Asian Journal of Applied Science and Technology (AJAST)
(Open Access Quarterly International Journal) Volume 2, Issue 2, Pages 186-192, April-June 2018

Smart Garden Monitoring System Using IOT

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Article Received: 24 January 2018 *Article Accepted: 27 February 2018* *Article Published: 08 April 2018*

ABSTRACT

The eternal need of every human being in this world is oxygen. Plants play a vital role in maintaining the carbon dioxide and oxygen content in the air. Number of plants are being destroyed each and every day for urbanization process. The number of plantings made is also reduced. Apart from these things more plants die due to lack of maintenance. The main aim of this project is to maintain the nature of the plants by continuously monitoring the parameters leading to the increased life of both plants and human beings. The automatic systems are preferred to a manual system. Android software is used to create mobile applications which are used to monitor the parameters of the garden and automate the watering process. NodeMCU is used to connect different sensors which collect the parameters of soil and transmits the information to firebase through inbuilt Wi-Fi.

Keywords: NodeMCU, Sensors, Android studio, Firebase.

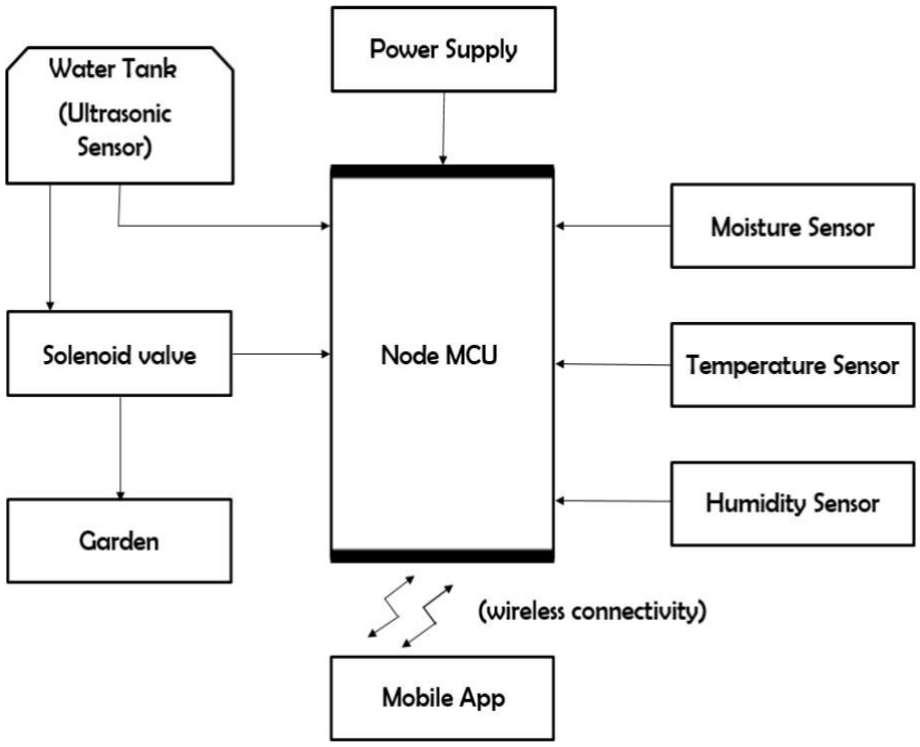
1. INTRODUCTION

Automation rules the world nowadays. It is a technique of using computers or mobile phones in monitoring and controlling the simple parameters of day to day life. The standard of our life will be nourished by the practice of using automation for simple things. Using the concept of IOT we make sensors to communicate with each other which are powerful in automation. The important aspect of this prototype is that it saves cost and ensures safety. When people try to make plantings and set up their own garden, they were cautious in maintenance at only in their beginning stages. As days go on due to lack of maintenance the plants get destroyed. This prototype will help people to automatically monitor the parameters and ensures maintenance of the garden. It plays a vital role and serves as a good companion for plants. IOT provides solutions for various problems and it allows things to be sensed or controlled remotely in network infrastructure.

