

# Smart Plant Monitoring System for Plant Fitness Using IoT

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## Abstract

Technology has made amazing strides in all regions of lifestyles which includes enterprise and agriculture. Agricultural improvement is vital to our survival. Researchers are looking to comprise current era into agriculture to broaden new techniques to enhance agricultural lifestyles. People in large towns have a difficult time retaining their veggies in exact condition. This article indicates smart IoT based plant fitness tracking system using microcontroller, sensors like soil moisture, Light detecting register. With the assist of Bolt-IoT cloud user may be capable of get statistics approximately plant fitness on their phone App. Users might be capable of higher control their gardens plant fitness and increase with the assist of this system. The basic application is terrace garden where working people can take care of their plants at office time plus get updated information on their Mobile App. The cause of this system is to introduce and enhance the improvement of IoT for cultivating terrace garden in smart towns in our society.

**Keywords:** IoT, NodeMCU, Smart Garden, Bolt-IoT cloud.

## I. INTRODUCTION

Everything in the world can now be automatically controlled and influenced. Our nation's agriculture depends heavily on crop monitoring because crops were grown under carefully managed climatic conditions for maximum yields. Automation is the process of taking over control of industrial equipment and operations from humans. The Internet of Things (IoT) is a method for using computers, mobile phones, or digital gadgets to monitor and control basic aspects of daily living. In this document, the technology of the plant monitoring system provides feedback to the user via smartphone or laptop [1]. These types of systems can monitor plants using IoT and cloud computing. This automatically helps in the sustainable growth of the plants with good health and best yield. The system uses various modules such as Bolt-IoT cloud, microcontroller, LDR (Light Detecting Resistor) and soil moisture sensor [3]. Automated systems reduce the need for human resources and hence reduce errors. This finally helps to easy the process of taking care of plants manually and helps the user to get the day by day update of the plants health status.

## II. BACKGROUND

Humidity levels exceeding 80-85% since they can increase the likelihood of disease and impede plant growth. Therefore, it is important to routine check the humidity of corps for their benefit. With the aid of MATLAB analysis, an innovative approach of physical parameter monitoring, data display, data integration to the cloud, alarm production, and value prediction is put into practice. Building an integrated system that will address all these issues. For instance, the essential elements such as temperature, humidity, water and nutrients are important for plant growth. Global Warming makes smart farming extremely vital. Real-time environmental and water management monitoring is a

crucial factor to take into account in smart plant monitoring [2]. With the use of a wireless sensor network the gardener will be able to govern faraway areas easily and thus they could take care of their plants health in a better way. There are hurdles like the perfect fusion of sensor, information interface, irrigation control, connectivity, and software design yet design systems that have the edge. This offers a framework for remote sensor monitoring using GSM and GPRS advancements, which could be an early indicator of the productivity of e-farming [5]. The major goal of this e-gardening creation is to enjoy gardening process by people and more people enroll for gardening.

### III. PROPOSED SYSTEM

The proposed system consist of NodeMCU ESP8286 with WIFI Modul, they serves as the basis for the prototype as show in figure 1 [4]. The ESP8286 WIFI MODULE is the brain of the system and is connected to the soil moisture sensor and LDR (Light Detecting Resistor) to detect the time to time status of the plant and inform the user immediately if there occurs any problem for the plant development or any resource is lacking for the plant.

