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IOT Based Smart Plant Monitoring System

Prathamesh Pawar[1], Aniket Gawade[2], Sagar Soni[3], Santosh Sutar[4], Harshada Sonkamble[5]
[1, 2, 3, 4]*BE Student, Department of Computer Science & Engineering, Vishwatmak Om Gurudev College of Engineering, Maharashtra, India.*
[5]*Mentor, Professor of Computer Science & Engineering, Vishwatmak Om Gurudev College of Engineering, Maharashtra, India.*

Abstract: ***As we can see in today's world only some devices like PC's and mobiles are connected to internet. Now-a-days world is fully overtaken by the internet and internet of things. Internet is use for basic need of all human beings. The Internet of Things (IOT) is the network of physical objects. It simply means to monitor a physical device or machine or it is inter-networking of physical devices which is embedded with electronics, sensors, software and network connectivity to enable it to achieve greater value and services by exchanging data with the manufacturer***
Agriculture is the backbone of our country; most of the people depend on agriculture. The main issue in agriculture is water scarcity. The water resource is not used in an effective manner, so the water is wasted. In order to overcome this irrigation process can be automated. The use of Internet of things in this field will be helpful to reduce the wastage of water. So that the temprature as well as humidity and light are measured by means of sensors and depend up on the outcome further processing can be performed. We propose a system that will capture all the details about the soil and the temprature by means of different sensors
IOT permits objects to be sensed or controlled remotely across the network infrastructure. The result improves accuracy, economic benefits, efficiency and reduces intervention of human. In this paper we are going to deal with basic and important concepts of IOT and its scope in upcoming future. This paper studies the need of IOT in day to day life for different applications and gives brief information about IOT. IOT contributes significantly toward revolutionary farming methods. So we are trying to demonstrate IOT in Automatic watering system. Automatic watering system monitors and maintain the approximate moisture content in soil. Arduino UNO is used as microcontroller to implement the control unit. The set up uses the temperature sensor, moisture sensor and humidity sensor which measure the approximate temperature, moisture and humidity in the soil. This value enables the system to useappropriate quantity of water which avoids over/under irrigation.
Keywords: IOT, Arduino UNO, NodeMCU 8266, Sensors, Arduino IDE, C++, Smart Plant Monitoring, Blynk App.

I. INTRODUCTION

Plant plays a vital role in maintaining the ecological cycle and forms the foundation of a food chain pyramid and thus to maintain the plant's proper growth and health adequate monitoring is required. Hence the aim at making plant monitoring system smart is using automation and Internet of Things (IOT) technology. This topic highlights various features such as smart decision making based on soil moisture real time data.

The computerized water system framework with IOT is practically and financially sufficient for planning water resources for plantation (group of a plant). Adopting the automatic water system framework we can demonstrate that the utilization of water can be decreased for various plantations (group of plants) usages. The system framework has an appropriated microwaves (wireless) chain of moisture content in the soil through soil moisture sensor, humidity and temperature sensor set in the root zone of the plants and level of water (ultrasonic) sensor is set in tank for checking the water level in tank. The data will gather from the sensors and send to the web server (cloud).

The background of chapter highlights the study of IOT in the field of agriculture. This shows how we can implement the IOT technology to make our planting smart and reliable with the real time updated data. This chapter also helps the beginners to implement the IOT technology and learn thebasics of this technology.

Internet of Things (IoT) plays an important role in most of the fields. The use of IoT increased because of the various advantages we can get from that. The agriculture is the area where a lot of improvement is needed because that is one of the essential needs and a large sector of people is involved in that. Most of the area the major problem is the water scarcity because of low rainfall and even though there is rainfall the water is wasted because of no proper arrangement for the storage of water. Many techniques are proposed in IoT in terms of providing a better irrigation to the crop. The IoT devices can also be used in home for monitoring the garden real time.

The Raspberry and Ardunio plays an important role in processing the information that is received from various sensors. The cost of these devices will be affordable and the major issue is the usage of large amount of sensors and other devices. Much research focus is on finding the effect of these devices in the environment, if it causes any side effects to the humans. The Rapberrypi is used wherever a large amount of processing is required and Ardunio in terms of interconnecting certain hardware devices and performs a little amount of processing. The installation of the sensors for finding the humidity level is one major factor to avoid the wastage of water.

