Smart Farming using IoT

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***Abstract*— The advancement in technology has helped in developing the agriculture Industry. The agriculture industry has just become smarter and data oriented. The recent lively growth in IOT based technologies has redesigned the way many industries work. This revolutionary change in Farming has generated various opportunities as well as new disputes. It's time for us to beat the clock and implement various IOT technologies in agriculture for higher production to keep up with the never-ending increasing demand for food all over the world. Supervising agricultural fields can be done with the help of data collection by various sensors for the farmer to monitor. Our Proposed System uses four different sensors with real time update on the status the sensors provide unlike existing systems which provides the status from time to time. The sensors that used helps in knowing the soil moisture, soil's ph. value, water level in the field. The water volume sensor detects the amount of water supplied to the field for a particular crop and supplies the required water and prevents overflow of water. The sensors are connected to the Arduino-UNO module for processing. The system can be operated from remote locations with the help of networking technology.**

Index Terms
1. Internet of Things (IoT),
2.Soil moisture sensor
3.Arduino-UNO.

I. INTRODUCTION

Regardless of natural constraints such as bad weather and climate change, the agriculture industry must grow to meet demand despite a growing population. A system for observing the agricultural field with the help of sensors that automates the agricultural system is constructed in IoT smart farming. When compared to conventional farming, IoT farming is very efficient. Farmers can access information on field conditions from anywhere. Farmers are reaping endless benefits from implementing the IoT system. It has aided farmers in lowering costs while increasing agricultural yields. The system's primary goal is to maintain the perfect growing environment for crops. Users can access the data via the mobile site using their cell phones and PCs. In the toolbar of the user interface, users may keep track of the crops and regulate the water supply, illumination, and motor. The basic goal of an irrigation control system is to produce and maintain best possible crop growth. Crop development can be improved by cultivating in an ecosystem with adequate water supply and an optimal temperature. As a result, the agricultural field's yield will rise. The productivity can be boosted and it is possible to keep up with the increasing demand in the future by utilizing this technology. With developments, IoT helps in transforming the agriculture industry and assists the farmers in dealing with their issues. They are cost-effective, and crop productivity will increase.

II. LITERATURE SURVEY

V. Palazzi et al[1] presented a Leaf Compatible temp sensing systemusing RFID.

Jitendra Patidar et al[2] explained the benefits of iot based farming by using various parameters by using programming hardware over traditional farming.

Nisar Ahmad et al[3] proposed that With the passage of time, farmers' use of machinery to improve the quality and quantity of agricultural output has increased. This study presents a multi-parameter observation system that will notify farmers and users with the help of the Internet.

G. S. Nagaraja et al[4] suggested that Crop output has grown as a result of the introduction of improved seed types, innovative agricultural technologies, and the use of effective fertilisers. However, without the use of wiser technologies, the agricultural domain will continue to be behind schedule. The traditional technique relies heavily on human instincts, which occasionally fail.

Sudhir K. Routray et al[5] presented Precision agriculture (PA) as the engineering of plants' exact requirements and productivity. In current times, PA collects data on the specific demands of plants and their productivity by using large quantity sensors in a networked design.

Pankaj Mohan Gupta et al[6] explained that Many farming cultures, such as Indians, continue to practise traditional farming methods. They must, however, contend with rising food demand (implying higher yields), water scarcity, arable land availability, insect assaults on crops, and climate change.

Rana Gill et al[7] proposed For agriculture, a design of low-cost sensor nodes based on the IOT. To monitor critical factors linked to soil and environment within the greenhouse, the sensor node is built using NodeMCU and four distinct sensors.

Kamlesh Kalbande et al[8] submitted that In India, IoT for precision farming is mixed in with the introduction of ultra-low-power and modern technology. A basic identity to overcome is assisting farmers in dealing with issues such as unstructured process automation, inefficient goods, insufficient resources resulting in machine damage, and so on.

R. Nageswara Rao et al[9] proposed a way for making farming smarter through the use of automation and IoT. Crop growth monitoring and selection, irrigation decision assistance, and other applications are enabled by the Internet of Things (IoT).