2. PROPOSED SYSTEM

It usually consists of a central microcontroller to which other objects are connected. The smart garden consists of NodeMCU as a hub to which different types of sensors such as moisture sensor, humidity sensor, temperature sensor and ultrasonic sensor are connected. The ultrasonic sensor is connected to a water tank which indicated the level of water in the tank. Other sensors are connected to their respective positions and these sensors send the data to NodeMCU which consists of an inbuilt Wi-Fi technology. Firebase is a database available on the internet in which real-time values of the sensor are updated every second. Android application is developed using android studio software. Within the software, the connectivity between the application and firebase will be made. So, the user can monitor the parameters from anywhere. Watering of garden varies with the type of soil. Hence the values of the sensors are predetermined for automation purposes inside the software. Whenever the user finds need of watering the garden, a switch in the application will automate the process. This helps in complete maintenance of the garden.

3. BLOCK DIAGRAM



4. SENSORS

The devices which converts the electrical signals into digital signals are known as sensors. The different types of sensors incorporated in this system are listed below.

- Humidity sensor – used to measure the humidity content of the soil.
- Temperature sensor – used to measure the temperature of the soil.
- Ultrasonic sensor – used to measure the water level in the tank.
- Moisture sensor – used to measure the moisture content of the soil.

Figure 1: Types of sensors used

5. NODEMCU

Smart Garden includes NodeMCU as a hub. NodeMCU is an open source IoT platform. It runs on ESP8266 Wi-Fi SoC from Espessif Systems, and hardware based on the ESP-12 module available at lowest cost. It is a Single – board microcontroller consists of 128kBytes of memory and 4Mbytes of storage. It was designed to for easy

programming and allows easy prototyping for developers. There are essentially three ways to build NodeMCU firmware: cloud build service, Docker image, Linux Build Environment. It consists of inbuilt Wi-Fi module which allows us to upload the values of the sensors to the firebase includes NodeMCU as a hub. NodeMCU is an open source IoT platform. It runs on ESP8266 Wi-Fi SoC from Espessif Systems, and hardware based on the ESP-12 module available at lowest cost. It is a Single – board microcontroller consists of 128kBytes of memory and 4Mbytes of storage. It was designed to for easy programming and allows easy prototyping for developers. There are essentially three ways to build NodeMCU firmware: cloud build service, Docker image, Linux Build Environment. It consists of inbuilt Wi-Fi module which allows us to upload the values of the sensors to the firebase.

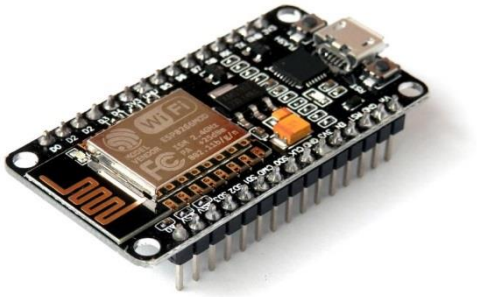


Figure 2: NodeMCU

6. FIREBASE

Firebase is a mobile and web app development platform owned by Google. It helps to build better mobile applications.

