CASE STUDY

INDUSTRIAL SHIELDS

CAN WE PREPARE FOR A TORNADO IMPACT?

Tornadoes are natural phenomenon that often have unpredictable and catastrophic consequences.

Knowing the origin and evolution of tornadoes can help to predict the impact they may have when the area where they hit is affected by one.

The main objective of this project is to obtain sufficient data using a weather station and provide information to establish different patterns of behaviour according to the type and intensity of tornadoes, in order to anticipate and mitigate the sometimes devastating effects of tornadoes.

CHALLENGE

The aim is to **manage a weather station** and then **monitor it through a cloud platform**.
The main parameters 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.

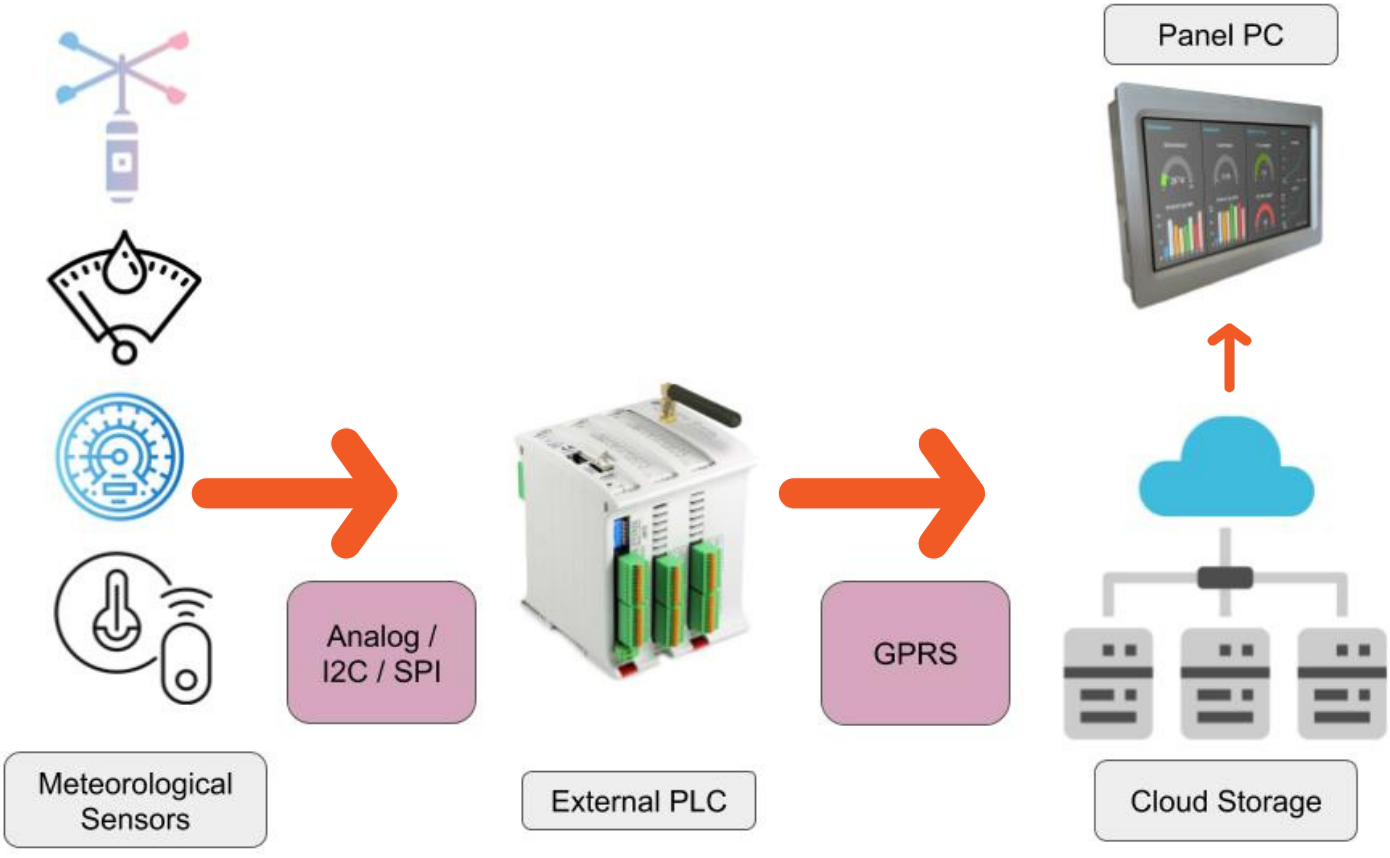
Firstly, the data are captured by all the different sensors. The information is sent to the PLC using the appropriate communication method for each sensor. The sensor communication is chosen according to the model and data type and the update time.