Nomenclature

Arduino Board
NodeMCU ESP8266
Temperature & Humidity Sensor
Soil Moisture Sensor
Relay 5V

II. LITERATURE SURVEY

In India about 35% of land was under reliably irrigated. And the 2/3rd part of land is depending on \monsoon for the water. Irrigation reduces dependency on monsoon, improves food security and improves productivity of agriculture and it offers more opportunities for jobs in rural areas. Farmers are facing problems related to watering system that how much water has to supply and at what time? Sometimes overwatering causes the damage to crops and as well as waste of water. Hence for avoid such damage we need to maintain approximate water level in soil.

In this paper, humidity sensor, moisture sensor, temperature sensors placed in root zone of plant and gateway unit (ESP8266) handles the sensor information and transmit data to a android application. This application is developed for measure approximate values of temperature sensor, humidity sensor and moisture sensor that was programmed into a microcontroller to control water quantity.

III. MATERIAL & METHOD

A. Arduino UNO

Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

B. NodeMCU ESP8266

Wi-Fi Module: ESP-12E module similar to ESP-12 module but with 6 extra GPIOs,
Support UART / GPIO data communication interface / Transfer rate: 110-460800bps.
USB: Micro USB port for power, programming and debugging.
Headers: 2x 2.54mm 15-pin header with access to GPIOs, SPI, UART, ADC and power pins.
Miscellaneous: Reset and flash buttons.
NodeMCU is an open-source Lua based firmware and development board specially targeted for IoT based Applications. It includes firmware that runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module.

C. Temperature and Humidity Sensor

Relative humidity and temperature measurement
All calibration, digital output
Excellent long-term stability
Long distance signal transmission
Low power consumption

D. Soil Moisture Sensor

Soil Moisture Meter Testing Humidity Sensor
Soil Humidity Sensor
Soil Hygrometer Detection Module for Arduino
Connect the wires from the other (4-pin) side of the amplifier to an **Arduino board**. The VCC goes to 5V, GND to ground, A0 to an analog pin, and D0 to a digital Arduino pin.
Instead of using weather data, soil moisture sensor controllers utilize a soil moisture sensor placed belowground in the root zone of lawns to determine water need. ... Similar to ET controllers, soil moisture controllers have been shown to reduce irrigation, while maintaining turfgrass quality.

E. Jumper Wires

Jumper wires are used for making connections between items on your breadboard and your Arduino's header pins. Use them to wire up all your circuits.

F. Relay 5v

Coil Voltage : DC 5V;Rated Load : 7A/250V
Number of Pins : 5;Contact : SPDT
Switching capacity to 7A.

G. Hardware Connection

1) Node MCU sensor connect pin A0,3V And Ground Pin connected to the Soil Moisture Sensor of A0,VCC,Ground. The pin of Temperature and Humidity Sensor is Positive, Negative and Out connected to NodeMCU sensor pin 3v,D4,Ground
2) Take Soil Moisture sensor and DHT11 Sensor connect the jumper wire with Vcc pin, ground.
3) LED Light you can connect an led light for notification purpose it will blink when Selonoid wter pump start..

Blynk app Connected with the NodeMCU. This will add a plus point because you don't have to monitor the sensor it will Measure the reading Automatically.

IV. IMPLEMENTATION

The proposed Plant Monitoring System uses NodeMCU as microcontroller. NodeMCU comes with the inbuilt ESP8266 WiFi module which connects our system to blynk app using WiFi. The program which controls the functioning of the whole system is fed into the microcontroller using Arduino IDE which is an environment which integrates code with the hardware. Soil moisture sensor continuously detects the level of moisture in the soil and displays it on the Virtual LCD widget on the Blynk app. If the water content in the soil is less than what is required by the plant, a notification is sent to the user‟s smartphone and he/she can switch ON the button widget in Blynk app which will turn ON the water supply. Real time values from the DHT11 temperature sensor are also displayed on the virtual LCD. Excessive heat from the sun can be harmful for plants to prevent them from dying we introduced a green shade which will automatically be drawn over the plant with the help of two DC motors which rotate clockwise and anti-clockwise to help movement of the shade. Temperature more than 30 ºC can cause shriveling of plant.
When temperature increases this limit the motor rotates and cause the shade to move automatically. The user is notified about each and every step through the notification feature of the Blynkapp. Hence, this system monitors and controls the plants requirements remotely.