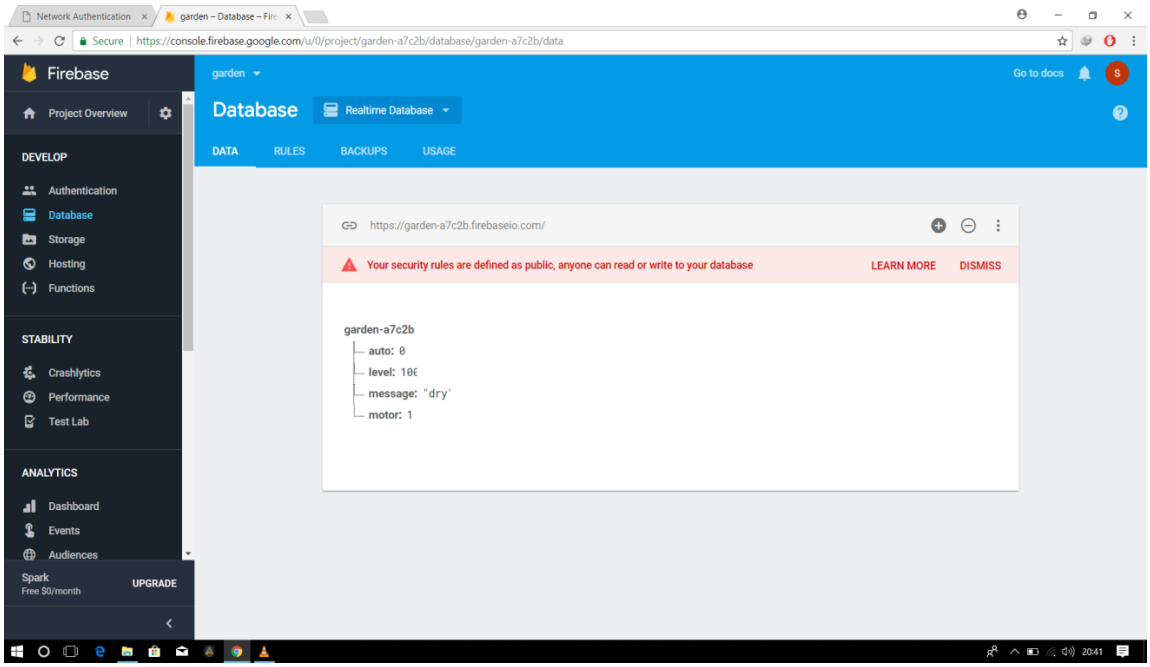


Figure 3: Real-time values of sensor updated in firebase

It gives functionalities like analytics, databases, messaging and crash reporting. It is built on Google infrastructure and scales automatically. It is easy to integrate firebase with iOS, Android, and the web. API's are packaged into a

single SDK hence it can be expanded to more platforms. It provides a real-time database and backend service. The real-time values from the sensors are uploaded to firebase through NodeMCU. The firebase is integrated with mobile apps for control purpose.

7. ARDUINO

The program for NodeMCU can be written in any programming language. The Arduino software provides a better Integrated Development Environment (IDE) for programming the NodeMCU. It is a cross-platform application written in Java. This software consists of various features which include code editor, text cutting and pasting, replacing text and searching, brace matching, automatic indenting, and syntax highlighting. The board in the software should be changed to NodeMCU from Arduino and the libraries for NodeMCU should be included in the software. The board is tested with a blinking LED program and then the program for the smart garden is written. The library files for firebase connectivity is included in the program. The program known as the sketch is saved with file extension .ino

