e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:04/Issue:04/April-2022 Impact Factor- 6.752 www.irjmets.com

DEVELOPING A SMART PLANT POT AS PROTOTYPE SOIL MONITORING SYSTEM USING IOT TECHNOLOGIES

Vishaal Baruah[*1]

[*1]North Eastern Hill University, Department Of IT, Institute, Shillong, Meghalaya,

ABSTRACT

Plants are one of the oldest living creatures to exist on this planet and even today we can see or feel their abundant presence in the world around us. But for plants to survive and facilitate the needs of human beings it must have an optimal moisture level, which can be defined as volumetric water content of the soil. If the moisture level falls below a critical point then the plant dies. Hence, as an objective of the project we have designed a prototype for a soil monitoring system which would enable the user to keep track of its moisture status and also notify the user with a text message when its moisture level reaches below a critical point. The objective of designing the prototype for soil monitoring system has been achieved with the help of one of the major research areas of the word today, the "Internet of Things".

Keywords: Internet Of Things, Soil Moisture Sensor, Microcontroller, Things Speak.

I. INTRODUCTION

Kevin Ashton, British technology pioneer, in 1999 was the first to use the term "Internet of Things" to describe a system in which objects in the physical world could be connected to the Internet and remotely controlled by sensory equiptments. Ashton coined the term to illustrate a work without human intervention by connecting Radio-Frequency Identification (RFID) tags13 used in corporate supply chains to the Internet in order to count and track goods on it's own[5]. The Internet of Things (IoT) is the internet-based interconnection of physical objects such as automobiles, buildings, and other items that are equipped with electronics, software, sensors, actuators, and network connectivity to gather and share data. The Internet of Things (IoT) is a popular issue in the technology sector, engineering circles, and even in policy formation decisions of governments. This technology is embodied in a diverse range of networked devices, systems, and sensors that take advantage of advances in processing power, electronics downsizing, and network linkages to provide previously unattainable capabilities. [1]. The large-scale installation of IoT devices aims to revolutionize many areas of the way we currently live. IoT may transform the way common interaction with the Internet takes place and the way such data derived and exchanged from that interaction comes from passive engagement with connected objects in the broader environment, the potential outcome would be a "hyper-connected world". This paper particularly focuses on using IoT in developing a prototype for a "Soil Monitoring System" that would help in sustaining an optimal moisture level in the soil which is very important for healthy growth of plants and appropiate fertilizer usage. Knowing the exact soil moisture conditions on their fields, not only are farmers able to generally use less water to grow a crop, they are also able to increase yields and the quality of the crop by improved management of soil moisture during critical plant growth stages. Hence, the prototype would enable the user to keep track of its moisture status and also notify the user with a text message when its moisture level reaches below a critical point.

II. METHODOLOGY

The methodology used in the process of developing the monitoring system is known as the "Device-to-Gateway model", or more typically, the device-to-application-layer gateway (ALG) model. In this model the IoT device connects through the device-to-application-layer gateway (ALG) model service as a channel to reach a cloud based service. Put simply, this means that there is application software operating on a local gateway device, which acts as an intermediary between the device and the cloud service and provides security and other functionality such as data or protocol translation[3].

IRJMETS

e-ISSN: 2582-5208

International Research Journal of Modernization in Engineering Technology and Science

(Peer-Reviewed, Open Access, Fully Refereed International Journal)

Volume:04/Issue:04/April-2022 Impact Factor- 6.752 www.irjmets.com

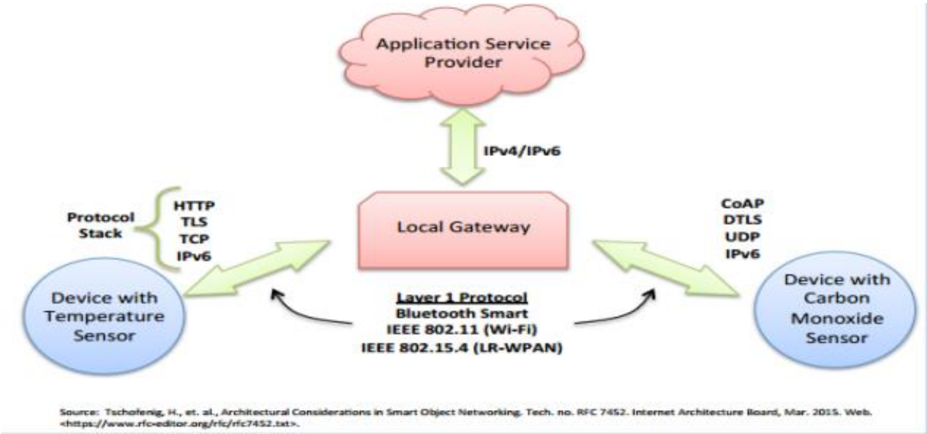

Figure 1: Device-to-Gateway Model.

I would now like to discuss some of the tools used to develop the prototype.