V. SYSTEM DESIGN

A. Methodology

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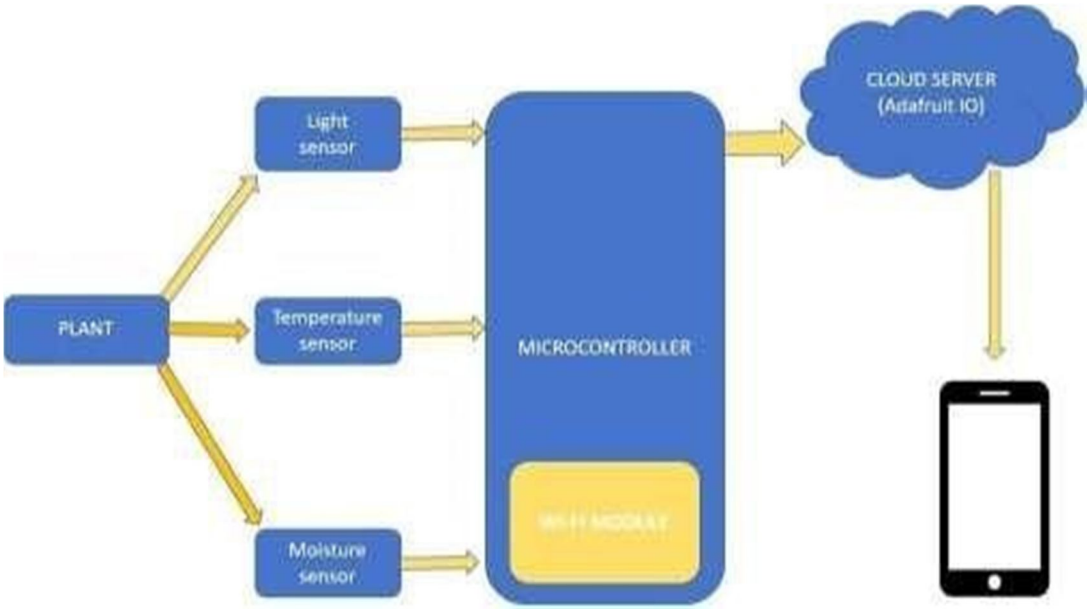
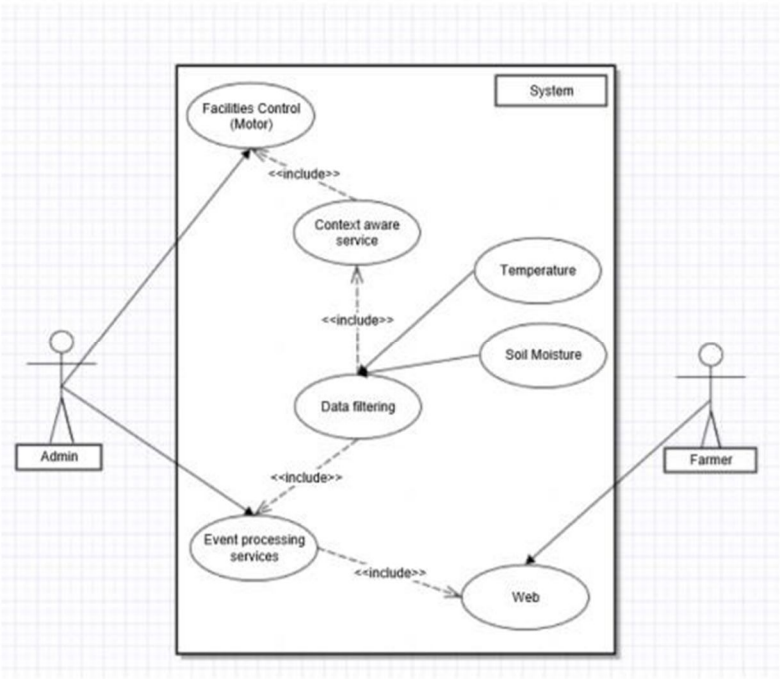
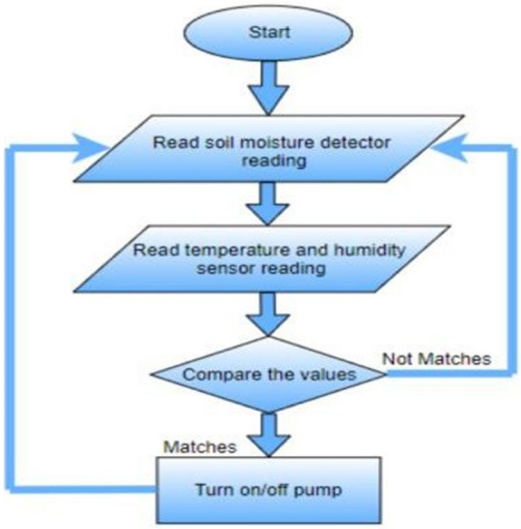
B. ER Diagram



