INDUSTRIAL SHIELDS

CASE STUDIES

Discover how to use Open Source Based Hardware for Industrial Solutions

CASE STUDY

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WEATHER STATION AND WIND STUDY IN PANAMA

Using Industrial Shields devices, a weather station can be built to study the wind and all related weather factors. All data can be taken by the appropriate sensors and sent to a PLC for processing and monitoring through one of our Panel PCs.

BIOGAS PLANT AUTOMATION AND MONITORING

Our customer's purpose is to centrally manage and monitor all steps of the biogas creation method. Biogas plants take advantage of that and treat the biomass to produce energy. These plants have a lot of machines like fermenters, agitators or multiple kind of meters, successfully complete each part of the process.

HOW TO AUTOMATE HOTEL ROOMS WITH INDUSTRIAL PLC

When people go to a hotel, they not only expect to spend the night and feel like home, but they also want to have a great experience. Thanks to Industrial Shields solutions, a brand-new technology can be implemented to provide room automation that puts guest in full control of their wishes.

HOW TO IMPROVE YOUR DATA CENTER PERFORMANCE

The versatility of the installed PLCs and the freedom of programming —thanks to the fact that the equipment is based on Open Source Hardware— have been decisive for the customer to carry out the installation, complementing and improving the existing one.

SEMICONDUCTOR MANUFACTURING PROCESS

In recent years, semiconductor materials have become increasingly important in our world. Today, they are present in almost all areas of our lives and are a key part of them. They can be used both as conductors and as insulators, depending on their characteristics, providing great usefulness in the industrial environment.

BENEFITS OF CLOUD STORAGE

Industries, abundant but still certainly rudimentary, are going to become part of a large ecosystem that must communicate, something that we already see in the rest of the sectors but that
we still see resistance in this one.

MODBUS COMMUNICATION PROTOCOLS ALSO FIGHT THE COVID-19

The objective of the system we designed is to be able to have a very extended registry of the body temperature, at world-wide level if it is possible, so that the statistical control and the end of the Coronavirus can be nearer.

COMMUNICATIONS FOR 4.0 INDUSTRY

This case we want to show you how to implement a versatile system in terms of communication to control the storage and labeling of wine production.
This project consists of using different PLCs connected using several types of communications.

CONTROLLING AN HVAC SYSTEMS FOR DIFFERENTS SECTORS

The HVAC system has to control temperature, humidity and air quality, using a set consisting of: air conditioning equipment, humidifiers and dehumidifiers, fans, sensors, an Industrial Shields PLC and a panel PC

CONTROL AND REGULATION OF PUBLIC LIGHTING

Knowing the state of public lighting and being able to control it from a distance are very useful functions when saving and modifying its use. In this Case Study, we will control and regulate public lighting using a "Smart Light Controller" (SLC).

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CONTROLLING TEMPERATURE AND HUMIDITY USING OPEN MOTE B

Elevated humidity levels promote the growth of mould, corrosion and rust on stored items. They cause condensation on walls, ceiling and floors, which helps to create conditions suitable for pests.

PRODUCTION MACHINE CONTROL

The Industrial PLC controllers are connected via Ethernet to the production network. The use of this network allows the industrial controller to receive information from the different encoders and sensors to control the state of the machine.

IMPROVING A MANUFACTURING LINE

A small company which works making components with indicators for cars needs to improve its manufacturing process because they have detected problems during the drilling process and in the QR used for traceability,

AUTOMATED WAREHOUSE

A single PLC controller will take care of the engine management.
We will also have PC Panels in the shipping area and in every loading dock for information and management of the tasks to do.

MONITORING TRAFFIC VOLUME IN A PETROL STATION

Today, service stations are not just places to fill your car with gasoline. They are centers that concentrate a very wide commercial offer of products and services for vehicles and occupants: refueling, restaurant, car wash services, workshop, supermarket, among others

AUTOMATED SECURITY SYSTEM

This project is designed to make a fully-equipped security system capable to be focused to different dangers, adapting itself to specific objectives. It is going to encompass a large range of possible hazard points as the steals, the fires and the gas contaminations.

RESTAURANT ORDER SYSTEM

The system will be automated using a PLC as the center of control and data bank, a switch and some PC Panels to monitorize and interact with the information input-output feed.

CONTROL A CONVEYOR BELT USING AN INVERTER

In this project we describe a model to control an asynchronous motor using a frequency inverter in one of our PLCs based on Arduino. It has been used an MDuino 42 I / Os PLUS and a frequency inverter.

AUTOMOTIVE PRODUCTION LINE

The automotive production line will be fully automated, insted of the specific control parameters that have to be set. All the important data could be collected through all kind of sensors, like the ones said previously.

ANIMAL FEEDING

The feeding process will be automatized using a PLC which controls the feeders and would have a track of the food to settle up the periods, quantities and food kinds.

HOW TO MONITOR AUTONOMOUS PANELS WITH ARDUINO BASED PLCS

The objective is to chase the sun, which is a moving target, so that we can all take advantage of it and generate more solar energy. Solar panels operated by automatic control systems can generate up to 30 % more energy than static panels.

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TOTALLY INTEGRATED AUTOMATION OF BOILERS

The automation of this process has considerably improved the benefits of the boiler control, mainly in the spèed of response and the good operation in a 100% safe state. If the proposed control levels or an element do not behave as desired, the Arduino based PLC could send a local alert in the control zone through the PC Panel.

HOSPITAL ROOM ALARM SYSTEM

The idea is to activate the alarm using a push button at patient disposal. Once the button is pushed the M-Duino will send a message to a Telegram Bot and will activate two outputs: an audible alarm and a visible alarm.

IOT GREENHOUSE USING OPEN MOTE

In this case study, a secure and useful solution is presented to automate and monitor the care of a greenhouse with the use of Open Mote, device designed for IoT uses. This IOT Mote incorporates digital and analog inputs for reading sensors.

ANALYZE ELECTRICAL NETWORK WITH INDUSTRIAL SHIELDS EQUIPMENT

Having real-time knowledge of the actual use of the current in urban street furniture can help us to have a better knowledge about the current expenditure that is carried out in the streets. Information is power.

AUTOMATION OF LABELING CONVEYOR SYSTEM

Bottles on a conveyor belt run through a labelling mechanism that applies a label to the bottle. The spacing of the bottles on the conveyor is not regulated and the conveyor can slow down, speed up, or stop at any time.

SMART CURRENT METERING

This project is designed to measure the current consumption in a company using a current sensor. Through a database in the Ethernet PLC itself, it is possible to know the consumption statistics for medium and long-term tracing and even stop the current in case they exceed the allowed limit.

CONTROL OF A PARKING AREA USING AN RFID SENSOR

This project allows access control in a parking area, and automate the opening of the gate from a system which uses an RFID sensor connected to the Arduino-based PLC by Industrial Shields.

AUTOMATING AND MONITORING WATER TREATMENT

This project consist on the implementation of a water threatment station using Industrial Shields equipment. The objective is display sensor data on a Panel PC and also allow this system to be configured remotely.

CONTROLLING AN HVAC SYSTEM WITH ARDUINO BASED PLCS

Implementation of an HVAC system using the Industrial Shields equipments for a specific solution in this sector.
Installation composed of a server immersion cooling system, besides controlling temperature, odors and ventilation of the room where the whole system is installed.

MONITORING A WEATHER STATION IN MEXICO

This project consist on a weather station with the objective of display sensor data on a web site and also allow this system to be configured remotely.

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MEAT SELECTION LINE BY INDUSTRIAL SHIELDS

In this use case, we have implemented a meat selection line controlled by an Industrial Shields arduino based PLC. The system we are going to build is very easy to install and program due to the few elements and open source programming.

AUTOMATED PIG FARM

On this occasion we will introduce the Industrial Shields technology to the farm sector. We are going to control and monitor a pig farm using a PLC and a PC panel connected to Wi-Fi, which can collect information from the system, store it into a server and analyze it.

SAFE ESTABLISHMENT - FIGHTING CORONAVIRUS

To achieve this objective, we have thought of creating an automated system, controlled by an Industrial Shields PLC in combination with a Touchberry Panel PC. In this way we can install sensors that monitor the system and an ozone machine.

HOME AUTOMATION WITH PLC & TOUCHBERRY

The aim of this project is to create a system which can collect the information from several sensors located in different parts of the house and also actuators in order to control the devices according to the information collected or the user's needs which can be preset.

CONTROL & MONITORING OF AN OIL WELL

The programming of the process will be done with the open source application Arduino IDE, since the heart of the PLC is an Arduino Mega board.

SMART HOTEL WITH TINKERTOUCH S 10.1”

In this article, we are going to talk about a way to use Tinkertouch S 10.1. This PC panel is one of Industrial Shields' newest and most versatile devices. It is Raspberry based and runs with Linux

CONTROL OF PUBLIC SPACES USING PLC WITH LORA

Nowadays, most of our customers are interested in the analysis of Big Data, because this fact can provide them a lot of information and let them know the environment better, take better decisions and have agility in internal management.

CONTROL OF COVID-19 VACCINE

The COVID-19 virus, which started as simple flu, has become one of the most infectious and dangerous pandemics in history. Two pharmaceutical companies have found the first vaccine using the messenger RNA method, which could be more than 90 % effective. However, these vaccines must be kept under strict conditions in order not to go bad.

AUTOMATION OF INDUSTRIAL ROBOTIC CELLS

Using industrial technics, we will be able to create a model of cell that could be easily replicated for all the processes where automation, monitorization and also interaction with the machine are nedeed.

IMPLEMENTATION OF AN ACADEMIC AUTOMATION MODEL

On this case study, we will build a demo consisting in the automatization of some sensors and actuators using an Arduino based PLC. We will program it with the Open Source Arduino IDE.

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CONTROL OF HVAC SYSTEM FOR SHOPPING CENTRE

Shopping centres require a wide variety of HVAC (heating, cooling, ventilation and air conditioning) solutions to ensure consumer comfort and energy efficiency.

WIRE ELECTRODE RESIDUAL ANALYZERS WITH TOUCHBERRY 10" PANEL PC

In welding, it is essential to know the surface condition of the wire electrodes used. They can deteriorate over time; wire feeding systems can become contaminated during storage or transport, affecting the quality of the weld.

HYDROMETEOROLOGICAL STATION AND AUTOMATIC WATER QUALITY IN THE UCAYALI RIVER BASIN

The implementation of this automatic system for measuring hydrometric levels in the Ucayali river basin will allow real-time recording of the variation of the river level and flow at different points. The pilot having started at the LPO station, as shown in the following graph.

SCADA APPLICATION IN A PANEL PC

In this Case Study, is seen an example of how to use our Panel PC Touchberry together with our M-Duino PLCs.

BATTERY LEVEL SENSOR

In this Case Study is shown how to measure a battery level with our equipment.
With arduino Leonardo or Mega you only can measure an analog input value of 5 V. With our boards, Ardbox or M-Duino, it's possible to measure an analog value input of 10Vdc. So the reading range is wider.

GREENHOUSE AUTOMATION

This project allows to control remotely the humidity, the ventilation, the Co2 level and the luminosity in a greenhouse It is configured with a graphical interface programmed in a Industrial Shields Panel PC with a RaspberryPi built-in.

AUTOMATION OF LOGISTICS USING A RASPBERRY PLC

Nowadays, if a company wants to compete in the market, apart from offering a good product, it has to do so in the shortest time. One of the best ways to reduce time is to optimise processes in order to achieve the maximum in the shortest possible time.

IMPROVE THE CONTROL, EFFICIENCY AND SAFETY OF YOUR FLEET, AND YOUR CUSTOMERS' SATISFACTION

Our customer's vehicle fleet has grown significantly over the last decade. The company deals with the processing, marketing and distribution of frozen foods and has an important commercial. In order to maintain the competitive level reached by the company, the quality of the product must be guaranteed and, at the same time, fleet management must be improved.

CONTROL OF SONIC BARRIERS FOR ENVIRONMENTAL PROTECTION OF BIRDS

Every year, thousands of birds are killed by colliding with wind turbine blades; a figure that is expected to rise as wind energy continues to develop.

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SILO MONITORING: KEEP YOUR HARVEST SAFE

The challenge for farmers and companies involved in the grain storage and distribution process is to ensure the quality of the product during the different phases and types of facilities where cereals are transported, processed and stored.

AUTOMATIZATION OF A CONCRETE PLANT

A concrete plant is an installation used to manufacture concrete from raw material which is composed by aggregate, cement and water. All these components are previously stored in the concrete plant and then they are dosed in the right proportions to be mixed.

MONITORING SOLUTIONS IN PETROCHEMICAL INDUSTRY

Monitoring in petrochemical facilities is a key element. A correct configuration of the elements to be monitored will allow us to:

AUTOMATION PROCESS WITH TOUCHBERRY

The Panel is based in OS GNU/Linux (Raspbian/Ubuntu) installed in an SD card. You can find examples and explanations in our Blog to learn how to program it.

MONITORING OF BEET MOUNTAINS

The main sugar beet growing areas are in the temperate regions of Europe and North America, with average heat wave temperatures between 16-25 ˚ C and annual rainfall of at least 600 mm.

AUTOMATIC CAR WASH

Car washing is simple activity done in order to keep the exterior of the car clean. Mostly it is done manually in automobile garage or service centres of automobile companies. This manual way of cleaning car results in more consumption of water, manpower and time.

MONITORING THE EFFECTS OF CLIMATE CHANGE

The study of polar ecosystems helps to understand alterations in climate change. One of the ways to analyse the environment under controlled conditions is through mesocosms or outdoor experimental systems.

FLEET MANAGEMENT

In this particular case, fleet management is implemented. It consists of installing, in each vehicle that composes the fleet, an equipment based on Arduino of Industrial Shields® with its set of sensors and actuators.

CASE STUDY

INDUSTRIAL SHIELDS

WEATHER STATION AND WIND STUDY IN PANAMA

Panama is a country affected by strong storms and meteorological phenomena like tornadoes, that can be very dangerous, and it is important to study them in order to predict and avoid their consequences.

Using Industrial Shields devices, a weather station can be built to study the wind and all related weather factors. All data can be taken by the appropriate sensors and sent to a PLC for processing and monitoring through one of our Panel PCs.

CHALLENGE

The aim is to **manage a weather station based on open source technology** and then **monitor it through a cloud platform**. The main paramaters that will be recorded by the sensors are the following:

- Wind speed and direction
- Temperature and humidity (internal and external)
- Current and accumulated rainfall (daily, monthly, yearly)
- Rainfall intensity
- Current atmospheric pressure
- Weather forecast

IMPLEMENTED SOLUTION

This project is based on the **MDuino.42+ w/GPRS & GSM** industrial PLC.

The different types of sensors already mentioned are connected to the PLC through different kinds of connections. Depending on the type and model of the sensor, it uses a specific communication or another (analogical, I2C, SPI, etc.).

After that, the PLC processes all the input data, and the output information is sent through GPRS signals. This is because GPRS is the only communication available in most areas where sensors need to be located to record data correctly. This output signal is sent to the cloud and the customer can display the information using his own devices such as computers, tablets or Industrial Shields Panel PCs, which are perfect for monitoring all kinds of data.

CASE STUDY

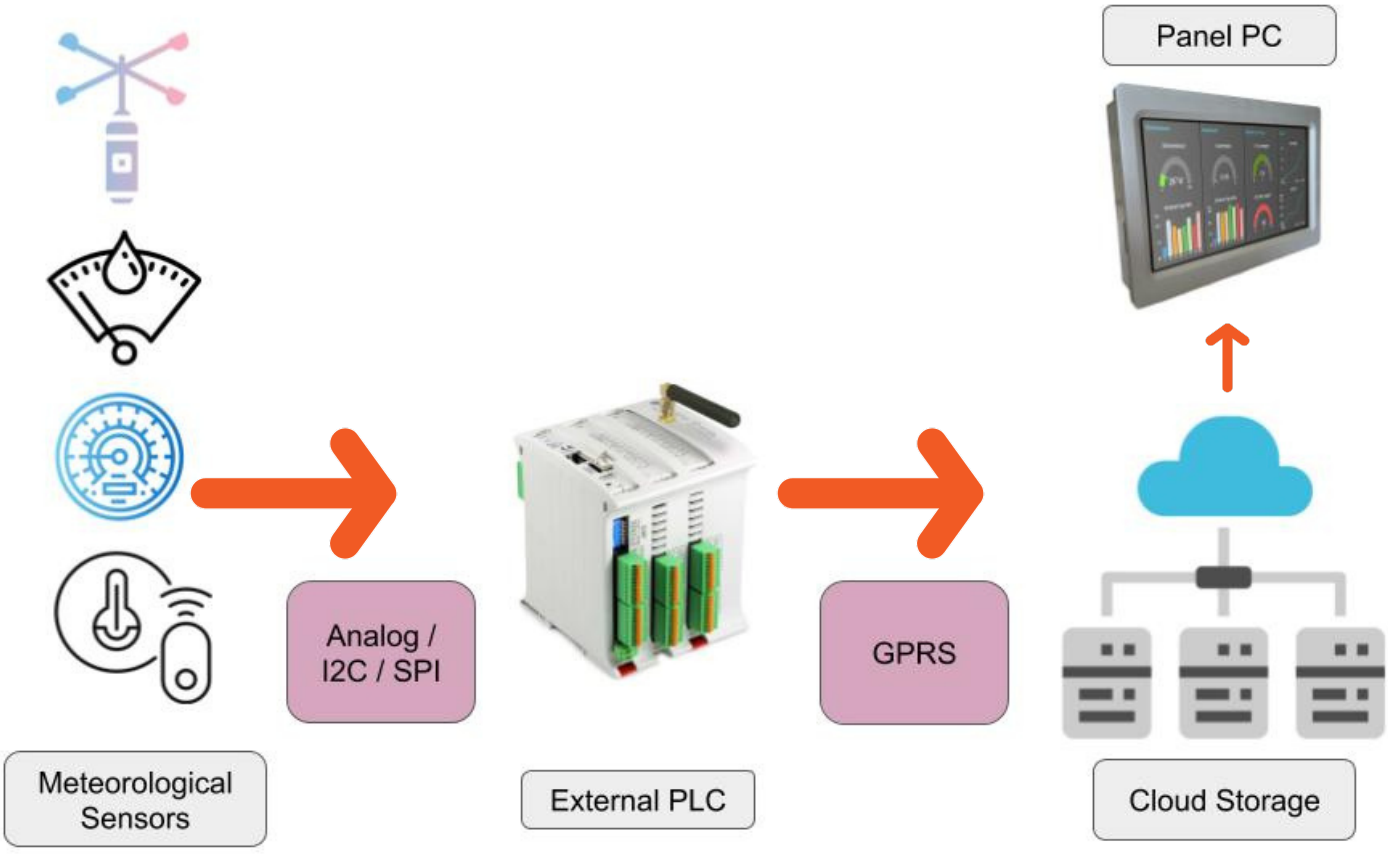
This idea starts with a main objective: **to keep a record and monitor the climatic phenomena in Panama. Firstly, the data are captured by all the different sensors**. The information is sent to the PLC using the appropiate communication method for each sensor, connected as input. The sensor communication is chosen according to the model and data type and the update time.

In the next stage, the PLC receives all the incoming data and, through a previously uploaded code, can manage and process all the information. Using the GPRS module and its correponding antenna, it sends this data to the cloud, taking advantage of protocols as HTTP or others.

All the information stored in the cloud is accesible through many devices, as long as they have a type of communication compatible with the protocol of the cloud you need to use. Therefore, data can be monitored by computers, tablets, HMI displays or Industrial Shields Panel PCs, which have a large number of communications and additional I/Os that can be very useful in most cases.

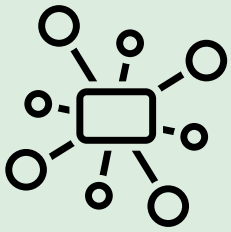
Monitoring cannot be done without an API or platform. This is devoloped to monitor all the information and make posssible a tracking and a real-time view of the weather to ensure a good forecast of these phenomena. To work with the platform, a database is also needed, so that the current information is as useful as the previous one, especially when making weather forecasts.

In short, although this project may seem complicated at first glance, separating each section while keeping a common goal in mind is the key to a successful outcome.



CASE STUDY

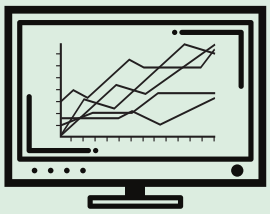
BENEFITS



Good communications

Thanks to the GPRS system, Industrial Shields PLCs have great versatility, as they can be installed where communication via Ethernet or Wifi is not possible.

Moreover, the GPRS/GMS controller family contains several communication ports which provide more flexibility and control.



Data monitoring

The information can be displayed on computers, tablets, or on Industrial Shields touch screens. These industrial Panel PCs are perfect for monitoring all types of data.

All information can be monitored and tracked to get a real time view of the weather and ensure a good weather forecast.

WHY INDUSTRIAL SHIELDS?

Industrial Shields won this project and beat its major competitor thanks to:

Open solution. No license fees.

Modular solution: The project can be extended in the future if the client requires it,

24/7 technical support: Our technical team is available to help you 24/7 via phone, mail or WhatsApp.

Equipment designed and manufactured for **industrial use** at a **lower price** than competitive products.

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CASE STUDY

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BIOGAS PLANT AUTOMATION AND MONITORING

Biogas is a fuel gas generated in natural environments or through specific devices, due to the biodegradation reactions of the organic material. It is produced by the action of microorganisms and other factors, always in the absence of oxygen .

Biogas plants take advantage of that and treat the biomass to produce energy. These plants have a lot of machines like fermenters, agitators or multiple kind of meters, successfully complete each part of the process.

CHALLENGE

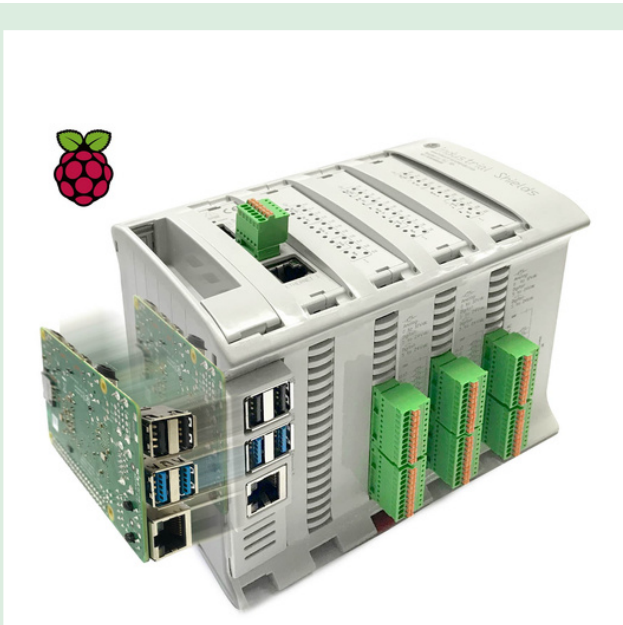
Our customer's purpose is to centrally manage and monitor all steps of the biogas creation method. This will involve the following sections:

- Implementation of the control system and the plant automation.
- Installation of a screen for local control and management of the machine.
- Implementation of sending data to the cloud.

IMPLEMENTED SOLUTION

The biogas plant is divided into four parts, each of which is responsible for a different process:

- The substrate input including the anaerobic digestion
- Nitrogen removal
- Effluent extraction
- The use of biogas to produce electric and thermal energy



The management is carried out by a **Raspberry 58+ PLC** due to the extensive number of digital and analog I/Os available, the Ethernet and Wi-Fi communications among others and, especially, to its high processing capacity, capable of developing multiple processes simultaneously providing a high response. A **TouchBerry Panel PC** monitors the information due to:

- its easy integration and communication with the PLC
- its high performance.

The sending of data to the cloud is done through the Ethernet connection, used to communicate with the server with a high speed interaction.

CASE STUDY

The customer's main objective is to **process biomass waste** that may have a vegetable or animal origin. This waste is placed in the anaerobic digestion module where biogas is created after a certain period of time. This biogas is implemented in an engine which is used to produce thermal and electrical energy.

A part of the waste from the anaerobic digestion module is sent to a nitrogen feed reactor, and the other part is sent to an operating accumulation pond. After all these processes, recirculation takes place as the product from the nitrogen feed reactor is sent to the anaerobic digestion module.

The anaerobic digestion module and the nitrogen feed reactor have to be under a heating system to maintain a certain temperature over time, so the customer uses a temperature sensor to achieve this. It is also important to get a real time control of the pressure through another specific probe, so pressure is always a vital parameter to take into account when talking about gas management. For this reason, the customer has implemented other sensors such as sludge probes, air and biogas meters, each with significant management over and above the overall system.

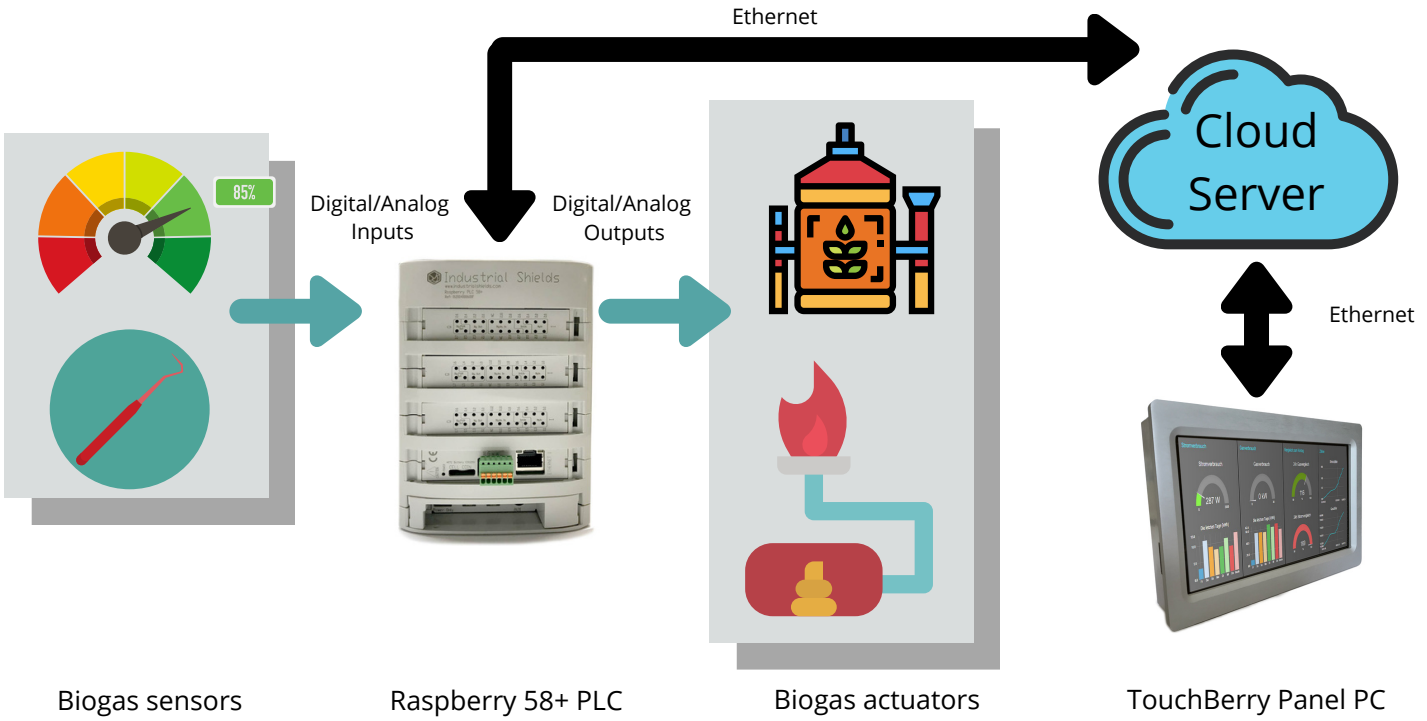
Another important aspect is the local machine management **display control**. Thanks to Industrial Shields technology, the customer has implemented:

- the monitoring of its plant situation in real time,
- the control over the different operations,
- the visualisation of certain alarms and sensor/actuator history,
- the configuration of all available parameters, and
- the definition of a hierarchy with respect to all possible users of the system.

Finally, **the sending of data to the cloud** is implemented. This process is based on a communication with the server. The chosen method is **Ethernet** due to its higher speed and bandwidth compared to other options such as Wi-Fi or GPRS.

Thanks to the design of an interface, all information is displayed in a convenient way by a **Touchberry Panel PC**.

Thanks to Industrial Shields technology, the customer has achieved its goal by fully automating the system.



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CASE STUDY

BENEFITS

Good communications

Ethernet communication has a higher speed and bandwidth than options such as Wi-Fi or GPRS.

Thanks to the dual Ethernet ports, the dual RS-485, WiFI, Bluetooth, CAN bus and other options, Raspberry Pi PLC family can connect to a large number of devices and to use multiple protocols and communication ports.

Data monitoring

Information can be displayed on Industrial Shields touch screens, which stand out for:

- monitoring all types of data, such as plant situation in real time,
- displaying certain alarms and sensors history,
- configurating all available parameters,
- processing large data packets due to their high capacities and
- working in many different standard protocols.

WHY INDUSTRIAL SHIELDS?

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CASE STUDY

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HOW TO AUTOMATE HOTEL ROOMS WITH INDUSTRIAL PLC

When people go to a hotel, they not only expect to spend the night and feel like home, but they also want to have a great experience. Thanks to Industrial Shields solutions, a brand-new technology can be implemented to provide room automation that puts guest in full control of their wishes.

CHALLENGE

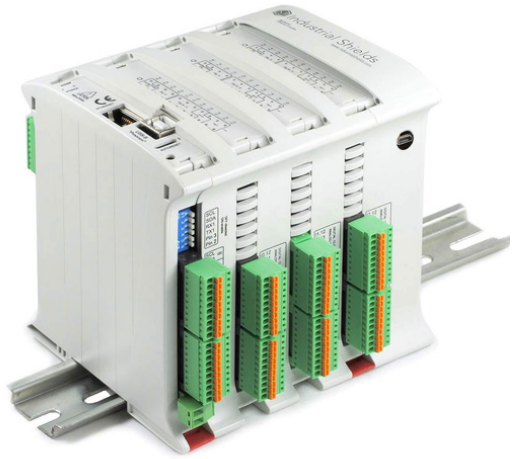
In order to attract customers and compete with other rivals, a different service must be offered to stand out. Can there be a better option than offering a cutting-edge technology for your guests?

A client who runs a hotel chain came to us asking if it was possible to **automate the hotels** of his company. His main idea was to delight his guests with new options and find a way to **save some energy** by controlling the temperature and lights in the rooms and common places.

The goal was to implement a system capable of offering the latest technology to the customers. A monitoring system would be installed to obtain data from specific areas and help identify where the most energy is being spent.

SOLUTION

Each room is equipped with an **Arduino-based PLC** and a **touch screen**, which are used to control the area. They are set in each room to be controlled and connected to a central node that will host all the information about the hotel preferences.



Guests can adjust the temperature on their liking, regulate lights or make requests to the hotel staff without leaving the room.

In addition, the PLC receives information from sensors, which inform it of the temperature or if there is someone staying in the room. Thanks to this information, if nobody is detected, the room temperature can be lowered, the lights can be switched off or the cleaning staff can be sent to do their job.

CASE STUDY

IMPLEMENTATION

To be implemented, this system requires:

- an industrial PLC,
- a connectable-touchscreen and
- some sensors and actuators.

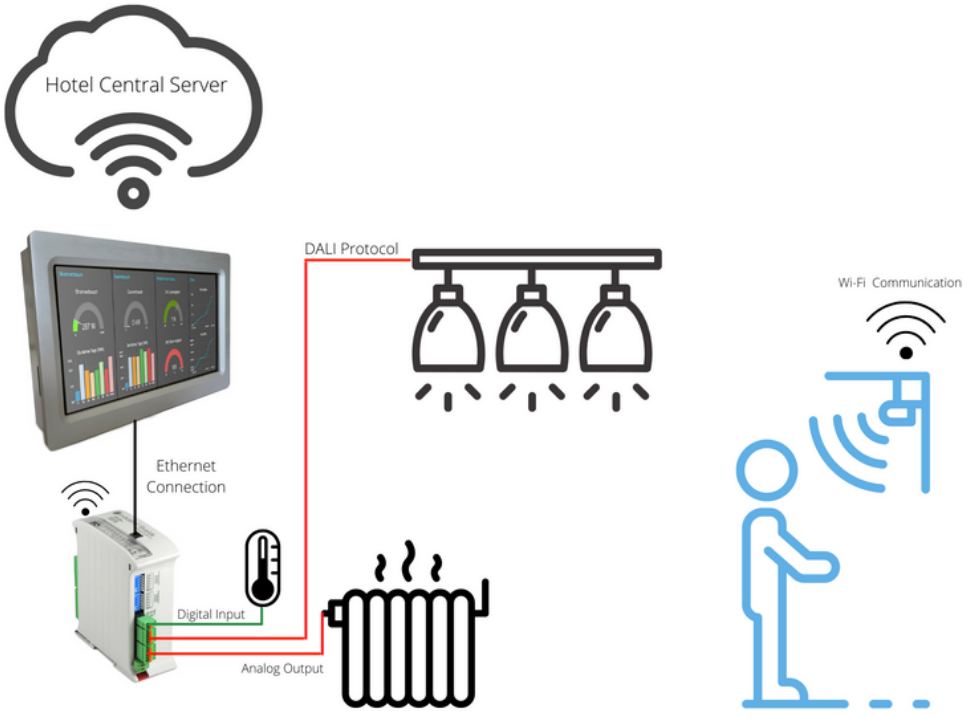
Our customer opted for an **Industrial Shields Ardbox Dali PLC** and a **TouchBerry Pi 10.1"** to set up the system at an affordable price.

The implementation has been done by placing the PLC together with the touch screen at the entrance of the room, where the guest can interact with the display. The touch screen has an interactive and user-friendly interface to control the room temperature, the lights and a request system to contact with hotel stuff in case of any problem.

On the other hand, to get information from the room, some sensors haver been installed around the place where the system is implemented. A **presence sensor** has been installed via Wi-Fi to know if there are people in the room. In case the room is empty for a certain period of time, an **automatic temperature** is set to save energy. If the **lights** are accidentally left open, they will be switched off. In addition, a notification will be sent to the hotel staff to let them know that the cleaning service can be done without disturbing. Another temperature sensor is wired connected to control the heating systems and show the guest the actual temperature of the room.

As for the lights, **Industrial Shields PLCs** have the option to work with **DALI,** a very useful protocol to control different lights individually. This would be especially useful as the guests can set the lights to different modes, such as a reading mode, which sets a lower light to make a pleasant atmosphere for reading.

- Note: This case study can also be applied in **industries** or **offices** which need to set up an **automatic system for their daily needs**.



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CASE STUDY

BENEFITS

Improved sustainability
Automating the temperature and lights will save a considerable amount of money, as well as helping the environment.

Enhaced customer experience
Guests gain a greater level of personalisation by making adjustments to their room to get it the precise way they want it.

Remote room controls
Hotel staff can access a variety of room controls from a remote location. This is especially useful when preparing a hotel room for a new guest.

Saving time and resorces: faster and more reliable repairs.
Thanks to room automation, hotel staff have the ability to anticipate technical problems with devices and make repairs quickly.

Scalable system
This system not only works for the rooms, but can be extended to all common areas of the hotel.

WHY INDUSTRIAL SHIELDS ?

Industrial Shields has won this project and beaten its main competitors thanks to the facts below:

Open solution. No license fees.

Modular solution: Product specifications can be expanded in the future.

24/7 technical support: Our team is available to help you 24/7 via phone, mail or WhatsApp.

Equipment designed and manufactured for **industrial use** at a **lower price** than competitive products.

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INDUSTRIAL SHIELDS

HOW TO IMPROVE YOUR DATA CENTER PERFORMANCE

In a data centre there are multiple factors that affect the optimal performance of the installation.

The conditions of temperature, humidity and condensation compromise, on the one hand, the **operation** and **safety** of the elements that make up the data centre. On the other hand, they affect **energy consumption** since, in order to maintain optimum conditions, it is necessary to overload one or more of the elements that keep the installation at suitable thresholds, either temperature control by means of air flow, or air conditioning in a more generic term.

SUMMARY

Temperature and humidity of the environment

The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) recommends that:

- **the temperature in this type of installation should range between 65°F (18.3°C) and 80°F (26°C) and**
- **the relative humidity should be between 40% and 60%.**

The ambient temperature threshold between these values is optimal for reliable systems and for the operator to work in a comfortable environment. Although much computer equipment can operate within a wide temperature range, temperatures close to 71.6°F (22°C) are recommended to provide safe humidity levels.

When it comes to relative humidity, we move in the 40-60% range. It is important to keep the level above 30-35%, as electrostatic discharges can occur and affect the operation of the installation. By maintaining an adequate level of humidity, the durability of the equipment is also improved by protecting it against possible corrosion.

Our customer wants to **rationalise energy consumption**, as its energy cost has skyrocketed as the number of equipment in the data centre has increased.

The installation has almost doubled the number of equipment after winning new contracts:

- a major deal with a large tele-operator that is investing in the country, and
- the expansion of services for some of the country's largest banks, a sector in which the company specialises in data management.

The increase in volume is carried out in previously sized rooms, with a clear commitment to growth due to the strong demand detected.

CASE STUDY

SOLUTION

The historical data is analysed to find patterns that indicate points where the facility is not operating at an adequate level and is consuming excess energy.

A plus point is that the facility is generally modern and has a powerful and versatile HVAC solution. In the different rooms, there are sensors for environmental control at room level.

Once the analysis has been carried out and the HVAC system has been correctly sized, a more detailed measurement is chosen. Data is taken at the foot of the rack and critical points are identified which are overheating the whole room and lowering, in turn, the relative humidity, with the consequent risk of electrostatic discharges. After identifying the problem, more sensors are added to give a complete view of the room, both at a general level and in terms of the details of the spaces where each of the racks and fractions of them are installed.

The new installation of sensors provides very valuable information about where to act in order to keep all the elements at the right temperature and humidity. This new vision of the installation, together with the versatility and power of the HVAC installation, changes some of the parameters initially established. The air flow and the control of the refrigerators are adapted to be more efficient in the management of temperature and humidity.

FINAL RESULT

Thanks to this fresh approach, significant improvements and benefits are achieved. The new range of installed sensors provides a large amount and quality of information. The **monitoring** of this information, together with the **analysis**, allows the creation of some automatisms and the configuration of a series of alerts and alarms when there are values out of range. Some of the most noteworthy points are:

Control and reduction of high temperatures in some racks or equipment. On occasions, there were extreme temperatures that put the correct functionality of the service and the optimum durability of the hardware at risk. By reducing the temperature and controlling the humidity adequately, customer service is ensured by **avoiding system failures** or falls; moreover, the hardware works in adequate conditions without suffering overheating or possible effects from electrostatic discharges.

As the customer has a powerful and versatile HVAC solution, it is configured appropriately based on the monitored values and thus acts on the areas in a specific way. This provides significant **energy savings**, as it avoids overloading or over-dimensioning the air conditioning system to maintain critical areas at the expense of the ones where more stable conditions exist.

The versatility of the installed PLCs and the freedom of programming —thanks to the fact that the equipment is based on Open Source Hardware— have been decisive for the customer to carry out the installation, complementing and improving the existing one.

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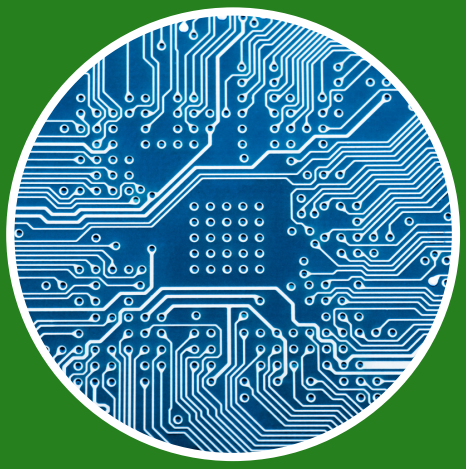
CASE STUDY

INDUSTRIAL SHIELDS



SEMICONDUCTOR MANUFACTURING PROCESS

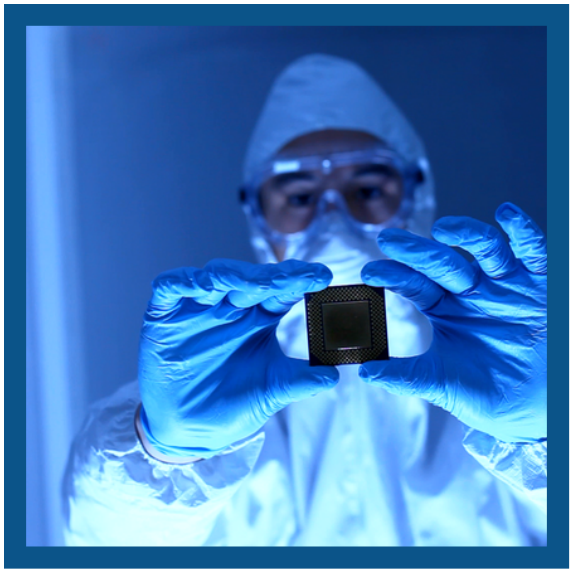
The semiconductor materials manufacturing industries have been improving their products at exponential levels for years. Technology advances very quickly and small changes are very important in order to compete on the market.

A distribution company is looking for a solution to implement some system for its final customers that will allow them to make a qualitative leap and get ahead of the competitors. In this case, the aim of Industrial Shields is to optimise process control and reduce costs.

SUMMARY

In recent years, **semiconductor** materials have become increasingly important in our world.

Today, they are present in almost all areas of our lives and are a key part of them. They can be used both as conductors and as insulators, depending on their characteristics, providing great usefulness in the industrial environment.



GOALS

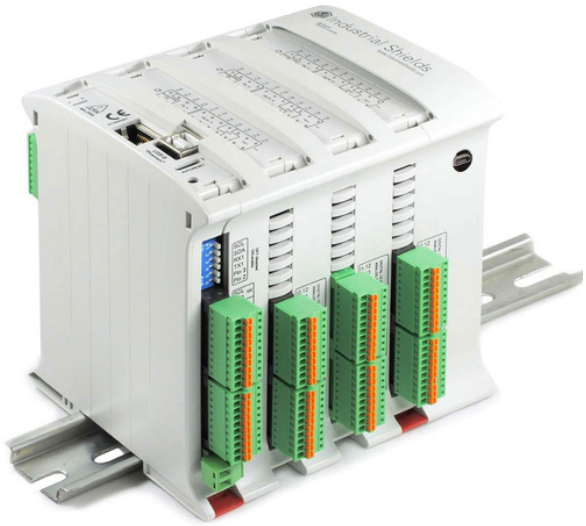
Our customer is looking for a solution to **optimize** some part of the semiconductor **manufacturing**, **reducing costs** to compete in the market.

As the whole creation process is already following strict requirements, Industrial Shields has focused on optimizing the clean room where the silicon wafers are stored before processing.

The goals are to implement:

- different types of **sensors** and
- an **electrical solution**

to regulate the lights and optimize their consumption..



CASE STUDY

CONCLUSION (HARDWARE)

Clean rooms must be permanently in very specific conditions so as not to damage the products. In the case of semiconductor materials, they should be exposed to an ideal room temperature of 22 degrees, between a maximum of 26º and a minimum of 18º; humidity levels should be between 30 and 60 %. In addition, there cannot be dust levels higher than 80k units for 0.028m3.

The system proposed to be installed will consist of an **open source based industrial PLC** that will act as a master controller for all sensors and will allow to:

- send the data to an external server and
- monitor an alarm system.

In addition, an extra **touch screen** will be placed to interact with the system from outside the clean room.

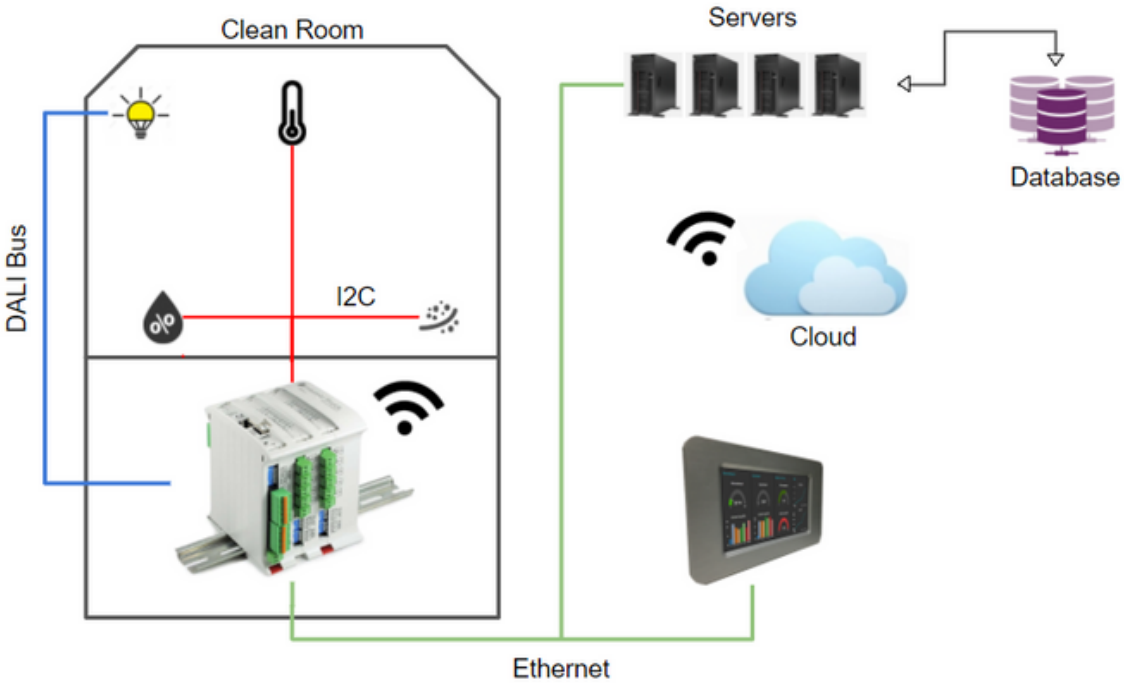
The first **sensors** to be implemented will be **temperature** ones. For a better measurement, it will be necessary to set some in the different places of the room, since any variation could permanently damage the products. Like the temperature sensors, the **humidity** and dust **sensors** will be placed throughout the room to obtain the maximum reliability in the results.

Industrial Shields PLCs can be set with multiple sensors working at the same time, choosing one of their communications, such as I2C or RS845 with Modbus, depending on the devices and the distance to operate. All collected data will be sent via Ethernet or Wi-Fi to a "backup" database server and also to a cloud server where it could be monitored from another location.

The **advantages** of working with open source PLCs are :

- their **economical price** and
- the **wide variety of options** they can provide.

Extra features could be added later to improve the system. One option would be to control the lights in the room with a DALI system, timing when they should be opened or turned off, thus saving money.



CASE STUDY

INDUSTRIAL SHIELDS

BENEFITS OF CLOUD STORAGE

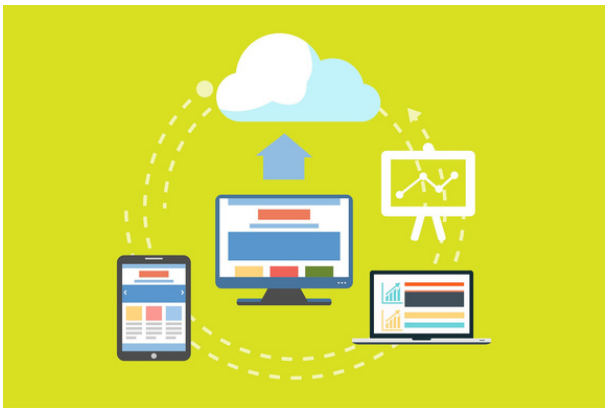
Industries, abundant but still certainly rudimentary, are going to become part of a large ecosystem that must communicate, something that we already see in the rest of the sectors but that we still see resistance in this one.

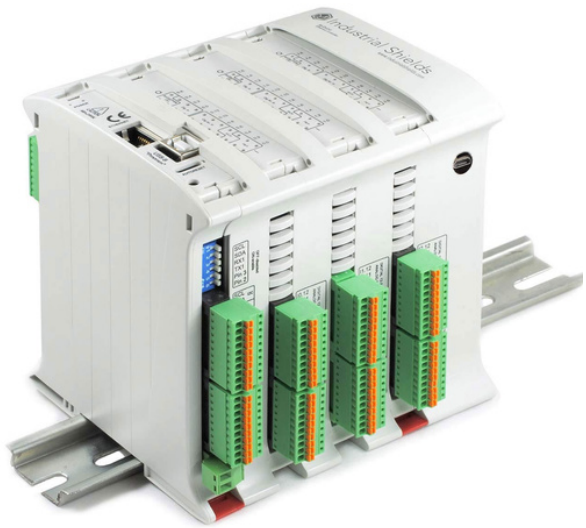
SUMMARY

The Industrial Cloud will be one of the main elements of what is already known as the fourth revolution, which is the one that will completely change the way of managing data thanks, in part, to the standardization of the Internet of Things and the hybridization of elements of reality.

