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Smart Irrigation using Android and IOT

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***Abstract-** Agriculture has been the most main tradition from very inception of the human humanization. Conservative methods that are used for irrigation, such as overhead sprinkler and flood type is not that much well organized. Due to wastage of water and high moisture in the soil It also promotes the formation of diseases and fungus. In order to eliminate the travail associated with irrigation We made the modish irrigation system with an Android-based mobile application and IOT sensors, controller and so forth. In this we basically use sensors (like humidity, moisture content, temperature) to appropriate real data from the irrigation site which are fed to the central regulator. Wi-Fi (WLAN) gadgets is used to provide Internet connectivity to a local and cloud server. An Android application is developed to display the four Sensors measurements on a user-friendly graphically interface in real-time as received from the server. The system automatically Enable and disable the irrigation pumps based on measurements received from the soil moisture sensor. after attaining certain measured threshold rate, it also gives to the user that flexibility of starting a pump on the farmland remotely using his Android mobile device. The main objective of this project is to control the water supply, provide adequate water to the plants through a smart phone and monitor them.*

***Index Terms-** Irrigation system, Internet of Things, soil moisture sensor, temperature sensor, Cloud, Server, Database.*

1. INTRODUCTION

India is one of the most famous agricultural countries in the world. Planting of plants and breeding of various animals started here around 9000 BC. The result is that agriculture first originated in the west of the Indus Valley, and in Mehrgarh in northeastern Balochistan, the first rural landmarks in India in the 5th millennium BCE. Later a wide variety of animals and plants were bred independently in different areas. According to the World Bank collection of development indicators for 2018, India has 60.43% agricultural land. And the population of India by 2020 will be around 138 crores. It is not easy to grow enough food for these people. Now crop control is also becoming more difficult as farmers in different areas are not able to harvest their crops properly due to low and flood (high) irrigation. Due to this, there is a possibility of food shortage in large numbers in the country. Such irrigation problems cannot be solved by the farmer alone so a modern irrigation system is required. That advanced drainage system can control the flow of water and control the same water on its own without the need for man. This process is made possible by technologies such as IoT, sensors, cloud and WIFI (wireless). This is the main objective of this paper. This smart irrigation system can solve the main water problem of the farmers. And time is also saved. In this process the microcontroller collects real time data with the help of soil moisture, temperature and humidity sensors. The data captured by the sensors is transmitted to a database on the server using a transmission. We use a method called Precision agriculture (PA) to make the crops grow well. The system will run automatically using the threshold value provided by PA based on the extracted data. And when the soil moisture reaches the threshold value it stops on its own. And with that, you can change the irrigation system to suit the season with a single click when planting crops to suit the season. The entire operation can be viewed and controlled remotely from anywhere in the world with smartphone or web application. And this does not cause any harm to the environment.

2. Related Works

In agriculture, crop yield time is estimated based on crop water. Providing adequate water for the crop at this stage is the most crucial task. Water is one of the most widely used natural resources for agriculture in the world. Plants get this source in two main ways. One of them is rain and the other is irrigation. Rainfed agriculture is called rainfed agriculture. Rainfed agriculture means the natural inflow of water to the land through direct rainfall. This makes food products less likely to be contaminated, depending on rainfall, but opens up to water scarcity when rainfall is low[2]. On the other hand, artificial applications of water increase the risk of contamination. The process of artificially watering plants is called irrigation. Part of this involves the use of systems such as tubes, pumps and sprays. Irrigation is usually used in areas where rainfall is irregular or in dry seasons or where drought is expected. In general, this drainage occurs in several ways. In this method water is supplied uniformly to the whole farm. Irrigation involves the use of water from groundwater, springs or wells, surface water, rivers, lakes or reservoirs, or other sources such as treated sewage or desalinated water. In agriculture, it is important for farmers to protect themselves from the possibility of contaminating their farm water resources[3][4]. The main methods used in this irrigation system are surface irrigation, drip irrigation, sprinkler irrigation, localized irrigation, central pivot irrigation etc.