C. Use Case Diagram



D. Data Flow Diagram



E. Result

Using Internet of Things we can establish communication between various household devices to bring out automation. Automation in routine household chores can save a lot of time and also organize the lifestyle of an individual. Point of this project was to layout a circuit that comprise of sensors and utilizing idea of Internet of things that monitors and analyses the information provided by the sensors and notifies the user regarding the changes in the plant's conditions. This plant monitoring systems a low cost system whose basic use is for the household purposes. Alongside it is kind of an interesting concept as the plant itself can call for water and protection whenever it needs it.The IOT system was thus developed using two major problems in context –to monitor and control the shade which inversely alters the amount of sunlight received by the plant. The catch of finding the correct shade time interval was crucial as too little sunlight would result in starvation due to lack of food preparation and too much would cause irreparable damage to the biological structure of it leading to eventual mortality

F. Problem Faced

Along the course of project completion, we encountered various problems and obstacles. Not everything that we had planned went smoothly during the project development span. Also, we had a limited amount of time for its completion so we were under a certain amount of pressure as well. We had to start from the research phase at the beginning and needed to gain knowledge on all the devices and components that we had intended to use for our project. Other phases of the project included coding, debugging, testing, documentation and implementation and it needed certain time for completion so we really had to manage the limited time available to us and work accordingly to finish the project within the schedule.

G. Future Scope

The performance of the system can be further improved in terms of the operating speed, memory capacity, and instruction cycle period of the microcontroller by using other high end controllers. The number of channels can be increased to interface more number of sensors which is possible by using advanced versions of controllers.

The system can be modified with the use of a data logger and a graphical LCD panel showing the measured sensor data over a period of time.A speaking voice alarm could be used.The device can be made to perform better by providing the power supply with the help of renewable source. Time bound administration of fertilizers, insecticides and pesticides can be introduced.

H. Limitation

1) Automated irrigation system uses only two parameters of soil like soil moisture and temperature other parameters humidity, light, air moisture, soil ph value not taken for decision making.
2) Excessive seepage and leakage of water forms marshes and ponds all along the channels. The marshes and the ponds in course of time become the colonies of the mosquito, which gives rise to a disease like malaria.

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VI. CONCLUSION

The implementation of Smart Garden system using the Internet of Things has been verified to satisfactorily work by connecting different parameters of the soil to the cloud and was successfully controlled remotely through a mobile application. The system designed not only monitors the sensor data, like moisture, humidity, temperature and ultrasonic but also actuates other parameters according to the requirement, for example, if the water level in tank is reduced to a minimum value then the motor switch is turned on automatically to the water level of the tank reaches the maximum value. The initial cost and the installation of this system are cheap and hence it can be implemented anywhere. With the development of sensor technology, the system can be elevated to the next level which helps the users to utilize their investment in an economic manner. If soil nutrient sensors can be installed, then the system can be modified to supply fertilizers to the garden precisely. This system saves manpower and efficiently utilizes the water resources available ultimately leading to more profit. The feedback provided by the system will improve the implementation of the gardening process

A system to monitor temperature, humidity, moisture level in the soil was designed and the project provides an opportunity to study the existing systems, along with their features and drawbacks. Agriculture is one of the most water-consuming activities. The proposed system can be used to switch the motor (on/off) depending on favourable condition of plants i.e sensor values, thereby automating the process of irrigation. Which is one of the most time efficient activities in farming, which helps to prevent over irrigation or under irrigation of soil thereby avoiding crop damage. The farm owner can monitor the process online through a android App. Though this project can be concluded that there can be considerable development in farming with the use of IOT and automation.

