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Monitoring the Soil Parameters Using IoT and Android Based Application for Smart Agriculture

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***Abstract*—Agriculture plays the major role in economics and survival of people in India. The purpose of this project is to provide embedded based system for soil monitoring and irrigation to reduce the manual monitoring of the field and get the information via mobile application. The system is proposed to help the farmers to increase the agricultural production. The present system is urbanized to collect a real-time data from the farm site such as light intensity, soil moisture, soil temperature, humidity, TDS sensor, pH sensor, temperature sensor along with color sensors for NPK nutrients of the soil. The heart of the whole system is ESP32 which enables the system to take away the sensor data directly on Wi-Fi, and then again to Google Firebase cloud server and Android phone application. Using Google Firebase cloud server, the user can record all the data of the sensor in the Firebase data storage element and access any smartphone or website. A special Android application is also developed that can run only authenticated user smartphone which offers the user-friendly GUI for monitoring the sensor data and irrigation control. Based on the result, the farmers can cultivate the appropriate crop that suits the soil.**

I. INTRODUCTION (*HEADING 1*)

Agriculture is the main stay of India's economy. It accounts for 26% of the gross domestic product so it is very important for us to use technology in agriculture and to bring modern approaches into agriculture to enhance the standard of living of the people who are dependent on agriculture.

So we are using IoT and android based systems to identify soil parameters as the soil is the very basis of any agricultural practice. Hence knowing the parameters of the soil should be given at-most attention.

1.1 Introduction to IoT

The IoT is a recent communication paradigm that envisions a near future, in which the objects of everyday life will be equipped with micro-controllers, trans-receivers for digital communication and suitable protocol stacks that will make them able to communicate with one another and with the user becoming an integral part of the internet.

The IoT concepts, hence, aims at becoming even more immersive and pervasive technology. Furthermore, by enabling easy access and interaction with a wide variety of devices such as for instance, surveillance cameras, monitoring sensors etc. The IoT will foster the development of a number of applications that make use of the potentially enormous amount and variety of data generated by such objects to provide new services to citizens, companies and public administrations.

1.2 Motivation

Intelligent schedule farming is an idea quickly gathering on in the agricultural industry. Proposing high-precision crop control, useful data assembly, and computerized agriculture methods, there are evidently several advantages a networked farm has to bid. The Internet, the invention of the century, has made revolution of bringing the world people closer to each other than ever before. With the computing advancements in technologies, communication is bringing the next generation Internet (IoT). As the population and urbanization increase, the larger cities have to be transformed into smart cities for smart farming which can be achieved with the help of Internet of Things. Addressing increasing water shortage, limited availability of lands and increasing costs at a very faster rate. While meeting the increasing consumption, needs of a global population is expected to grow by 70% by 2050. Influence of IoT on remotely monitored sensors that can detect soil moisture, crop growth and livestock feed levels, is to manage and control their smartly connected

harvesting and irrigation equipment's. Currently, technical solutions for monitoring, controlling and documenting agricultural farming processes, logistics, transportation, environments is easily and effectively done by IoT supported devices.

The smart farms built by manipulating the IoT prototype represent foremost means to reach these goals. In a smart farm, the status of the crop and terrain are always under control, many of the production actions can be actuated remotely by the farmer, sales can be coordinated with the manufacture and the usage of capitals ties the actual needs, thus, the surplus is circumvented.

Smart devices or objects, capable of communication and computation, ranging from simple sensor nodes to home appliances and sophisticated smartphones are present everywhere around us. The heterogeneous network composing of such objects comes under the umbrella of a concept with a fast growing popularity, referred to as IoT that IoT signifies an international network of exceptionally addressable interlocked objects. The customary IoT typically involves various Wireless Sensor Networks (WSN) and numerous sensors installed on a specific location, the auxiliary sensor nodes bring together data from site, collected data is stockpiled in a coordinator node, which interconnects Wi-Fi cloud server over internet and manageable the sensor data on smart handset/ tablet/ laptop/ PC. To build the IoT based, system generally the sensor node based on X-Bee will collect the information and at the coordinator side the GPRS based GSM system (SIM900A) is used.