This section combines technologies in different ways in which we provide water suitable for agriculture through smart irrigation systems. We mainly use sensors in it. These sensors play a major role in IoT. The sensors convert stimuli such as light, motion, heat and sound into electrical signals. These codes are sent through an interface that converts them into binary code and sends them to a computer for processing. One of the main sensors used is the soil moisturesensor. It has two electrodes. It captures the moisture in the soil and sends it to the microcontroller in the form of readings between 0 and 1024. Based on the signals sent by these sensors, this advanced irrigation system is activated. This state-of-the-art irrigation system can be controlled in two ways. One is manual control and the other is automatic control. The stimuli perceived by the sensors in this automatic control are compared with the threshold value in the algorithm. This threshold value is in the program in the microcontroller. Based on the information provided by the sensors in the system, the water pump in the irrigation system will start automatically. The motor pump stays on until the moisture content of the month absorbed by the sensors equals the threshold value of the algorithm. The pump shuts off automatically when the sensor readings are equal to the threshold value. The data provided by these soil moisture sensors are also compared with the temperature and humidity provided by the DHT11 sensors. The motor does not turn on during the rainy season based on the algorithm. This allows you to predict when it will rain. Thereby preventing water wastage. The manual control of this system is controlled by humans. Based on this manual control the farmers can water at any time they want. Data captured by sensors on this system is transferred over the Internet to an IoT server or cloud server using protocols such as http / UDP / TCP. That information is stored in a database on the server. This is called real time data. The data in this database can be viewed remotely from the device. This whole system can be controlled with a remote device. In this smart irrigation the option called notification is very useful for the farmers[1]. This makes it very easy to know when the water in the soil is low. This notification monitors soil moisture sensor and DHT11 sensor readings. The server sends a notification or phone call or message to the mobile as soon as the water level drops[5][6].

This irrigation system is connected to the cloud server so we can control this irrigation system from anywhere in the world. All it takes is an internet connection.

2.1.USED SENSORS:

The system uses nodes such as WiFi and cloud. Other nodes can also be used. These nodes are responsible for the data transmission of the sensors in the system. Here the sensors are connected to the microcontroller. The data extracted from the sensors reaches the microcontroller via connections. Here we use NodeMCU (ESP8266) or Arduino UNO R3 or Raspberry pi. The collected data is sent to servers with protocols.This real-time data can be viewed by hosting the server as well as controlling the microcontroller. There are several types of controllers available for such projects.

2.2. DHT SENSOR:

DHT is a digital sensor used to measure humidity and temperature[8]. It instantly measures temperature and humidity in the air and easily combines those readings with any micro- controller. There are two common types of DHT sensors available DHT11 and DHT22. DHT22 provides slightly accurate data compared to DHT11. When writing a program for integrating these DHT sensors in the microcontroller, a separate library must be included for these. This sensor measures with accuracy in the range of -40 to +125 to +0.5

degrees. So, it changes in DHT11. It measures with accuracy in the range of +2 degrees from 0 to 50 degrees Celsius.

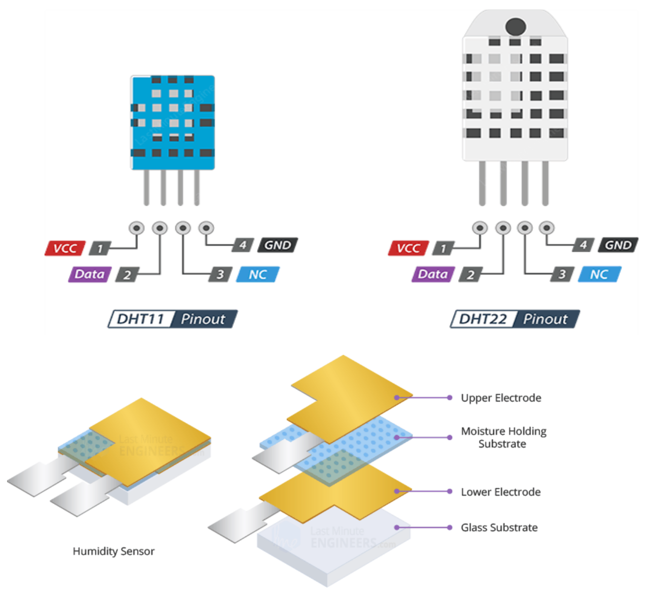

Fig. 1: DHT Sensors

2.3.SOIL MOISTURE SENSOR

soil moisture sensor is a digital sensor used to measure moisture in water. It instantly measures the moisture in the water and easily combines those readings with any micro-controller[9][10]. These Soil moisture sensors do not directly measure soil moisture. Based on some algorithms predict soil moisture. These readings on the microcontroller range from 0 to 1024. This sensor consists of two parts, one part with two electrodes. The other part contains the potentiometer and the LM393 comparator[7]. The threshold can be set using a potentiometer so that when the humidity level exceeds the threshold value, the module will output more or less. This setup is very useful when you want to start the action when the specific threshold is reached[11][12]. The LM393 comparator measures the amount of water inside the soil (based on resistance / conductivity) and gives the moisture level as output. Soil moisture sensor has both digital and analog output. So, this LM393 comparator is useful in both. In addition, pins VCC, GND, D0, A0 in part 2 are used for communication and power supply.

