SCADA Monitoring on Radio Relayed Station at Hydro Melioration System Supported in IoT Network

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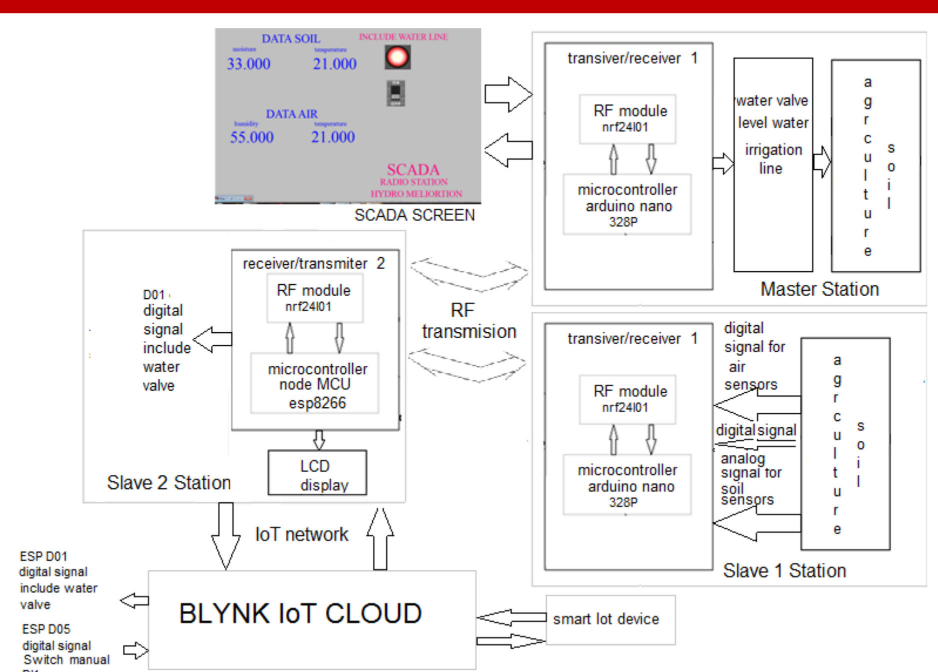
INTRODUCTION

In modern agricultural production, implementing a monitoring and quality control system is considered essential, as supported by various studies (Fountas, 2020), (Narendra, 2019), (Narendra, V.N, 2019), (S. Rotz, 2019) and (V. Saiz-Rubio, 2020). Such systems should provide timely management of the quantities needed to obtain a quality product. On the other hand, these systems should provide the opportunity to collect and process data on control values in the agricultural plant, (Bennett, 1982), (Hor, 2005). In real industrial agricultural processes, there are standalone plants that operate as independent self-contained units. Most often these plants are far from intra and internet network of the agricultural production companies. Therefore, there is a need to automate and connect these agricultural plants in the company intranet and more widely on the Internet (IoT) network.

In this paper an electronic system is designed that provides a solution to a problem in hydro melioration system. Specifically, it presents the development, design and practical implementation of a smart electric system that enables data exchange between the soil irrigation line (SLAVE 1), a MASTER station equipped with a SCADA interface, and SLAVE 2 station connected to an IoT network.

