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AGRICULTURE MONITORING AND AUTOMATION

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ABSTRACT

In this work, we present a cost-effective smart automated irrigation system for agricultural applications by integrating Arduino technology with the Internet of Things (IoT). Our system continuously monitors soil moisture levels, temperature, and humidity, offering an enhanced alternative to traditional irrigation methods. Utilizing soil moisture detectors, temperature sensors, and humidity sensors positioned near plant roots, the system gathers essential data and communicates it to a central Arduino-based controller. When the soil moisture level falls below a pre-defined threshold, the system triggers an alert via a mobile application, enhancing user convenience and control. The system employs Arduino UNO and Blynk Mobile App for seamless communication and automation. When moisture deficits are detected, the system automatically activates the irrigation motor, ensuring timely and efficient watering of farmlands. By extending our initial irrigation system with temperature and humidity sensors, we offer a comprehensive agricultural solution that facilitates better crop management. This low-cost, sustainable farming approach significantly reduces operational expenses while providing essential environmental data for optimizing crop growth. Our solution not only competes favorable in terms of cost but also offers a substantial advantage over existing commercial alternatives in the market.

Keywords: Arduino, Irrigation Systems, Internet of Things (IoT), Arduino UNO, Blynk Mobile App, Soil Moisture Detector, Temperature Sensor, Humidity Sensor, Sustainable Farming.

I.INTRODUCTION:

Traditional irrigation systems are based on manual irrigation of farmlands by farmers. These processes take longer with wastage of available resources like manpower, available water resources and others. which traditionally requires laborious continuous surveillance of fields Low-cost smart systems using the concept of IoT automation can be used to mitigate these issues, which can also increase productivity. Such smart systems can be remotely synchronized with electronic gadgets or mobile applications. Implementation of such automated irrigation systems for agriculture for more profitability to farmers in terms of time saving and accurate usage of water without wastage. In today's digital world, automatization of the systems makes tasks easy, comfortable, fast and efficient.

II.MOTIVATION:

The motivation behind this project lies in the pressing need to optimize water usage in agriculture and to enhance crop yields. By seamlessly integrating IoT devices, mobile applications, and irrigation systems, this innovative approach empowers farmers with the ability to monitor and manage soil moisture remotely. This not only conserves precious water resources but also contributes to increased crop productivity. The project underscores the transformative potential of IoT in agriculture, offering a sustainable and efficient solution for modern farming practices.

III.LITERATURE REVIEW

1. Smart watering system for garden using WSN 2 The first paper was proposed by Mr. Ahmad Hussain in the year of 2014. This paper discusses the usage of WSN in irrigation management by a sensible watering system during which the irrigation method is controlled by valves. It helps to utilize water resources very efficiently.

2. Efficient Design of a Low-Cost Portable Weather Station The second paper was proposed by Mr. Asif Imtiaz in the year of 2018. This paper presents the implementation of Arduino meteorological observation post that was designed in order that individuals can monitor real time weather knowledge victimization this weather station. The aim of this project is to style such a weather station at a less expensive value which will take a true data of temperature, pressure, wetness and wind speed from the weather station.

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IV.PROBLEM DEFINATION

Traditional agriculture practices often suffer from inefficiencies in the management of water resources, leading to over-irrigation or under-irrigation of crops. This lack of precise control can result in reduced crop yields, increased water consumption, and, in some cases, environmental degradation. Inefficient irrigation practices not only waste water but also contribute to higher operational costs for farmers. Furthermore, the lack of real-time, remote monitoring and control mechanisms makes it challenging for farmers to respond to changing soil moisture conditions effectively.

V.WORKING PRINCIPLE

This smart irrigation technique comprises of three separated sub-modules. In first module, Blynk Application is employed to get the status of the garden or farm, whereas second module aggregates different sensors such as moisture sensor to gauge the soil moistness level, and lastly the third module comprises of a microcontroller acting as a central system that communicate with different system via Wi-Fi. The microcontroller is additionally interfaced with relay module to control the water motor at gardens or farms. From sensors, various data are fetched, and based on those values, user are notified on smart phones, tablets or on web via defined user interface. Basically, control of water pump is dependent on artificial intelligence concept for automatic switching between on and off states. Using relay, Arduino uno automatically issues appropriate commands for switching the water pump on or off in the garden or farm. The proposed system can be operated using two threshold modes: programmed set on Arduino uno and in manual mode, which user can set utilizing BLYNK Application. When it is set at programmed mode farms and garden are automated to operate based on measurements by the sensors. Then again, when it is set at manual mode, the user can control every one of the gardens or farms by means of their mobile phone or from computing device.