Such systems are bulky, consumes more power (nearly 1.5A) and hence not suitable for remote applications. While the ESP8266 based coordinator node is small having much less power sinking (nearly 120 ma). They reported the wireless monitoring system for handling and transportation of soybeans, using GPS and X-Bee series, that range limited and user can face the connections problem during long transportation routes. The solution is to implement the system with ESP8266 that provides the real-time information of sensors, worldwide access is possible through a Wi-Fi to internet connectivity via hot spot of the smartphone. They used the ESP8266 with the X-Bee network to monitor the temperature.

In this project, attention is focused towards the hardware part (signal conditions, calibration of sensors and interfacing with MCU), sensing technology (I2C and One wire), communication system (Wi-Fi) and software applications (android application and cloud server).

1.3 Technical Aspects

IoT uses various technologies and implementation methodologies as listed below:

*i. Arduino:*it is an open source computer hardware and software company, project, and user community that designs and manufactures single-board micro-controllers and micro-controller kits for building digital devices and interactive objects that can sense and control objects in the physical world.

ii. GSM Module: When a GSM modem is connected to a computer, this allows the computer to use the GSM modem to communicate over the mobile network. While these GSM modems are most frequently used to provide mobile internet connectivity, many of them can also be used for sending and receiving SMS and MMS messages.

*iii. Sensors:*a sensor is a device, module, or subsystem whose purpose is to detect events or changes in its environment and send the information to other electronics, frequently a computer processor. A sensor is always used with other electronics, whether as simple as a light or as complex as a computer.A sensor's sensitivity indicates how much the sensor's output changes when the input quantity being measured changes. Some sensors can also affect what they measure and sensors are usually designed to have a small effect on what is measured; making the sensor

smaller often improves this and may introduce other advantages

*iv. IoT peripherals nodes:*Finally, at the periphery of the IoT system, we find the devices in charge of producing the data to be delivered to the controlled centre, which are usually called as IoT peripheral nodes.

*v. Protocols used in GSM communication***:**Mobile Station Protocol, based on the interface, the GSM signal-ling protocol is assembled into three general layers:

Layer 1: The physical layer. It uses the channel structures over the air interface.

Layer 2: The data-link layer. Across the Um interface, the data-link layer is a modified version of the Link access protocol for the D channel (LAP-D) protocol used in ISDN, called Link access protocol on the Dm channel (LAP-Dm). Across the A interface, the Message Transfer Part (MTP), Layer 2 of SS7 is used.

Layer 3: GSM signal-ling protocol's third layer is divided into three sub layers:Radio Resource Management (RR),Mobility Management (MM), and Connection Management (CM).

1.4 Overview of application based smart agriculture with supervision of soil parameter

In order to achieve a complete framework for managing the soil parameters, we need to include three features of being instrumented, interconnected and intelligence. To achieve these features, we have following development phases listed below:

a. *Hardware phase:*This stage includes installing sensors (ESP32 Micro-controller, Color Sensor, TDS Sensor, Gas Sensor, DHT11, etc) for everything and connecting them to internet. We integrate our device with ESP32 Micro-controller. This part is to achieve first level of IoT development called instrumentation.

b. *Communication phase:*This stage allows communication of the device with the user using GSM module connected to the Arduino using cellular message. GSM module registers the SIM card to the network provider and establishes a communication channel.

c. *Notification phase:*The advanced stage of IoT development is achieved only when the above two phases are integrated and represented in informational manner through cellular messages alerting the users to see the result f the soil and take precautionary measures.

1.5 Impact of IOT in soil management systems

We are living in an age where tasks and systems are fusing together with the power of IOT to have a more efficient system of working and to execute jobs quickly! With all the power at our finger tips this is what we have come up with.

The Internet of Things (IoT) shall be able to incorporate transparently and seamlessly a large number of different systems, while providing data for millions of people to use and capitalize. Building a general architecture for the IoT is hence a very complex task, mainly because of the extremely large variety of devices, link layer technologies, and services that may be involved in such a system.

1.6 Summary

This chapter introduces IoT and its application to achieve smart system to manage the soil parameters. It highlights the need of IoT to meet the unique needs of today's connected world. Understanding IoT and its motivation, paves a way to

bring smart approach in smart city applications including a smart implementation to handle soil quality crisis.