This virtual space works by hiring certain services, each one that you need, that will allow you to manage your information and store it securely on the servers. You will have access through the use of the Internet, to different softwares, which will be the ones we use to modify our files, share them and store them safely.

At the same time, being in the Cloud, you can configure which user will be able to access, alter and edit a certain document. In this sense, it is also possible to protect confidential data with user control.





The main benefits of the cloud storage are:

- The reduction of obstacles and barriers.
- A considerable economic saving.
- Increase in the speed of information transmission, one of the main current problems in the industry.
- Compatibility with the specific demand that different industrial companies may have.
- The information remains secure, being practically inviolable.

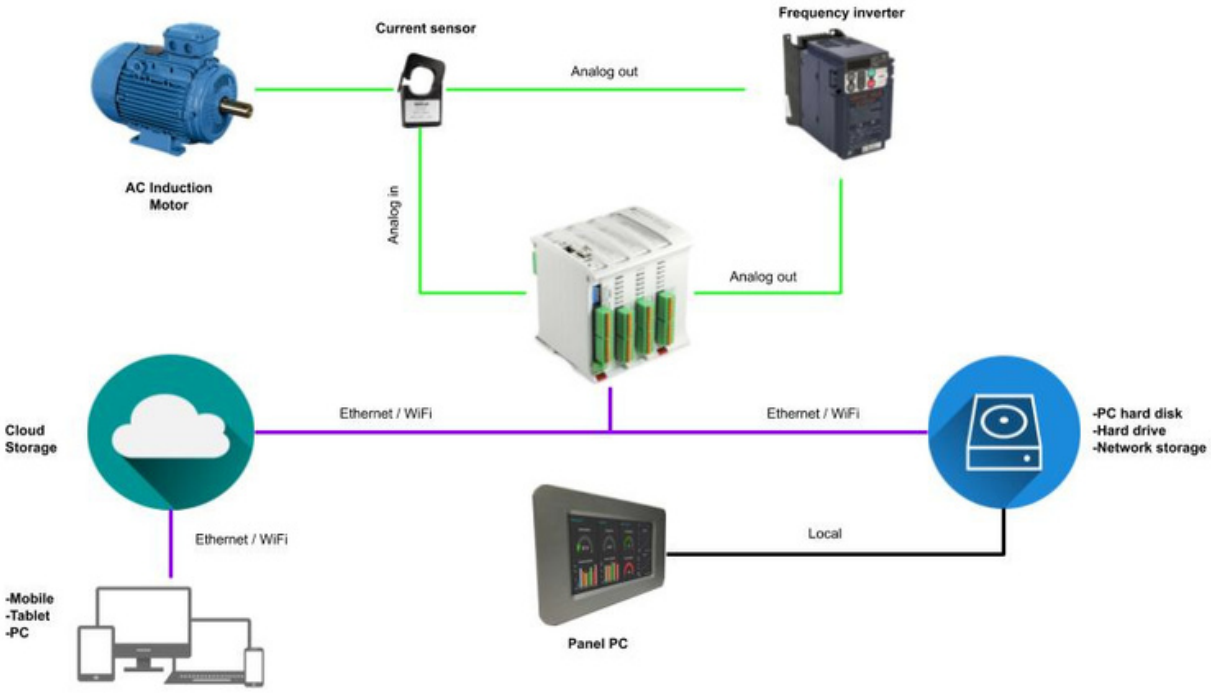
CASE STUDY

GOAL

The objective of this study is to design a system which have multiple data inputs from industrial machinery or user information which have to deal with that and process all the data to store it locally in devices such as PC hard disks, hard drive or network storage and for, after that, monitor this in a PC Panel. Another and the main option is to store all the information in the cloud, to be able to consult it anytime thorugh devices like PC, tablets or mobile phones.

CONCLUSION (HARDWARE)

This system is composed by a PLC, which is the brain in charge to manage the inputs from all the industrial machines and the data input from a users manager interface and its appropriate database. It also have the control over several outputs, whether they are analog, digital or relay, used to control more machines or devices. After that, all this information have to be stored here, two paths open; on the one hand, the data can be stored locally in physical devices such as the previously said and can be managed through a Panel PC. Or, on the other hand, it can be stored in the cloud with the objective to be accessed anywhere using all kind of compatible devices. Both PLC connections, the cloud and the local, are made by Ethernet cable or WiFi, depending on the final preferences and on the spects of the selected PLC. Having two kind of copies of the information is always a good idea; a local one to ensure that the original data is reliable and unchanged, and a cloud one to provide security and a wide range of accessibility.



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CASE STUDY

INDUSTRIAL SHIELDS

MODBUS COMMUNICATION PROTOCOLS ALSO FIGHT THE COVID-19

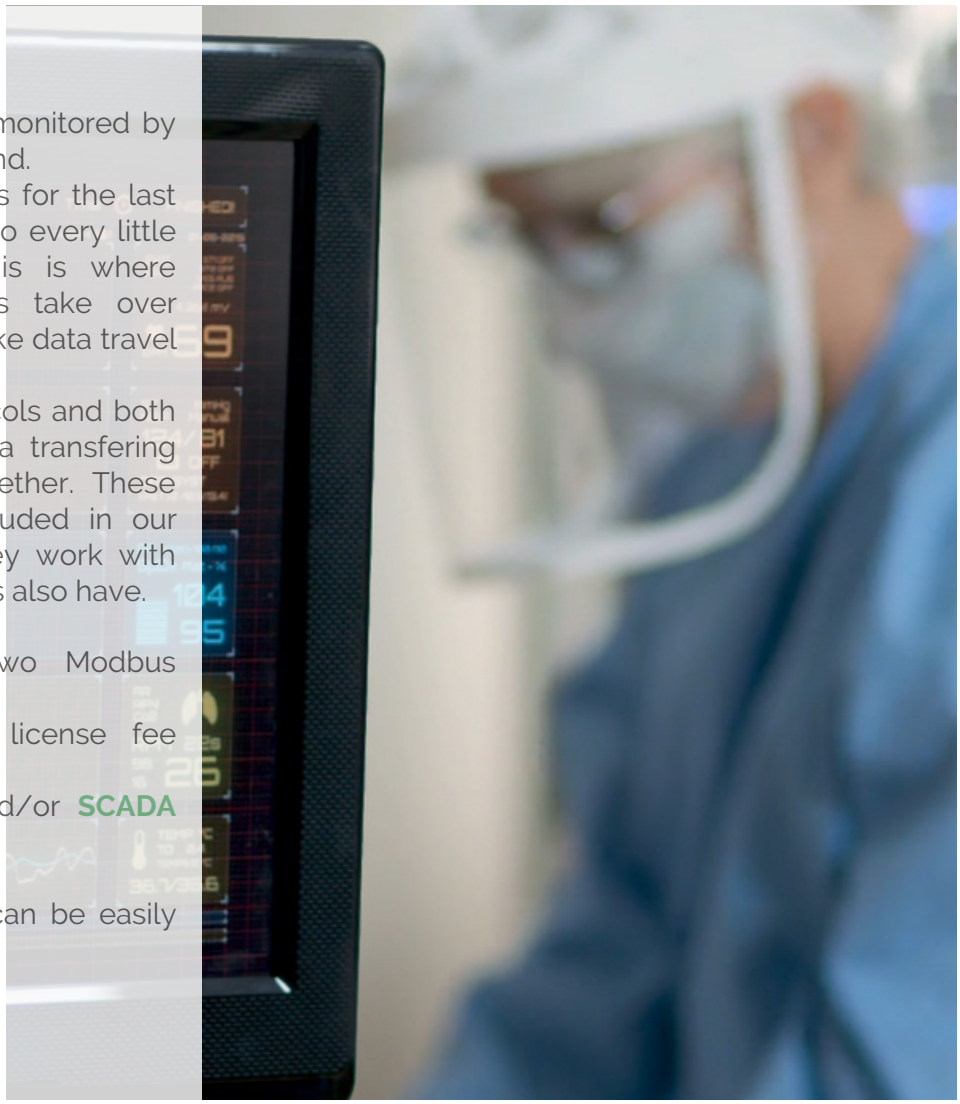
The use of today's technology is a very effective and fast way to make information flow everywhere in a short time.
The Modbus communication protocol by Modicon is a worldwide extended protocol that was born in 1979. The two most common types of it are Modbus RTU and Modbus TCP/IP.

SUMMARY

In a world where most things are monitored by technology, you cannot be left behind.
Coronavirus has been living with us for the last six months and still has time left, so every little step to overcome it counts. This is where Modbus communication protocols take over control and helps us humans to make data travel around the world.
There are two main Modbus protocols and both play an important role in the idata transfering work, furthermore, they work together. These communication protocols are included in our Arduino based controllers and they work with Ethernet, a connection that our PLCs also have.

The benefits of using these two Modbus protocols are:

- **Open source** code and no license fee required.
- Widely supported by **HMIs** and/or **SCADA** software.
- Easy to use.
- Various **industrial equipment** can be easily integrated.
- **Low** developement **cost**.
- Widely known in the industry.



CASE STUDY

GOAL

The objective of the system we designed is to be able to have a very extended registry of the body temperature, at world-wide level if it is possible, so that the statistical control and the end of the Coronavirus can be nearer. To achieve this, we are going to use the **Industrial Shields equipment**.

CONCLUSION (HARDWARE)

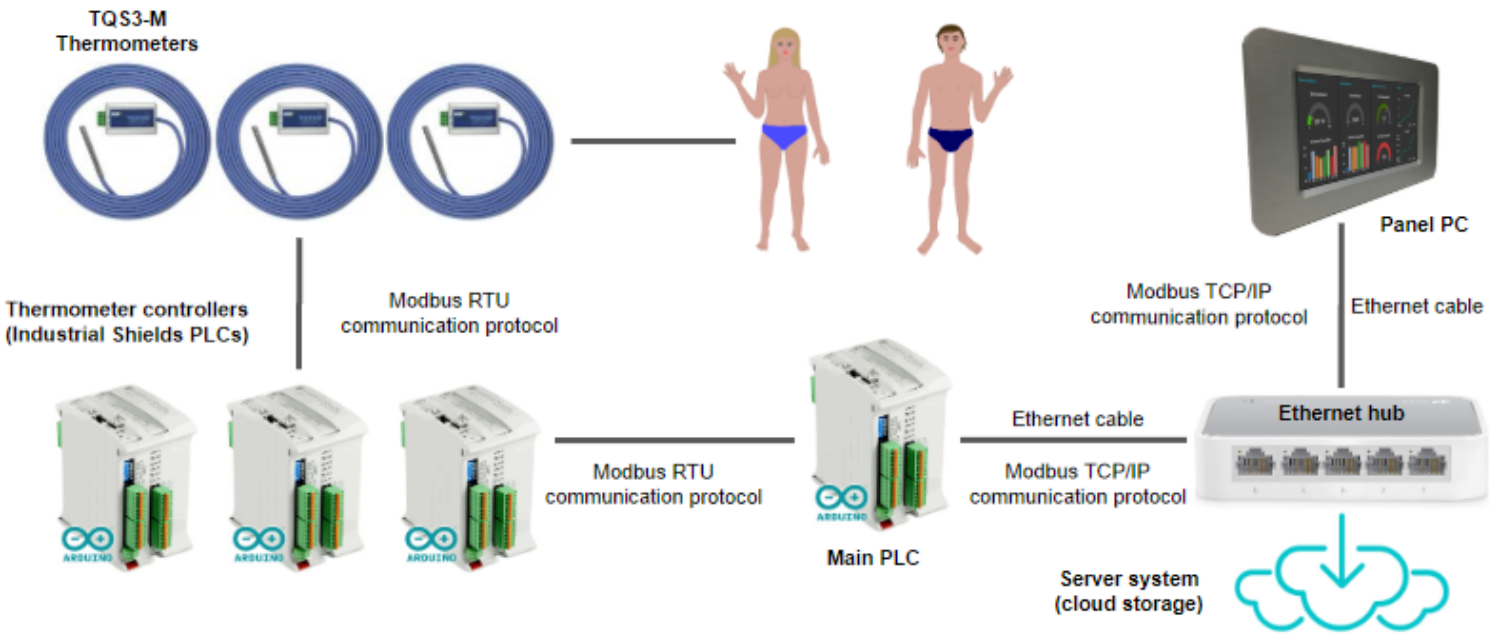
The **TQS3-M thermometer** will be the first thing used, by measuring the temperature to the users. The thermometer will send the users' temperature data to the **Industrial Shields PLCs** via **Modbus RTU**, which is a binary communication protocol with a continuous flow. After this, the controllers will use the same communication protocol to forward the data to the main controller.

A new communication protocol will be used from the main PLC. This will be **Modbus TCP/IP**, which reaches the devices through the **Ethernet network**. The operation of this protocol is very similar to the RTU one, but it uses the **TCP** (Transmission Control Protocol) and the IP (Internet Protocol).

The main Industrial Shields controller will send the data to an Ethernet hub that will be connected to a **Server system** and a **Panel PC,** also from Industrial Shields.

On the one hand, the Server system will work as a **cloud storage** and will be ready to store all the users' temperature data.

On the other hand, the Panel PC will be a visible interface for the instructions that the main PLC (**master**) monitors and/or the data that it receives from the other PLCs (**slaves**).



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CASE STUDY

INDUSTRIAL SHIELDS

COMMUNICATIONS FOR 4.0 INDUSTRY

In this case we want to show you how to implement a versatile system in terms of communication to control the storage and labeling of wine production.

This project consists of using different PLCs connected using several types of communications.

SUMMARY

We work with a wine factory that needs to control and monitor two rooms:

- In the first room, there is the bottle labeling and engraving line.
- The second room is the cellar where the bottles are stored for later sale.

To transport the bottles from one place to another, we will need to implement a conveyor belt system capable of redirecting the bottles on different belts depending on the capacity of the racks.

Our system will incorporate a **server** where all the data collected from the system will be stored, a **Panel PC** that will serve as a monitoring and control point and **four Arduino based PLCs**, in addition to **sensors** and **peripheral devices**.

CASE STUDY

IMPLEMENTATION

The whole system will be controlled by the master PLC that will be in charge of controlling the other three slave PLCs through LoRa (wireless radio frequencies communication protocol). This PLC will continously send the process information to the server using an ethernet connected router and then transfer it, in real time, to the Panel PC (control point)

The PLC nr. 2 will control the conveyor belts. Let's imagine that there are 5 belts to be controlled. The first one will be in the labeling and engraving line, the second one will take the bottles from this station to the storage area where they will be derived by 3 other conveyor belts depending on the capacity of the racks. If the first rack is full, the first conveyor will stop and the second one will turn on to fill shelf nr. 2 and so on continuously. This system can incorporate an unlimited number of conveyor belts depending on the capacity of the warehouse. This PLC will be an M-Duino 57R + since it has relay outputs that can activate monophase 220V engines that carry the conveyor belts.

The PLC nr.3 will control both machines, the labeling machine and the engraving one. So the labeling machine will communicate with the PLC through the RS-485 protocol since it is the most common in the market for this type of devices. The laser engraver could communicate with the same protocol, but we can take advantage of the versatility of the Industrial Shields equipment, doing it via Bluetooth, thus avoiding physical wiring. The equipment chosen for this application will be an M-Duino 21+ WiFi / Bluetooth.

Finally, the PLC nr. 4 will be in the warehouse where all the bottles on the conveyor belts are stored. In this case, the customer has asked us to control the temperature and humidity of the cellar so that the wine is kept in optimal conditions. In the racks we will install photoelectric sensors that will indicate the capacity of the shelves, in case they are full we can communicate it to the PLC nr.2 and activate the second conveyor belt to fill the second rack. To control the climate there will be a temperature and humidity sensor and depending on the selected parameters, we will turn on the dehumidifier and the air conditioning. Apart from seeing these parameters on the Panel PC we have installed a small LCD screen in the warehouse where we can also see them. This screen will be controlled through I2C, which is a very usefull protocol for this type of application. The PLC which will do this task is an M-Duino 19R+, also with relay outputs to activate the dehumidifier and the air conditioning.

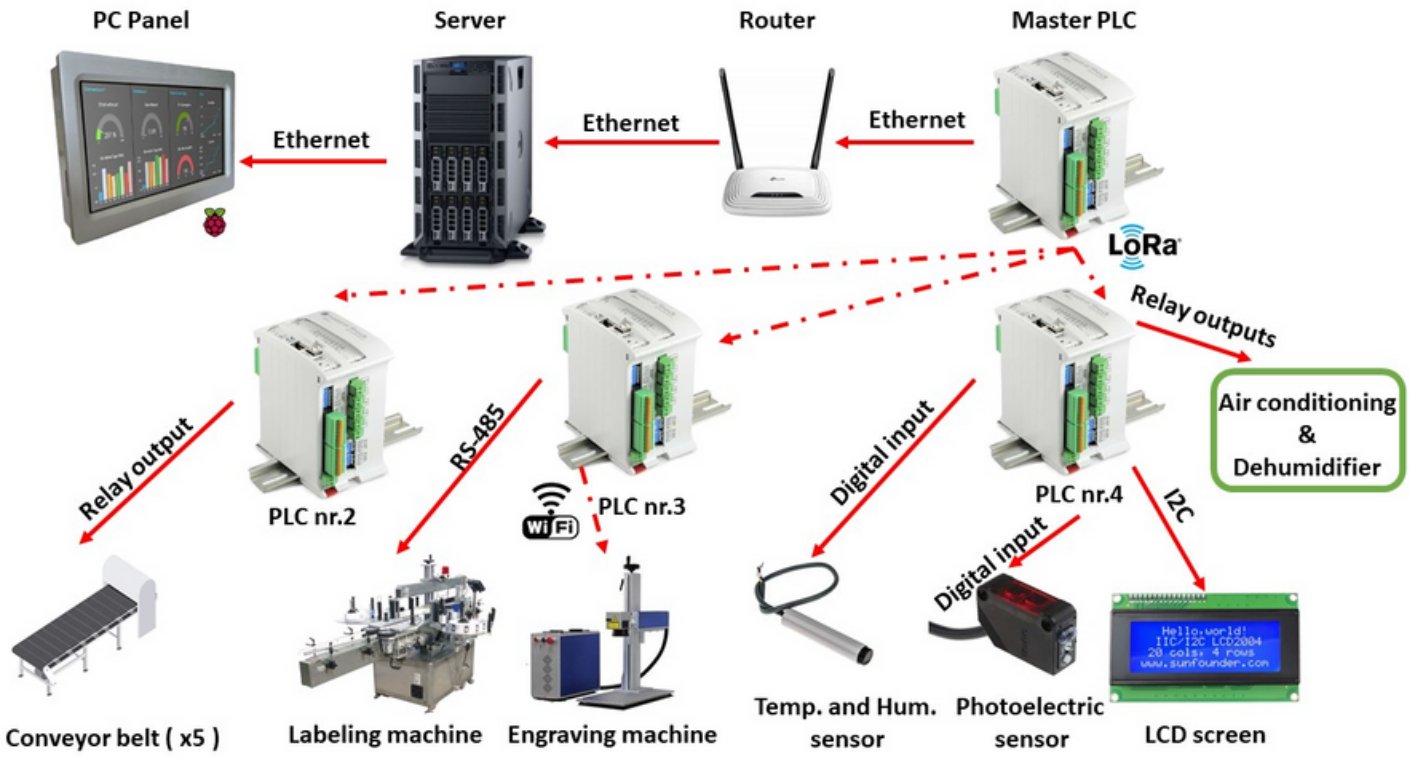
CASE STUDY

CONNECTION LAYOUT

This system can be easily replicated for any winery or bottling plant, adding elements depending on the needs of the system and extending it to several rooms or industrial warehouses since the LoRa communication has a range of more than 15km, thus creating a very wide network of controllers.

With this example we have seen the importance of the most innovative communications of Industrial Shields and also its effectiveness in terms of implementation since they are predefined and there are own libraries with example codes which makes programming simple apart from being Open Source.

Below you can see the assembly scheme of the system:



Industrial Shields

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CASE STUDY

INDUSTRIAL SHIELDS

CONTROLLING AN HVAC SYSTEM FOR DIFFERENT SECTECTORS

The purpose of this case is to show our customers that we can implement an HVAC system using Industrial Shields Arduino based PLCs addressed to hospitals, factories, pharma industry, etc.

The installation that we want to describe is composed of a control system with comunication protocol in association with cooling and dehumidifier devices.

SUMMARY

As hospitals, pharma industry, food factories, etc. need accuracy in their climatic conditions -necessities of air conditioning and saving energy-, Industrial Shields has thought about an effective solution to guarantee a high performance technology of control and monitoring the climatic parameters using its Arduino PLCs.

Due to the open source programming software Arduino IDE , the real cost of the project will consist just in the initial investment of the devices because the software will not have to be updated and no payment of license is requested.

CASE STUDY

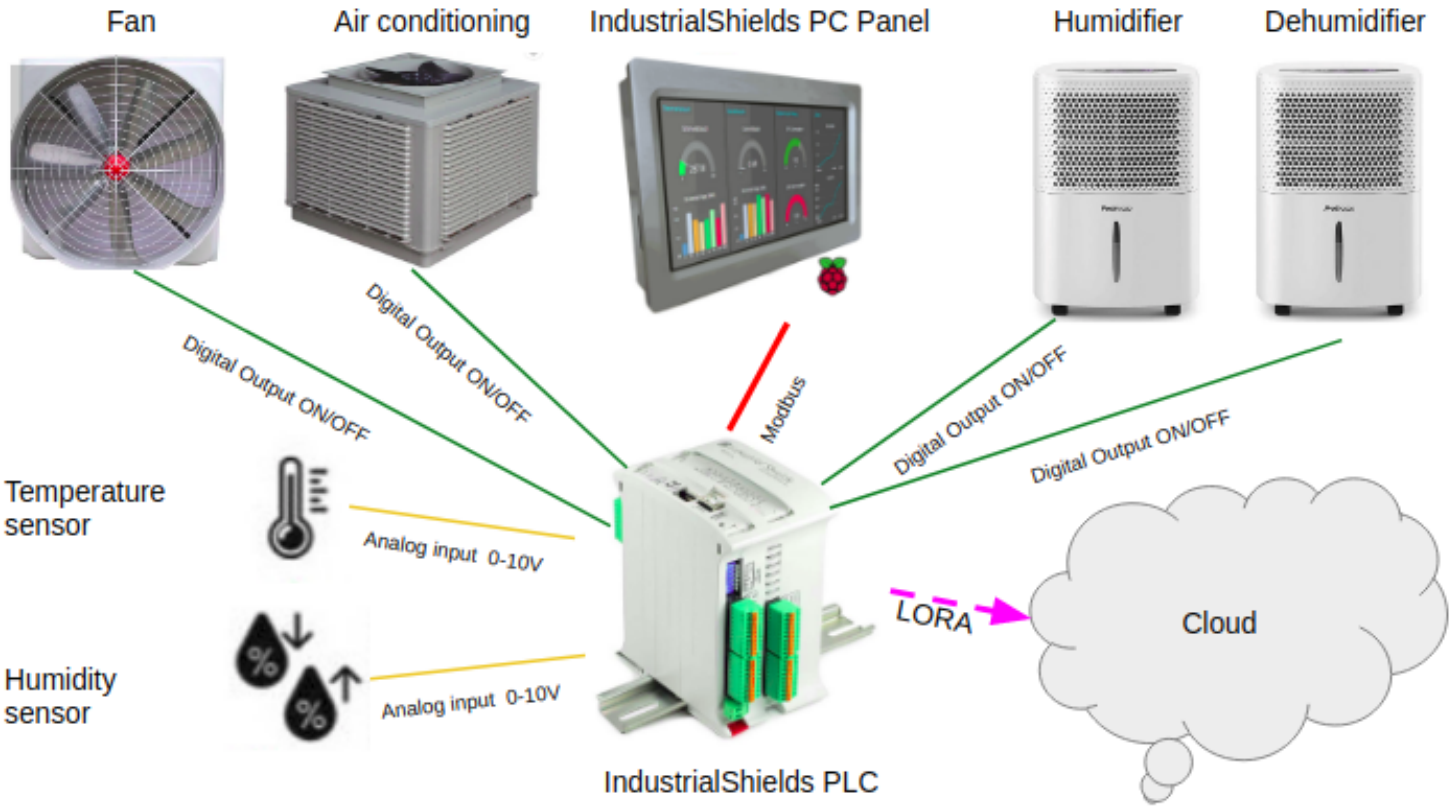
GOAL

The HVAC system has to control temperature, humidity and air quality, using a set consisting of: air conditioning equipment, humidifiers and dehumidifiers, fans, sensors, an Industrial Shields PLC and a panel PC. We have thought about this application due to the difficulty that involves keeping this kind of parameters in a certain range in hospitals, laboratories, pharma factories and all kinds of rooms where an exact regulation of climatic conditions is needed.

Apart from that, we need to save the energy used to operate these devices making them work just the time required.

CONCLUSION (HARDWARE)

To control these parameters, we just need the devices mentioned above. The PLC will get all the information from these sensors and it will be processed to actuate the air conditioning, the de/humidifiers and the flow system, depending on the values and the hysteresis that has the system. Due to the implementation of a PC panel, we can monitor the evolution of all the variables and make changes if necessary, activate and deactivate rooms, save historical data and send it by LORA to the cloud.



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CASE STUDY

INDUSTRIAL SHIELDS

CONTROL AND REGULATION OF PUBLIC LIGHTING

Knowing the state of public lighting and being able to control it from a distance are very useful functions when saving and modifying its use. In this Case Study, we will control and regulate public lighting using a "Smart Light Controller" (SLC). Thanks to its characteristics, we will be able to adapt the placement of the equipment according to our needs. We will make a database in SQL where the lighting data will be stored; from a server, we will allow to act on the lighting and program each zone separately (for example, the time of on and / or off).

SUMMARY

An SLC has been used for this project implementation.

A current analyzer is also required to measure the voltage and intensity in each of the lines that we activate. Communication between SLC and the network analyzers will be through an RS-485 channel using the Modbus RTU protocol for data transmission.

A database in SQL has been needed when saving data, Finally, we will have a server that can send action and configuration commands to activate each remote line.

Thanks to this system, the following advantages are obtained:

- **Controlling remotely the status of lights**: this way, we can implement a server with our own requirements.

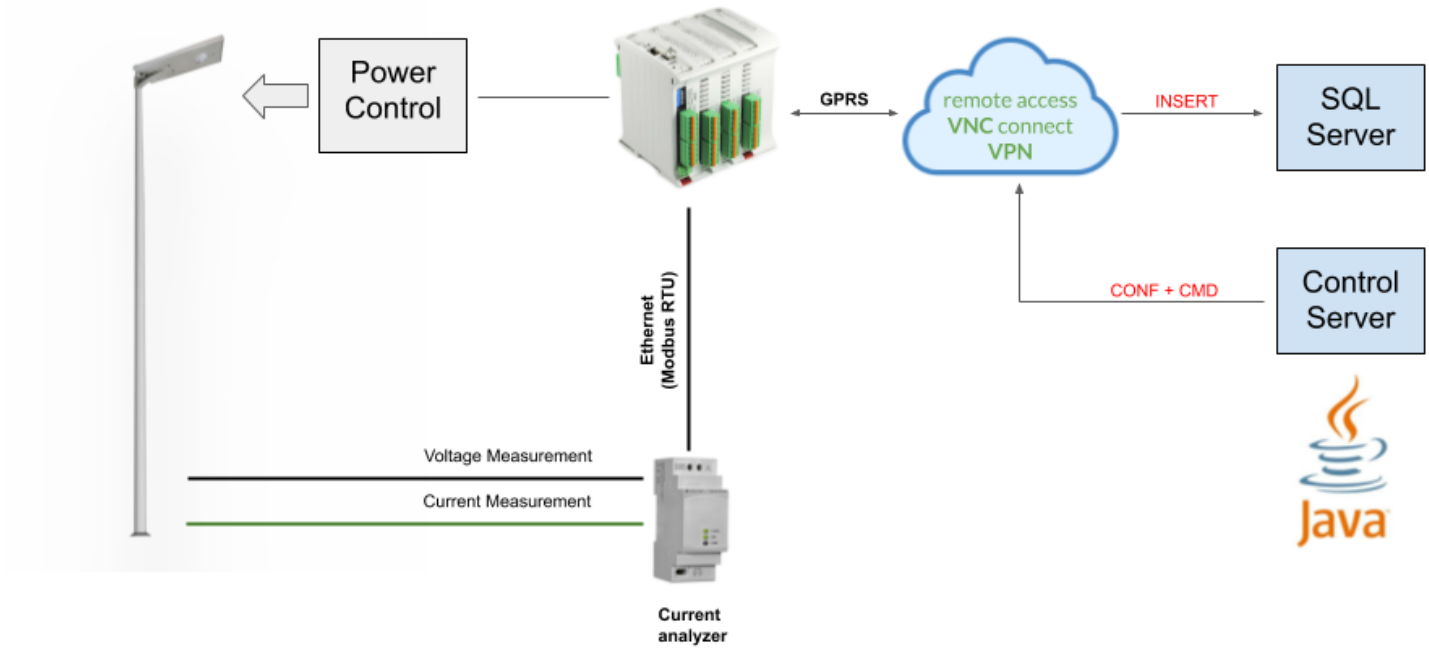
- **Status management**: Thanks to the fact that all the information about the status of the lines is being saved, we can program each system separately and make, for example, a zone light a little later to save energy, or turn it on a little earlier in order to avoid leaving a dark sector.

- **Security**: Optionally, a sensor for open door detection can be added to the electrical panel where the SLC and other components are housed to warn of possible thefts.

CASE STUDY

CONCLUSION (HARDWARE)

An SLC with relay outputs has been used to implement the system, The SLC will be connected to a line analyzer that will read the status of the area to which the device is connected. Communication between the controller with GPRS and the network analyzer will be through Modbus RTU using Ethernet.
The SLC will also be connected to the power control of each one of these lines. This control usually consists of a relay that opens or closes the power supply of the corresponding zones.
Finally, using the GPRS included in the SLC, a protocol to communicate with the server has been created . "Java" has been used to implement the control and configuration functions,
We will also make information entries in the database created with SQL, so that we can consult them every time we need to know the historical status of the lines, and manage several parameters selected by the customer such as the "on" and "off" time or the analysis of consumption, among others.



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CASE STUDY

INDUSTRIAL SHIELDS

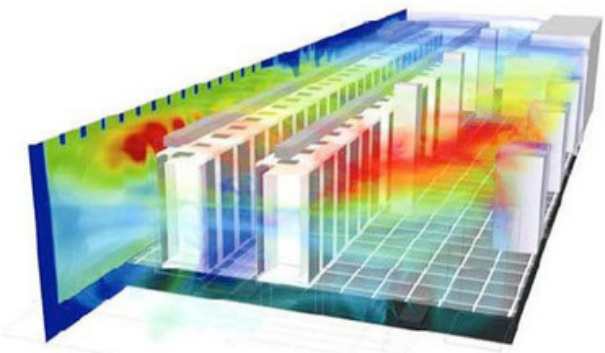
CONTROLLING TEMPERATURE AND HUMIDITY USING OPEN MOTE B

In workplaces, **temperature** and **relative humidity** must be kept at a comfort zone by law.
In this particular case, the warehouse temperature must be 23-27ºC in summer and 17-24ºC in winter, with typical value of 23ºC. Relative humidity must be within 30-70% around the year, with typical value of 50%.
The temperature and humidity ranges must be controlled **automatically** and sensors will be installed throughout the warehouse to ensure that the measurements are reliable.

SUMMARY

Elevated humidity levels promote the growth of mould, corrosion and rust on stored items. They cause condensation on walls, ceiling and floors, which helps to create conditions suitable for pests. It can also lead to additional insurance costs for mould and mildew claims from customers. During the heat of the day, humidity can be around 30% or lower, but that can be misleading because humidity can reach 70-80% during the night, therefore 24/7 monitoring is required.

Relative humidity (**RH**) is directly related to the temperature of the air. If the temperature of the warehouse increases, the relative humidity will decrease and vice versa. Relative humidity does not reflect how much water vapour is actually in the air, but it tells how close the air is to being saturated. That is why ideally humidity and temperature should be monitored simultaneously to have the full spectrum of the environmental data.



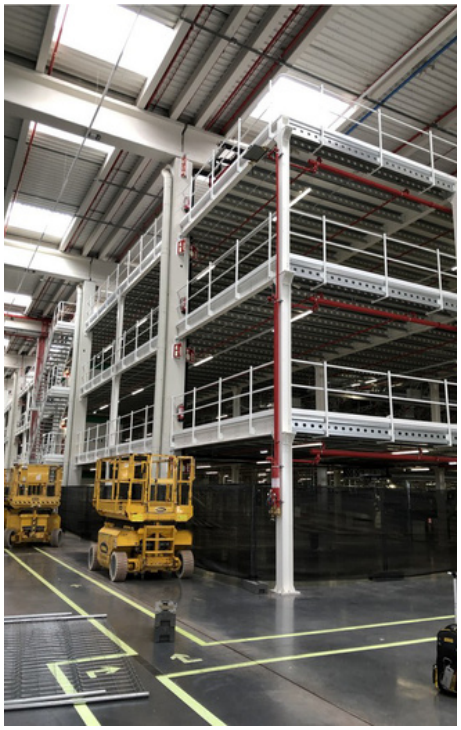
CASE STUDY

ENGINEERING CHALLENGE

Environmental conditions must be known to determine the necessary hardware. In this specific case, the points to be taken into account are:

- Warehouse measurements: 450x250 meters = 100.000m^2
- Measuring Temperature to 0.1ºC and Relative Humidity to 1% every 1 minute
- Nodes have to be low-power **(>1 year)**, cheap **(<100€)** and easy to install **(< 15 minutes)**.

WAREHOUSE OVERVIEW



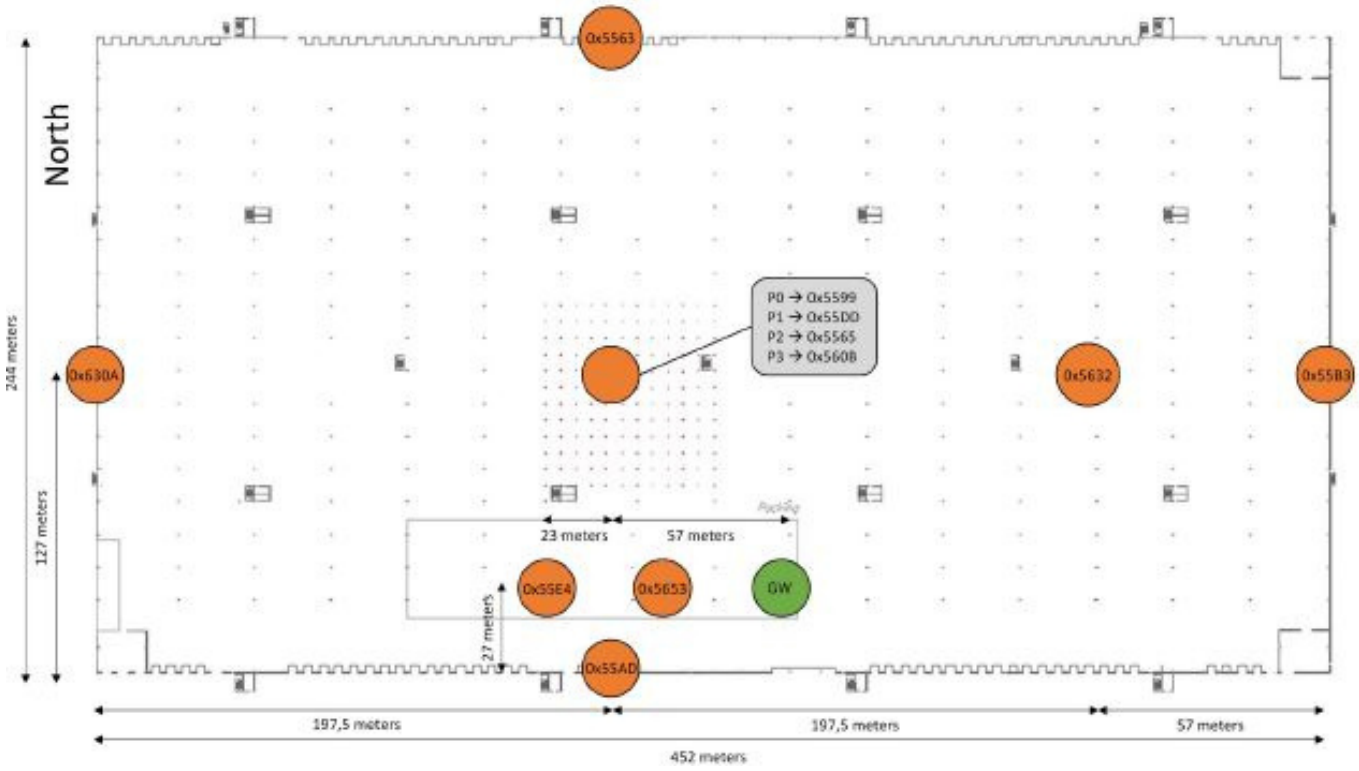
Analyzing the whole structure of the facilities, it has been determined that a total of **11 data collection points** must be installed. In them, the relative humidity and ambient temperature data will be taken and sent directly to the Gateway.

Apart from taking the temperature and relative humidity data, the **RSSI** and **CCA RSSI** statuses are also sent periodically to the Gateway to **measure the power level of the signals received** from each OpenMote B. In this way, we know the status of each device: if one of the modules is failing, it would be detected quickly both the kind of failure and the wrong module.

CASE STUDY

DEPLOYMENT MAP

Below you can see the distribution of the 11 data collection points around the warehouse. You can also see the position of the **Gateway** (green color). There is also a table attached with the respective OpenMote B distances from the Gateway



EUI-64 (last 2-bytes)	Distance (m)	Height (m)
56-53	34.0	12
55-AD	63.0	2
55-E4	80.0	6
55-99	115.1	2
55-DD	115.1	6
55-65	115.1	10
56-0B	115.1	14
56-32	172.5	2
55-B3	221.4	2
55-63	224.4	2
63-0A	273.5	2

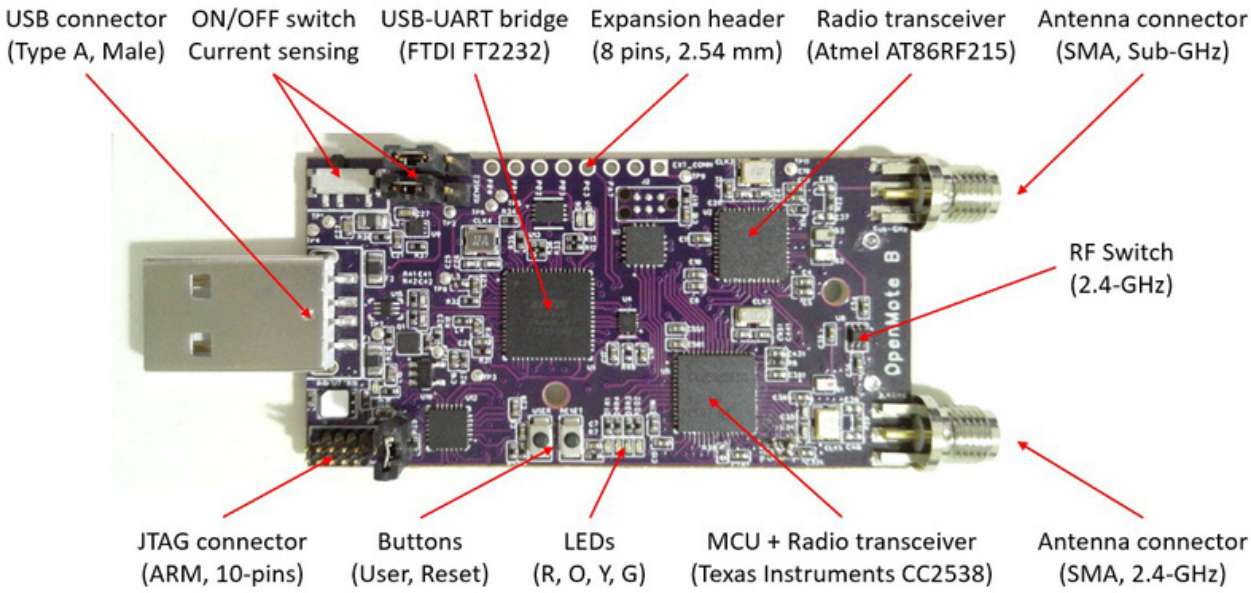
CASE STUDY

HARDWARE SOLUTION (SENSOR NODES)

Each data collection point is composed of the following components:

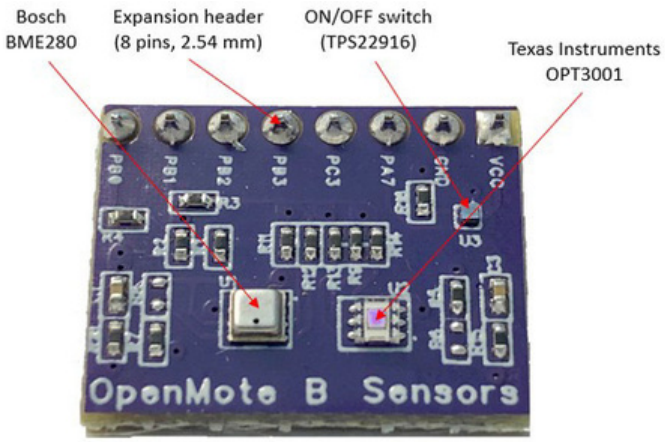
OpenMote-B board

- Texas Instruments CC2538
- Atmel AT86RF215
- 2xAA batteries (3V, 1500 mAh)



OpenMote-Sensors board

- Bosch BME280 (T, RH, P)
- Texas Instruments OPT3001 (L)
- Sensors have been calibrated with 1-point calibration to remove per-device offset



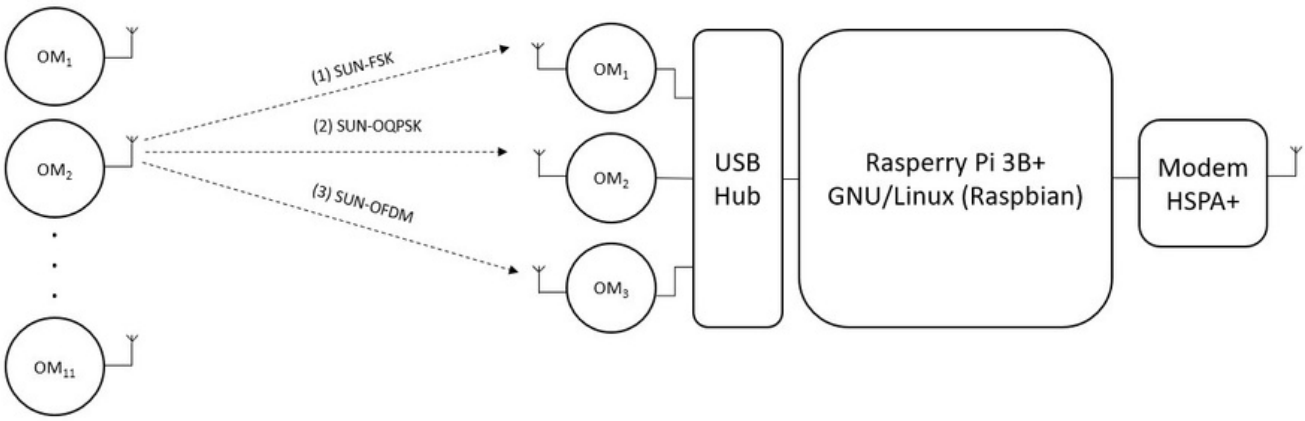
CASE STUDY

HARDWARE SOLUTION (GATEWAY)

The designed Gateway is composed of the following components:

Gateway Parts:

- Raspberry Pi 3B+ w/Raspbian
- 3x OpenMote B w/FreeRTOS
  - SUN-FSK, SUN OQPSK, SUN-OFDM
- 1x Huawei E3372 LTE w/ SIM Card (Movistar)
- Gateway Server w/Python 3
  - Serializes data from USB and transmits packets via MQTT



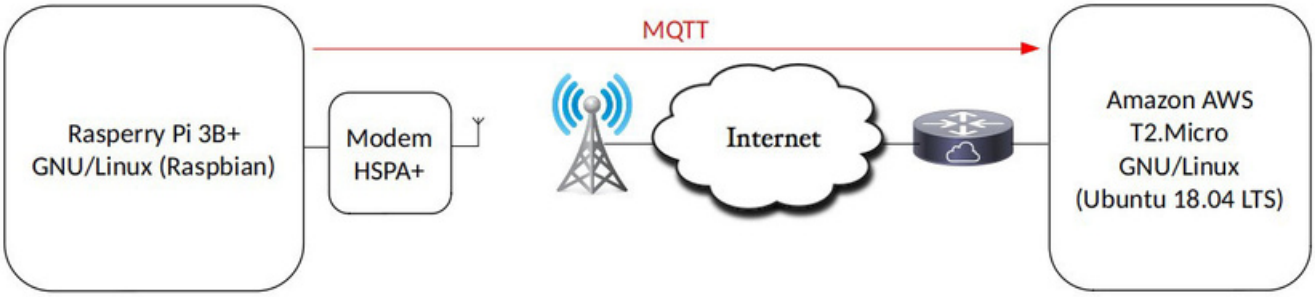
CASE STUDY

ARQUITECTURE SOLUTION

The system is inside the cloud; the back-end is deployed in Amazon AWS:

- T2.Micro instance w/Ubuntu 18.04 LTS
  - 1x vCPU (Intel Xeon E5-2676@2.4GHz)
  - 1 GByte RAM, 8 GByte Disk
- Cloud-Server w/Python3 (custom)
  - Receives data through MQTT, aggregates duplicate packets and performs calibration.
- Node-Red, Grafana & InfluxDB stack
  - Performs Monitoring: data aggregation, storage and representation.

ARQUITECTURE SOLUTION DIAGRAM



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CASE STUDY

INSTALLATION

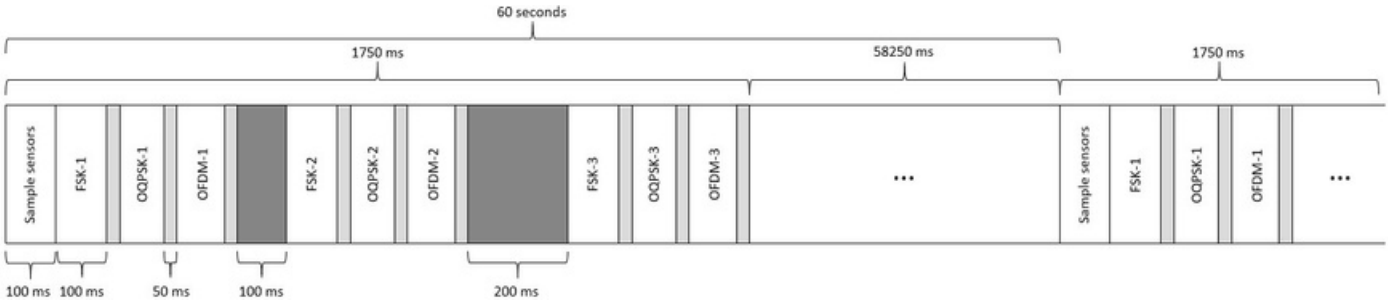
All the installation process was deployed in two phases:

- First Phase: (July 16): The Gateway and 5 sensor nodes were installed.
- Second Phase (July 30): Other 6 sensor nodes were installed to complete deployment.
- Each node took about 10 minutes maximum to be installed properly.

SOLUTION OPERATION

Every sensor in the network performs the following operation:

- Waking-up every 60 seconds and sampling the Temperature and Relative Humidity sensors.
- Preparing the data packet (sensor data) and transmiting it three times (at 100ms, 650ms, 1300ms)
- In each repetition, the packet is transmitted three times (FSK, OQPSK,OFDM) with 50ms separation



CASE STUDY

SOLUTION OPERATION

Regardless of modulation, every packet in the network has the following structure:

LENGTH	PAN ID	EUI-16	TX MODE	TX COUNTER	PACKET COUNTER	TEMPERATURE	HUMIDITY	PRESSURE	LIGHT	CSMA RETRIES	CSMA RSSI
1 Byte	2 Bytes	2 Bytes	1 Byte	1 Byte	4 Bytes	2 Bytes	2 Bytes	2 Bytes	2 Bytes	1 Byte	1 Byte
0-255	0xCAFE		{0,1,2}	{0,1,2}	$\{0 - 2^{32}-1\}$						

It is important to consider that:

- When transmitting, the packet encodes (FSK, OQPSK, OFDM) and the counter transmits the repetition (1,2,3) for each data collection module.
- Packet counter is monotonically increasing and allows to detect packet losses and node resets.
- Packets are transmitted using CSMA-CA and CCA, with 3 iterations if channel is found busy.
- Packets are 21 bytes long, but encrypted using AES-128. The final PSDU is always 32 bytes.
- CSMA RETRIES inidcates retries for each mode, CSMA RSSI indicates the channel noise when transmitting.

