Automatic Field Irrigation System

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Abstract. In this project, we will learn about the IoT Based Smart Agriculture & Automatic Irrigation System with Nodemcu ESP8266. Agriculture plays a vital role in the development of agricultural countries. Some issues concerning agriculture have been always hindering the development of the country. Consequently, the only solution to this problem is smart agriculture by modernizing the current traditional methods of agriculture. Hence the method is making agriculture smart using automation and IoT technologies. The Internet of Things (IoT) enables various applications of crop growth monitoring and selection, automatic irrigation decision support, etc. We proposed the ESP8266 IoT Automatic irrigation system to modernize and improve the productivity of the crop. This project explains how to make IoT Smart Agriculture with Automatic Irrigation System using some simple sensors that are available in the market. Irrigation is the supply of controlled and adequate amounts of water to the soil to enable the proper growth of plants. Primitive irrigation practices have notable issues such as water wastage, underwatering of crops, high labor intensity, etc. Recent developments in technology have led to several methods of automating the irrigation process on farms to combat the aforementioned problems and improve crop yield. Most implementations of automated irrigation involve sensors, a processing device (e.g. a microcontroller), and actuators. The sensors collect data (e.g. soil moisture, humidity, temperature) from the farm, then the microcontroller processes the sensor data to determine the right time to supply water to the crops being planted.

Keywords: - IoT, Microcontroller, Smart Irrigation, Soil Sensing.

1. Introduction

Agriculture plays an important role in the development and economy of a country, especially for a country of scale such as India. Irrigation is defined as the application of controlled amounts of water to plants at necessary intervals, the amount of water provided to plants depends on the soil type and the plant's nature. [4][6] This process usually takes a lot of time and it is mostly if not always operated manually. If this process can be automated then the farmers can use that workforce and time to manage other important areas in the field, this way they get more productivity out of their day. By automating this process plants and crops alike are provided with just the right amount of water needed for their growth, which saves water and increases the efficiency of the farm. The need for automating the process of irrigation comes from the following causes:

- Motors/pumps being manually switched on/off, this can easily be automated and no labor will be used.
- It is time-saving and eliminates the human error factor from irrigation.
- Workforce allocated to irrigation can be used elsewhere and increase overall productivity.

- By monitoring soil moisture level, the crops can be watered as per their needs and not more or not less.

The irrigation system refers to how water is delivered to the soil i.e. the plant's root zone. There are two types of irrigation systems: surface irrigation (wild) and pressure irrigation. Drip irrigation and sprinkler irrigation systems are examples of pressure irrigation systems.

2. Methodology

This application precisely controls the water system for the agricultural field by using sensors and a microcontroller system. It is achieved by installing sensors in the field to monitor the temperature and soil moisture which transmits the data to the microcontroller for estimation of water demands of plant drivers, android application, and step-down transformer [1]. The methodology is clearly shown in figure 1.

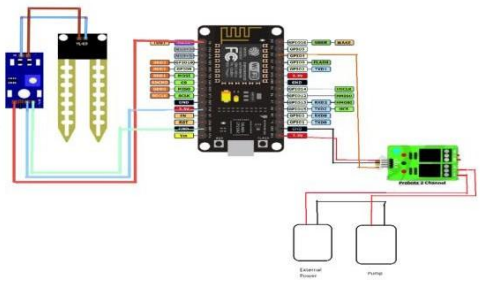

Figure 1: Circuit diagram of smart irrigation system.

The main component used in this automatic plant irrigation system is a 7404 Hex Inverter. The main function of the inverter output is proportional to the input. It means, if the input of the inverter is low, then the output of the inverter will be high, and the inverter will give low output if the input is high. The Hex inverter 7404 IC includes six independent inverters and the range of operating voltage is around 4.75V to 5.5V, and the Supply voltage is 5V [3][5]. They are used in many applications such as drivers, inverting buffers, etc. This IC is available in different packages like quad-flat package and dual-inline package