Literature Review

The literature review has been conducted to collect information on development of IoT projects by various published journals and conference proceedings of related field. This chapter orderly includes survey on IoT, Monitoring the Soil Parameters using IoT and Android Based Application for Smart Agriculture and sensors. A collective content of the literature review gives idea on bringing a smart approach for Soil analysis.

2.1 Literature Survey on IoT

The idea for IoT technology and its implementation was proposed by S.S Navghane. It aims to structure a state of the art review on IoT. He explained this technology as a connection between human-computer-things. All the equipment's we use in our day to day life can be controlled and monitored by IoT.Smart collection bin works in the similar manner with the combination of sensors. These sensors will show us various levels of pH rate, Temperature, water level and TDS Level and so on, able of tracking the soil resource level and monitoring PH rate, water level and temperature alerts through SMS to predefined numbers.

Directing at the current development condition of the internet of things and based on the available technology analysis of the internet of things, analysis and research on the internet of things in terms of technological levels and systems are made. Started from three aspects, respectively, data collection, network service, date fusion and computation, analyzing the technologies like RFID, ZigBee, sensors, Cloud Computing and so on are done, based on which further the technological system framework of the internet of things are brought forth. Moreover, analysis and research works on the sensor nodes of the system, analysis and discussion on the various technologies involved are carried on. Internet of Things refers to a network allows a series of intelligent activities like identification, positioning, tracking, monitoring and management by linking devices like RFID, Smart Sense, GPS (Global Positioning System) etc. in objects to wireless network via interfaces to endow objects with intelligence, therefore realize the communication and dialogue between human and objects as well as objects and objects. Moreover, series of research and exploring works have been launched. There are certain blindness in the research and development of the IOT technology. In terms of the proper definition, the fundamental principles, the architecture and the system model of IOT, there are plenty of questions to be considered and discussed. Based on the current IOT technology analysis, by analyzing and discussing the technological levels and systems of IOT, it is going to start the research on the architecture and the framework of IOT. Started from the intelligent transportation, logistic scheduling and tracing and base station monitoring, IOT extends its application domain to public oriented personal medical treatment, intelligent home furnishing and so on, and its applications can be found in all walks of life. However, being in the preliminary stage and asking for innovations, IOT hasn't been popularized in large scales.

Researchers have proposed different IoT-based technologies in the agriculture field that are increasing the production with less workforce effort. Researchers have also worked on different IoT-based agriculture projects to improve the quality and increase agricultural productivity. Some IoT-based agricultural techniques have been identified from the literature, which have been summarized in this section. Carnegie Melon University has worked on a plant nursery by using wireless sensors technology.In , a WSN-based poly-house monitoring system has been presented that makes use of carbon dioxide, humidity, temperature and light detection modules. By using GPS technology and ZigBee protocol a WSN-based system has been proposed that monitors different agricultural parameters. A real-time rice crop monitoring system has been designed to increase the productivity. The crop monitoring system has been presented in, which collects the information of rainfall and temperature and analyzes it to mitigate the risk of crop loss and enhance crop productivity. A low-cost Bluetooth-based system has been proposed in for monitoring various

agricultural variables such as temperature by using a micro-controller that works as a weather station.

The proposed system is best for monitoring real-time field data. Moreover, the disadvantage of this system is its limited communication range and required Bluetooth configuration with smartphones for continuous monitoring. A smart sensing platform based on ZigBee has developed by for monitoring different environmental conditions such as humidity, temperature, sunlight, and pressure.The developed platform provides a fast data rate, low-cost hardware, and an accurate sensor working on mesh network so that each node can communicate with each other effectively. A Global System for Mobile Communications (GSM) based irrigation monitoring system has been developed that uses an android app for measuring different environmental conditions such as humidity, temperature, and control of the water level. The basic purpose of this system is to develop a low-cost wireless system,

whereas the negative aspect of the system is to know the operating command to actuate the fieldmotor and agriculture parameters. To measure the greenhouse parameters such as humidity and temperature, a system has been proposed on the basis of GSM and Field Programmable Gate Array(FPGA). The proposed system provides cost-effective and timely monitoring solutions to monitor crop and soil conditions. In a simple, flexible networking low-cost system has been proposed that uses a fuzzy control system to monitor different greenhouse parameters. The operation and design methodologies for WSN have been proposed in for a more advanced monitoring and controlling system in the greenhouse. Multiple environmental problems related to greenhouses have also been addressed such as WSN components standardization, wireless node packaging, and electromagnetic field interference. In, a system has been proposed that monitors the animal's health as well as identifies the widespread diseases, whether it originates from biological attacks or natural causes. A low-cost animal health monitoring system is presented in that measures the heart rate, postures, and body temperature.

