STUDIES ON THE IMPLEMENTATION AND DEVELOPMENT OF AN AUTOMATED PROTOTYPE OF AN IRRIGATION SYSTEM

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ABSTRACT: The paper is based on the in-depth study of the automation methods of the classical drip irrigation system. As a way of working, we will use the LabView program with which we will be able to measure environmental factors such as temperature, soil moisture and light intensity. Depending on the values of these factors, different orders will go to a water pump, which will meet the need for soil moisture. This paper involves the need for tools such as sensors and water pumps. These will be connected to an Arduino Mega2560 board and then to the computer to run the project program. The recorded data will be displayed in a text file, where the date and time will also be specified.

KEY WORDS: sensors, LabView, automation.

1. Introduction

The automation of irrigation systems is achieved by equipping them with machines that partially or totally take over some activities performed by the operating personnel, such as the functions of measurement, memory, decision, command and control.

The irrigation system appeared as a need to save water and also for extreme situations such as drought. For the good development of crops from small to large, this system is ideal. Expert studies show that irrigation is mainly used in areas where long periods of drought are expected or irregular rainfall is known.

The objectives of the thesis are to offer new perspectives on the needs of farmers in terms of irrigation of cultivated areas. In order to give the users of this system a clearer overview of the main functionalities, an experimental stand was created consisting of: humidity, temperature and light intensity sensors, Arduino Mega2560 board, water pump, 12V power supply, driver, hoses, wires, Lenovo laptop, plastic box and 12 kg of earth.

2. The current stage

Irrigation systems are in a continuous process of performance evolution, with reflection on the quality of watering application, labor productivity and easier adaptation to natural conditions. All this is done in order to achieve a high degree of automation and, of course, increased agricultural production. Rehabilitation, automation or modernization of irrigation systems will bring major benefits to the agricultural sector.

Among the irrigation systems to be mentioned are those that have a high degree of use and are noted for their low and well-controlled water consumption even in the event of major climate change.

Irrigation systems are in full development, with a focus on renewable energy sources or even water recycling. For the purpose of understanding these types of systems, in Figure 1- block diagram of the pumping system, there is a diagram of an algorithm that uses solar energy as a power supply.

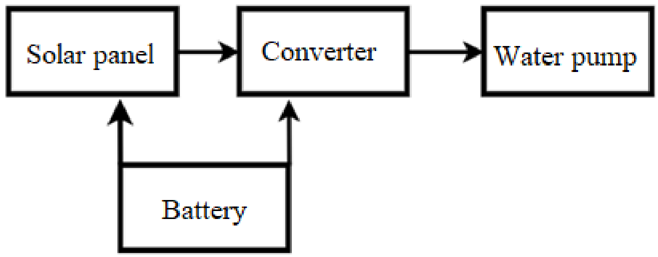


Fig. 1. Block diagram of the pumping system

3. Own contribution

For a better understanding of the operation of the experimental stand, the following mechanical diagram was made:

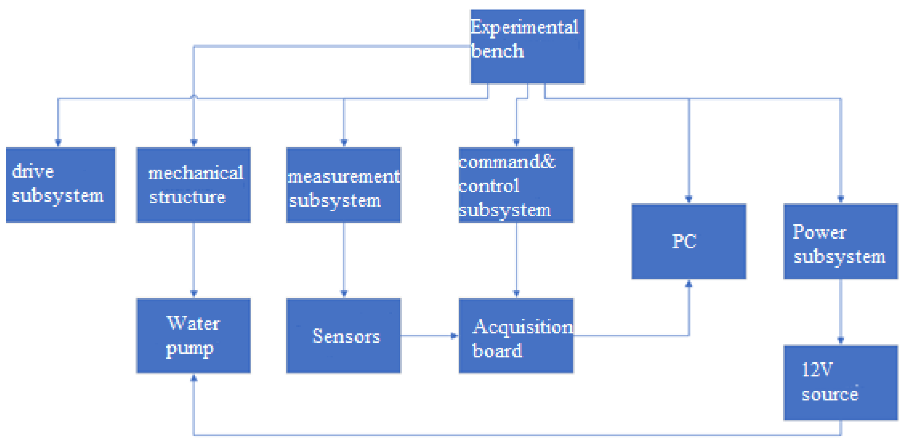


Fig.2. Mechanical scheme of the experimental stand.