RESULTS

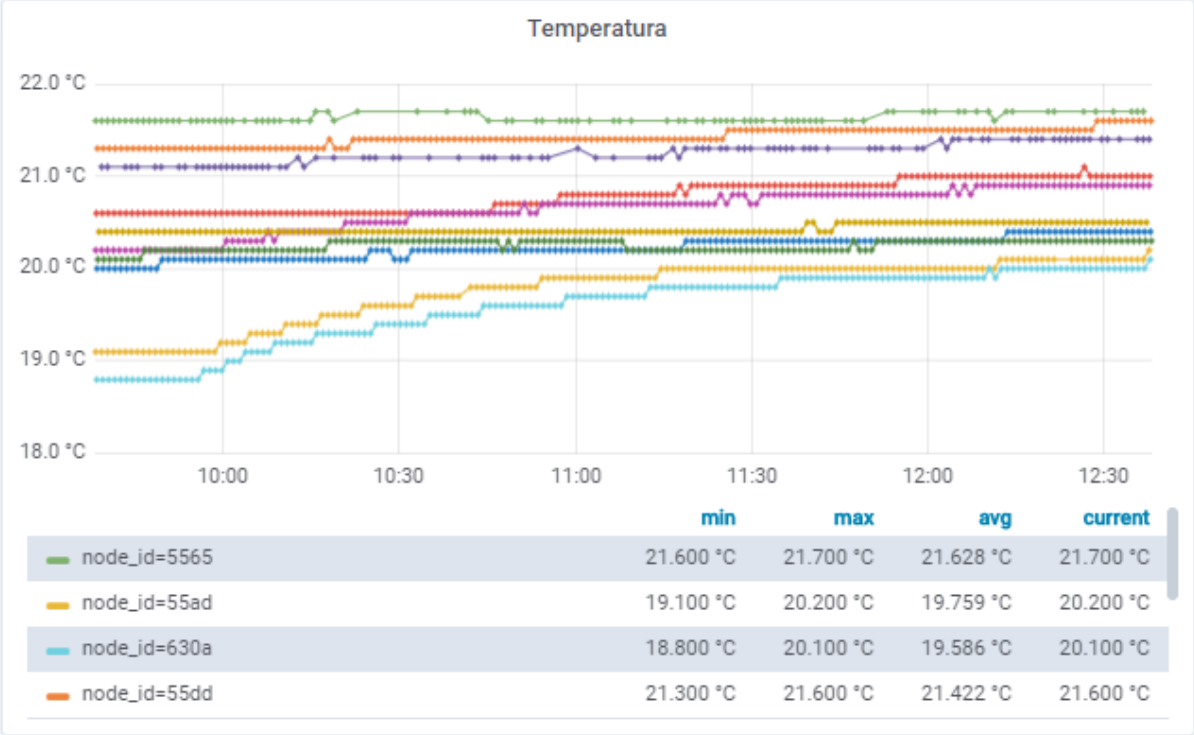
Finally, the main needs that the client marked at the beginning of this project have been met:

- A system where each wireless data collection node has cost less than € 100 has been achieved.
- Measurements of both temperature and humidity are obtained simultaneously from the 11 points every minute.
- Thanks to the sleep method, a lot of battery from the wireless nodes is saved, so they will last more than a year without changing batteries.
- The average installation time of each node has been shorter than requested (15 min), which has been lowered to 10 min
- Additionally, with the study of the RSSI and the CSMA RSSI it is possible to know if any of the nodes have transmission problems and quickly detect a system failure.

CASE STUDY

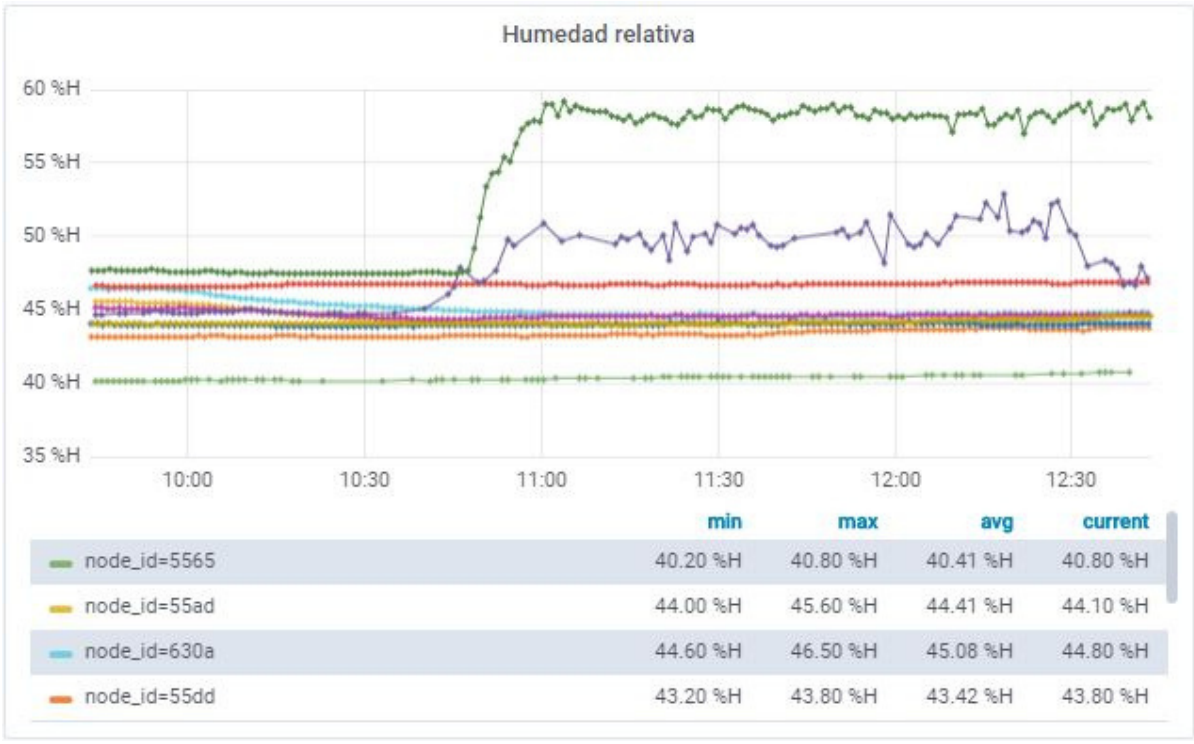
RESULTS (MONITORING)

Temperature graph



	min	max	avg	current
node_id=5565	21.600 °C	21.700 °C	21.628 °C	21.700 °C
node_id=55ad	19.100 °C	20.200 °C	19.759 °C	20.200 °C
node_id=630a	18.800 °C	20.100 °C	19.586 °C	20.100 °C
node_id=55dd	21.300 °C	21.600 °C	21.422 °C	21.600 °C

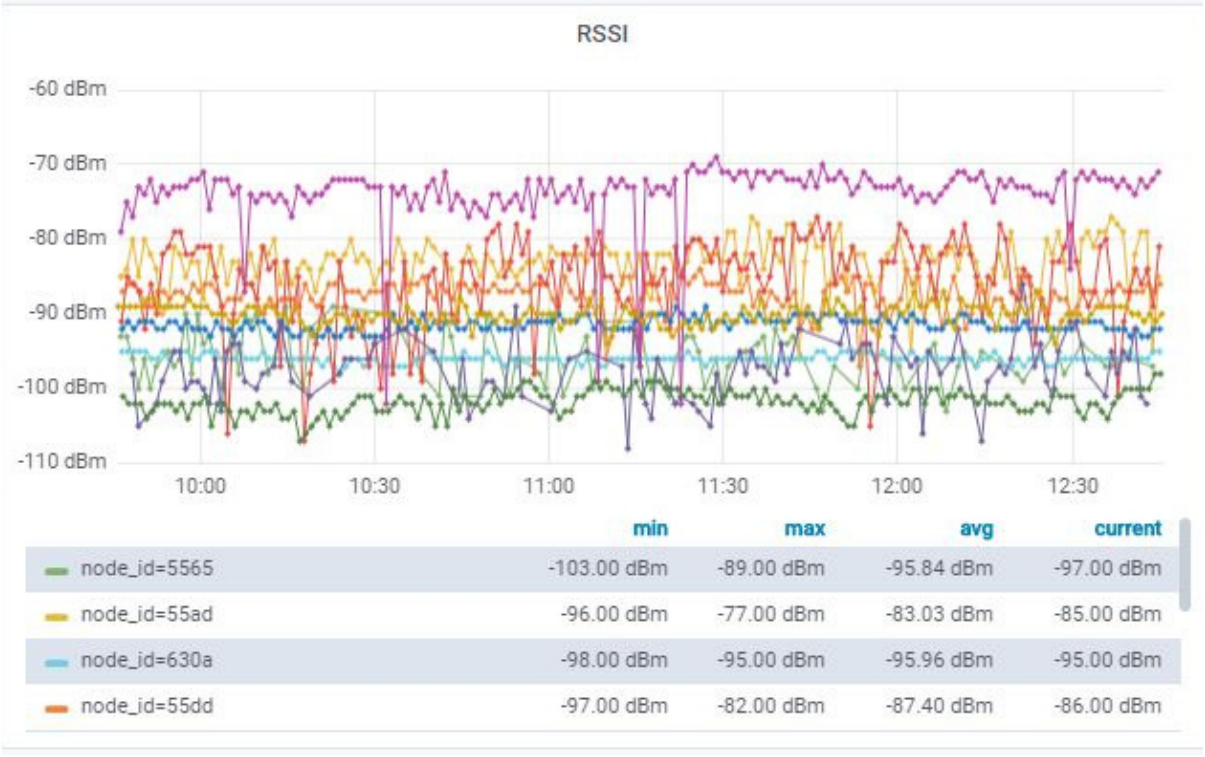
Relative humidity graph



	min	max	avg	current
node_id=5565	40.20 %H	40.80 %H	40.41 %H	40.80 %H
node_id=55ad	44.00 %H	45.60 %H	44.41 %H	44.10 %H
node_id=630a	44.60 %H	46.50 %H	45.08 %H	44.80 %H
node_id=55dd	43.20 %H	43.80 %H	43.42 %H	43.80 %H

CASE STUDY

RSSI graph



CCA RSSI graph

CASE STUDY

INDUSTRIAL SHIELDS

PRODUCTION MACHINE CONTROL

The open source M-DUINO PLCs control the production machine

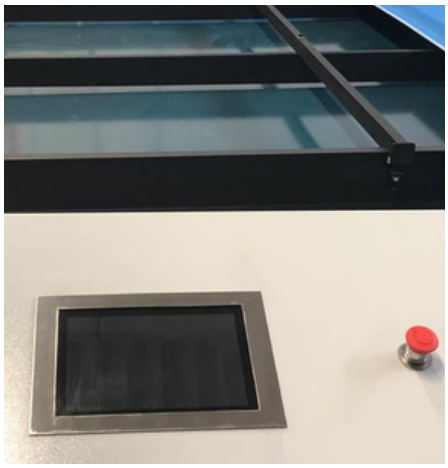
About the customer

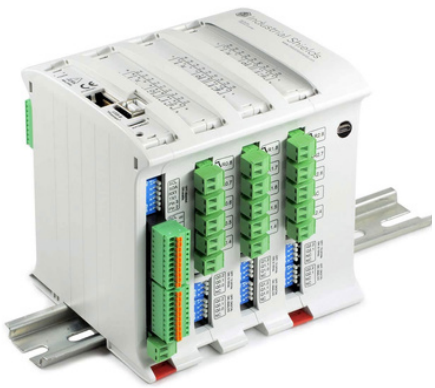
This is a company founded in 1992 which is dedicated to the repair and manufacture of spare parts and machines for textile machinery. It has an engineering department and manufactures special machines. In 2018, it expanded its offer of services to its customer portfolio with the incorporation of specialized staff in process improvement solutions, production, automation and other services focused on digital transformation within what can be considered INDUSTRY 4.0.

SUMMARY

Arduino industrial controllers allow the monitoring of complete machines or production lines in order to obtain relevant data. Some data can be monitored in real time using the PC Panel based on Raspberry Pi. The adjustment of specific parameters to be monitored will allow the activation of alarms and/or warnings.

Other data that require analysis and a historical summary, will allow decision-making related to predictive maintenance or continuous improvement. Through the Arduino PLC and the Raspberry Pi Panel working in tandem, control actions can also be carried out on elements of the machine or the production line itself.





CASE STUDY

GOALS

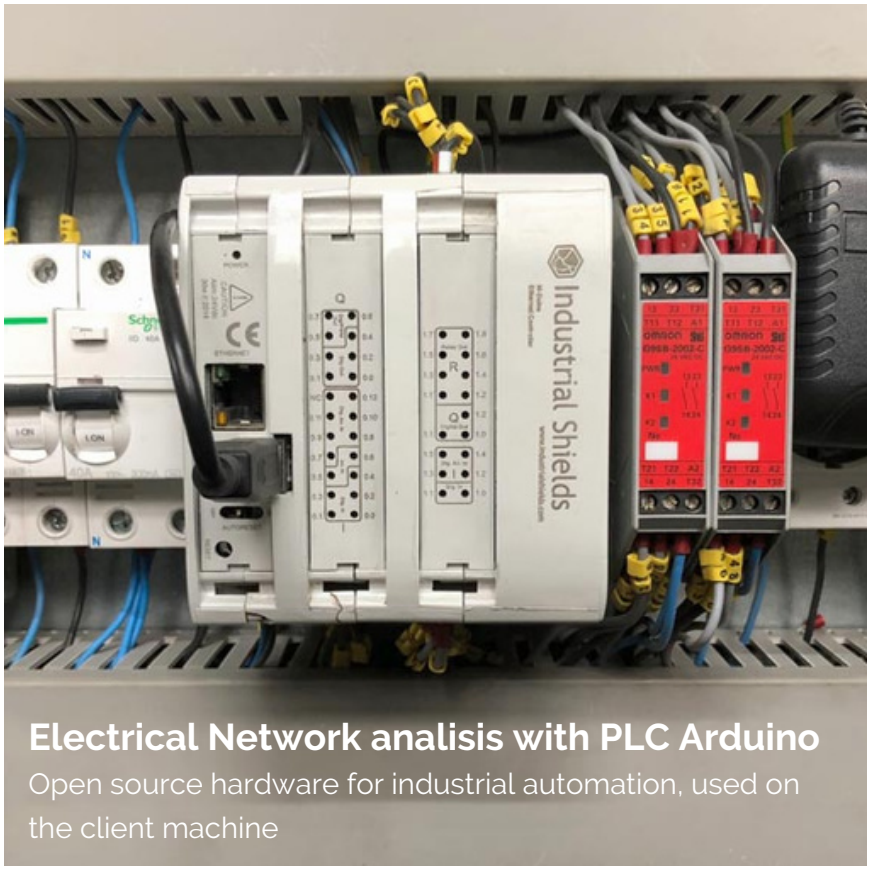
The Industrial PLC controllers are connected via Ethernet to the production network. The use of this network allows the industrial controller to receive information from the different encoders and sensors to control the state of the machine. All data is sent to a MySQL database, where it is analyzed to control the performance and efficiency of the machine, consumption, etc. This MySQL database is connected to the resource planning tool for machine maintenance.

The company's goals are:

- Improving the efficiency of its production with an Industrial Controller Arduino
- Preventive and predictive maintenance

The installed software allows:

- Capturing data from machine sensors.
- Monitoring the machine with the indicators customized by the customer and receiving alerts sent via mail or mobile messaging.
- Receiving warnings/alerts of preventive maintenance according to established parameters in the production lines.
- Doing a predictive maintenance of the machines thanks to available historical data specific sensors.



Electrical Network analisis with PLC Arduino
Open source hardware for industrial automation, used on the client machine

The Raspberry Pi Panel PCs allow the customer to start monitoring data in real time.

Raspberry Pi®

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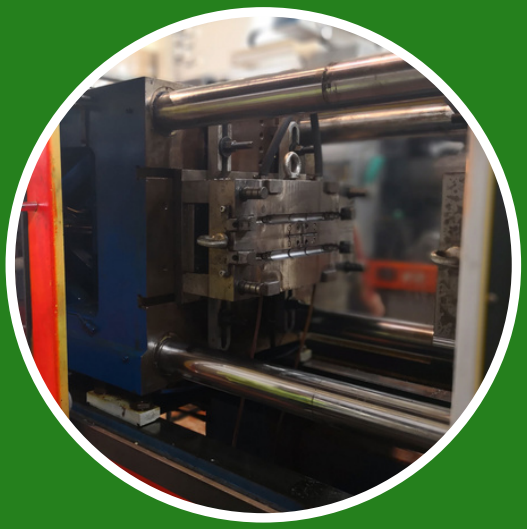
CASE STUDY

INDUSTRIAL SHIELDS



IMPROVING A MANUFACTURING LINE

This project is designed to improve the production line of a small factory which is dedicated to the production of indicator parts for cars. Our customer needs improvements in three verification processes to reduce non-compliant products. The company needs to ensure that the holes made by a drill in the pieces using a support are placed in the right position. They also need to check that the LEDs placed in the pieces work correctly. Finally, they need to verify that the QR sticker deposited on the products can be correctly read. In this case, the company requests a solution as economical as possible.

SUMMARY

A small company which works making components with indicators for cars needs to improve its manufacturing process because they have detected problems during the drilling process and in the QR used for traceability, They have detected that QRs are not correctly read in 7 % of the cases. In addition, they want to verify that the LED strips of the system work correctly as well.
As the support was manufactured with a measurement error, there is a problem in the drilling process which makes the piece not fit perfectly.
Due to the environmental state of the factory, QRs are not sometimes printed correctly.
Regarding the LEDs, they never had any significant problems, but the company wants to be able to verify their quality even changing their supplier.
As this is a small company, a very economical and efficient solution is requested.

GOALS

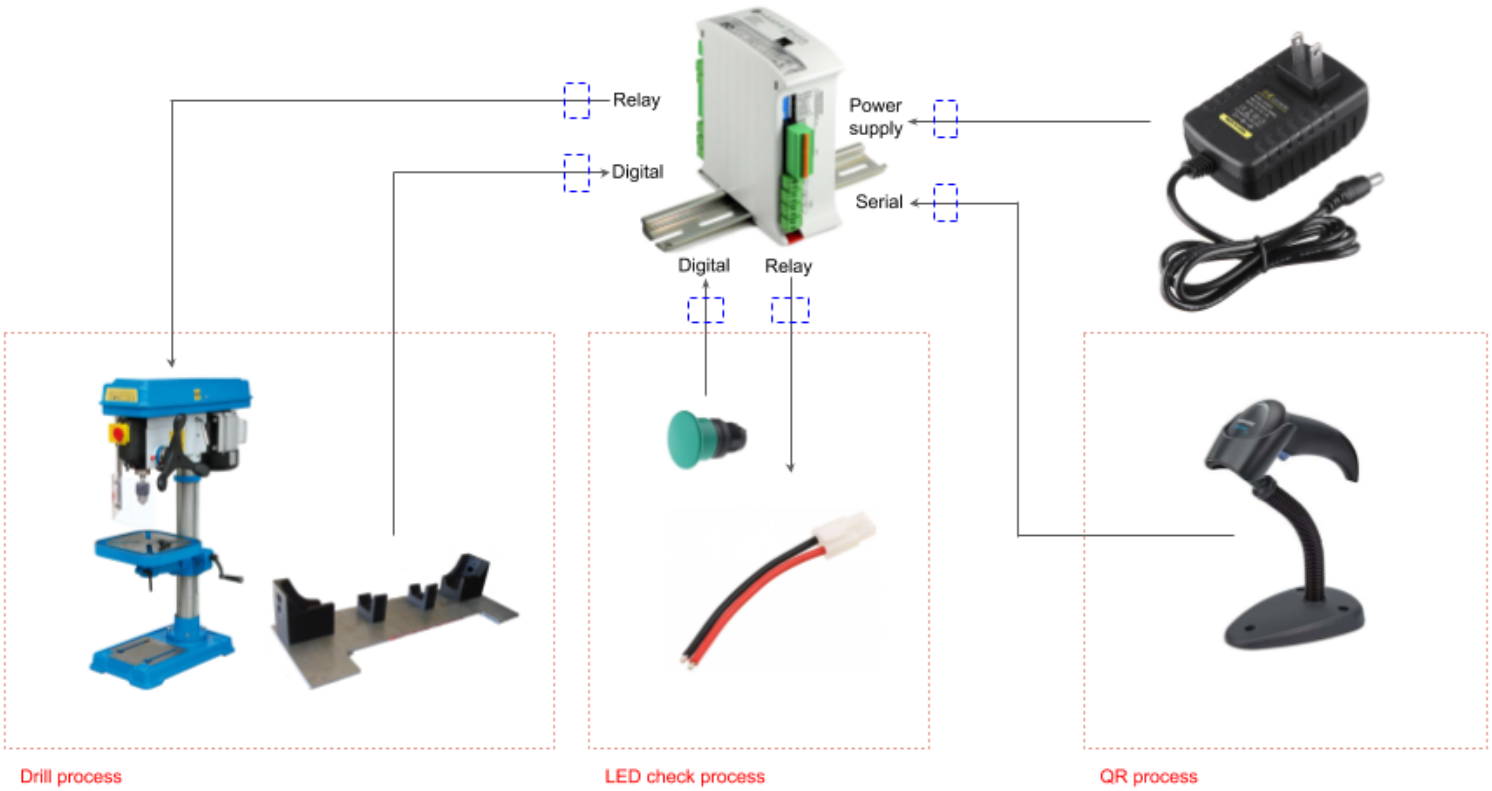
The main points of the project are as follows:

- Ensuring that the plastic part is correctly located when the drilling process begins.
- Turning on the LED strip so that the operator can verify that they work correctly.
- At the end of the process, verifying that the QR codes can be read correctly and allowing the operator to check it before finishing the process.
- Minimizing the budget, so that these improvements do not involve a very high cost and the expenses can be recovered in the short term.

CASE STUDY

CONCLUSION (HARDWARE)

In this case, we will use an **ARDBOX PLC 20 I / Os RELAY HF** which will allow us to act with the relays on the 230V supply of the drill.
First of all, we have to keep in mind that we will take advantage of a 12V / 2A power supply that the company had from a prototype that they made long ago. In this way, we will be able to feed the PLC without spend resources on a new power supply.
To make the first modification, we will place a small button on the support which will be active when the piece is correctly placed. We will develop a program to disable the current on the drill if no pieces are detected or they are wrongly placed. Therefore, it will not be possible to make any holes while the piece is misplaced.
Regarding the LEDs, the same power supply used to power the PLC will be connected to a relay, so that when pushing a button, this relay will be activated and the LED strip will turn. This will let the operator see that the lights work correctly.
Finally, we will place a reader that works by RS232 in order to check the QR. The PLC will read the QR. If it receives a correct reference, a LED will be lighted up to inform that the QR has been correctly read.
The whole system we have installed has cost less than 300 € (including the QR reader, the LEDs and the button). Moreover, we must keep in mind that there are still free PLC inputs and outputs, so more processes could be carried out with the same PLC.



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CASE STUDY

INDUSTRIAL SHIELDS

AUTOMATED WAREHOUSE

In this case, a warehouse will be automated to store boxes of different weights in a group of shelves. The solution will be able to request stored products and send them to their corresponding line at the loading docks as well.

To have a good traceability process, a tracking system will also be implemented using QR codes. This will let the user know, at all times, the state of the warehouse. Touchberry touch screens will be used to display the package information and inform the operator that is receiving the goods as necessary.

This system will be remotely manageable thanks to a server that will connect every process via WiFi.

SUMMARY

The boxes enter into the system by reading the QR code that identifies them. The application weights the parcel and stores it in the warehouse, placing the heaviest boxes at the bottom of the shelf. Once a box is requested at a loading bay, the application searches on the warehouse and positions the parcel on the shipping conveyor. When a package for a specific dock is detected, it is moved to the conveyor in its own area.

GOALS

The requests of this system are as follows:
- Automated storage of a stock of boxes.
- Performing and recording the tracking of each package.
- Optimizing the energy consumed by raising loads.
- Operating at several shipping docks.
- Remotely managing the state of the warehouse.

A single PLC controller will take care of the engine management.

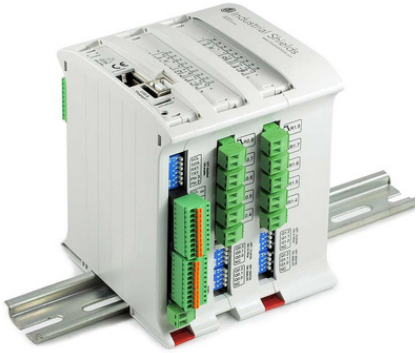
We will also have PC Panels in the shipping area and in every loading dock for information and management of the tasks to do.

STUDY CASE

CONCLUSION (HARDWARE)

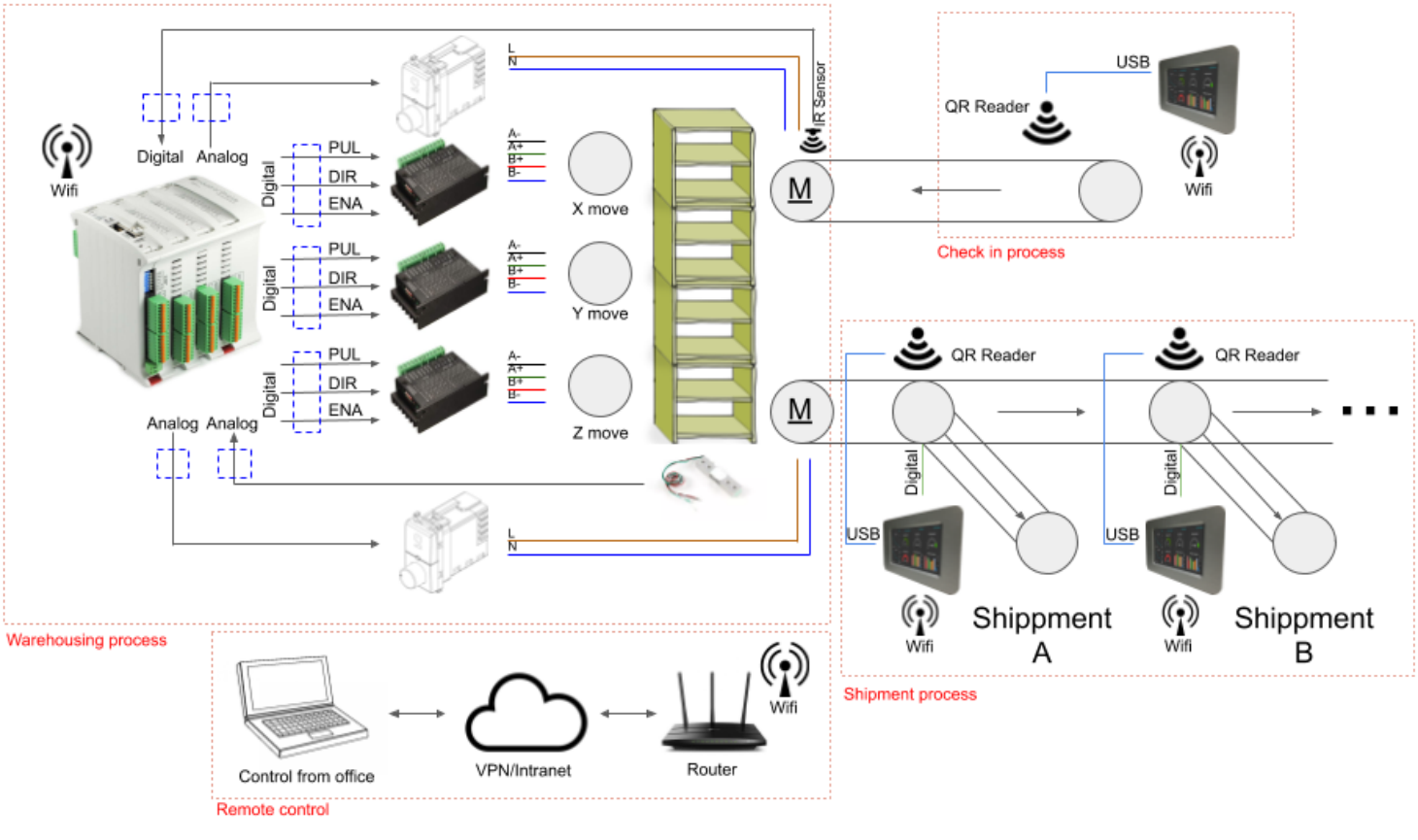
The information will be entered through a Touchberry screen, which allows the connection of a QR code reader and provides WiFi connectivity.

Once a new box is detected in the system, the Arduino PLC (M-DUINO) will turn on the conveyor through a drive. When the box reaches the warehouse location, a system consisting of three servomotors will act on the package.



The system will weigh the load by an extensiometric gause and will be able to sort the heaviest loads in an ascending order, optimizing the energetic resources and improving the structural load in the warehouse.

After requesting a package from a Touchberry screen or directly from an external server, an Arduino automaton will send the collection of the parcel, bring it to the conveyor, and divert it to its area by a QR reader. This will happen when the shipping dock screen detects that the box is directed to its position.



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CASE STUDY

INDUSTRIAL SHIELDS

MONITORING TRAFFIC VOLUME IN A PETROL STATION

In this case, our client located in Tarragona (Spain) wanted to monitor the traffic of vehicles at his service station. In 2016, service stations in Spain could only change the price of fuel once a day. Currently, each station tries to develop its own system to fluctuate prices according to customer behavior.
Therefore, our client wanted to have a real-time study of vehicle traffic in their area to have solid data and have a market strategy based on the data collected.

SUMMARY

Today, service stations are not just places to fill your car with gasoline. They are centers that concentrate a very wide commercial offer of products and services for vehicles and occupants: refueling, restaurant, car wash services, workshop, supermarket, among others.

Knowing the behavior of the consumer in different periods of time, and on specific dates, allows service station managers to plan the commercial offer to launch special promotions or even adapt the price of fuels at key moments, how they could be on weekends or the busiest hours on holidays.

The solution proposed by Industrial Shields in this case adapts to the environment and uses wireless communication to collect and send the data to a server.

GOALS

- The fuel company wants to know the average duration of the stay of the vehicles, to have forecast of specific moments where queues are generated to refuel and when to make changes in the price of gasoline, among other utilities.

- Also wants to know the rate of vehicles that access the service area and do not refuel. This is important to know not only the vehicles that do not refuel but also those that stop to consume at the bar or the store of the gas station, that way is it possible to know the best time to promote products, both from the store, the cafeteria or the gas station.

- The project has also planned to measure the volume of traffic that passes along the road in front of the service station every hour to compare data with customer consumption.

CASE STUDY

CONCLUSION (HARDWARE)

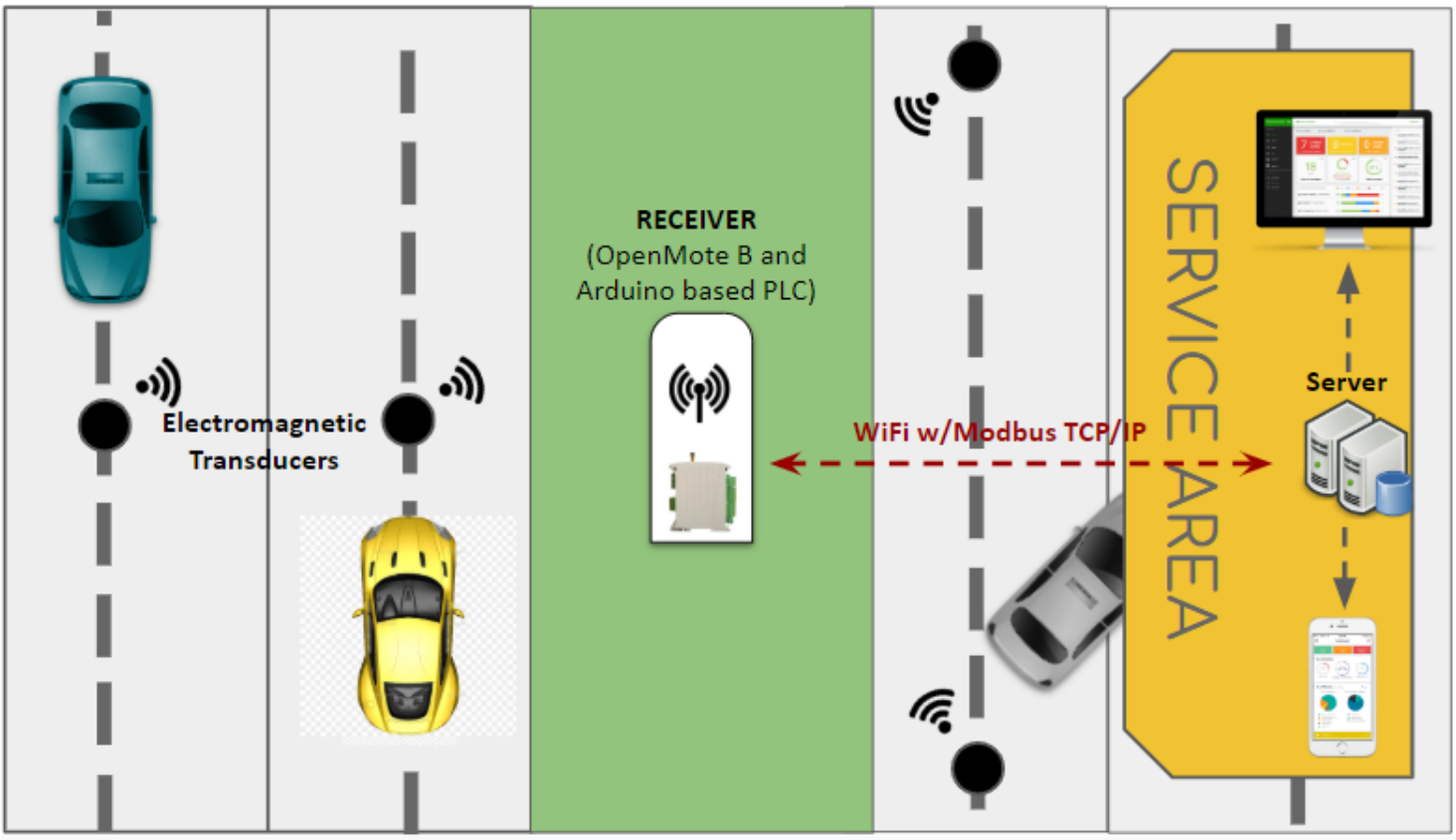
To obtain all the traffic information in the area near the service area, the following system has been prepared:

To detect the vehicles: electromagnetic transducers have been located in each of the lanes of the highway that pass just in front of the service area, the transducers have also been placed at the entrance and exit to the service area to be able to study the vehicles that enter, and the average time each of them spends inside the station.

Each time they detect a vehicle, electromagnetic transducers send the data captured via radio to the receiver. The receiver is an OpenMote B module that receives data from all transducers installed in the area. OpenMote B modules work with Open Source 6TiSCG implementation.

The OpenMote B receiver is connected to an Industrial Shields controller of the WiFi & Bluetooth LE family. The Industrial Shields PLC can log into the local network of the service area via WiFi and using the Modbus TCP/IP protocol..

The data is stored on the server and monitored with the use of Node-Red. The client can access the data and visualize it according to the area, the desired time slot and even compare them with other days to facilitate the study of traffic.



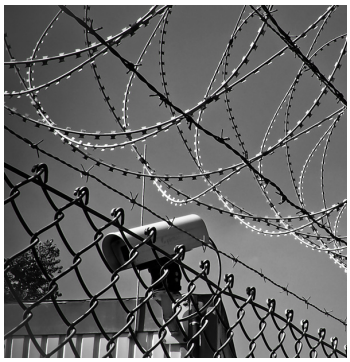
CASE STUDY

INDUSTRIAL SHIELDS

AUTOMATED SECURITY SYSTEM

This project is designed to make a fully-equipped security system capable to be focused to different dangers, adapting itself to specific objectives. It is going to encompass a large range of possible hazard points as the steals, the fires and the gas contaminations. All of these will be tracked by different kind of sensors, managed by an Arduino based PLC. The data is going to be monitored by several PC Panels and a MQTT Server which will provide the possibility of the simultaneous connection of distinct devices. It will provide a 24/7 backup, saving the data in the SD card and sending it to the Server through an optimized and secure method called FTP.

SUMMARY



The system is going to follow a defined structure. The data will be registered by several sensors; to have stealing protection, they going to be needed security cameras and motion sensors, for more industrial dangerous processes, it will be important to have gas and fire protection with the respective sensors for each other. All of this information will be sent to an Ethernet & GPRS/GSM PLC which will be the center of operations of the system. To be monitored and controlled, these data will be shown, though a Switch, to several Panel PCs and, through a broker MQTT Server too, it will bring the chance to manage the system with an external remote device as a phone, tablet or PC. All the interface is going to be based in Node-Red. It is crucial to have a backup; the sensors data is saved in the PLC's SD card and send to the Server using FTP and the camera part is sent directly to the server because of the size of the video files.

OBJECTIVE

The main points to achieve are the following:

- Automate a security system.
- All processes controlled and monitored 24/7.
- Easy management; through the PLC, the Panel PC, even so using a mobile phone, a tablet or a PC.
- High security level; the system is going to be built to be proof against thieves, hackers, fire and gas.
- Versatility as a security weapon; more sensors and monitoring methods could be added and the data always have a backup using different communication ways (Ethernet and GPRS/GSM).
- Adaptability; the system could be modified respect the hardware and reprogrammed respect the software to adapt to every little change in the system.

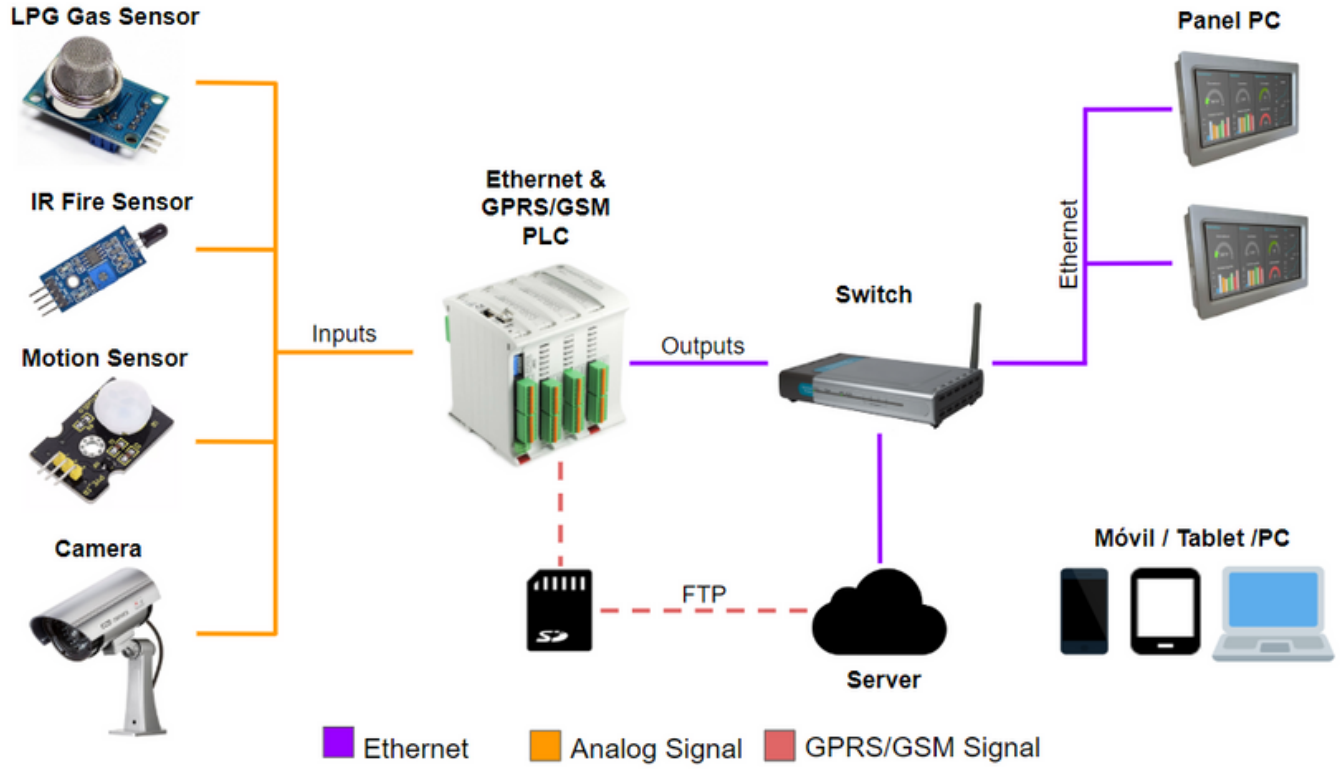
CASE STUDY

FINAL SOLUTION (HARDWARE)

The security system will be fully automated, instead of some specific parameters that have to be set and the reaction method chose against the danger. There will be four type of sensors; motion sensors and security cameras to avoid robberies, Infra-Red sensors to avoid fires and gas sensors to avoid intoxication caused by this kind of contamination. The information collected by all of these analog inputs will be processed by an Ethernet & GPRS/GSM PLC that is going to be previously programmed for this kind of use. The communication between the sensors and the PLC could be done using different protocols as RS232 and RS485, always checking if the sensors support them.

Once the data passed through the brain of the system, it has to be monitored by two different methods; the first one is using several PC Panels connected by Ethernet cable and a Switch to distribute the different connections. The second one is, using a MQTT dedicated Server where the data is sent, you could connect to it and manage the system with different devices such as phones, tablets and PCs, anywhere and anytime. Both ways are going to provide a Node-Red based interface, easy to interact and ready to fit to different professional profiles.

A very important factor and more in a security system is to have a backup copy, always available to be consulted. This distribution provides one divided in two parts; the sensor data is saved in the PLC's SD card and send through GPRS/GSM signal to the Server which is going to be the information warehouse. Whereas the sensors backup will be sent with FTP (File Transfer Protocol), the camera recordings are going to be saved directly to the Server because the video files are too big for this protocol.



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CASE STUDY

INDUSTRIAL SHIELDS

RESTAURANT ORDER SYSTEM

This project is designed to make an order system for restaurants, capable to be adapted to different needs and made to fit in the modern restaurant sector of nowadays. The system will be automated using a PLC as the center of control and data bank, a switch and some PC Panels to monitorize and interact with the information input-output feed.

This application is created to work with two types of connection, Ethernet and WiFi, and it will be necessary an MQTT server connected through a VPN to the WiFi PLC. This database could be shown on several Panel PCs based on Rasberry Pi3 that will monitor all the information.

SUMMARY

The system will follow some defined patterns. The clients will have at their disposal three different ways to order the food; through the classic Q&A model, using their own mobiles or tablets inside the establishment through a brand new order application, or the delivery method using the website or calling to the restaurant phone number. All this information will be sent to an Arduino based PLC through WiFi or Ethernet connection, where the information will be processed. The PLC will be connected to a switch through Ethernet cable and this to several Panel PCs to monitorize all the orders. The screens will be distributed on the kitchen and the order preparation area. The interface of the Panel PCs will be easy to use, made with Node-Red, and the restaurant workers will be able to introduce infromation and interact with the panels to ensure that the orders always follow the right way until be prepared for the client and, in the case of the take away food, to be delivered, tracking all the process.

OBJECTIVE

The main points to achieve are the following:

- Restaurant order system semi-automation.
- All processes controlled and monitorized all the time.
- Easy management; through the PLC, the Panel PC, even so, using a mobile phone or a tablet.
- Divided labor camps respect the monitoring interface (the cooks and the preparation area workers will have their own proper interface).
- Provide to clients the maximum and easier number of ordering ways.
- Adaptability; the system could be modified respect the hardware and reprogrammed respect the software to adapt to every little change.

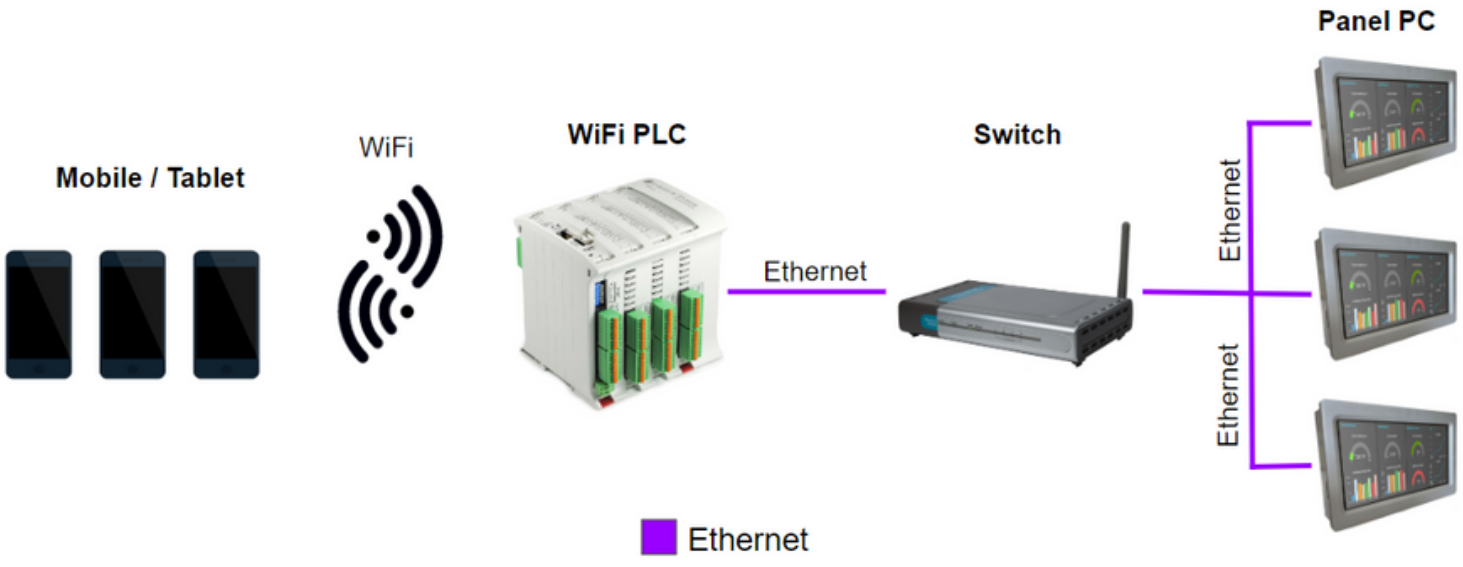
CASE STUDY

FINAL SOLUTION (HARDWARE)

The restaurant order system will bring to the customers three different ways to order; in the classic Q&A method, the employees will introduce the client orders in the Panel PCs, in the Mobile/Tablet method, the clients will be able to make the order with their own devices using a brand new app of the company and, in the last way, the delivery method, the clients will have the possibility to make the order through the restaurant website or through phone calls (in the case of the calls it will work like the Q&A method as the data will be introduced by the worker using the Panel PC).

All this information will be sent by WiFi or Ethernet connection to the WiFi PLC, which will develop the task of being the brain, the center of the system. The PLC will process this information and will send it to the Panel PCs using Ethernet cable (using a switch to distribute the connections). This data will be rightly shown in the Panel PCs interface, the kitchen ones will show a proper interface for the cooks, with only the useful information for them, and it will show all the order details for the workers of the order preparation area cause they have to ensure that there is no lack of anything and everything is on point to be served to the client.

To carry out this system it will be nedeed to create a proper server and use Node-Red to develop the interface. It will bring to both, client and worker, loads of facilities and options such as to cancel the order or to mark the orders that are already made. It will provide an order tracking at every moment and point of the order, untill the client have the food. From the point of view of the delivery method, the distributors will be able to control their orders using the app (a version for them) through their phone (or one given by the company).



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CASE STUDY

INDUSTRIAL SHIELDS

CONTROL A CONVEYOR BELT USING AN INVERTER

In this project we describe a model to control an asynchronous motor using a frequency inverter in one of our PLCs based on Arduino.

It has been used an MDuino 42 I / Os PLUS and a frequency inverter.

An Industrial Shields Panel PC has also been used to manually monitor and control the speed of the conveyor belt and make it more intuitive.

SUMMARY

We use the frequency inverter to completely control the induction electric motors by means of the control of the supplied power frequency.

It focuses on the control of engine speed by varying the frequency of the supply voltage.

The PLC contains a program made with Arduino IDE with the functions that will control, on one hand, the parameters of the frequency inverter, and on the other hand, the reading of the current that reaches the motor.

The frequency inverter controls the induction motor according to the commands it receives from the Arduino based PLC.

The Panel PC will have the main function of showing on screen the values in real time and the possibility of modifying them at any time, as well as, additional functions that are exposed below.