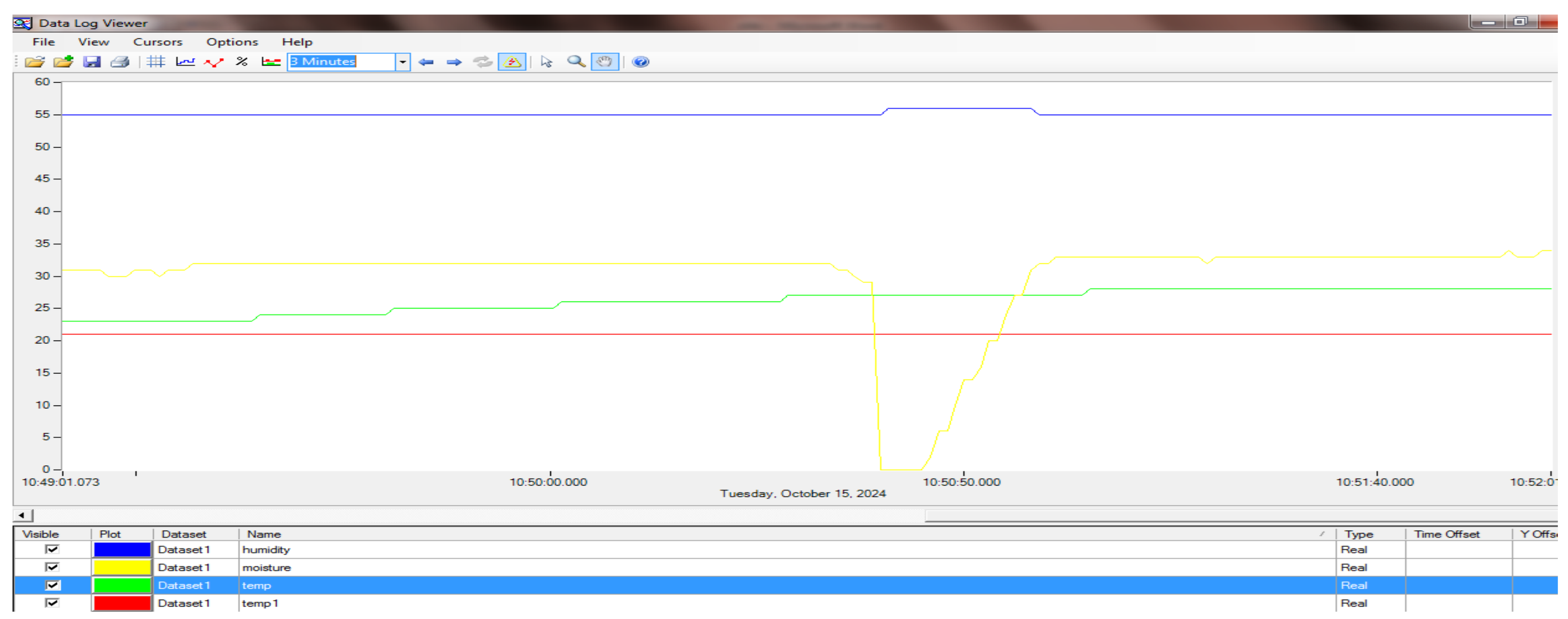
DESIGN OF SCADA MONITORING FOR RADIO-RELAYED STATION IN HYDRO MELIORATION SYSTEM



The block diagram illustrates the design and practical implementation of a smart electronic system that enables data exchange between SLAVE 1 station, MASTER station equiped with a SCADA interface and the SLAVE 2 stations. The SL 1 station is installed within the agriculture plant, where it collects real- time data from soil sensors and transmits it to the MASTER station via RF Network. The MASTER station is installed in one part on agriculture industrial plant and is equipped with a SCADA screen for real- time monitoring and control of the system. The SL 2 station is installed in another part on industrial plant and is connected via RF to the SL 1station and to IoT network via Wi-Fi.

EXPERIMENTAL RESULTS

The solution provides an opportunity to apply a smart electronic system in agriculture. In the paper, the main benefit is the radio transmission of moisture and temperature signals from the irrigation line to the MASTER station. This eliminates the need for a wired connection of the sensors to the MASTER station. The used RF modules have been tested and enable radio transmission of process data from 100 to 5000m SCADA monitoring of process data is built into the MASTER station with support for waveforms of real-time quantities as well as a data log file for them. A radio connection was established among three points: SLAVE 1, MASTER and SLAVE 2. In the SLAVE 2 station, an IoT microcontroller is built-in, and enables the transmission of measurement data in the Internet network. The SLAVE 2 station allows the measurement data to be stored in a data log file on a personal computer or on the Blynk IoT cloud.



The waveforms of the measured values in real time

The blue line in the waveforms shown in Figure 17 represents the humidity on air, the yellow line is the moisture on soil, the green is soil temperature while the red line is the temperature on air.

CONCLUSION

This paper presents the design and experimental deployed prototype on SCADA radio relay station for data transmission in agriculture plants. A solution was implemented that enables RF communication between the soil sensors located in the irrigation line and the control room. The tested nRF24L01 modules provide the possibility of remote wireless transmission of signals from 100m to 5km in open air. SL 1 station receives digital and analog signals from soil and air sensors and transmit them to MASTER and SL 2 stations. The SCADA system visualizes the data from SL 1 on the control room screen, while SL 2 displays the data on a local LCD and sends it IoT cloud. To ensure data integrity, three data log files have been generated, one stored in the MASTER station and two stored in the SLAVE 2 station.

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