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SMART WATER CONTROLLER FOR IRRIGATION USING IOT

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Abstract : One of the essential and basic services to survive on earth is Water. Recent time increasing the scarcity of water due to growing in population. So, this is becoming as a universal obstacle. The old irrigation system which demands a lot of water, so it needs smart techniques for reducing the percentage of wasting available water for the irrigation. We have been seeing the increasing of huge demand for Internet of things in every domain from small and simple applications to large and complex applications. Practically implementation of a Smart Irrigation is very complex deal, but association with IoT using Smart wireless sensors it brings a great management system. The Humidity and Temperature Sensor sense the both water vapor content and temperature around the plant. The Soil Moisture Sensor sense the soil moisture of a plant, if water content is below minimum requirement then water will supply from water reservoir using relay and WATER LEVEL sensor measures the water level of reservoir after that sends the data to ESP8266 Node MCU. ESP8266 Node MCU isa Microcontroller gets the data from smart wireless sensors, process the data and send to destination, that is blynk application.

Index Terms: Smart Irrigation, Internet of Things, water, Soil Moisture Sensor, water level sensor, blynk application, Humidity and Temperature Sensor.

I. INTRODUCTION

Agricultureisconsideredasthebasisoflifefor usasitis the main source of food and other raw materials. It plays vital role in the growth of country's economy. Growth in agricultural sector is necessary for the development of economic condition of the country. Unfortunately, many farmers still use the traditional methods of farming. In India most of the irrigation system are manually operated one's. These outdated techniques are replaced with automatedtechniques.

This project focuses primarily on reducing the wastage of water and minimizing the manual labour on field for irrigation Recent advances in soil water monitoring combined with the growing popularity of Wireless Sensor Networks make the commercial use of such systems applicable for agriculture. In this technique, soil moisture sensors are placed root zone of plant and near the module and gateway unit handles the sensor information and transmitdatatothecontrollerwhichinturnsoperatestheof controltheflowofwaterthroughthevalves.Togiveproper attention to the land located far away from the human settlement, supervisory automatic control systems like multi - terminal control systems are used since inmany processes, factors like soil, temperature, humidity, etc. needs repeated tasks and have to work in abnormal environmental conditions of the soil and to overcome the flaws in the existing system here we are irrigating the land basedon thesoilhumidityandatthesametimethestatusof the irrigation is updated wirelessly to the mobile phone. The proposed system will allow farmers to continuously monitor the moisture level in the field, controlling the supply remotely over the internet. When moisture goes below a certain level, sprinklers would be turned on, thus achieving optimal irrigation using Internet ofThings.

II. EXISTING PROBLEMS

In the case of traditional system water supply is done manually by farmers. Since, the water is irrigated directly in the land, plants under go high stress from variation in soil moisture, therefore plant appearance is reduced. The absence of automatic controlling of the system result in irregular water supply for agriculturallands.

Limitations of Existing System:

- Physical work of farmer to controlirrigation.
- Wastage ofwater.
- Wastage oftime.

III. PROPOSED SYSTEM

We have proposed a system in which the data of sensors will sense the moisture level of the soil, temperature and humidity of surrounding, predict if the soil needs to be watered and supply water as per the requirement. The advantages of these smart water controller systems arewide reaching. This system will help you have better control of your land and irrigation needs. This will help save a significant amount of money on water bills through intelligent control and automation, smart water controller system will optimize the usage ofwater.

Smart water controller System uses valves to turn water ON and OFF the motor. These valves may be easily automated by using controllers. Automating farm water supply allows farmers to apply the right amount of water at the right time, regardless of the availability of labour.

Benefits of Smart Irrigation are:

- Save water andmoney.
- Make maintaining yard easy andconvenient.
- Minimize the infrastructure to carrywater.
- Protect the water resources for futuregeneration.

This project proposes irrigation system which describes the combination of the IoT communication technology and cloud server to accomplish performance of system. The proposed system provides remote monitoring and automated

controlling of irrigation with real time sensing of atmospheric and soil conditions like air temperature, humidity and soil moisture. IoT (blynk app) based water controller improves farm production without any human participation.