The application was made using the LabView program. The values of the 3 factors of major interest were constantly monitored: soil moisture, outside temperature and light intensity. The operating conditions are:

1. If the temperature is below 25 degrees Celsius and the soil moisture is below 60%, then the system can start.
2. If the humidity is below 60%, but the temperature above 25 degrees Celsius the system will not start.
3. Another factor to consider is light intensity. If the temperature is higher than 25 degrees, but the light intensity is in the range of 20,000 - 30,000 Lushes, then the system can start.

Ascan be seen in figures 2 and 3 - The program of the experimental stand, the Ardunio board is connected to the laptop, then the board port is selected and the sensors are connected to the board.

The signal transmitted by them is read with the help of analog and digital read functions, creating constants for each occupied port. The pump is represented by a boolean indicating its position, in the case shown, whether wet or not. A local variable has been created for the boolean that represents the pump to be connected to the various conditions in the application. The program was created using a while loop because it records the values continuously.

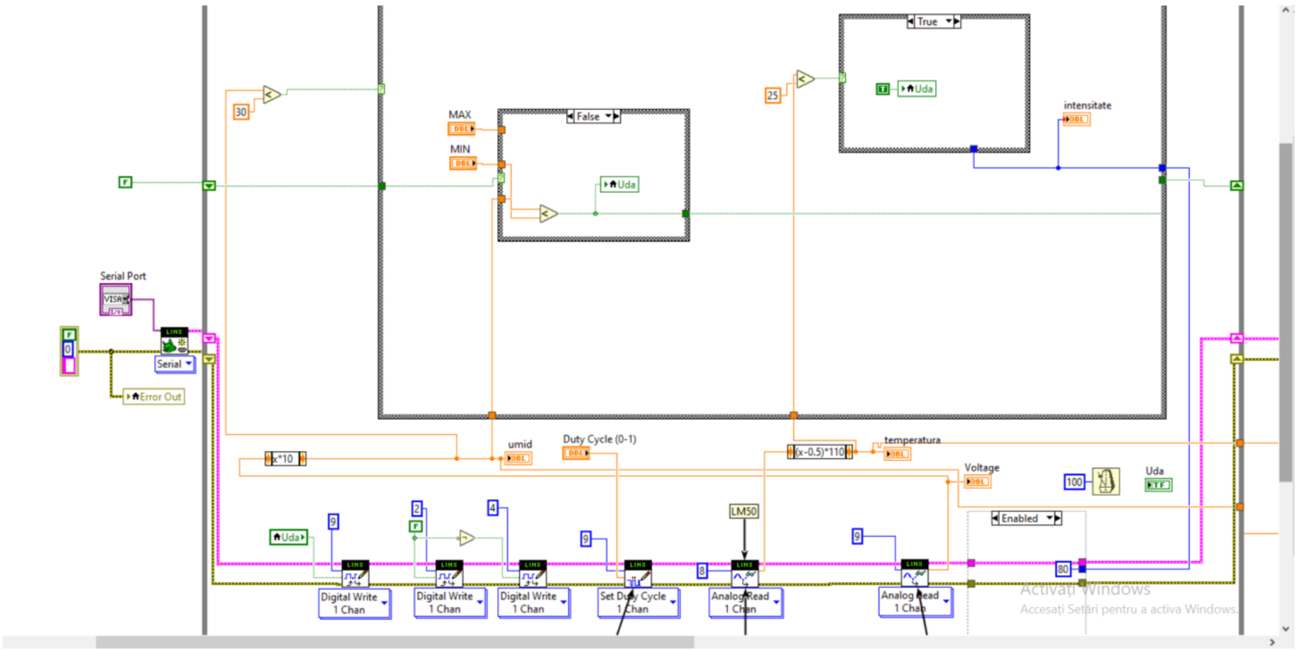


Fig.3.Program of the experimental stand

The program interface in Labview is shown in Figure 4 - The front panel of the program. There are two indicator type boxes that constantly show the values recorded by the sensors. The error box helps us to identify the errors that may occur, and the box entitled "Duty Cycle" helps us to control the speed of the water pump.