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 corresponding 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.

Monitoring cannot be done without an API or platform. This is developed to monitor all the information and make possible 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.

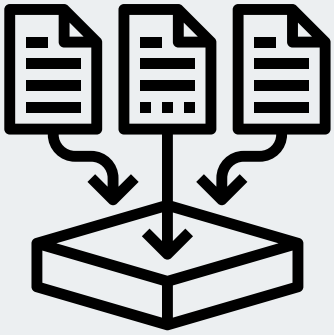


CASE STUDY

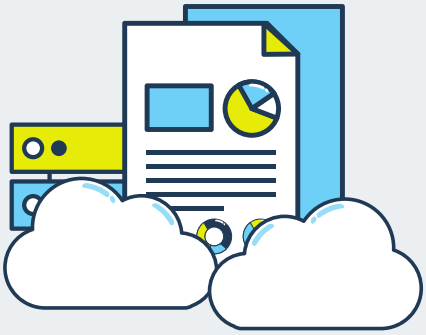
BENEFITS

Thanks to a complete monitoring system, it is possible to have relevant data to study and understand the behaviour of tornadoes and their destructive capacity. This understanding will make it possible to anticipate how a tornado may affect people, buildings, infrastructures, etc., and to try to minimise the impact as much as possible.

First is key to get all the raw data from the sensors.



All this data is transformed into valuable information that can be easily access and analysed.



The analysis of the data allow the team in charge of the study to learn, understand, and take the right decisions.

WHY INDUSTRIAL SHIELDS?

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Open solution. No license fees.

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

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CASE STUDY

INDUSTRIAL SHIELDS

COMPLEX INSTALLATIONS WITH SIMPLE SOLUTIONS? LET'S SEE.

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.

Multiple elements of many different types to monitor makes it difficult to integrate global solutions. In order to take on 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

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 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 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 **Raspberry 58+ PLCs** 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. Several **TouchBerry Panel PC** are monitoring 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 at 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.