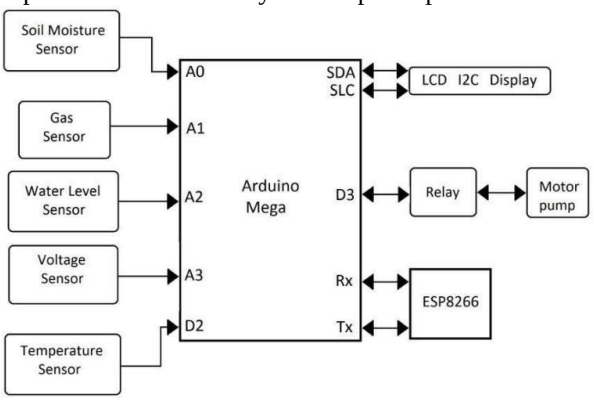

Fig 1: Architecture of the proposed system

To build this system we used the following important hardware and software components:

Arduino mega 2560: Arduino MEGA 2560 board is justlikeabrotherofArduinoUNOboard.Itiswaymore powerful than Arduino UNO and also twice as long from it. This board is the successor of Arduino MEGA. It can be named asATMega2560.

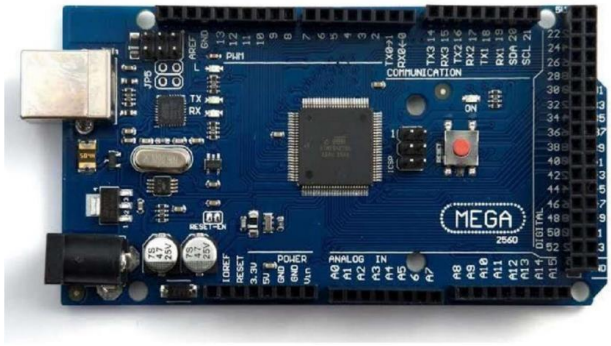

Fig 2: Arduino Mega 2560

ESP8266 WiFi Module: ESP8266 is a complete and self-contained Wi-Fi network solution that can carry software applications, or through another application processor uninstall all Wi-Fi networkingcapabilities

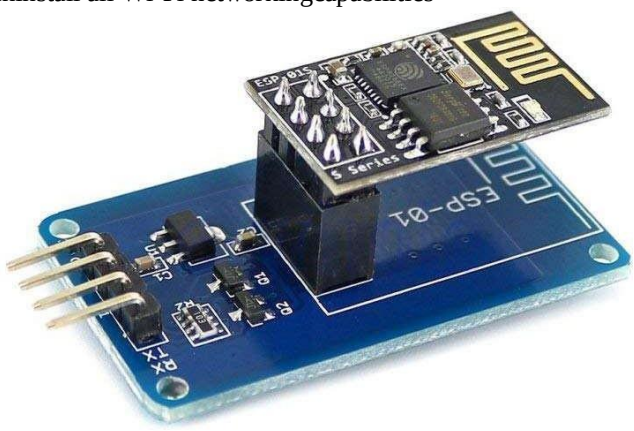

Fig.3: ESP8266 Wi-Fi module

Soil Moisture Sensor: The soil moisture sensor has two probeswhichisinsertedintothesoil.Theprobesareusedto pass current through the soil. The moisture soil has less resistance and hence passes more current through the soil. Whereas, the dry soil has high resistance and passes less current through the soil. The resistance value helps in detecting the soil moisturelevel.

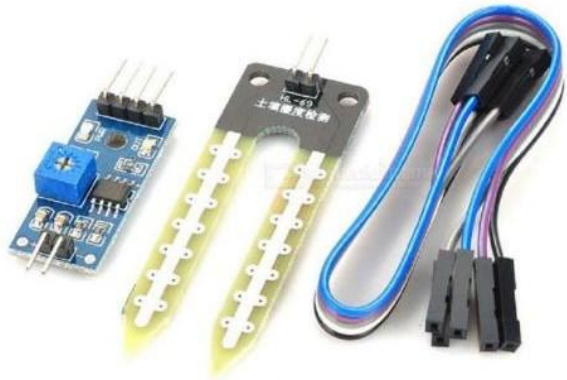

Fig. 4: Soil Moisture Sensor

Submersible Water Pump: A submersible pump (or sub pump, electric submersible pump) is a device which has a hermetically sealed motor close-coupled to the pump body. The whole assembly is submerged in the fluid to be pumped.