VI.DESIGN AND IMPLEMENTATION

Agriculture monitoring and Automation presented in this paper implemented by Arduino UNO, relay module, Soil Moisture Sensor, DC Motor Pump ,IOT based Blynk application .Implementation of the system is separated using hardware and software. The hardware module is used to detect the moisture in the soil connected near plants through soil moisture sensor, proceedings of data to the Arduino and DC Motor. Whenever it reaches the less than the limit it Turn ON the Pump and Turn OFF when it is above limit value. A low cost ,efficient and smart control of the irrigation system can therefore be effectuated using the IOT. The circuit diagram of the setup is presented in the following Figure 1

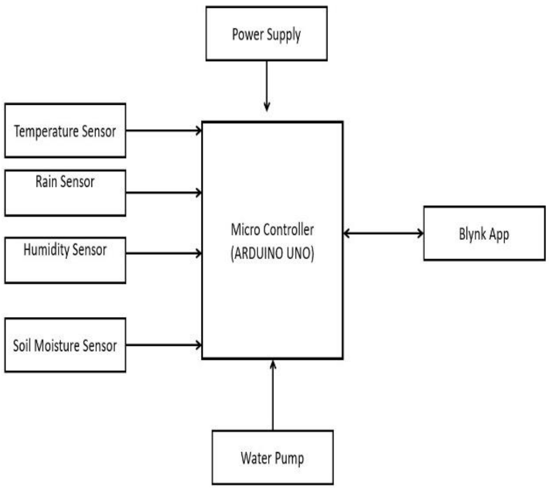

Fig 1: Circuit diagram

VII.COMPONENTS REQUIRED

a) Arduino:

Arduino UNO is based on an ATmega328P microcontroller. It is easy to use compared to other boards, such as the Arduino Mega board, etc. The board consists of digital and analog Input/Output pins (I/O), shields, and other circuits. The Arduino UNO includes 6 analog pin inputs, 14 digital pins, a USB connector, a power jack, and an ICSP (In-Circuit Serial Programming) header. It is programmed based on IDE, which stands for Integrated Development Environment. It can run on both online and offline platforms.

Fig 2: Arduino

b) Relay Module:

A relay is an electrically operated switch that can be turned on or off, letting the current go through or not, and can be controlled with low voltages, like the 5V or 3.3V provided by the pins of a controller board. This relay module (has two channels (those blue cubes). Other models with one, four and eight channels are also available. Relay modules that are powered using 3.3V are ideal for ESP32, ESP8266, and other microcontrollers.

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Fig 3: Relay module

c)Soil Moisture Sensor:

The soil moisture sensor uses capacitance to measure dielectric permittivity of the surrounding medium. In soil, dielectric permittivity is a function of the water content. The sensor creates a voltage proportional to the dielectric permittivity, and therefore the water content of the soil. The sensor averages the water content over the entire length of the sensor. There is a 2 cm zone of influence with respect to the flat surface of the sensor, but it has little or no sensitivity at the extreme edges. The soil moisture sensor is used to measure the loss of moisture over time due to evaporation and plant uptake, evaluate optimum soil moisture contents for various species of plants, monitor soil moisture content to control irrigation in greenhouses and enhance bottle biology experiments

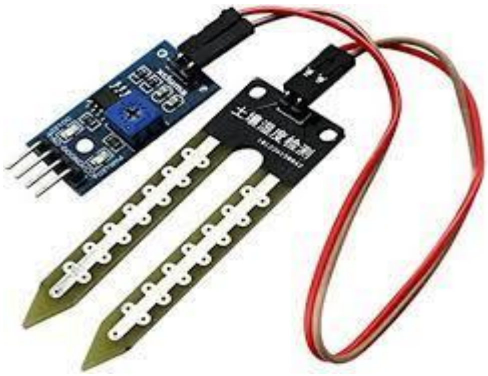

Fig 4: Soil moisture sensor

d) DC Motor Pump:

Smaller electric water pumps, such as the kinds used in homes, usually have small DC motors. The DC motor is contained in a sealed case attached to the impeller and powers it through a simple gear drive. In the centre of the motor is a rotor with coils around it. Around those coils are magnets, which create a permanent magnetic field that flows through the rotor. When the motor turns on, electricity runs through the coils, producing a magnetic field that repels the magnets around the rotor, causing the rotor to spin around 180 degrees. When the rotor spins, the direction of the electricity in the coil’s flips, pushing the rotor again and

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causing it to spin the rest of the way around. Through a series of pushes, the rotor continues to spin, driving the impeller and powering the pump .