Sebastian Sadowski et al[10] proposed Precision farming , which entails employing revolutionary technology and measuring instruments to observe crops and offer exact treatments as needed, is one way to accomplish smart farming.

Sashant Suhag et al[11] proposed an IoT framework for soil nutriment and plant disease observation. It uses different sensors and uses smart sensors to gather the information in the form of images over different time periods.

Yash Bhojwani et al[12] proposed that Working accomplishes this by monitoring the environmental elements such as temperature, soil moisture, and other factors that impact crop development, as well as assisting farmers in determining the ideal crop that is suitable for the farmers based on the data gathered and environmental circumstances.

N Sneha et al[13] research concentrates on the expansion of two studies that focus on applying Data mining technologies such as DBSCAN, PAM, CLARA, Chameleon and a regression approach to improve agriculture.

Carlos Kamienski et al[14] presented the The project's SWAMP perspective, pilots, and scenario-based development method.

M. Suresh et al[15] proposed that The goal is to complete the adoption of mechanisation to handle electrical motors in the agricultural area. As a result of the sparse distribution of devices, it is a natural work. Farmers' ability to run and control these gadgets in real time is quite difficult.

Dr. Akey Sungheetha et al[16] proposed that to improve the accuracy of the system, integration of image processing schemes is done in this system. The rules are formulated such that the true detection rate is improved.

III. PROPOSED WORK

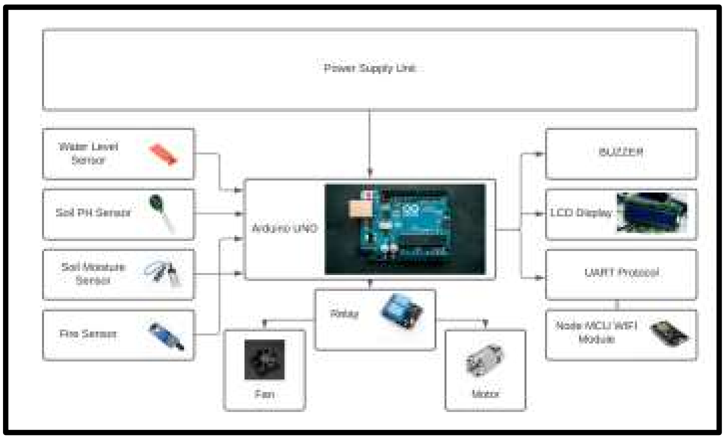

Fig 1: Architecture Diagram of the Proposed System

This systemmakes use of sensors such as a ph sensor and soil moisture sensor to monitor farming conditions. The level of water must be measured in order to monitor the amount of water provided and utilised. This is accomplished through the use of water volume sensors. These sensors connect to the Arduino-UNO processing module. The Display is used to show the state of several sensors. When water levels in the ground fall below a certain level, the moisture level in the soil is detected by soil moisture sensor. When the ground becomes dry and the sensor recognises it, the DC water pump is turned on. The DC water pump will cut off once the floor has been moistened. Through IOT mobile site, the information can be analyzed in our mobiles. According to Figure.1 there are totally four sensors used in this system.

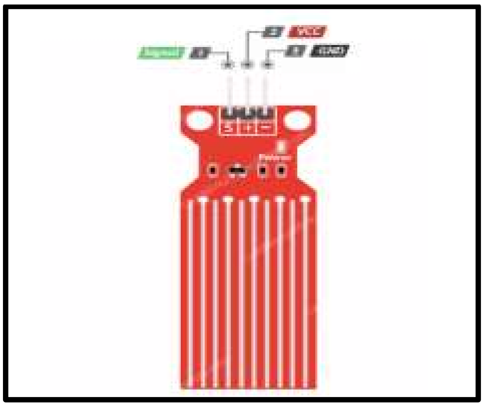

Fig 2:Water Level Sensor

Sensors that monitor the amount of liquid that flow are known as water level sensors. The water's level can be measured in containers or by assessing the level of water body. And then, the data might be transferred to further devices that determine the next step. If there is no water level sensor, then someone has to check upon each tank of water to fill it or empty it.

