Agro-SCADA: An SCADA system to support Sensor Monitoring in Agriculture

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Abstract

This paper describes an SCADA system (Supervisory Control And Data Acquisition), which was developed to support sensor monitoring in Agriculture applications. This system is based on electronic devices that use MODBUS and Zigbee protocols. Also, our system has a Server that contains the Pentaho suite, which allows to support all the steps required for Decision support. This work describes the technology platfform that we have built and some proofs that we have performed until now. The system that we build is an important platfform to develop other projects for DSS in Agriculture.

1 Introduction

In recent years, new technologies to build Sensor Networks have arised. One of them is the Zigbee technology, that is based on IEEE 802.15.4 protocol. Zigbee plays an important role today in the world of Wireless Sensor Networks (WSNs). Wireless Sensor Networks are composed by a great number of nodes that have wireless data communication modules and sensor modules. By means of this combination, variables as temperature, humidity, CO2 percentage, etc., can be measured and transmitted over the air until Data processing points, which could be Servers that show graphics, statistics, alarms, etc. On the other hand, other technologies that until now have been used in Industrial Data Networks, such as MODBUS networks, now can be used in Agriculture. This technology can be mixed with WSN based on Zigbee to bring support to Agriculture applications that need to obtain measures of variables which are important for several Crops, and thus, they bring information to DSS systems in Agriculture production.

The use of the tools named before for agriculture is in an early stage in the world and their use is not common yet among farmers. With the aim of reduce the digital divide that exists in Latin American agriculture fields, we have developed an infrastructure composed by Controllers and nodes based on communications technologies such as Zigbee, MODBUS and GPRS (the data service for Cellular mobile Networks). Employing such a sensor network, we can sense several variables in crops and then transmit their measures by means of wireless communication methods until a central point that has interconnection with internet, and thus, it is connected to a Data Processing server that is based on data processing technologies that allows to perform data mining and Big Data processing.

In our system [2], we used as software plattform a free version of Pentaho Suite [3], developed by Hitachi Corporation. In this early stage of the project, we can take the data and make graphics of variables versus time. Then, we use an analogy of the Supervisory, Control and Data Acquisition systems (SCADA) used in Industrial Data Networks to give a name for our system (we named Agro-SCADA), because our system is being used in Agriculture environments. In a second part of our project, we will use data mining to discover relationships and to make proyections for typical Colombian crops such as Tomatoes.

