Using Open Source Based Hardware





INDUSTRIAL SHIELDS



HOW TO GET THE MOST OUT OF SOLAR PANELS?

Solar panels are a key element in obtaining sustainable energy. **Optimal performance** is also **crucial** in this type of installation.

This can be achieved through proper monitoring of the installation as a whole, and of each one of the panels that compose it, individually.

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 increasing need for energy, solar 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 system viability and reliability and a long lifetime of your controllers,
- know the amount of energy and other data at any time and have them in the cloud, and
- reduce the maintenance costs.







GOAL

The aim is generate more energy by chasing the sun, which is a moving target.

Solar panels operating by automatic control systems can generate up to 30 % more energy than static panels.

CONCLUSION

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 will be transferred to the 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 information from the cloud will be useful to improve the PLC 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.





BENEFITS

Once the system allowing the solar panels to follow the path of the sun is installed, **the increase obtained is close to 35%** compared to fixed installations.

As a result of the improved efficiency, increased investments can be offset much quicker and paybacks can be achieved sooner.

FASTER PAYBACK





WHY INDUSTRIAL SHIELDS? CHECK THE BENEFITS FOR THE CUSTOMER

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



Open solution:

No license fees.



Modular solution:

In the future, the project can be extended based on the client's 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 **competitive price**.



Industrial Shields ®

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IMPROVE STREET LIGHT THROUGH MONITORING AND CONTROL

Knowing the state of street lighting and being able to control it remotely are very useful functions when saving and modifying its use.

Thanks to its characteristics, the system **can easily adapt** to the customer's needs.

It will have a SQL database where the lighting data will be stored; from a server, it will allow to act on the lighting and to program each zone separately (e.g. switching on and/or off time).

SMART LIGHT CONTROL

Smart Light Controller 19R

N: 202012150005

Ref: 099000100100

RTC Battery (CR12

SUMMARY

In this project, several goals had to be achieved.

Monitoring

Thanks to the monitoring of the installation and subsequent analysis of the information, significant savings and benefits can occur by doing:

- prevention energy leaks
- consumption optimisation
- light pollution prevention
- implementation of preventive maintenance
- implementation of predictive maintenance
- adjustment operators' routes in case of failures or emergencies

Control

Remote control of the installation ensures the best performance and functionality.

Either automatically or manually from a remote centre, the **control for switching ON and OFF** is key to the operation of the installation and to ensure the best service to the pedestrians and/or vehicles.

With a good planning and execution it is **possible to control each element separately** or groups of lamppost (by quantity, street, area...).

By doing this it is possible to foresee excess consumption, major breakdowns and, again, to save a significant amount of money and reduce carbon footprint by reducing wasted energy,



BRIEF OVERVIEW OF THE HARDWARE SOLUTION

Electrical cabinet with all the components of the complete solution, wired and identified, to facilitate the technician's configuration and maintenance tasks.





A **Smart Light Controller PLC** has been used for this project implementation. A current analyser is also required to measure the voltage and intensity in each of the lines that it's activated.

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, there is a server that can send action and configuration commands to activate each remote line. Thanks to this system, the following advantages are

- **Remote control of the status of lights**: In this way, a server with special requirements can be implemented.

- **Status management**: Thanks to the fact that all the information about the status of the lines is being saved, it is possible to program each system separately and make, for example, to switch a zone on a little later to save energy, or to activate it a little earlier so as not to leave a sector dark.

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



- Power consumption

obtained:



CONCLUSION

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 via Modbus RTU over Ethernet.

The Smart Light Controller 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.

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,





The system enters information in the database using SQL, so the user can consult it every time he needs 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.





COMPLEX INSTALLATIONS WITH SIMPLE SOLUTIONS?

In biogas plants, it is necessary to have eyes, ears, nose and hands in multiple places at the same time.

The very need for safety in this type of plant makes it essential to install a large number and type of sensors.

The existence of multiple elements of a very diverse nature to be monitored makes it difficult to integrate global solutions. To tackle a project of this type, costs soar, as the diversity itself makes it difficult to adopt standards that communicate easily with each other. Both on the control side and on the monitoring side.

CHALLENGE

The customer's objective 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 screens for local control and management of the machines.
- Implementation of sending data to the cloud.

IMPLEMENTED SOLUTION

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

- 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 Raspberry 58+ PLCs due to the large number of digital and analog I/Os available, the Ethernet and Wi-Fi communications among others and, especially, to its high processing capacity, able of developing multiple processes simultaneously providing a high response. Several TouchBerry Panel PCs are monitoring the information due to:

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

Sending data to the cloud is done through the Ethernet connection, used to communicate with the server at a high speed interaction.







The customer's main objective is to process biomass waste, which can be of 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 their 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 Touchberry Panel PCs.



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BENEFITS

By being able to realise a complex installation of sensors connected to few but powerful devices, the entire installation has been simplified. This also allows costs to be reduced in the short, medium and long term.

The fewer elements that are part of the solution, the easier and quicker it is to configure, maintain and manage.

The customer's goal was to have an automated and secure installation. Likewise, the entire visualization and control part outside of the automated processes was also key to making the biogas plant productive, safe, and at the same time easy to control and measure.



Data monitoring

Information is displayed on Industrial Shields HMI, which stand out for:

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





PRODUCTIVE, PROFITABLE AND TROUBLE-FREE WIND FARMS

Windmill installations are becoming increasingly common as part of the new green energy.

There are different types of windmills with heights from tens of meters to some close to 200 meters.

