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Irrigation Monitoring System using Node MCU and Blynk app

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ABSTRACT: This paper aims at achieving automation of plant monitoring and irrigation system, using Node MCU and Blynk application. Sensors are used for monitoring the environmental conditions surrounding the crop and outputs are obtained on an Android based mobile application. The updates of the atmospheric conditions such as temperature, humidity and soil moisture can be fetched from anywhere in the world and it is shared it on the cloud platform. A record of this data can be maintained and it is used for future reference, i.e., in the next cropping season. This will enhance the planning and development of crop production.

KEYWORDS: NodeMCU, Soil Moisture Sensor, Mini-DC Pump, BLYNK Application, Relay Module

I. INTRODUCTION

In India, 50% of the population doing agriculture and related activities in one or the other way to support their lives. Agriculture plays an important role by contributing 16% to the country's total GDP. A lot of water is required for the agriculture sector. The plants require water regularly based on the weather conditions. If the water supply is not sufficient, it may lead to the crop yield, loss yielding, etc. There are some good farming methods can help farmers to have a good yielding. More methods of irrigation have been done and adapted for the minimal usage of water. It is designed to permit the desired plant growth in offset drought in semiarid regions or subhumid regions. Even in areas where average seasonal precipitation may seem ample, rains are frequently unevenly distributed, or soils have low water holding capacities so that traditional rainfed agriculture is a high-risk enterprise. Irrigation provides a means for stable food production. In some areas, irrigation prolongs the effective growing season. With the security provided by irrigation, additional inputs like higher producing varieties, additional fertilizer, better pest control, and improved tillage, become economically feasible. Irrigation reduces the risk of these expensive inputs being wasted by drought. By the advancement of technology, few sensors are used to implement irrigation. The method of controlling water supply can greatly increase the productivity of crops by reducing its wastage. The main objective of this project is to study and develop a worldwide database of atmospheric pattern prevailing in a particular region [2], year after year and to maintain an Automatic system of crop monitoring and watering. This database will prove to be very useful for making future predictions of crop requirements following the beatentrack.

The main objective of proposed paper is to use the NodeMCU & Blynk app to achieve the following goal.

- To reduce & control the wastage of irrigation water.
- To provide the water for crops at night time.
- To implement the modern irrigation system.
- To improve the yielding of crops.

II.RELATED WORK

Agriculture is the backbone of Indian economy. Research and surveys have been done to enhance the technology to make agriculture easy and to increase the productivity of the soil. S.R.N.Reddy and D.Bansal presented a paper, which dealt about the irrigation time depending on the temperature and humidity reading. The benefit achieved is automatically irrigate the field when unattended. However, this technique is not suitable for India, as installing and using GPS in rural areas is difficult due to poor connectivity. S.G.Zareen, K.S.Zarrin, A.R.Ali and S.D.Pingle presented a paper in the topic of Intelligent Automatic Plant Irrigation System. This paper analyzes about the modeling and working of automatic irrigation system. R.Vagulabranan, M.Karthikeyan and V.Sasikala presented a paper on the topic of Automatic Irrigation System on Sensing Soil Moisture content. The drawback of it being that it was restricted in terms of its resource sharing as the information could not be accessed globally. M. Ramu and C.H.Rajendra presented their work on intelligent irrigation system using microcontroller 8051. This paper is focused on atomizing the irrigation system for social welfare of Indian agriculture system and also perfect irrigation in particular area.

III.SYSTEM ARCHITECTURE

The Fig. 1 shown below depicts the system architecture of the proposed project.



Fig. 1: Prototype of Plant Watering and Monitoring System

Using the system shown above we are able to achieve an automatic control of the DC pump supply water to the plant. Also, soil sensor, I2C module, LCD display, Relay Module are connected to the Nodemcu which serves as the central unit for the entire system. The mini DC pump receives power supply from 12VDC adapter and the relays are given a power supply of 5V..