3. Block diagram

A block diagram is a drawing illustration of a system whose major parts or components are represented by blocks. These blocks are joined by lines to display the relationship between subsequent blocks. We use block diagrams to visualize the functional view of a system. It uses blocks connected with lines to represent components of a system. This venture centers around the robotization of machines with the assistance of an android application. [2]

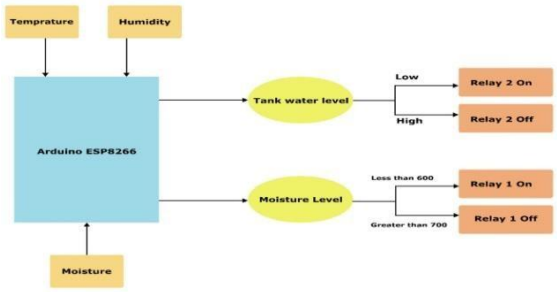

Figure 2: Block Diagram of Smart Irrigation System.

In this day and age, enhancement is the primary thought process. A block diagram is a drawing illustration of a system whose major parts or components are represented by blocks. These blocks are joined by lines to display the relationship between subsequent blocks. We use block diagrams to visualize the functional view of a system. It uses blocks connected with lines to represent components of a system. The architecture of this device is shown in figure 2. There are three main parts of this smart irrigation system which are given below.

- Arduino Node MCU
- Temperature Senor
- Moisture sensor
- Humidity sensor

4. Description of Hardware

4.1 Arduino Node MCUWIFI 4-channel relay module

NodeMCU is an open-source platform based on ESP8266 which can connect objects and let data transfer using the Wi-Fi protocol. In addition, by providing some of the most important features of microcontrollers such as GPIO, PWM, ADC, etc, it can solve many of the project's needs alone.

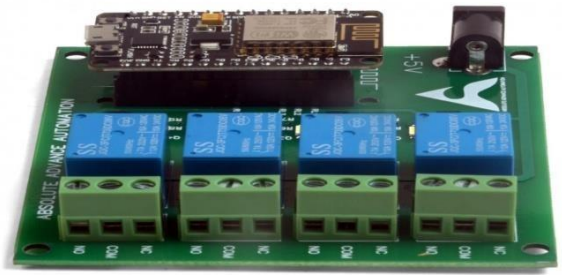

Figure 3: Arduino Node MCUWIFI 4-channel relay module.

The general features of this board are as follows:

- Easy to use
- Programmability with Arduino IDE or IUA languages
- Available as an access point or station
- practicable in Event-driven API applications
- Having an internal antenna
- Containing 13 GPIO pins, 10 PWM channels, I2C, SPI, ADC, UART, and 1-Wire Arduino node MCU also simplifies the process of working with microcontrollers, but it offers some advantages for teachers, students, and interested amateurs over other systems. Open source and extensible hardware - The plans of the Arduino node MCU boards are published under a Creative Commons license, so experienced circuit designers can make their version of the module, extending it and improving it. Even relatively inexperienced users can build the breadboard version of the module to understand how it works and save money. Figure 3 explains the concept.

4.2 Moisture Sensor

They measure the amount of water in the soil by following the capacitance to measure the volumetric content of water. It also helps users to understand climatic conditions as they change. Also, the moisture sensors help to protect vital water resources. It is shown in figure 4.

Figure 4: Moisture Sensor

The soil moisture sensor is one kind of sensor used to gauge the volumetric content of water within the soil. The straight gravimetric dimension of soil moisture needs eliminating, drying, as well as sample weighting. These sensors measure the volumetric water content not directly with the help of some other rules of soil like dielectric constant, electrical resistance, otherwise interaction with neutrons, and replacement of the moisture content.

4.3 Soil Moisture Sensor Pin Configuration:

The FC-28 soil moisture sensor includes 4-pins

- VCC pin is used for power
- A0 pin is an analog output

- D0 pin is a digital output
- GND pin is a Ground

4.4 Humidity sensor and Temperature sensor

The humidity sensor is what measures relative humidity. It is also called a hygrometer— this is a device to determine moisture-to-air percentage in a specific area. In short, the percentage of water vapor present in the environment around the device. It has two or several electrical conductors which catch the relative humidity. Then it converts the electronic reading to a digital output for the user to understand easily. Next, the advantage of a dehumidifier comes in controlling the humidity. There are different types of humidity sensors but their working mechanism is more it less identical.