2.2 Literature Survey on Application based smart agriculture with supervision of soil parameters.

***Abhishek Srivastava, Dushmanta Kumar Das, Ravi Kumar,* Monitoring of Soil Parameters and Controlling of Soil Moisture through IoT based Smart Agriculture IEEE 2020.[1]**

Agriculture plays a vital role in the economic growth and development of any nation. Changing climatic condition have badly affected the production of agriculture products. Therefore, to improve the quality and quantity of agriculture products, many new technologies are being developed to practice smart agriculture which can adapt to the changing climatic condition. In this paper, one such method is proposed. The developed method is a new and simple internet of thing based approach to practice smart agriculture. In this proposed approach, a hardware and software setup is used to monitor important soil parameters from a remote location and automatic control of soil moisture content. The proposed approach helps in remote monitoring and water conservation process.

***R. Madhumathi, T. Arumuganathan, R. Shruthi,* Soil NPK and Moisture analysis using Wireless Sensor Networks IEEE 2020.[2]**

Agriculture plays a vital role in the economic development of our country. Crop yield primarily depends on soil fertility and moisture level. Fertilizers are normally recommended based on the nutrient present in the soil. To recommend a suitable fertilizer level, the soil nutrient analysis is essential which is done mostly using laboratory techniques. Manual methods of measuring soil nutrients are time consuming. Many farmers refrain to perform soil testing in the laboratory and grow the same crop in the land continuously, hence soil loses its fertility. A system has been proposed to adopt precision agriculture using Wireless Sensor Networks, which enables remote monitoring of soil fertility and other parameters namely soil moisture, pH and temperature. This data is transmitted to the cloud and the corresponding values are displayed on a mobile application. The proposed Internet of things (IoT) based software system has the intelligence to recommend the quantity of water and fertilizer which improves the quality of the soil and ensures optimum growth of the crop.

Smita Kapse, Samanta Kale, Sharanya Bhongade, **IOT Enable Soil Testing & NPK Nutrient Detection IJCT 2020[3]**

A vast fraction of population of India considers agriculture as their primary occupation. Production of crops plays an important role in our country. Bad quality crop production is often due to either excessive use of fertilizer or using not enough fertilizer. For efficient crop growth, it is essential to measure the level of nutrients present in the soil. The proposed system of IOT enabled soil testing is based on measuring and observing soil parameters. This system lowers the probability of soil degradation and helps maintain crop health. Different sensors such as pH, soil moisture are used in this system for monitoring temperature, humidity, soil moisture and soil pH along with color sensors for NPK nutrients of the soil. The data sensed by these sensors is stored on the cloud and analyzed based on which suggestions for growth of the suitable crop is made. A Wi-Fi module interfaced with Arduino is used for displaying test result data along with a list of particular crops suitable for the tested soil. A web portal is also created which gives information about the fertilizer(s) required for their crops. This paper presents a study of soil and the relevant parameters involved in the prediction of suitable crops to avoid the problem of soil infertility and to improve the quality of crops. This system is designed by keeping the needs of farmers in mind which results in its capacity to make suggestions via mobile application

Ioana M. Marcu, George Suciu, Cristina M. Balaceanu, Alexandru Banaru, **IOT based System for Smart Agriculture IEEE 2019[4]**

Agriculture is the most traditional activity over time. Since the beginning of it, agriculture has suffered many changes to improve productivity and quality of crops. Some of the first significant improvements have been remarked when machines and new tools such as irrigation systems, harvest machines, farmland clearing machines were introduced in the primitive agriculture, where these activities were performed mainly by humans and animals. Over time, agriculture has been affected by weather disasters (such as storms or extreme temperatures) and by natural disasters (such as pests and plant diseases). Thus, the next step in the development of the agriculture domain was to propose the Internet of Things (IoT) solutions for monitoring of many parameters for better precision agriculture. Such a system would provide useful information on plant growth, crops' diseases, and soil properties that are a benefit for crops. This paper describes a possible solution for a more reliable IoT-based system using Libelium for Smart Agriculture to monitor the parameters that have a direct impact on crops. Moreover, the monitoring system aims to manage agricultural issues related to irrigation and analyses the effect of the measured parameters on agriculture, helping the farmers to have healthy crops.