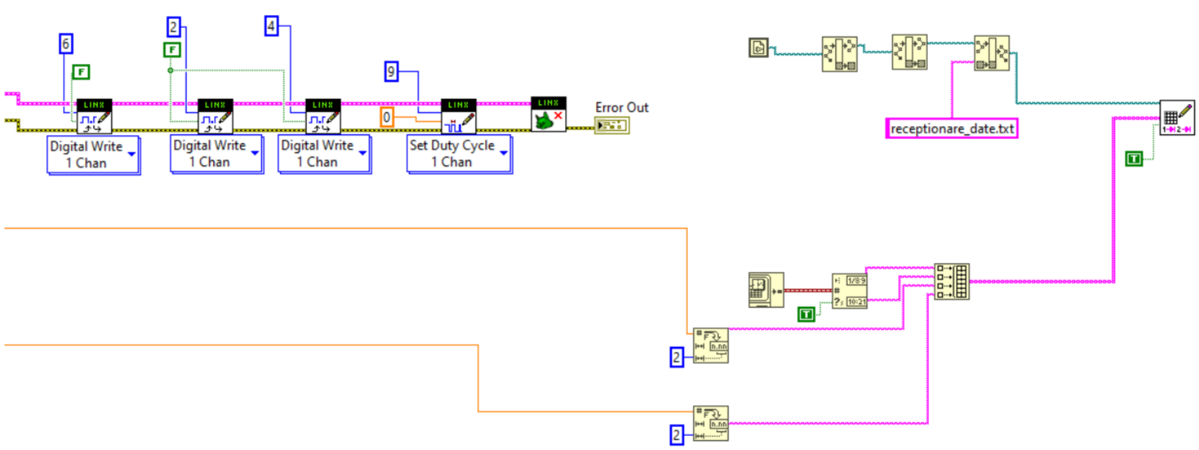


Fig.4.Program of the experimental stand

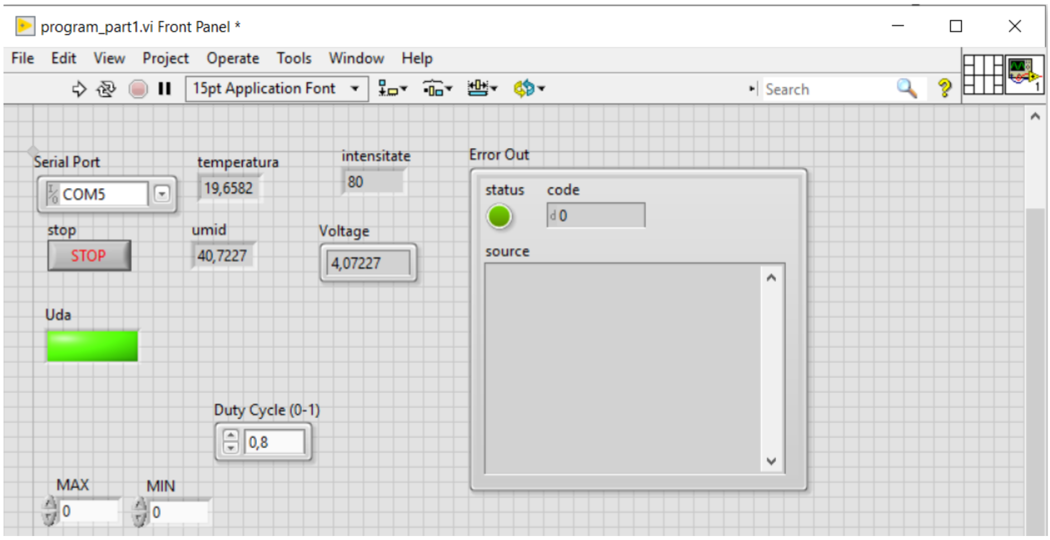
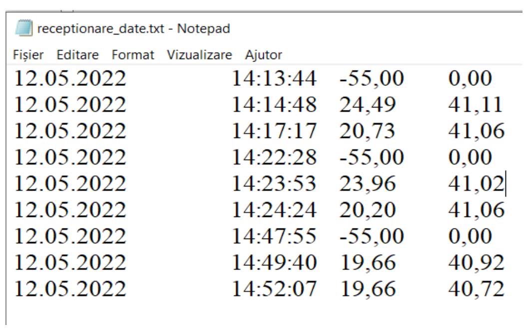


Fig.5. The front panel of the program

Figure 6, called the received data file, shows that the measured data is stored in a text file.



