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Smart Farming Based On IoT

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Abstract- Smart farming and precision agriculture involve the integration of advanced technologies into existing farming practices in order to increase production efficiency and the quality of agricultural products. Here we develop our idea, that smart farming for vertical garden. A vertical garden is a technique used to grow plants on a vertically suspended panel by using hydroponics. These unique structures can either be freestanding or attached to a wall. Our proposed model guide the persons who have vertical garden, our process make anyone can do farming Main ideology behind this project is to efficiently make use of water. This is made Possible by sending the received data to the android device using Bluetooth technology using Bluetooth module. The entire system is controlled and executed by Arduino Uno Board microcontroller.

Keywords— Smart farming, Precision Agriculture, Vertical Garden, Bluetooth Technology

1.0 Introduction

In this modern world, most of the farmer lack proper knowledge regarding farming and agriculture making it more erratic. Most part of farming and agricultural related activities are based on prediction and forecasting. When it fails, the farmers have to bear huge losses and some end up committing suicide. Since we are aware of the benefit of quality of soil and air, irrigational and in the growth of crops such parameters such as temperature, moisture cannot be neglected. Internet of Things was introduced in 2009 and it aims in incorporating all gadgets and devices to the web. “The Internet of Thing” is changing every second. IoT enhances our lives in terms of business; medical- health and society by modifying products which are IoT based making our life easier. It is predicted that by 2020, ‘50 billion devices will be connected to the web and the market will be worth of $14 T’.

Internet of thing is an emerging topic of technical, social and economic development. Products like consumer items, big machineries, vehicles, mechanical and utility segment, sensors and others are connected to internet availability giving necessary information that guarantee to change the manner in which we work making our life simpler. There are five hottest topics of computer in this modern world. These are IoT, Big Data, Cloud Computing, Data Mining and Cyber Security. IoT is one from this topic and this is mostly related to device. It is advance automation and analytic system which is based on physical device. IoT system is unique from rest of the system and is more flexible since it enable many automate features and value. These devices mostly use sensors, AI, and other 2 electronic device. It is upcoming topic in computer world and they are not world widely in used. Some are under implementation and some are under observation.

2.0 IoT in Agriculture

There are numerous IoT applications in farming such as collecting data on temperature, rainfall, humidity, wind speed, pest infestation, and soil content. This data can be used to automate farming techniques, take informed decisions to improve quality and quantity, minimize risk and waste, and reduce effort required to manage crops. For example, farmers can now monitor soil temperature and moisture from afar, and even apply IoT-acquired data to precision fertilization programs.

In August 2018, Toyota Tsusho began a partnership with Microsoft to create fish farming tools using the Microsoft Azure application suite for IoT technologies related to water management. Developed in part by researchers from Kindai University, the water pump mechanisms use artificial intelligence to count the number of fish on a conveyor belt, analyze the number of fish, and deduce the effectiveness of water flow from the data. The specific computer programs used in the process fall under the Azure Machine Learning and the Azure IoT Hub platforms.

2.1 Trends and characteristics

The IoT's major significant trend in recent years is the explosive growth of devices connected and controlled by the Internet. The wide range of applications for IoT technology mean that the specifics can be very different from one device to the next but there are basic characteristics shared by most. The IoT creates opportunities for more direct integration of the physical world into computer-based systems, resulting in efficiency improvements, economic benefits, and reduced human exertions.

The number of IoT devices increased 31% year-over-year to 8.4 billion in the year 2017 and it is estimated that there will be 30 billion devices by 2020. The global market value of IoT is projected to reach $7.1 trillion by 2020.

2.2 IoT Applications

IoT is essentially a platform where embedded devices are connected to the internet, so they can collect and exchange data with each other. It enables devices to interact, collaborate and, learn from each other's experiences just like humans do.