Smita Pawar, Shreya Tembe, Rujuta Acharekar, Sahar Khan, Sheetal Yadav, **Design of an IoT enabled Automated Hydroponics system using NodeMCU and Blynk, IEEE 2019[5]**

India's economic development is primarily dependent on Agriculture. If India wants to become powerful economically in the world, then there is a need for advanced methods to be used for cultivating good quality crops. One of the most convenient methods amongst all is hydroponics. Hydroponics is a method of planting or cultivating plants without the use of soil. The technique graces us with superior-grade crops by replicating their environmental requirements. It is also referred to as vertical farming, because this type of farming allows plants to be grown in layers, on shelves or trays, one layer over another. Sand, gravel, rock wool and coco peat are some mediums used to replace soil used in conventional farming. According to a recent study, the plants do not really require soil, but just the nutrients to grow; soil introduces 90% of the pests. Conventional farming has evolved after the growing use of commercial hydroponics in developing countries like India, Israel, Brazil, Southeast Asia, Italy and many more.

2.3 Existing System

The existing system of Soil analysis is found to be inefficient as the devices for measuring the soil are more and inaccurate. Farmers must take the soil to the lab to find out the parameters of the soil.

Disadvantages of the Existing System

- Cost is more as the lab charges the farmers more since they don't know what is really going on inside the lab.
- No particular device for measuring the soil completely.
- The existing systems are not user friendly.

2.4 Proposed System

In our proposed work it is going to be focused on the agriculture. By using the same existing the soils pH rate, Temperature, water level and TDS Level can be monitored using the wireless sensors. soil can monitor their pH rate, temperature regularly. The monitored report of their land can access this information from their mobiles via wireless network and can check their pH rate at their own time. If they notice abnormalities, they can immediately notice their land and use pesticides to overcome the abnormalities. This project aims in designing a system which is capable of tracking the soil resource level and monitoring PH rate, water level and temperature alerts through SMS to predefined numbers.

The measurement of Nitrogen, Phosphorus and Potassium, (i.e. N, P, K respectively) levels of soil is vital to make a decision what quantity additional contents of those nutrients are required to extend fertility of soil. The standard of soil is thus enhanced which subsequently provides a better yield quality of crop. In the present work, color detector which primarily uses fiber optic technology has been integrated with the system to read N, P and K levels as high, medium and low of the sample soil. The absorption of color is the primary principle of color detector. It is helpful in dispensing solely the specified quantity of fertilizers within the soil..

Advantages

- Reduces the farmer's workload
- Alerts on soil resources to the predefined number
- Works anywhere in the world

2.5 Aim, Objectives and Methodology

AIM: The aim of the project is to provide an IOT and android based approach towards agriculture where we find soil parameters like temperature, humidity, type of atmospheric gas, [H value, N P K values through an embedded device and the output is sent to the mobile phones through wireless network

Objectives:

1. To provide all the information to farmers via their mobiles via wireless network.
2. To provide a system which is capable of tracking the soil moisture level and water the soil as it is required.
3. To make sure that farmers are getting all the information they need to know about their soil by using a single device.

Methodology:

- Methodology for Objective-1:

Using Google Firebase cloud server, the user can record all the data of the sensor in the fire base data storage element and access any smartphone or website.

- Methodology for Objective-2:

  As soon as the Soil moisture sensor detects less moisture level, the water pump will automatically water the soil to it's required level.

- Methodology for Objective-3:

  Instead of using several devices to find several information about the soil, it is better to find out all the values using a single device by making it easy to the farmers.

2.6 Summary

In today's time when IoT is finding its space in various sectors, the work and research done in this field inspires us to find various smart solutions to the problems existing in our society. Therefore, the approach of IoT in various papers gives an idea to implement an efficient way to Monitor the Soil Parameters using IoT and Android Based Application for Smart Agriculture.