Fig.5: Submersible Water Pump

DHT11 Sensor: The DHT11 is a commonly used Temperature and humiditysensor. The sensor comes with a dedicated NTC to measure temperature and an 8-bit microcontroller to output the values of temperature and humidity as serialdata.

Fig.6: DHT11 Sensor

LCD: The LCD is a horizontal panel display unit that make use of light modulating properties of liquid crystals. The liquid crystal does not produce light straight is shown in fig. 7 16x2 LCD display unit is very basic module and is identical normally used in different devices and circuits. These units are favored over 7 sections and other multi sectionsLEDs.A16x2LCDdisplays16charactersperline and there are 2 suchlines.

Fig.7: LCD screen

Arduino IDE: The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. It runs on Windows, Mac OS X, and Linux. The environment is written in Java and based on Processing and another open-sourcesoftware.

The Arduino Software (IDE) allows you to write programs and upload them to your board. The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and Genuino hardware to upload programs and communicate with them.

User Interface Design: The user interface design is part of the project where the end user interacts with the system. Basically, in this project the end user can view values of different sensor values provided by system and verify the data. GUI also provides user with option of selecting automatic or manual operations. The selection of manual operation provides switch to control motorfunctions.

In this project, we use an open source platform named Blynk. Blynk is a new platform that allows you to quickly build interfaces for controlling and monitoring your hardwareprojectsfrom youriOSandAndroiddevice.After downloading the Blynk app, you can create a project dashboard and arrange buttons, sliders, graphs, and other widgets onto the screen. Using the widgets, you can turn pins on and off or display data fromsensors.