3.0 LITERATURE SURVEY

3.1 Mobile Integrated Smart Irrigation Management and Monitoring System Using IOT
Vaishali S, Suraj S, Vignesh G, Dhivya S and Udhayakumar S, June 2017 Agriculture has been the most important practice from very beginning of the human civilization. Traditional methods that are used for irrigation, such as overhead sprinkler and flood type, is not that much efficient. They results in a lot of wastage of water and can also promote disease such as fungus formation due to over moisture in the soil. Automated irrigation system is essential for conservation of the water and indirectly viability of the farm since it is an important commodity. About 85% of total available water resources across the world are solely used for the irrigation purpose. In upcoming years this demand is likely to increase because of increasing population. To meet this demand we must adopt new techniques which will conserve need of water for irrigation process. In automation system water availability to crop is monitored through sensors and as per need watering is done through the controlled irrigation. The almost infinite capabilities of storage and processing, the rapid elasticity makes cloud computing an attractive solution to the large amount of data generated. The idea is to focus on parameters such as temperature and soil moisture. This is a Mobile Integrated and smart irrigation system using IOT based on application controlled monitoring system. The main objective of this project is to control the water supply and monitor the plants through a Smartphone.

Efficiency: A custom sensor design for power efficiency, cost effectiveness, cheap components, as well as scalability end ease of use.
Drawbacks: In future there are some tasks that should be done and would develop the system to a more mature state. The system may be further extended for outdoor utilization

3.2 Smart Irrigation with Embedded System
K K Namala, Krishna Kanth Prabhu A V, Anushree Math, Ashwini Kumari, Supraja Kulkarni
Year:December 2016

This method proposes intelligent and smart Irrigation system which can be used for controlling the watering or irrigation of flowering plants. It controls the irrigation of plants automatically where the need of human intervention can be reduced. This mainly focused on wastage of water, which is a major concern of modern era. It also aids time saving, cost effectiveness, environmental protection, and low maintenance and operating cost and efficient irrigation service. Raspberry Pi (open source) is used in the design of the prototype model in making the system compact and sustainable. The system has sensor which measures the moisture of the soil and switches relay which controls solenoid valve according to the requirement. The model demonstrated gave expected results at the different moisture levels.

Efficiency: The smart irrigation system implemented is feasible and cost effective for optimizing water resources for agricultural production. It doesn't need individuals on duty as it is so easy and reliable.
Drawbacks : High computational complexity Measurements have several drawbacks such as accuracy predictions

3.3 Design of Wireless Sensor Network (WSN) with RF Module for Smart Irrigation System in Large Cultivated Area
Fajar Siti Muzdrikah, Muhammad Rivai Year, March 2018

Give water to crops that is usually called as irrigation is one of the most important activities in farming system. Because water determine the crops growth and development, it should be available sufficiently inside the planting media. Recently, such control technology for crops irrigation has been developed though its application for such drip irrigation is still limited in small cultivated area. For extensive crop cultivation areas such as plantations, it needs a strategy to apply the technology in large cultivated area. We propose a model that is called as a smart irrigation systems (SIS). In the model, the large cultivated area is divided into several plots, where each plot has an independently automatic irrigation system. In order to be easily managed, each irrigation system in each plot can communicate to others and all information should be collected in a data server that is connected to cloud system. Since that common plantation area has limitation of communication lines, we propose a wireless sensor network (WSN) based on a radio frequency (RF) communication to connect all automatic irrigation systems. This paper focuses on designing a WSN prototype based on a radio frequency (RF) module to develop a smart drip irrigation system for large cultivated land. The WSN is designed from a master node functioned as coordinator and three slave nodes. The master and slave nodes are equipped with an RF module with a 2.4GHz frequency for communication. After construction, the WSN prototype with star topology is then tested for its ability, especially for transmitting data from slave to master and vice versa. The prototype has been tested with varied distance of 50 m, 100 m and 150 m between master and slave in a tree-blocked open space. Based on the data losses, the prototype has a good performance if the distances is less than 100 m.