Design

Design is the technique which is used to do the system analysis, it would be necessary to identify the data that is required to be processed to produce the outputs. Design

features can ensure reliability of the system and generate correct reports from the accurate data. It is also possible to determine whether the user can interact efficiently with the system.

The system registers the service provider and the end users, who can upload or download a required file. The cloud server checks for malicious files among the files that are uploaded by the service provider. An alert message is sent to the particular service provider

3.1 Design Procedure

Design is the technique which is used to do the system analysis, it would be necessary to identify the data that is required to be processed to produce the outputs. Design features can ensure reliability of the system and generate correct reports from the accurate data. It is also possible to determine whether the user can interact efficiently with the system.

The process takes the data from the database and checks these data with the user inputted data. Once the process has been finished, the output or the report will be generated based on the process results

3.2 System Architecture

The system architecture clearly explains the entire system. The architecture consists of the following system entities.

3.2.1 HARDWARE USED:

- ESP32 Microcontroller
- Color Sensor
- TDS Sensor
- Gas Sensor
- DHT11
- Moisture Sensor
- OLED
- Buzzer
- Relay
- Water pump

3.2.2 SOFTWARE USED:

- Embedded C
- Arduino IDE
- Google Firebase Cloud
- MIT App Inventor Tool

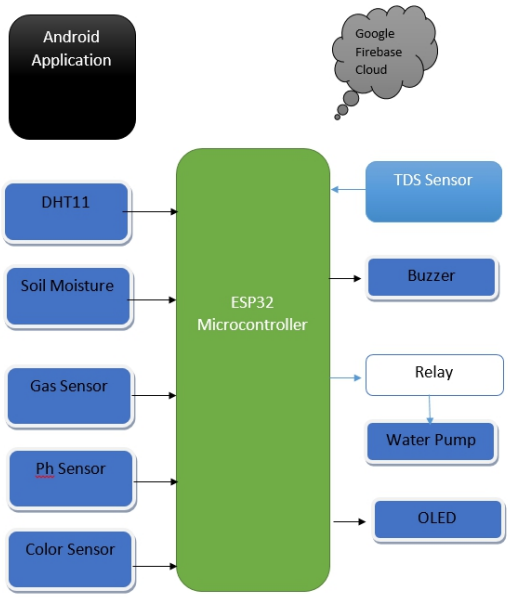

Fig 3.1 Flow diagram

This is the brief overview of the flow diagram of the analysis of soil contents project. As shown in the fig, the sensors are attached in the same way to the arduino chip

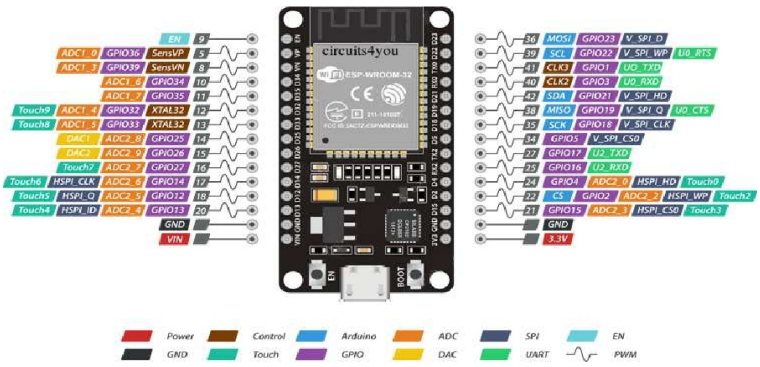

Fig 3.2 ESP32 Micro-controller:

ESP32 can perform as a complete standalone system or as a slave device to a host MCU, reducing communication stack overhead on the main application processor. ESP32 can interface with other systems to provide Wi-Fi and Bluetooth functionality through its SPI / SDIO or I2C / UART interfaces.

Fig 3.3 DTH 11 Sensor:

The DHT11 is a basic, ultra low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin (no analog input pins needed). Its fairly simple to use, but requires careful timing to grab data.

Fig 3.4 Soil Moisture Sensor:

The soil moisture sensor consists of two probes that are used to measure the volumetric content of water. The two probes allow the current to pass through the soil, which gives the resistance value to measure the moisture value.