Fig 3:Soil PH Sensor

The soil pH sensor is a device that measures the soil's current pH value. Plants can grow in a wide range of pHs, but each plant has its own ideal pH. Crop growth can be aided by maintaining a reasonable pH level in the soil.

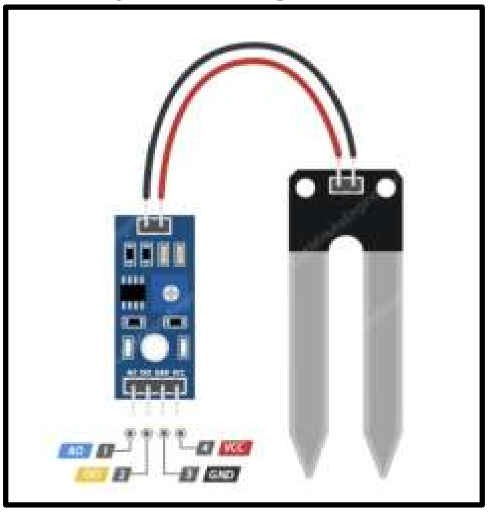

Fig 4:Soil Moisture Sensor

This Sensor helps in monitoring the amount of water in the soil. It can be used to check the presence of water around the sensor, allowing crops to seek manual help.

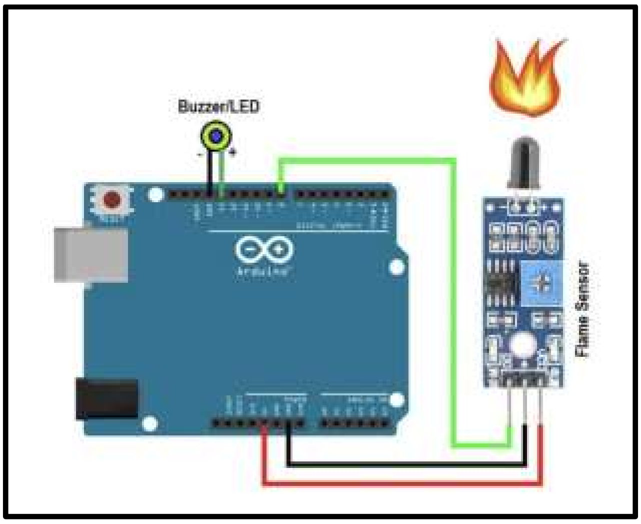

Fig 5:Fire Sensor

A flame detector is a device that reacts to the presence of a flame or fire. In order to detect the presence of flame, an Arduino is connected to a flame sensor. These sensor devices respond to the presence of particularly high temperatures generated by a fire. When the device is turned on, it sends a signal to the buzzer, directing it to carry out the pre-programmed reaction When a detector goes off, it sends a signal to the alarm system, instructing it to take the appropriate action. Many users configure their systems to send a distress signal to a nearby station immediately after the device is initialised.

Arduino is a microcontroller board built on the ATmega328P microchip that is produced by Arduino as an open-source project. It may accept a variety of sensors as input and output the desired result. It is simple to use for individuals who are familiar with basic electronics and the C programming language. The platform is composed of two components: the Arduino Board and the Arduino IDE. This is the method through which it is programmed. It features a total of Twenty digital pins, six are utilised as PWM outputs and six as analogue inputs. The Arduino IDE is a Java software that runs on Mac OS, Windows and Linux computers.

Reasons why Arduino Uno is used in this project

- First of all, the price factor when compared to other boards Arduino Uno is the lowest.
- The board design is simple which makes it easy to understand. It’s very much suitable for absolute beginners like me to use this.

The LCD Display is used as an output device to display the status of each sensor.