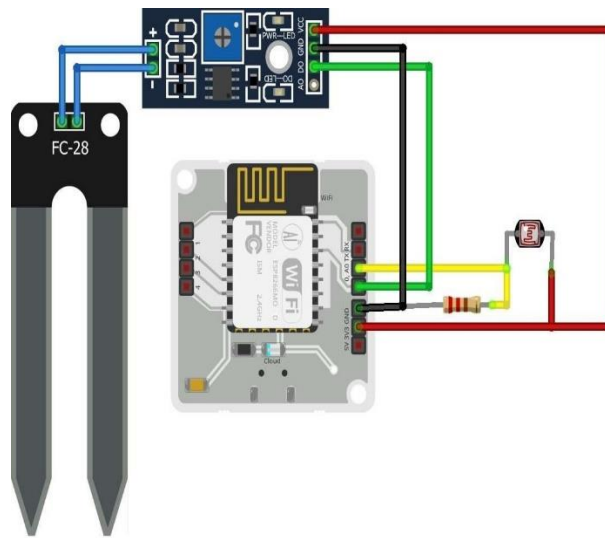


Figure 1 Interfacing Diagram NodeMCU with WiFi Model and Soil Moisture

Steps to design the system as show in figure 2 & 3

1. Join the LDR's two ends, one end to pin A0 and the other end to the 3.3V power supply.
2. Connect a 10k ohm resistor between the volt's A0 and GND pins.
3. Next, connect the Vcc, GND, and Do (digital output) pins of the amplifier circuit to 3.3V of the volt unit using the female header, and attach the soil sensor probe to the circuit using female header wires.
4. Insert the soil sensor probe into the plant, then turn the bolt on.
5. Create an Integromat account first on the website integromat.com.
6. To create a new scenario after creating your account, by clicking on the Create New Scenario icon.
7. In the services, select Twilio messaging and Bolt IoT.
8. Now try to create the necessary logic flow using the services.

I. BLOCK DIAGRAM OF THE SYSTEM

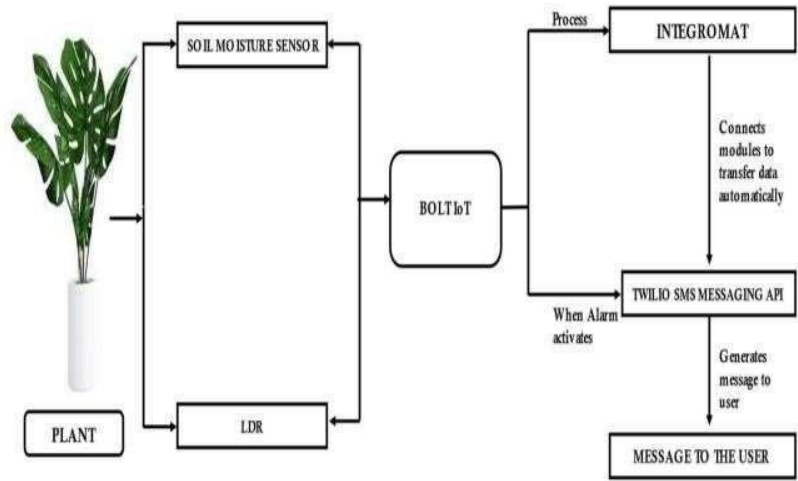


Figure 2 Block Diagram of the system

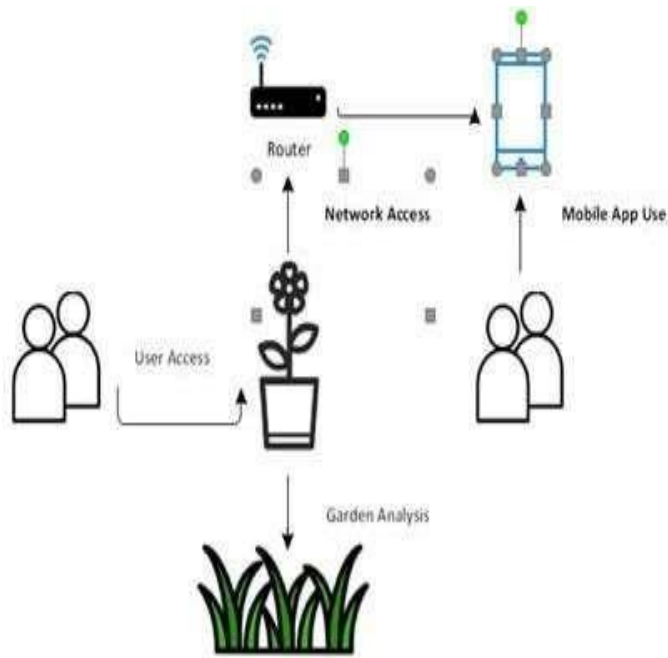


Figure 3 Representation Flow

ANALYSIS OF THE BLOCK DIAGRAM

1) Bolt IoT Platform: Provides the ability to control the device and securely and reliably collect data from IoT devices as show in figure 4.