Fig 3.5 Gas Sensor

This is a generic Arduino gas sensor. It has MQ2 probe which is able to detect LPG, i-butane, propane, methane ,alcohol, Hydrogen, smoke. It can be used in gas leakage detecting device in consumer and industry markets. It has a high sensitivity and fast response time.

Fig 3.6 PH Sensor

Arduino pH Meter. pH scale is used to measure the acidity and basicity of a liquid. It can have readings ranging from 1-14 where 1 shows the most acidic liquid and 14 shows the most basic liquid. 7 pH is for neutral substances that are neither acidic nor basic.

Fig 3.7 Color Sensor

A colour sensor is a type of "photoelectric sensor" which emits light from a transmitter, and then detects the light reflected back from the detection object with a receiver.

Fig 3.8 TDS Sensor

Gravity Analog TDS Sensor is an Arduino-compatible TDS sensor/Meter Kit for measuring TDS value of the water. It can be applied to domestic water, hydroponic and other fields of water quality testing. The TDS probe is waterproof, it can be immersed in water for long time measurement.

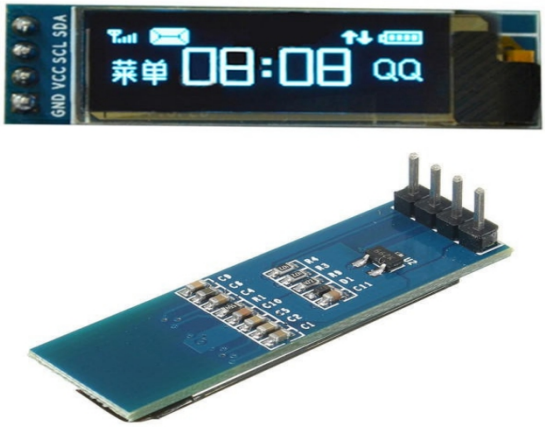

Fig 3.9 OLED Display

The display connects to Arduino using only four wires – two for power and two for data, making the wiring very simple.The SSD1306 is a 128×64 dot single chip driver with a controller that's used for graphic display systems.

Fig 3.10 Buzzer

A "piezo buzzer" is basically a tiny speaker that you can connect directly to an Arduino. "Piezoelectricity" is an effect where certain crystals will change shape when you apply electricity to them. By applying an electric signal at the right frequency, the crystal can make sound**.**

Fig 3.11 Relay

A relay is an electrically operated switch that can be turned on or off, letting the current go through or not, and can be controlled with low voltages, like the 5V provided by the Arduino pins. Controlling a relay module with the Arduino is as simple as controlling any other output as we'll see later on.

Fig 3.12 Water Pump

A water pump is a machine used to increase the pressure of water in order to move it from one point to another.

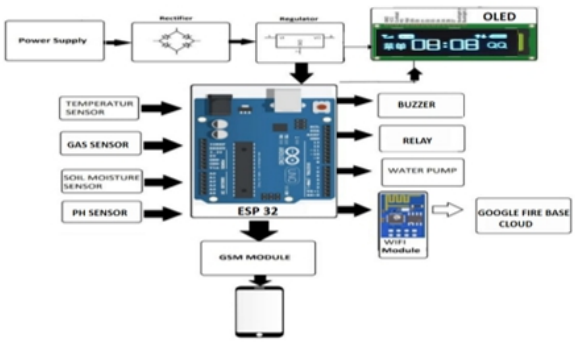

Fig 3.13 Block diagram

It shows the block diagram of System with Internet of Things. System Hardware mainly includes an ESP32 Arduino micro controller chip, GSM module, sensors and Wi-Fi module.

Implementation

Implementation is the stage of the project when the theoretical design is turned out into a working system. Thus the implementation part can be considered to be the most critical stage in achieving a successful new system and in giving the user, confidence that the new system will work and be effective.

The implementation stage involves careful planning, investigation of the existing system and it's constraints on implementation, designing of methods to achieve changeover and evaluation of changeover methods.