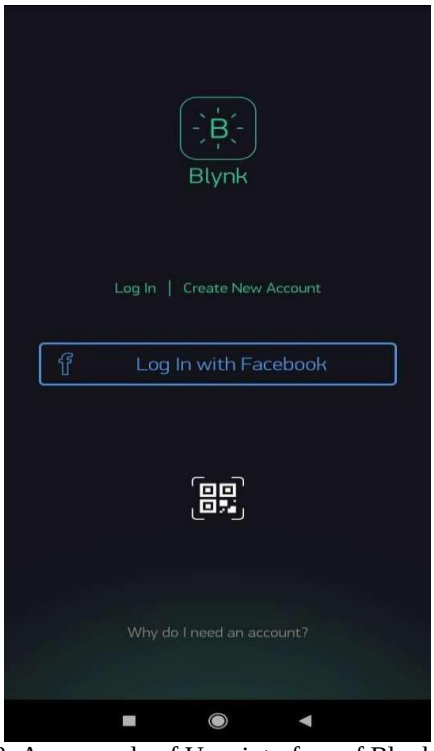

Fig.8: An example of User interface of Blynk app

IV. IMPLEMENTATION

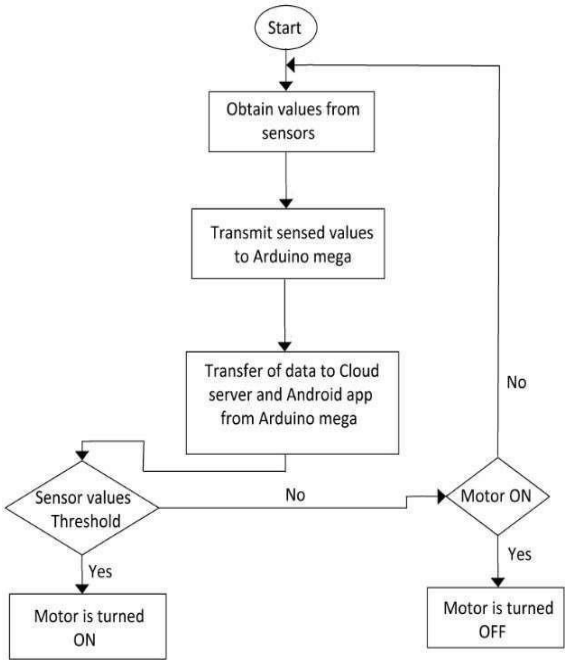

Fig.9: Flow-Chart of Proposed Architecture

The implementation phase is the most important phase as it yields the final solution, which solves the problem addressed. The proposed system consists of five sensors namely, soil moisture sensor, temperature sensor, gas sensor, voltage sensor and water level sensor. The soil moisture sensor is used to sense the moisture level of the field and it varies according to the environmental changes in the field. The temperature sensor is used to sense the temperature value of

surrounding. The gas sensor is used to monitor the level of CO (Carbon Monoxide) and LPG (Liquid petroleum gas) in surrounding. The water level sensor is used to examine the amount of water in tank. The data from sensor is taken as input by the Arduino microcontroller and microcontroller is programmed using embedded C in Arduino IDE. Using ESP8266 Wi-Fi module the data from microcontroller is transmitted to the cloud server and the values will be displayed in the android application, that is blynk. Threshold values are set for each sensor in the field. If the sensed data is less than the pre-defined threshold value the necessary action to turn on the water pump occurs. Likewise, the user can also request to turn the motor ON or OFF manually by simple click in android application or with the help of AI.

The logics of the algorithm helps to identify whether there is need of water to plant. Further, logics and decision-making conditions help soil moisture condition of the soil and it always maintain moisture and also the user getsthestatusofthemotoronthemobile.Firstthemoisture sensor senses the soil. The output of the moisture is in the analog form. The ADC of the Arduino converts the output of the moisture sensor into digital form. Thedigital value is then sent to the Arduino Mega 2560 through Wi-Fimodule whichdecideswhethertosoiliswet ordryandaccordingto that value the water is supplied. If the soil is dry, Arduino Mega 2560 actuates the relay and water pump starts which leadstowatertoflow.IfthesoiliswetArduinoMega2560 turns the relay of as a result water pump is off and water flowstop.

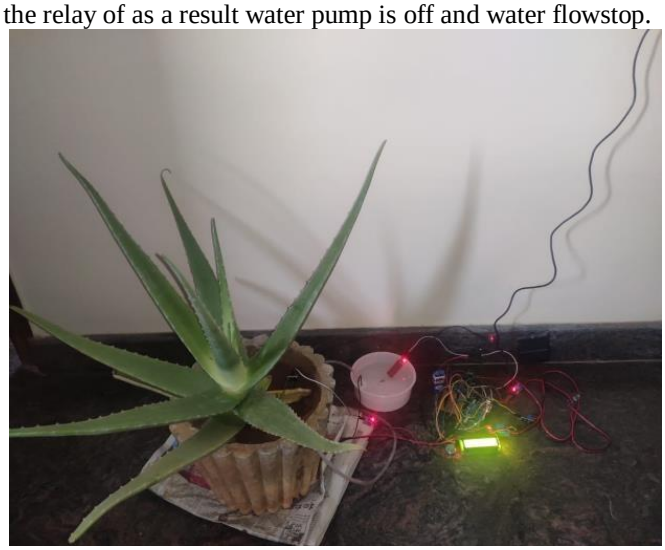

Fig.10: Instrumental Setup

Fig.11: Sensor Readings

Fig.12: Blynk app widget setup

V. TEST RESULTS

Before implementing the new system operation or functionality, a test run of the system is done for removing the bugs. It is an important phase of any successful system. After codifying the whole programs of the system, a test plan should be developed and run on a set of test data. The output of the test run should match the expected results. System testing is considered as a part of implementation process. Testing involves a variety of things, but most importantly it measures the quality of the software we are developing. This view will find out the defects in the software waiting to be discovered and this view is rarely disproved or even disputed.