Fig 5 : Dc motor

e)DHT 22 SENSOR :

The DHT22 sensor is a digital temperature and humidity sensor that provides accurate readings. It has a wide measurement range (-40°C to 80°C for temperature and 0% to 100% RH for humidity) and operates on 3.3V to 5.5V. Communication is digital, and it typically requires a library for easy integration with microcontrollers like Arduino. It's commonly used in environmental monitoring and home automation projects.

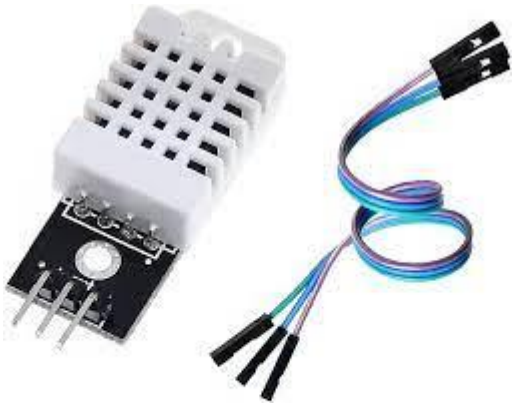

Fig 6: Dht 22 sensor

f)IOT Based Blynk Application:

Blynk is a platform with IOS and Android apps to control Arduino, Raspberry Pi and other similar controller boards over the Internet. It’s a digital dashboard where a graphic interface for a project can be built by simply dragging and dropping widgets. The interface of the application is shown in Figure 7 below. IoT based Blynk Application In this model the demonstration is about finding the water quantity in soil, supplying water whenever required for plant and measuring water level of a reservoir. The Soil Moisture Sensor which interfaced with microcontroller gets the values from the soil where it placed. The Soil Moisture Sensor is an analog one so these values converted into digital from by inbuilt ADC of ESP8266 NodeMCU. The digital form range is 0-1023 and this digital form represents the resistance of soil. For dry soil

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resistance is high and wet soil has lower resistance respectively.

FIG 7: BLYNK Application

g)RAIN SENSOR:

A rain sensor is a device used to detect the presence of rain or moisture. It typically has two states: dry and wet. When raindrops or moisture contacts the sensor's surface, it transitions to the wet state. Rain sensors are commonly used in weather stations, automatic sprinkler systems, and vehicle windshield wipers for rain detection and control. They help automate systems based on weather conditions and improve safety and convenience.

Fig 8: Rain sensor

VIII.RESULT

When water Level is Low the Water Pump Automatically Turn ON

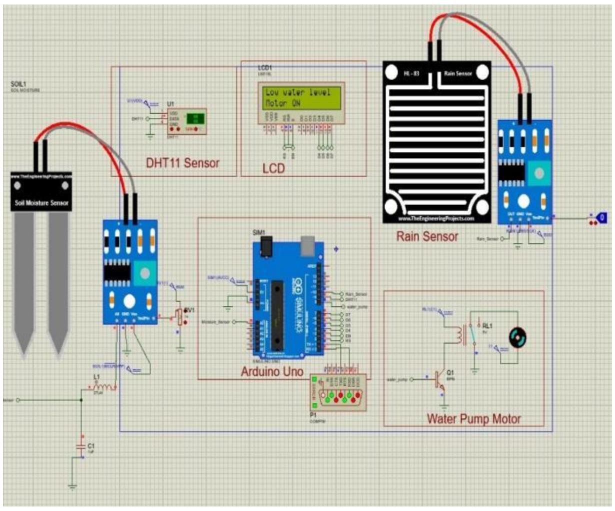

FIG 9 : Low Water Level: Motor ON

When the Water level Reaches above the limit the Water Pump Turn OFF Automatically

