

PLANT MONITORING SYSTEM

Khush Patel
Information Technology
C S Patel Institute of Technology,
CHARUSAT
Changa, India
20it098@charusat.edu.in

Rudra Patel
Information Technology
C S Patel Institute of Technology,
CHARUSAT
Changa, India
20it111@charusat.edu.in

Parth Shah
Information Technology
C S Patel Institute of Technology,
CHARUSAT
Changa, India
parthshah.ce@charusat.ac.in

Abstract—Technology has bought the unexpected revolution to each field of common man's life by introducing innovative technology to make thing smart and intelligent. Internet of Things (IoT) refers to a network of things which make a self-configuring network. The development of Intelligent Plant Monitoring IoT based device can turn plant easier and help in reducing wastage. The paper describes IoT based Plant monitoring System aiding the users the Live Data (Temperature, Soil Moisture) for efficient environment monitoring which help to improve the method of planting with coordinate of Technology. It will beneficial to increase their overall growth and quality of plant. The IoT based Plant monitoring System is being integrated with Arduino Technology mixed with different Sensors and a WIFI module producing live data which will connected by an application made on flutter, so it could support both Android as well as iOS. The application will show the data (Temperature, Moisture of Soil) So that it could get idea when to supply water to plant. Mostly, people supply water at a particular time each day, without knowing the necessity of plant. It should be understood when plant need water accordingly, it should be supplied. Due to this both things can be saved water and fulfill the requirement of plant.

I. INTRODUCTION

A. Overview

The main aim of this work is to propose IoT based Plant Monitoring System which will enable the owner to have live data of soil moisture environment temperature at exceptionally low cost with live monitoring.

B. IoT Technologies and Monitoring

Internet of things is of two words Internet and Things. In this the term things reflects the various IoT devices which have some unique identities. It have capabilities to perform remote sensing, live monitoring of certain sort of data. IoT applications collect the data, then process them and send them to various servers. Mancuso and Franco [2], had already done similar research on tomato greenhouse in the South of Italy.

An ideal IoT device consists of different interface for connecting device. IoT devices can be of various forms such as smart watches, IoT smart home monitoring, IoT intelligent transport systems, IoT smart health devices etc.

Automated irrigation system [3] is one of the relevant examples to minimize use of water for agriculture crops. Soil

moisture sensor was inserted to measure water content in soil. The system was tested in a sage crop field for 136 days.

C. IoT Enabling Technologies

IoT has a fanatical support of various other technologies such as Wireless Sensor Networks, Cloud Computing, Big Data, Internet and Search Engines, Communication Protocols, etc.

- **Wireless Sensor Network (WSN):** It include sensors or nodes which are integrated in such a way that it can watch data in sorted form.
- **Cloud Computing:** Cloud computing supplies shared processing resources and data to computer and other devices according to the demand. It could be in any form such as IaaS, PaaS, DaaS, etc.
- **Big Data Analytics:** Big Data analytics is needed to examine large amount of data sets which hold various forms of data types. Big Data is used to uncover hidden patterns, market trends, etc.
- **Communication Protocols:** It work as backbone of IoT ssystems to supply connectivity for applications and protocols which allow us to exchange of data over the network.

D. Plant Monitoring using IoT

As IoT is already adopted in different field such as Industry, Homes, now it seems everything could be Intelligently and smartly managed.

So, it is time to simplify problems with help of IoT and on large scale, it could even help Agriculture with help of IoT.

Following are the benefits for IoT in Plant Monitoring:

- 1) *IOT (Internet of Things) help to manage a substantial number data collected from sensors and connectivity among all the parties concerned.*
- 2) *IoT is regard as one of the components for Smart way to check Plant with correct sensors and smart equipment's.*
- 3) *With the help of IoT, quality of product can be improved.*
- 4) *With IoT, level would be increased in terms of usage of soil, water, fertilizers, etc.*
- 5) *IoT will indirectly lead to improve our environment.*

Initially, implying on a plant but on a large scale it could use IoT on a large scale in an agriculture level which could use by farmers.

IOT will be used as future in many sectors and agriculture is one of it. Back before IOT was not recognised much but thanks to technology, IOT is very well known to most of people. Due to its implications, it is easy to recognise and it will create a significant impact on future as data shown in Table (1). In current scenario 600 million farmers all over world is known for their use of IOT based technology. In 2050, it could be predicted that over 2 billion farmers will be using IOT based farming.