Softwares

1. **Arduino IDE:** The Arduino Software (IDE) includes a text editor for writing code, a message area, a text terminal, a toolbar with buttons for basic operations, and a series of menus.It communicates with the Arduino and Genuino devices by connecting to them and transmitting code into them. "Sketches" are programes created with the Arduino Software (IDE). These sketches were created with a text editor and saved with the".ino" file extension.
2. **Lua**: Lua is a lightweight multi-paradigm and cross-platform programming language written in ANSI C with a very basic Common API(CAPI). It was designed primarily for embedded devices and clients. It was created in 1993 as a language for extending software applications to meet the growing demand for customization. Lua's creators worked on enhancing its speed, portability, extensibility, and ease-of-use in development because it was meant to be a generic embeddable extension language[2].

Hardwares

1. **Microcontroller:** A MCU, short of Microcontroller, is a single-integrated circuit based small sized computer system. A microcontroller is a device containing one or more CPUs, memory, and programmable input/output peripherals. A tiny amount of RAM, as well as programme memory in the form of Ferroelectric RAM, NOR flash, or OTP ROM, is frequently provided on chip. We used a microcontroller called the AI-THINKER NODE MCU to create the module. The NodeMCU platform is a free and open source IoT platform. It includes firmware that works on Espressif Systems' ESP8266 Wi-Fi SoC, the XTOS operating system that runs this microcontroller, and hardware is based on the ESP-12 module. The ESP-8266 is the WiFi Module utilised by the NODE MCU. Espressif System, located in Shanghai, produces the ESP8266, a low-cost Wi-Fi chip with a full TCP/IP stack and MCU (Micro Controller Unit) functionality.

Figure 2: AI-Thinker Node MCU

2. **Funduino Soil Moisture Sensor:** The soil moisture sensors are designed to estimate soil volumetric water content based on the dielectric constant (soil bulk permittivity) of the soil.The dielectric constant of soil increases as the water content of the soil increases. Because of the fact that dielectric constant of water is much larger than the other soil components, including air the sensor is able to produce these results. Thus, by measuring the dielectric constant gives a predictable estimation of water content in the soil.

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:04/Issue:04/April-2022 Impact Factor- 6.752 www.irjmets.com

Figure 3: Funduino Soil Moisture Sensor

III. MODELING AND ANALYSIS

Flow Chart working of the Soil Monitoring System Prototype:

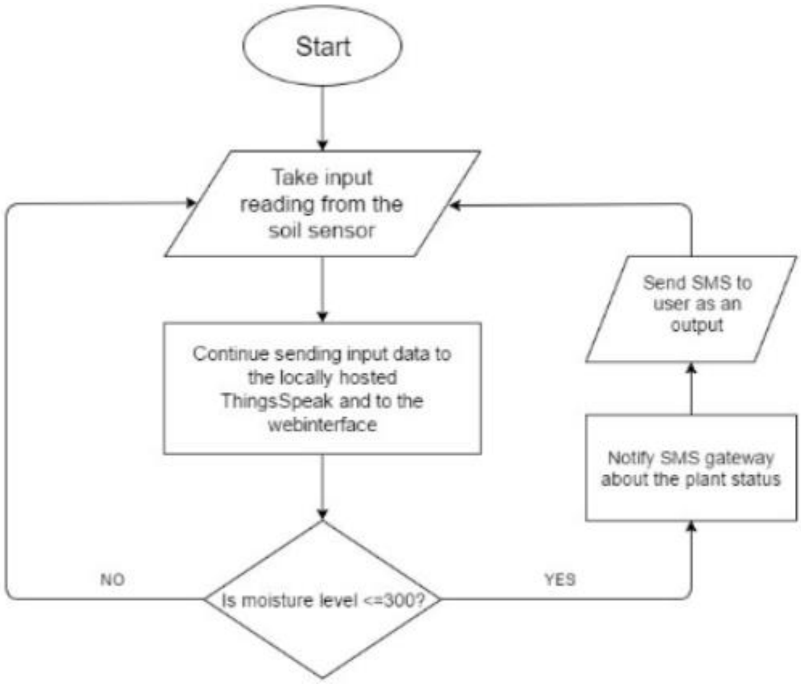

Figure 4: Working of the prototype.

Visual Representation of the prototype:

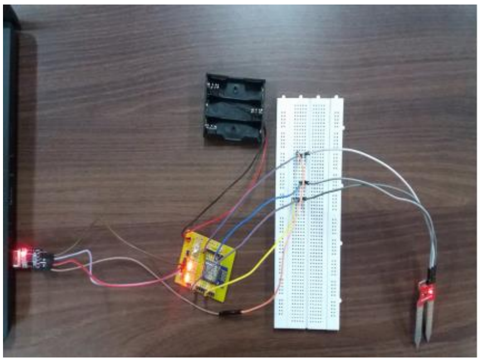

Figure 5: Importing program into microcontroller.