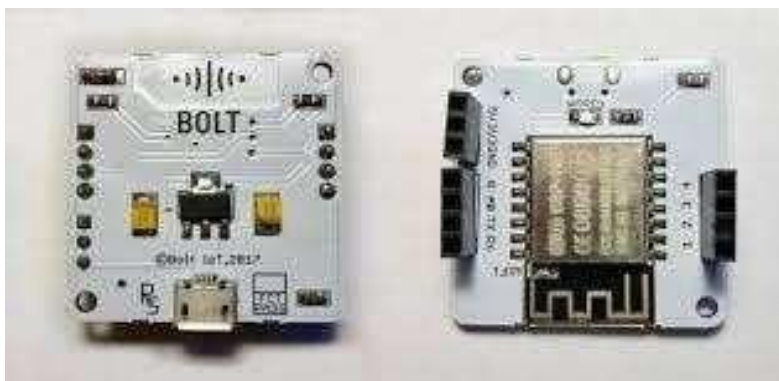


Figure 4 Bolt IoT

2) Integromat: The role of Integromat is to create an environment that automatically sends and transforms data by simply connecting the app to a compact module. It recognizes the RFID tags are affixed to the products using EM-Fields. Every tag has a unique serial number.



Figure 5 Twilio

3) Twilio: Twilio is the latest communication API that developers use to build communications. The Twilio Communications API enables voice, messaging, and video conversations within web and mobile apps as show in figure 5. This makes it easy for developers to communicate between different apps as shown in figure 6 .

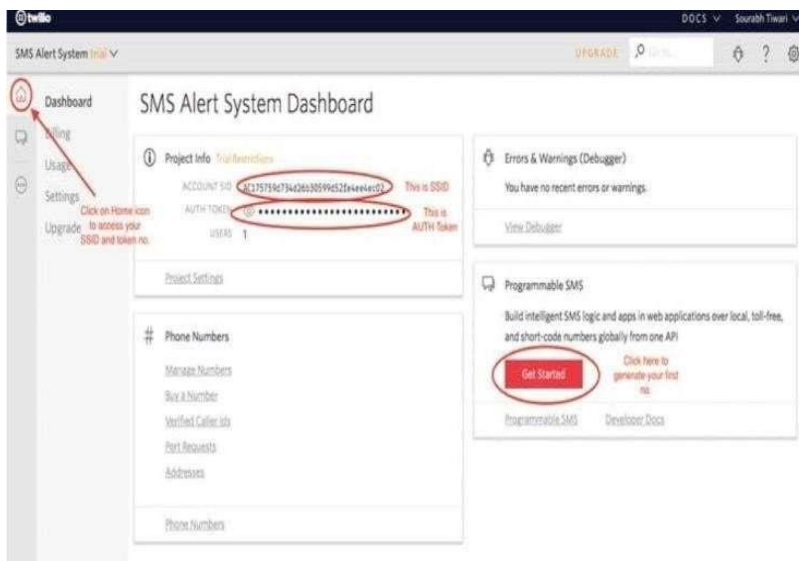


Figure 6 Dashboard Twilio

4) Soil Moisture Sensor: This sensor measures the soil's water content. Between the sensor's two electrodes, the electrical resistance is measured as show in figure 7. When a programmable threshold is exceeded, a comparator triggers a digital output. According on the soil moisture level, the sensor's output voltage varies. The output voltage drops when the soil is wet. Dry: An rise in output voltage



Figure 7 Soil Moisture Sensor

5) LDR: A light sensing resistor, also known as a photoresistor as show in figure 8, is an electronic device used to measure the amount of light a plant receives.

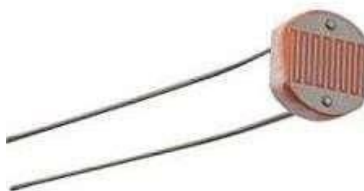


Figure 8 LDR

6) Jumper wires: Used to complete a circuit by joining two sites as shown in figure 9. Frequently used to make it simple to update a circuit as needed while using breadboards and other prototyping tools.



Figure 9 Jumper Wire

7) Header pins: Female pin header is a type of electrical connector which is widely used in instrumentation of PCB as show in figure 10.



Figure 10 Header pins

8) Node MCU: The ESP8266 NodeMCU (Node Microcontroller Unit) as shown in figure 11 development environment is used, a System on a Chip (SoC) with a very cheap cost, which connects objects via the Wi- Fi protocol to transfer data. You can transfer it.