1. Capacitive humidity sensors
2. Resistive humidity sensors
3. Thermal Conductivity humidity sensors.

Once your sensor detects the humidity level, the user can use a dehumidifier to control the moisture to keep your work going safely.

Parameters of Judgement: Once users got one, they must keep an eye on the performance.

- **Accuracy:** The sensor itself has a standard curve. It will pitch the pros against the cons in the chart.
- **Linearity:** It will read out the distinguished value from the BFSL and the measured one and give relative humidity.
- **Reliability:** The sensor must provide reliable measurements.
- **Response time:** Usually, the rise time is 66% and the fall time is 33% of the maximum voltage output, which is known as response time.

4.5 Temperature Sensor

Temperature sensors are simple instrument that measures the degree of hotness or coolness and converts it into a readable unit. Well, this is accomplished through some of the specialized temperature sensors. It is shown in figure 5.

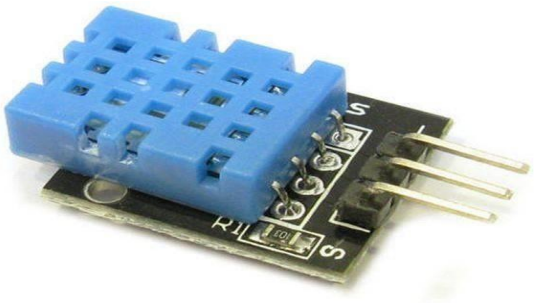

Figure 5: Temperature Sensor

Temperature sensors are designed to keep a regular check on concrete structures, bridges, railway tracks, soil, etc. A temperature sensor is a device, typically, a thermocouple or resistance temperature detector, that provides temperature measurement in a readable form through an electrical signal. A thermometer is the most basic form of a temperature meter that is used to measure the degree of hotness and coolness. Temperature meters are used in the geotechnical field to monitor concrete, structures, soil, water, bridges, etc. for structural changes in them due to seasonal variations.

Advantage

- Better crop management
- Optimum growth rate for crop
- Monitor product growth in real-time
- Reduced overall water consumption
- Prevent diseases

5. Result

According to the proposed plan, the outcome of this paper leads to the development of a smart irrigation system. Moreover, this system proves to be cost-effective and proficient in conserving water and reduces its wastage. The attached sensors will find the various situations of the soil and based on soil moisture percent, the land gets automatically irrigated. It means when a field needs water then automatically the motor will get ON and it will get OFF when it gets enough. It is shown in figure 6,7,8 and 9.