The microcontroller is connected to the laptop using a USB connecter. During this process the microcontroller is getting power supply from the laptop itself. The connections are shown in figure 5. The microcontroller has three 1.5V Alkaline batteries as its power source and is connected to the Funduino soil moisture sensor. The sesnsor, in turn, has been planted near the roots of an Aloe Vera plant for getting proper data of its moisture content, As shown in Figure 6. The ESP-8266 WiFi module facilitates the microcontroller to send the obtained data to the locally hosted ThingsSpeak where the data is represented in the form of graphs and other visualisations. Also, a message is sent to the registered phone number to alert the user to water the soil incase of deficiency.

Figure 6: Soil Monitoring System Prototype.

IV. RESULTS AND DISCUSSION

The data that has been collected from the soil moisture sensor is being sent to the locally hosted ThingsSpeak and then to the developed webinterface. Figure 7 shows graph in ThingsSpeak while Figure 8 displays the visual representation in the web interface.

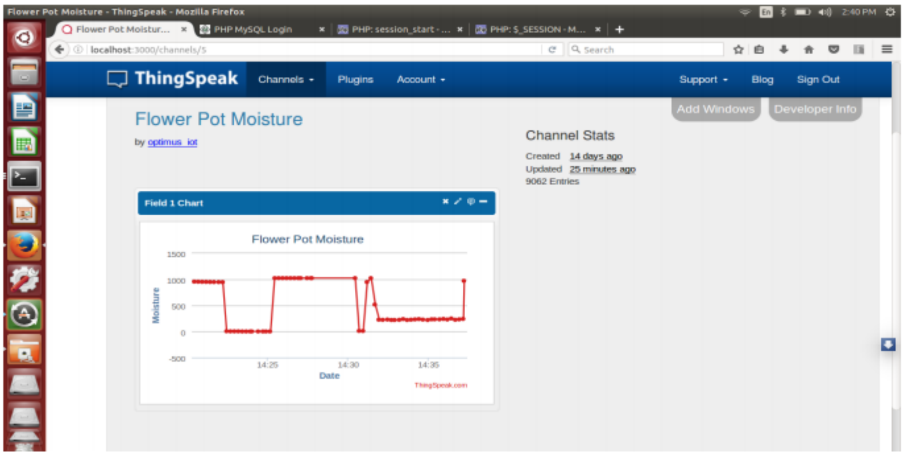

Figure 7: Collected data being displayed on locally hosted ThingsSpeak API.

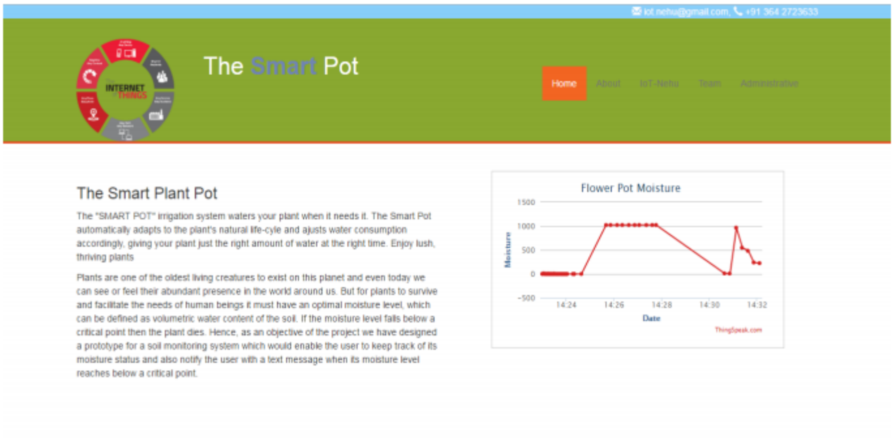

Figure 8: Calculated Data Shown in Web-interface.

V. CONCLUSION

The prototype has been programmed successfully and was also tested successfully. Itis very cheap and was designed at a very low cost. The web interface related to the module is also very user friendly, and has required options, which can be utilized by the user to keep updated with the latest trends of the plant health and also perform the desired operations. The module is capable of meeting the information requirements specified to a great extent. The module has been designed keeping in view the present and future requirements in mind and made very flexible. The goals that are achieved by the complete are instant, and accurate to a great extent. It is kept in mind that our module would be able to improve productivity of the plant but also it would help the plant to have optimum utilization of resources, and enable the user to have an efficient management of records

VI. REFERENCES

[1] Angelo Castellani Lorenzo Vangelista Michele Zorzi Andrea Zanella, Nicola Bui. Internet of things for smart cities 2014.

[2] Dave Evans. The internet of things-how the next evolution of the internet is changing everything. 2011.

[3] Mulligan Avesand Karnouskos Boyle Holler, Tsiatsis. From machine-to-machine to the internet of things: Introduction to a new age of intelligence. 2014.

[4] Amitabh Dixit Vishal Gupta Joseph Bradley, Christopher Reberger. Internet of everything: A $4.6 trillion publicsector opportunity. 2013.

[5] Amir Vahid Dastjerdi Rajkumar Buyya. Internet of things -principles and paradigms. 2016.