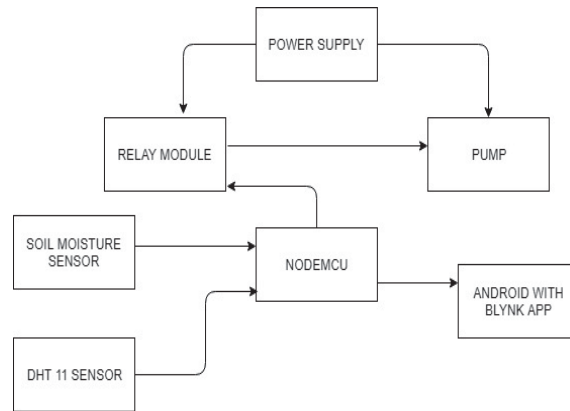


Fig. 2: Technical Block Diagram

1. NodeMCU

The NodeMCU abbreviated as Node Microcontroller Unit built around on a chip known as ESP8266. Its cost is very low. It has Wifi capabilities, with the help of Wifi we can control it wirelessly and make it work on a remote installation. It has four power pins. They are Vin pin and three 3.3V pins. Vin pin used to supply the power to NodeMCU and three 3.3V pins are used to supply power to external components. GND is the ground pin of NodeMCU. I2C pins connect I2C sensors and peripherals. NodeMCU contains two UART interfaces, UART0 and UART1 (Transmit only data signal). NodeMCU features two SPI's pins in slave and master modes. SDIO pins features Secure Digital Input/Output Interface used to directly interface SD cards. It also includes pins like Chip Enable Pin (EN), Reset pin (RST) and WAKE pin. EN pin used to enable the chip. RST pin used to reset the chip. WAKE pin used to wake up the chip.

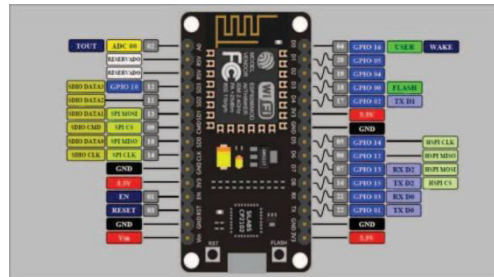


Fig. 3: Node MCU

2. Relay

Relay module is an electrically operated switch that can be turned on/off deciding let current flow through it or not. The I/P voltage of the relay signal ranges from 0 to 5V. It control both AC and DC appliances and also used in Solenoids, Motors, lights, fans, Industrial R&D project etc. The screw terminals in relay are of high quality and for quick and easy connection. The three screw terminals are NO-normally open, NC & Normally closed, COM-common. The RED LED in relay is for power indication. The GREEN LED IS FOR ON/OFF status indicator. It also has mounting holes. It also has diode protection to protect our microcontroller. This relay can be interfaced with Arduino, Raspberry Pi, AVR, PIC 8051 etc... The Pin configuration of an relay are Pin1 (End 1)- It is used to actuate the relay; this pin is connected to 5volts. Pin2 (End 2)- This pin is also used to activate the relay. Pin3 (common (COM)); this pin is connected to the main terminal of the load make it active. Pin4 (Normally closed (NC)); the second terminal of the load is connected to either NC/NO pins. Pin6 (Normally open (NO)); if the second terminal of the load is allied to the NO pin. The O/P terminal of the relay module is located at left hand side used to fix AC/DC load & AC/DC I/P power source. It has a switching transistor. Switching transistor in this module is to strengthen the current to the requirement of the minimum current level of the relay coil. In this project irrigation monitoring system using NodeMCU and Blynk, the input terminal of the relay module is connected to D4 pin of NodeMCU. The Ground terminal of the relay to negative of the bread

board.Vcc terminal of the relay to positive of the bread board.when we switch on, this relay will current to flow through the components connected to it.