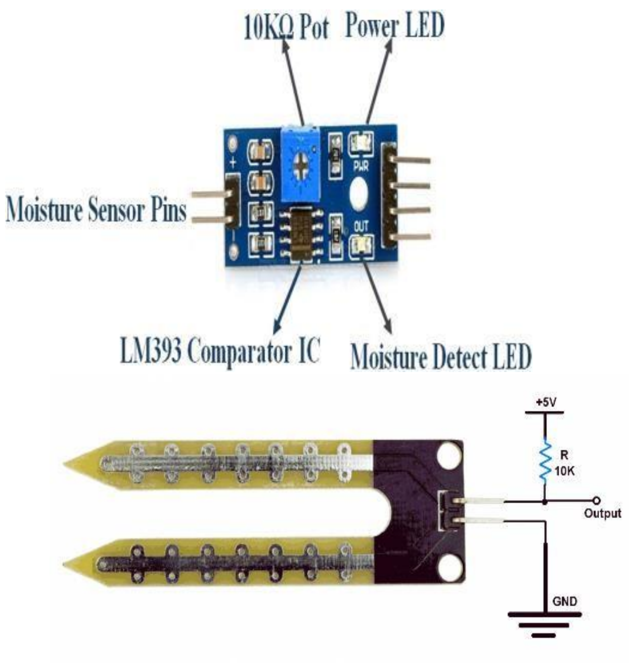

Fig. 2: Soil Moisture Sensor and it's parts

3. PROPOSED SYSTEM (METHODOLOGY)

A. *Collecting Sensing Data*

We used a soil moisture sensor and a DHT11 sensor. The sensors must be connected to a microcontroller such as the Arduino or ESP8266 or the Raspberry Pi. Here the soil moisture sensor collects the moisture level

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readings in the soil and DHT11 sensor collects the temperature and humidity readings. This sensor sends data to the microcontroller. The data in the microcontroller is distributed to the cloud server based on protocols with the help of internet and WIFI module, the data is sent from the cloud server to the database and stored there. The mobile device communicates with the server through a cloud server using MQTT / HTTP to access the data sent from the server and for remote control.

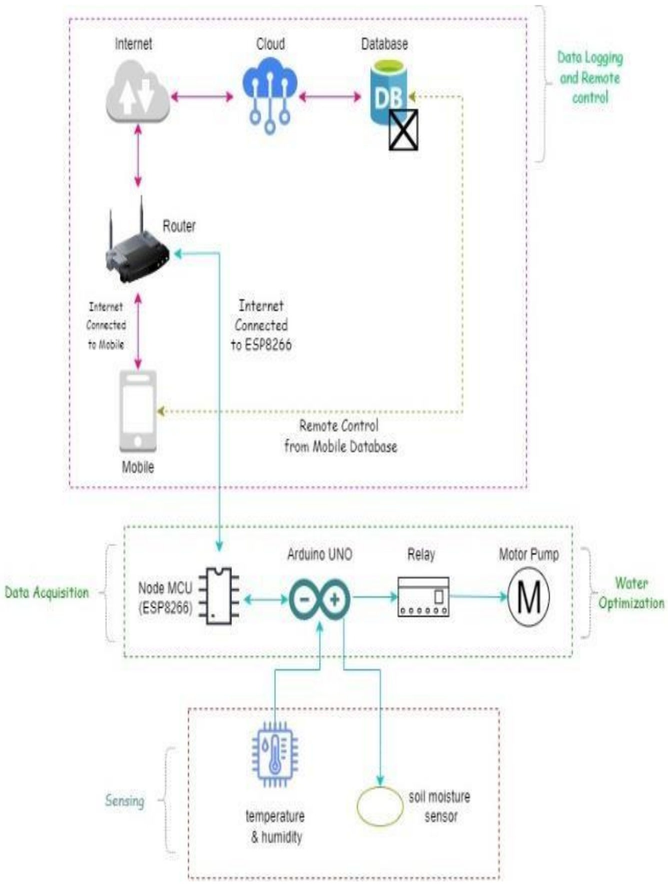
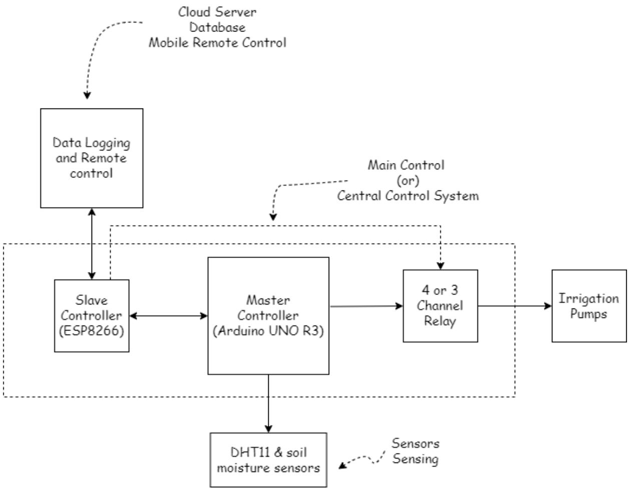


