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Smart Irrigation based on Soil Moisture and Cloud Monitoring over IoT

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Abstract:
Agriculture is becoming an essential portion throughout the world because of rise in population. Extensive challenge in agriculture is to develop farm productivity and quality of farming without continuous manual monitoring to meet the quickgrowing demand for food. The system is proposed using IOT, MPLAB and PROTEUS software. So, this paper focus onthe development of smart farming method which is economical and gives the automation in farm based on Internet of Things (IoT) to deal with the environmental unfriendly situations and also detects the moisture content in soil, PH level of temperature and humidity using moisture sensor.The main aim of the project is to make agriculture smart using automation and IoT technology.

Keywords:*IoT,Moisture sensor, AC submersible pump,LED, ESP8266 NodeMCU-12E,Wi-Fi Module,DHT11 Sensor*

I. Introduction

Agriculture is the backbone of Indian Economy. Improving farm yield is essential to meet the rapid growth in demand of food for population across the world. India's major root of income is from agriculture sector and more than 60 % of the people relies on agriculture. The current solutions for irrigation system can be operated manually which requires both man power and Continuous power supply, however irrigation systems has been improved to smart working system using Bluetooth technology and Arduino to provide scalability for network.

In order to manage and check the irrigation process, smart and self regulatingirrigation system is developed, Implemented and tested. There is a need for self regulating irrigation system because it is simpler compared to other and installation is easy. An irrigation system has been designed to facilitate the self regulating supply of adequate water from a storage to field or domiciliary crops in all seasonal agriculture. One of the most objective of this work is to analyze how human control could be reduced from irrigation and also to enhance the usage of water in the process.

The Proposed method engaged is to continuously monitor the soil moisture level to decide whether irrigation is necessary, how much quantity of water is needed in the soil and also humidity-temperature measured for quick irrigation based on soil moisture

This paper is organized as follows: section I Existing methods, section II Proposed method, section III Materials and methods followed by result in section IV and conclusion in section V.

II. Existing Irrigation System

This part illustrates the present methods of irrigation system in agriculture.

A. Irrigation system using Bluetooth technology

The automated irrigation and monitoring system consists of raspberry pi, water pump, moisture and temperature sensor. Smart phones module is used for communication. Crops or plants are considered along with their water requirement at different stages. The crops or plants are irrigated with respect to the water requirement at different stages of their growth. The idea is to concentrate on parameters such as soil moisture and temperature. A Bluetooth module[1] is used to create such as communication. Common commands like set passwords, set username etc. can be helpful to change arrangement if the Bluetooth module used.

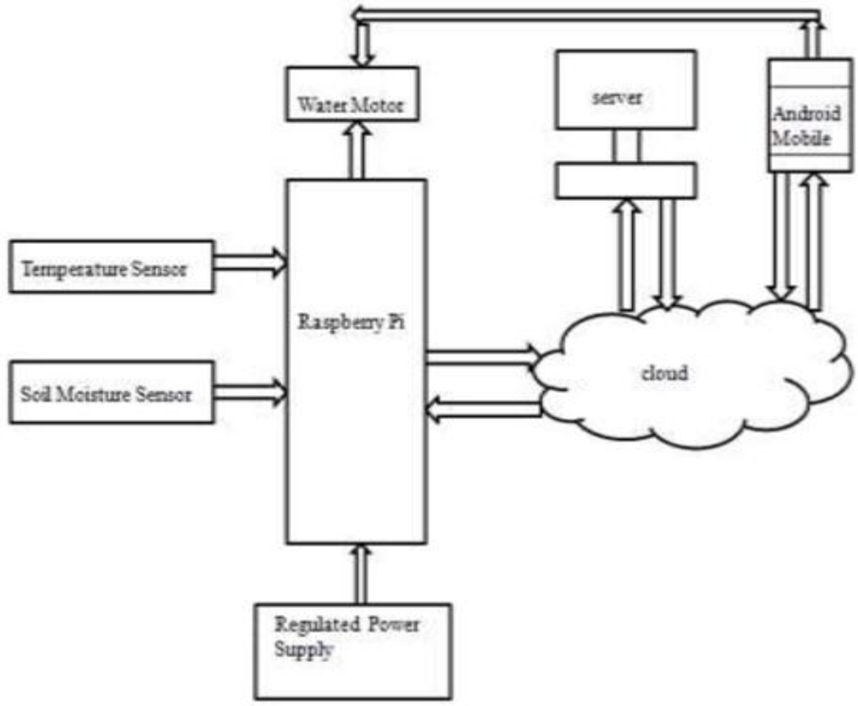

Fig. 1 shows the architectural design of the project.