3. LM393 Comparator

The sensor also contains an electronic module that connects the probe to the Arduino. The module produces an output voltage according to the resistance of the probe and is made available at an Analog Output (AO) pin.The signal is fed to a LM393 High Precision Comparator to digitize it and it is available at an Digital Output (DO) pin.The module has a built-in potentiometer and it is used for sensitivity adjustment of the digital output (DO).Set a threshold value by using a potentiometer.So that when the moisture level exceeds the threshold value,the output of the module will be LOW otherwise HIGH.when certain threshold is reached,it will help us to trigger an action. For example, when the moisture level in the soil crosses a threshold, you can activate a relay to start pumping water. Apart from this, the module having two LEDs.When the module is powered,the Power LED will light up. when the digital output goes LOW,the Status LED will light up.As you know that the module provides both analog and digital output, so for our first experiment we will measure the soil moisture by reading the analog output.



Fig. 4: LM393 Comparator

4. Soil Moisture Sensor

The soil moisture sensor plays a vital role in the irrigation field. Nutrients in the soil provides food to the plants for their growth. In order to change the temperature of the plants Supply water to the plants is essential. The temperature of the plant can be changed by using the method like transpiration. Extreme soil moisture levels can guide to anaerobic situations that can encourage the plant's growth as well as soil pathogens. This article discusses an overview of the soil moisture sensor, working and it's applications..The relation among the calculated property as well as moisture of soil should be adjusted & may change based on ecological factors like temperature, type of soil, otherwise electric conductivity. The microwave is emitted which can be influenced by the moisture of soil .These sensors normally used to check volumetric water content of the soil.Another group of sensors calculates a new property of moisture within soil named as water potential. Generally, these sensors are commonly known as as soil water potential sensors .The relationship existing between the measured parameter and moisture of the soil must be estimated by using the topp equation and may differ.This sensor mainly utilizes capacitance to gauge the water content of the soil. The working of this sensor can be done by dipping this sensor into the earth and the status of the water content in the soil can be reported in the form of a percent in the blynk app as well as LED.

Pins of Moisture Sensor

- VCC pin is used for power
- A0 pin is an analog output
- D0 pin is a digital output
- GND pin is a Ground

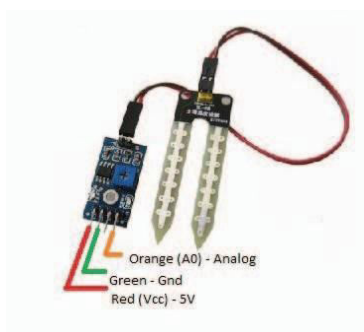


Fig. 5: Soil moisture sensor

5. Mini-DC Pump

A pump is a device which is used for mechanical action to transfer fluid (liquids). The mechanism used in a pump is mainly reciprocating or rotary device, in order to do the mechanical work and they also consume some energy. Pumps are available in varying sizes ranging from smaller pumps used for medical purposes to larger ones used in industries. Fig. 6 depicts the Mini-DC Pump which has been used. Here we have used a mini dc pump which runs on 12 volt dc supply. Pumps can be operated manually or by using electricity. Some pumps are operated by using engines and power generated from the wind.



Fig. 6: Mini-DC pump

6. I2C 16x2 LCD

The I2C 16x2 LCD Screen is using an I2C communication interface. It is able to display 16x2 characters on 2 lines, white characters on blue background. This display overcomes the drawback of LCD 1602 Parallel LCD Display in which you'll waste about 8 Pins on your MCU board for the display to get working. In this product, an I2C adapter is directly soldered right onto the pins of the display. I2C has good library in Arduino IDE for easy coding.