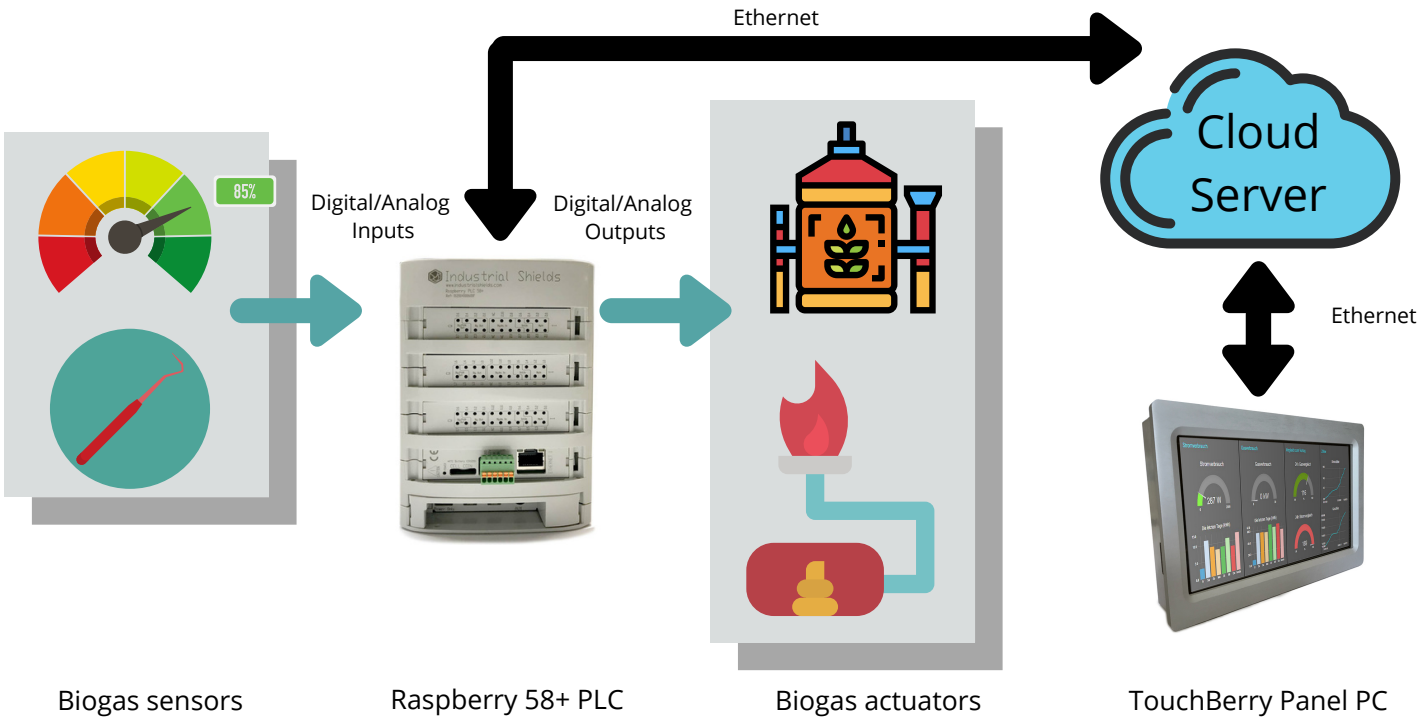
Another important aspect is the local machine management **display control**. Thanks to Industrial Shields technology, the customer has implemented:

- 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 **Touchberry Panel PCs**.

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



CASE STUDY

BENEFITS

By being able to realize 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 objective 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 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
- working in many different standard protocols.

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CASE STUDY

INDUSTRIAL SHIELDS

IMPROVING DATA CENTER PERFORMANCE? DONE!

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. It's KEY to have this values totally under control.

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
- the expansion of services for some of the **country's largest banks**, a sector in which the company specializes 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

HOW MUCH DOES STREET LIGHTING CONSUME?

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 control and regulate public lighting using a "**Smart Light Controller**" (SLC).

Thanks to its characteristics, we are 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

In this project, several objectives had to be achieved.
- To monitor the energy consumption of the system. Composed of luminaires lines, to facilitate analysis and possible intervention in the event of detecting any anomaly.
- To be able to control the switching **ON** and **OFF**. Either automatically or manually, and always remotely from a control centre.