Test cases	Description	Expected result	Actual result	Status of test cases(P/F)
1.	Temperature detection	Temperature value must be displayed on app	The value of temperature is displayed	Pass
2.	Moisture detection	When the moisture level is low it should be displayed	The low moisture level is displayed on different block	Pass
3.	Moisture detection	When the moisture level is high it should be displayed	The high moisture level is displayed on different block	Pass
4.	On moisture level low	When the moisture level is low motor should get automatically on	Motor gets automatically on when moisture level is low	Pass
5.	By detecting moisture level	The motor should get turned automatically on/off according to moisture level	According to moisture level motor gets turned on/off	Pass
6.	When requested to turn on motor manually	Motor should turned on	Motor gets turned on	Pass
7.	When requested to turn off motor manually	Motor should turned off	Motor gets turned off.	Pass
8.	On the basis of command given to google assistant as on /off	With the command turn on /off the motor should get turned on/off	Motor gets turned on/off by the command	Pass
9.	Connection	Should get connected with valid Wi-Fi	Successfully gets connected with valid Wi-Fi	Pass
10.	Gas detection	LPG and CO values must be detected	As expected the LPG and CO values is detected	Pass

Table.1: Test Cases

Fig13: Motor turned ON when moisture level is low.

Fig.15: Motor Turned OFF with high moisture value

Fig.14: Motor turned OFF when moisture level is high.

Fig.16: Motor turned ON with high moisture value.

Fig.17: Smoke level detection

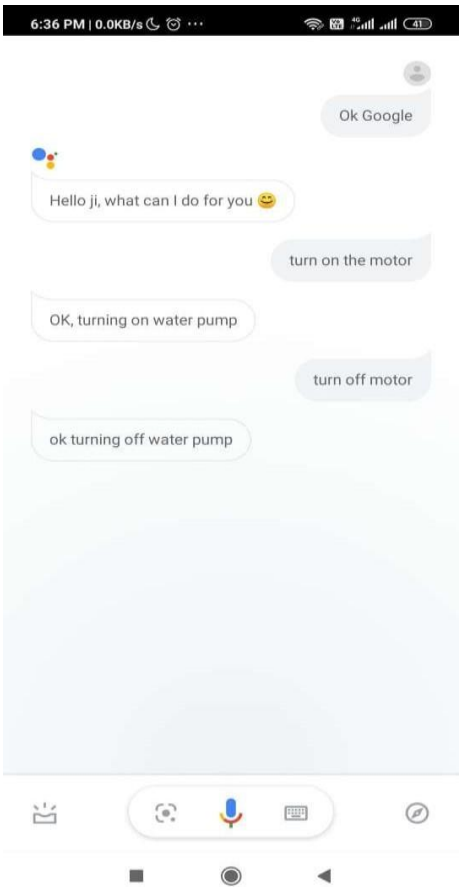

Fig.18: Turn ON & OFF Motor

V. ADVANTAGES OF THISSYSTEM

- The automated irrigation system is convenient to use.
- Low costs and minimallabour.
- Itiscosteffectiveasitoptimizesusewater resources for agriculturalproduction.
- This system avoids decrease in soil quality due to overheadwatering.
- This system improves cropquality.

V. CONCLUSION

In this work, we have successfully developed a system that can help in an automated irrigation system by analyzing the moisture level of the soil. The smart water controller system proves to be a useful as it automates and regulates the watering without any manual intervention. The moisture sensors and temperature sensor measure the moisturelevel(watercontent)andtemperatureoftheplants. If the moisture level is found to be below the desired level, Water Pump to turn ON and the water to respective plant is supplied. Also, we can obtain the information regarding the water level, moisture level, temperature and smoke even when we are away from theland.

FUTURE ENHANCEMENTS

This system can be further enhanced by providing support to different forms of irrigation namely sprinkler irrigation, drip irrigation, center pivot irrigation etc. Sytem to support rain water harvesting can be considered which helps to save water. The system may be further extended for outdoor utilization.

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