12.05.2022	14:13:44	-55,00	0,00
12.05.2022	14:14:48	24,49	41,11
12.05.2022	14:17:17	20,73	41,06
12.05.2022	14:22:28	-55,00	0,00
12.05.2022	14:23:53	23,96	41,02
12.05.2022	14:24:24	20,20	41,06
12.05.2022	14:47:55	-55,00	0,00
12.05.2022	14:49:40	19,66	40,92
12.05.2022	14:52:07	19,66	40,72

Fig.6.File with received data

Components of the experimental stand

- Arduino Mega 2560 board - this type of development board connects the sensors mentioned above, the stand's power supply and the water pump [1].
- LM50 temperature sensor - this sensor measures temperature, which is the main influencing factor in the watering process. It delivers 5V voltage and has 3 input / output pins. [2]
- Shield for VNH 5019 engine driver - helps to make the connections between the acquisition board and the rest of the components. It provides the necessary voltage and current for the water pump. [3]
- Light intensity sensor - with this we can start the system if the temperature can exceed 25 degrees Celsius, but the intensity does not exceed 30,000 Lukes. [4]
- Soil Moisture Sensor - This sensor tracks minimum and maximum soil moisture. [5]
- 12 V power supply. [6]

The elements listed above were assembled according to Figure 3 - The experimental stand of the irrigation system.

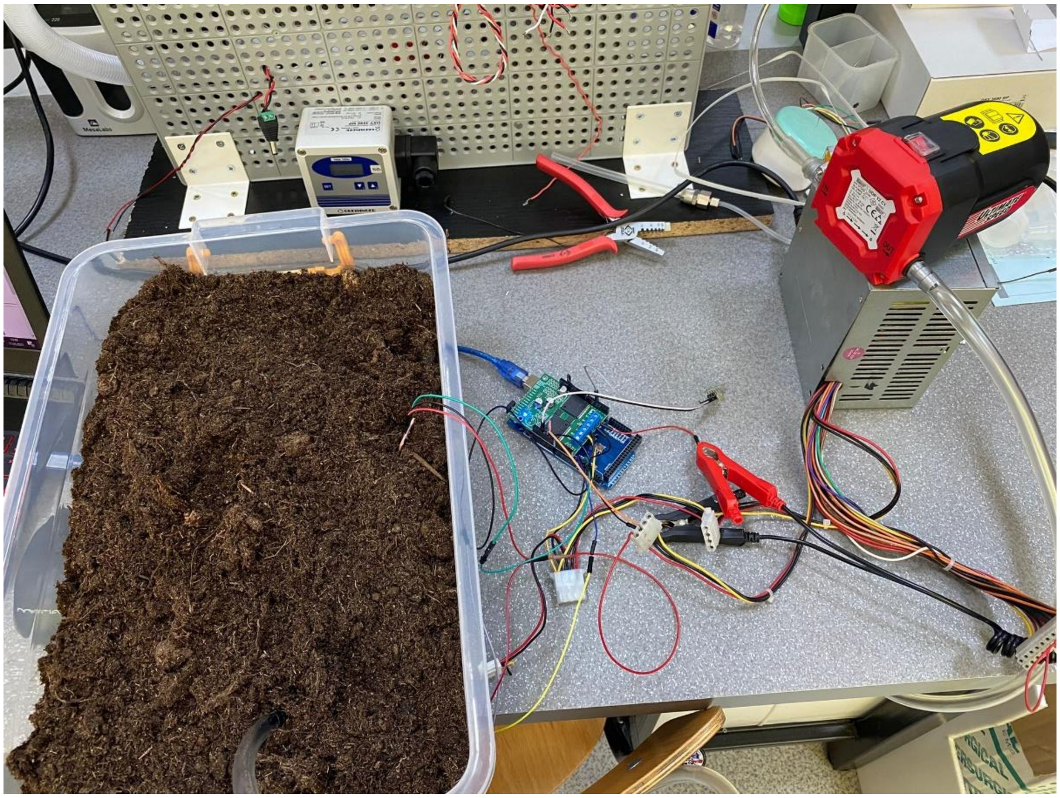


Fig.6. Experimental stand of the irrigation system

4. Conclusions and directions of development

This paper aims to increase the productivity of farmers and beyond. The implementation of such a system can allow the monitoring of the essential parameters in the development of crops. The system can be improved by adding hole hoses for efficient plant irrigation. A web service will be created that will contain two control buttons that will allow the system to switch from automatic mode to manual mode and pump control at any time.

5. Bibliography

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