Efficiency: Along with the development of information and communication technology based on internet that is very cheap with high capability, the drip irrigation system with a limited range allows it to be integrated with the technology so that irrigation arrangements for large areas can be done easily.
Drawbacks: Irrigation arrangements for small areas not done so its need to tested different environments

3.4 Smart Irrigation: A Smart Drip Irrigation System Using Cloud, Android And Data Mining Subhashree Ghosh, Sumaiya Sayyed Year:January 2016

Water is an essential component for the development of plants in agriculture or irrigation. The paper stresses on the need of an externally hosted cloud computing platform to manage the database, android and the isolated server by the users across the country for irrigation. The system proposed in this paper uses information and communication technologies, allowing the user to consider and examine the information obtained by different sensors. Here we are using different sensors like humidity, temperature, moisture, light etc. These sensors give signal to the micro controller. Micro-controller gives the data to the isolated server through a serial communication. According to sensor values graph will be display on PC and Smart phone side and by using this graph user can on or off drip devices. In this we keep threshold value for each sensor. The data is sent and processed on an isolated server, which stores the information from the sensors in a database, allowing further interpretation of data in a simple and flexible way. The intended system may lead to enhance the farming practices, overcoming the water crises and developing an upgraded agricultural system for the country.

Efficiency: A remote control for drip irrigation is the most beneficial approach for the farmers. This system reduces the extra manpower of the farmer for his farm like supplying water to plants. This approach is very beneficial for the farmer for increasing crop production.
Drawbacks: This simulation process need to be tested with various conditions

3.5 Vegetable Traceability with smart irrigation using IOT Manali Hate, Swagata Jadhav, Hitesh Pat,Yeaar: July 2017

Vegetable Traceability System is the process of all the way traceability of vegetables or fruits starting from planting, harvesting, processing to distribution and delivery. In India, Agriculture is a source of livelihood for majority of people and has a great impact on the economy of the country. On the statistical scale, India ranks second in worldwide in farm outputs. The growth of the India's GDP (Gross Domestic Product) is increasing day by day. From the past few years with the traditional farming, India is also practicing the smart farming. Various techniques have been used for smart farming out of which one technique is IOT (Internet of things). IOT has been the significant means to reduce costs, improve efficiency and achieve intelligent in the field of agriculture. The project aims at designing a smart wireless sensor network to monitor an agricultural environment. Here we mainly focus on monitoring soil moisture, humidity, water supply control and temperature of a particular farmland. And to monitor all the above things the sensors used here are soil moisture, humidity, and water level and temperature sensor respectively. The microcontroller will receive the information from all the sensors and display in an application.

Efficiency: Existing systems have the technology at a high cost. We are trying to implement the system with low cost, It gives the output is at a high level or else output is at a low level. It doesn't need individuals on duty as it is so easy and reliable. The smart irrigation system implemented is feasible and cost effective for optimizing water resources for agricultural production.
Drawbacks: Future work includes long-term assessment of the system performance in different home environments.

4.0 EXISTING SYSTEM

This Soil Moisture Detector Circuit is very simple. Here we have used a soil moisture detector probe to sense the moisture in the soil and an NPN transistor to trigger the Buzzer and LED. This soil moisture

detector probe is homemade and built using general purpose PCB. Buzzer and LED are used as an indication of soil moisture detection.

DRAWBACKS

This sensor only gives alert. It didn't provide any suggestion for person who didn't have agriculture knowledge.

5.0 PROPOSED SYSTEM

In our proposed method, we monitor soil moisture value with moisture sensor this value is compared with plant's preset value. This data is send to the app via Bluetooth our Bluetooth app give suggestion based on the plant as voice.

Modification:
We have used a soil moisture detector inquiry to sense the moisture in the soil and an NPN transistor to trigger the Buzzer and LED. This soil moisture detector probe is homemade and built using general purpose PCB. Buzzer and LED are used as an symptom of soil moisture detection

ADVANTAGES

1. No need for technical knowledge handle
2. Easy to implement
3. Multi plant suggestion in single application
4. Cost effective