Fig. 3: Block diagram of the smart irrigation

B. Central Control System

Central control System is responsible for this. This central control is divided into two parts. One of them is the master controller and the other is the slave controller. The node MCU is responsible for the Place of the slave controller. It is connected to the router. From there it communicates with the server database in the remote login with the help of the internet. It sends the data and functions collected from the master controller (Arduino) to the cloud server as well as the data and functions collected from the cloud server to the master controller (Arduino). And we use Arduino or Raspberry pie as the master controller. The master controller collects the sensing information absorbed by the sensors from the sensors using wires. It is transferred to the slave controller. The slave controller captures the transferred data and sends it to the cloud server using the Internet. And a device called a relay is connected to the master controller. This relay is also connected to both controllers. This relay is a device that works with switches. It consists of a set of input and operating contact terminals for single or multiple control signals. This relay works on the instructions given by the master controller. With its help the master controller operates the motor pump. This complete operation can be monitored via mobile or PC. also, can be controlled remotely using mobile.

Fig. 4: Block diagram of the Main Control or Central Control System



C. *Control Features for Users in GUI*

This smart irrigation system can be controlled from anywhere in the world from mobile phone or devices like desktop, laptop. These devices are called remote devices. The sensor readings on the remote system are displayed through the GUI (Graphical User Interface). And real-time data in the form of graphs are also displayed. Additionally, a motor switch is available for manual control. Notification option for alert is available from time to time. Voice mode is also included in this notification for the illiterate. This voice mode notification notifies the farmer in a language known to the farmer. In addition, water measurements required for certain crops to supply water to seasonal crops are pre-set. This makes it easier to provide the required water for different crops without changing the settings. Some of the crop names and their symbols are given earlier in this feature. With a single click on the crop we want, the threshold value of the soil moisture sensor in the algorithm changes depending on that crop. This option can easily provide the water needed for any crop. We can also control the features of this remote device by voice.

