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New Trends and Developments in Automation in Agriculture

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Abstract: In this paper we deal with the creation and design of fuzzy controller using Matlab. Control Systems allow deprive people of monotonous and tiring work, are able to guarantee throughout the operation stable and high activity, which is a strong improvement over uneven performance man in traditional systems. In the classical view of the control and automation is usually all depends on the dominant position of the controller in the control loop [3]. In this paper we describe the implementation of smart irrigation system, which works according to the data from the sensors to determine the moisture sensor and rain. The irrigation system allows the user to control irrigation in agriculture. The system is fully controlled online interface and requires an active Internet connection. In case of loss of internet connection, irrigation system works on the basis of previously saved settings.

Keywords: fuzzy controller; regulation; Android; irrigation system

I. INTRODUCTION

The scarcity of water resources, associated with the growing need for water, is one of the most critical problems of humanity. At the same time, irregular rainfall, coupled with the occurrence of high temperatures, are strong obstacles to the preservation and growth of plants, causing high rates of water deficiency [2]. Crop growth and development are important variables in analyzing the influence of climate and other factors on crop physiological processes. In addition, they are necessary variables for optimizing crop production [1].

Intelligent systems and their components (Control computer) has now become a kind of higher standards in the design and building realization of homes. We can meet them, for example in the form of intelligent ventilation, lighting, and irrigation.

Recently, several systems of soil monitoring and irrigation control have been developed with the aim of improving water use efficiency [2].

The speed of information processing of data collected in fields can be a deciding factor in the efficiency of an irrigation system, responding appropriately to crops' water requirements [4].

In managing irrigation often we use knowledge-based knowledge from the use of so-called PID controllers.

Its practical application in the agricultural demonstration fields shows that this system is suitable for large acreage fields with its stability in running, convenience in operation and low cost in use [5].

The irrigation system consists of several modules, which can be divided into three parts: the control part, the regulatory part and server part. The control portion comprises from Android application which forms the front end of the system and can be implemented on any mobile phone with Android OS 4.0.3 and above. The control section consists of hardware elements, wherein the core comprises a microcontroller Arduino Yun and provides switching solenoid valves according to the requirements coming from the control unit. The server part acts as a mediator between the control part and regulation part, thereby enabling communication in the network Internet without the need make use of a public IP address.

II. THE DESIGN OF CONTROL PART OF THE IRRIGATION SYSTEM

Module for regulation is responsible for the correct interpretation of the values contained in the database, processing and representation at the physical layer. It consists of control electronics and power of electrical parts. Hardware that was used for building control part comprises a logical drive Arduino Yun, module of real-time clock DS1302, two humidity sensors, relay module containing two relays for switching solenoid valves, solenoid valves with manual control and power supply ZSR-30th.

III. ARDUINO YUN

The core of module for regulation is microcontroller Arduino Yun, which is based on a chip ATmega32U4 and processor Atheros AR9331. Atheros supports Linux distribution that is based on OpenWrt with a name OpenWrt-Yun. The device has built-in support for Ethernet, WiFi, USB-A port, micro-SD slot, twenty digital input / output pins, 16MHz crystal oscillator, a micro USB connector and three buttons for reset. This device has proved to be a great choice because it combines several advantages. Chip ATmega32U4 provides option for read and write data to output ports in real time, their processing takes place therefore, very quickly and with minimal response.

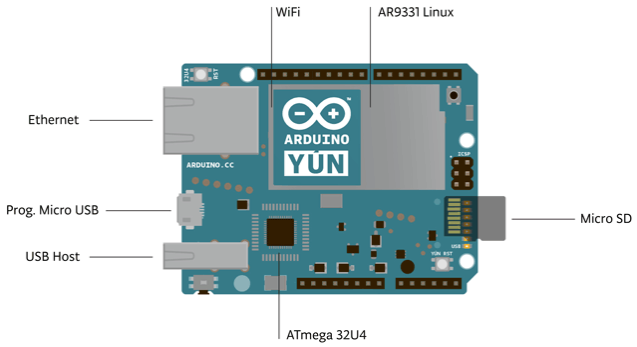

Fig. 1 Arduino YUN board

The Atheros chip enables the use these peripherals (WiFi, Ethernet, USB, micro-SD) and provides a suitable environment for solving complex tasks such as TCP communication with a remote server, database management, and essentially all Linux supported features. In Figure 2 we see a block diagram as these two chips communicate with each other. Communication is realized by the library, which is called Bridge library. Using this library can be directly from source Arduino call a shell script to communicate with network interfaces and receive information from the processor AR9331.