6.0 SYSTEM ARCHITECTURE

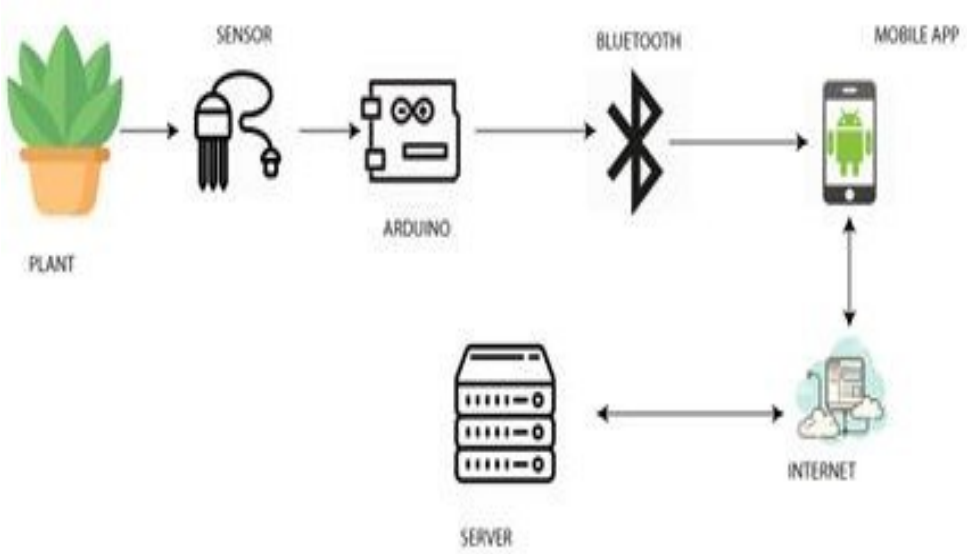


Figure: 6.0: System Architecture

It will monitor soil moisture value with moisture sensor this value is compared with plant's present value. This data is send to the app via Bluetooth our Bluetooth application give suggestion based on the plant as voice. We conduct a Power saving method using the solar power system to minimizing the system cost.

This project tracks the soil moisture value with moisture sensor, this data is compared with plant's preset value. This data is send to the application via Bluetooth which give suggestion based on the plant as voice.

The app not only provides notifications but also suggestions related to the farming activities by considering soil conditions of the user's place.

6.1 BLOCK DIAGRAM (Sensor)

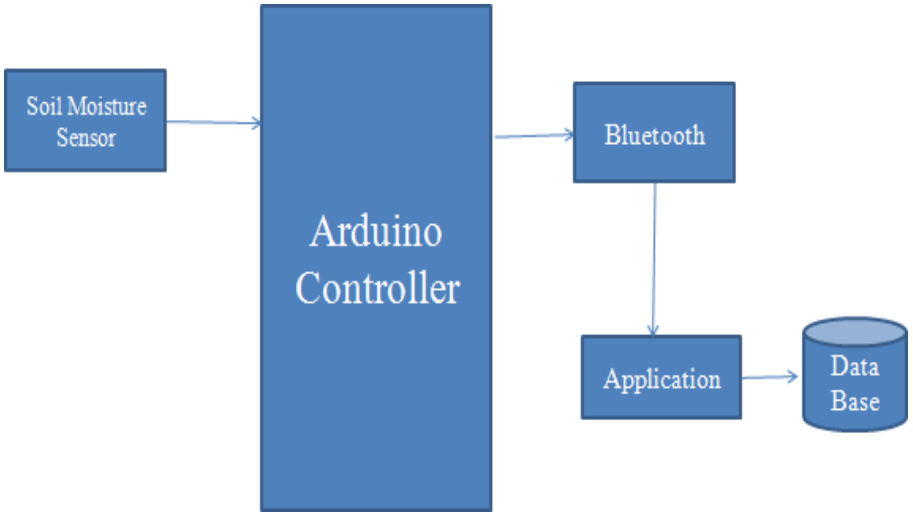


Figure 6.1: Sensor Block Diagram

To monitor the soil moisture value with moisture sensor thereby Enhancing the growth of the crops in an Efficient manner. To provide recommendation related to the farming activities by considering soil conditions of the user's place.

