



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

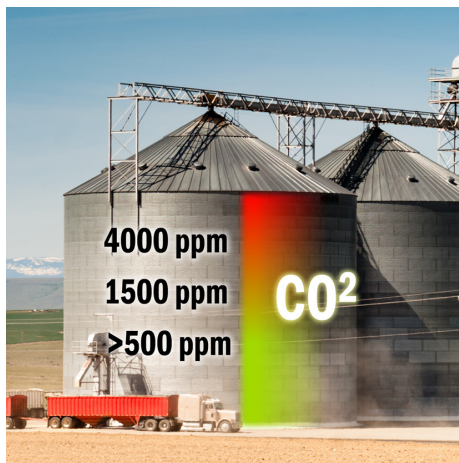
According to research from prestigious universities in areas where wheat cultivation is an essential part of the economy, **CO₂ control allows effective monitoring of grain quality** and other key indicators, to ensure that the product is in optimum condition and remains competitive in the market.

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.



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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.

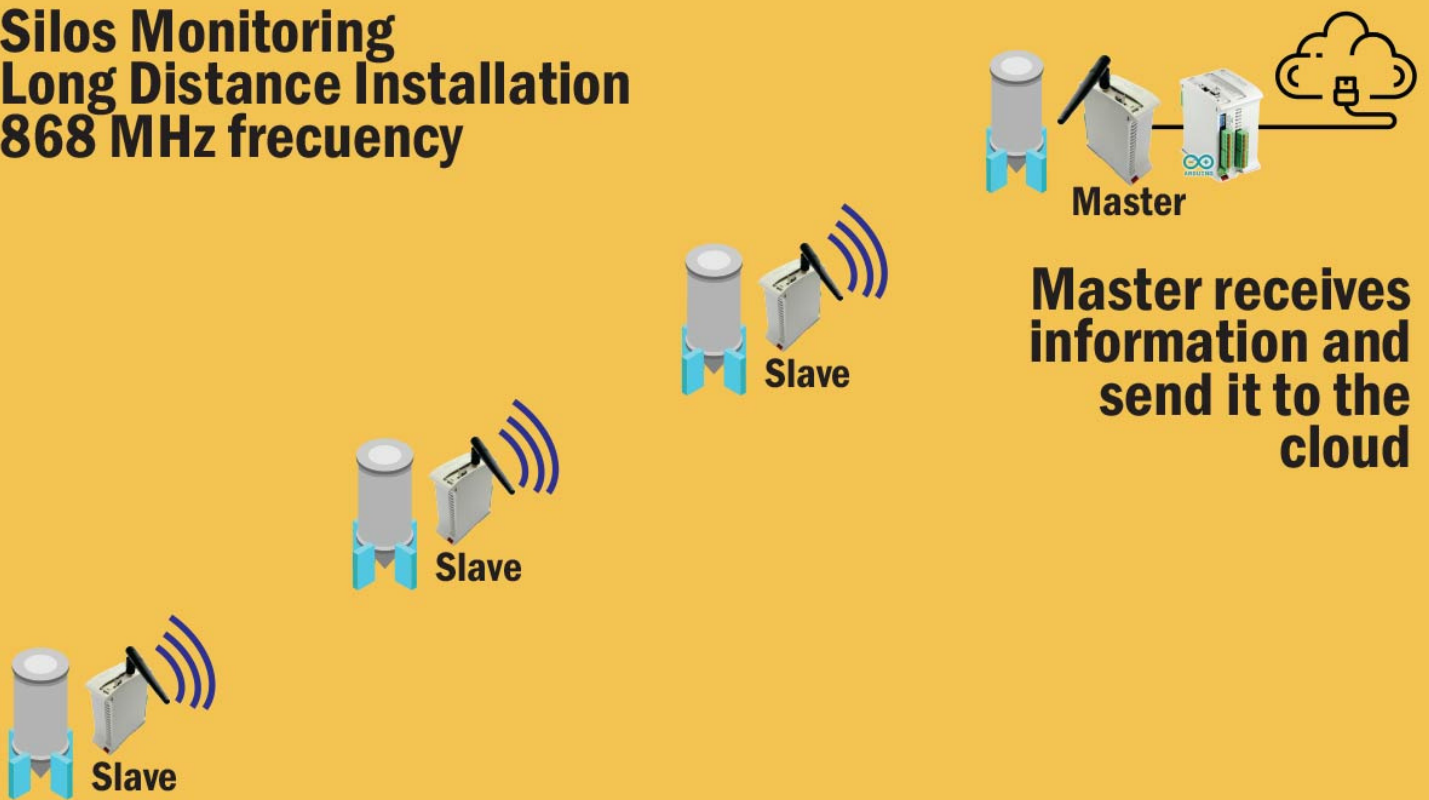
The different OpenMotes B installed in slave mode collect information every 30 minutes and send it to a master device, which in turn communicates with a PLC connected to the cloud. All the information can be viewed and processed remotely and in a very up-to-date way.

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.



Silos Monitoring Long Distance Installation 868 MHz frequency



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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.