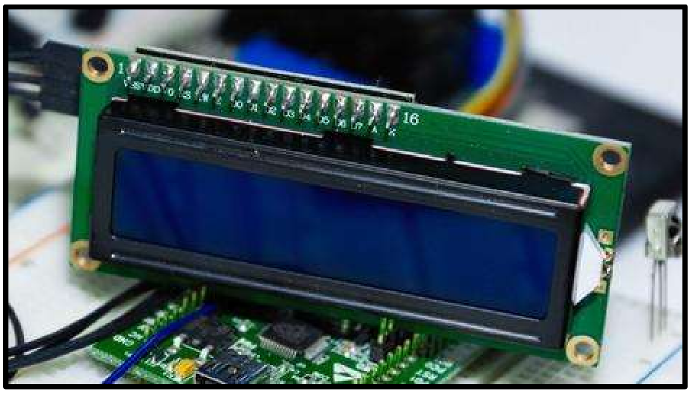

Fig 7:LCD Display

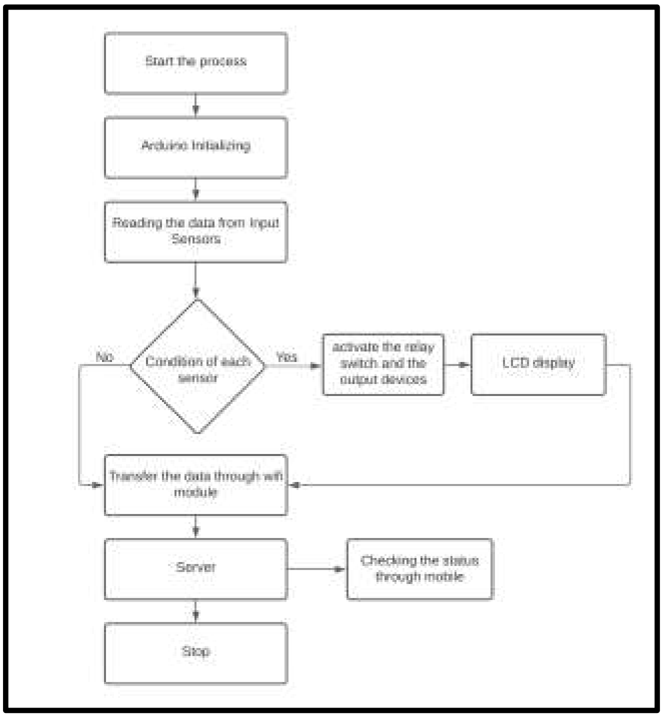

Fig 8:Data Flow Diagram Of The Proposed System

UART Protocol also Known as Universal Asynchronous Receiver/Transmitter.

It is a serial communication. Bits are transmitted in sequential order. The communication is simple in UART, it consists of 2 lines, one for transmitting Tx and the other is for receiving Rx. On the Arduino Uno Board, the USB connection is set with two digital pins namely, *GPIO 0* and *GPIO 1*.

GIPO (General purpose Input Output)

IV. METHODOLOGY

Step 1: Connect all the Input devices, Output devices like (Buzzer, LCD, Motor and Fan) and Communication devices (Node MCU) to the Arduino Uno as per the Architectural Diagram.

Step 2: Check the input & output voltage and input & output current for all electronic components.
Step 3: Write the code in Arduino IDE software. In this code the Arduino Microcontroller can understand the sensor values and it can send the commands to output devices.
Step 4: After writing the code, upload it into the Microcontroller using the USB cable.
Step 5: After uploading the code, supply the power to all input & output devices. Place the soil pH sensor and Moisture sensor to the sample sand. These sensors measure the pH level & Moisture level of the soil.
Step 6: The Sensor data is always updated in Microcontroller. Now if the moisture value is lower than the expected level, the Microcontroller turns ON the relay. So that the Motor would run and the water flows to the agricultural land. Again, the Sensor value transmits to the Microcontroller, When the Moisture level value is greater than the required value, the Motor turns OFF automatically.
Step 7: The pH sensor allows you to see the pH level of your soil. Soil pH is typically between 1 and 14, but the optimum range for most crops is 5.5 to 7.5. If the pH value is less than or greater than the particular range indicated by the sensor, the fertilizer is fed to maintain the pH level of the soil.
Step 8: In case a fire spreads to our land it can automatically be controlled with Motor & Fan by turning them ON. With the help of microcontroller and the buzzer, workers nearby can be alerted.
Step 9: Water level sensor helps to know the information of water level in our land. Also on rainy days, water level increases in our land, so that excess water is reduced.
Step 10: All the values are updated in Firebase through the Wi-Fi. To maintain the fastest internet access, information can be collected and actions can be taken depending on the information.