6.2 BLOCK DIAGRAM (Server)

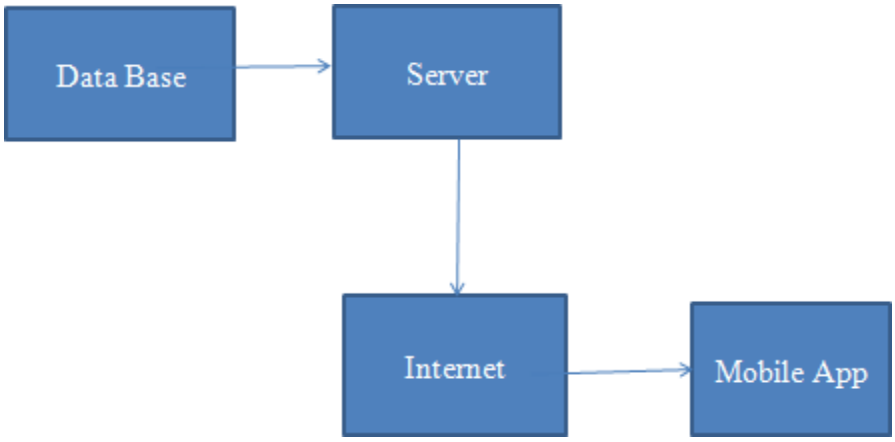


Figure 6.2: Server Block Diagram

7.0 MODULE DESCRIPTION

7.1 Soil Moisture Detection
7.2 Module Buzzer
7.3 Alert Module
7.4 Disease Prediction Module
7.5 Mobile App Module

7.1 Soil Moisture Detection Module

The soil moisture sensor consists of two probes which are used to measure the volumetric content of water. The two probes allow the current to pass through the soil and then it gets the resistance value to measure the moisture value. When there is more water, the soil will conduct more electricity which means that there will be less resistance. Therefore, the moisture level will be higher. Dry soil conducts electricity poorly, so when there will be less water, then the soil will conduct less electricity which means that there will be more resistance. Therefore, the moisture level will be lower.

This sensor can be connected in two modes; Analog mode and digital mode. First, we will connect it in Analog mode and then we will use it in Digital mode. The Moisture sensor is used to measure the water content (moisture) of soil. When the soil is having water shortage, the module output is at high level, else the output is at low level. This sensor reminds the user to water their plants and also monitors the moisture content of soil. It has been widely used in agriculture, land irrigation and botanical gardening.

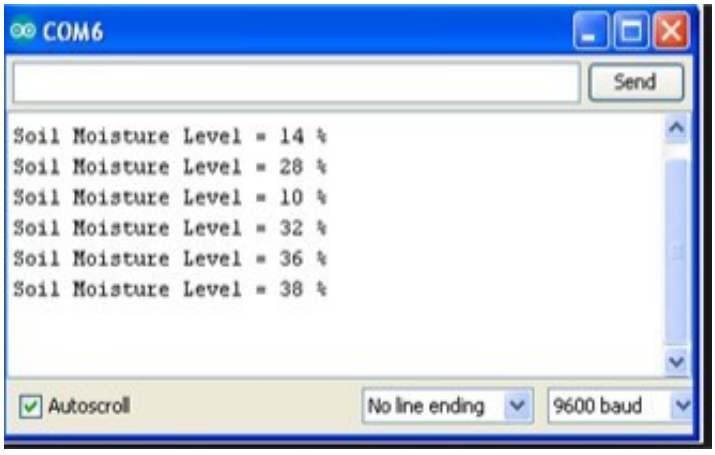


Figure 7.1: Soil Moisture Detection Module

Soil Moisture Sensor:

Soil Moisture Sensor Optimum water content: 60 %
Mobile App alert if it goes above 60% or below 55%

7.2 Buzzer Alert Module

A 5V Active Alarm Buzzer Module for Arduino is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric. ... Typical uses of buzzers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke.