The smart phone is connected to raspberry pi through Bluetooth. The motor is controlled by the smart phone by the values ON and OFF.

B. Smart irrigation based on soil moisture using Zigbee communication

This system is based on IoT that uses real time input data. Smart farmstead irrigation system uses android phone for remote monitoring and controlled of drips through wireless sensor network. Zigbee[2] is used for communicate between detector nodes and ground station. This architecture is intended using arduino technology to produce expandability for network. It uses AtMega 328 microcontroller at each node. The irrigation system is optimized in order to provide irrigation efficiency which will allow saving water as well as improving the crop quality

Fig. 2 smart irrigation using Zigbee

ISSN: 0193-4120 Page No. 16063- 16069

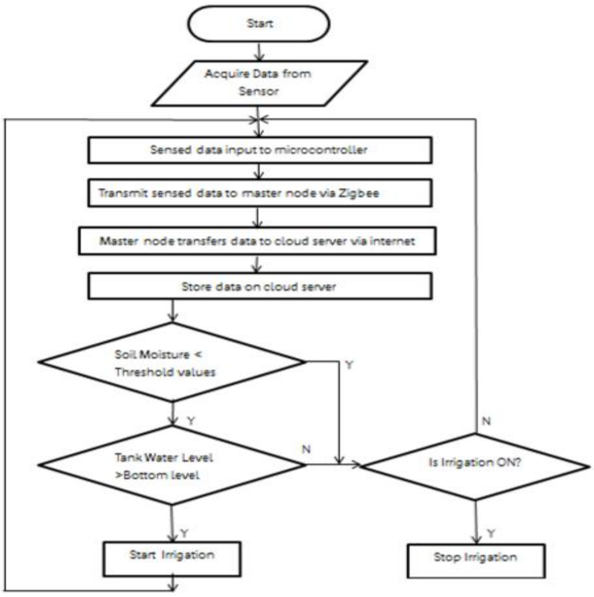

Fig. 3 Workflow diagram of smart irrigation using Zigbee

1.3 Modern irrigation method based on soil moisture using Arduino Technology:

This system consists of moisture sensor, Arduino board, smart phone, Bluetooth module, d.c. motor, laptop. The soil is watered as and when required by constantly checking the moisture level. Main ideology back of this project is to minimize human intrusion and effectively make use of water. This is made feasible by forwarding the received data to the android device using Bluetooth technology and module[4].The entire System is monitored and implemented by Arduino Uno Board microcontroller.

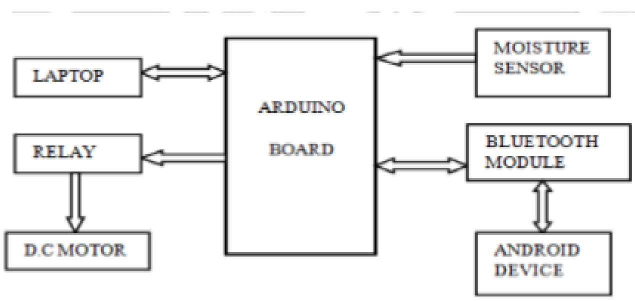

Fig. 4 Workflow diagram for modern irrigation method

III. Proposed System

The proposed automated irrigation and monitoring system consists of the waterpump,moisture sensor and temperature-humidity sensors using NODEMCU ESP8266. Smart phones module is used for communication. In the proposed work, crops or plants are considered along with their water requirement at different stages and thus the crops or plants are irrigated with respect to the water requirements at different stages of their growth.

The “Smart Irrigation system based on soil moisture and cloud monitoingove IoT” is implemented and tested successfully. It has been improved by integral features of all the hardware devices used. The system has been tested to function automatically. The moisture sensors determine the moisture level or water content of the various plants. If the moisture level goes less than the desired and limited level, the moisture sensor sends the signal to the Arduino board which instigates the Water Pump(Drip Irrigation) to switch ON and supply the water to respective plant. When the appropriate moisture level is attained, the system holds on its own and the water Pump is switched OFF even more the temperature and humidity is also measured using DHT11 sensor. Thus, the functionality of the complete system has been tested and it is said to function successfully.