V. RESULTS AND DISCUSSIONS

Fig 9:Components of the circuit

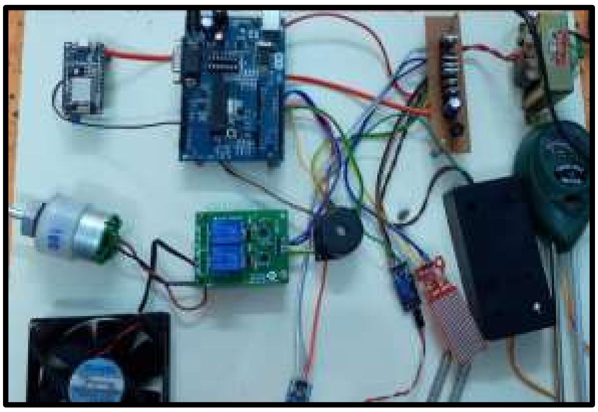

Fig 10:Assembled Circuit

The components are assembled with the arduino board which is shown in the figure 10.

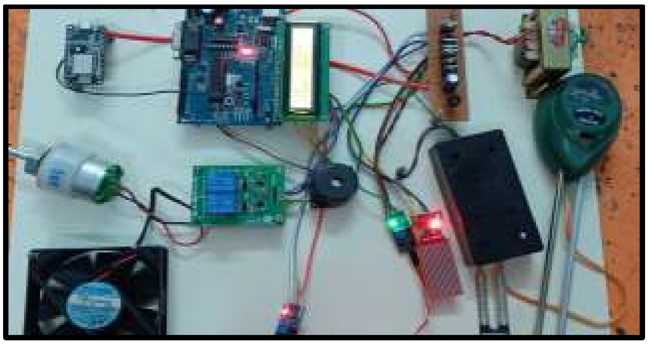

Fig 11:Status of Various Sensors

Power is supplied to the circuit to get the output of the sensors.

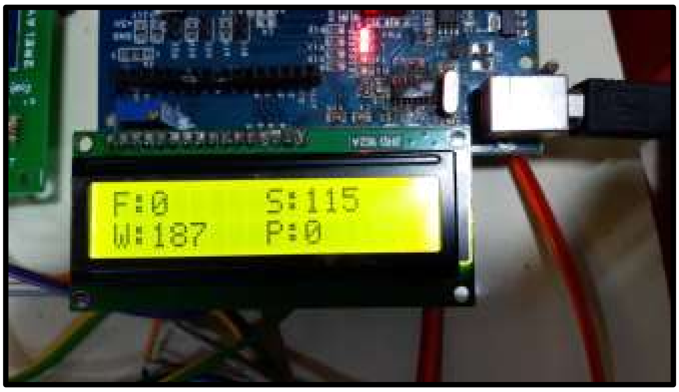

Fig 12:Values of various sensors

Figure 12 shows the values of the sensors that are in the circuit. F represents the fire sensors which shows zero. The moisture of soil is represented as 115 , water level sensor has a value of 187 in the figure 12 and the pH value is represented as p.
Water level sensor shows a value as 187 which indicates the sensor is partially submerged. A completely submerged sensor would show a value ranging from 450 to 500.

Soil Moisture sensor shows a value of 115 which may differ for different types of soil. This sensor uses trial and error method to get the threshold values for determining the dryness and wetness of the soil. Here it indicates the soil is dry.

Fire Sensor shows a value of 0 which indicates no flame is detected. Logic 1 indicates flame is detected and triggers the buzzer.

VI. CONCLUSION

To conclude, humans can improve crop yield in agricultural farms by implementing IoT. Weather conditions such as humidity and temperature can be monitored using this IoT platform. The farm's necessities such as moisture of the soil can also be adjusted by this way. With the use of IoT and wireless communication sensors and microcontrollers may be interfaced with each other. This can decrease the weather-related issues that farmers confront. As a result, farmers may use their mobile phones or laptops to check the state of their farms. These technologies deliver higher agricultural yields and better output results. The crop yield in agricultural production can be increased in India by using these techniques. It also has the potential to minimise agriculture labour. IoT is capable of monitoring and managing crop and its growth.

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