Each GPIO Pin has a unique I/O Index number, which is utilised for GPIO Pin addressing. A full and independent WiFi networking solution is provided by the ESP8266EX. It can be used to float WiFi networking tasks from another application processor or host the application. The ESP8266EX launches the application straight from an external flash when it serves as the host. To enhance the system's performance in certain applications, it features inbuilt caching.

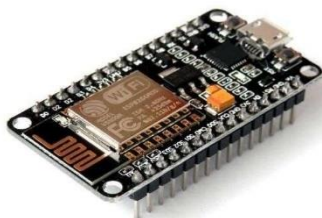


Figure 12 NodeMCU ESP8266EX

The soil sensor measures how wet the soil is, while the LDR gauges how much light is reaching the plant. The Bolt unit reads both data and transfers them to the Integromat logic when it receives a read request. For soil sensors, the sensor output will be LOW if the water content is below the threshold (specified by the user), and HIGH if it is higher. Pin 0 of the bolt is used to read this digital data. Analog data is read from bolt pin A0 for LDR as shown in figure 13.

You may monitor your crops' exposure to sunshine and water levels using the straightforward techniques above, and you'll get alerts when you need to take action.



Figure 13 System

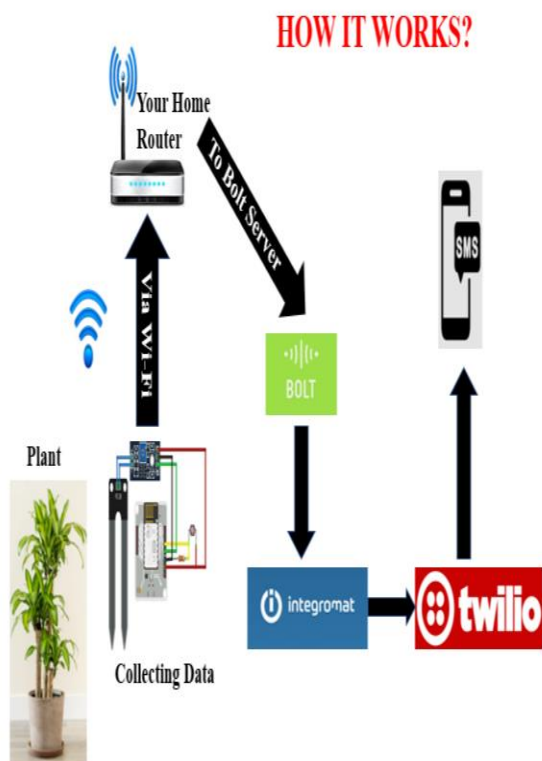


Figure 13 How it Works

Steps Flow Chart as shown in figure 13.

1. First of all, place the soil moisture sensor in the soil of the plant and the LDR in the direction where the plant is getting sunlight.
2. After the setup is done start the simulation in the Integromat software.
3. The sensor sends the information of the plants Light Intensity and soil moisture to the BoltIoT cloud server with the help of our router system.

4. The cloud server if the BoltIoT takes the information time by time and gives the information to the Integromat Software.
5. Here in the Integromat Software the information goes through the logic created and then according to the satisfied logic the Programmed Message goes to the Twilio server.
6. Then the Twilio server configures the Users Mobile number and sends the information to the user successfully.
7. Thus, the user gets the information about the health of their plant to their mobile according to the alarm time set by them in the Integromat Software.

The Steps to configure the software setup is as follows as shown in figure 14:

1. First make an account on Integromat using the intergromat.com website.
2. After setting up the account, create a new scenario using the 'Create a new scenario' button located on the top right corner in dashboard.
3. In the services choose BoltIoT and Twilio.
4. Now using the services build the required logic flow
5. Enter the required credentials of the Twilio in the Twilio services respectively.
6. Enter the required credentials of the BoltIoT in the BoltIoT services respectively.
7. Now after the required logic using the Integromat is ready Enter the required logic for the sending the information to the user mobile using the Twilio services.
8. After the setup is ready run it to check for the errors.