PIN DETAILS:-

1. VCC,
2. GND,
3. SDA,
4. SCL.

The I2C is a type of serial bus developed by Philips. I2C uses two bidirectional lines called SDA (Serial Data Line) and SCL (Serial Clock Line). SDA and SCL must be connected by pulled-up resistors. The standard voltage is 5V. I2C 16x2 LCD



Fig.7:I2C 16x2 LCD

a) Arduino IDE Software

It is an open-source Arduino Software (IDE) that makes it easy to write code and upload it to the board. It connects to the Arduino hardware to upload programs through a port. The language used to program the Arduino is C++. As the Arduino IDE is compatible with a number of different circuit boards, here we have integrated the IDE with NodeMCU board.

b) BLYNK Application

Blynk application is a new platform that allows you to build interfaces for controlling and monitoring your hardware projects from your iOS and Android device. Blynk supports most Arduino boards, Raspberry Pi models, the ESP8266, Particle Core, and a handful of other common microcontrollers and single-board computers, and more are being added over time. The main advantage of Blynk is that it is not hardware dependent and can be linked using internet over Wi-Fi or Ethernet.

IV. METHODOLOGY

Automatic Control: In order to achieve Automatic Control, a relay module is interfaced to Node MCU board at the receiver end while on the transmitter end, a set point on the soil moisture sensor is considered. If the moisture of the soil falls below the set-point, the relay switches on and allows the mini-dc pump to conduct and supply water to the crop fields. Once the required moisture level is reached, the soil moisture sensor sends the signal to the relay module via Node MCU. The relay switches off and thus switching off the mini-dc pump. Also, the humidity of the atmosphere is measured using the DHT-11 sensor. Outputs are displayed on the BLYNK app.

Fig. 8 shows the flow chart depicting the methodology. It shows how the control shifts from the soil moisture sensor to the pump depending upon whether the soil moisture is the same as required by the crop.



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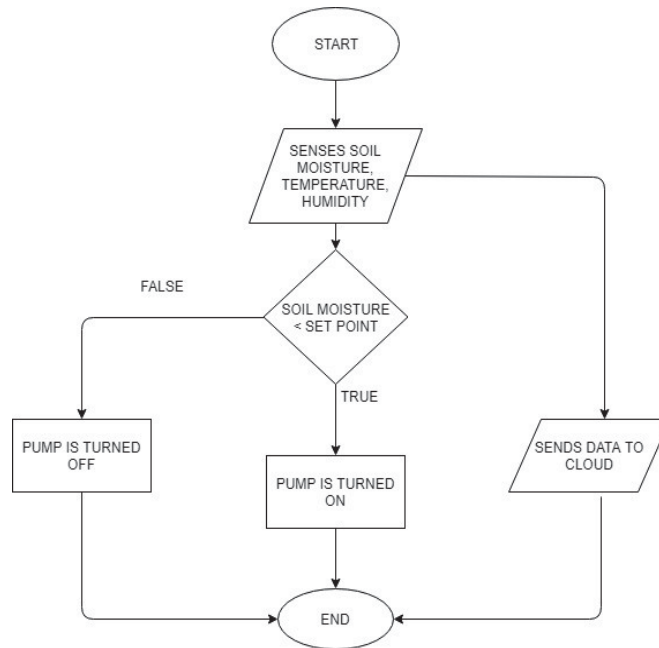


Fig.8: Flow chart of the Process

V.EXPERIMENTAL RESULTS

Experimental Results have been obtained after the successful implementation of the circuitry. Fig. 8 shows the output sensed by the sensors on the Blynk application installed on the Smartphone of the user. It monitors the moisture content of the soil. The screenshots of the Blynk app has been shown in order to validate the results obtained.



Fig.9: Output on Blynk app in gauge format

VI.CONCLUSION

Thus, the purpose of “ Automatic Plant Watering and Monitoring System” is rightly served by providing ease to farmers. It will also be helpful in saving wastage of water as it uses automatic drip irrigation method. Therefore, rigorous labor required for watering the fields can be reduced to a great extent giving some relief to the farmers.



We have tested the system and carefully and closely observed the results achieved thereafter. All the hardware components have been integrated to develop the system. The working of each and every module has been reasoned out with utter carefulness and they have been placed in such a way that they contribute towards getting the best results from the system.

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