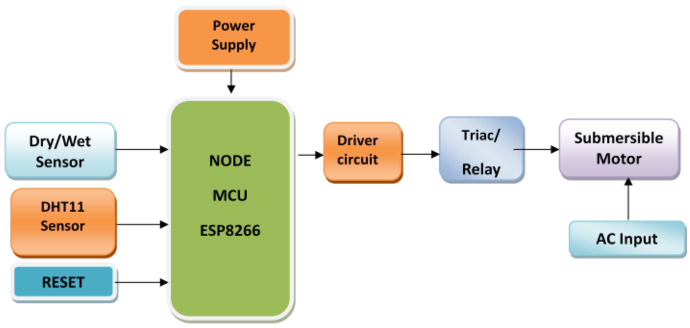

Fig. 5 Shows block diagram of the Proposed Method

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IV. MATERIALS AND METHODS

A. Soil Moisture Sensor

Sensors are the devices which converts the physical parameter into the electric signal. The system consists of soil moisture sensor. The output of the sensor is an analog signal which is then converted into digital signal and then fed to the processor. Copper electrodes are used to sense the moisture of the soil. The conductibility between the electrodes supports to determine the moisture content level.

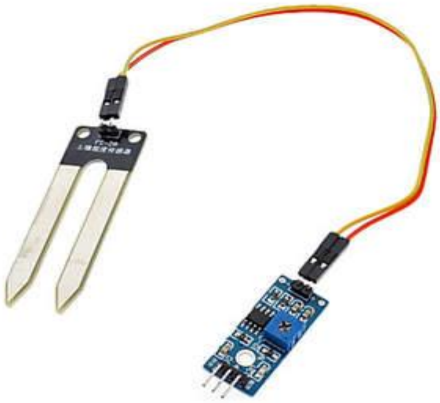

Fig. 6 Soil moisture sensor module

B. ESP8266 NodeMCU-12E

NodeMCU is used broadly in embedded applications for its ergonomical approach. It uses Wi-Fi and Lua script to run complex programs without any issue and recompilation and it is shown in figure 7. It is control board friendly as the pins are configured narrow and solid and it also used for the Arduino development environment [6]. It has the ability to control the readings of the sensor and has the property of bringing all the sensors into opt memory system processing. From the external hardware, it takes only limited number of value in consideration and only takes very little space in PCBs. It does not take any external hardware support for the Radio Frequency as it adjusts itself with the on-board RF signals. It can also be integrated with Bluetooth, BLE, etc.

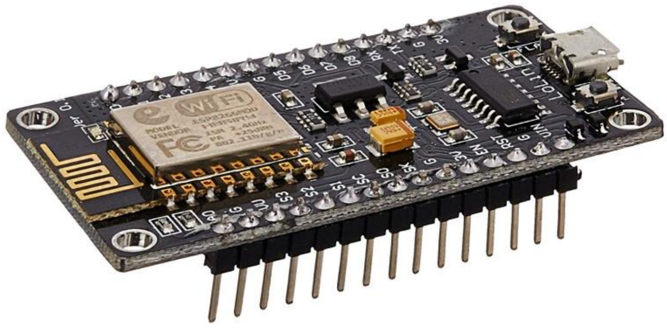

Fig. 7ESP8266 NodeMCU-12E

C. Relay

A **relay** is an electrically operated switch. It consists of a set of input ports for one or more control signals, and a set of function contact ports . Relays are used where it is necessary to manage a system by an self sufficient less energy signal, or where several circuits must be controlled by single signal. Relays were first used in far distance flash circuits as signal repeaters.

They refresh the signal approach in from one circuit by transferring it on another circuit. Relays were used greatly in telephone exchanges and previous computers to perform logical operations.

Fig.8 Relay

D. DHT11 Sensor

To measure temperature and humidity DHT11 Sensor is used, it is used for serialized digital output. DHT11 can be combined with various microcontrollers like Raspberry Pi, Arduino etc to get immediate results. DHT11 is a low expensive Temperature and Humidity sensor which provides high accuracy and long duration stability.It uses a capacitive thermistor and humidity sensor to determine the neighbouring airand generates a digital signal on the data pin (no analog input pins required). Its very easy to uselibraries and example codes are accessible for Raspberry Pi and Arduino.

This module is simple to attach the DHT11 sensor to an microcontrolleror Arduino as it includes the pull up resistor required to use the sensor.Three connections are needed to use the sensor - Vcc,Gnd and Output. It has moreauthenticity and finest long-term stability.They are commonly used to detect the humans present in a room and security alarm systems. PIR sensors are used as motion detectors in many applications such as Hospitals, ATM and libraries.

Fig 9:DHT11Sensor

E. Submersible motor:

An electric submersible motor is a pump that can be fully immersedin water.

The motor pump is hermetically fixed and closely connected to the body of the pump.A submersible motor pumps water to the surface by remodel spinning energy into kinetic energy and then to pressure energy. This will make the water being pulled into the pump.Initially in the intake,where the spinning of the simpler pushes the water and passes through the diffuser. From that point it flows to the surface.