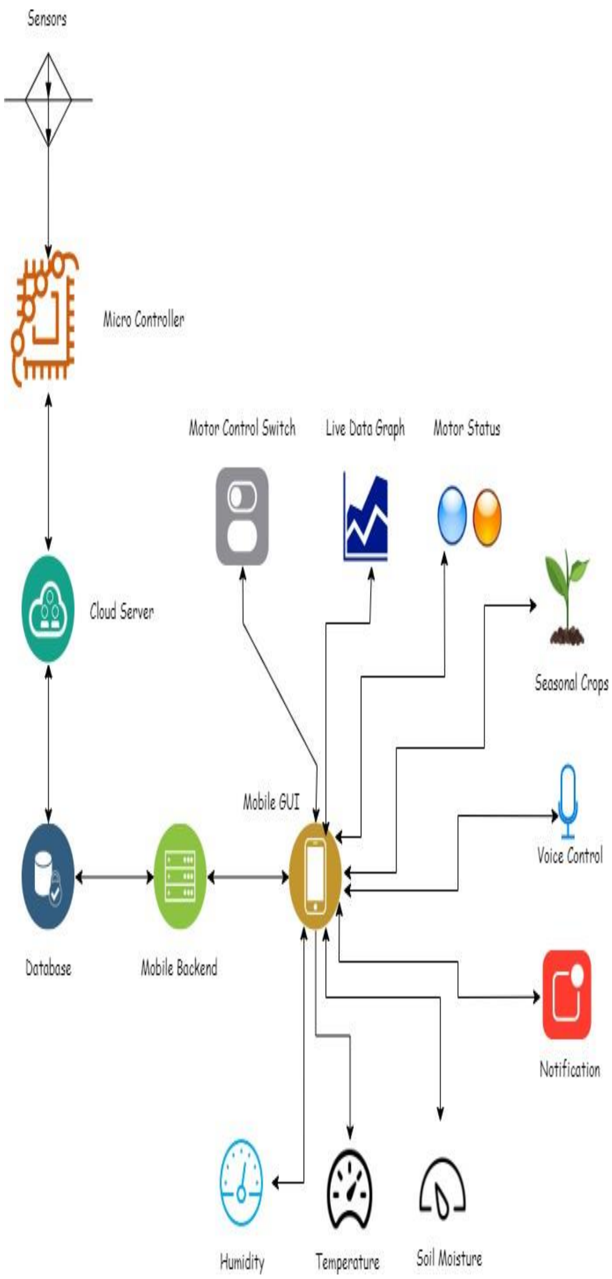


Fig. 5: Block diagram of Remote-Control

PROPOSED ARCHITECTURE

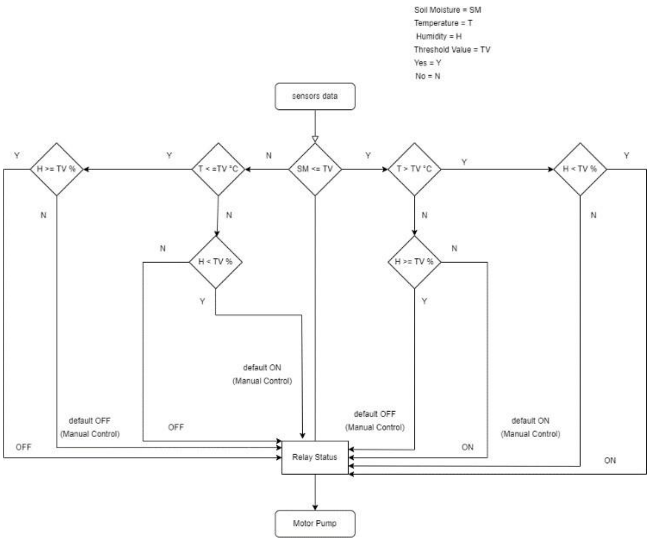


Fig. 6: Flow Chart of Automatic Irrigation System

4. RESULT ANALYSIS

This smart irrigation system works manually and automatically. Farmers can operate the system manually in manual mode. Soil moisture sensor readings in the GUI on the screen of a remote device range from 0 to 100 percent, which is equivalent to readings from 0 to 1024. And the temperature provided by the DHT11 sensor ranges from 0 to 100 C. And humidity readings ranging from 0 to 100 percent appear on the screen. As well as their graphs appear. These readings belong to a real-time database. All this data is always stored in the database. Data can be shown in graphs from one hour to one month. The data in these graphs is updated every second. So that it shows the exact result. This system works based on the values shown below. And gives that output.

Soil moisture (%)	Temperature (°C)	Humidity (%)	Class
<30	>45	<30	Highly Needed
30–45	35–45	30–45	Needed
46–60	25–34	46–60	Average
61–80	20–24	61–80	Not Needed
80–100	<20	>80	Highly not Needed

Table 1: sensor data

5. CONCLUSION

In this article, we have proposed Real Time Automatic and Manual Smart Irrigation System. This smart irrigation system is made using IoT. Irrigation can be facilitated based on the proposed Smart Irrigation System. In particular water wastage can be reduced. It can save time as well. This system is a cost- effective solution. The motor in the system can be controlled by its microcontroller. This smart irrigation system is designed with future generations in mind. More features can be added to it using future technology. This irrigation system can also be controlled by Artificial Intelligence. We will add a list of more seasonal crops in the future. There is no harm to the environment due to this smart irrigation system. The use of this irrigation system reduces the pollution of cultivable water. So that the crops grow well. This smart irrigation system is very useful in areas where irrigation water is challenging.

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