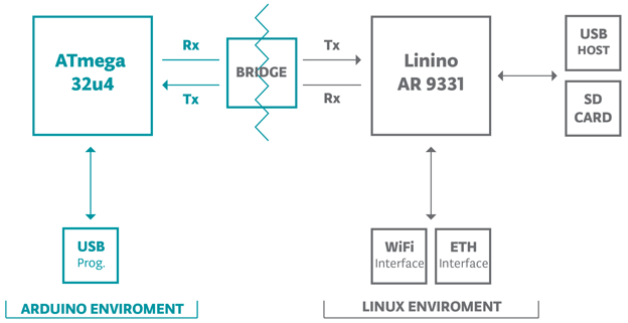

Fig. 2 Block diagram of a communication ATmega32U4 and Atheros AR9331

IV. MODULE OF REAL TIME CLOCK

As a module of real-time clock was used circuit DS1302-0902A4. The module is able to remember and offset time (leap years and under) with an accuracy of seconds until 2100. It is powered by a clock battery and can work with consumption of less than 1μW. Access requires a minimum of five drivers and two are for power. This module communicates with microcontroller using 3 SCLK signal cables, I / O, CE.

Fig. 3 Module of Real Time Clock DS1302

V. SOFTWARE FOR CONTROLLING IRRIGATION SYSTEM

During the development of the system we used several programs through which we can program, test and check the correctness of our code and functionality of the system (Atmel Studio 6 and the Arduino IDE, Putty, Eclipse + AndroidSDK, WinSCP, Notepad ++).

When designing the concept of communication we take into account the requirements that have been imposed on the system. One of the main requirements was to be able of the system to wirelessly control not only within the local network, but from virtually anywhere in the country where the phone serving as the control unit is an internet connection available. We have proposed two solutions of which would permit such communication.

The first option was to establish a connection Client-Server (Arduino-Mobile). In this a concept we must ensure that Arduino was available across the Internet, and thus this design of the concept would require a static IP for Arduino. Another option is to have a static public IP address of the router in the local network and ensure redirect requests to the server in Arduino.

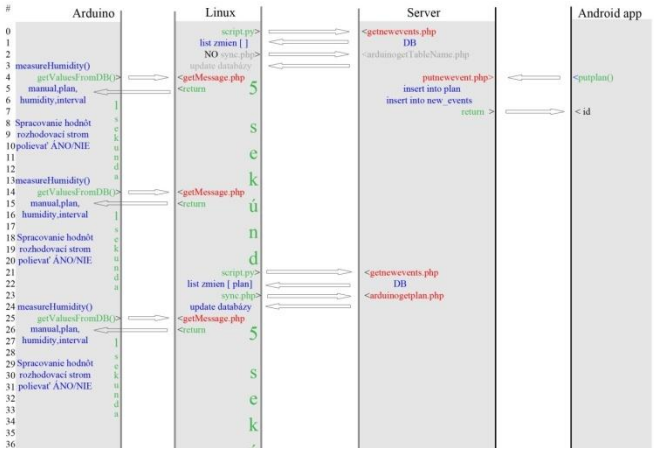

Fig. 4 Concept of the communication

In Figure 5, the real scheme of connection, by using we have created a irrigation system. The irrigation system consisting of the following blocks:

1. Arduino Yun
2. Module of Real Time Clock
3. The moisture sensor
4. Module of Relay
5. Solenoid Valves
6. Power supply ZSR - 30

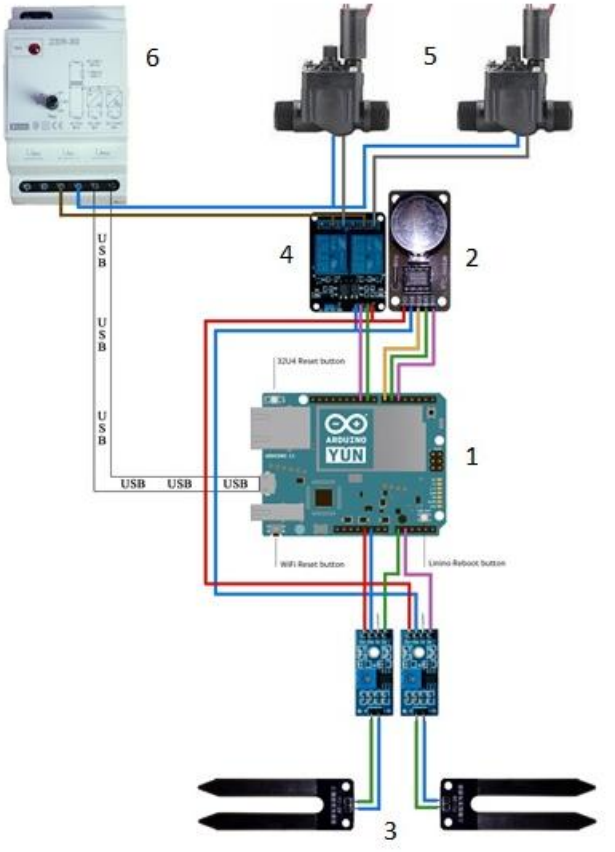

Fig. 5 The scheme of connection of wiring irrigation system

VI. Conclusion

Automatic irrigation system is indeed higher initial investment but has very quick returns in terms of saving time and money for water. Irrigation system irrigates well as during the absence and is switched off when the plants do not need water. Irrigation system irrigates evenly as needed. By using automatic irrigation system we can save half the water consumption than the manual watering. Approximate return on investment on irrigation system is about one year. By connection to another alternative source of water as is the return on investment even faster.

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