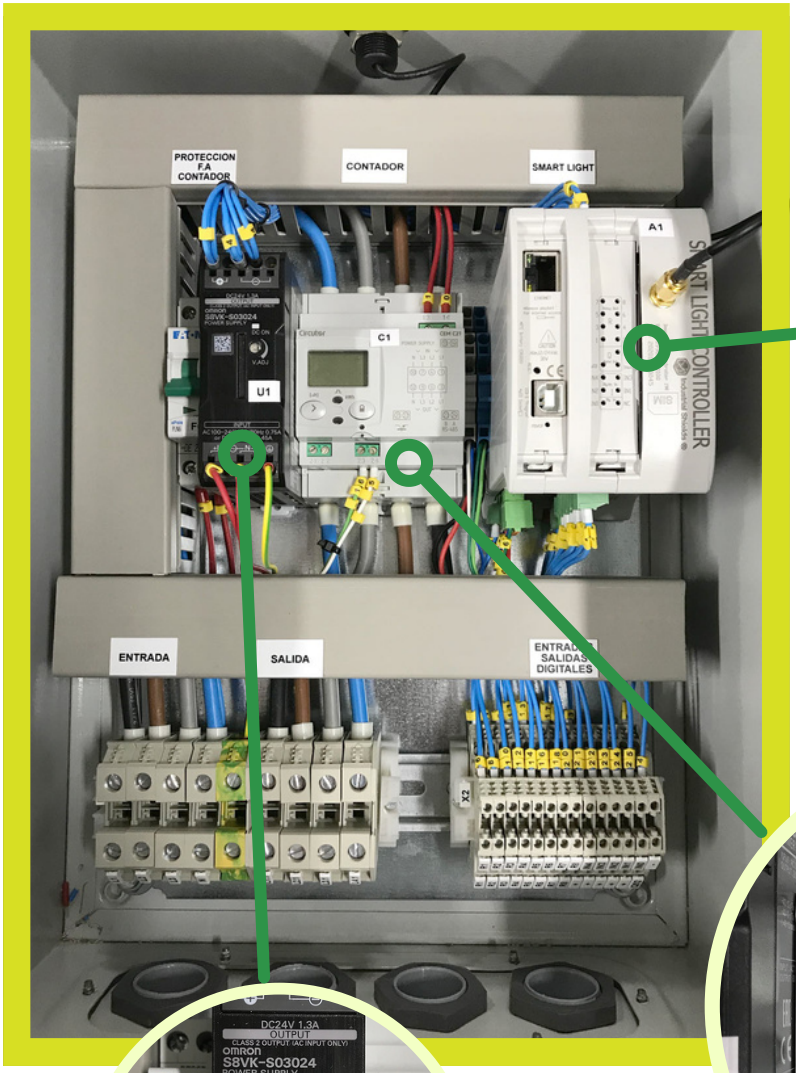
A **Smart Light Controller PLC** has been used for this project implementation.
A current analyzer is also required to measure the voltage and intensity in each of the lines that we activate. Communication between **SLC** and the network analyzers will be through an RS-485 channel using the Modbus RTU protocol for data transmission.

A database in SQL has been needed when saving data, Finally, we 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.
- **Energy consumption**

CASE STUDY

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.
Ready for on-site assembly and commissioning in the shortest possible time.



SMART LIGHT CONTROLLER

Network analyser

Power supply

CASE STUDY

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 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 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.

WHY INDUSTRIAL SHIELDS?

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CASE STUDY

INDUSTRIAL SHIELDS

IMPROVING PRODUCTION BY GETTING THE RIGHT INFORMATION

The lack of information in the production lines and machines was an old issue that the customer needed and wanted to be solved.

By knowing relevant data of their production, machines and lines, important decision-making related to predictive maintenance or continuous improvement started to arise.

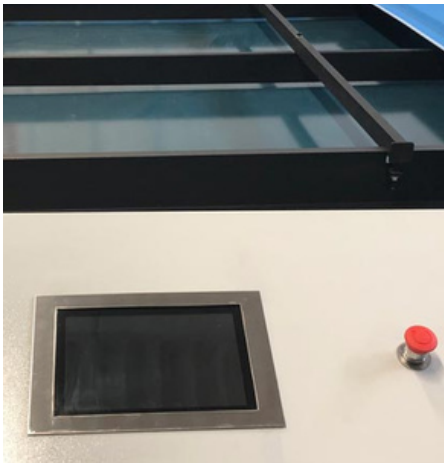
SUMMARY

Condition Monitoring and **Predictive Maintenance** systems use a number of smart sensor nodes in the equipment that are either directly connected to the cloud or via intermediate gateways, like the Arduino based PLC in this application.

Once the customer had analysed their needs, the necessary elements were installed to be able to monitor the production lines and individual machines. Different types of sensors, depending on the indicators required.

When all the acquisition system was installed, then started all the control part, that allow the production responsible to **start/stop** the lines or machines, or setup automatic options according to the technology available on site.