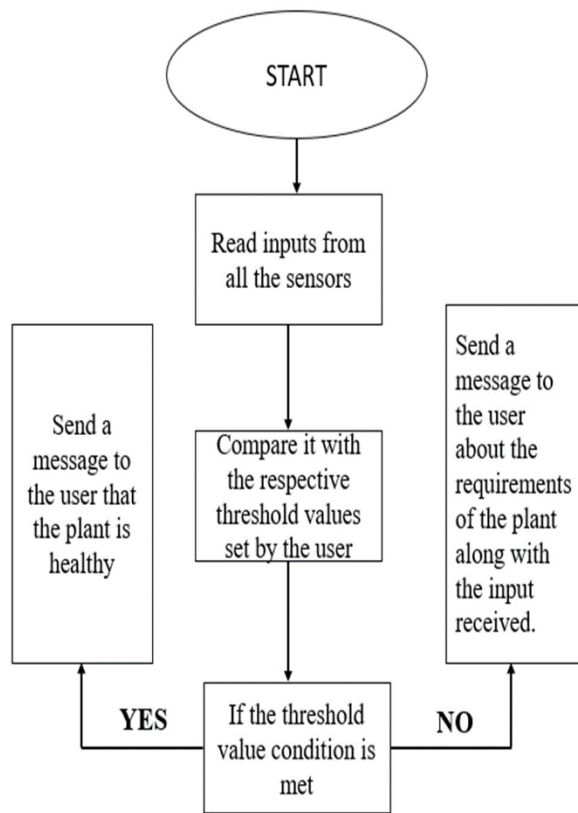


Figure 14 Flow Chart

#### IV. RESULTS

The purpose of this paper was to design a circuit using the idea of the Internet of Things, which consists of sensors, monitors, processing, upload data on cloud and analyzes the information provided by the sensors, and informs the user about changes in the state of the plant. Automating watering of plant can save a lot of time and also organize an individual's lifestyle. This device monitoring system is an inexpensive system whose basic use is for home purposes. Besides, it's quite an interesting concept because the plant itself can call for water and protection whenever it needs it. So, with this IOT based automated system we can monitor the farm and also the irrigation process. A system that takes into account the farm environment and acts according to our needs. This plant monitoring system successfully sends the plant health report to the user as shown in figure 14 and 15. This allows users to easily maintain plant growth.



Figure 15 Software Display

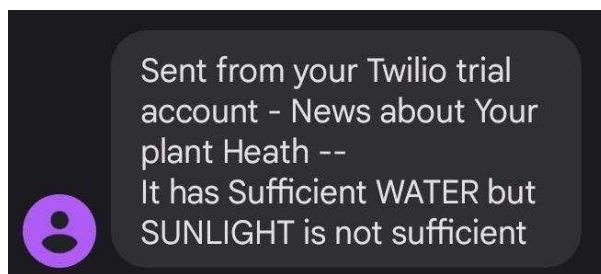


Figure 16 Software Display

## V. CONCLUSION

The proposed method for intelligent plant monitoring systems is based on Node MCU microcontrollers, mobile computer and Internet of Things. It provides real-time statistics about the natural elements need of plant in the garden and allows local users and growers to take care of their crops. Soil moisture, Light requirement and associated humidity are considered natural factors. The results are displayed on the LCD screen via the proposed device. The results are provided via a mobile application. This strategy can address the horticultural issues that arise in urban areas since there aren't enough farmers there. This system can be used anywhere because of its low initial cost and simple installation. The system can be expanded to the next level thanks to the advancement of sensor technology, enabling customers to make the most of their investment.. The system can be modified to deliver fertilizer exactly to the garden if sensors for soil nutrients can be fitted. This system saves manpower and makes efficient use of available water resources, ultimately resulting in good systems. The system's feedback will help the gardening procedure be implemented more effectively. A system has been developed to monitor temperature, humidity, and soil moisture levels, and this project offers the chance to examine current systems, their benefits, and their drawbacks.

Agriculture is one of the activities with the largest water consumption, The farm owner can monitor the process with the help of their Android mobile. In future to expand the performance we plan to expand the performance of the system by adding a link to a vital archive of all history records. In addition, add standard care features and familiar plant safety precautions. This is displayed as the value of a specific parameter value. This allows consumers and farmers to manage their crops or plants more carefully.

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