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Research Article on Smart Irrigation System using IOT

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Abstract: In this paper we have proposed smart irrigation system using Microcontroller NodeMCU ESP8266 . We have used the concept of Internet of Things. The system checks the humidity and temperature of the soil using the soil sensor and waters the plants based on the readings. Also the system will send an e-mail whenever the plants are being watered and all the relevant conditions of the plant like temperature, humidity etc. The principle that we've used is very simple and easy to implement. It'll save the manpower and is time efficient.
Keywords: IOT(Internet of Things), Smart irrigation system.

I. AIM AND INTRODUCTION

This project is all about a smart irrigation system. As we all know irrigation is the application of providing controlled amounts of water to plants at needed intervals. It helps to grow agricultural crops, maintain landscapes, soil, consolidation and revegetate disturbed soils in dry areas and during periods of less than average rainfall. The objective of our project is to design an automated irrigation system which is cost effective and time saving using Node microcontroller. The NodeMCU (Node MicroController Unit) is an open source software and hardware development environment that is built around a very inexpensive System-on-a-Chip (SoC) called the ESP8266.The proposed system will automatically water the plants when the soil moisture sensor detects insufficient amount of moisture in soil using as the centrecore. We also aim to connect the system with internet so that it can also manually be operated by smartphone app from anywhere-anytime.

The concept of this project is to allow the owners of fields to control and observe the growth of their plants in their farms. This is achieved by using a smart platform of IoT and solenoid valves to control the flow of water based on the moisture of the soil and gives real time surveillance to the owners who stay far away from the farms. This project also allows surveillance on the personnel and their crops so as to not occur losses. It is easy to use for anyone with a Smartphone and doesn't require maintenance once set up. This project has been designed for surveillance of irrigation systems in farms without the need of manual checking of irrigation systems. For example, if you are staying in Bangalore, and have your farm in Andhra Pradesh or elsewhere and it is not possible for you to go to the farms every time to keep a tab on the plants. Instead, this project allows you to check up on your plants using a simple IoT system. The positive part of this project is that, the node used to connect the system to your smart device, also controls the flow of water from the pump and also the timing intervals in between the irrigation cycles. In this paper we will be discussing all about the project as to how it is constructed and how it works.

II. LITERATURE REVIEW

Archana and Priya published a paper in which determined value of soil and a temperature sensor placed in roots of plantscontrol the switch on and switch OFF of the water motor. The drawback of their project is that they didn't include any technique to send the status of the agriculture field to the user. [2]

Karan Kansara build an automatic irrigation system project in which include the drawback of the Archana and Priya published paper. The drawback of this project is that this system is not capable to determine the nutrient value of the plants. [3]

The published paper on "Automatic Irrigation System on Sensing Soil Moisture Content" only includes measuring the moisture of the soil. Nut in our proposed system we have also included a temperature sensor along with soil moisture sensor.

Prof C.H.Chavan and P.V.Karnade proposed a system smart wireless sensor network for monitoring environmental parameters using Zigbee. In this model, nodes can send data to a central server, which stores and further process the data and then displayed it. The drawback is weather forecasting and nutrient content is not determined in their proposed system. [4]

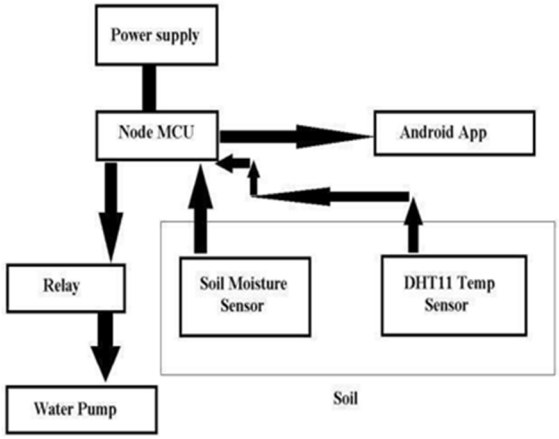
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III. HARDWARE DESIGN

There are two functional components in this project:

1) The Sensors (Soil Moisture Sensor, Temperature and Humidity Sensor) and the Motor/Water pump. The moisture sensors measure the moisture level (water content) of the different plants. If the moisture level is found to be below the desired level, the moisture sensor sends the signal.
2) The sensors and the water pump is connected to the microcontroller NodeMCU ESP8266.
3) On receiving the signal the Microcontroller triggers the Water Pump to turn ON and supply the water to respective plant. When the desired moisture level is reached, the system halts on its own and the Water Pump is turned OFF. The Temperature and Humidity Sensors measure temperature and humidity to provide data for data logging and deciding intervals for watering.