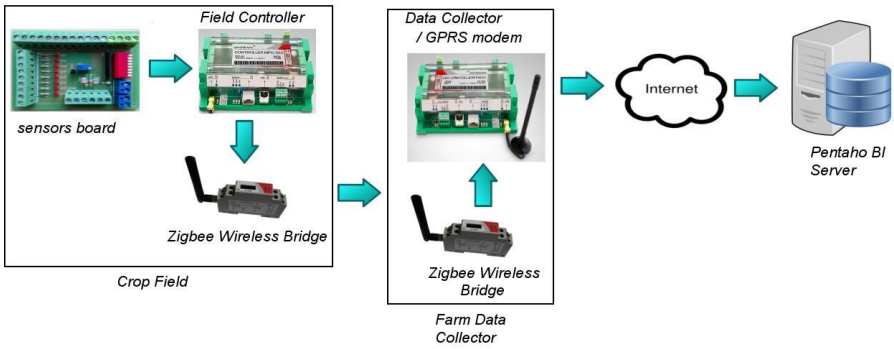

Figure 1: Agro-SCADA system infrastructure

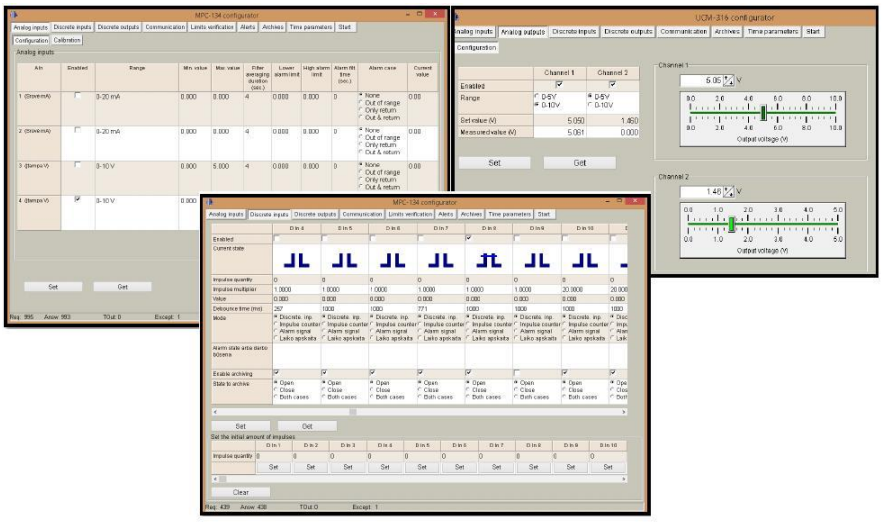

Figure 2: sensors configuration interface for MODBUS Controller

2 Developed infrastructure Description

Agro-SCADA system (Figure 1) is an infrastructure that take measures from crops and transmit those measures to a Data Server that shows graphics for several variables versus time. To do this, it is composed by MODBUS Controllers developed by advanticsys [1], which are allocated in crop fields and they take measures from sensors. At the same time, controllers are connected to Zigbee Wireless Bridges that transport data over the air until a central point, which is a data collector that send that information over a mobile data link (with GPRS technology) to a Pentaho BI Server allocated in any site in Internet.

3 Results

We have developed several tests and we have obtained good results. First, it is possible to configure all the sensors connected to de MODBUS controller in an easy way by means of a graphical interface as can be seen on Figure 2.

Also, we use wireless sensors that measure CO2, relative humidity and Temperature and send those data by means of Zigbee technology until the Farm Data Collector directly or by means of the Wireless Zigbee Bridge.

Besides, we built several topologies for our sensor networks. This is important because we can adapt our system to different situations in several crops. One key feature of our system is that it uses GPRS

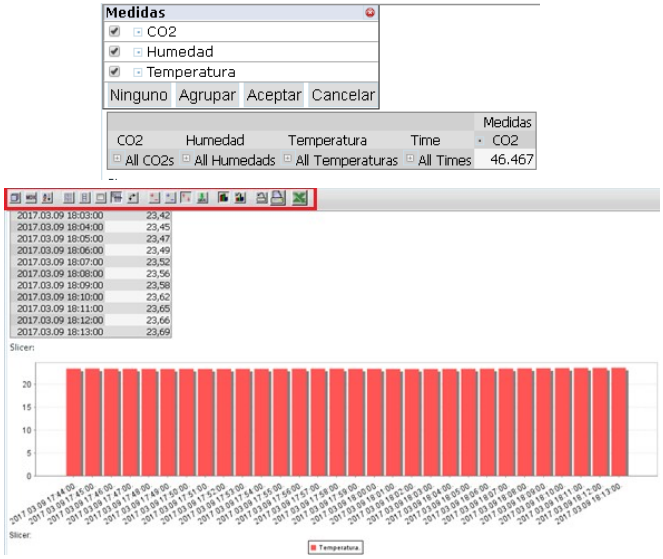

Figure 3: Pentaho BI Server graphical interface

technology to connect to Internet. With this issue, it is possible to connect our system to internet from any place that have cellular phone communications. Thus, it is no necessary to have fixed internet service, which could be a problem in certain zones in the country where cellular communications with GPRS technology are common.

Data are registered in Data Collector Node in hexa code. Such Data are transmitted to the server in a text file form, and then, that file can be showed in Pentaho BI Server as can be observed in Figure 3, where a graph for selected variable is displayed.

References

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[3] Hitachi Corp. http://www.pentaho.com/product/business-visualization-analytics. on line, 2016.