The investment involved in a wind farm is very significant, so it **is essential to have a monitoring system**.

SUMMARY

This project consists of monitoring wind turbines using Arduino PLCs with GPRS.

Proper monitoring ensures that:

- each of the mills is operating at the expected performance,
- has no incidents or breakdowns,
- and all this remotely.

The fact that staff in charge of supervision and maintenance have to check on site whether everything is working properly **is a cost in time and resources that is totally outdated** considering the technologies available today.



STATUS

The customer needs a programmable logic controller with sufficient inputs and GPRS communication to be able to install it in windmills that are already in operation, without having to carry out major works or actions.

WHAT DO WE DO?

Once the necessary information has been defined in the monitoring platform and agreed with the technical team that knows the operation and characteristics of the mill, the appropriate PLC is defined.



OBJECTIVE

In this project, the customer wanted to install in each mill a PLC with GPRS to be able to:

- measure the electrical energy generated in real time
- know if all the sensors are working correctly and indicate correct values
- detect incidents or faults
- anticipate overhaul and maintenance works
- avoid the installation of an extra communication system

On the other hand, having a PLC in the windmill also facilitates communication to configure a series of warnings or alarms, as appropriate, after checking the information received in real time from the wind turbine itself.

Thanks to GPRS communication, it is possible to cover the entire range of the wind farm without the need for a double Ethernet or fiber optic installation, with the consequent savings in installation and maintenance.





The messages sent and received by the PLC have been simplified as much as possible to optimise performance.



BENEFITS

This project has also developed the software platform for interacting with the mill.

Through a series of menus and dashboards, the necessary information can be accessed and acted upon. Both in terms of performance and maintenance.



KPI'S

Some of the most relevant indicators to be taken into account for the correct operation and performance of the wind turbine are the following:

- Condition of the moving elements and with wear of the wind turbine.
- Temperature in the nacelle and outside.
- Wind speed
- Rotor speed
- Pitch System
- Total Power

Being able to have a vision of the state of the wind farm allows to plan the revision works of the maintenance team.

Nowadays it is essential to work with preventive and predictive maintenance to **avoid unnecessary breakdowns (sometimes costly), unexpected shutdowns, and in short, to save time and resources** to have a facility that remains operational without incidents and ensure its profitability.





The result of having the Arduino PLC has allowed the customer to save a significant amount of time and money in all the revision and maintenance tasks in the field.



On the other hand, having the platform with real-time information of each wind turbine and the wind farm, allows the entire installation to be configured according to the energy demand, obtaining optimal performance.



Thanks to the absence of software licenses, the short, medium and long term savings are close to 33%.





A RELIABLE, SCALABLE AND COST-EFFECTIVE SOLUTION FOR WATER TREATMENT

A water treatment plant has to be continuously maintained and controlled.

There are multiple elements to monitor and control in such a plant. Due to the wide variety of sensors and operations that are performed out in the different treatment stages, versatile controllers are needed to perform the necessary operations easily and at a sustainable cost.

SUMMARY

This project allows to automatize and monitoring a treatment water plant.

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.



STATUS

The customer needs an autonomous water treatment station that can be monitored for remoted access data. Also it also needs to be easy to replicate throughout the area and allow the system to setup remotely.

WHAT DO 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.





OBJECTIVE

The control system implementation for water treatment must be able to obtain the solution composition measuring the pH level and chlorine level. Analogue sensors will periodically read the pH and chlorine levels.

If the water quality properties are below the minimum value, the solenoid valves will deposit chemicals products in order to obtain the values that are within the allowed ranges. Finally, the system must also regualte the speed of dosing pump to ensure the correct dosage.

PROJECT (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 values 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. The Industrial Shields Panel PC can also be used to automate the predefined dosing values..



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BENEFITS

Thanks to the use of industrial controllers based on open source hardware, the total cost of installation was reduced by around 40%. In addition, the use of software with no additional licensing costs also leads to savings in the short, medium and long term.



Moreover, the flexibility of open source technology favours the use of specific communication protocols that are better adapted to the customer's needs.

At the start of the project, it was already known that it would continue to grow for some time.

The ease of installation and integration of hardware based on open technology was a key element in making the various expansions easy, fast and cost-effective.





Boot & Work Corp. S.L. is a company committed to the promotion, development, manufacture and selling of products based on Open Source technology to liberalize the industrial sector and boost the growth of its customers.

COMPANY

Industrial Shields is the brand that provides **Open Source Hardware** based for industrial use, including all necessary design and safety, combining the best of both worlds.

Our company's goal is to provide you low-cost solutions for automation in industrial environments. The **Open Source Hardware** solutions in the industrial sector are a growing market and we are its pioneers.

The balance between quality and cost is very important for the market, using Open Source solutions you can get more specifications at a better price.

Even more, the Open Source solutions are more flexible and accessible than the standard industrial solutions and the software is licence-free.

You can focus on Industry 4.0 and the Internet of Things thanks to Open Source Hardware products.











In compliance with : EN61010-1 | EN61010-2-201 | EN61131-2:2007 (Clause 8: Zone A/B EMC and clause 11:LVD) EN61000-6-4:2007 + A1 2011 (Emissions) | EN 61000-6-2:2005 (Inmunity) | EMC: FCC Part 15

Working worldwide through distributors, or in direct contact with the customers. We have been working since 2016 with big players of the market that are selling our products in their websites.

Our **commercial, technical and support team** will assist you by phone, email, skype; or using the ticket system or chat directly in our website.