The adjustment of specific parameters to be monitored also allowed the activation of **alarms and/or warnings.**



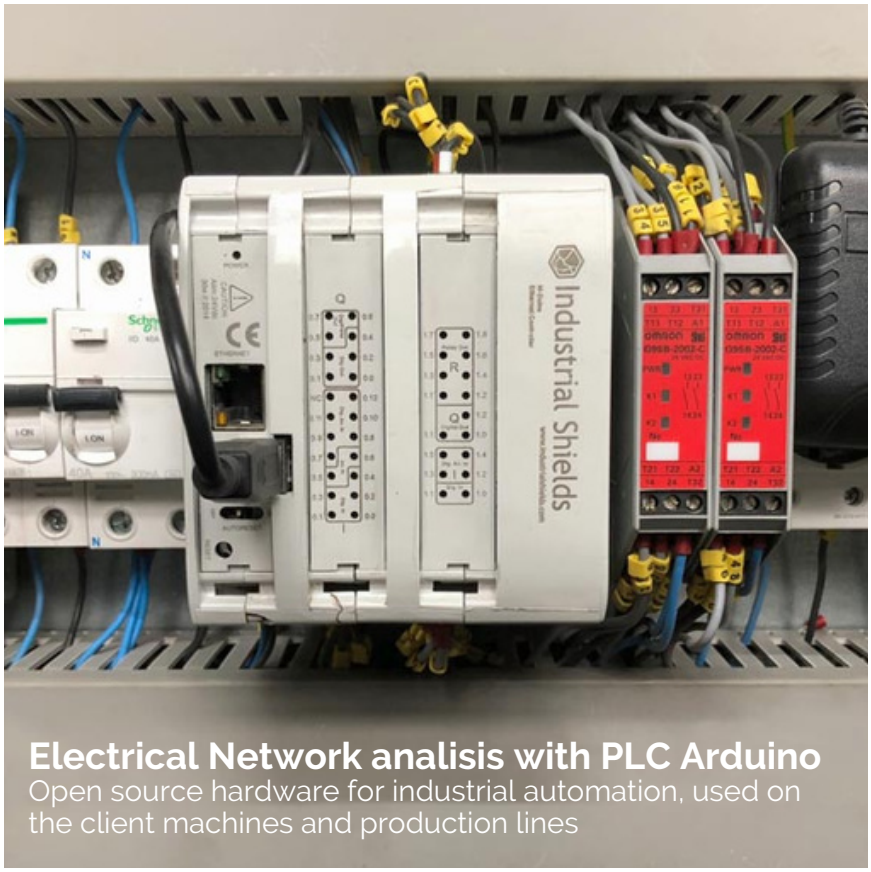
CASE STUDY

HARDWARE SOLUTION

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 database is connected to the resource planning tool for machine maintenance.

GOALS ACHIEVED

- Improving the efficiency of its production by monitoring relevant data.
- Start a preventive and predictive maintenance plan.
- Acquiring extra data from multiple 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 machines and production lines

Thanks to the monitoring solution the customer is able to get the right information in real time.
It can also control and interact with the production line and machines, and automate some of the processes.

The Raspberry Pi Panel PCs allow the customer to control and monitor his installation.

Raspberry Pi®

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CASE STUDY

INDUSTRIAL SHIELDS

IMPROVING THE CUSTOMER EXPERIENCE AT A SERVICE STATION

The customer has no data on the behaviour of its customers.
It is not just a question of knowing the volume of business they bring in, the refuelling, the car wash, the shop, the supermarket and the bar-restaurant service, but of being able to analyse how long customers spend at the facility and to improve the customer experience, while improving commercial performance and turnover.

SUMMARY

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.

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.

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.

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.