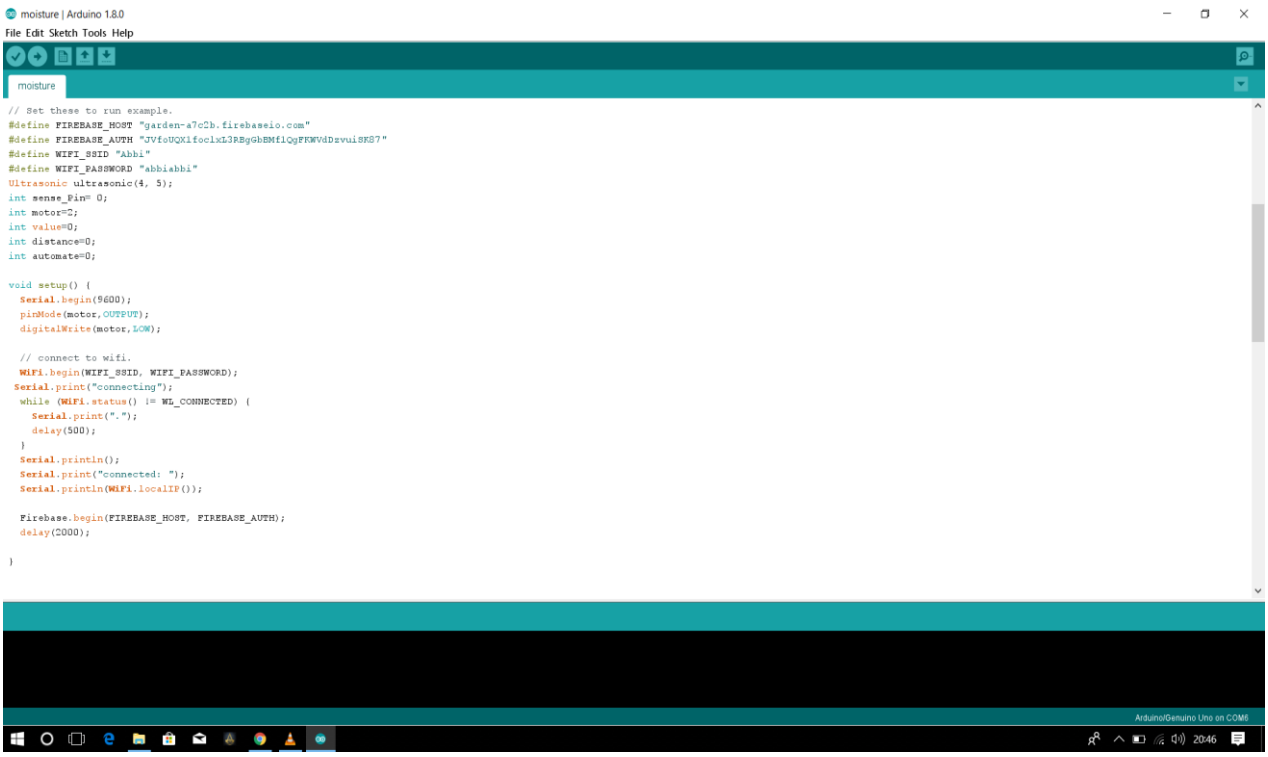


Figure 4: Code for Smart Garden

8. ANDROID STUDIO

It is an open-source Integrated Development Environment for building Android applications developed by JetBrains. This software is compatible with Windows, macOS, and Linux. It consists of various features which let the users create Android applications with a better user interface. It supports programming languages such as Java, Kotlin, and Python. It owns Android Virtual Device to run and debug applications in Android studio. In the Garden app, the program for implementation is written in Java and the code for designing part is written in XML. The

firebase connectivity is also done in the implementation part. This app consists of a login screen followed by the home screen. It consists of various events for automating the Smart Garden. This mobile application allows the user to monitor and control the Smart Garden System via locally or remotely. Whenever the values the sensor crosses the maximum or threshold value it alerts the user by push notifications and allows the user to take control of the system from the remote location. This method is cost effective since it is open-source.

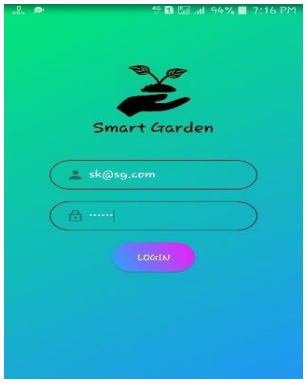


Figure 5: Login screen of Garden application

Figure 6: Home screen

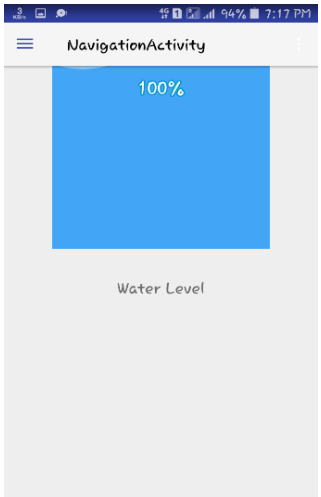


Figure 7: Water level Indication in tank

9. CONCLUSION

The implementation of Smart Garden system using the Internet of Things has been verified to satisfactorily work by connecting different parameters of the soil to the cloud and was successfully controlled remotely through a mobile application. The system designed not only monitors the sensor data, like moisture, humidity, temperature and ultrasonic but also actuates other parameters according to the requirement, for example, if the water level in tank is reduced to a minimum value then the motor switch is turned on automatically to the water level of the tank reaches the maximum value.

The initial cost and the installation of this system are cheap and hence it can be implemented anywhere. With the development of sensor technology, the system can be elevated to the next level which helps the users to utilize their investment in an economic manner. If soil nutrient sensors can be installed, then the system can be modified to supply fertilizers to the garden precisely. This system saves manpower and efficiently utilizes the water resources available ultimately leading to more profit. The feedback provided by the system will improve the implementation of the gardening process.

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