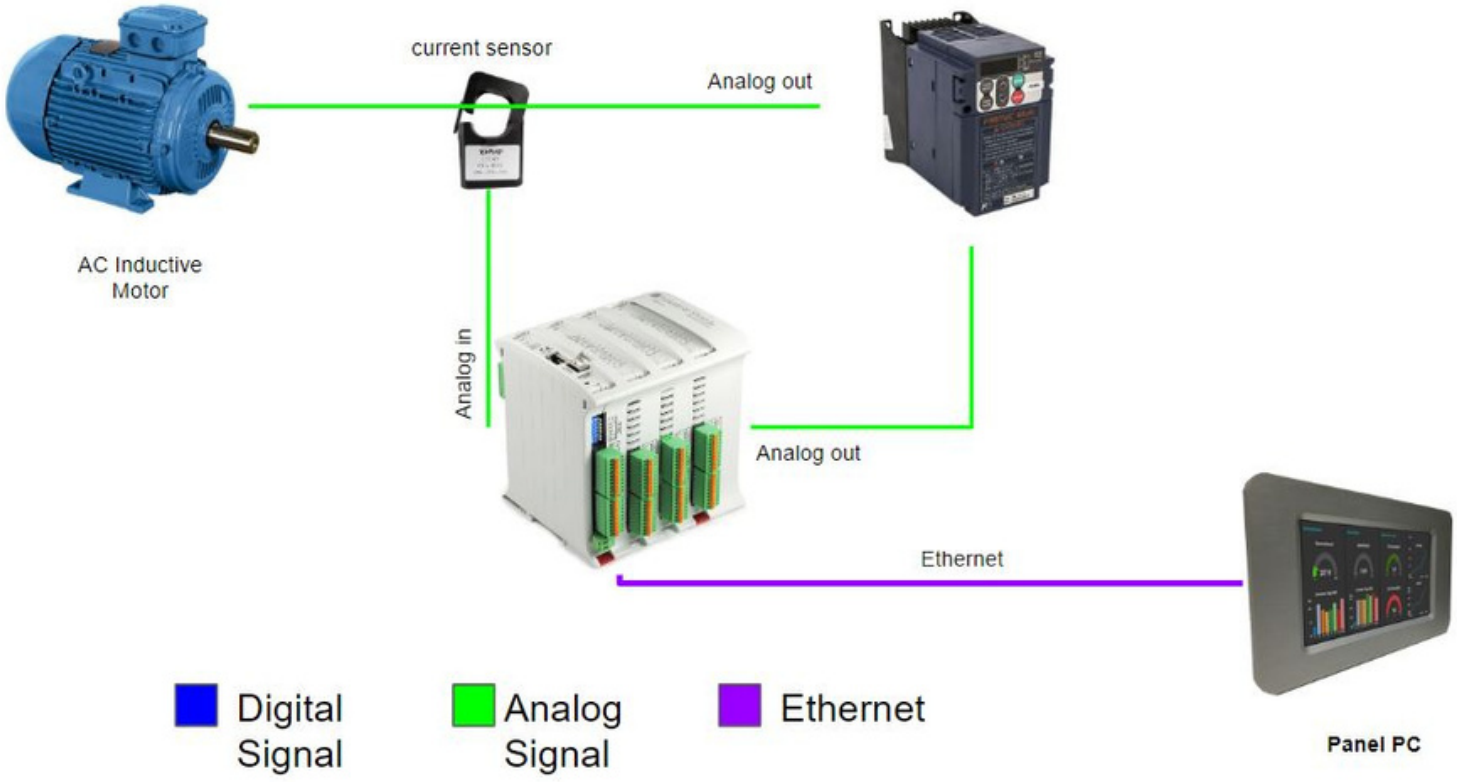
CASE STUDY

FINAL SOLUTION (HARDWARE)

The current sensor installed between the frequency inverter and the inductive AC motor allows the PLC to make decisions based on the current read and can indicate the desired values to the frequency inverter. In this way we have an autonomous system that regulates the speed depending on the desired parameters.

If a manual modification of the speed of the conveyor is required, the Panel PC connected to the Arduino-based PLC is used through the Ethernet port.
The Panel PC also fulfills other specific functions such as:

- Alarm if the limit speed is exceeded
- Real-time sampling of the AC motor speed.
- Emergency stop function
- Start function



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CASE STUDY

INDUSTRIAL SHIELDS

AUTOMOTIVE PRODUCTION LINE

This project is designed to make an automotive production line system capable to be adapted to different needs. The production line will be automated using an Arduino based PLC that will control all the processes and the robots behaviours, and a Panel PC will be able to monitorize them and to become the management point of the input-output data feed.

This application could be applied remotely using an Ethernet PLC if it is necessary and the information can be accessed wherever you want, through a VPN connected to our MQTT server. This database could be shown on a Panel PC based on Rasberry Pi3 that will monitor all the information.

SUMMARY

All the important production line data will be collected using several sensors; for example, load cells to weigh certain pieces, lasers to measure distances, pressure devices to measure the force applied assembling the pieces, etc. All this information will be sent to an Arduino based PLC, where it will be processed and, considering the specific orders previously programmed or the ones introduced through the Panel PC, the PLC may send the commands to the production line actuators such as all the mechanized arms and the robots to execute all the orders. All this information can be monitorized through the Panel PC, where you can control and configure all the system parameters.
In the Panel PC there will be also a broker server (MQTT) that is responsible for receiving and sending data between the PLC and the Panel PC.
To monitor the data, Node-Red will be used.

OBJECTIVE

The main points to achieve are the following:

- Automate an automotive production line.
- All processes controlled and monitorized 24/7.
- Easy management; through the PLC, the Panel PC, even so using a mobile phone or a tablet.
- Divided labor camps regarding the monitoring interface.
- Wide embracing in relation with the different lines (possibility to select one line or another and to apply this to different parameters).
- Adaptability; the system could be modified respect the hardware and reprogrammed respect the software to adapt to every little change in the line.

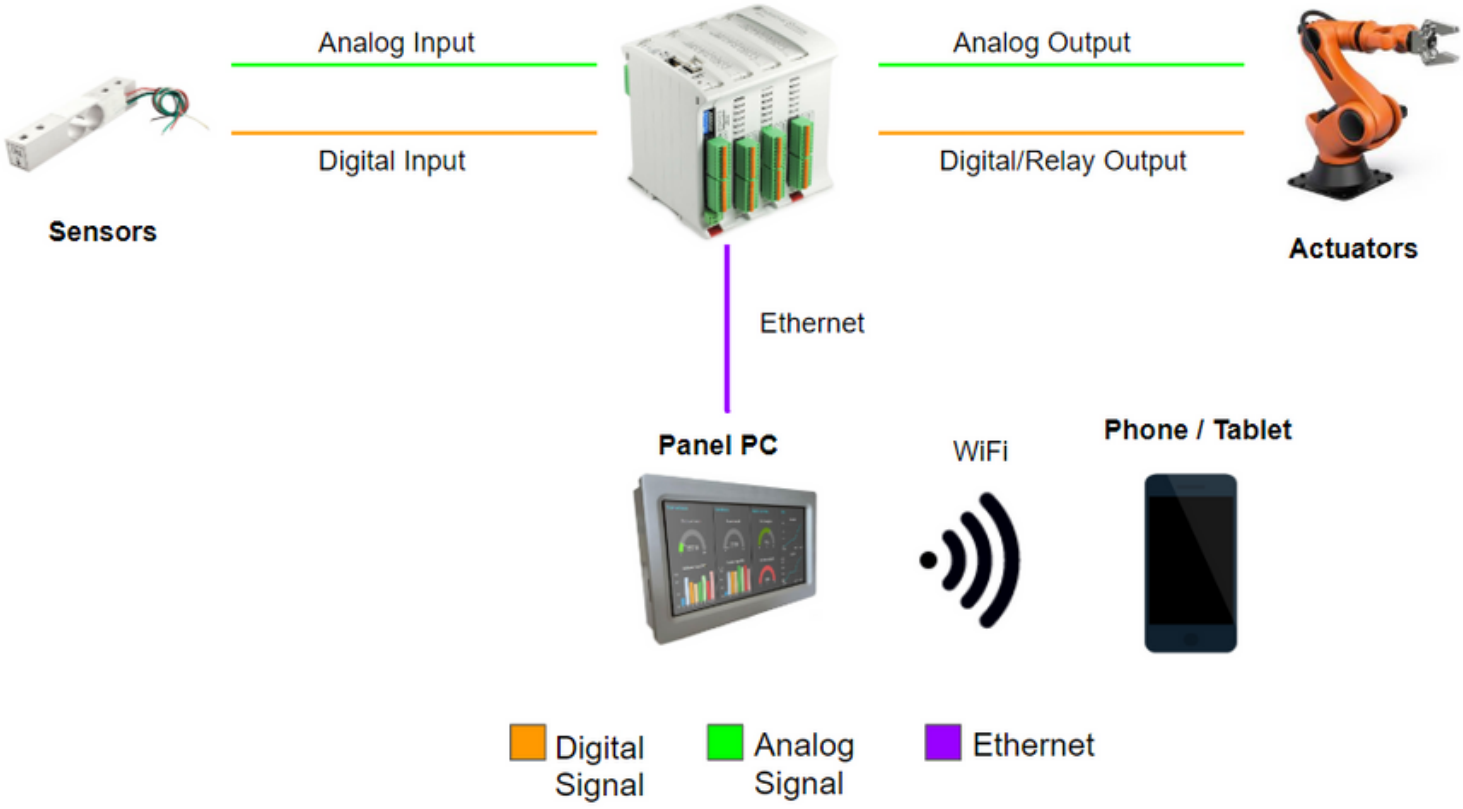
CASE STUDY

FINAL SOLUTION (HARDWARE)

The automotive production line will be fully automated, insted of the specific control parameters that have to be set. All the important data could be collected through all kind of sensors, like the ones said previously. This information will be sent to an Ethernet PLC which will be previously programmed to process all the input data and manage the output orders to the actuators in a certain way.

When the input data will be in the PLC, it will send it to the Panel PC using Ethernet and you could monitorize it. Like we said, there could be specific orders previously saved inside the PLC or we can change and manage this control with the Panel PC too. All this Panel PC actions could be done through another device such as a cell phone or a tablet because of the WiFi connection between this and the panel. To monitor all the data and to stablish this connections with a phone/tablet, Node-Red will be used and a server has to be created and configured.

Once all the orders are introduced to the system, they will be sent to the actuators in the line machinery (robots, mechanized arms, etc.). All the input and output data could be digital or analog, always taking into account the available i/o in our devices. The actuators will execute the orders and you can monitorize and manage everything through the Panel PC, the phone or the tablet. This system could be applied to different production lines and adapted to different changes. Remember that this is a case study and it can be modified as your thoughts.



CASE STUDY

INDUSTRIAL SHIELDS

ANIMAL FEEDING

This project is designed to make an animal feeding system for all kinds of use; cattle raising, farms, horse stables and many more. The feeding process will be automatized using a PLC which controls the feeders and would have a track of the food to settle up the periods, quantities and food kinds.

This application could be applied remotely using an Ethernet PLC if it is necessary and the information can be accessed wherever you want, through a VPN connected to our MQTT server. This database could be shown on a Panel PC based on Rasberry Pi3 that will monitor all the information.

SUMMARY

There will be some load cells sensors in the feeders. and they might send the food weight data to the Arduino based PLC, where the data will be processed and, considering this and the specific orders stablished by the animal carers (kind of food, temperature, etc.), the PLC may send the order to the feeding system which will dispense the correct amount of food. All this information can be monitorized through the panel, where you can control and configure all the system parameters.
In the Panel PC there will be also a broker server (MQTT) that is responsible for receiving and sending data between the PLC and the Panel PC.
To monitor the data, Node-Red will be used.

OBJECTIVE

The main points to achieve are the following:

- Animal feeding.
- The food amounts monitorized 24/7.
- Measurement and control of food parameters easily managed through the panel.
- The distribution system will provide the right amount of food, even medicines if they are necessary.
- There will be an evacuation system to throw off the remaining food and a cleaning one to take care of the system.
- All the food, medicines and cleaning liquids may be stored in tanks and distributed through a gravity pipe system or a piston one.

CASE STUDY

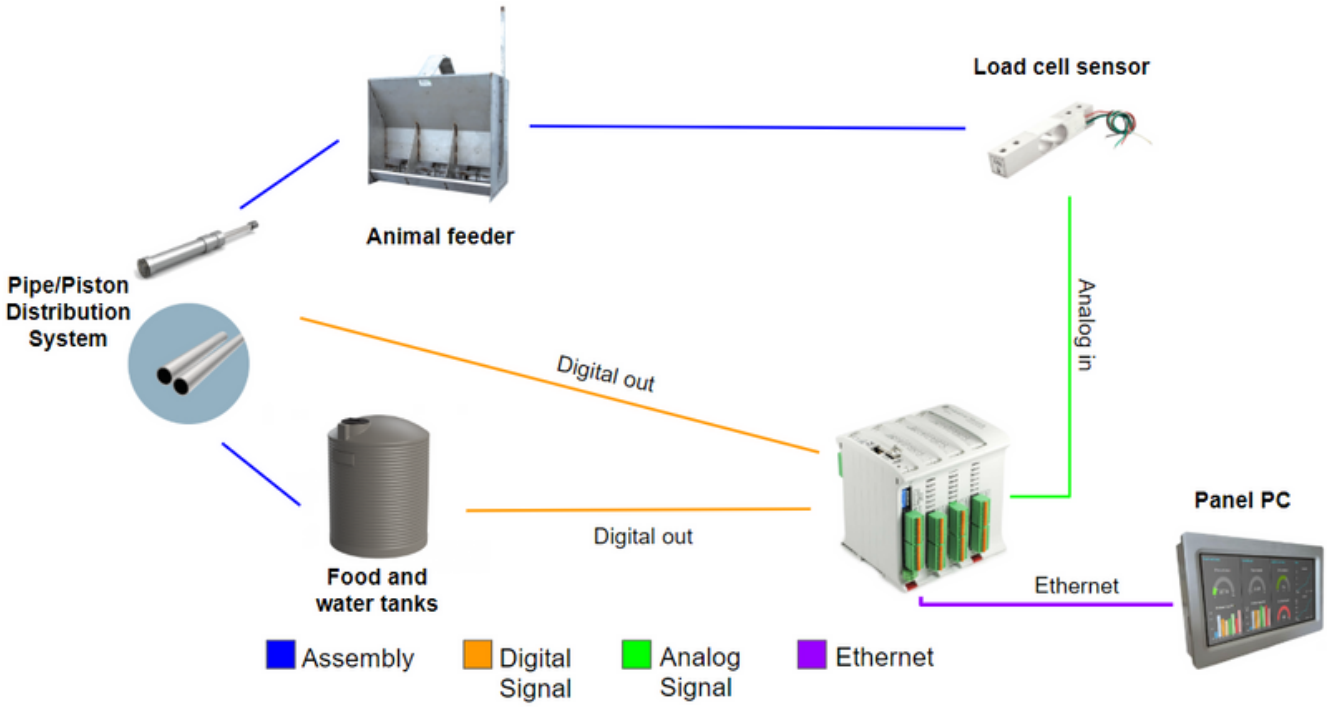
FINAL SOLUTION (HARDWARE)

Each feeder will have a load cell sensor which collects data and might send it to the PLC to control the food and state levels. Programming the PLC or directly managing it through the panel you could stablish all the food parameters, as well as the water, medicines, cleaning liquids or whatever you want to distribute through the system.

When the parameters will be set, the distribution system will start; the tanks will provide the exact food amount through an automatized gate and it will be given to the animals through a pipe or piston system, depending on which will be the best option for the choosen kind of food (the fodder is easier to move with the pipe gravity system and the strow with the piston one).

The mechanism could be cleaned easily because it will include an evacuation section to throw off all the remaining food (using pipes or pistons too) and you can select the right cleaning products to be distributed for all over the place and evacuated through a drain.

All this options said in this post and many as you can think will be controlled and monitoritzed through the panel that could be fixed or remotely controlled using the Ethernet adaptation previously said (using a MDuino and a proper server). Remember that this is a case study and you can use it and change it as your thoughts.



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CASE STUDY

INDUSTRIAL SHIELDS

HOW TO MONITOR AUTONOMOUS SOLAR PANELS WITH ARDUINO BASED PLCS

The use of renewable energy is increasing at cruising speed every passing day.

Solar energy is the most popular and has a huge range of possible applications in our daily lifes. It also offers many natural and environment advantages.

SUMMARY

In a world where most energy production comes from non-renewable resources, people are trying to find efficient and price-effective ways to use renewable energy. One of the great leaps forward in renewable technology has been the solar panel, which is composed of several solar cells that convert light into electricity.

Knowing the growing need of energy, the solar one is more efficient if the panels are controlled by two linear motors each. One for the x-axis and the other one for the y-axis, so they can take advantage from the weather conditions and all sunshine hours during the days.

That said, **monitoring** your solar installation will allow you to:

- know the current status of the **weather conditions** and the **position of the photovoltaic panels** at all times,
- produce the necessary and **extra energy**,
- have a **good viability** and reliability of the system and a **long life** of the controllers,
- know the **amount of energy** and other data at any time and have them in the **cloud**, and
- reduce the **manteinance costs**.

CASE STUDY

GOAL

The objective is to chase the sun, which is a moving target, so that we can all take advantage of it and generate more solar energy. Solar panels operated by automatic control systems can generate up to 30 % more energy than static panels.

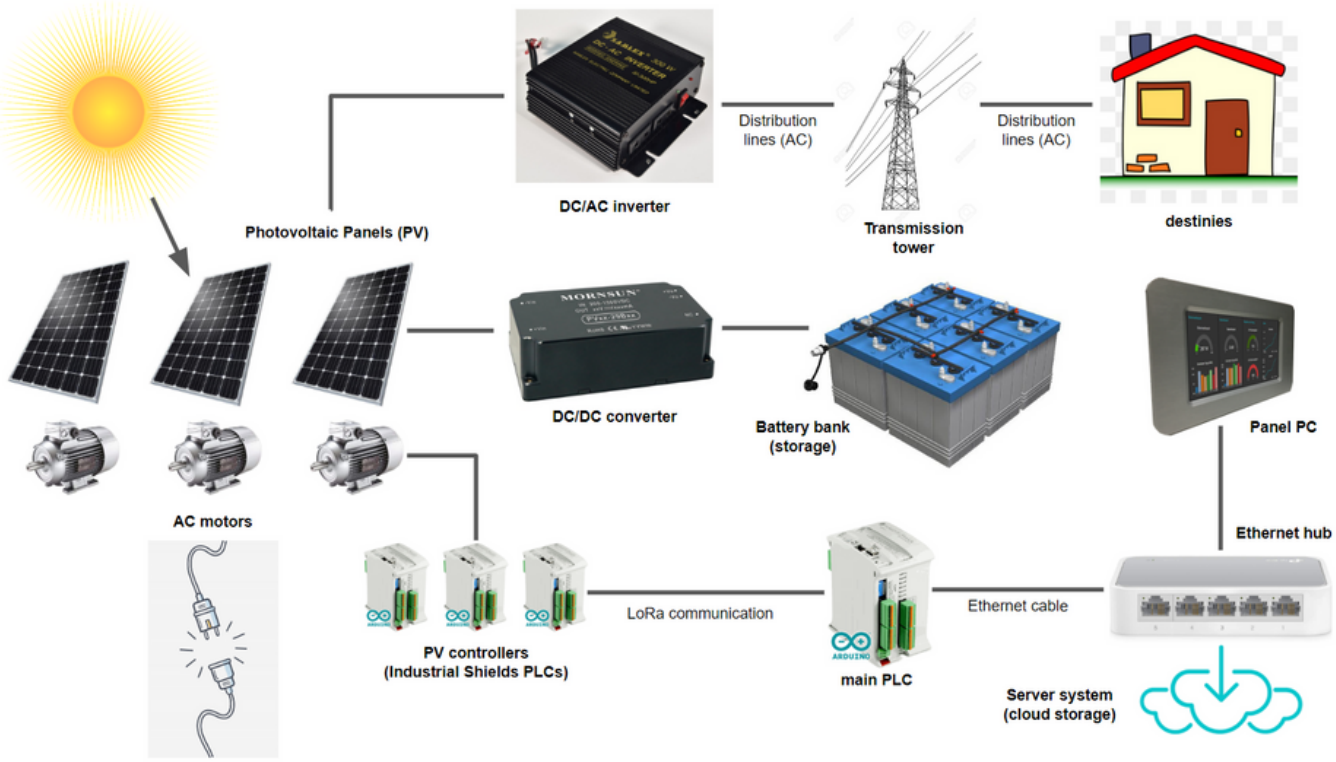
CONCLUSION (HARDWARE)

The **Industrial Shields equipment** is going to control the AC motors connected to the photovoltaic panels, so they can **take advantage** of the weather conditions and **produce** as much solar energy as possible.

The control will be done with some previous calculations for the different positions of the sun as the hours go by and ans will be transferred to our PLCs by the Arduino IDE.

The main **PLC** will be the master, which will receive the data from the others (one for each PV group), and transfer them to the **Panel PC** (HMI), Human to Machine Interface, and upload it to the cloud. The cloud information will be useful to improve the PLC's Software in the long term.

The achieved energy will be distributed in two different ways. One will be converted with a DC/AC inverter, so it can pass trough the high voltage lines and reach the destinations where it is needed. The other distribution way will be made for extra power that has no destination. This will have its voltage adapted with a DC/DC converter, so it can be stored in the battery bank for a future use.



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CASE STUDY

INDUSTRIAL SHIELDS

TOTALLY INTEGRATED AUTOMATION OF BOILERS

In this case, you will see how to implement the control of a boiler process, in which we are using the Industrial Shields Arduino based PLCs with WiFi and a PC Panel to monitor the SCADA system.

The incorporation of the equipment with WiFi gives you the possibility to monitor and act on the system remotely. (IoTI System).

SUMMARY

To achieve this, a viable option is the use of mobile applications and the Internet Of Things that allow communication between the automated process and the user, which, when implemented in industry, give rise to the Industrial Revolution 4.0. This system will include a database and an mobile application that implements security alerts and emergency equipment shutdowny. In this case we are working with a pyrotubular boiler but you can implement all types of boilers using the same system.

The automation of this process has considerably improved the benefits of the boiler control, mainly in the spèed of response and the good operation in a 100% safe state. If the proposed control levels or an element do not behave as desired, the Arduino based PLC could send a local alert in the control zone through the PC Panel, but in case no one is available, the alert would have to be sent remotely.

CASE STUDY

IMPLEMENTATION

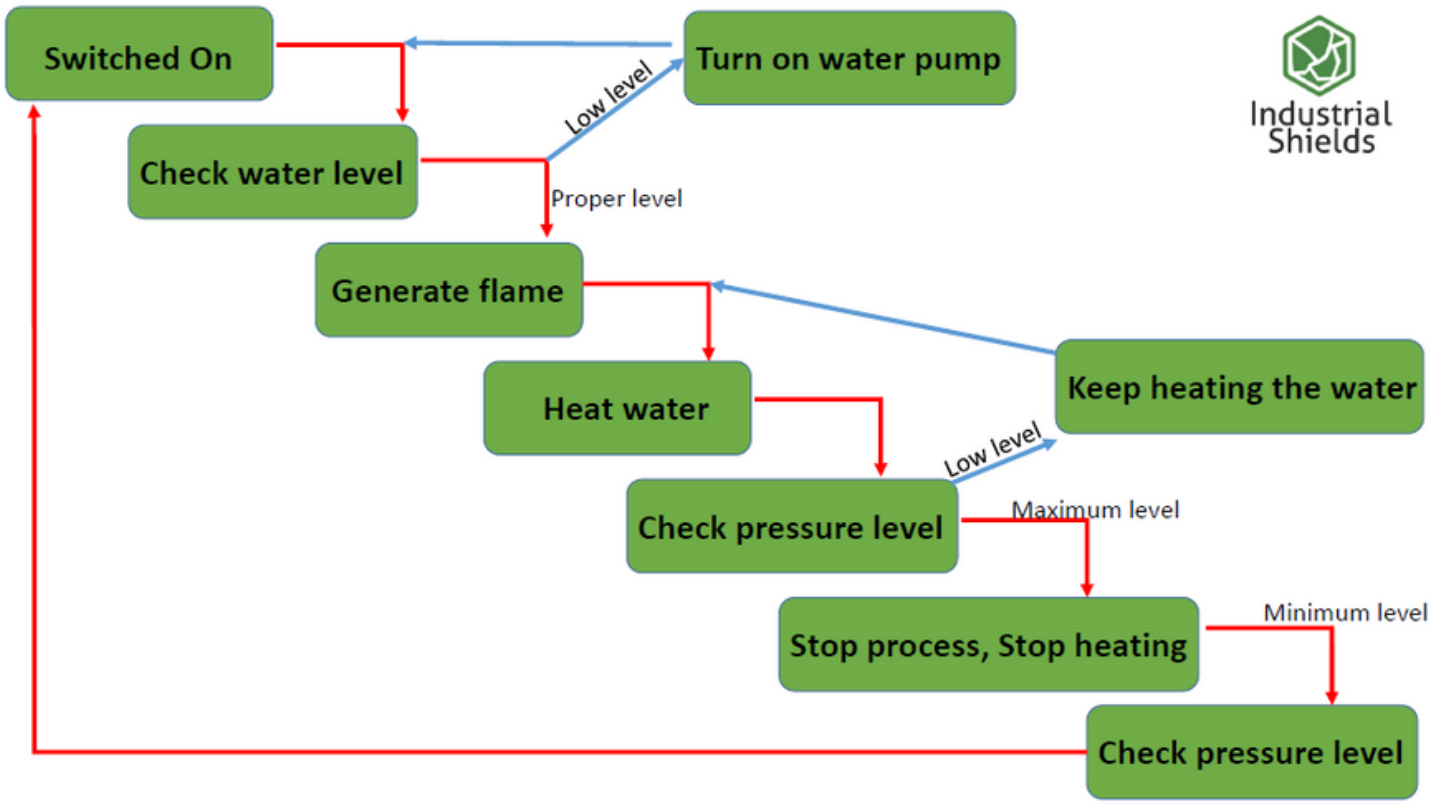
For the correct and safe operation of the steam generation process in the boiler, certain steps must be followed:

- The first one consists of checking the existence of water using the concentrated level sensor as a digital input; if there is not enough water, the pumped is turned on until the desired level is reached, after which the combustion gases are swept for a defined time.

- When the sweep is completed, it begins the ignition consisting of activating the transformer (spark burner) and opening the solenoid valve allowing gas to pass; if there is flame, it is detected by the sensor and in case of no flame, the ignition is repeated three times. If this happens a fourth time, another sweep is performed and the ignition is aborted.

- If a flame is detected, the process does not stop and continues to record the amount of pressure in the boiler until reaching 2 bar. When this happens, the burner is switched off until the pressure drop to 1 bar, then the system starts again in a continuous cycle until the user stop it.

You can see the flow diagram to understand better the process:



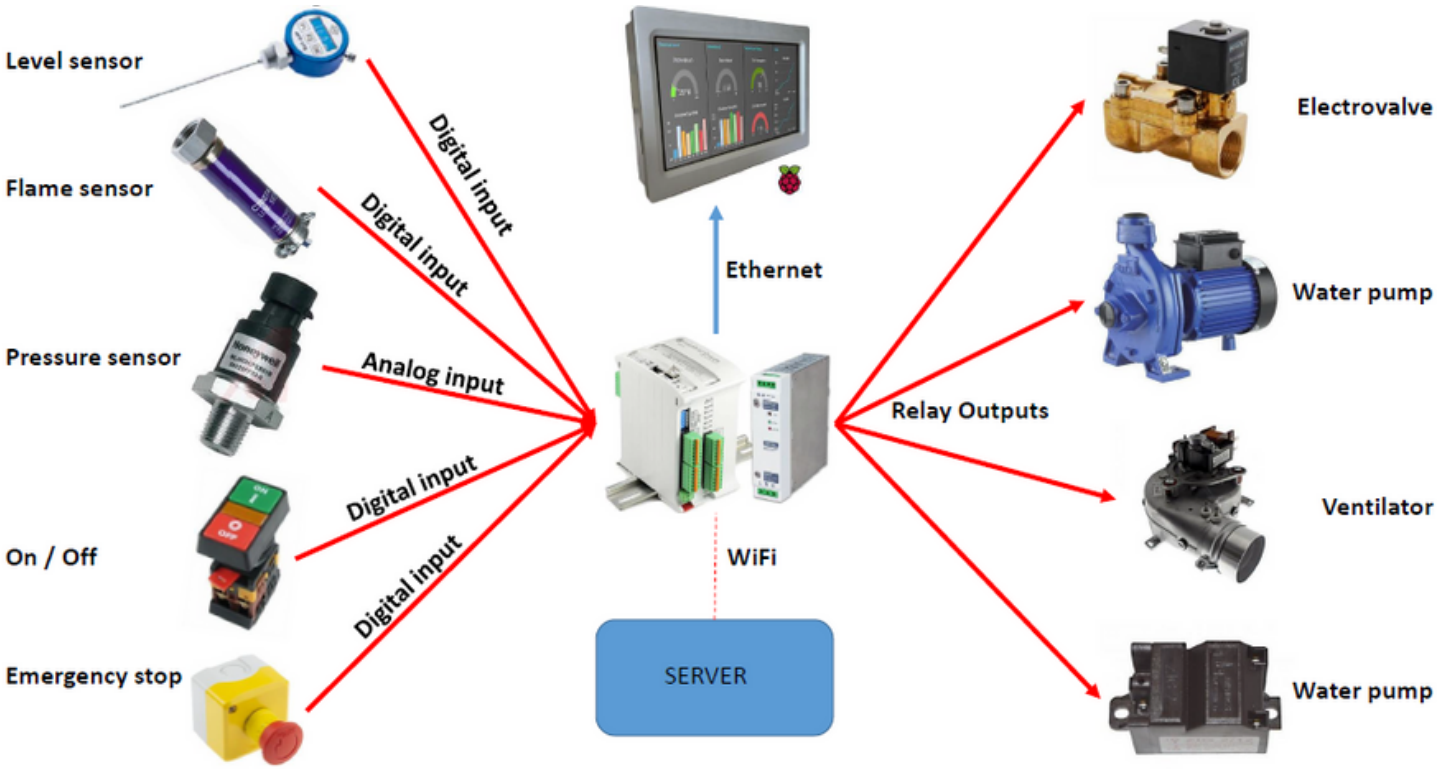
CASE STUDY

CONNECTION LAYOUT

Basically, in this system there are a series of actuators that work with 220V (Pump, fan, transformer and solenoid valve) so we recommend the PLC with relay and WiFi outputs, in addition to the sensor (pressure, level and flame sensor) and two buttons to control the boiler: On/Off and Emergency Stop.

The PC panel is connected to the PLC through Ethernet and you can control the different actuators manually and see the parameters in real time, as you can see in the web server where you are sending all the information through WiFi.

As you can see, it is very easy and low cost to implement this kind of system with Industrial Shields equipment due to the few elements that are involved and the ease to program it using the Open Source Arduino IDE platform This particular system can be replicated in several boilers with an Arduino based PLC and all connected to the PC Panel and the web server in order to create a network and control it from a single point.



Industrial Shields

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CASE STUDY

INDUSTRIAL SHIELDS

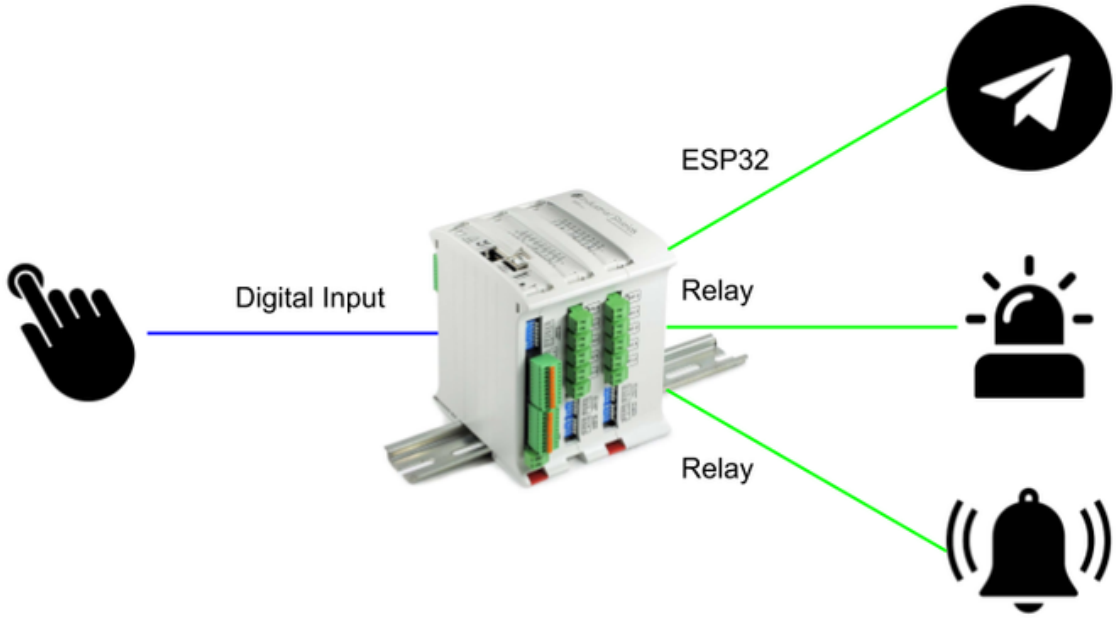
HOSPITAL ROOM ALARM SYSTEM

INTRODUCTION

The aim of this Case Study is to show you a way to activate a hospital alarm and communicate the emergency to the nurse team using a Telegram Bot.

CASE

The idea is to activate the alarm using a push button at patient disposal. Once the button is pushed the M-Duino will send a message to a Telegram Bot and will activate two outputs: an audible alarm and a visible alarm.



CASE STUDY

TELEGRAM BOT

In Telegram you can create a Bot. Bot is the programmable interface of Telegram. You can make different services like share information to a N number of users, and that's what we want, to send an emergency message to the nurse team.

For that, all the nurse team have to install the Telegram Message App to their smartphones. Otherwise they wouldn't have acces to the Bot and wouldn't be able to receive the alarm messages.

COMMUNICATION WITH TELEGRAM

In Arduino you have available the UniversalTelegramBot library that offers you some tools to communicate with Telegram.

When you create a Bot, it returns a token like: **XXXXXXXXX : Array of Numbers and Letters.** Where **X** are digits from 0 to 9. You have to create a client that will connect to the Bot. This token allows you to link the client with the Telegram Bot.

ALARM

When the button is pushed, the **Audible** alarm is activated so a nurse nearby to the patient can hear. The alarm isn't deactivated until someone pushes the button again.

The **Visible** alarm is activated at the same time that the audible alarm. However, even if the audible alarm is deactivated, the visible alarm is still active for a certain time, *

*According to Hospital Regulations the visible alarm has to be kept active even if the audible is deactivated.

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CASE STUDY

INDUSTRIAL SHIELDS

IOT GREENHOUSE USING OPEN MOTE

In this occasion we will see how the client has used Open Mote to collect data obtained from different sensors, transmit that data to a Panel PC, which will monitor the data, and send it to the Arduino-based PLC to automate the operation of the actuators.

SUMMARY

In this case study, a secure and useful solution is presented to automate and monitor the care of a greenhouse with the use of Open Mote, device designed for IoT uses. This IOT Mote incorporates digital and analog inputs for reading sensors.

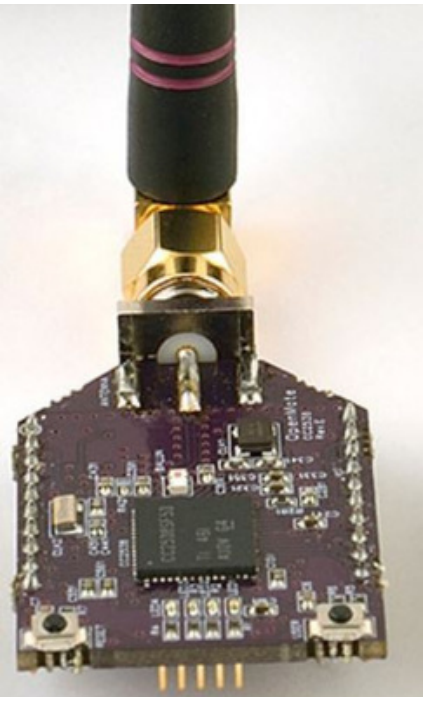
One of the great advantages that it presents is the high autonomy of this device (less than 50µA of consumption).
Using the 2.4GHz antenna we can communicate wirelessly by radio using the free Contiki software.

What is achieved using this system is a wireless communication between the sensors and the terminal where the data is managed, thus being able to conveniently locate all the Open Mote beacons throughout the greenhouse and centralize all the information in a single Open Mote that acts as a gateway.

Open Mote also allows direct connection to our range of Panel PCs and, in this way, it is easy to monitor the data.

CASE STUDY

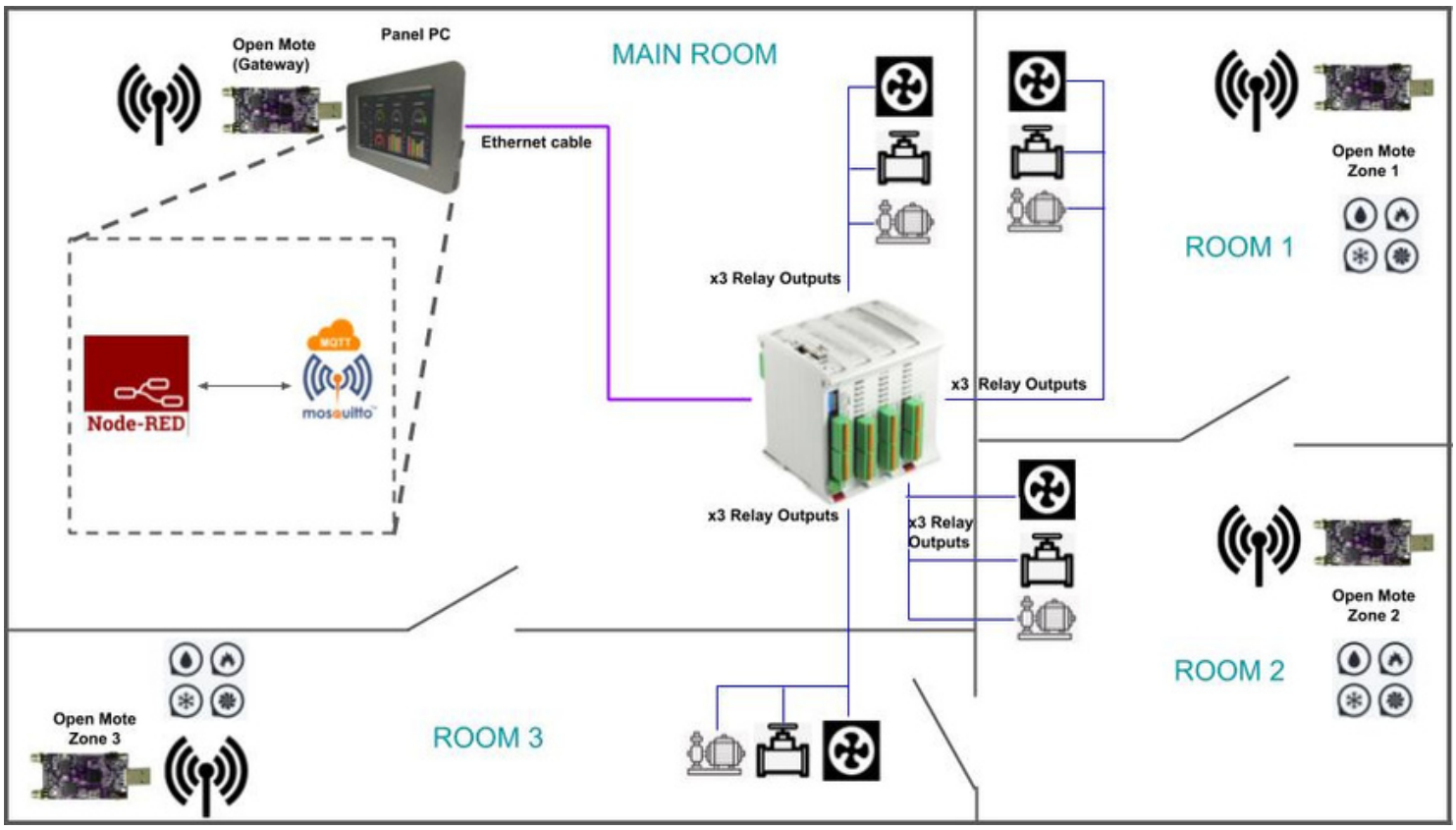
FINAL APPLICATION (HARDWARE)



The client has chosen to place an Open Mote in each of the compartments of the greenhouse. Each of the Open Motes has an Open Mote Sensor Board that is composed of humidity, temperature, pressure and brightness meters.

In the main compartment of the greenhouse, an M-Duino 57R I / Os PLUS connected via Ethernet to a Panel PC has been installed. The PC panel has an Open Mote connected by the USB port, this Open Mote will act as a Gateway for the others that are located throughout the greenhouse.

Depending on the data received, if any of the values sent by the Open Mote are unwanted, the Arduino based PLC is notified to activate the necessary actuators in the compartment where unwanted values have been detected (Actuators are connected to the M-Duino Relay Outputs).



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CASE STUDY

INDUSTRIAL SHIELDS

ANALYZE ELECTRICAL NETWORK USING INDUSTRIAL SHIELDS EQUIPMENT

On this occasion, a current analyzer was used together with the Industrial Shields equipment to have a **real-time control of the consumption** in street lamp posts.

SUMMARY

Having real-time knowledge of the actual use of the current in **urban street furniture** can help us to have a better knowledge about the current expenditure that is carried out in the streets. **Information is power.**

With this information, and the help of an **Arduino-based PLC** to manage all received data, alarms can be set when the current exceeds a set limit, as well as to process the data and display them in real time.

The possibilities offered by our equipment to communicate with the current analyzer are:

- To control alarms, digital inputs of the equipment can be used.
(These alarms will reach the server through the Ethernet port of the Arduino-based PLC).

- Digital outputs to relay for the action on circuits of the installation.

- RS485 port for peripherals.
(Normally Current Analyzers allow communication with RS485. Modbus RTU is a good protocol for such communication).

Even so, there is also the possibility of using RS232 or SPI, among others.

CASE STUDY

FINAL SOLUTION (HARDWARE)

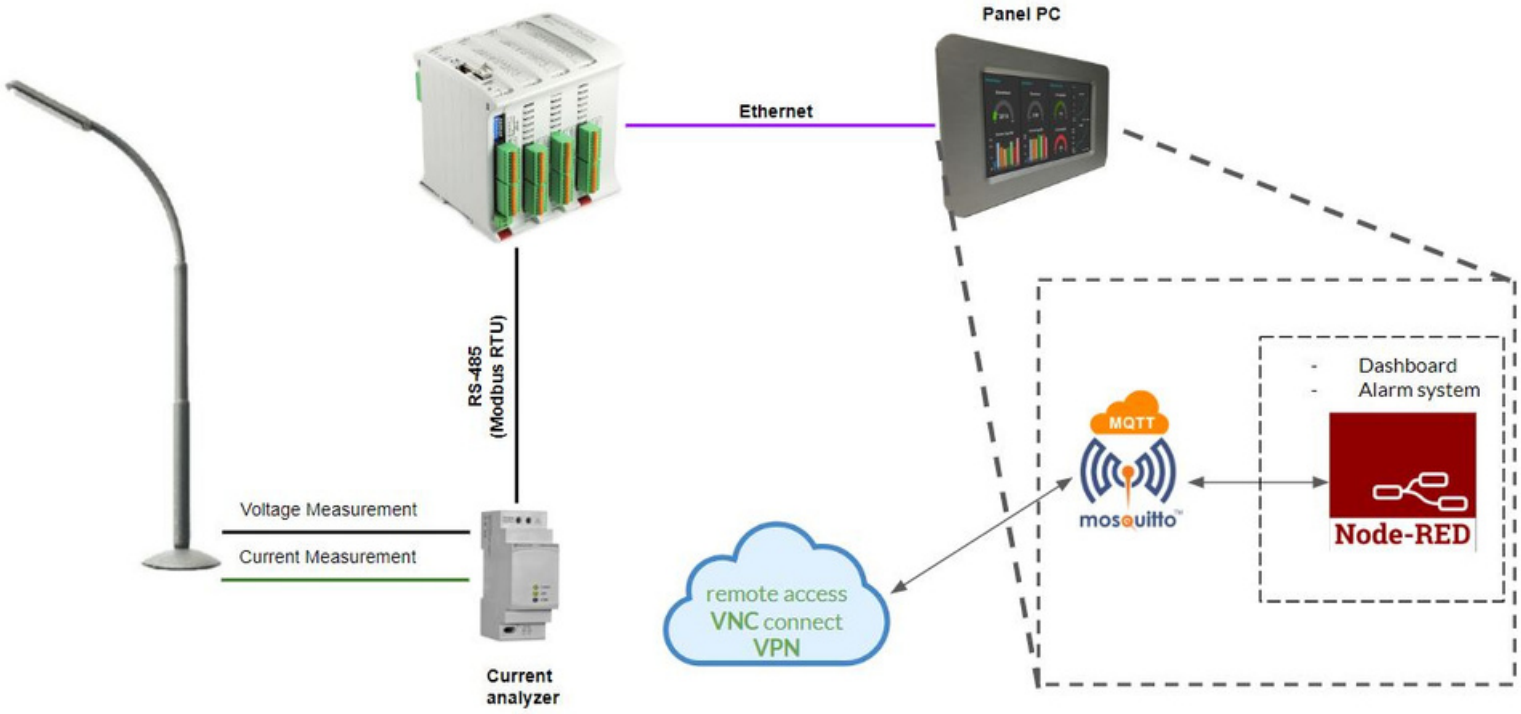
The hardware implementation of the system consists of receiving the voltage and current data through the current analyzer.

This information will be directed to the Arduino-based PLC (MDuino 19R +), which optionally may also have contactors connected to its relay outputs to act on the current flow in the event of an alarm.

Once the information is managed, it is send to the Panel PC that has an MQTT broker server to share the data in Node-Red.

Node-Red allows us to perform a dashboard to sample the data in real time and even warn in case of alarm status.

The Panel PC will also have connection via VPN to be able to share the data in a virtual private network and have access from any other point (PC, smartphone, ...).
To ensure the time synchronicity, there is an internal clock with 3.3V lithium cell coin battery.



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CASE STUDY

INDUSTRIAL SHIELDS

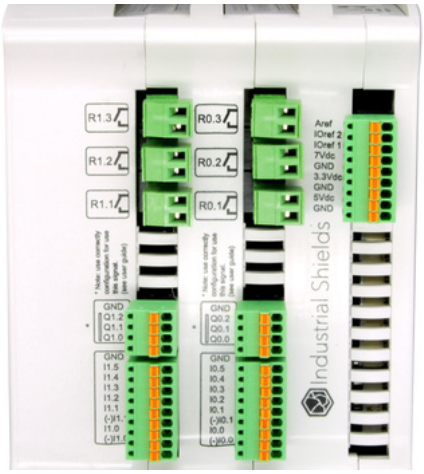
AUTOMATION OF A LABELING CONVEYOR SYSTEM

In this project an Arduino based PLC has been used to automate the labeling of bottles on a conveyor belt. Two stepper motors are used, the first one is used to control the large label roll and the second one moves the conveyor belt.

In order to ensure that each bottle has been labeled, an encoder has been required to manage the speed of the conveyor belt and a photocell to know the position of each bottle.

SUMMARY

Bottles on a conveyor belt run through a labelling mechanism that applies a label to the bottle. The spacing of the bottles on the conveyor is not regulated and the conveyor can slow down, speed up, or stop at any time.



OBJECTIVE

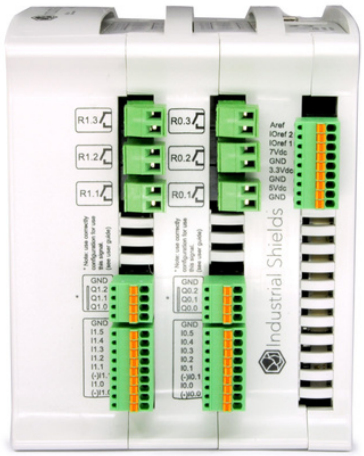
Our costumer requirments were the following:

- Accurately apply labels to bottles in motion
- Allow to variable conveyor speed
- Allow for inconsistent distance between bottles
- Pull label web through dispenser
- Smooth, consistent labelling at all speeds

The Arduino based PLC accepts input from an encoder mounted to the conveyor and reference all of the speeds and distances of the label roll with the help of a photocell that detects the position of the bottle at the time of labeling.