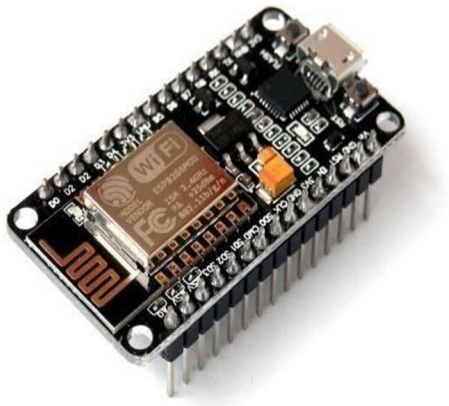
And in the last stage of the project an email is sent to the user regarding the real time state of the plant.



A. *Hardware Specifications*

These are the main components used in the project:

1) *Node MCU (ESP8266) Wifi Module:* NodeMCU [5] is an advanced Application Programming Interface for hardware input/output device. It uses a code like Arduino but rather is an interactive script named Lua. It is an open source IoT platform. It is implemented on a firmware of ESP8266 WiFi Soc produced by Espressif systems. NodeMCU has 16 input/output pins and hence 16 nodes can be connected to a single node. The ESP8266 is Wi-Fi Soc which is integrated with a Tensilica Xtensa LX106 core which is widely used in IoT applications.” NodeMCU” refers in default to the firmware rather than the development kits. ESP8266 is an inbuilt WiFi module.

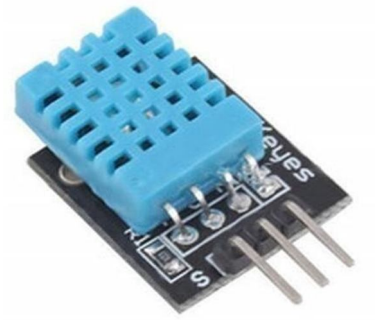


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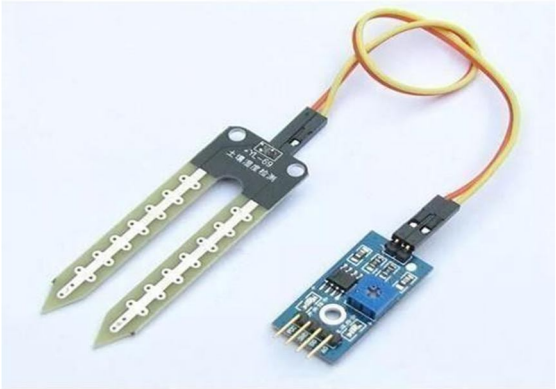
2) *Relay Module:* A relay is an electrically operated switch that can be turned on or off, letting the current go through or not, and can be controlled with low voltages, like the 5V provided by the Arduino pins.



3) *DHT11 (Temperature and Humidity Sensor):* The DHT11 [6] is a basic, low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and provides a digital signal on the data pin (no analog input pins needed). It is simple to use, but requires careful timing to collect data.



4) *Soil Moisture Sensor:* The soil moisture sensor is used to measure the volumetric content of water within the soil. It measures loss of moisture over time due to evaporation and plant uptake. It consist of two probes which are used to measure the volumetric content of water. The probes allow the current to pass through the soil and then it gets the resistance value to measure the moisture value. When there is more water the soil will conduct more electricity which means that there will be less resistance, therefore moisture level will be higher and vice- versa for dry soil.