The main advantage to a submersible motor pump is that it never has to be prepared, because it is earlier submerged in the fluid. Submersible pumps are also very adequate.Water pressure drives the water into a submersible pump, thus “saving” a lot of the pump’s energy.

Fig10 : Submersible motor

V. Hardware and Software Result

Hardware and software results showing the smart irrigation using soil moisture:

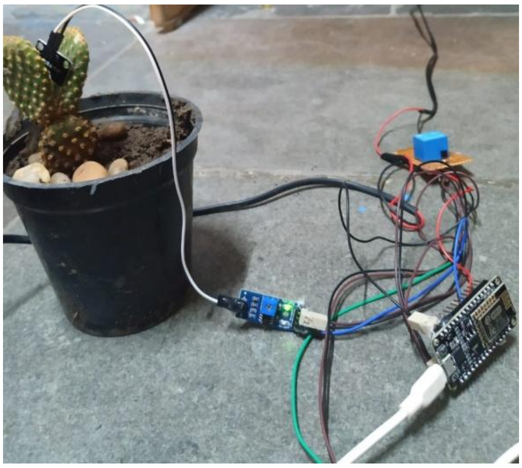

Fig.11 Dry soil Detection

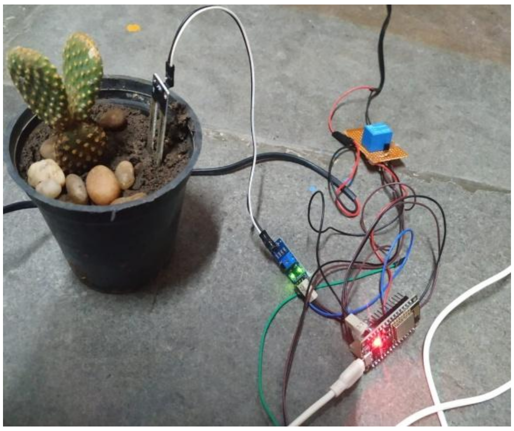

Fig.12 Wet soil Detection

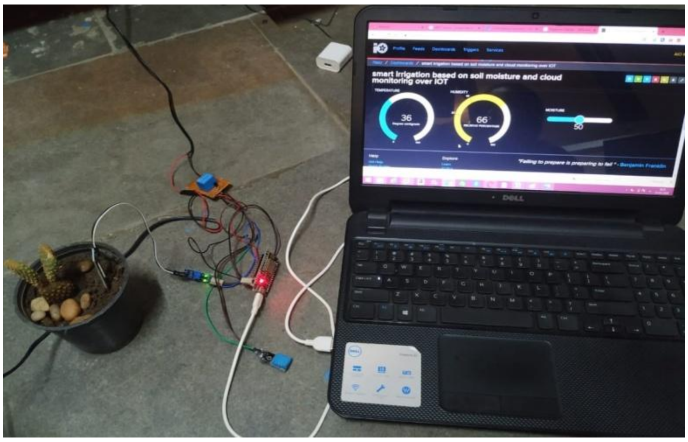

Fig.13Set up

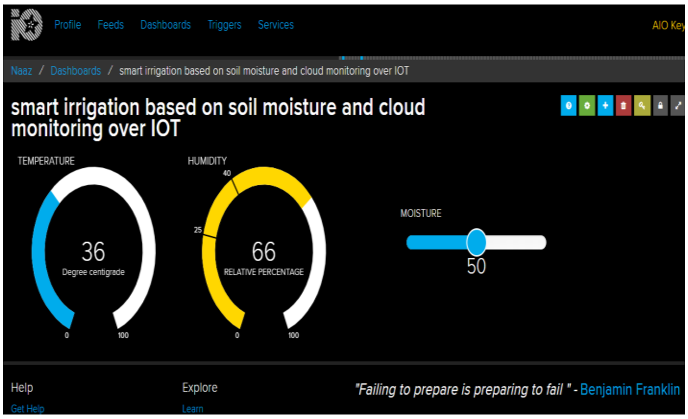

Fig.14 Software result of Temperature and Humidity

Fig.15 Drip Irrigation System

VI. CONCLUSION

Thus the "Smart Irrigation system based on soil moisture and cloud monitoring over IoT" is implemented and tested successfully. It has been improved by integrated features of all the hardware components used. The system has been tested to function automatically. The moisture sensors measure the moisture level (water content) of the different field crops. If the moisture level goes less than the required and limited level, the moisture sensor forward the signal to the Node MCU board which activates the Water Pump(Drip irrigation) to switch ON and provide the water to respective plant. When the particular moisture level ,Humidity and Temperature Level is reached, the system holds on its own and the water Pump is switched OFF. Thus, the functionality of the system has been tested entirely and it is said to function successfully.

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