Description:

In our proposed work it is going to be focused on the agriculture. By using the same existing the soils pH rate, Temperature, water level and TDS Level can be monitored using the wireless sensors. soil can monitor their pH rate, temperature regularly. The monitored report of their land can access this information from their mobiles via wireless network and can check their pH rate at their own time. If they notice abnormalities, they can immediately notice their land and use pesticides to overcome the abnormalities. This project aims in designing a system which is capable of tracking the soil resource level and monitoring PH rate, water level and temperature alerts through SMS to predefined numbers.

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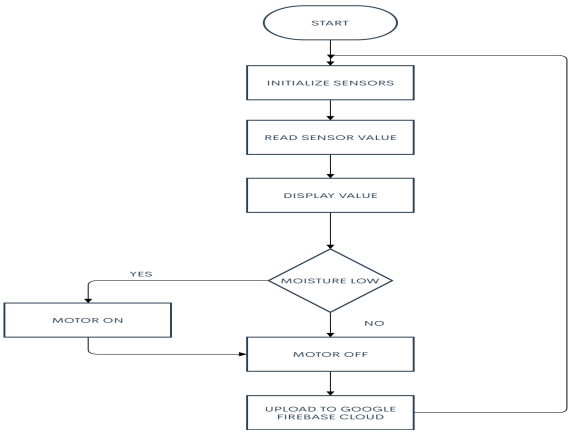

Fig 4.1 Work flow of the system

- **Step 1**: Process started.
- **Step 2**: All the sensors are initialized using IoT.
- **Step 3**: Sensor values are checked. Soil sensor gives soil Status whether soil dry/wet. DHT11 sensor gives the Humidity and Temperature
- **Step 4**: If the soil status is up to required level, motor remains off.
- **Step 5**: If the soil status is dry then motor gets ON automatically.
- **Step 6**: Initialize all the sensor values after completion of step 5. Process is completed and moves to original state.

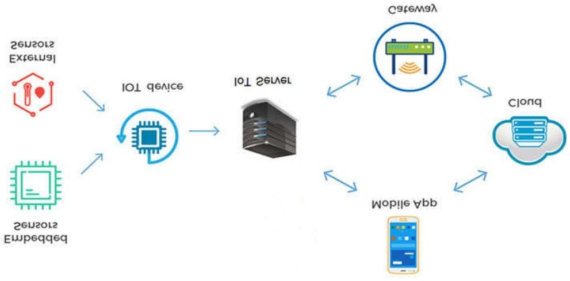

Fig 4.2 Brief Overview of Project

The brief overview of the device is shown

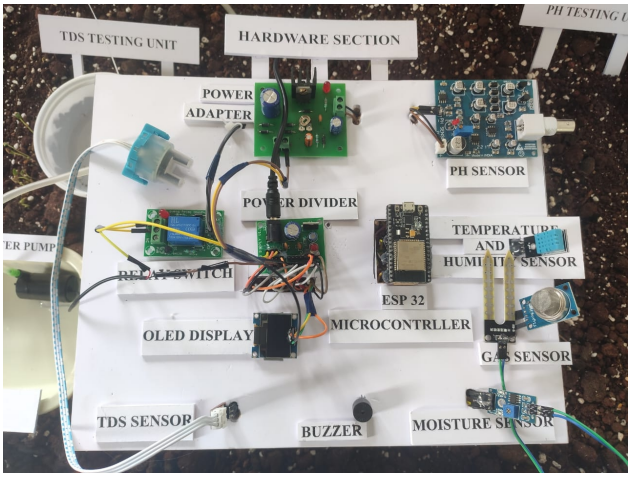

Fig 4.1 Overview of the device

Conclusion and Future Work

Conclusion :

- The remote monitoring of the soil pH rate and its temperature rate has been done with the very minimal cost
- The values can be viewed by the farmer's anywhere in the world at any time
- The temperature sensor, Humidity sensor and soil moisture sensor can be interfaced to the micro-controller to assess any further data
- The resulting system was also low in power and cost, noninvasive and provisional real time monitoring on the agriculture.
- It is also easy to use and provide accurate measurements.

Future work :

This device currently detects the soil moisture, NPK , temperature, gas levels in the soil for a small amount of soil. In future many more sensors can be added to this device and make it a real time soil analysis device with accurate values. It can be improved by suggesting water level and also can suggest crop cultivation depending on the complete analysis of soi

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