Specifications

The specifications of the active buzzer are as follows

- It operates at a voltage range of 3.3 – 5V
- It operates at a frequency of near 2 KHz
- It has small size: 3.3 x 1.3 x 1.2 cm

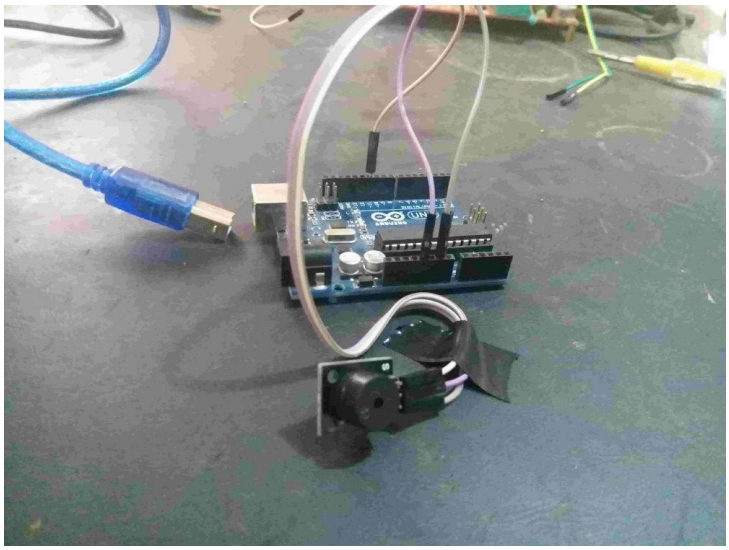


Figure 7.2: Buzzer Alert Module

The buzzer consists of an outside case with two pins to attach it to power and ground. Inside is a piezo element, which consists of a central ceramic disc surrounded by a metal (often bronze) vibration disc. Changing then causes the surrounding disc to vibrate. That's the sound that you hear.

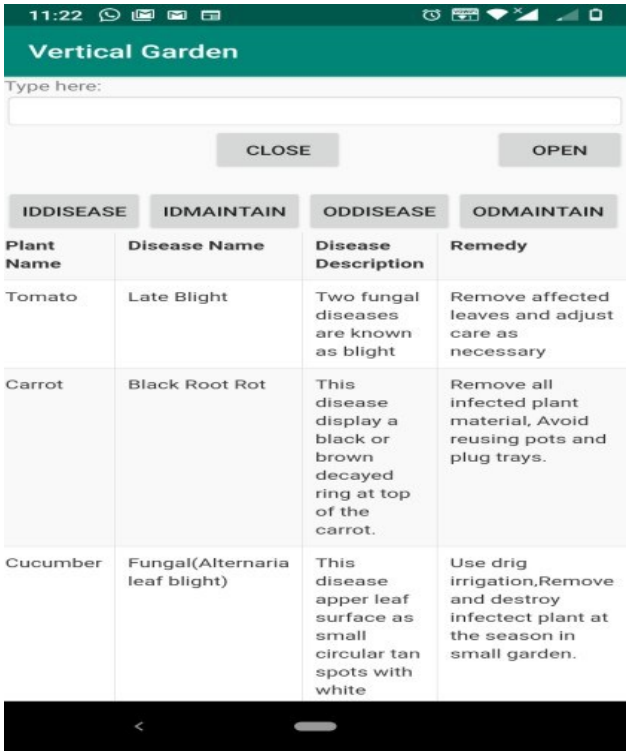
Working Principle of Magnetic Buzzers

The vibrating disk in a magnetic buzzer is attracted to the pole by the magnetic field. When an oscillating signal is moved through the coil, it produces a fluctuating magnetic field which vibrates the disk at a frequency equal to that of the drive signal.

An active buzzer generates the sound itself. You just have to connect the pins and turn the logic high and low similar to like you glow an LED. However, some buzzer requires more current then the Arduino digital pin gives, then you will have to connect the MOSFET to amplify the current. While for the passive buzzer, you will have to send the sound signal to control the sound. We have to use the pin to send the sound signal. It has various applications. You can use it to play music.