CASE STUDY

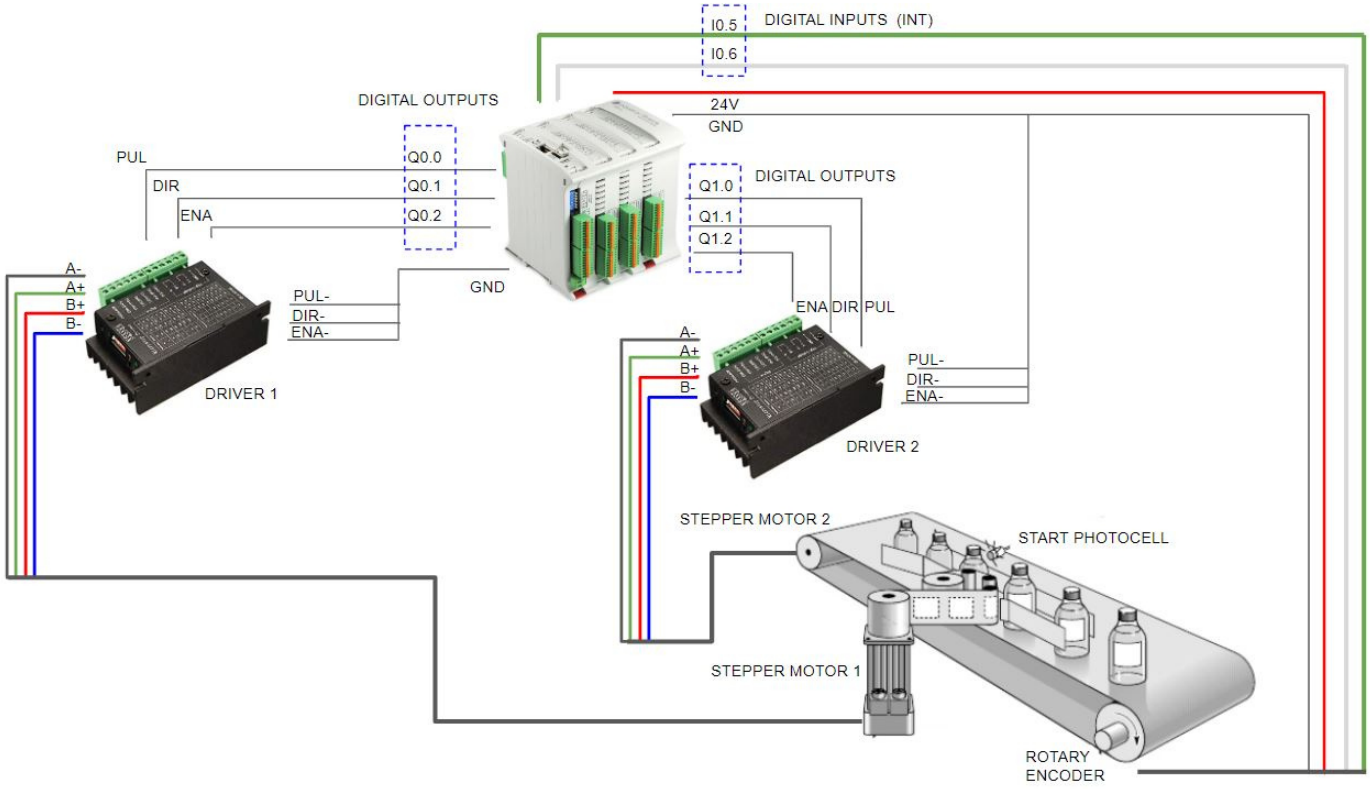
FINAL SOLUTION (HARDWARE)



A servo system is required to provide the torque and speed to overcome the friction of the dispensing head and the inertia of the large label roll. A second servo motor is used to rotate the conveyor.

As previously mentioned, a photosensor connected to the Arduino based PLC controls the position of the bottles on the conveyor belt.

The controller commands the label motor to accelerate to the line speed at the moment when the first edge of the label comes into contact with the bottle. The motor moves at the speed of the line until the full label is applied, and then slows to a stop and waits for the next bottle. To obtain the data of the encoder, it has been connected to two inputs with interruption of the PLC based on Arduino, in this way, the Industrial Shields PLC will not be making requests constantly to obtain the data of the encoder, it has been connected to two inputs with interruption of the Arduino based PLC. For each servo, purely digital PLC outputs are needed (making the connections with its respective driver).



CASE STUDY

INDUSTRIAL SHIELDS

SMART CURRENT METERING

This project is designed to measure the current consumption in a company using a current sensor. Through a database in the Ethernet PLC itself, it is possible to know the consumption statistics for medium and long-term tracing and even stop the current in case they exceed the allowed limit.

The information can be accessed remotely, through a VPN connected to our MQTT server.
In the company, a Panel PC based on Raspberry Pi3 will monitor the results in graphic form.

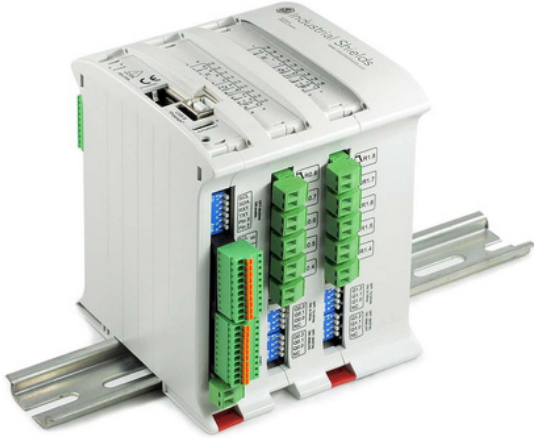
SUMMARY

The current sensor is located at a strategic point of current flow.
The data is processed in the PLC based on Arduino and these are sent to the Panel PC, where the database is located. In the Panel PC there is also a broker server (MQTT) that is responsible for receiving and sending data between the PLC and the Panel PC.
To monitor the data, Node-Red has been used.

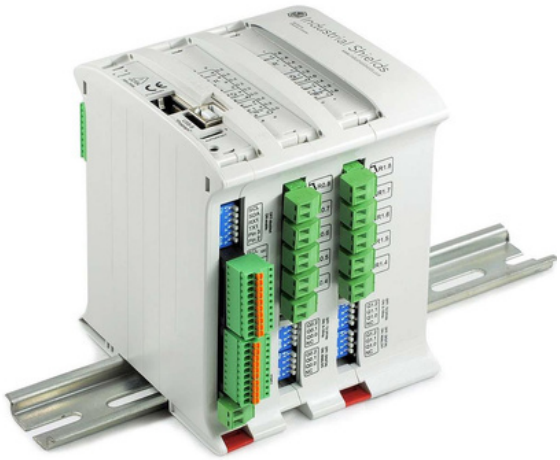
OBJECTIVE

The main points to solve are the following:

- Accuracy in the measurement.
- In the taking of measurement no longer intervene people, reason why it is effective against the errors of reading.
- Measurement and control of cutting and pre-cutting of electrical energy from the control center in a fully automatic way.
- It offers data storage, event log, lack of voltage and current. With this feature it would not be necessary for the final consumer to notify or complain due to lack of energy since the team immediately warns the center.



CASE STUDY

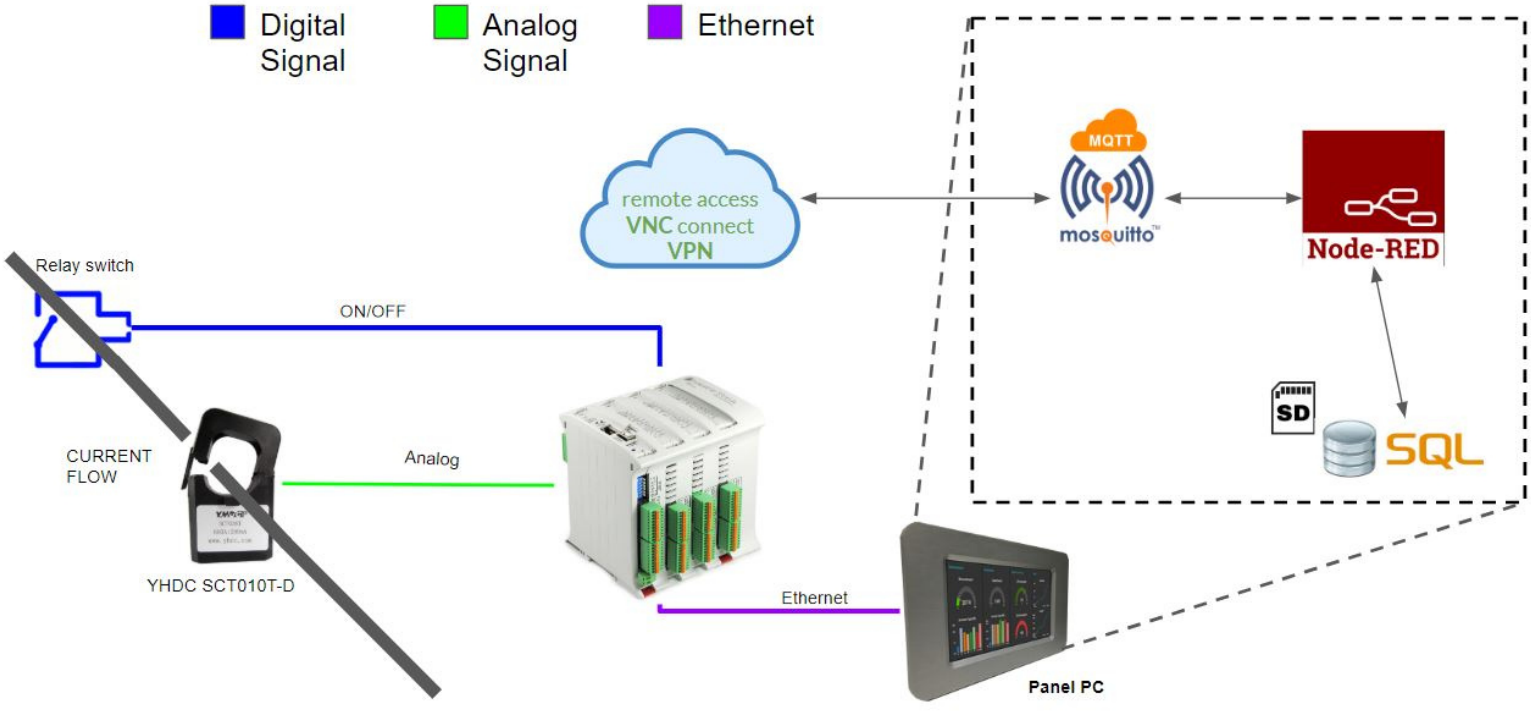


FINAL SOLUTION (HARDWARE)

The YHDC current sensor SCT010T-D will be connected to the Ethernet PLC on an analog input. The data is received periodically and it will be sent to the Panel PC via ethernet using the MQTT protocol for sending and receiving data.

Once the data arrives at the Panel PC, these are stored in the SD memory. The database located inside the Panel PC will collect the data received from the PLC, and using the Node-Network tool to monitor all the data, in graphic format, to observe the results in the medium and long term.
The client also wanted to remotely access the information, for this reason the system has been connected to a VPN so that a web client can access the server remotely as long as it has permissions.

If an anomaly is detected in the system, the PLC automatically cuts the electrical current with a relay output.



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CASE STUDY

INDUSTRIAL SHIELDS

CONTROL OF A PARKING AREA USING AN RFID SENSOR

This project allows access control in a parking area, and automate the opening of the gate from a system which uses an RFID sensor connected to the Arduino-based PLC by Industrial Shields.

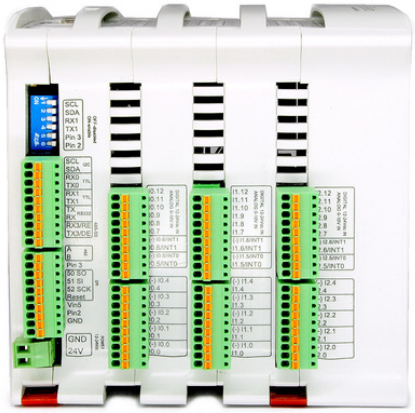
Each user owns a unique card which contains the access data. A local database is stored in the SD memory card and it contains all the user access references. The system also monitors all the card reading process and allows the users have knowledge about the process.

SUMMARY

Using this installation, each user will have a personalized card with a unique reference. All the references will be stored on an external server. Each time that the database is modified, the Ethernet PLC will update it on its memory card. When RFID sensor detects a registered reference, activates the motor until the gate is fully open.

OBJECTIVE

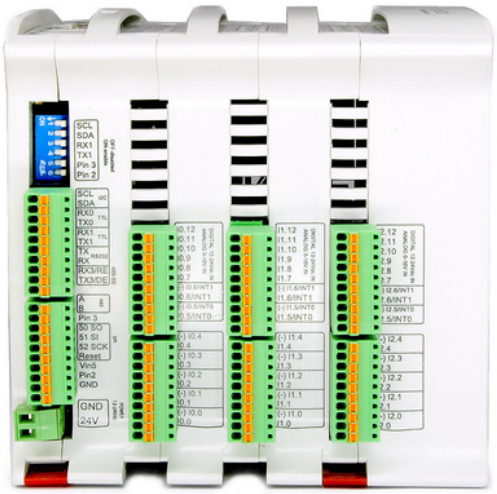
- Our customer wants to control the access to the parking of his company using Open Source technology with a single PLC that has knowledge of all the registered users, that is remotely modifiable, acts on the gate, and allows to monitor the full process.



WHAT WE DO?

- The company was looking for an easily integrated PLC solution. Using multiple communication protocols (Ethernet, SPI/I2C, UART) and also with its own buffer, to allow database storage. With Industrial Shields Ethernet PLC all the specified requirements were fulfilled.

CASE STUDY

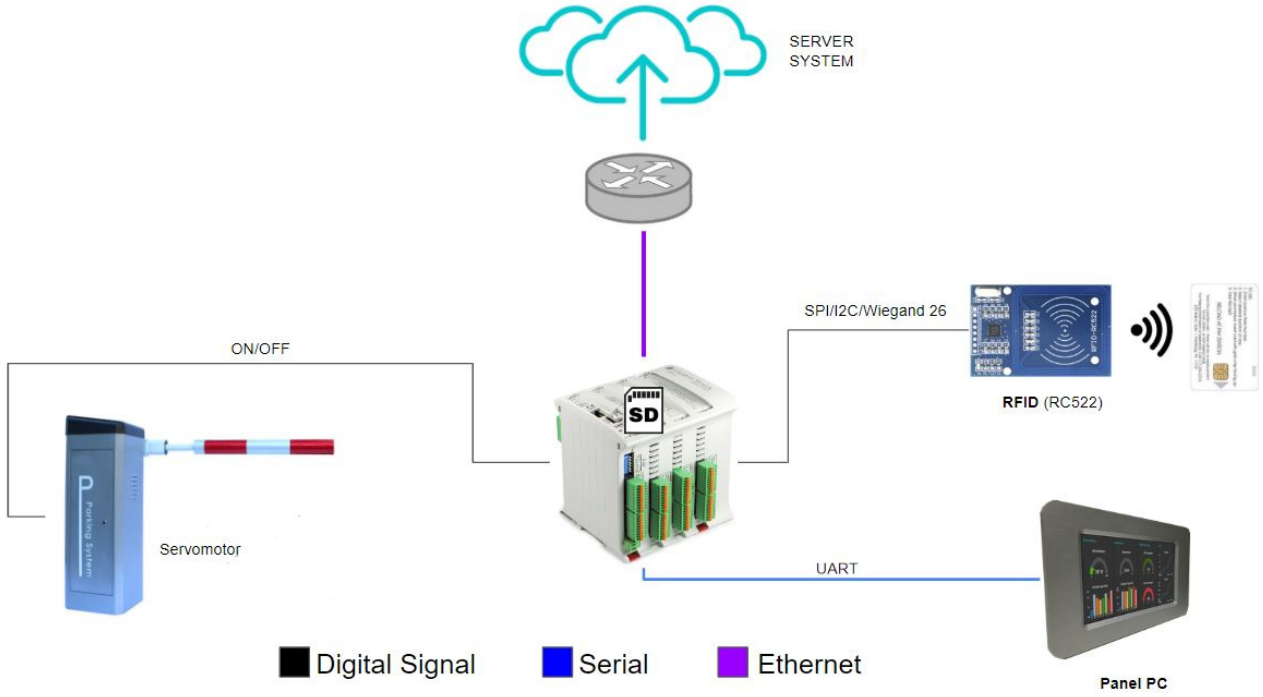


OBJECTIVE

The Industrial Shields equipment must be able to detect correctly the parking card, check if the user is part of the allowed users, and open the gate in case the statement is correct. On the other hand, you must also be able to manage the users database remotely through a server in the cloud. The process of reading the card will be shown on a Industrial Shields Panel PC to the user while he is making the entry.

FINAL SOLUTION (HARDWARE)

An RFID sensor (RC522) is used to read the card using the Weigand 26 communication protocol via SPI/I2C. Once the user is confirmed, the Ethernet PLC will act on the servomotor to open and subsequently close the gate. Next to the RFID, an Industrial Shields Panel PC connected to the Ethernet PLC is installed through the serial port using UART protocol to monitor the status of the card reading process. For the database, the server system will be connected to the cloud and if it is modified, the Ethernet PLC is notified and modifies the local database in the SD memory.



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CASE STUDY

INDUSTRIAL SHIELDS

AUTOMATING AND MONITORING WATER TREATMENT

This project allows to automatize and monitoring a treatment water plant using the Industrial Shields equipments.

Using this installation allow to the operators to know remotely the plant status and also control all the parameters: electrovalves, dosage of chemical products, dosing pumps speed regulation, pH measuring, chlorin, turbidity, among others .

SUMMARY

This project consist on the implementation of a water threatment station using Industrial Shields equipment. The objective is display sensor data on a Panel PC and also allow this system to be configured remotely.

OBJECTIVE

- The customer needs an autonomous water treatment station that could be monitorized in order to access remotely to the data. Also it has to be easy to replicate across the area and allow the system to setup remotely.

WHAT WE DO?

- Our customer was looking for an easily integrated PLC solution. The free cost of the programming platform was also a definitive incentive, together with the flexibility of the programming itself, using Arduino IDE for the PLC and Node JS for the user interface and the database.

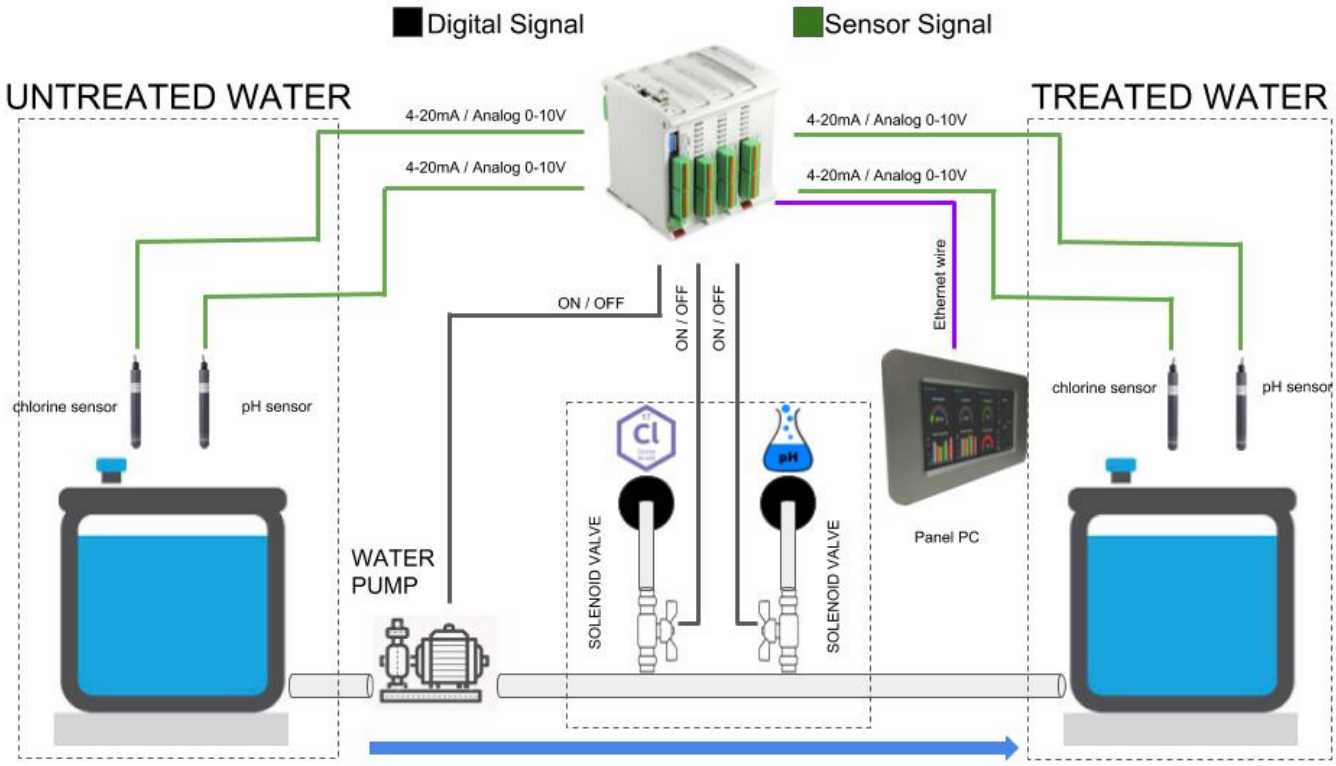
CASE STUDY

OBJECTIVE

The control system implementation for water treatment must be able to obtain the solution composition measuring the pH level and chlorine level. Analog sensors will read the pH and chlorine levels periodically. If the quality properties of the water are below the minimum value, the solenoid,valves will deposit chemical products to be able to obtain the values that are between the allowed ranges. Finally, the system also needs to regulate the speed of dosing pump ensuring the right dose.

FINAL SOLUTION (HARDWARE)

In the untreated water tank there are two sensors that measure the levels of chlorine and pH. These values can be displayed in the Industrial Shields Panel PC located in the installation through MQTT protocol. If the values are not within the range, the valves will be used to correct the chemical solution. The water will reach the treated water tank; in this one, two sensors will check again the correct state of the water already treated. Using the Industrial Shields Panel PC you can also automate the predefined dosage values.



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CASE STUDY

INDUSTRIAL SHIELDS

CONTROLLING AN HVAC SYSTEM WITH ARDUINO BASED PLC'S

Implementation of an HVAC system using the Industrial Shields equipments for a specific solution in this sector.

Installation composed of a server immersion cooling system, besides controlling temperature, odors and ventilation of the room where the whole system is installed.

SUMMARY

Owing to the plant new requirements, the customer needs a new and powerful refrigerating system to improve the actual HVAC installation. It is also important to create an installation model that could be easily replicated, with flexibility to modify the actual sequence because it exists the possibility of sharing the oil refrigerator with new server farms, due to the spec of the cooler.

The project is a server farm with an specific refrigerator system based on oil. The particularity of this installation requires a great control and monitoring of the different critical parameters. Starting from the working temperature of the servers, the humidity, and also the oil odors, to maintain the environment clean and also functional.

CASE STUDY

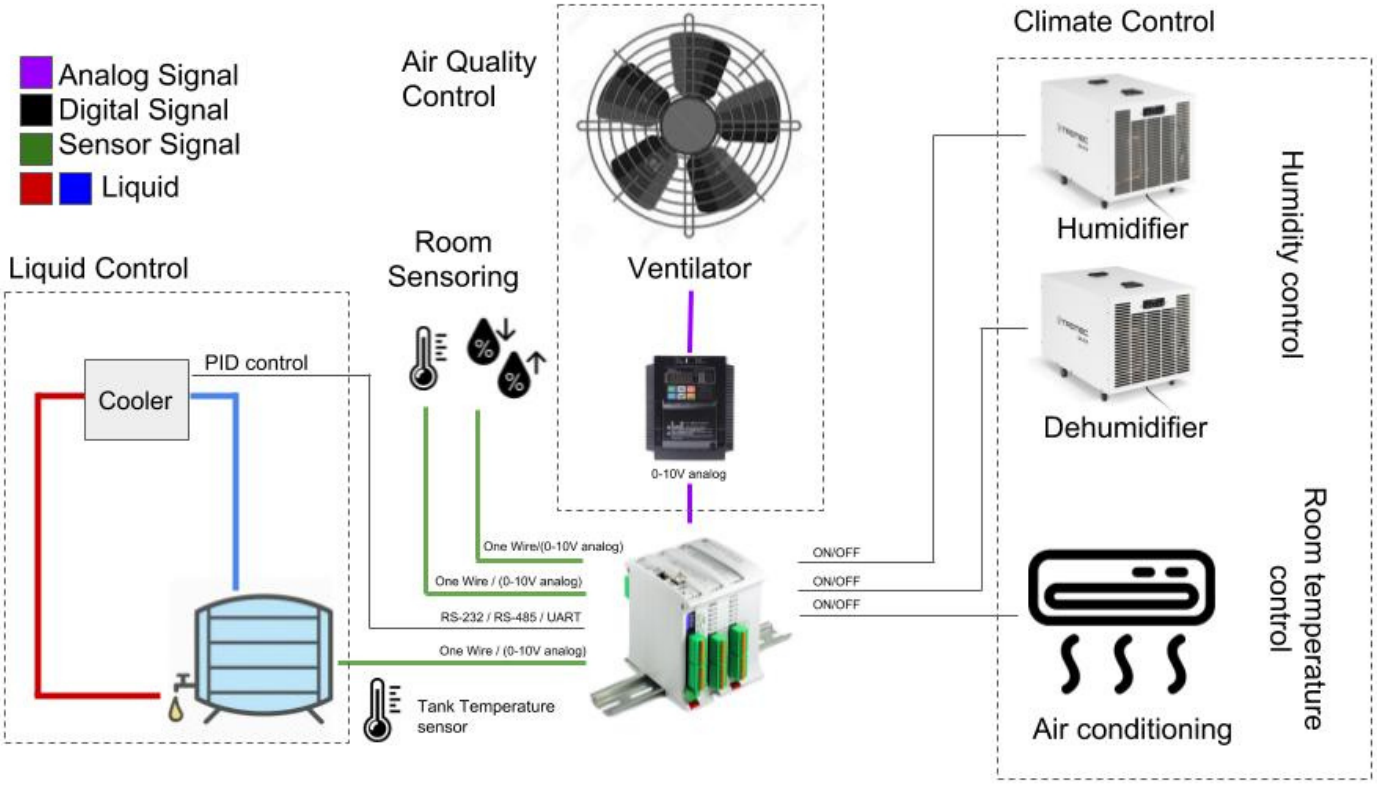
OBJECTIVE

The HVAC system has to control a server submerged in a cooling system. The room and the tank has to be inside a certain range of temperature and humidity. A part from that, there is a ventilation system which is responsible for reducing oil odors that are in the plant so the operators can work on it.

FINAL SOLUTION (HARDWARE)

The Industrial Shields equipment has to control the temperature (room and fluid), the humidity and the ventilation of an entire room with two critical elements, the temperature and also the odors.

To control the fluid it is required a PID implementation in the Arduino based PLC with a temperature sensor. The sensor value is compared with a setpoint and the PLC treats the flow that the cooler has to implement.
The room climate is controlled by a dehumidifier/humidifier and an air conditioning. They are enabled or disabled depending on the values of the temperature and humidity sensors.
The ventilation is treated with a variable frequency drive, The Arduino PLC makes the ventilator rotate faster or slower depending on the odor. The AFD (variable frequency drive) is controlled using an analog signal.



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CASE STUDY

INDUSTRIAL SHIELDS

MONITORING A WEATHER STATION IN MEXICO

This project is installed on Valle del Yaqui by Red de Estaciones Meteorológicas del Distrito de Riego del Río Yaqui in Mexico and it was developed, designed and installed by Ing. Juan Carlos Raygoza, Ciudad Obregon, Sonora, Mexico.

Using this installation allow to the meteorologist to know remotely the important weather parameters of this place. Also allow them to configure their station in order to actuate and add some modifications to the station.

SUMMARY

This project consist on a weather station with the objective of display sensor data on a web site and also allow this system to be configured remotely.

OBJECTIVE

- The customer needs an autonomous weather station that could be monitorized in order to get the data in an easy way. It has to be easy to replicate across the area and allow the system to setup remotely.

WHAT WE DO?

- Our customer was looking for a PLC solution that could be easily integrated with the sensors and that was also easy to program. The free cost of the programming platform, was also a definitive incentive, together with the flexibility of the programming itself.

CASE STUDY

BACKGROUND

The client had experience in well-known brands, but also knowledge and experience in the use of Arduino. That was what allowed to raise the project of the weather station with a broader vision, incorporating to the project the Industrial PLCs based on Arduino.

FINAL SOLUTION (HARDWARE)

- On this project Industrial Shields PLC's have the function to get the data acquisition from different ADCON weather sensors as temperature, humidity, solar radiation, wind speed, barometric pressure and rain meter. Then transmit this data to a intermediate communication Telnet server. Also there is installed an SD card to store local data, an RTC (real time clock) to get the real time, some wireless communication systems, security cameras and alarms. All of these devices are controlled by an M-Duino 42.

FINAL SOLUTION (SOFTWARE)

- The PLC program was developed with Arduino IDE. The intermediate software between the web site and the PLC is a Telnet server. This Telnet server has a database, some REST service and finally the web site using Angular 4 to show the data on MetApp (weather station web site). Some of these configurations can be configured by remote control using the Telnet platform.

Valores promedio en el Valle del Yaqui

Temperatura: **16.03 ℃**	Horas Frío Acum. (Ciclo): **41.92 Hrs.**	Vel/Dir Viento: **10.05 Km/hr | 236.02 °N**
Humedad Relativa: **71.21 %**	Precipitación Acum. (Ciclo): **5.22 mm**	Ráfagas de Viento: **12.16 Km/hr**
Radiación Solar: **155.95 W/㎡**	Presión Barométrica: **771.67 mmHg**	Punto de Rocío: **10.75 ℃**

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CASE STUDY

INDUSTRIAL SHIELDS

MEAT SELECTION LINE BY INDUSTRIAL SHIELDS

In this use case, we have implemented a meat selection line controlled by an Industrial Shields arduino based PLC. The system we are going to build is very easy to install and program due to the few elements and open source programming.

SUMMARY

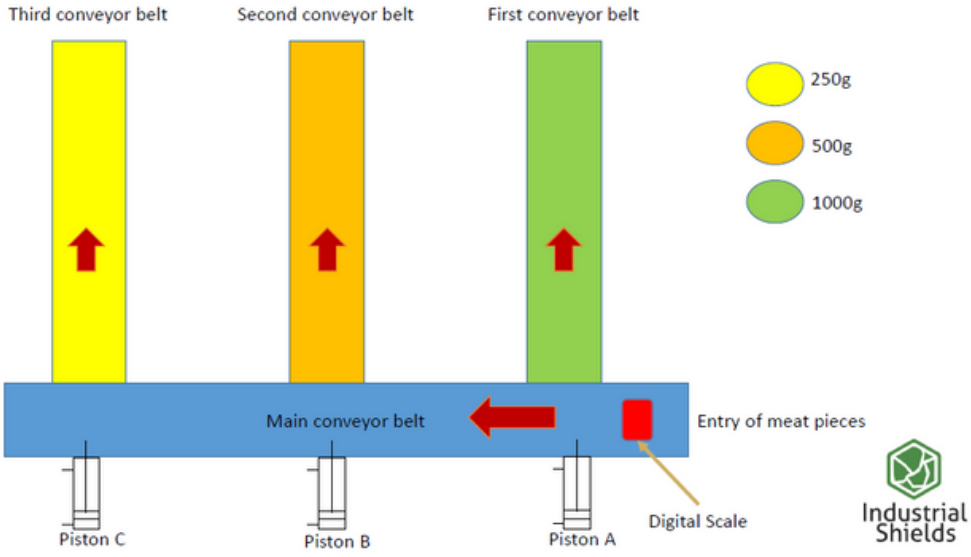
Installing the system that we are showing, you will have a completly automatized meat selection line which can offer you many advantages, since there are no personnel handling, therefore it is completely hygienic, as well as there is a high degree of accuracy in selection and there will be perfect climatic conditions for meat. You can also save a lot of time since the system has a very high speed. Following the proposed system, there is the option of implementing a packaging and labeling system since the meat is directly selected.

GOAL

The system that we are going to implement consists of the selection between three calibres of meat by weight. To do this, first you will need to install 4 conveyor belts: a main one through which all the pieces of different sizes will come together and the other 3 will carry each type separately. For the selection, you must install a digital scale on the first belt and depending on the weight of the piece, it will be automatically diverted through one of the 3 channels. The deviation of the pieces will be done by a pneumatic piston controlled by an electrovalve.

Another very important aspect that you have to implement is the air conditioning system in the room to ensure that the handling is done in optimal conditions.

Below you can see the distribution of the tapes and devices.



CASE STUDY

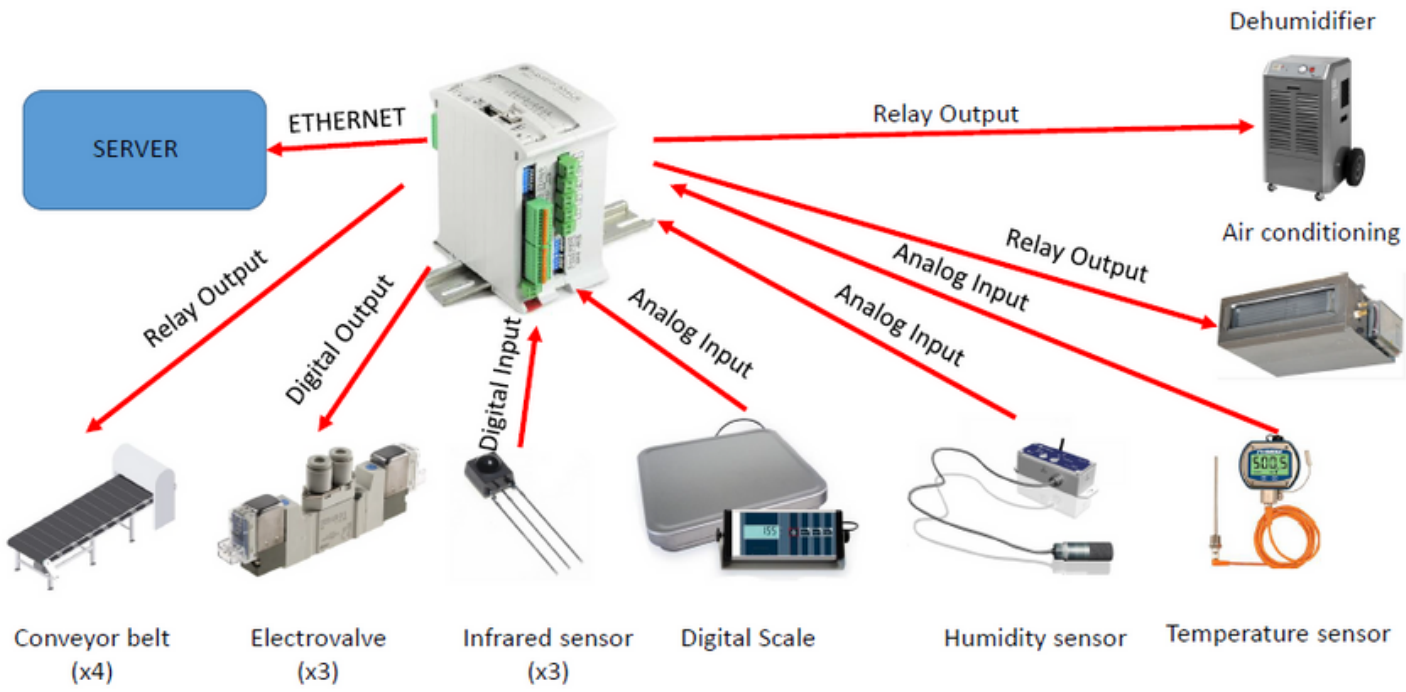
IMPLEMENTATION

The Industrial Shields PLC will control the whole system, so firstly you are going to connect the conveyor belts to the PLC, which will be relay outputs since they work at 220Vac. The main conveyor belt will always work since you must have a constant flow of meat. The other 3 conveyor belts will only be activated when the corresponging piston is activated, because if there is no piece of meat you are not interested in it working so as not to waste energy.

The digital scale will be an analog input for your PLC and will be in charge of weighing each piece and transmitting the data to the PLC. Depending on the weight of the piece, we will activate the piston corresponding to each belt. To activate the piston just when the piece passes in front of it, you have to install an infrared sensor that ensures that the piston pushes the piece of meat to the other belt. As we mentioned before, you will need 3 solenoid valves to activate each of the pistons and for the PLC there will be 3 digital outputs.

The climate of the room will be controlled by 2 sensors (humidity and temperature) and depending on the collected values, you will turn on the air conditioning and dehumidifier.

Finally your PLC has Ethernet communication, so you can create three registers for each size of meat and constantly send the number you have registred to the server. This allows you to have a real time inventory of the production.



Industrial Shields

CASE STUDY

INDUSTRIAL SHIELDS

AUTOMATED PIG FARM

On this occasion we will introduce the Industrial Shields technology to the farm sector. We are going to control and monitor a pig farm using a PLC and a PC panel connected to Wi-Fi, which can collect information from the system, store it into a server and analyze it.

SUMMARY

Today, meat producers can see that the demand for their products is increasing due to the world population growth and prosperity. Food quality and safety standards are also becoming more stringent, while the costs of raw materials, labour and energy are rising.

The sector faces the challenge of producing enough safe, affordable and sustainable food of guaranteed quality, using efficient methods.

GOAL

Industrial Shields facilitates both environmental control for improved animal welfare -such as management, automation and optimization systems- and information exchange in the process chain.

We also offer technical solutions that allow you to control the individual welfare of your animals, their production and condition, so that the business of livestock producers can grow in a sustainable way.

Our system will take care of the control of different actions such as the air conditioning of the enclosure so that the animal lives in optimal conditions, as well as its feeding by performing an exact weighing of both water and food in order to ensure its proper growth, which also allows us to have the inventory at all times.

Another important aspect to take into account is the concentration of CO_2 and ammoniac which are very harmful gases for the animals. For this we need an extraction system in combination with filters to guarantee air quality in the enclosure as well as not expelling it into the environment.

Finally we need to do a scheduled cleaning of each cage and also control the opening of the doors.

Keep in mind that this is a generic idea easily expandable by adding parameters to control depending on the needs and tastes of each customer.

CASE STUDY

IMPLEMENTATION

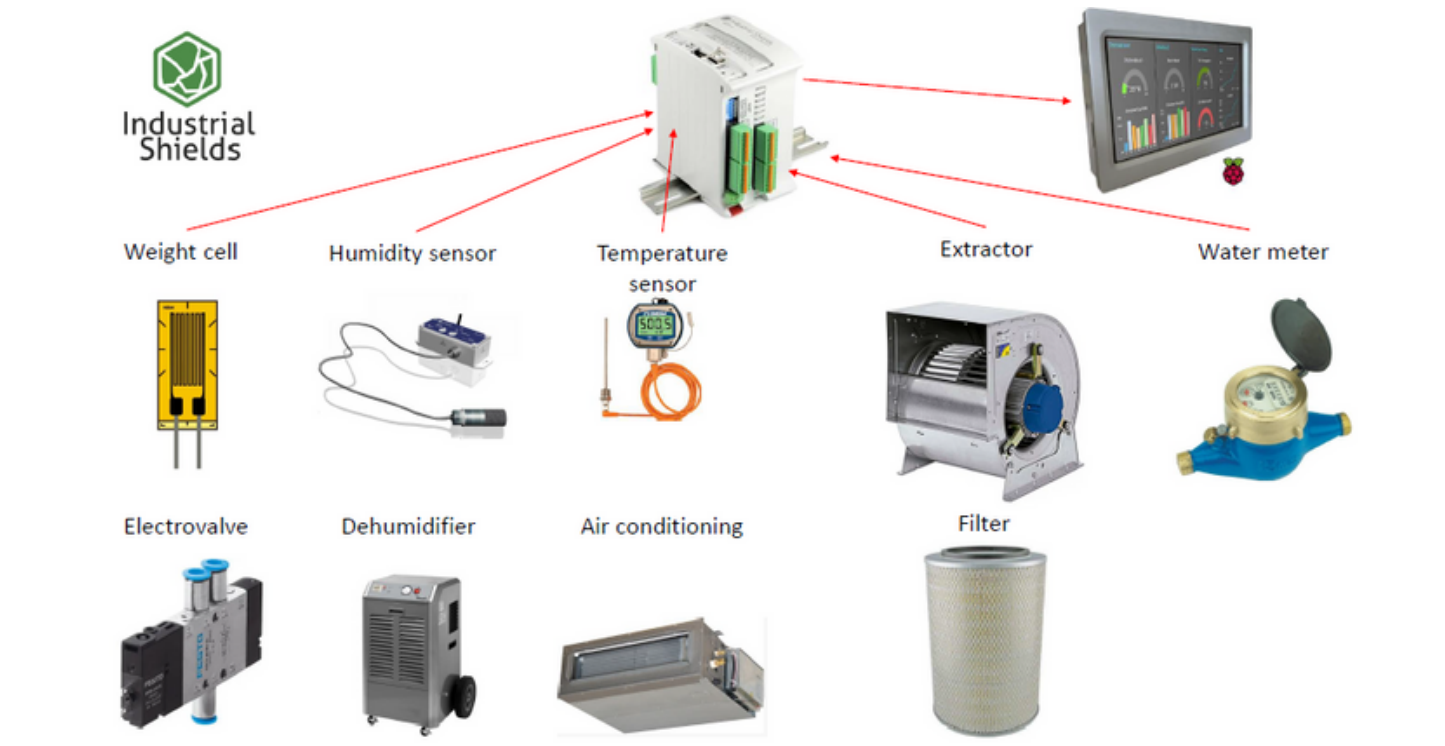
First of all, we will look at the air conditioning that consists of controlling the temperature and humidity of the room. To do this we need an air conditioner and a dehumidifier as well as to 2 sensors, one for temperature and one for humidity. Depending on the pre-selected and recorded values, we will turn the devices on.

In relation to the food, we will install a gate controlled by a solenoid valve and a scale, so in this way we will drop food into the scale by opening the solenoid valve to the predetermined value. Then we will close the solenoid valve and through another door we will drop the food for the animal. For water we can simply add a full meter of liquid into the tube letting the exact amount pass as well. The program will be in charge of making a record of all the amount of food distributed by adding the quantities of each cage and the rest of the total so we have the inventory done.

As we have mentioned before, in this type of farm the concentrations of CO_2 and ammonia are very harmful for both people and animals and for this we need to have good ventilation and filtering so as not to expel the gases to the outside. We will install extractors in combination with filters.

With regard to the cleaning of the cages, taking advantage of the drainage we can introduce two pipes to high pressure and when it is activated by program they will wash the cage, as long as we open the doors (by means of an electrovalve) so that the animal goes out to the common area and does not suffer.

This system will have a control point through a TinkerTouch PC panel where the menu of programs will appear with all the processes to establish all the parameters and schedules.



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CASE STUDY

INDUSTRIAL SHIELDS

SAFE ESTABLISHMENT #CORONAVIRUS

Given the exceptional situation we are facing due to the COVID-19 crisis and the measures approved by the government in relation to small businesses, which have to respect the limitations imposed about social distancing and hygiene, we have thought of an effective and low-cost solution that drastically reduces the risk of contagion from our business and also complies with current regulations. In this way, customers will have a certain security to go to the store feeling comfortable when buying or requesting a service.

SUMMARY

The idea consists in having a control over the people that enter in our shop, which will allow us to:

- know the facility capacity at any time,
- as well as taking each customer's temperature to ensure that they are not infected.

Another function of our system is to sanitize the room using ozone. This process can be carried out during lunch break and at night to ensure a clean and disinfected store.

It is important to say that ozone is one of the compounds with the highest oxidizing capacity, far superior to chlorine, which means that it has a higher biocidal efficiency, so we can ensure 100 % disinfection.

To achieve this objective, we have thought of creating an automated system, controlled by an Industrial Shields PLC in combination with a Touchberry Panel PC. In this way we can install sensors that monitor the system and an ozone machine. Through the Touchberry we can receive system alarms as well as visualize and/or modify the different parameters.

CASE STUDY

IMPLEMENTATION

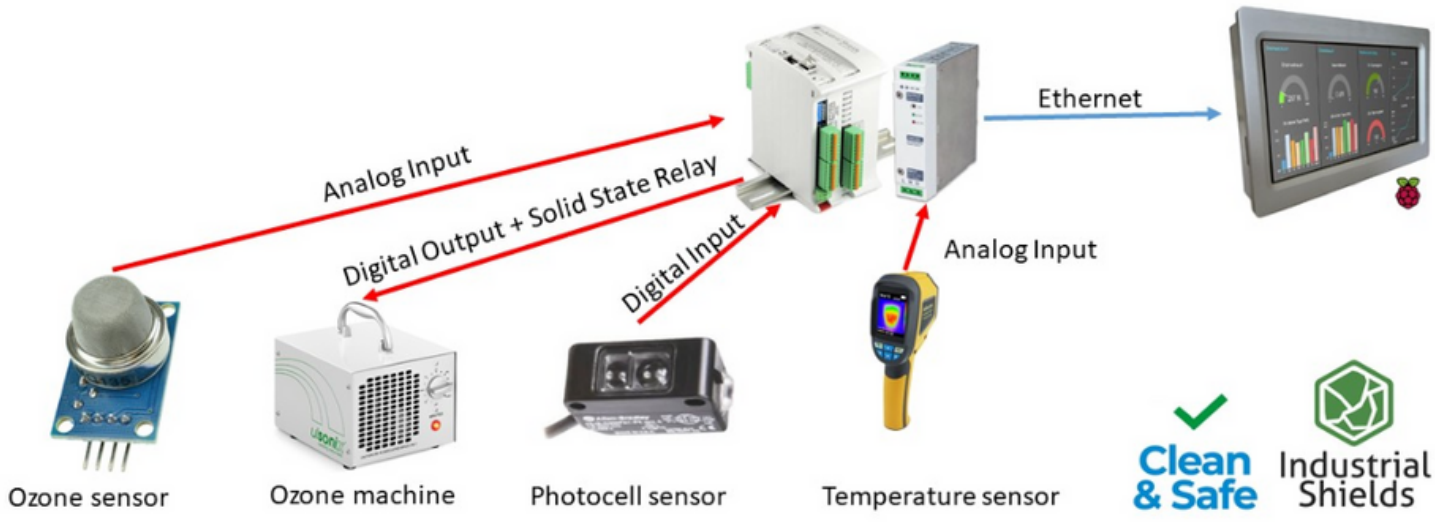
As we mentioned before, the device in charge of controlling the system will be the PLC which needs a 24V power supply to switch on. These two items are priced at 235 euros.

Once we have the automaton on, we can connect the other gadgets:

- **Panel PC TouchBerry,** via Ethernet. This device has a market price of 488 euros.
- **Ozone machine**. To make the connection using a digital output, we will need a solid state relay since the machine is powered by 220V and the digital output provides 24V at most. (Approx 300 euros).
- **Photocell (infrared) sensor**. It will indicate the passage of people through the door of the store in order to control the capacity. (approx. 50 euros).
- **Ozone sensor.** To guarantee the disinfection of the establishment, there must be a certain concentration of ozone in the air. Through this sensor we will know how long the ozone machine has to operate. (Approx. 60 euros).
- **Temperature sensor (laser)**. We will use it to take the temperature of each customer. (Approx 30 euros)

The sequence of our system will start with the configuration. Through the PC Panel, we will introduce the maximum capacity of the store and the hours when we want the disinfection process to take place. With these parameters in mind, a people counter will be started. When the limit has been reached, a warning message will be shown on the screen advising that new people cannot enter until someone leaves. When there is a person detection, the temperature sensor will be read; if it exceeds the limit, an alarm message will be displayed on the screen. The disinfection process will consist of automatically turning on the ozone machine according to the schedule and letting it run until the ozone concentration is adequate.

As you can see, the total budget of the project is really low and ranges between 1500 - 2000 euros including the programming of the system.



CASE STUDY

INDUSTRIAL SHIELDS

HOME AUTOMATION WITH PLC & TOUCHBERRY

Home automation is the concept referred to the integration of different technologies at home through the simultaneous use of electricity, electronics, computers and telecommunications. Its purpose is to improve safety, comfort, flexibility, communications, energy savings, facilitate comprehensive control of systems for users and offer new services.

SUMMARY

Home automation is a way of adapting to social changes. One of its functions is to facilitate and automate routine processes, so that you gain more time to do what really matters. However, it is worth making a clarification: although there is a lot of technology involved, home automation allows you to have more humane, more personal, multifunctional and flexible homes. In conclusion, if you have a smart home, you will not probably spend more energy starting the washing machine every day.

This type of project belongs to the so-called IoT since it incorporates different devices connected to each other and controlled by a programmable automaton, with which you can communicate to extract information or modify their behavior.

These are the areas on which this project will be based:

- **Automation and Control** - includes the control (open/close and regulation) of lighting, air conditioning, blinds, doors, and appliances.
- **Security** - includes intrusion alarms and technical alarms (fire, gas, power failure).
- **Audio and video** - includes the distribution of video images recorded with cameras inside and outside the home to the µSD card of the PLC.

