IOT based Soil Moisture Measuring System for Indian Agriculture

V Vanitha*, Rajat Kumar Dwibedi, Ben Painadthu, Kiran Venugopal, and Aby Varghese Thomas
Department of Electronics and Communication Engineering, Aarupadai Veedu Institute of Technology, Chennai-603 104, Tamil Nadu, India
Email: *vanitha.ece@avit.ac.in

Abstract. In the field of agriculture Internet of Things (IoT) plays a vital role for the farmers in a high range with the help of these technologies soil moisture is measured and its accuracy is computed for further validation. IoT Technology has paved the way to gather knowledge about conditions such as wind, humidity, water, temperature, soil fertility and online cultivation tracking to identify weeds, the level of farmers connecting to the farm from everywhere. Wireless sensor network is used to track farms and to manage and automate the harvested farm using microcontrollers. An intelligent computer, namely a cell phone, can allow farmers, at all times and everywhere in the world, to keep up to date with the present conditions in the agricultural field. The use of IOT costs can be minimised and high precision efficiency increased in conventional farming.

Keywords: cloud, firebase, internet of things, mobile application, soil moisture sensor

1. Introduction
IOT seeks to create a large network by integrating multiple forms of linked devices. Air and water quality, temperature and soil levels are considered to be the IOT dependent surveillance method [1]. Sensors are used to track various ambient parameters such as water level, humidity, temperature and so on. The device architecture uses wireless nodes with a wireless module built on the MCU node [2]. For the retrieval and storing of records, the database and the android programme [3]. We must use suitable technologies to determine the quality of crops to increase production there by helping and promoting both farmers and countries [4]. In controlling environmental factors, the soil moisture plays a major role [5].

We provide a soil moisture sensor system to test and monitor soil humidity with the Node MCU system [6]. The two major modules are Moisture measuring system and Mobile application would be made user friendly [7]. The content of the memory is accessed by the mobile application whenever required. When there is a fall in soil moisture, it would be altered through mobile application. The mobile application would be made generic for the other sensor and required security is provided at user level [8]. And also cloud based platform is designed, so that any users can query soil moisture for any land resource through smart phones [9].
2. Benefits of using IoT Solutions For Soil Conditions Monitoring
   
   a) Less likely to over or under water crops
   In agriculture, overwatering crops can impact the amount of oxygen that enters the roots, preventing them from normally growing [10]. Any trees, on the other hand, can also cause root rot, which can ultimately cause the crop to fail. In comparison, under watering plants typically have the same effects as overwatering: crops cannot grow properly without adequate irrigation or can ultimately go down and die [11].

   b) Better water conservation
   Agriculture and farming use about 70 % of the world's freshwater supply, based on the World Wildlife Fund survey and study [12]. Water management will ensure the soil water reserves are not depleted or that excess soil is diverted into rivers and other water body.

   c) Save time and resources
   From another field inspection angle, soil humidity levels can be tested manually, and temperature ensures more time will be spent on other areas of the organisation, such as bookkeeping or meeting clients [13]. Preserving time and money also leads to higher income, with also smaller prices and time spent tracking crops.

3. System Architecture
   
   3.1 Hardware Details
   This work takes the form of Launch Pad: CC3200 and FC-28, available on Simple Link Wi-Fi module (SIF), from the Texas Instruments [14].

   Figure 1: Block Diagram of the Firmware

   This deployment technique includes detecting moisture using a sensor FC-28, and processing of these values onto a CC3200 Launch Pad. Firmware block diagram is shown in Figure 1 and pin configuration of the Launch pad is shown in Figure 2.
The firmware is designed using the Integrated Development Environment (IDE) energy source. The values are uploaded through the use of the Wi-Fi chip to the Cloud infrastructure and smartphone tracking programme. In AT&T's M2X website and in the Blynk framework, the real-time sensor data are displayed on the cell phone.

4. Software Description

The firmware is created using Energia IDE in this study.

The Figure 3 shows the proposed model which comprises of controller, wifi module, moisture sensor etc. Here the software is writer through c program.
5. Results & Discussions

We suggest a soil humidity analysis method in diverse terrains (black and red soil) in this manuscript. The analysis was originally carried out using gravimetric dry specific technology. The amount of soil moisture in this technique is initially collected and measured at 3.35% in black soil and 0.78% in red soil. The value of the soil moisture is 0 per cent in red soils and 2 percent in Black dried soil in the other method of measuring using hygrometric techniques. In both methods, the error rate is 0.78 in red soil and 1.35 in black soil. The time change is due to the mistake in soil dampness measurement. For sensor values and then for M2X Cloud’s MT&T’s AT&T saved in the cloud, the CC3200 Launch Pad is used. Upload the values found in an Excel sheet. The black soil moisture is equal to the red soil in the diagram. The M2X Cloud web pages are seen. The public computer and data on a separate machine is provided in the webpage of M2X is shown in Figures 3 and Figure 4. The sensor data is also seen via the Blynk application on the cell phone. Figure 5 shows the soil humidity data obtained in a device. It is a cloud server in which sensor obtained information is fed to the cloud server. Figure 6 shows the Data acquisition screen shot with M2X response code. It is a cloud server in which sensor obtained information is fed to the cloud server. The M2X Cloud web pages are seen the public computer and data on a separate machine is provided in the webpage. Figure 7 shows the flow chart of the proposed system which runs through a sequential order. Here the protocol begins with the SSID and Password section. Then it is connected to a network from which data exchange takes place.

6. Problem Statement

a. Existing system

A smart web-based wireless sensor device for soil measurement using sensors. The details are processed only in other applications by government departments. The sensor technology provides information on soil moisture in fields based on time.

b. Proposed system

The IOT plays an important role in precision agriculture in order to increase land productivity. The demand for food is rising rapidly with an increasing number of people, but with minimal land resources. In numerous ways, IOT can help farmers. Agricultural yield depends in particular on many growing parameters, such as precipitation, temperature, rain and soil. The soil humidity calculation and control device is possible by interfacing with the Node MCU low-cost soil humidity sensor. Also, a cloud-based platform is designed, so that any users can be able to check soil moisture for their specific piece of land through their smart phone. It mainly contains two major modules they are Moisture measuring system and mobile application as an interactive system for the end user. The moisture measuring system measures the content and stores it in the memory periodically. The content of the memory is accessed by the mobile application whenever it is necessary. The system is configured to read the values of different sensors kept at different locations.

Figure 4: Excel database
Figure 5: Soil humidity data accessed via a screen shot on another device.

Figure 6: Data acquisition screen shot with M2X response code

7. Conclusion
We also developed a framework to control soil moisture using cloud IOT and Android for this project. The app is used to capture and display data in real time using the cloud-based technology using an Android application programme. The entity can view the data anywhere and can automatically react with mobile computing technologies based on ground moisture and other parameters. We can forecast soil moisture levels, can track the irrigation system correctly, and can improve efficiency, save water. In order to gather information from atmosphere shifts, the network of Wireless Sensors and various sensors are used, and this information is transmitted to the farmers who activate actions through the network. Farmers are still related and conscious of the conditions in their unique farming area.
Figure 7: Diagram of the software established during the current work.
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