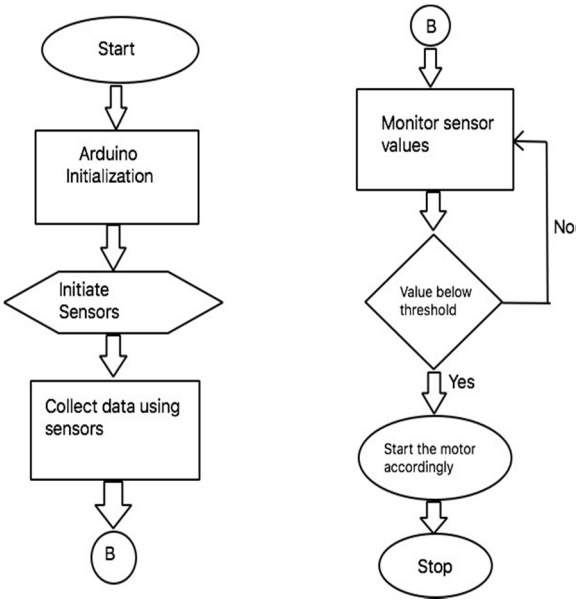


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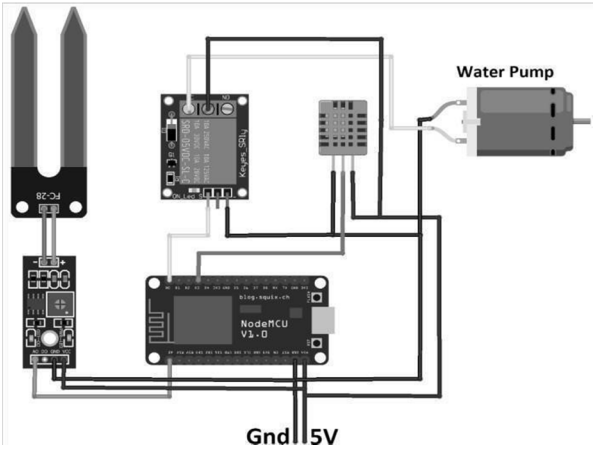
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IV. SOFTWARE IMPLEMENTATION

Arduino Integrated Development Environment (IDE) [7] is used to write the program. The Arduino IDE is a cross platform application (for Windows, macOS , Linux) which is used to write and upload programs to Arduino compatible boards and also with development boards such as NodeMCU. It is derived using C and C++.



V. CIRCUIT DIAGRAM



VI. ADVANTAGES AND DISADVANTAGES

A. Advantages

1) This idea is applicable in real life application.
2) Cost effective in production level.
3) User friendly.
4) It provides more accuracy compare to humans.

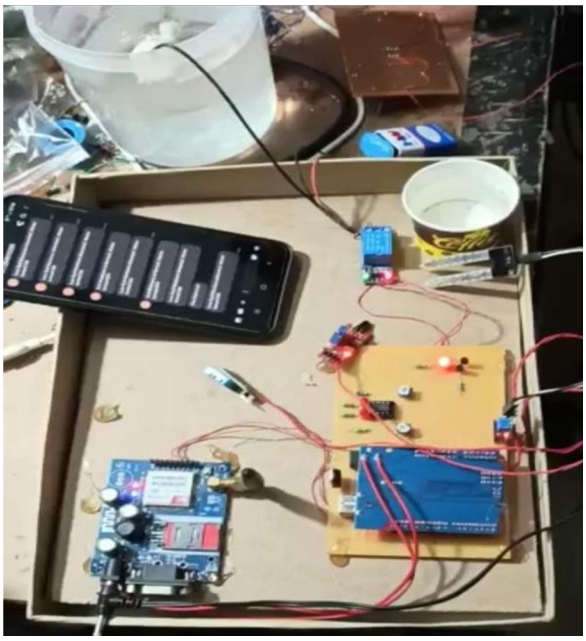
B. Disadvantages

1) User must have operational knowledge.
2) Programming knowledge is required.