Apart from the devices we are implementing, you could add functionalities such as warnings by phone, sms or email of the arrival or departure of third parties to the home such as children or housekeepers.

CASE STUDY

GOAL

The aim of this project is to create a system which can collect the information from several sensors located in different parts of the house and also actuators in order to control the devices according to the information collected or the user's needs which can be preset.

CONCLUSION (HARDWARE)

To achieve our goal, let's design the structure of the system. We have thought of a simplified model because the main idea will be easier to understand and, starting from this point on, you will be able to develop it for your house.

All the devices and sensors will be controlled by an Industrial Shields' PLC; in this case, you will need one industrial controller of the GPRS family to be able to send the alarms to your phone.

To collect all the necessary information to be able to act on the different devices, you will need a series of sensors that will be directly connected to the PLC:

- For air conditioning you will need a thermostat (**temperature sensor**) that will provide an analog input and depending on the selected temperature you will turn the air on or off.
- In the case of the accesses to the house (doors and windows), you are going to install **capacitive sensors** in each one of them (digital inputs), that will indicate when they are open.
- The lights in each room will be switched on based on the **presence sensors** installed in each room, so there will only be light in a room if there is someone there.
- In order to create the alarms, you need 2 types of sensors; to detect a fire, there will be a **smoke sensor** and if there is a gas leak you will know it by an **air quality sensor**.

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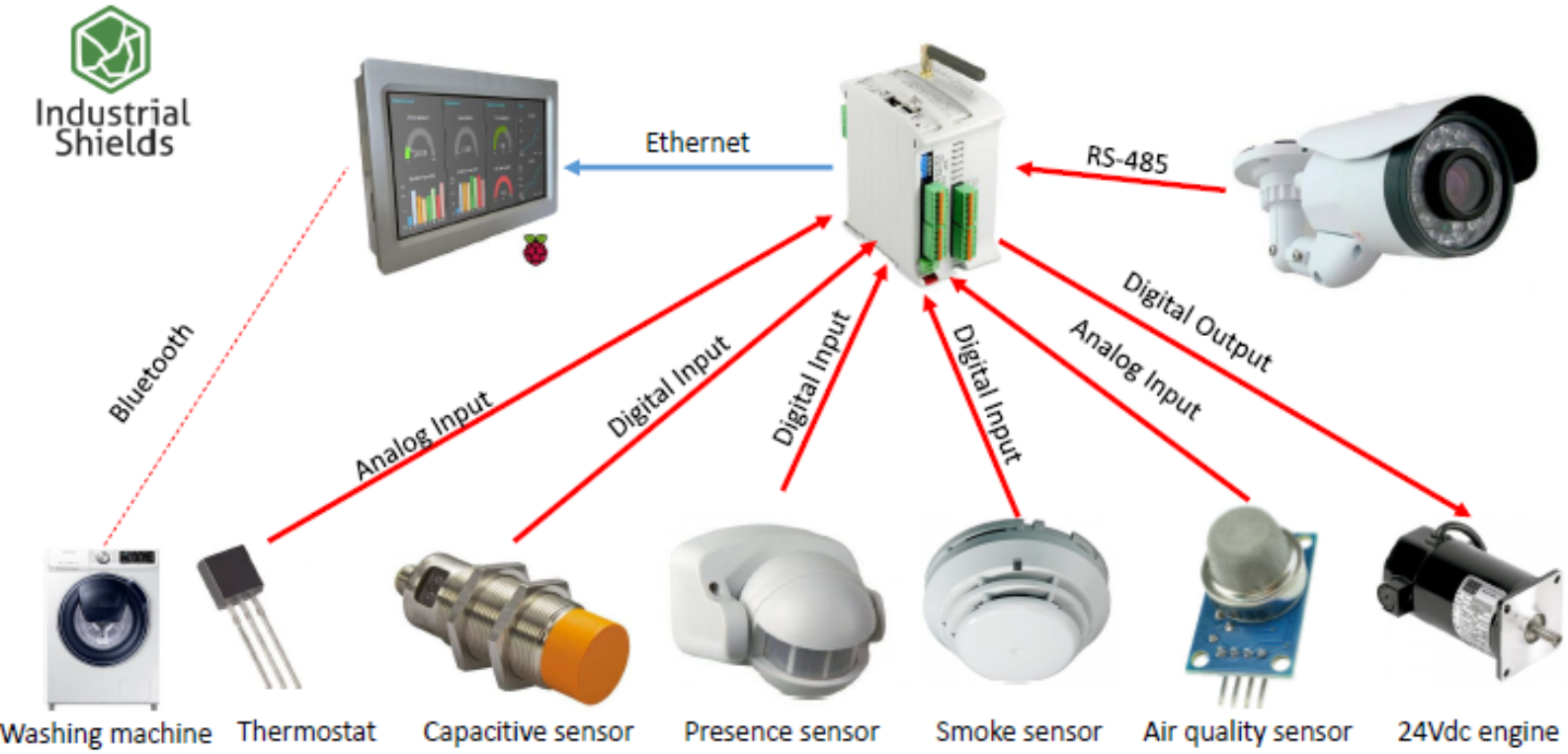
CASE STUDY

The blinds of the house will be able to go up and down by means of engines connected to the PLC. In the case of appliances, they will have to be smart to be able to transmit the information through Bluetooth and you are going to control them directly with the PC panel since it has this kind of communication

The alarms that will be sent to your phone will be activated according to the smoke levels and air quality. When you leave the house, you will have to press a button that will be read by the program and will interpret that there is nobody in the house. In the event that a window or door is opened, the alarm will be activated and you will be notified. There is also the option of installing surveillance cameras that can transmit everything they are recording to the PLC and save it on the µSD card of the PLC.

The TouchBerry PC panel will control the PLC and will be the user's interface where you can control all the system.



CASE STUDY

INDUSTRIAL SHIELDS

CONTROL & MONITORING OF AN OIL WELL

In this case study, we will introduce the Industrial Shields' technology to the oil sector. We are going to control and monitor an oil well using a PLC and sensors connected wireless to the cloud.

SUMMARY

Why did we think of this application?

The main reason is because it is very interesting to show our costumers the capacity and effectiveness of our equipment to be used in any type of environment in addition to the communicative versatility that allows us to collect information from the devices without having to be on the site.The programming of the process will be done with the open source application Arduino IDE, since the heart of the PLC is an Arduino Mega board.

The variables that we are going to visualize in an oil extraction process are basically:

- The oil temperature.
- The pressure and the flow rate with which it is extracted, which can be very useful for forecasting production.
- Possible damage to the probe.

GOAL

As we mentioned before, we want to visualize those process variables that will be provided by the sensors. We will use the Bluetooth module of the PLC to receive this information without wires, and later we will send it to the cloud via GPRS. The data will be processed by an online application that will monitor the process. In addition, it would be interesting to program a series of alarms for critical levels so as not have to be constantly consulting variables.

CASE STUDY

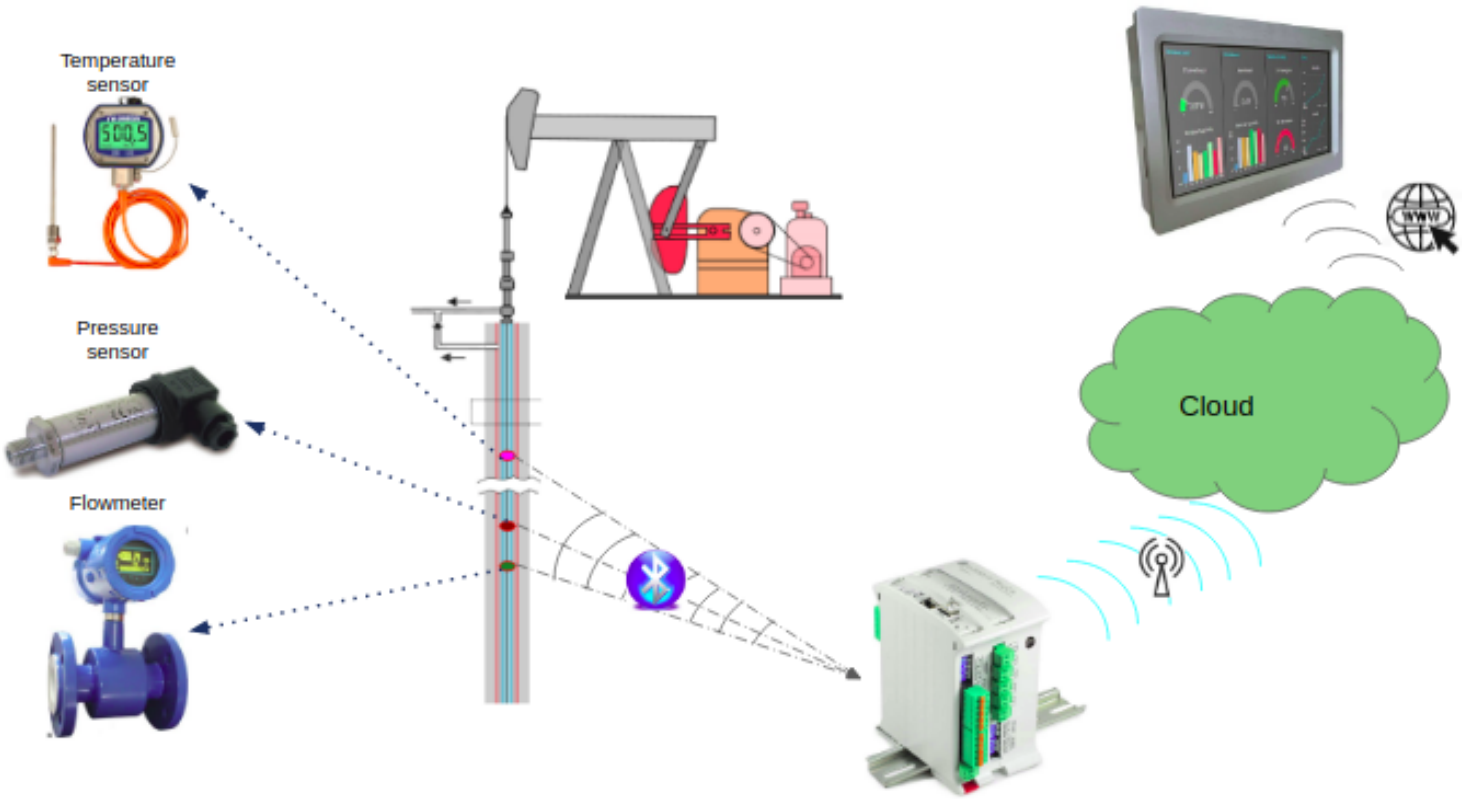
CONCLUSION (HARDWARE)

The PLC will control the three sensors that we need: pressure, temperature and digital flowmeter. These sensors will provide us with 10-bit analog signals (0 - 1023), which will be later converted to the unit of measure by program. The connection between the PLC and the devices will be by Bluetooth. Periodically, the PLC will read the peripherals and send the data to the cloud, which the application will access to collect real data and display it on the screen. When one of the sensors reaches a critical level, it will activate an alarm that will give us the option of stopping the process or slowing it down remotely. In order to be able to act on the system, we need to include an emergency stop and another button that will slow down the extraction speed. These controls will be virtual so we will read by program if the button has been pressed or not, a condition that will arrive via GPRS.

From this model we could multiply it and create a network of wells in different regions and even countries and have a centralized control of all of them. We could also make a study of all the data collected and create a calculated trend in each region to see where the most frequently failures in the system occur and thus be able to anticipate solutions.

The way we have connected the devices and the fact of transmitting the data to the cloud makes the project become an IoT application.

Finally, in the following scheme can see the distribution of the devices.



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CASE STUDY

INDUSTRIAL SHIELDS

SMART HOTEL WITH TINKERTOUCH S 10.1”

In this article, we are going to talk about a way to use Tinkertouch S 10.1. This PC panel is one of Industrial Shields' newest and most versatile devices. It is Raspberry based and runs with Linux.

After reading this essay, you will know more about what a smart hotel actually is, why the technology is becoming so important and which are its main advantages.

SUMMARY

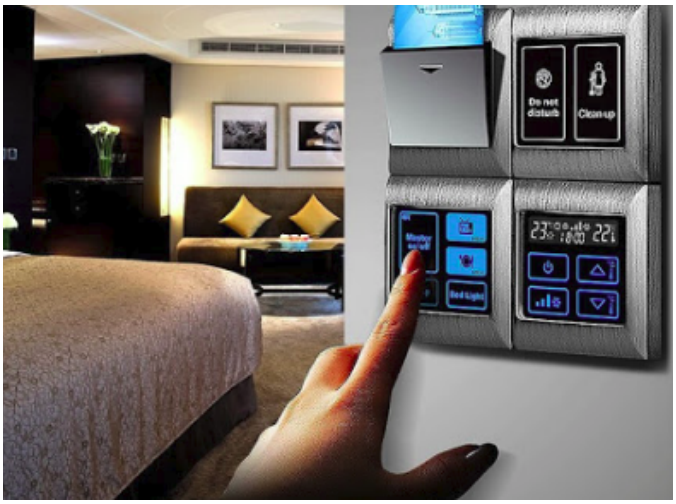
Meaning of the concept "smart hotel"

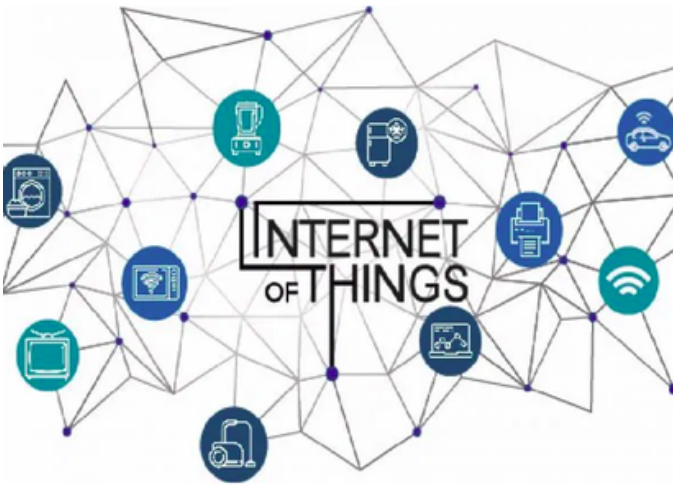
The main idea is that a smart hotel is a hotel using devices interconnected all together and to the cloud. In this way, they are able to interactuate and give us valuable information.

The functionality of this concept allows guests to manage multiples devices from a single point of control and also gives an intelligent answer to the necessities of costumers based on their preferences.

A lot of important hotel chains like Hilton or Mariott have already installed the most advanced technology, This fact improves significantly the costumer experience, facilitates hotel workers' life and saves owner's money.

Using smart rooms, guests are able to control multiple components and have their rooms just the way they like it. They also find it both faster and easier to get important information. Moreover, creating a smart hotel can also reduce the number of operational costs.





CASE STUDY

GOAL

The main objective is to make a model which can help to transform a hotel into a smart accomodation. To reach this goal, we need to think about an appropriate and viable way to implement it. We will install several Raspberry based PLCs and Tinkertouch S 10.1", several sensors, scanners and a server to upload all the information.

CONCLUSION (HARDWARE)

The IoT system that we want to implement consists of creating a network between the main PC Panel and the slaves located in every room. The master is situated at the entrance of the hotel and will be the one welcoming us, scanning IDs, filling out all the forms, asking for signature and sending it by email to the costumer. All this information will be scanned from the ID card and will be previously sent along with the number of the room assigned, to the PC Panel. In the PC Panel, we will show a menu where our guests will be able to choose their preferences; the room will be assigned based on the customer's preferences. The main PLC is connected to the cloud via GPRS to transfer all the customers' data; we will also connect the PC Panel by Ethernet and the scanner using RS-485.

To be able to communicate with the others PLCs from the rooms, we need to create a WiFi network where the main PLC of the entrance will be the master.

Now let's go to the rooms. There we will also find a PLC in association with a PC Panel. For this application, the most appropriate PLC is one with Relay Outputs to control 220V devices.

- Climatic Sytem. Using a temperature sensor as Digital Input to the PLC, and the Air Conditionating as Relay Output.
- Lights of the room. Using leds as PWM Output we can change the intensity.
- The fridge. Relay output; when the room is assigned, the fridge will be ON so we do not waste energy.
- Bath water. By installing two solenoid valves (cold/hot water) in digital outputs of your PLC, we can begin to fill the bath using the PC panel to have it ready to use.

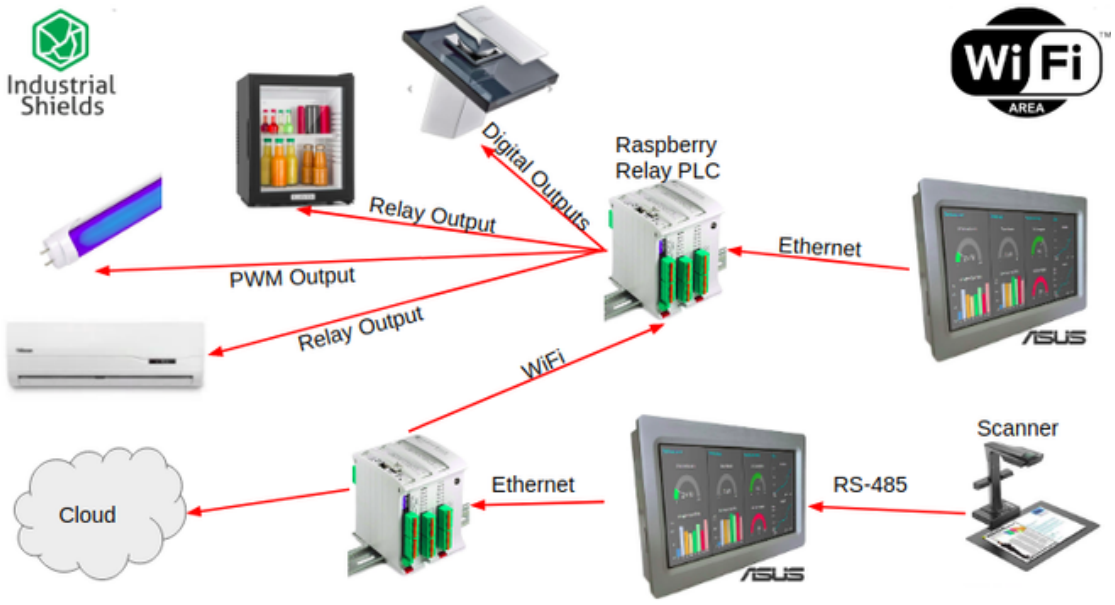
In the PC Panel, there will be the menu to control all these variables and also the following information:

- Digital Clock
- Hours remaining until the Checkout time and the next alarm.
- Spa, sauna, gym and swimming pool. The costumer can select when he/she wishes to use those services and the PC panel, based on the information from other users, can tell us which is the best time to visit the facilities so we can enjoy the sauna without too many people inside.
- City Maps and suggestions about restaurants, markets, pharmacies and places to visit based on age, nationality and more parameters of the costumer.
- Restaurant times and menus also adapted on every guest.
- All the contacts of the hotel, police etc.

CASE STUDY

ADVANTAGES

- **More sustainable hotel rooms**: From the owner's perspective, one of the most important benefits is the improved sustainability available. This is primary linked to energy saving possibilities in the rooms, which can be aided by the automation that IoT offers. Leds can be set up to automatically increase or decrease in power, based on the levels of light in the room at any given time. In the same way, heating can be configured to automatically maintain a certain temperature, with air stopping once that temperature is achieved. All these facts then lead to lower energy bills.
- **Improved levels of personalization**: A smart hotel offers excellent opportunities to deliver personalization, The PC Panel can be remotely set up to address guests by their own name, it is also used as a central control point by the guests to set the conditions of the room. Also as an extra, through IoT technology, smart TVs and smart speakers can provide guests with the ability to access their own accounts on services like Netflix and Youtube.
- **Easier access to information for costumers**: Another important advantage of smart hotel technology is the ability to gain access to information. With the Tinkertouch S 10", costumers can get all the essential information to have a wonderful stay.
- **Data-driven decision making**: Workers from hotel industry should be careful with smart hotel systems, specially in terms of protecting costumer privacy. As long as hotels are transparent and comply with the data protection legislation, some costumer information from smart hotels can be useful. This can allow hotels to find out the most popular TV channels, restaurants or places to visit, times of using hotel services, etc., allowing for data-driven decisions on what to set as default options.
- **Pre-emptive maintenance and repairs**: Costumers and hotel owners can benefit from the ability that a smart hotel provides for pre-emptive maintenance and repairs. Basically this can be achieved because the IoT allows hotel staff to see performances information and operational data for specific devices in real-time. Using this technique, hotel staff can solve problems quickly, or even before they happen, allowing repairs to be made earlier. This can save a lot of money to the hotel owner. On this model, we have not implemented this function but it would be possible installing sensors on the different devices (e. g. pressure, temperature, humidity or air quality sensors) and sending the data to the server to analyze it later.



CASE STUDY

INDUSTRIAL SHIELDS

CONTROL OF PUBLIC SPACES (LORA)

Knowing the flow of people who enter in public spaces, like big squares, can be useful to know in advance the number of people who will assist at public events or demostrations. In order to anticipate, we have to analyze the previous data and take advantage of it.

The anticipation consists in knowing, for example, how many police officers or ambulances will be needed for an event. It will also let us know people's trends and preferences; for example, which events will be the most crowded.

SUMMARY

Why have we thought about this application?

Nowadays, most of our customers are interested in the analysis of Big Data, because this fact can provide them a lot of information and let them know the environment better, take better decisions and have agility in internal management.

Basically, Big Data analysis consists of building models from observable patterns in large amounts of data. Models offer a better visualization of relational variables, making it much easier to extract useful information.

CASE STUDY

GOALS

The aim of this project is to create a system which can collect the information from several sensors situated in the different accesses of a square and store it in data packages (registers). Due to the big amount of information, we need to transmit cyclically those registers in order to be sure that we have stored them in a safe way.

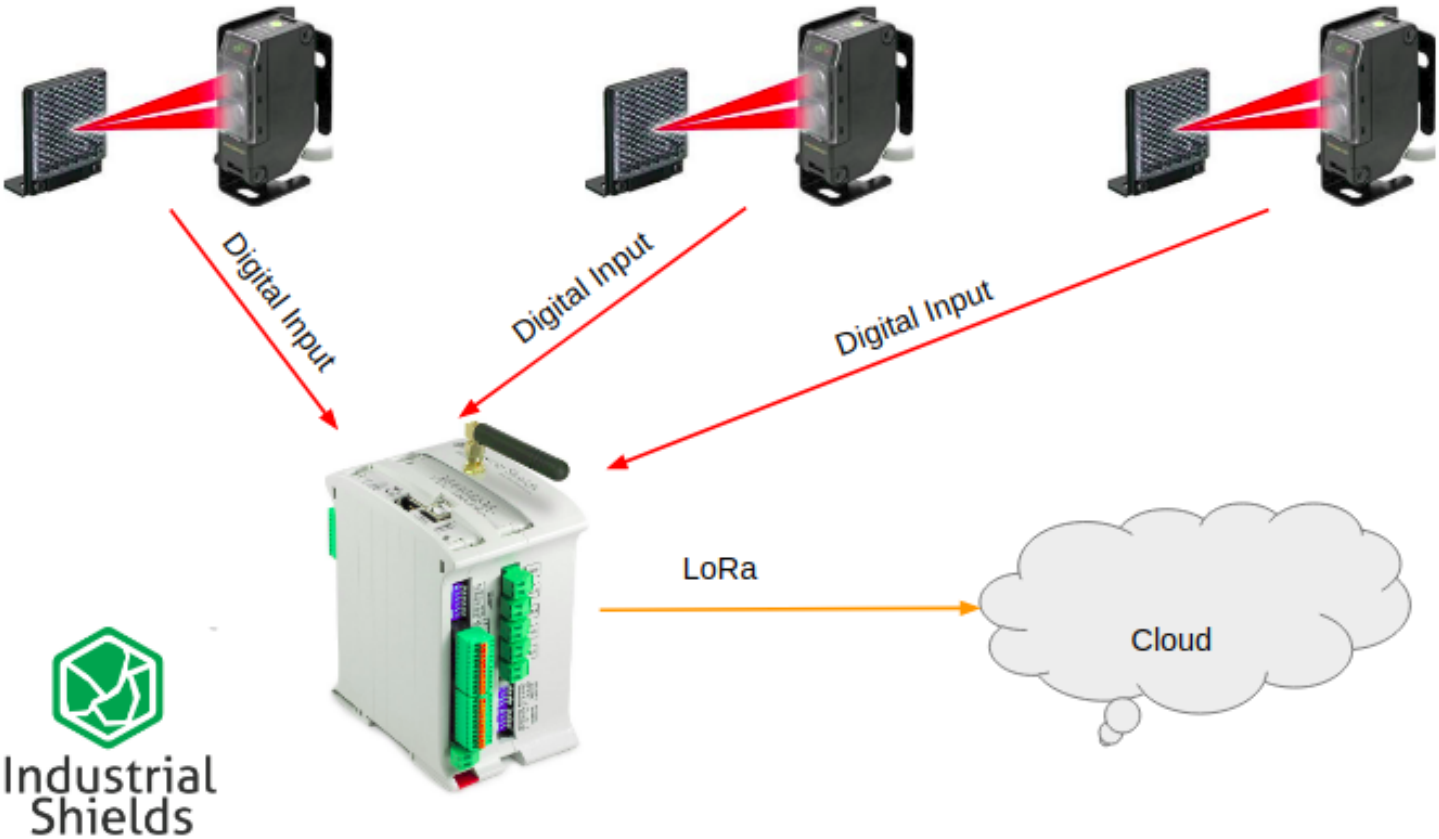
CONCLUSION (HARDWARE)

To achieve our goal, let's design the structure of the system. We have thought in a simplified model because the main idea will be easier to understand and, starting from this point, all our customers will be able to develop it for their specific applications.

Firstly, we have chosen an Arduino based PLC with LoRa communication: MDUINO PLC ARDUINO ETHERNET & LoRa 21 I/Os ANALOG/DIGITAL PLUS. This will be the brain of this system.
With this device, we can collect the information from the sensors and send it by LoRa to the cloud. The software used to program this PLC is Arduino IDE, an open source platform totally free.

To be able to detect the passage of people, we will install several photo-electric sensors which will return us a high voltage level. Our PLC will interpret this pulse and will increase the counter (+1). This counter will be our register and it will be sent to the cloud to another general register.

In the following picture, you can see clearly the system structure.



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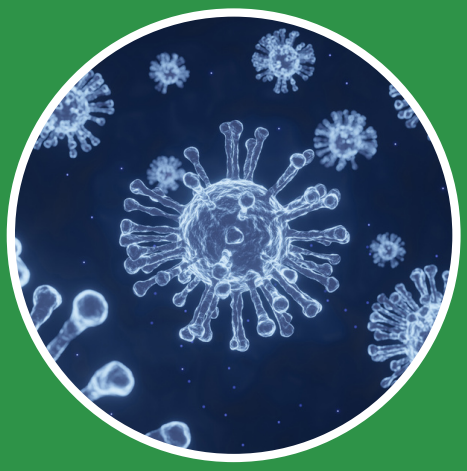
CASE STUDY

INDUSTRIAL SHIELDS®



CONTROL OF COVID-19 VACCINE

Pfizer and Moderna pharmaceutical laboratories have confirmed that they are close to finding the first vaccine against COVID-19. Both companies have been the first to announce the preliminary results of the Phase 3 trials of their respective vaccines. They claim that the new drug is highly effective against a virus that has caused more than 55 million infections and 1.3 million deaths worldwide.

2020 has been a year to record in the history books. The COVID-19 virus, which started as a simple flu, has become one of the most infectious and dangerous pandemics in history. More than 55 million people worldwide have been infected while experts were unable to control the situation.

Recently, two pharmaceutical companies have found the first vaccine using the messenger RNA method, which could be more than 90 % effective. However, these vaccines must be kept under strict conditions in order not to go bad.

More than 55 million infections and 1.3 million deaths worldwide 2020-12-17 | Source: OMS.

CHALLENGE

The messenger RNA, which is very susceptible to degradation, can be implemented in different ways; depending on the concentration of RNA, it must be preserved at one temperature or another. As for the Pfizer vaccine, it should be kept below -80 °C; while the Moderna vaccine can be between 2-8 °C up to 30 days, or up to 6 months if it is below -20 °C.

In order to guarantee that the drug reaches the end customer in perfect condition, it is necessary to ensure the correct distribution of the product by maintaining optimal temperature conditions for its proper preservation.

CASE STUDY

SOLUTION

Thanks to an Industrial Shields® PLC, a system will be implemented to:

- monitor the temperature to which the vaccines are exposed, and
- know if there are any problems to be considered.

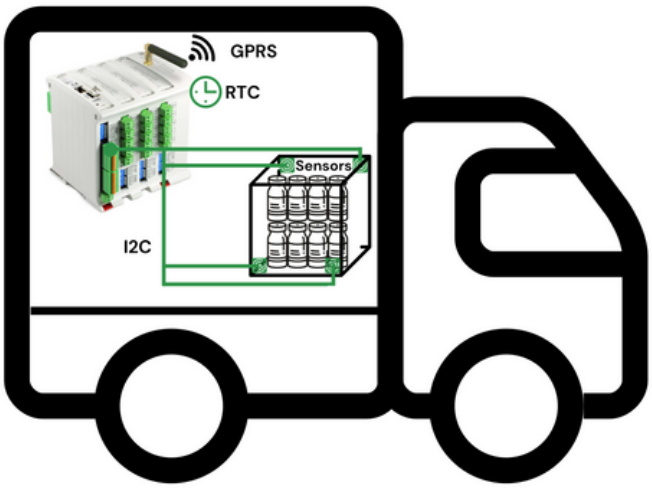
In addition, an extra implementation can be added, such as an alarm, which would be activated in case of any error.

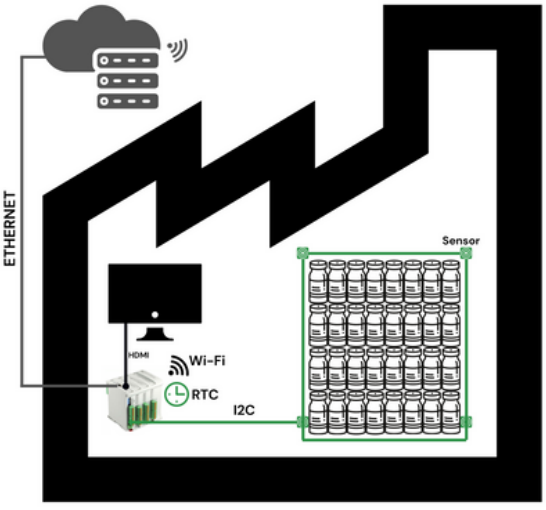
Both vaccines should be stored and transported in extremely cold storage tanks so as not to diminish their effectiveness. Although the Moderna drug can withstand higher temperatures, an ideal temperature below -20°C is still necessary for logistics. The solution is to implement a system that uses temperature sensors, which will constantly monitor the heat to which the vaccines are exposed.

An **Industrial Shields controller** is placed outside the freezing tank, and some **sensors** are inside, communicating the information. The temperature sensors are distributed along the vaccine reservoir for more accurate data reading. The information collected is transmitted at the same time thanks to the cable communication of the I2C PLC . If the heat in the tank exceeds a temperature limit, the **Raspberry PLC** detects the inconsistency and immediately triggers an alarm to warn the supervisors, as it is crucial to act and correct the error in the shortest possible time so as not to spoil any samples. In addition, thanks to the **RTC** (Real Time Clock) it is possible to know how many days have passed since the vaccine has been deposited in the tank, as the product must be used within one month for proper effectiveness.

By working with the Raspberry PLC, the user can have an **internal database** to store all the data collected while connecting to a Wireless or Ethernet network to send it to the cloud. All sensor information can be displayed on a **screen** using an **HDMI** connection.

Using any device of the **GPRS&GSM family**, the information collected by the sensors could be sent to a server while the tank is being transported by trucks or any other logistic system, having a **full time control** of the vaccines.





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CASE STUDY

WHY INDUSTRIAL SHIELDS ?

Economic savings

Thanks to the suggested solution, the customer will minimise the economic losses caused by the deterioration of the products.

Guaranteed quality

Temperature control helps the customer to keep the product in optimal conditions.

Saving time and resources

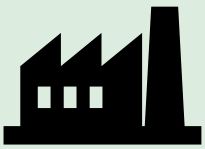
As the product is kept in optimal conditions, it is not necessary to allocate resources to the handling and disposal of products in poor condition.

Open solution

No license fee. The great advantage of open source based solutions is that there is no cost in licenses that can be dedicated to other resources.

Modular solution

Expandable in the future if required by the customer.



Industrial design

Equipment designed and manufactured for industrial use at a very competitive price, compared to existing solutions on the market.

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CASE STUDY

INDUSTRIAL SHIELDS

AUTOMATION OF INDUSTRIAL ROBOTIC CELLS

Implementation of an industrial welding process using Industrial Shields equipments.

The cell of welding is composed by welding tools, robots, safety devices and Industrial Shields PLCs.
Using our Arduino based PLCs, you can get the open source app Arduino IDE; it means that you do not have to pay for it as no licence is required. Moreover, you can visit Industrial Shields', Arduino's or others' websites and get a lot of examples to program our open source based PLCs.

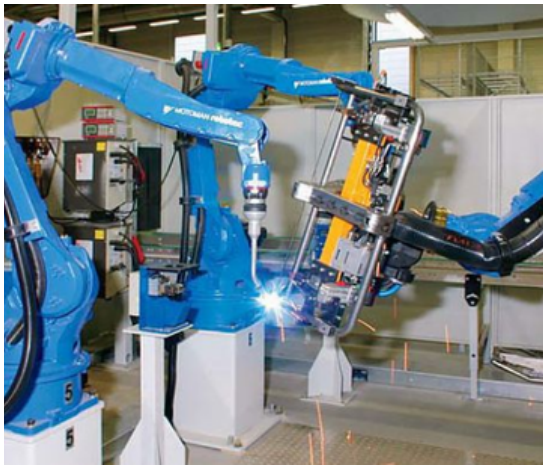
SUMMARY

Replying to our customers' requests, we have been developing a solution for the automotive industry.

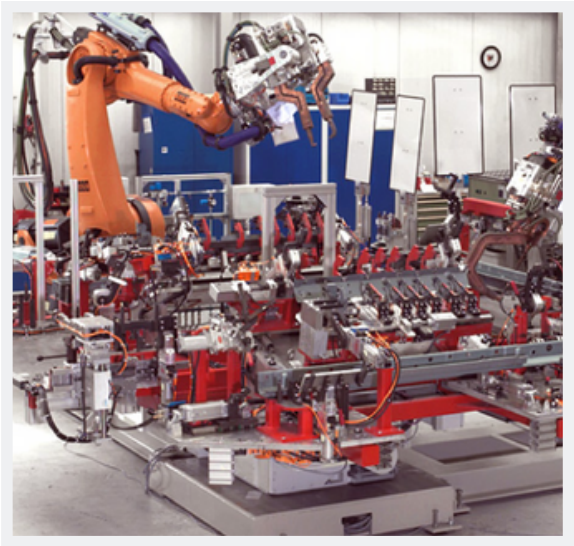
Some of the most common machines within this sector are robotic cells, which can be of painting, handling, palletizing or, in our case, welding.

Using industrial technics, we will be able to create a model of cell that could be easily replicated for all the processes where automation, monitorization and also interaction with the machine are nedeed.

It is important to say that this kind of project can be implemented not only in the automotive sector but in other sectors as well: metallurgical, plastic, etc. Basicaly, where serial production is requested.



CASE STUDY



GOAL

We need a machine capable to produce constantly with accuracy and complying with safety regulations. To reach this goal, all the components have to work in harmony controled by a PLC and a PC Panel .

CONCLUSION (HARDWARE)

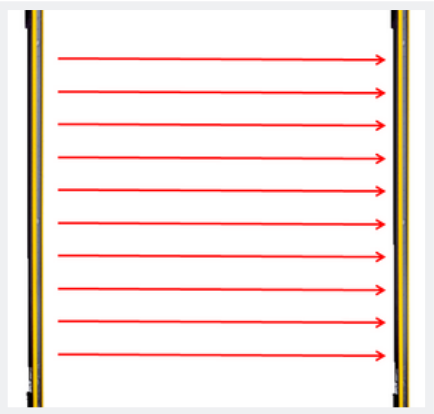
Industrial Shields equipment has to control and monitor all the I/O such as the welding tool, robots, lights and all the safety devices.

To understand how to interconnect the installation you can use the schematic below.

First, we will talk about **safety** because we believe that is the most important part of the machine.

To get the safety required by law, we will use the following devices connected directly to the inputs of our PLC; thus, we can guarantee its efectivity in case of danger.

- **Photoelectric safety barriers**: used to control the presence inside the cell. If, for example, the operator enters to charge a tool, the barriers will detect him and stop the power supply, the air and the robot so there will be no danger.
- **Safety lock**: used to control the backdoor through which we can acces to the robots. If the door is opened, the PLC will do the same as when you cross the barriers and it also will stop the robots and the spinning table.
- **Safety scanner**: we can put it under the welding tool to make sure that no piece falls in the cell as it could break the robots or the spinning table.



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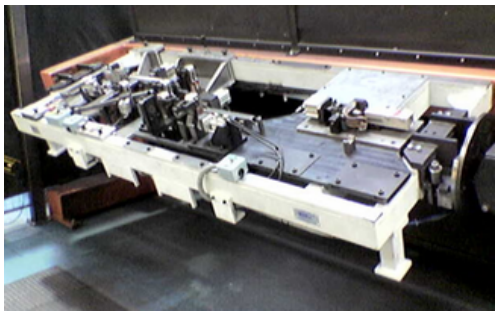
CASE STUDY

Secondly, we need to install the **robots** and the **spinning table.** This is where we will put the welding tools. Normally, there are two tables so while the robot is welding in one of them, the other can be charged; thislet us win a lot of time cycle. The robots have their own program installed so we will use the PLC just to control them, that is to say, giving them orders about when they have to weld and get information from them, like which piece is being welded and other parameters of interest.

The next thing we need is a **welding machine**. In this case, it will be a robot which will control the characteristics of the welding and the different programs that it has inside.

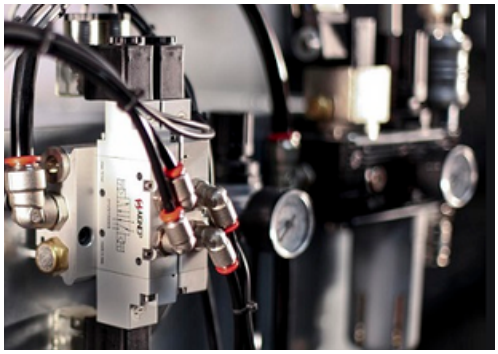
Welding machine

Fourthly, we have to consider the **welding tools**. They are made to fix the pieces that we want to weld. These fixtures consist in pneumatic cylinders and clamps that are moved by an electrovalves pack. We also find sensors to know the state of the cylinders and presence sensors to detect the pieces we want to weld. These components are controlled by our PLC which gives an opening and closing sequence. Due to the elevate number of sensors, we need a signal distributor to connect them. However, we do not need too many I/O in our PLC because we can communicate them using Modbus, so every sensor and electrovalve will have its own address.



Welding tools

The pneumatic and gas system consists of a **fluid panel** where we can find the general valves that provide compressed air to the welding tools and gas to the robots. So, firstly, the air will enter in the general valve and then it will be distributed to the other ones. When one of our safety devices is activated, the general valve will cut the air in all the installation. The gas will enter also in a general valve of gas and will supply to the robots using other valves. The valves are controlled by the PLC, giving them orders to open or close depending on the situation.



Fluid panel

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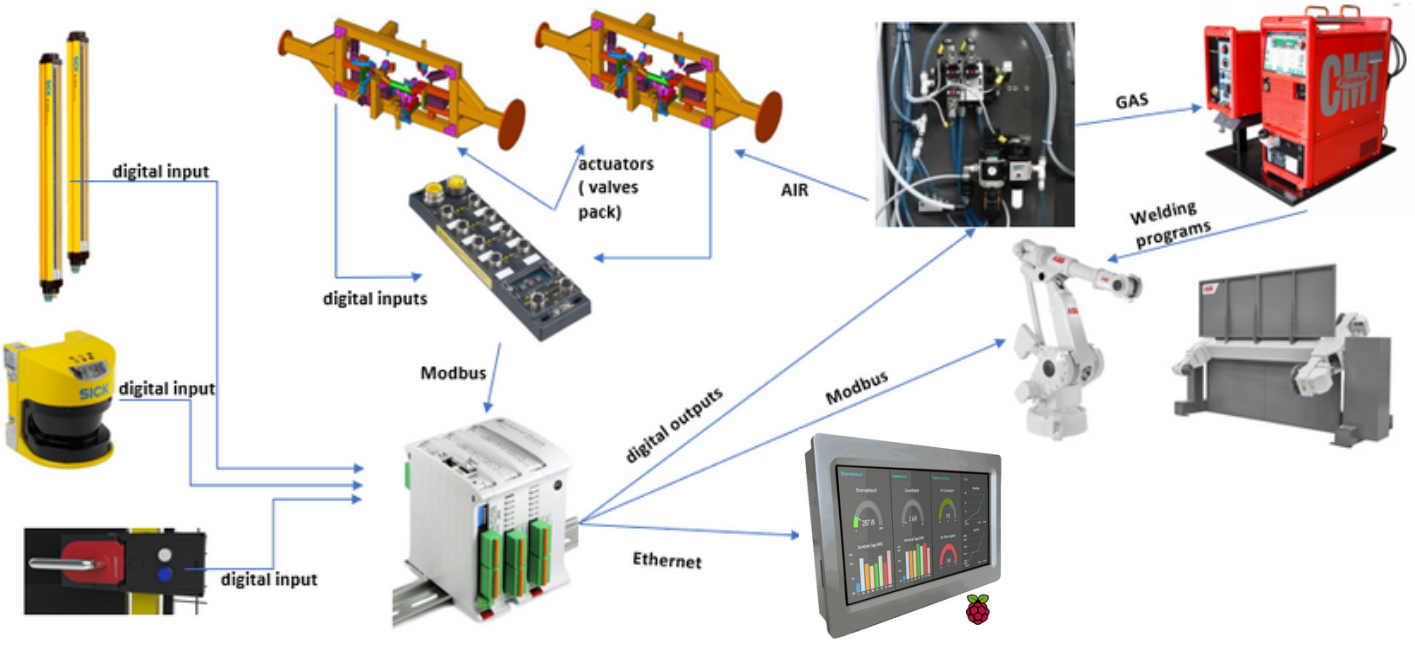
CASE STUDY

The **control panel** where the operator will have all the buttons to control work mode, reset error, stop emergency etc., will go directly to the inputs of the PLC .
As mentioned above, the PLC and the PC panel are the brain of this installation:

- ✅ Our Arduino based PLC will control everthing inside the cell.
- ✅ On the PC panel, we will see the synoptic of the welding tools with every cylinder and sensor and we can navigate and know the state from there. Basically, thanks to this Panel we can monitor and control every parameter of this process.

In the **schematic** below you can see in a clear way the connections you will have to do for your project and also understand better the idea and distribution of the components of the cell.



As we said at the begining of this case study, this example is applied to welding cells. In case different cells are needed -for example a painting one-, no welding tools nor a spinning will be required but the main structure will be the same, adding or removing the devices necessary for your application.

CASE STUDY

INDUSTRIAL SHIELDS

IMPLEMENTATION OF AN ACADEMIC AUTOMATION MODEL

On this case study, we will build a demo consisting in the automatization of some sensors and actuators using an Arduino based PLC. We will program it with the Open Source Arduino IDE.

SUMMARY

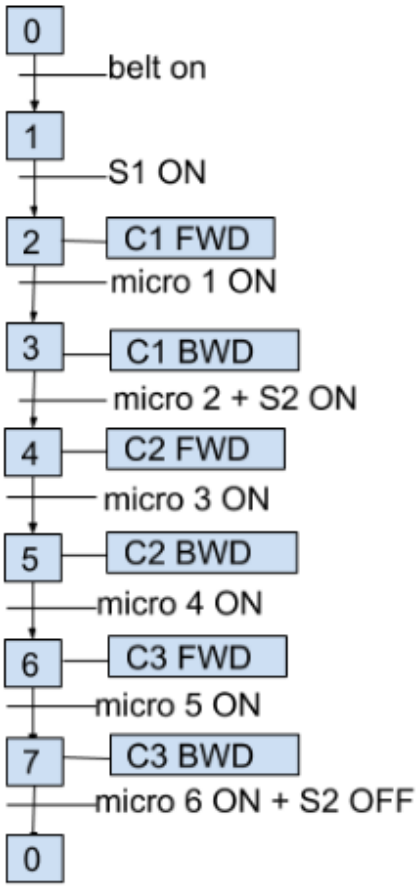
Why did we think of this application?
The main reason is because it is very interesting to show to the students that there is another alternative, apart from the big brands of PLCs that work with programming languages.

Our PLC is based on an Arduino board which controls different kinds of inputs/outputs using a micro-controller, for example, Analogic, Digital and PWM.

The software is called Arduino IDE; it is totally free and easy to use and its language of programming is C (lineal code).

We would also like to say that using our PLCs, you can communicate them with your PC Panel (HMI) by USB, and with other devices by Ethernet, Wifi, GPRS, Lora and Modbus.

CASE STUDY



GOAL

After reading this case study, you will be able to build an academic model and show to your students a new and intelligent way to automate everything you want to, and you will also have some ideas to create new projects.
This model consists in a labelling line of boxes.

CONCLUSION (HARDWARE)

The Industrial Shields' equipment has to control 3 cylinders (Ci), 2 capacitive sensors (S1 and S2), 6 micro inductive sensors (each cylinder has 2 of them) (micro i) and a conveyer belt, using the following sequence:

- The conveyer belt starts moving.
- First sensor (S1) checks if there is a box on the belt.
- The box is placed on the conveyer belt by the first cilinder (the box passes throw micro 1 and turns it ON) (C1).
- The cilinder (C1) is raised until the box is detected by micro 2.
- If S2 is ON, then C2 is moved until the box is detected by micro 3 in order to put the label.
- C2 is moved up until micro 4 detects the box,
- C3 is moved until its detection by micro 5. This cilinder takes the box out of the labelling area.
- Finally, C3 goes back until it is detected by micro 6.

You can see the GRAFCET of the sequence on the adjacent picture.

We need to connect both kinds of sensors to the digital inputs of the PLC.

The cylinders are moved with compressed air, so we need 3 electrovalves which are controlled by digital outputs of the PLC.

The conveyer belt is moved by an engine which is also controlled by a digital output of the PLC.

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CASE STUDY

INDUSTRIAL SHIELDS

CONTROL OF HVAC SYSTEM FOR SHOPPING CENTRE

Shopping centres require a wide variety of HVAC (heating, cooling, ventilation and air conditioning) solutions to ensure consumer comfort and energy efficiency.

With a PLC from **Industrial Shields**, you can **automate**, **control** and **monitor** these installations. In addition, the remote programming of a SCADA system makes it possible to manage the automation of the HVAC installation in order to ensure thermal comfort within the commercial premises.

CHALLENGE

Heating, Ventilation and Air Conditioning (**HVAC**) is an indoor and vehicular environmental comfort technology that provides **thermal comfort** and acceptable indoor **air quality**.

HVAC is an important part of shopping centres, residential structures such as single-family houses, industrial buildings, among others, where safe and healthy building conditions are regulated regarding temperature and humidity, using fresh outdoor air.

The Gañar Group company requested the improvement of the design of an HVAC system to manage the heating, ventilation and air conditioning installations of a shopping centre,
The goal was to **automate, control and monitor** the system with **open source** technology. By means of a single PLC with the knowledge and recording of the operating hours, as well as the air conditioning parameters, Gañar Group wanted to **remotely manage** the monitoring of the entire process with quality technology and easy programming.

GAÑAR GROUP

CASE STUDY

SOLUTION

The solution suggested by Industrial Shields consists of installing a **Raspberry PLC & GPRS 21 I/Os Analog/Digital PLUS** industrial controller.

The installation of this PLC provides the customer with an easily integrable solution because:

- using a variety of inputs and outputs, the controller can be easily integrated into an existing system;
- it is a scalable system, which can be expanded without becoming obsolete; and
- data transfer is improved thanks to GPRS.

IMPLEMENTATION

Gañar Group, together with its integration partner Square One Project Group, integrated an Industrial Shields **Raspberry PLC** in order to **automate**, **control** and remotely **monitor** a 5000 m2 area in Pretoria, South Africa.

Gañar first assessed the size of the HVAC unit required. Then, the company began manufacturing and programming the system once the laboratory tests were completed. Finally, the completed unit was shipped to the end customer for on-site commissioning.