7.3 Disease Prediction Module

Plant diseases are known from times preceding the earliest writings. Fossil evidence indicates that plants were affected by disease 250 million years ago. The Bible and other early writings mention diseases, such as rusts, mildews, and blights that have caused famine and other drastic changes in the economy of nations since the dawn of recorded history. Other plant disease outbreaks with similar far-reaching effects in more recent times include late blight of potato in powdery and downy mildews of grape in coffee rust Fusarium wilts of cotton and flax, southern bacterial wilt of tobacco, Sigatoka leaf spot and Panama disease of banana in Central America, black stem rust of wheat southern corn leaf blight in the United States.

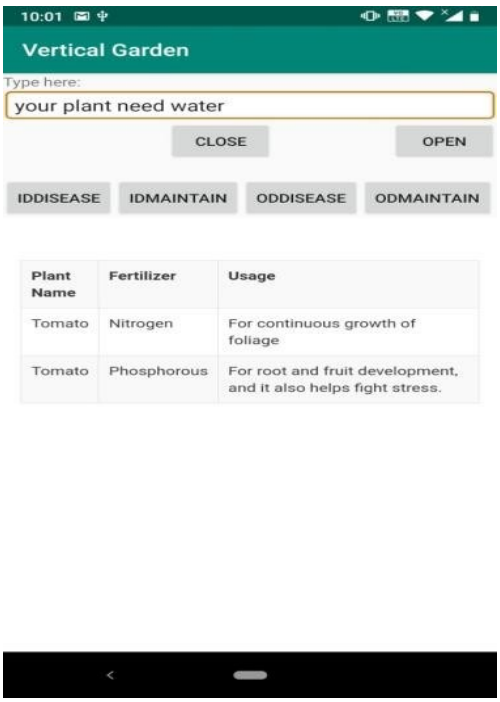


Panama disease of banana in Asia, Australia, and Africa and coffee rust in Central and South America. Such losses from plant diseases can have a significant economic impact, causing a reduction in income for crop producers and distributors and higher prices for consumers. In Mobile Application various disease were uploaded, it will display the both Indoor and Outdoor plants disease .It will deliver only the predictions of plant disease.

7.4 Mobile App Module

Android app is created by Java, in eclipse software, so that we can continues monitoring, if necessary we can update the plant values of disease and maintenance. In the application, it suggest us to pour water when the plant needed .we can see the disease, fertilizer and maintenance of the plant. In case of getting affected by the disease, we can see what kind of pestilence is it. We can also add more detail about the plant through server and view it in the application.

This project tracks the soil moisture value with moisture sensor, this data is compared with plant's preset value. This data is send to the application via Bluetooth which give suggestion based on the plant as voice. The disease prediction is included in the application that might likely affect the crops.



8.0 CONCLUSION

Mobility has rapidly become the world's most used techniques of transmitting data, voice as well as various sorts of services in the world today. As the use of mobiles is increasing at an exponentially high rate, therefore, even the companies are starting to explore how they can make most of the mobile technology to enhance their business. The best way to deliver information and services to the clients, is certainly the use of apps. Mobile applications allow the companies to reach a wider audience, in a more cost effective and personalize manner. Be it retail, banking, or healthcare, the mobility has transformed each and every sector, and now is marching towards the Farming sector as well.
The app not only provides notifications but also suggestions related to the farming activities by considering soil conditions of the user's place. This app is quite user friendly that it can be functioned with mediocre intelligence and without any preliminary training. Also app is easy to operate as compared to websites

9.0 FUTURE WORK

In the future, to provide more accurate weather reports of agriculture field and garden. Replace complex system, and software tools and have made provision to act through internet.

Given below are some of the main future scopes of IoT:

1. Smart agro-logistic: It is all about smart food and agri-business. It focuses on servicing fresh product quality and natural production process with flexible chain- and compassing tracking and tracing system.

2. Smart Food Awareness: It deals with customer profile, health and awareness and normal day's in the future super market. The demand for healthier but enjoyable diet is increasing, so we need to consider and serve it. Therefore we have to develop a system using IoT which will aim for creating awareness in food quality.

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