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VII. RESULT AND CONCLUSION

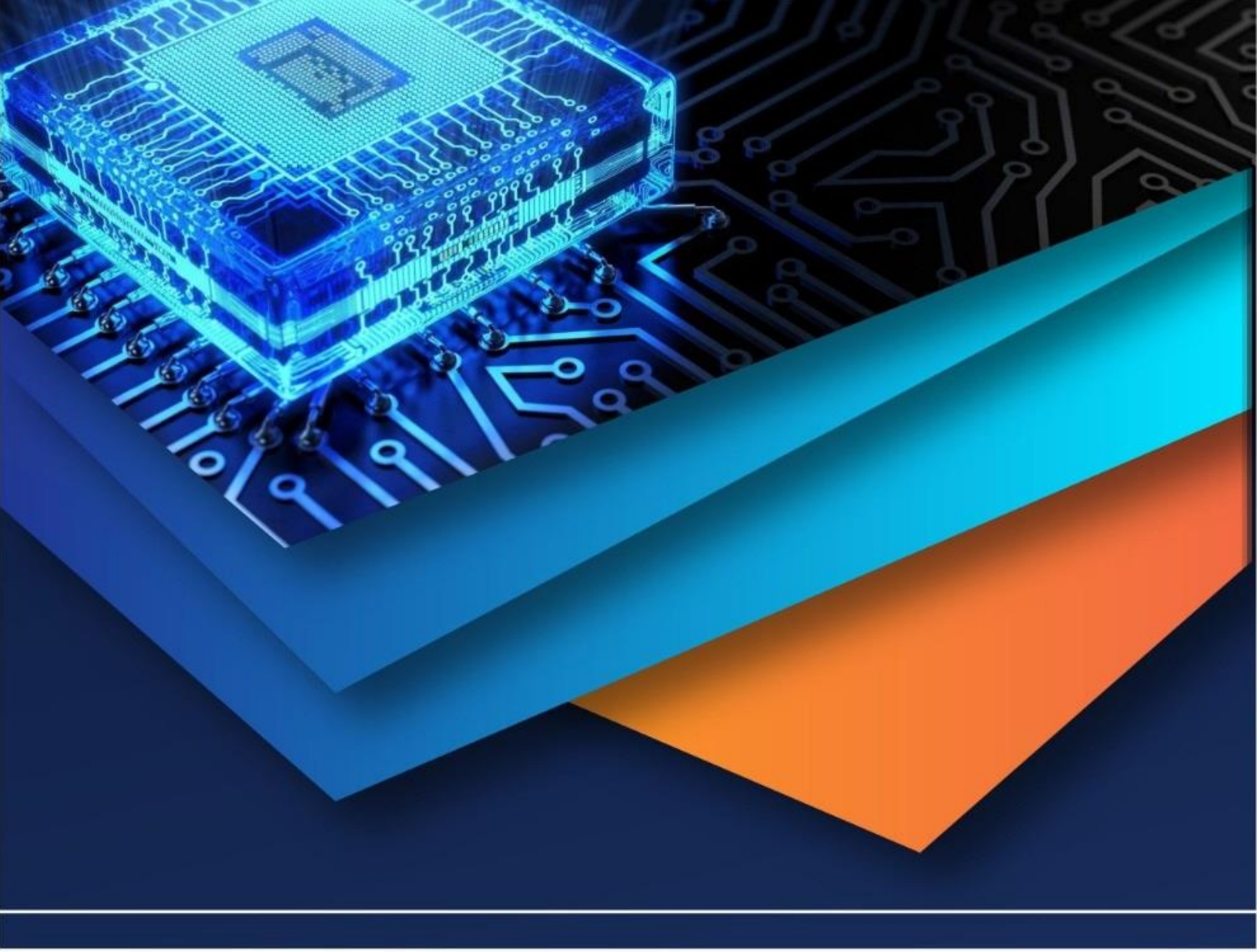
We have successfully designed and implemented a smart irrigation system using the concept of Internet of Things. This automated irrigation system is easily controlled using a computer. It behave as an intelligent switching system that detects the soil moisture level and irrigates the plant if necessary. This will also save time and energy, as well as minimize energy loss. With the use of sensors whose cost is low and with simple circuitry this experiment aims in low cost solution, which can be bought even by a poor farmer and it is also easy to implement.



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