The Raspberry's GPRS and WiFi communications facilitate greater data transfer for **remote monitoring** in the SCADA system and greater data management.

Thanks to this application, the 5000 m2 of shopping area can be managed to improve the comfort and health of the mall.

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CASE STUDY

ADVANTAGES

Remote management

With a single PLC, it is possible to remotely manage the entire process.

Quality

Industrial Shields offers quality technology, guaranteed by verification systems and internal audits.

Easy programming

The Raspberry PLC can be programmed with the system that best suits the customer's needs.

WHY INDUSTRIAL SHIELDS?

Industrial Shields won the project and beat its main competitors thanks to the key points below:

Open solution. No licence fees.

Modular solution: Product specifications can be extended in the future.

24/7 technical support: Our team is available 24 hours a day, 7 days a week, by phone, mail or WhatsApp.

Equipment designed and manufactured for **industrial use** at a lower price than competing products.

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CASE STUDY

INDUSTRIAL SHIELDS

WIRE ELECTRODE RESIDUAL ANALYZERS WITH TOUCHBERRY 10” PANEL PC

In welding, it is essential to know the surface condition of the wire electrodes used. They can deteriorate over time; wire feeding systems can become contaminated during storage or transport, affecting the quality of the weld.

Although it is difficult in practice, assessing the surface condition and therefore knowing the condition of the electrode are very important for a reliable and good welding process. So one of our customers has developed a solution for this.

CHALLENGE

MIGAL.CO is a German manufacturer of high quality filler metals for MIG and TIG welding. Founded in January 2000 with headquarters in Landau / Isar, Bavaria. MIGAL.CO is present in all world markets.

Company's goal: **to develop** a flexible and adaptable **SMKY 2 Residual analyzer**, without paying licensing fees of any kind.

SOLUTION

Industrial Shields suggested the installation of a **Touchberry 10" Panel PC** on the customer's equipment. Being open source based, the Panel PC operating system does not require any licensing, making it the perfect choice for applications such as these where flexibility is required.

The analyser takes a 25 cm long piece of cable that is clamped inside the machine. This piece of cable is then heated almost to its melting temperature. This causes all the contaminants in the cable to evaporate and these vapours are collected by a sensor.

The sensors send their reading to the Touchberry 10" touch screen via UART, which is further processed within the Panel PC. The results are then processed and displayed on the Panel PC within minutes, both in graphical and numerical format.

Migal.co has pre-set parameters for most materials on the market, although new parameters can be added or modified if required.

The **SMKY2 Residual Analyser** also has the ability to integrate into production plants and have more peripheral devices connected to it, such as barcode scanners, to make the whole process of data collection, storage and processing more efficient.

CASE STUDY

BENEFITS

Fast information

Thanks to the system implemented by Industrial Shields, the information reaches the customer with the maximum immediacy thanks to:

- the speed of data processing
- the visibility of the data in an user-friendly environment

Adaptable system

Industrial Shields open source technology offers the customer:

- a flexible and adaptable system which can be expanded according to the customer's requests
- a free solution with no licence fees of any kind

WHY INDUSTRIAL SHIELDS?

Industrial Shields won this project and beat its major competitor thanks to the key points below:

The customer is the **owner of the whole application**, because he knows the code used.

Wide range of products (PLCs, Panel PCs and OpenMotes) to cover all customer needs.

24/7 technical support: Our technical team is available to help you 24/7 via phone, mail or WhatsApp.

Equipment designed and manufactured for **industrial use** at a **lower price** than competitive products.

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CASE STUDY

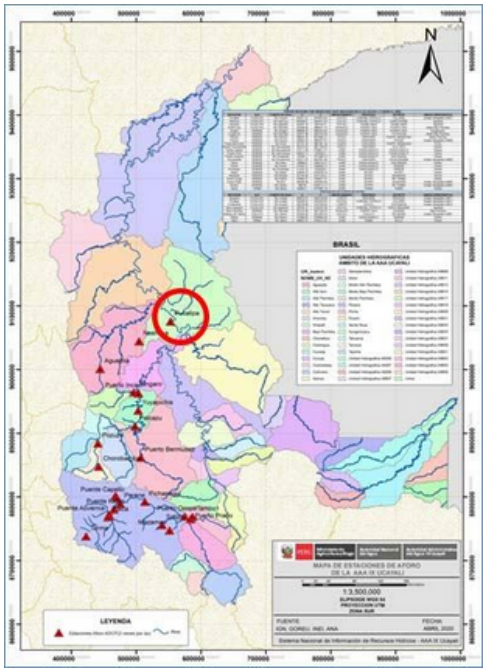
INDUSTRIAL SHIELDS

HYDROMETEOROLOGICAL STATION AND AUTOMATIC WATER QUALITY IN THE UCAYALI RIVER BASIN

PERÚ Ministerio de Agricultura y Riego

ANA Autoridad Nacional del Agua

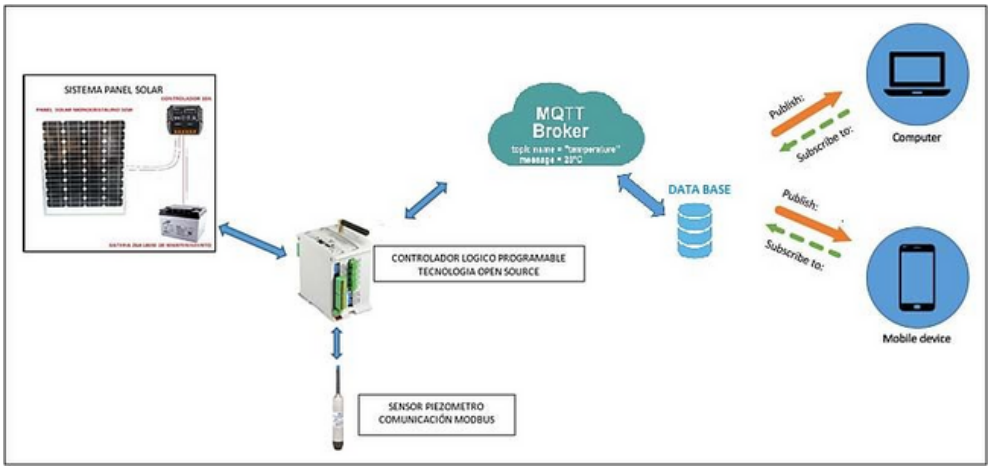
The implementation of this automatic system for measuring hydrometric levels in the Ucayali river basin will allow real-time recording of the variation of the river level and flow at different points. The pilot having started at the LPO station, as shown in the following graph.



COMPONENTS OF THE MEASURING EQUIPMENT

The hydrometric measurement system will be made up of the following:

- **Programmable Logic Controller (PLC)** with network communication and/or GPRS (cellular network) on battery and alternate to direct power network.
- **Piezometer sensor** (measures column of water from the river bed to mirror of water).
- **Solar Panel** type power supply system.



CASE STUDY

ARDUINO PLC & PIEZOMETRIC SENSOR

This is the **first Arduino technology based computer** designed for professional use.
The PLC consists of 17 inputs/outputs. It also contains several communication ports that provide greater flexibility and control.
The M-DUINO family offers the possibility of expanding up to 127 modules through I2C, which means that it can have up to 7100 Inputs / Outputs in Master-Slave connections, in addition to sensors, etc...

Characteristics:

- Measurement range: 0 - 10 meters
- 12-24v power supply
- RS-485 MODBUS RTU communication
- IP68 protection

FUNCTIONING & OPERATION

The System works by means of a piezometer sensor that will obtain the river levels in real-time, which will be registered by a Programmable Logic Controller (PLC) sending the signal via the internet (cellular network) to a web application, for information queries. The power supply is through a solar panel system.

MQTT + php MySQL

MQTT

MQTT is an **M2M (machine-to-machine) communication protocol** of the message queue type, it has become one of the main pillars of the IoT due to its simplicity and lightness, given that IoT devices often have power limitations, consumption, and bandwidth.

The computer architecture allows a reliable and secure wireless communication, which will allow the monitoring of the sensor in real-time to modify the frequency of sending the information to the internet network (by default the sending frequency is 1 minute); once the information is sent to hosting on the internet, it is stored in a database.

The hardware and software to be used are made up of a code-level control system and free hardware, for which no payment will be made for the rights to use the technology to be used.

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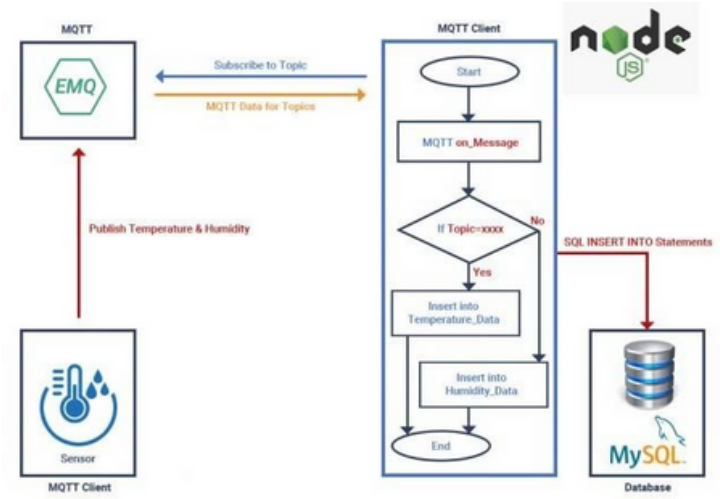
CASE STUDY

FUNCTIONING & OPERATION



GRAPHICAL SIMULATION OF PIEZOMETRIC LEVELS

	Fecha	Nivel(msnm)
1	2020-04-15 05:30:28	71.698
2	2020-04-15 05:30:40	124.948
3	2020-04-15 05:30:48	116.304
4	2020-04-15 05:30:58	144.008
5	2020-04-15 05:31:08	114.303
6	2020-04-15 05:31:17	132.015
7	2020-04-15 05:31:28	111.367
8	2020-04-15 05:31:39	60.573
9	2020-04-15 05:31:48	127.053
10	2020-04-15 05:31:58	142.067
11	2020-04-15 05:32:07	82.046
12	2020-04-15 05:32:18	120.569
13	2020-04-15 05:32:28	88.856
14	2020-04-15 05:32:39	134.66
15	2020-04-15 05:32:48	134.84
16	2020-04-15 05:32:58	73.679
17	2020-04-15 05:33:09	111.435
18	2020-04-15 05:33:27	93.037
19	2020-04-15 05:33:37	129.335
20	2020-04-15 05:36:09	94.846

Nivel(msnm)
Alerta(146.5 msnm)

Ecuación Potencial-Curva de Calibración

POTENCIAL

$Q = a * H^b$

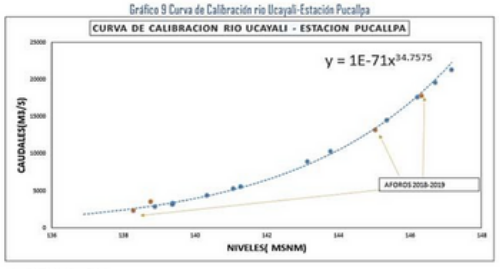
En todas ellas se tiene que :

Q	:	Caudal (m^3/s)
ab	:	Coeficientes a determinar
H	:	Altura de nivel (m)

Fuente: ANA - Equipo Técnico

Dando como resultado la siguiente formula y grafico

Gráfico 9 Curva de Calibración rio Ucayali-Estación Pucallpa



Fuente: ANA - Equipo Técnico

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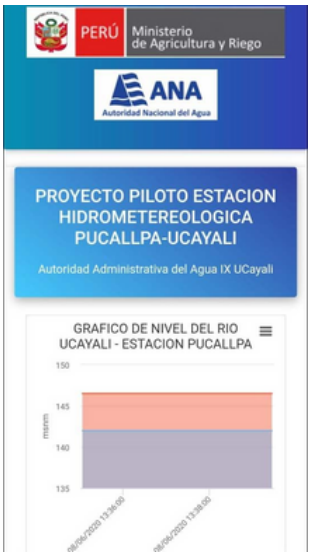
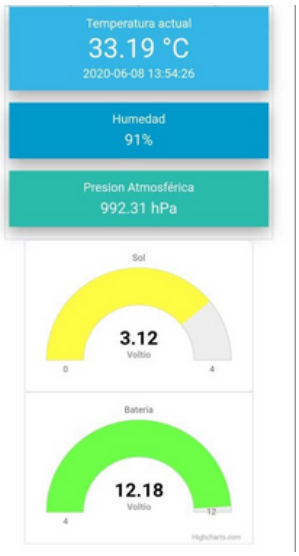
CASE STUDY

INFORMATION RECEPTION PROCESS

The reception of information in the Programmable Logic Controller (PLC) sending the signal via internet (cellular network) to a direct information APPLICATION in real time.

A restriction is foreseen in its use, since information can only be received with the internet service (cellular). Otherwise, it can be remedied using a satellite communication system.





FIELD INSTALLATION PROCESS

On May 13, 2020, the test of the hydrometric measurement equipment built by the AAA-Ucayali was carried out, achieving good results and the emission of the signal via cell phone from the simulated levels of the Ucayali river.
The test was carried out at the facilities of the Peruvian Navy (Puerto de la Capitanía de Pucallpa).
Later, the equipment is installed in the LPO company where it is currently being tested, receiving the information from a flow base of 4,358.8 M3 / s (June 3, 2020).

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CASE STUDY

UCAYALI RIVER GAUGING PROCESS AND CALIBRATION

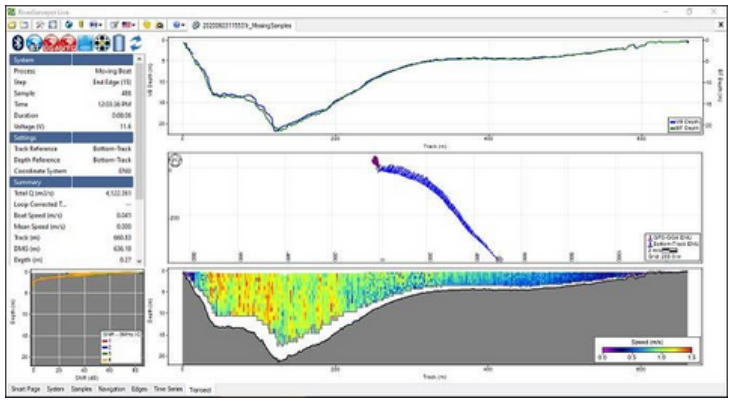





Comparative: gauging data and flow sensor

MEDICION DE AFORO CON ADCP M9

FECHA	DISTANCIA(m)	AREA(m2)	MAXIMA PROFUNDIDAD(m)	MAXIMA VELOCIDAD(m/s)	CAUDAL(m3/s)
16/06/2020 09:30	671.404	5212.816	20.642	1.964	**5122.84**



PROJECTION OF STUDIES

Projection of studies to be carried out with the implementation of the Project

The implementation of the hydrometric measurement equipment will **allow us to have information on flow rates at the hourly level, values of the large Amazon basins** such as the Ucayali river, similar to the Requena station thanks to the latest missions carried out by the HYBAM Project (IRD / SENAMHI / UNALM Agreement, www.mpl.ird.fr/hybam), information analyzed by SENAMHI Peru and recently documented by Espinoza Villar et al. (2009) and the last study carried out by UNESCO (2006) that allowed this study to be carried out.

The lack of run-off data in the sub-basin of the Ucayali river basin (232 744.6 km2) makes it **necessary to execute the project proposal**, in reference to the fact that there is only one drainage station for this entire large area.

Specify a study plan for hydrological models based on research carried out in the Amazon and Ucayali basins.

Hydrometric reports of the Ucayali river basin of the AAA- Ucayali (ANA) accredited and authorized entity to report information at regional and local level.

The implementation of a PILOT of this equipment will **allow SELF-MANAGEMENT in its installation**, operation, maintenance and monitoring, which will decrease the costs in reference to its implementation and will save human resources.

They will complement the needs of this AAA - Ucayali regarding:

Water use rights at a multisectoral level, delimitation of marginal strips, execution of hydraulic works, detection of early alerts, capacity campaigns to determine the QH expenditure curves of maximum avenues and minimums in times of drought, studies and planning of the council's basin water resources, **GETRAM (specialized multi-sectoral workgroup - Ucayali). INTEGRAL MANAGEMENT OF WATER RESOURCES**

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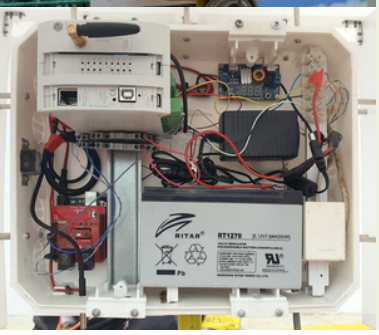
CASE STUDY

MONITORING OF SURFACE WATER QUALITY IN REAL TIME



Registration of automated water quality parameters

Automated registration of daily and hourly data.
Parameters evaluated:

- **Temperature**
- **EC**
- **Dissolved O2**
- **pH**

Individual sensors are permanently coupled in the hydrometric station.
Sensor cost approx. S /. 8,000 soles.
01-year calibration certificate accredited by INACAL.
Information collected every hour per year.

? WHY INDUSTRIAL SHIELDS?

Industrial Shields won this project and beat its major competitor thanks to the key points below:

Open solution
No licence fees.

24/7 technical support
Our team is available 24 hours a day, 7 days a week, by phone, mail or WhatsApp.

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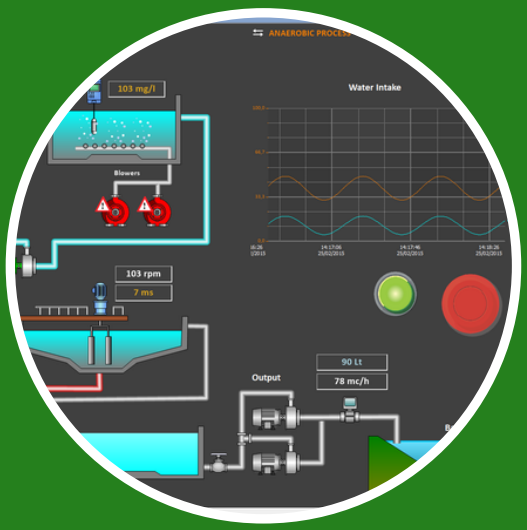
CASE STUDY

INDUSTRIAL SHIELDS



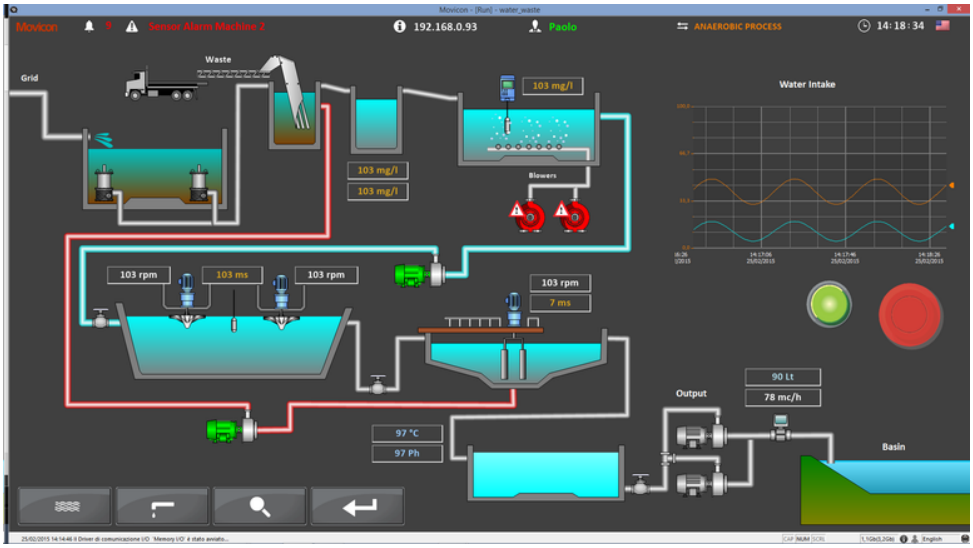
SCADA APPLICATION IN A PANEL PC

INTRODUCTION

In this Case Study, is seen an example of how to use our **Panel PC Touchberry** together with our **M-Duino PLCs**.

SCADA

Supervisory Control and Data Acquisition. Any application that receives operational data about a system in order to control and optimize that system is a SCADA application. In the image below there's an example of a SCADA application that controls different sensors like turbine speed, pressure, and temperature, and displays them in a panel.



CASE STUDY

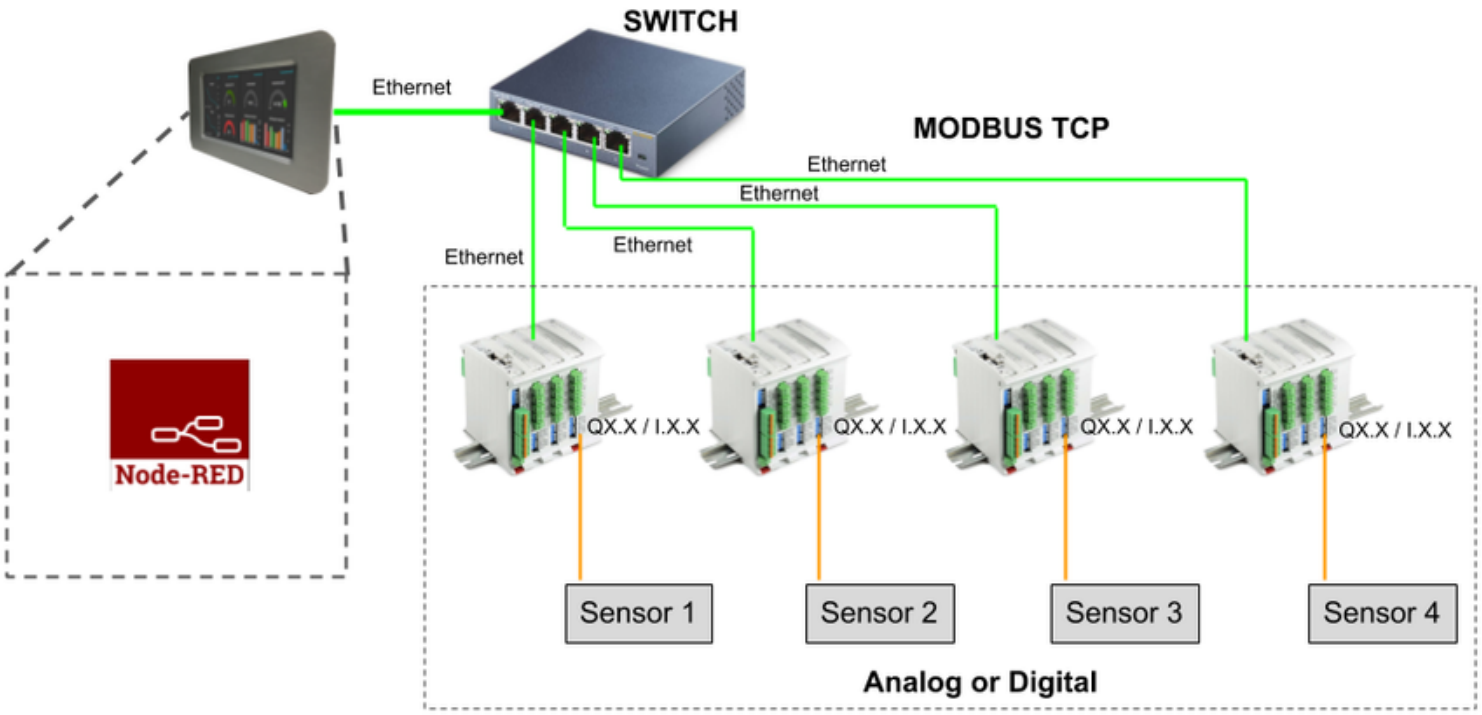
APPLICATION

Let's suppose that we have some sensors that get values from different parts of a system. With all this data we can create a SCADA application.
We have different ways to transmit these values to the panel PC: **Modbus RTU**, **Modbus TCP**, **MQTT,** and our library **Simplecomm**. In this case, its used the second one, Modbus TCP.

Modbus is a standard serial communication protocol that has been used for PLCs since 1979. Modbus allows communication between devices in the same network. Modbus TCP/IP is a variant of Modbus that is used for communications over TCP/IP networks.
With the M-Duino family, we are able to send the data to the panel PC using the Ethernet connection. Due to there being more than one M-Duino, we use a switch to connect it all.

Node-RED allows us to create communications connections from different systems. In this case, we can configure that in the panel PC we will receive data by the Ethernet connection (One node), we will read it, and display it in the way we want (Another node). The idea of this Case Study is to show the data in a SCADA application.

Here you have a diagram that shows the system connections:



CASE STUDY

INDUSTRIAL SHIELDS

BATTERY LEVEL SENSOR

INTRODUCTION

In this Case Study is shown how to measure a battery level with our equipment.
With arduino Leonardo or Mega you only can measure an analog input value of 5 V. With our boards, Ardbox or M-Duino, it's possible to measure an analog value input of 10Vdc. So **the reading range is wider**.

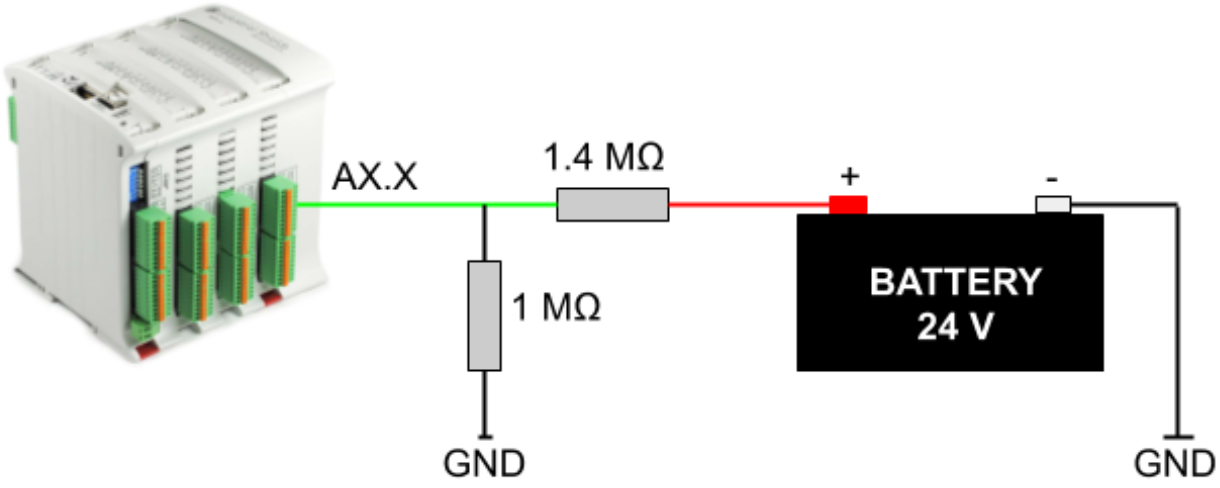
CASE

This Case Study is very simple, read the voltage values of a battery by an analog input. The advantage of using our equipments is that you can read up to 10 Vdc voltage values. However, in the case of measuring a larger battery, like 24 V, a voltage divider is required to reduce the input voltage. Then in the program you have to multiply the value read by the resistor relation of the voltage divider to get the right voltage value. You have to adapt the resistors values taking into account the voltage of the battery you want to measure.

In case of measuring 24 V, the resistors of the voltage divider should be R1 = 1M and R2 = 1.4 M Ohms. So, after read the analog pin, you have to multiply the value by (R2 + R1) / R1 = (1+1.4)/1 = 2.4.

CASE STUDY

Here you have a connection example:



REMEMBER:
The Analog pins return values between 0 and 1023, because you read a register value of 10 bits (2^10 = 1024). So, to know the equivalence to the real value you have to multiply it by (10 / 1024) because the range of the Analog pins are from 0 to 10 V.

Here you have a code example:

```
battery_level = analogRead(battery_pin); // Values between 0 and 1023

battery_level = battery_level * (10.0 / 1024);  // Transform to voltage values between 0 and 10 V

battery_level = battery_level * ((R1 + R2) / R1);. // Calculate the real level of voltage between 0 - 24 V
```

CASE STUDY

INDUSTRIAL SHIELDS

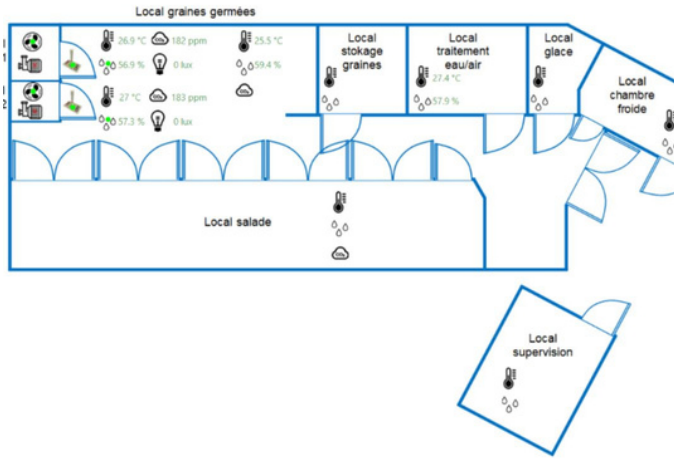
GREENHOUSE AUTOMATION

Our customer, William Kimchou, was looking for an Open Source solution in order to implement all the technical specifications he wants with unlimited options, which can not be done with a turnkey solution.

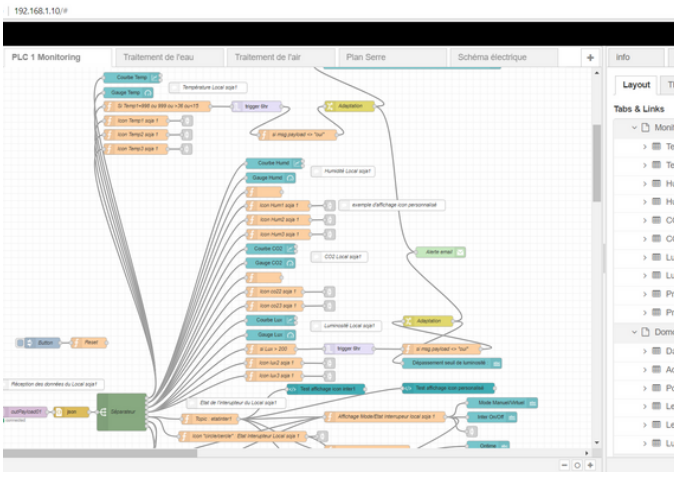
William decided to use the Industrial Shields equipment among other reasons for the saving in expenses, the ease of wiring with a screwless connector, or ease of program using Arduino IDE.

SUMMARY

This project allows controlling remotely the humidity, the ventilation, the Co2 level, and the luminosity in a greenhouse. It is configured with a graphical interface programmed in an Industrial Shields Panel PC with a RaspberryPi built-in. While the control of humidity, Co2, and the air is automatic, Lights are controlled according to the time, although they can be set manually.



OBJECTIVE



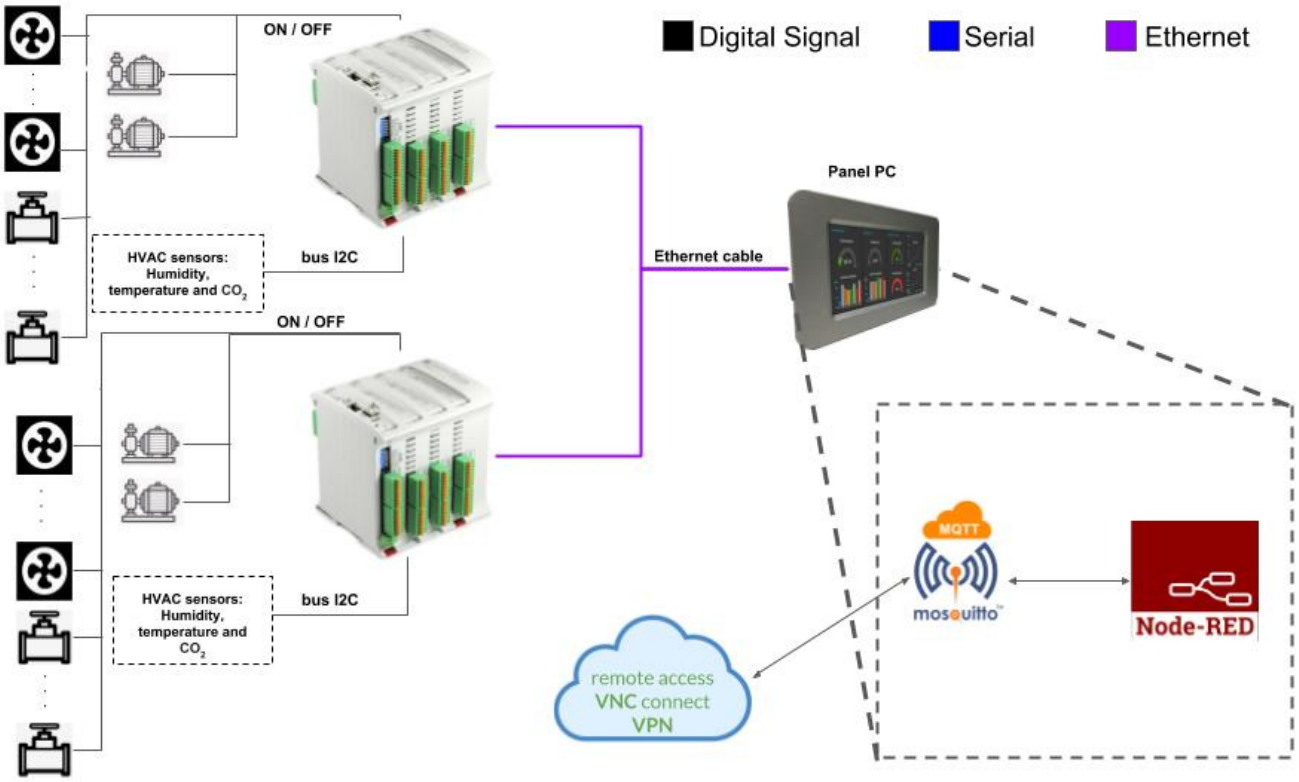
CASE STUDY

SOLUTION (HARDWARE)

In order to control the entire installation, William has required two Ethernet PLCs. On the one hand, the PLCs received the data from the HVAC sensors, at the first choice, connected by an I2C bus, I2C multiplexers have also been added to cover the entire installation, at the second and third choice, the installation also combines digital and analog sensors. William has implemented a control system for each of the phases (humidity, temperature, level of Co2, and luminosity) were looking at the level of each variable from the sensors decided on the actuators (pumps, valves, ventilation, light) in a sketch made with Arduino IDE (Open Source).

To have control over the situation in the greenhouse, William added a Panel PC from Industrial Shields to the system. The data of the two Ethernet PLCs are sent via Ethernet to the Panel PC.

In the Panel PC, an MQTT broker has been configured to handle the requests and the Node-red programming tool has been used to create the framework and manage the communications between the Ethernet PLCs and the Panel PC.



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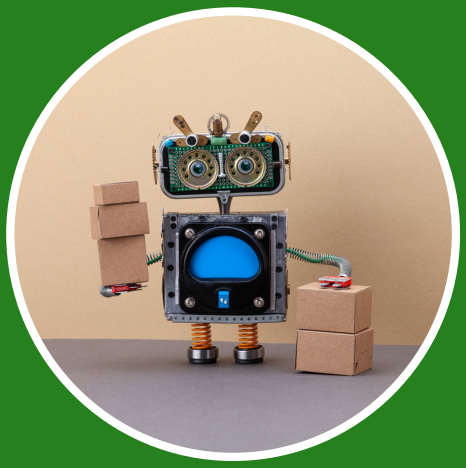
CASE STUDY

INDUSTRIAL SHIELDS



AUTOMATION OF LOGISTICS USING A RASPBERRY PLC

Logistics by definition is the set of means and methods necessary to carry out the organisation of a company or a service, especially distribution.

Good planning is key to the success of a project, so having a good logistics structure can be the determining factor between success and failure.

SUMMARY

Nowadays, if a company wants to compete in the market, apart from offering a good product, it has to do so in the shortest time. One of the best ways to reduce time is to optimise processes in order to achieve the maximum in the shortest possible time. It has been demonstrated that the optimum automation, which is the most viable and has the greatest potential for logistics, is to apply the use of electronic systems or elements to improve its operation.

The different stages of the material collection and distribution process can be controlled using sensors. Furthermore, if we add communication elements to the above, an obsolete operation can become a leader in the 4.0 industry.

GOAL

The objective here is the development and optimisation of a logistics warehouse using Industrial Shields Raspberry Pi based PLCs.

Our intention is to introduce an automatic management for the distribution of the packages when they enter: they will be sorted according to desired patterns and stored so that their location is known at all times.

In addition, it is intended to develop a server to store data and have remote control from anywhere. Thanks to the power of the Raspberry PLC, all these goals can be achieved with a rapid implementation of the components.

CASE STUDY

CONCLUSION (HARDWARE)

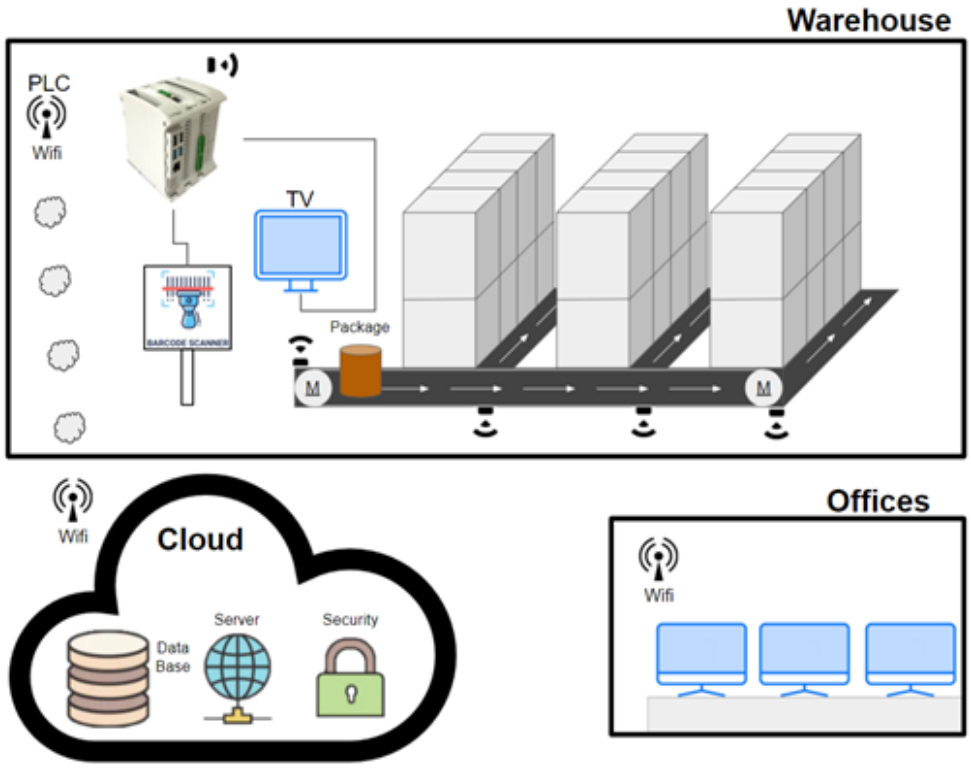
It is essential not to lose control of the packages throughout the process and, for that, it will be necessary to have control at the moment of entry.

The proposed system will be formed by an open source industrial PLC that will act as a master controller of all the sensors and will allow:
✔ to save the information in its own database and, at the same time,
✔ to be running its own server where you can access to visualize everything.
In addition, an extra display screen will be placed in the warehouse to interact with the system and know its status at all times

At the beginning, a bar reader connected by USB will be implemented, which will detect all the corresponding information and, by means of a TV with HDMI connection, it will be possible to visualize it at all times. When the package is confirmed, the PLC will activate a system of motors that will move the package through some conveyor belts to its corresponding destination. Each box will have a specific place, controlled by sensors, to have total control of the stock.

At the same time, the PLC will update the database with the new information received and will make backup copies to the cloud. All data will also be uploaded to the own server implemented in the Raspberry Pi, which will allow remote control from a remote internet connection. In this way, it will be possible to have the control of the warehouse from the main office, being able to send orders and manipulate the chain, and send emergency or on/off messages.

For the management of the motors, a frequency inverter will be used, which allows to have the control of the devices without losing unnecessary I/Os. One option for the sensors would be to use motion or weight detectors, to know where the package is in the process.



CASE STUDY

INDUSTRIAL SHIELDS

IMPROVE THE CONTROL, EFFICIENCY AND SAFETY OF YOUR FLEET, AND YOUR CUSTOMERS' SATISFACTION

Thanks to fleet management and its benefits at various levels, many companies have implemented this kind of solution.

The geolocation of vehicles, the kilometres they travel, the downtime, etc. are variables that have a direct impact on costs and quality of the service offered.

The use of technologies based on open code applied to this type of solutions, allows you the flexibility and adaptability that other standard market products cannot offer.

SUMMARY

Evolution and adaptation

Our customer's vehicle fleet has grown significantly over the last decade. The company deals with the **processing, marketing and distribution of frozen foods** and has an important commercial network. Over the past few years, several needs to be addressed have appeared. On the one hand, due to the business strategy; on the other hand, because it is necessary to follow the regulations about the transport of this type of goods regarding to the cold chain; and last but not least, because the control of working hours is required by law.

In order to maintain the competitive level reached by the company, **the quality of the product must be guaranteed** and, at the same time, **fleet management must be improved** by taking advantage of the possibilities offered by new technology.

In order not to lose competitiveness, it is necessary to face up to the behaviours that have been changing in recent times, such as **loading and unloading in large logistics platforms**, **accessing to pedestrian areas** where goods are unloaded, among others.

SOLUTION

After analysing the necessary requirements and which Arduino PLC best suits the number of inputs, outputs and accessories, a standard product is defined to be installed in the whole fleet. At the same time, communications, data to be saved in local mode, and data (most of them) to be sent through GPRS to the data centre for analysis and decision making in real time must be prepared.

The Ardbox Analog GPRS with GPS from 20IOs family meets the customer's needs thanks to its quantity and types of inputs and outputs, and also allows a growth in input and output needs that may arise in the future, without having to change the installed hardware.

The priority in this project is the GPS positioning and the temperature of the goods. From the data returned by the GPS, speeds, routes, types of driving, stops, and other relevant information can be analysed to improve productivity, save fuel and improve efficiency.

The company's competitiveness increases entirely thanks to a small investment, while maintaining its commitment to maximum quality with customers in a sector as sensitive as the food industry.

CASE STUDY

FINAL OUTCOME

After installation in the whole fleet, the first equipment is prepared in two kinds of vehicles with very different types of routes.

- **A very local route with a small size vehicle** (3500Kgs), which makes many stops, and many openings and closings of the trailer.
- Another route in a **large vehicle** that makes only **two stops in two large distribution centres**, but making a much longer route by contrast.

Their behaviour is very different but, in both cases, there are patterns that allow improvements in the routes, to a greater or lesser extent. It is also observed that **the cold chain is not threatened in any case**, despite the fact that the test is carried out at the end of summer, when temperatures may not be very severe but, equally, the margin of frigidity is still very wide.

The installation of different sensors and antennas is carried out very quickly and does not affect the trailer or tractor in any way. The power supply of the Arduino PLC is also easily solved, as this type of vehicle has an extra installation that facilitates this work.

One of the existing doubts was the one related to the GPS tracking, but it is not a problem because the accuracy and quantity of the data are more than enough. The software selected by the company manages quickly the data received and shows control panels adapted to the different needs defined.

Having control of the vehicles also facilitates communication with the logistics centres to ensure that the planned schedules can be met. Due to the size of some of these facilities, it is increasingly necessary to schedule the arrival, so a tracking system is crucial to avoid stops and loss of time of vehicles and drivers in these loading-unloading platforms.

Thanks to the installation of the drivers with GPRS/GSM and GPS, the customer has achieved the points below:

- Improving the safety of drivers
- Optimising vehicle consumption
- Improving the safety of vehicles
- Complementing the records of the working day
- Savings on insurance costs (some companies offer discounts of up to 30-35 % for vehicles equipped with tracking systems)
- Real-time route changes to avoid accidents, road works or congestion.

On the other hand, customers also benefit from these improvements as they see reduced delivery times and always receive deliveries on time.
One of the improvements envisaged from the possibilities of the system is to share with customers the real-time information of the vehicles and the temperature of the load.

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CASE STUDY

INDUSTRIAL SHIELDS

CONTROL OF SONIC BARRIERS FOR ENVIRONMENTAL PROTECTION OF BIRDS

Every year, thousands of birds are killed by colliding with wind turbine blades; a figure that is expected to rise as wind energy continues to develop.

With the help of an Industrial Shields PLC, bird collisions with wind farm generators can be prevented. With the remote programming of a SCADA system, the automatic switching on and off of sonic bird barriers can be managed to protect the lives of these animals.

CHALLENGE

According to a **study** by the **US Fish and Wildlife Service**, wind power generation by turbines or wind turbines result in the death of **140,000** to **500,000** birds annually.

Although the magnitude of the figures must be interpreted, this issue has become an ongoing problem, as seemingly small mortality rates can be fatal for endangered species.

It is therefore important to plan, develop and monitor wind energy projects in order to minimise bird deaths and thus ensure the continuity of the species.

With the aim of safeguarding bird populations, the company **ATS Panama** has asked us to **improve an already proven sonic barrier design**. Our client wanted to control the sonic barriers installed in the wind farm using open source technology: using a single PLC with the information and recording of the operating hours, ATS Panama wanted to remotely manage the monitoring of the whole process.

ATS PANAMA
AMBIENTE, TECNOLOGÍA Y SEGURIDAD

CASE STUDY

SOLUTION

The solution suggested by Industrial Shields consists of the installation of the industrial controller **M-DUINO PLC Arduino Ethernet 38AR I/Os Analog / Digital / Relay PLUS**. The installation of this PLC provides the customer with an easily integrated solution, since:

- using a **variety of inputs and outputs**, the controller can be easily integrated into an existing system;
- it is a **scalable system** and can be expanded without becoming obsolete.

IMPLEMENTATION

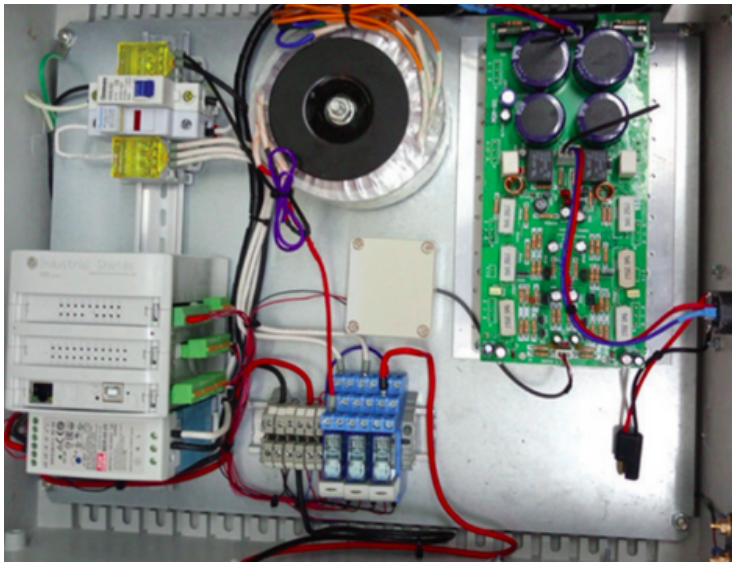
ATS Panama has proceeded to integrate the Industrial Shields PLC in order to manage the **automatic switch-on of the barriers** according to the schedules established by the environmental authorities. As these schedules vary according to the time of year, the controller has been programmed taking this variable into account.

In addition, the barriers can be switched on remotely from the customer's **SCADA** system if required, without the need for on-site activation.

In addition, the customer decided to **store within a removable µSD** memory a log with:

- the operating hours and
- the most important operating parameters of the implemented system.

Thanks to this application, authorities will be able to audit the proper functioning of the equipment.



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CASE STUDY

BENEFITS

Resource optimisation

No turbine shutdowns are necessary because the mortality rate is under control thanks to the sonic bird barriers.

Remote management

Users can remotely manage the monitoring of the entire process with a single PLC.

Monitoring and control

Thanks to the storage of data on a removable memory, it is possible to audit the proper functioning of the equipment.

WHY INDUSTRIAL SHIELDS?

Industrial Shields won the project and beat its main competitors thanks to the key factors below:

Open solution. No licence fees.

Modular solution: Product specifications can be scalable in the future.

24/7 technical support: Our team is available 24/7 via phone, mail or WhatsApp.

Equipment designed and manufactured for **industrial use** at a **lower price** than competitive products.

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CASE STUDY

INDUSTRIAL SHIELDS

SILO MONITORING: KEEP YOUR HARVEST SAFE

Every year, the agricultural sector suffers from the deterioration or even loss of large quantities of stored grain due to fungal growth and insect-related decay.