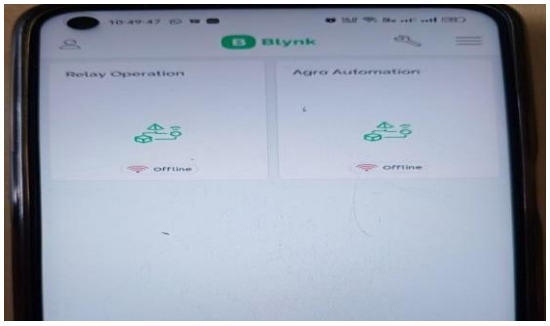

Figure 6: Initial state

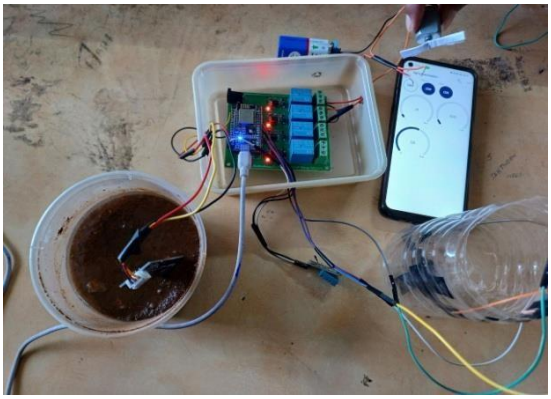

Figure 7: Before connection

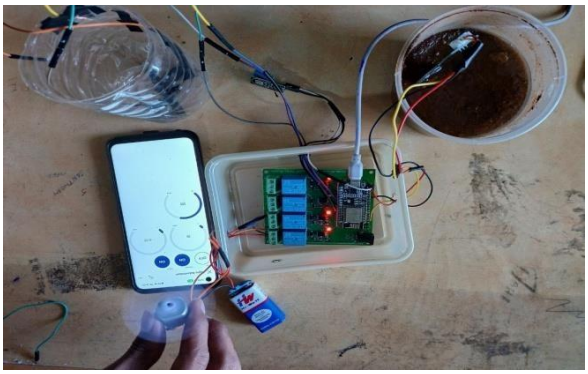

Figure 8: After connection done

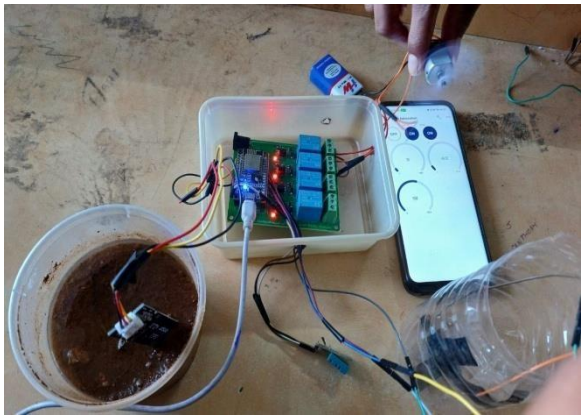

Figure 9: Final Output

6. Conclusion

The design of pressurized irrigation systems with high initial investment costs is also a very complex and time-consuming process. It was determined that computer-aided software models should be used to minimize the errors that may occur during the design and operation of these systems.

It was concluded that automation-based and remote control of irrigation systems was able to prevent human errors and save labor/time. Studies have also proven that automation-based irrigation systems increase product yield and quality.

References

1. Mayuresh Pande1 , Ankit Atal2 , Naval Jakkan3 , Pravin Veer4 , Mrs. Vidya Dhamdhere5 1, 2, 3, 4Student, 5Asst. Prof of Department Computer Engineering, G H Raisoni College Of Engineering & Management, Wagholi, Pune, India, ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429 Volume 8 Issue VI June 2020.
2. Md. Sajid Abbas, Md. AswerMohiddin, N. Y. S. Pavan Teja, Ch. Nanda Kumar Department of Electrical and Electronics Engineering, Pragati Engineering College, Surampalem, Andhra Pradesh, India, International Journal of Trend in Scientific Research and Development (IJTSRD) Volume: 3 | Issue: 3 | Mar-Apr 2019 Available Online: www.ijtsrd.com e-ISSN: 2456 - 6470
3. Akash Kaluse, Arvind Kadam, Vishal Patil, Sharad Dhage STES Sinhgad Institute of Technology and Science, Narhe, Pune-411041 Department of Computer Engineering, International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056 Volume: 03 Issue: 11 | Nov -2016.
4. Manish Vasant Gurao, “Changing computer use in agriculture: evidence from Ohio”, Computers and Electronics in Agriculture, Elsevier science publishers, vol. 47, 1–13, 2005.
5. Aadithyan V, T Sai Samrat Goud, G Karthik Reddy, P Naga Chaitanya, V Jaya Surya, Dr. K Prabhakara Rao Department of ECE, B V Raju Institute of Technology, NARSAPUR, Medak District, IOSR Journal of Electronics and Communication Engineering (IOSR-JECE) e-ISSN: 2278-2834,p- ISSN: 2278-8735.Volume 14, Issue 5, Ser. I (Sep.-Oct. 2019), PP 01-04.
6. UroromuIghrakpata, Mohamed Chouikha, O’tega A. Ejofodomi and Godswill OfualagbaRacett Nigeria Ltd., Zone 8, FCT, Abuja, Nigeria, International Journal Water Resources Management and Irrigation Engineering Research Vol 2, No.1, pp.11-27, September 2019.