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)

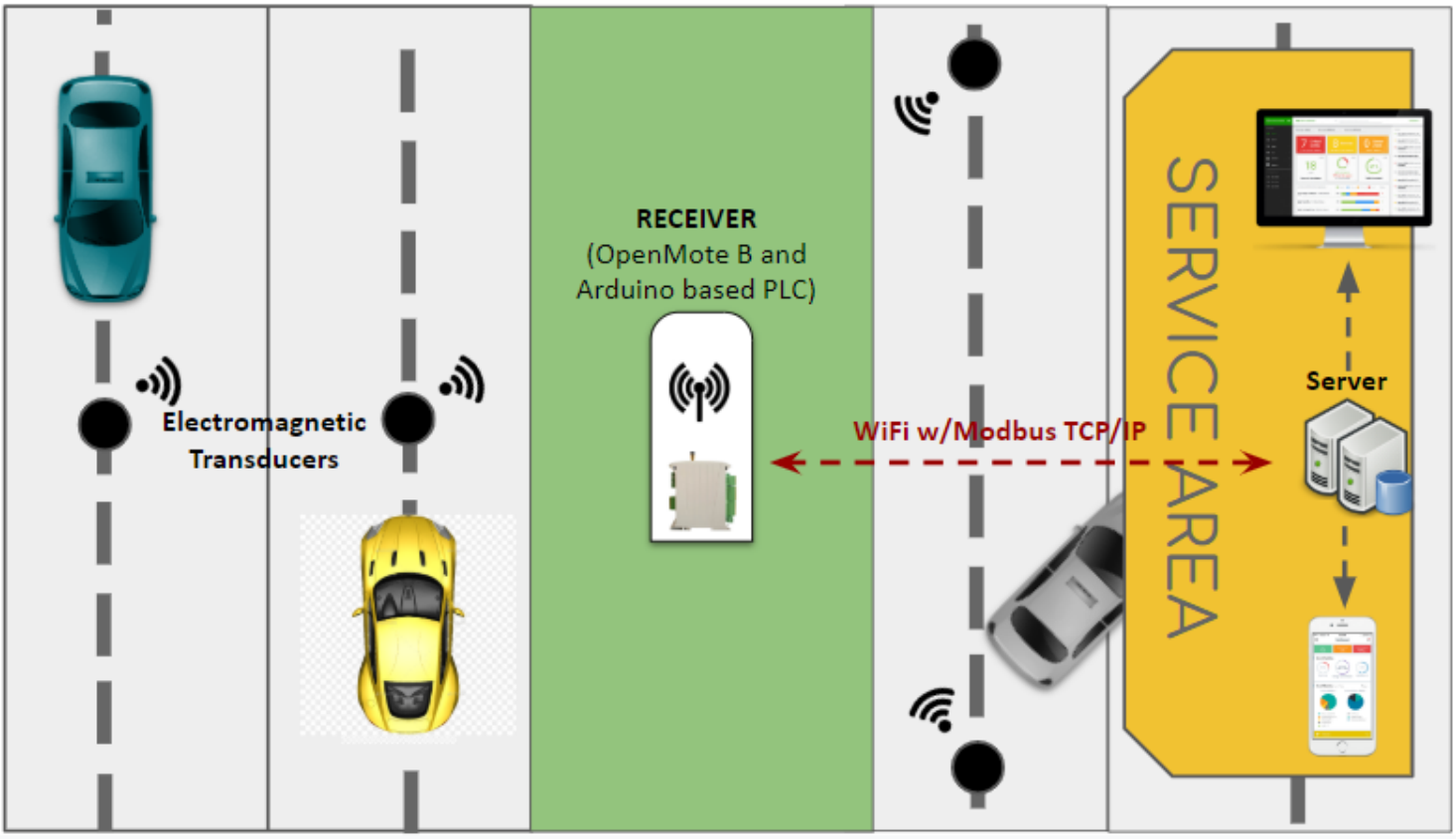
To obtain all the traffic information in the area near the service area, the following system has been prepared:

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

BENEFITS

The customer now has data which, once analysed, becomes valuable information about customer behaviour patterns.
A large amount of information is obtained to be able to adapt the best offer according to the day:
- whether it is a public holiday or not
- the beginning or end of the week
- the time of day
- the time of year

Until now, this fluctuation in traffic was only intuited but without reliable data to enable decision making.

Exact figures have also been obtained on the number of vehicles circulating, accessing the service station, refuelling and using the automatic car wash. The offer of all services is now better adapted to the customers fluctuation. These changes have increased fuel consumption, higher turnover in extra services (shop, restaurant, car wash), and better customer satisfaction.