The challenge for farmers and companies involved in the grain storage and distribution process is to ensure the quality of the product during the different phases and types of facilities where cereals are transported, processed and stored.

CHALLENGE

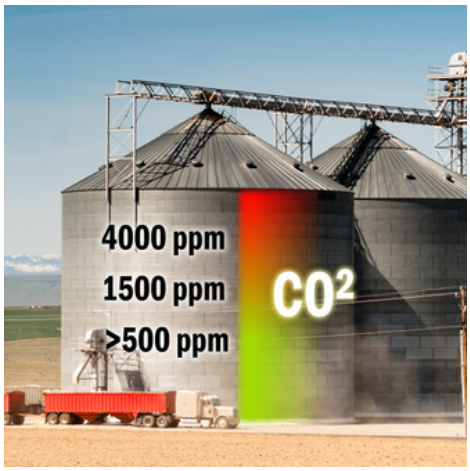
According to research from prestigious universities in areas where wheat cultivation is an essential part of the economy, **CO2 control allows effective monitoring of grain quality** and other key indicators, to ensure that the product is in optimum condition and remains competitive in the market.

Our customer, based in Canada, needs to ensure the quality of his stored grain through CO2 monitoring. Having that key indicator will allow him to obtain more and better information —faster and cheaper— about the state of his product.

So far, the customer had to make a visual inspection that forced him to go to the silo. The installation of dozens of silos over large areas of land facilitates the harvesting process, but it also involves:

- the difficulty of having a good control of the state of the wheat stored in them;
- an investment in time to make a visual check on each silo.

There is also a very important risk of not being able to reverse a process of product degradation caused by a change in the environment inside the silos and losing part or all of the stored grain. Or the product could lose its quality and see its value reduced on the market significantly.



CASE STUDY

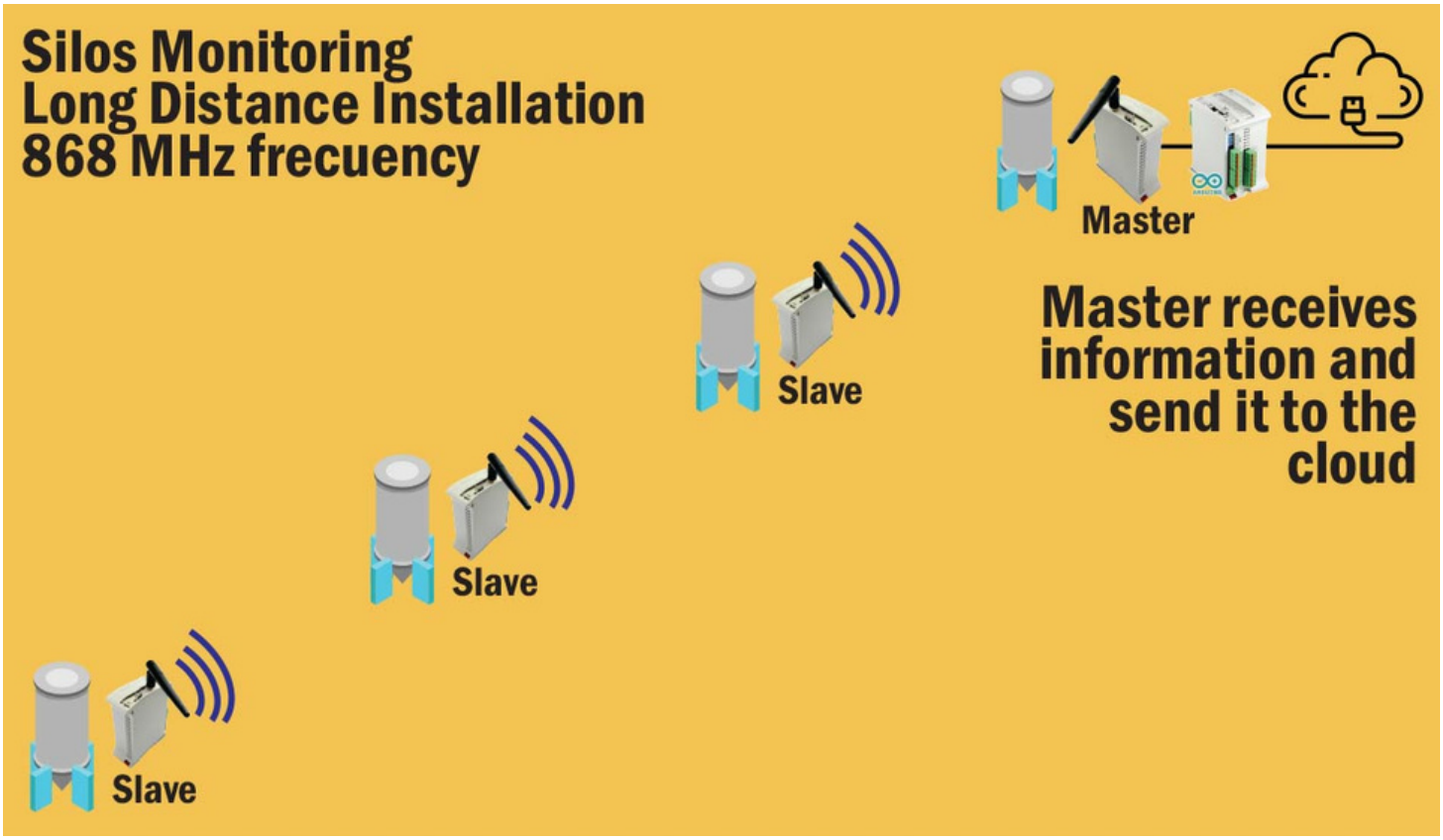
INDUSTRIAL SHIELDS SOLUTION

Based on the needs required by the customer, we propose the installation of different sensors (not only the CO2 ones) to monitor a series of silos distributed over a large area.

OpenMotes B have been installed in each silo, powered by solar panels. In this way, any type of wiring between silos is avoided, as the communication between OpenMote B devices is wireless via radio frequency.
The different OpenMotes B installed in slave mode collect information every 30 minutes and send it to a master device, which in turn communicates with a PLC connected to the cloud. All the information can be viewed and processed remotely and in a very up-to-date way.

The master module also collects other types of data as a test to improve the installation in the future.

About the software part, it has been programmed using Python on one hand, and bash scripts on the other. Both solutions are easily adaptable and editable if the customer needs to make some changes in his reading times, types of sensors, signals to be sent to actuators, etc.



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CASE STUDY

BENEFITS

There are a number of clear benefits obtained by the customer thanks to this type of installation:

- **Time saving:** unnecessary trips will be avoided thanks to the remote verification of the state of the cereals.
- **Eco-Friendly**: avoiding commutes means lower emission of CO2 particles.
- **Economic savings**: thanks to the reduction in trips, fuel consumption will be lower; furthermore, the vehicle wear will be reduced.
- **Risk prevention**: reducing the number of trips means decreasing the risk of accidents at work.
- **Production optimisation**: thanks to real-time knowledge of the state of the product, material losses are minimised.
- **Guaranteed product quality**: thanks to permanent monitoring of CO2 levels, cereals are kept in good condition.

- System **without wiring** and with a **low consumption** fed by solar panels.
- The used radio frequency system works with **unlicensed** frequency signals that do not require a cost for sending data.
- The customer can access and extend the different modules at their convenience **without** having to pay an **extra cost**.
- If the number of elements to be monitored needs to be increased, the OpenMotes B still have **free ports** to add more sensors or actuators.
- Thanks to solar panels, there is **no** need to change **batteries**.
- The OpenMote device can **anticipate** running out of batteries to keep the installation operational.

WHY INDUSTRIAL SHIELDS?

The solution with OpenMotes B has convinced the client because it is very **competitively priced**, it is **easily expandable** without the need of expensive installations and it does not require the payment of any type of software license to adapt the programming to what the client requires.

It is a **robust solution** prepared for the environment where it will be installed.

The fact that it is a **modular solution** also makes it easy to choose with a view to expanding or improving the possibilities of remote management.

As Industrial Shields is a **world leader** in the development and manufacture of equipment based on Open Source Hardware, this facilitated that the client had **full confidence** in both the **company** and the **proposed solution** by the technicians of Industrial Shields.

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CASE STUDY

INDUSTRIAL SHIELDS

AUTOMATIZATION OF A CONCRETE PLANT

A concrete plant is an installation used to manufacture concrete from raw material which is composed by aggregate, cement and water. All these components are previously stored in the concrete plant and then they are dosed in the right proportions to be mixed.

Altough there are several kinds of concrete stations classified according to the type of materials used there (dry and wet concrete), our system let us implement all of them.

SUMMARY

Replying to our customers' requests, we have been developing a solution for the construction industry.

Using industrial technics, we will be able to create a model of concrete plant that could be easily replicated and adjusted to the different kinds of concrete (dry and wet).

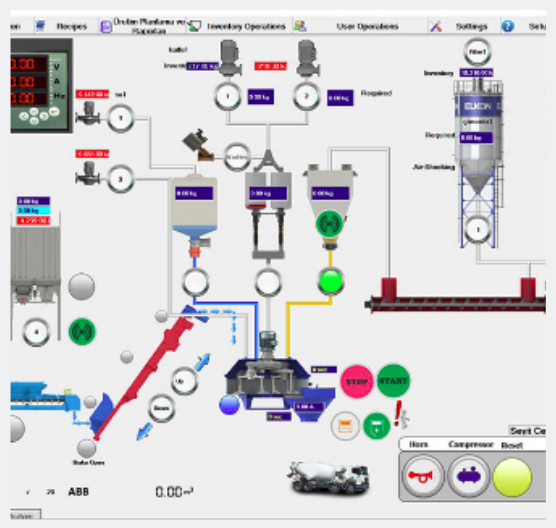
The aim of this project is:

- to get the most out of it,
- to save cycle time,
- not to have to act manually in the process,
- to have a monitoring and
- to send all the information to the cloud so that we can make a forecast of the raw materials that we need.

CASE STUDY

GOAL

We need a machine capable to produce constantly with accuracy and complying with safety regulations. To reach this goal, all the components have to work in harmony controled by a PLC and a PC Panel .



CONCLUSION (HARDWARE)

Industrial Shields equipment has to control and monitor all the I/O such as hoppers or weighing systems, aggregate lifting, transport system and a kneader.
In the first place, through the TouchBerry PI (PC Panel) we can select the type of concrete, the quantity and time of mixing. We can also store the historic of production, the times of mixing, the quantities of each type of elements and send them to our PLC. All this information can be sent by LoRa (wireless technology using radio-frequency modulation) to the server. In this way we can make a forecast of production, billing and also machine failures.

Secondly, we have all the hoppers where the raw materials are stored. Inside of them, we can put, for example, three capacitive sensors to know the level of material in. We will connect these sensors to our PLC and they will return us digital values corresponding to:

- 1st sensor - if this one return us "1", it means that the level is minimum.
- 2nd sensor - if both return "1", that means that the level is medium.
- 3rd sensor - if all three sensors return "1", it means that it is full.

The next step is to take out those raw materials to the weighing system. To carry out this action, we will use the lifting and transport system composed of conveyor belts; this is the more reliable and less maintenance option that we can choose. Regarding the programming part, it would be a good idea to use one of our Mduino PLCs with relays so we can control the digital output to move the conveyor belts when needed.

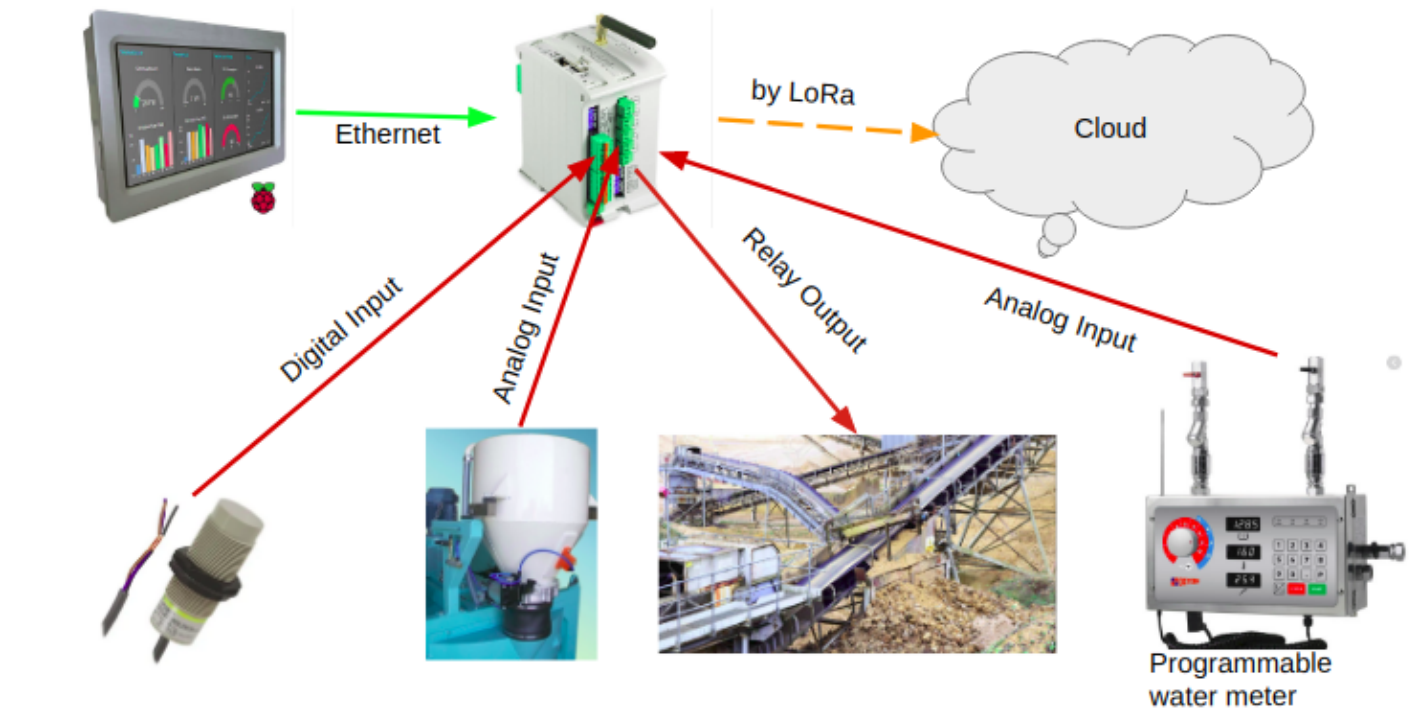
CASE STUDY

As we said, the next step is to weigh the materials and then be able can mix them. For this purpose we are going to use a programmable weighing machine. According to the type of concrete, we will weigh the exact quantity of material that we need. The PLC will receive an analogic input and when it reaches the necessary value, the system will not dump more material.

After weighing each material, the gate is opened and drops them into the mixing station. The mixing time depends on the type of concrete. For the PLC, the engine inside the mixer is just another relay output controlled by a timer.

To weigh the water for the mix, we can use a water meter to measure the volume of the water, instead of a weighing machine. Once we have the homogenized mixture, the concrete will be dropped to the truck and ready to be transported.

In the same area, we can duplicate this system and produce constantly and different types of concrete at the same time.



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Industrial Shields

ARDUINO Raspberry Pi

MONITORING SOLUTIONS IN PETROCHEMICAL INDUSTRY

Monitoring in petrochemical facilities is a key element. A correct configuration of the elements to be monitored will allow us to:

see in real time the key indicators of the production that is being carried out, so that we can make decisions quickly and efficiently. Decisions driven by data.

filter by production line, machine, process or installation, and see the current status according to the detail and types of configured events (stop, breakdown, gear, change, maintenance, etc.).

anticipate stoppages and incidents in the different productive elements thanks to a vision of the materials or products involved, or the state of equipment or facilities.

make the key security elements visible to reduce the critical parts in operations and facilities and thus be able to guarantee the safety of the installation and the operators working there.

program and configure warnings, alerts or notifications on the different systems which compose the installation to ensure safety and view the status during production.

prevent errors, low efficiency and delays due to manual data entry into the system, as opposed to automated entry.

get relevant data for each level of responsibility and thus facilitate the creation of dashboards adapted to the user's requirements. Otherwise, when there is a lack of information, decision making is slow and lacking in arguments.

contain and control the inestability caused by impurities or other reasons that could jeopardize the process, as the processes of the petrochemical sector work with elements in exact values and measurements.

The sum of the benefits that can be obtained will result in a cost and resource optimization, and a greater benefit at all levels, including a justification for future investments.

HAVE THE CURRENT AND PAST VIEW, AND ANTICIPATE THE FUTURE ONE

PERSONALIZE YOUR DASHBOARDS

TECHNICAL FEATURES

INDUSTRIAL AUTOMATION

INSTANT CONNECTION

Industrial Shields PLCs are programmed through the USB ports or through the Ethernet port, remotely. This offers immediate access to the program. You can also continuously monitor the status of all variables, inputs, outputs, etc.

OPEN SOURCE SOFTWARE PROGRAMMING

Arduino automata can be programmed using any platform allowing to program an Arduino device, such as Arduino IDE, which can be downloaded for **free**.

RANGES DEPENDING ON NEEDS

Ardbox | Ethernet | GPRS | WiFi

Up to 36 Inputs:

· (16x) Analog Inputs (0-10Vdc)
Digital Inputs (5-24Vdc) configurable by software.
· (20x) Isolated digital inputs (5-24Vdc)

Up to 22 Outputs:

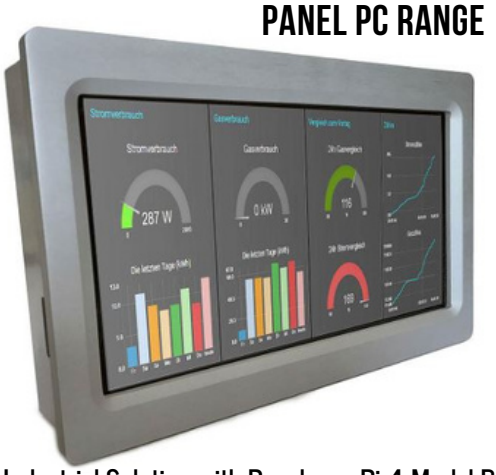
· (22x) Isolated digital Outputs (5-24Vdc)
(8 of them) PWM configurable by software.
(8 of them) Analog Outputs (0-10Vdc)

COMMUNICATIONS

(1x) Ethernet port
(1x) USB port (type B)
(1x) I2C port. (Communication with Industrial Shields devices, sensors, E/S modules)
(3x) TTL ports
(1x) RS-232
(1x) HALF/FULL Duplex RS-485 port
(1x) External SPI port (Usa MOSI, MISO, SS pins from Arduino)
TCP IP / Modbus TCP / Modbus RTU
WebServer Capacity
Industrial Protocols

ARDUINO PLC

TOUCHBERRY PANEL PC RANGE



Industrial Solution with Raspberry Pi 4 Model B

PC panel based on the GNU / Linux operating system installed on an SD card. It has several integrated interfaces: Ethernet, USB, WiFi ...

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FC CE RoHS COMPLIANT

CASE STUDY

INDUSTRIAL SHIELDS

AUTOMATION PROCESS WITH TOUCHBERRY

On this case study, we will show you how to automate a process without using a PLC.. To reach this goal, we just can use our PC Panel Touchberry 7".

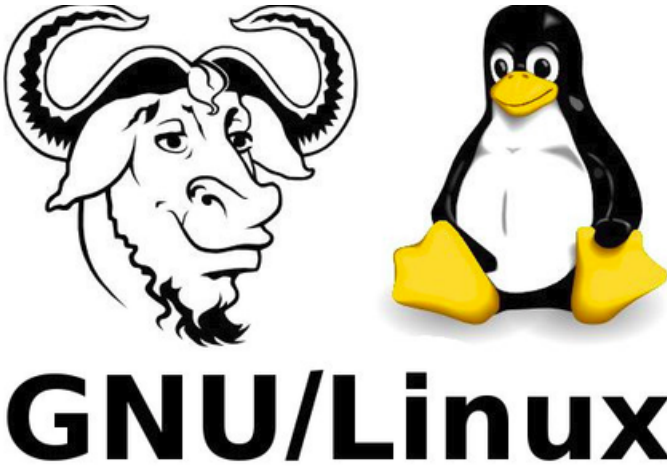
SUMMARY

Why did we think about this application?

The main reason is because our customers do not often know the **versatility** that our Panels have. Touchberry 7" can be used as a PLC because it has 10 I/O at (5-24Vdc) configurable by software. Regarding the communications, it has WiFi, RS-485 - RS-232, Serial TTL, I2C, SPI, Ethernet and USB. Using Ethernet and WiFi, you can control the diferents parameters and I/O of the system.

One of the most useful characteristics of the Panel is that, in complex systems, you can create a **network** between several Touchberries, providing a comprehensive monitoring and control solution for complete production plants and real-time data at hand.

The Panel is based in OS GNU/Linux (Raspbian/Ubuntu) installed in an SD card. You can find examples and explanations in our Blog to learn how to program it.



CASE STUDY

GOAL

The goal that we have to reach is controlling some peripheral devices using TouchBerry 7". The importance of this project consists in learning which devices can be used (or not) in the functionality and how to connect them. So this is just an example.

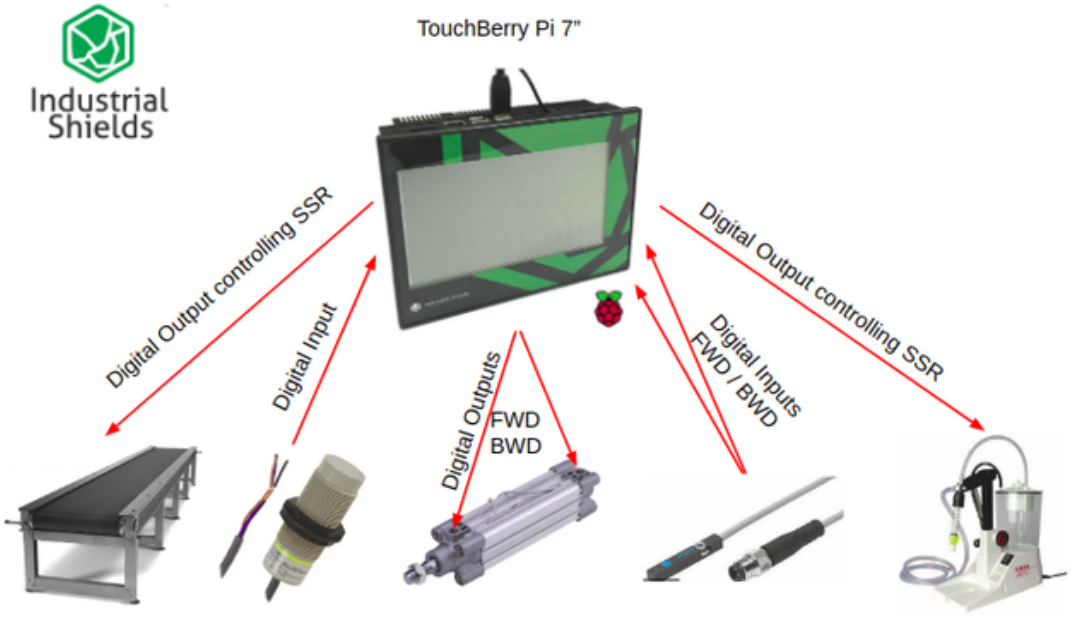
CONCLUSION (HARDWARE)

The Touchberry 7" has to control a water bottling plant. We thought about this application because the number of sensors and actuators is limited so with our number of I/O we can control all this process. In this project, we want to control a lot of signals so we can use a signal distributor of 16 I/O programmable by software and communicate it with the Panel using RS-485. Moreover, apart from using the Panel PC as a PLC, you can use it as an HMI so you can monitor all these signals and compile data from them (cycle time, hour, batch, machine failures etc.).

To make this project, we will use the devices detailed below. We are using 7 I/O in total:

- conveyor belt (x1) (1 Digital Output with solid state relay to control the engine) (See example in the our Blog).
- capacitive sensor (x1) (1 Digital Input)
- cylinder (x1) (2 Digital Outputs for the electrovalve - 1 for Forward, 1 for Backward)
- cylinder inductive sensor (x2) (2 Digital Inputs)
- water pump (x1) (1 Digital Output with solid state relay to control the engine) (See example in our Blog).
- PC Panel Touchberry PI 7"

The sequence will be as follows: **(1.)** The bottles will arrive to the conveyor belt. **(2.)** The capacitive sensor will be under the water pump; this sensor will detect the bottle when it is just under the pump. **(3.)** Then the cylinder bringing the pump will go forward. **(4.)** Finally, when the inductive sensor is high, the pump will begin to fill the bottle with the correct quantity of water.



CASE STUDY

INDUSTRIAL SHIELDS

MONITORING OF BEET MOUNTAINS

The main sugar beet growing areas are in the temperate regions of Europe and North America, with average heat wave temperatures between 16-25 ° C and annual rainfall of at least 600 mm.

Before the beet is processed, its is stacked in huge mountains outside. Although the mountain hold the beets well, those on the inside of the pile are more affected by heat and moisture to the point of damage.

CHALLENGE

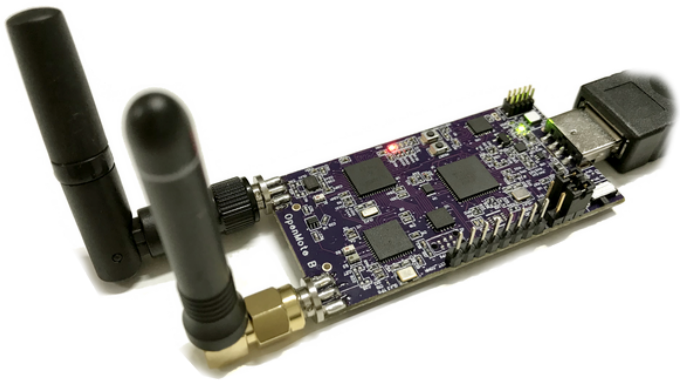
Our customer is a major Spanish sugar manufacturer who wanted to implement a system to control and monitor his beet mountains. He realised that the beets at the bottom centre of the mountain were spoiling even before being removed to start the sugar conversion process. As a result, a percentage of the raw material had to be discarded, losing significant amounts of money at the end of the year.

In short, they wanted a system that could detect when the beets were about to start rotting and, therefore, prevent it and extract them in time. It must be taken into account that the system will be outdoors, so it must face possible climatic adversities.

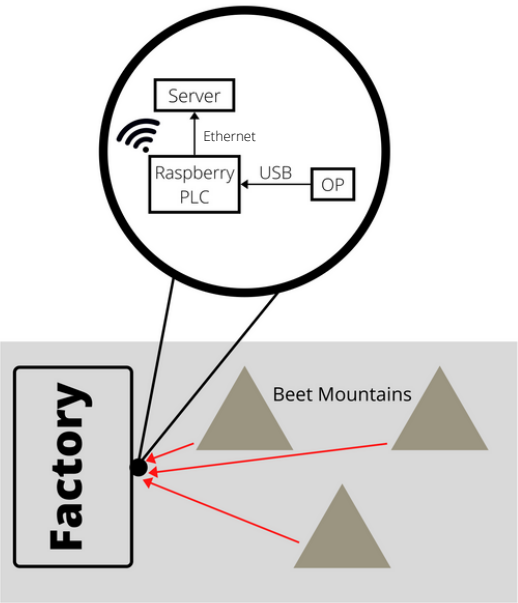
IMPLEMENTED SOLUTION

In order to solve the problem, a system using Industrial Shields devices is applied to monitor temperature and humidity inside the mountains. An Open Mote B connected to the corresponding sensors is implemented in each mountain, sending the collected data to another one that will act as a master.

All the data collected by the master are redirected to a Raspberry PLC that send them via Ethernet or Wi-Fi to a server.



CASE STUDY

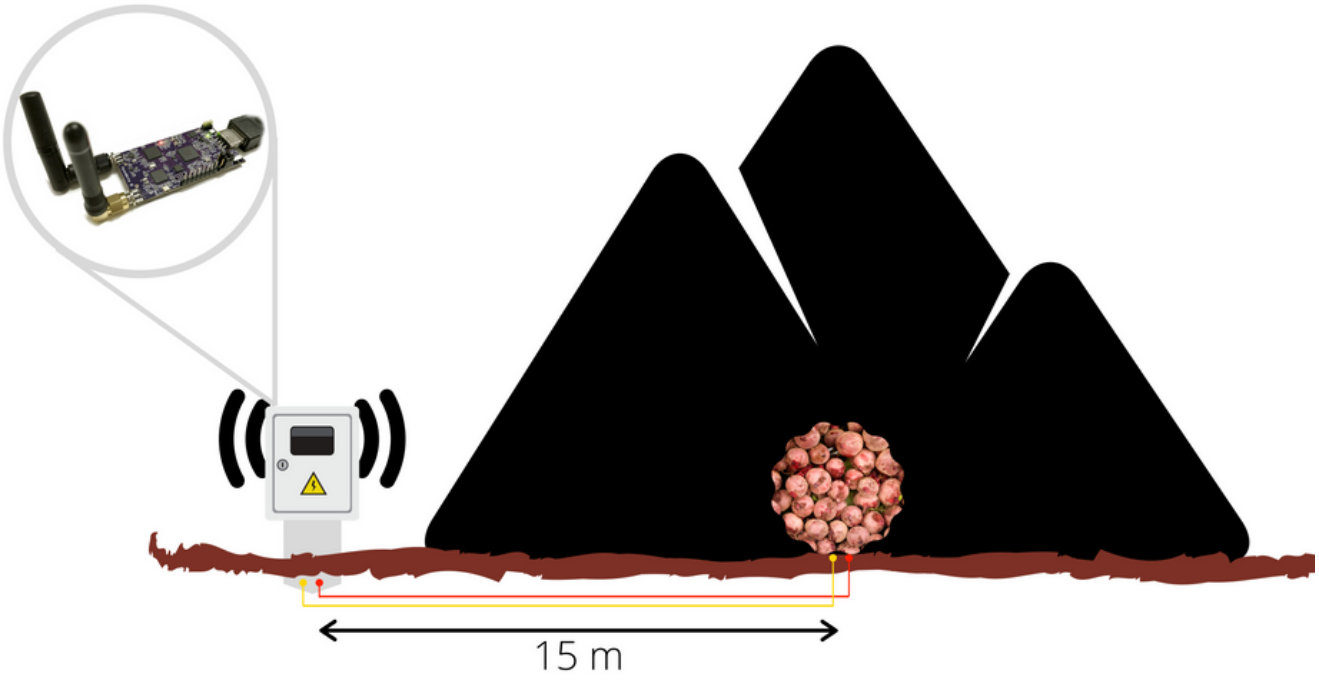


It is essential to control the temperature and the humidity to know if the beets are still in good condition or have started to take root. If a high level of heat and humidity is detected, a warning signal is sent. As the beets are removed with bulldozers, the sensors must be buried underground avoiding the bulldozers levers but still being able to detect the beets.

The Open Mote B uses a DS18B20 sensor to detect the weather information. The Open Mote B will be located outside the mountain, inside an electrica box, while the sensor, as mentioned above, is buried down the mountain within a 15 m radius. As the sensor works at 5v while the Open Mote at 3.3, a level shifter is necessary. They are powered by batteries that, thanks to their advanced hardware, will not be necessary to replace in a period of almost 2 years.

A program will be loaded into the device being able to switch it on from time to time to save energy. As the beets do not take root for a period of minutes, a signal "wakes them up" every hour to send the actual data to the master by radiofrequency; they can operate using a 2.4 GHz signal (less distance but better data rate) or a 868 MHz signal (more distance but worse data rate).

The Master Open Mote B is located near the factory connected to an Industrial Shields Raspberry PLC via USB connection. The Raspberry PLC sends all the information to an internal database or directly to the cloud via Ethernet or Wi-Fi. In the near future a beacon could be added to the electric boxes where the Open Motes B are located for a visual alert when the levels exceed the limits, so the customer can see them easily.



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CASE STUDY

BENEFITS

Economic savings

Thanks to the implemented solution, the customer has minimized the economic losses caused by the deterioration of the products.

Guaranteed quality

Control of temperature and humidity helps the customer to keep the product in good condition.

Saving time and resources

Since the product is kept in optimal conditions, it is not necessary to allocate resources to the handling and disposal of products in poor condition.

WHY INDUSTRIAL SHIELDS?

Industrial Shields won this project and beat its major competition thanks to:

Open solution. No license fees.

Wireless system with low energy consumption. The **batteries** of the equipment have a long life.

Modular solution: if the customer requires it, there is the possibility to extend it in the future.

Safety of the installation: being underground, the sensors are safe from damage that could be caused by excavators.

Equipment designed and manufactured for **industrial use** at a **lower price** than competitive products.

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CASE STUDY

INDUSTRIAL SHIELDS

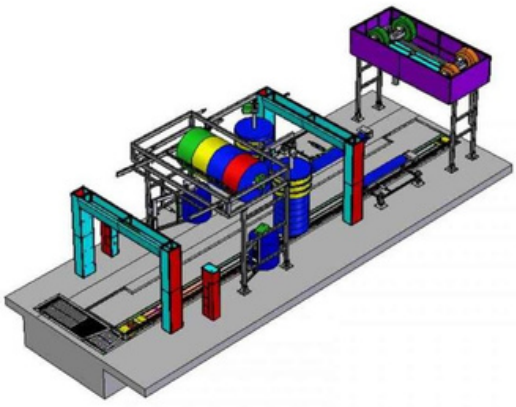
AUTOMATIC CAR WASH

In this Case Study, an automatic car wash process is implemented.
For this purpose, a PLC of the MDuino family has been used and a set of sensors and actuators are described below.

When a Car enters the hall, a certain sequence has to be followed automatically.
Steps are:

1. Soaping
2. Washing
3. Drying.

SUMMARY



Car washing is a simple activity done in order to keep the exterior of the car clean. Mostly it is done manually in automobile garages or service centers of automobile companies.

This manual way of cleaning cars results in more consumption of water, manpower, and time.

The automatic car washing system explained in this Case Study minimizes the use of water and also manpower requirement. Our car washing system utilizes control using PLC.

To detect the car automatically, load cells can be used, or any other sensor such as Infrared Sensor can also be used.

Soaping, Washing, and Drying are performed for a particular time, hence generating time delay for these outputs becomes mandatory, so three different timers are used, but you could also have chosen the use of motion sensors to detect when the vehicle reaches each phase.

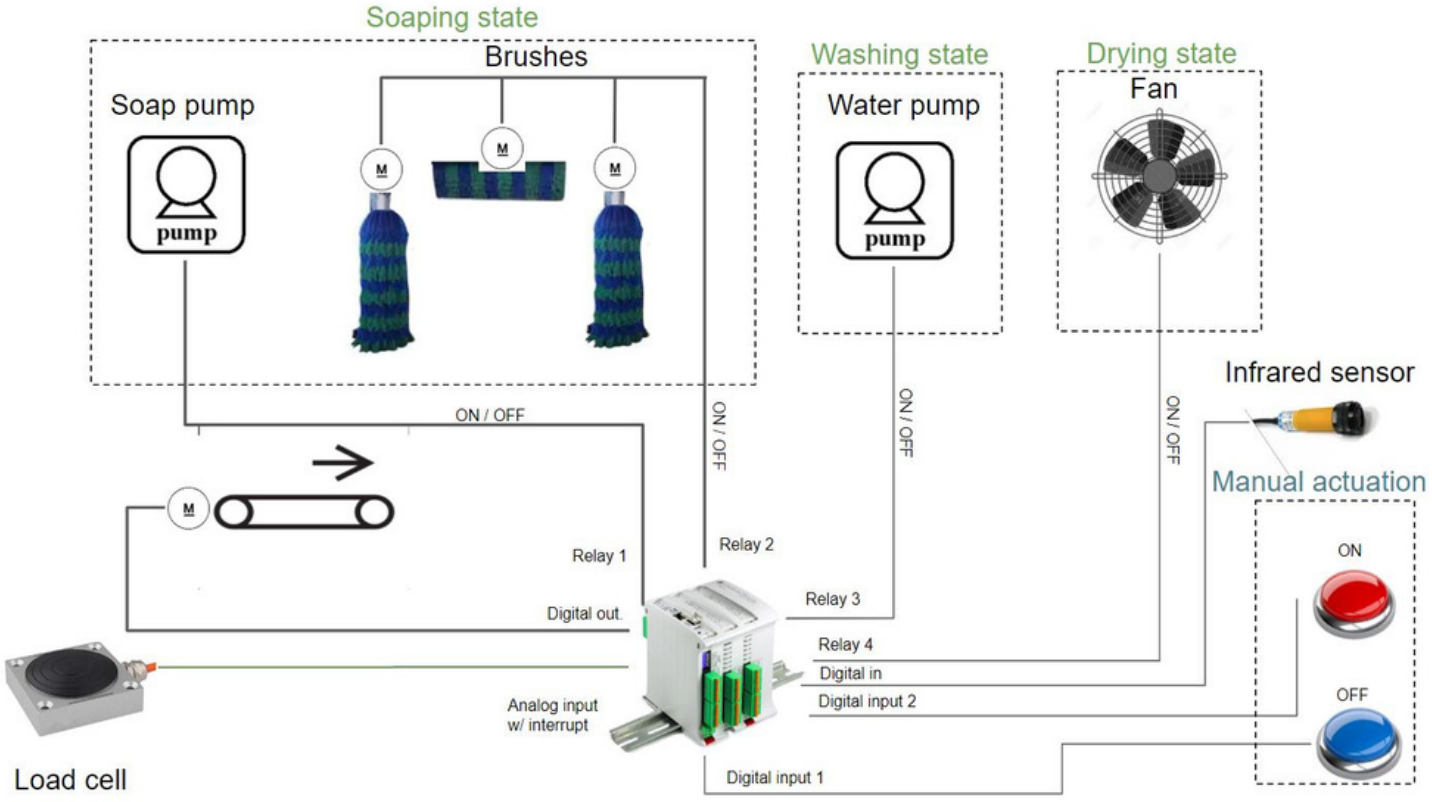
CASE STUDY

SOLUTION (HARDWARE)

At the beginning of the circuit, when the load cell detects a weight similar to that of a vehicle, it activates the motor that controls the conveyor belt and begins counting the soap, washing, and drying timers.

For the soaping, the PLC acts on the soap dosing pump, once the time is completed, the washing pump is activated. In parallel, a relay that controls the 3 motors of each brush is activated to scrub the car with soap.

Finally, when the third timer (the drying one) is activated, the fans are activated.
To finish, the conveyor belt takes the car to the end of the route and when it is detected by the limit switch, the entire process is closed. Manual on/off buttons has been installed to stop or turn it on when required.



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CASE STUDY

INDUSTRIAL SHIELDS

MONITORING THE EFFECTS OF CLIMATE CHANGE

The study of polar ecosystems helps to understand alterations in climate change. One of the ways to analyse the environment under controlled conditions is through mesocosms or outdoor **experimental systems**.

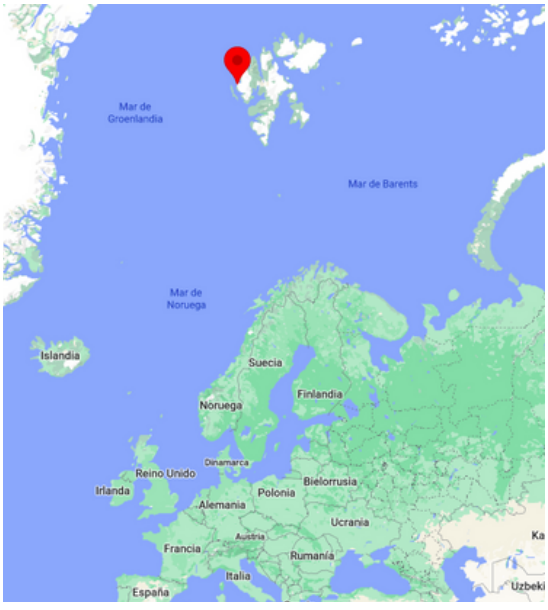
In the following Success Story, you will see how our customer installed **12 mesocosms** in the town of New Ålesund —in the island of Svalbard (Norway)— to monitor changes at the North Pole.

CUSTOMER

The rapid disappearance of sea ice is a clear indicator of the global climate crisis. Glacial fronts and sea-ice systems are hotspots of biodiversity. Their evaporation will threaten Arctic coastal ecosystem function and ultimately local livelihoods.

The overall objective of **FACE-IT** is to enable adaptive co-management of **social-ecological fjord systems** in the Arctic in the face of rapid changes in the cryosphere and biodiversity.

FACE-IT
Arctic Biodiversity & Livelihoods



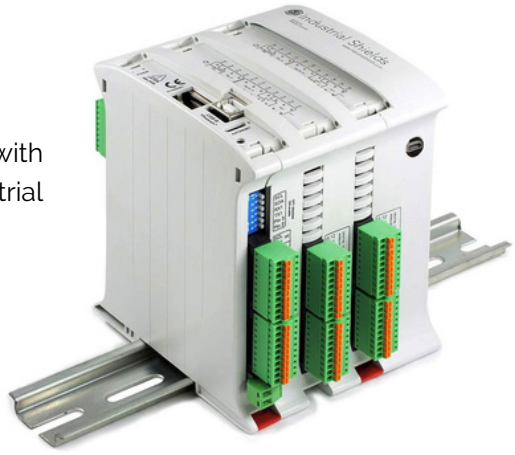
CHALLENGE

Our customer's goal is to study the effects of global warming, such as:

- increase in water temperature
- decrease in salinity
- turbidity

CASE STUDY

SOLUTION



FACE-IT was looking for a PLC solution easy to program and integrate with sensors. In order to manage and implement a monitoring system, Industrial Shields proposed the installation of several **M-Duino42+ PLCs**.

IMPLEMENTATION

The implemented solution consists of locating 12 mesocosms:

- 3 of them will be control mesocosms
- the experiment will be applied in the remaining 9 mesocosms

Each mesocosm has its own 3-way temperature control valve and 2-way fresh water control valve, connected to the analogue signal in the PLCs.

Multiple **sensors** connected to an **RS-485** bus are used to measure multiple parameters such as salinity, turbidity and temperature.

Each PLC is responsible for the regulation of 3 mesocosms. The master PLC is responsible for data logging, via a **µSD card** and communication with a control computer.

The connection between the PLCs and the computer is made through **RJ45** ports, via **websocket** protocol.

Finally, a C# programming language interface is developed on the computer to **monitor** and **control** the experiment.

WHY INDUSTRIAL SHIELDS?

Industrial Shields won the project and beat its main competitors thanks to two main factors:

- **Free cost** of the programming platform
- **Flexibility** of programming

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CASE STUDY

INDUSTRIAL SHIELDS

FLEET MANAGEMENT

In this particular case, fleet management is implemented.
It consists in installing, in each vehicle that composes the fleet, equipment based on Arduino of Industrial Shields with its set of sensors and actuators.

With this assembly, we can obtain the address, speed, and location of each vehicle and send this data to a server with its database. From the cloud, we will be able to access these data and display them on the screen, in the headquarter.

It also contemplates the case in which, from the headquarter, messages can be sent to the desired truck by installing a Bluetooth module in each truck that interacts with the driver's mobile.

SUMMARY

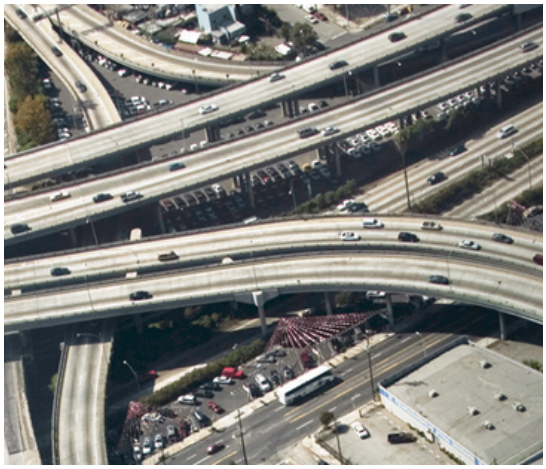
Each truck in the fleet will have an Arduino Based PLC connected to the truck's 12V power supply.

Each piece of equipment will have three modules to obtain the information, send it to the cloud, and also receive messages from the headquarter:

1x GPS Module: It will give us the location, address, and speed of the vehicle.

1x GPRS Module: Connected to a SIM card, it allows us to send data to the cloud that will be collected by the server and stored in the database.

1x BT/LE Module: When the driver receives an alert or message from the headquarter through the GPRS module, with the Bluetooth module, we can send this information to the driver's phone.



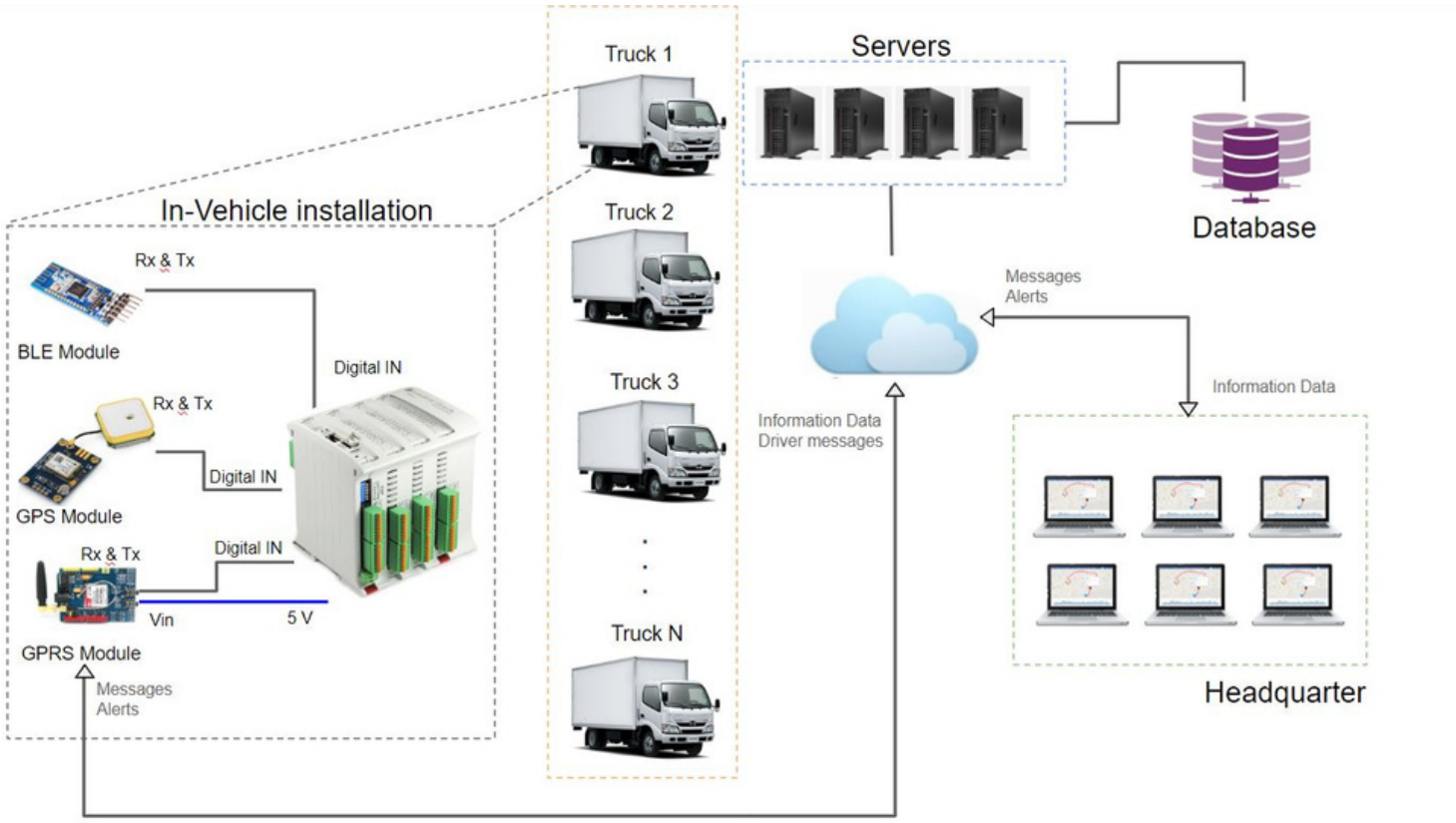
CASE STUDY

FINAL SOLUTION (HARDWARE)

Once the location, direction, and speed of the vehicle are determined from the GPS components, the additional tracking capabilities (GPRS modules) transmit this information to the server and it is stored in the database. The server sends the data to the terminals located in the headquarter and they display them on the screen in a visually graphic interface.

In the terminals, the same interface allows to send alert messages to the desired truck and once the information arrives at the Arduino-based equipment, from the Bluetooth module, the mobile phone of the driver will receive the message instantly.

The system is scalable and designed so that the entry of new trucks into the fleet does not affect the correct operation of the fleet management system.



Thank you very much for your time

Boot & Work Corp, S.L.
If you have comments or questions do not hesitate to contact us

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