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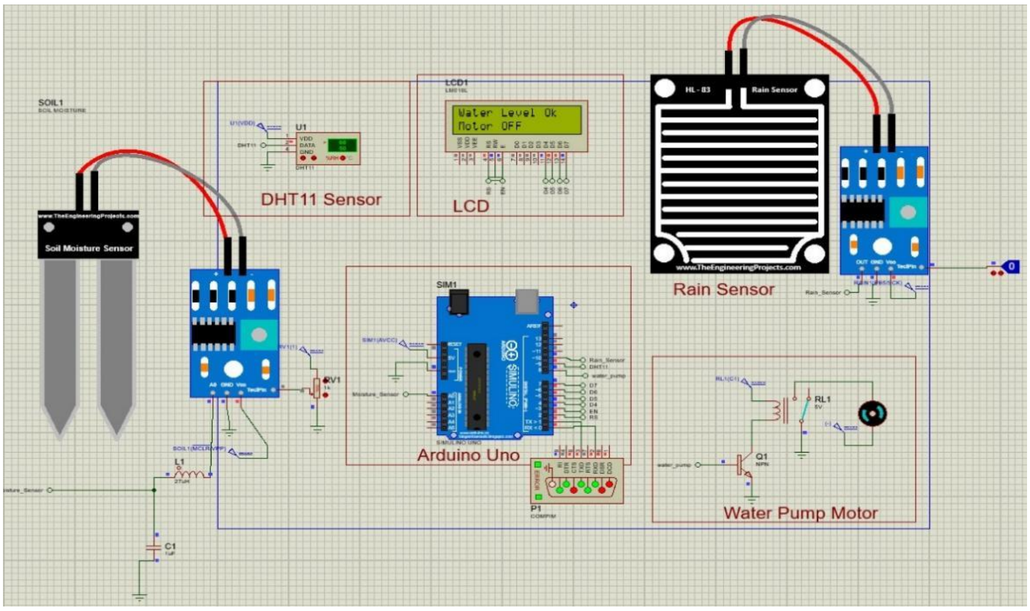

Fig 10 : Water Level OK: Motor OFF

Connecting the Blynk Application Server to the Interface for the Real Time Monitoring of the data from the Remote Location.

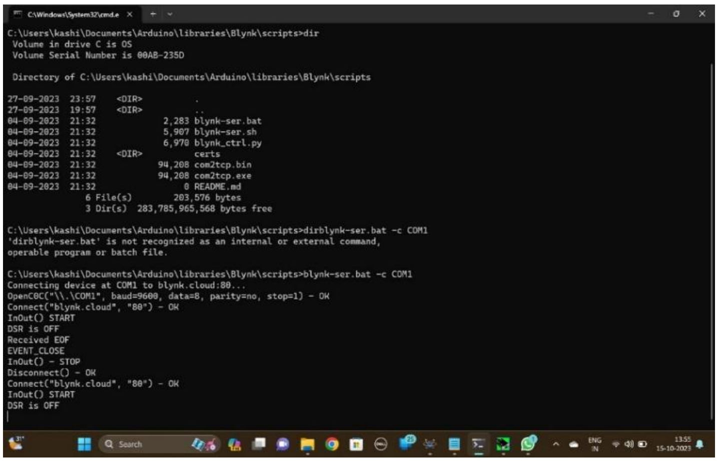

FIG 11 : Blynk Application Server

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Monitoring the Data from the Bynk Application

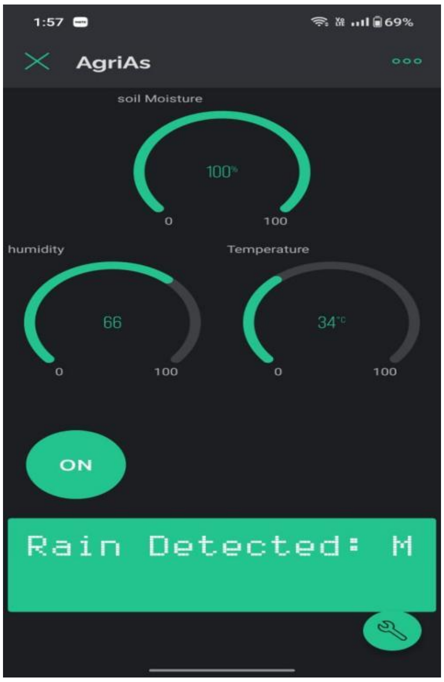

FIG 12: Blynk Application Interface 1

FIG 13 Blynk Application Interface 2

IX.CONCLUSION

In this work we developed a Agriculture Monitoring and Automation System using IoT which helped us to full fill the required automation in our irrigation fields and lands by synchronizing the system with BLYNK application for monitoring and control the system. moisture sensor and microcontroller in such a way that the data are transmitted with Wi-Fi module remotely and the devices are controlled through Blynk application. This transmitted information monitored and controlled by utilizing concept of IoT. The result shows us the three modules worked together to sense the moisture content of soil, analyzing the results fetched by the sensor, transferring data and communicating with user and lastly switching on or turning off the motor pump according to requirements. Such low cost, sustainable and environment friendly automated irrigation system increases productivity and reduces human effort in agriculture.

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