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CASE STUDY

INDUSTRIAL SHIELDS

HOW TO GET THE MOST OUT OF SOLAR PANELS?

Solar panels are a key element in obtaining sustainable energy. It is also key to ensure optimum performance in this type of installation.

This can be done with a correct monitoring of the installation as a whole and of the different 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 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 **maintenance costs**.

CASE STUDY

GOAL

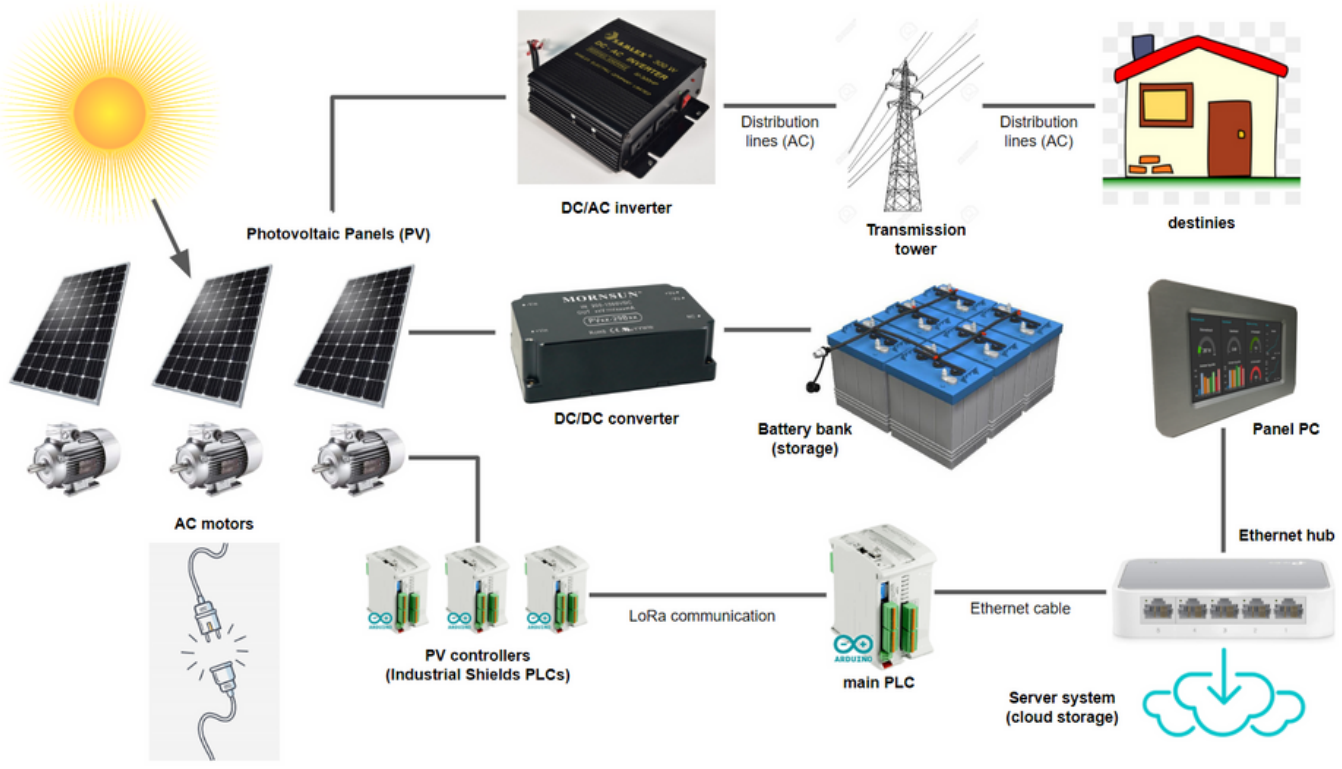
The objective is generate more energy by chasing the sun, which is a moving target.
Solar panels operated by automatic control systems can generate up to 30 % more energy than static panels.

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 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.



CASE STUDY

BENEFITS

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

This improved efficiency allows for a quicker offset of the increased investment and a faster payback later on.