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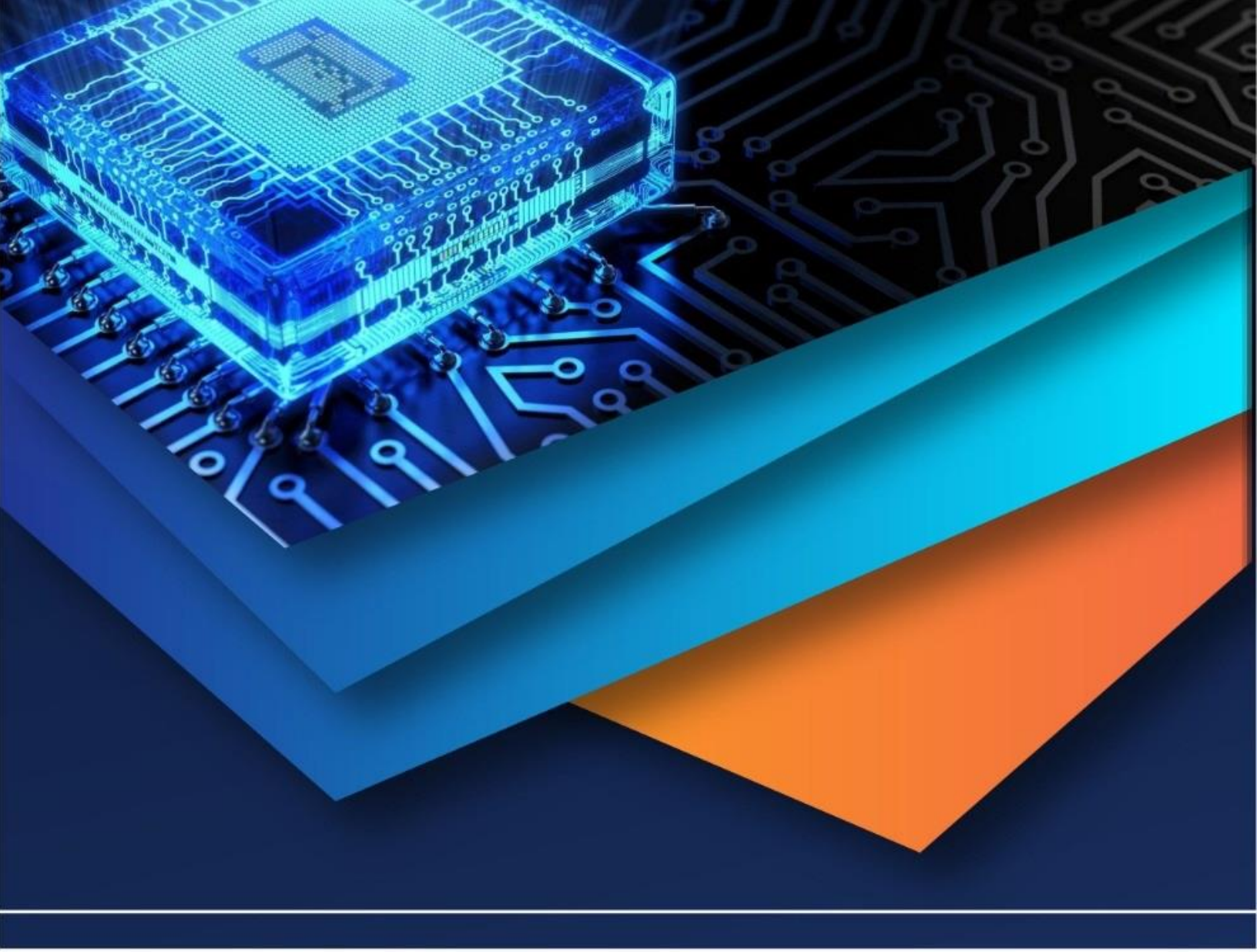

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