TABLE I. SHOWS THE GROWTH OF IoT BASED ADOPTION IN AGRICULTURE SECTOR FROM YEAR 2000-2016 AND FORECASTS OF YEAR 2035-2050.

Year	Data Analysis
2016	Almost 540 million Farms till Date are connected to IoT
2035	780 million Farms would be connected to IoT
2050	2 billion Farms are likely to be connected to IoT

The structure of the paper is as follows: Section I covers the overview of IoT Technology and Concept for Planting with IoT [1]. Section II covers the applications of IoT based Monitoring, the components and modules used in it. The working principal is also explained in it. In section III algorithm, flowchart of overall process which is carried out by system are covered. Section IV includes conclusion, future scope, and references.

II. PROPOSED WORK

A. IoT based on Smart Planting System

IoT based Plant Monitoring System is focused on Live Monitoring of Environmental data in terms of Temperature, Moisture and other types which depends on the requirement of sensors used in our system. It helps to get Live data on various devices which will generated via sensor and can be viewed easily.

In [4] authors reported about different sensors, microcontrollers. The system can be developed at low power device. Remote control with wireless sensor network technology proved, by reducing manual work and converted to automation remote system. The proposed system will later sort the data via Big Data Analytics from time to time.

B. Components and Modules

In this section, the parts and modules which are being used for IoT based Plant Monitoring System are being discussed:

1) WIFI MODULE- ESP 8266

WIFI module is SOC (System on Chip) with IP (Internet Protocol) protocol stack integrated which facilities any microcontroller to access WIFI network as shown in Fig. 1. ESP8266 is less expensive module and support Applications [5]. It is an open-source Lua predicated firmware and development board specially targeted for IoT predicated Applications. It includes firmware that runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is predicated on the ESP-12 module.

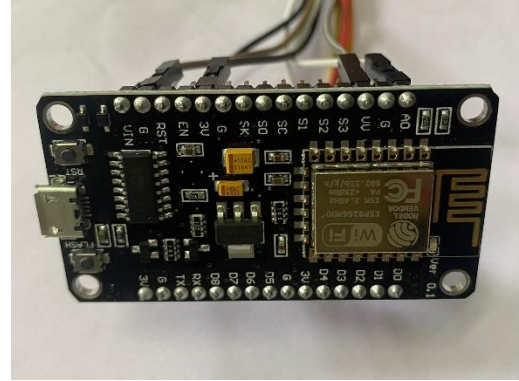


Fig. 1 Nodemcu esp8266

2) Sensors

a) Temperature Sensor

Temperature sensor supplies 9-bit to 12-bit Celsius temperature measurements and has alarm function so it could send an alert on time [6]. Temperature Sensor can measure -55°C to $+125^{\circ}\text{C}$; So that it could convert 12-bit digital word in 750ms.

b) DHT 11

DHT 11 is a low-cost digital temperature and humidity Sensor as shown in Fig. 2. It uses capacitive humidity sensor to measure the atmosphere in the surrounding. It shows the digital data signal on a data pin. As referred from reference [7].

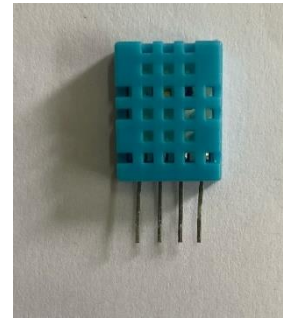


Fig. 2 DHT11

c) Soil Moisture Sensor

As the Fig. 3 suggest it is used to measure the moisture of soil and similar materials. The sensor holds two long pads which functions as information collector for the sensor. Two of them together acts as variable resistor.

When the water level will reduce in soil, voltage will be shown low and this will increase when the conductivity between electrodes in the soil changes. It will ease watering the plant.

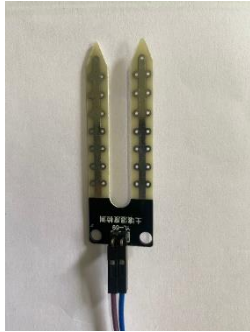


Fig. 3 Soil Moisture Sensor

3) BATTERY

It is a common size battery with rectangular prism shape (Fig. 4). This nine-voltage format is commonly available in primary carbon-zinc and alkaline chemistry. It is built of six individual 1.5V LR61 cells enclosed in a cover.