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CASE STUDY

INDUSTRIAL SHIELDS

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 carried out in the different treatment stages, versatile controllers are needed that allow the necessary operations to be carried out 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 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.

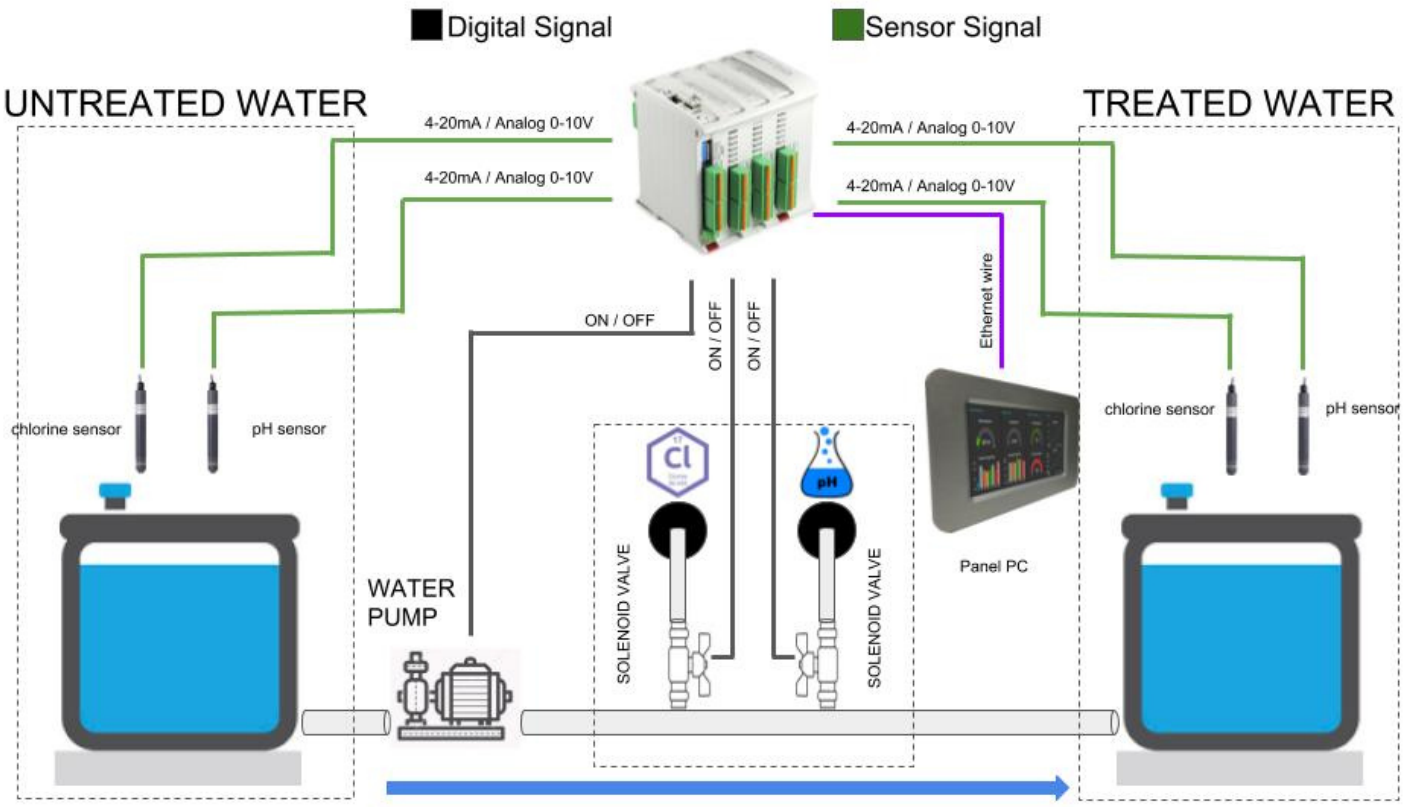
CASE STUDY

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.

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 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.



CASE STUDY

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.
It was already known at the start of the project that it would continue to grow for some time to come. 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.

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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