Fig. 4 9v Battery

4) Motor

It is a primary mover or motor that works on principal of Kinetic Energy, or by weight of water. A waterwheel is fitted to supply water. Image can refer from Fig. 5. Micro DC 6-9V Submersible Pump Mini Water Pump DC Motor.



Fig. 5 Motor

5) RELAY MODULE (1 CHANNEL)

A relay module (Fig. 6) is an electric switch that ran by an electromagnet. It can allow current to pass or to hold which could be controlled by Arduino pins. It can have a relay rated up to 10A per channel at 250VAC or 30VDC.



Fig. 6 1-Channel Relay Module

6) JUMP WIRES

They are simple wires that include connector pins at each end, it allows to connect two points to without any soldering. As it seems in fig (7).



Fig. 7 Jump Wires

C. Circuit Description and Working Principal

In below circuit ARDUINO is being programmed and connected to sensors (soil moisture and temperature) and a Node MCU. The main task is to collect data from sensor and pass to WIFI module. The module will keep the system updated through the application with help of WIFI. The real time data will keep on updating on its own. A battery is connected to relay to supply current in circuit to make it work. It can supply power by adapter to NodeMCU circuits. Working model can be verified from Fig. 8.

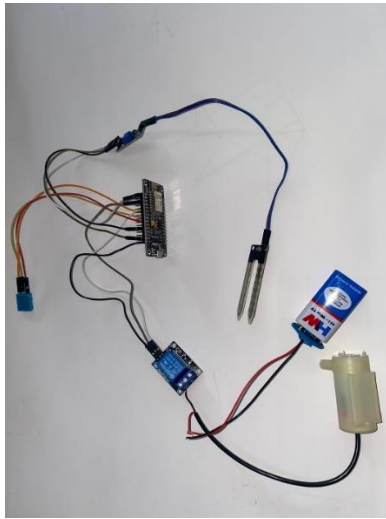


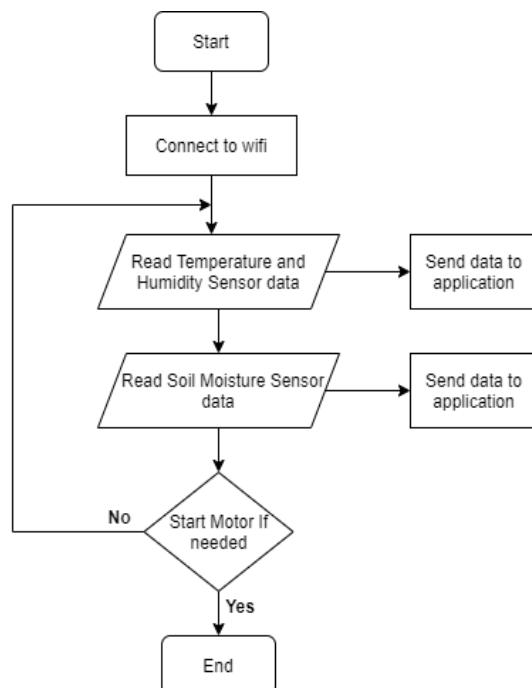
Fig. 8 Working Model

III. PROCEDURE & FLOW CHART

A. Procedure

Connect the battery with motor in series with relay module. Once all the connections are done, connect WI-FI with Nodemcu and parallelly connect Wi-Fi with the device. Once its ready open app and soil moisture and temperature and humidity will be displayed with help of their respective sensor. All the data will be transmitted to application, so that it could be refer whether plant need water or not. If it seems required start the motor to supply water to plants. Application will update its data frequently so it is easy to view. From this it will save our time as by just using an IoT based app we could measure a plant requirement and can even save water.

B. Flowchart



IV. CONCLUSION & FUTURE SCOPE

A. Conclusion

IoT predicated keenly intellective monitoring of temperature and moisture has connected utilizing Arduino. The system is highly correct in accumulating data. It would avail to preserve water as it will show when plant required water. Due to soil moisture sensor, it can get constant data for soil moisture. So, it can tell via application that when water is needed. Application has facility to turn ON/OFF the motor. So that it could be facilely manage the plant. For other applications refer to [10].

B. Future Scope

Later, it could be focused more on increasing sensors and can control whole farm. More number of sensors can be fixed at a fixed distance to fetch data. Then Pest Control and GPS module can be used. Due to IoT it would be interesting, and many people could find it interesting and adapt this technology.

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