Smart Agriculture System

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Abstract— The Internet of Things (IoT) is a typical example that is rapidly growing in the world of modern wireless telecommunication. It refers to a wireless network between objects. Internet of Things refers to the concept that the Internet is no longer just a global network for people to communicate with one another using computers, but it is also a platform for devices to communicate electronically with the world around them. Agriculture is the main occupation in India. India's two-third of population is directly or indirectly dependent on agriculture. Agriculture's performance has a substantial impact on the economy of our country. The agricultural productivity may be harmed mainly because of the problems like unplanned irrigation, intruder attacks. In agriculture, irrigation system plays an important role in getting the good yield. Traditional method of irrigation system is done manually which causes wastage of water. Crops may also be destroyed by the predators' attack which leads to production loss. The solution to this problem is making agriculture smart by using automation and IoT technologies. Hence this project aims at modernizing the current traditional methods of agriculture by making use of smart irrigation system by taking intelligent decisions based on the accurate field data. The intruders' problem can be overcome by monitoring the field and threatening the intruder. These can be made happened by using various sensors, GSM modem, Wi-Fi with microcontrollers.

Keywords: Smart Agriculture System, Internet of Things (IoT), GSM Modem

I. INTRODUCTION

A. Introduction to Internet of Things

Internet of Things, likewise considered the Internet of Objects refers to the idea that the Internet is never again only a worldwide system for individuals to communicate with each other using computers, but it is also a platform for devices to communicate electronically with their general surroundings. The Internet of Things(IoT) is an typical example that is quickly making progress in the modern wireless telecommunication. IoT is the system of physical devices, home appliances, vehicles and different things embedded with hardware, software, sensors, and network which empowers these things to connect, collect and exchange data. The Internet of Things allows objects to be controlled and sensed remotely across existing network and creating opportunities for more direct co-ordination of the computer based systems with physical world and bringing about accuracy, improved efficiency and economic benefit.

IoT is continuously changing and developing. There are difficulties related with the IoTs. The zones of trust and security, standardization and administration required to guarantee a reasonable and reliable open IoT which offers some benefit to every one of the things in the society. The Internet of things incorporates a threelayer framework. They are network layer, perception layer and application layer. Perception layer incorporates sensor nodes. Sensor nodes and Information communication technology enabled devices are the basic components of the sensor technology. It comprises of cameras, RFID tags, sensors and sensor network used to distinguish items and gathering data. Network layer is framework layer of IoT. It coordinates towards the combination of the application layer and the perception layer. The application layer incorporates the IoT with the innovation of explicit industry. The IoT is connected in the vast majority of the fields including agriculture.

'Things' in the IoT can refer to different objects. These objects gather valuable data with the assistance of different existing technologies and after that automatically transfer the information between different objects. IoT is likewise expected to produce a lot of information from different areas that is aggregated in all respects rapidly, in this manner expanding the need to record, store and process such information.

In the first place, so as to interface everyday devices and objects to network and to extensive databases and in reality to the network of networks (the internet), a cost effective, simple and unobtrusive system of item identification is critical. Only then information about things be gathered and handled. Radio-Frequency Identification (RFID) offers this function. Second, information accumulation will profit by the capacity to recognize changes in the physical status of things utilizing sensor technologies. Embedded knowledge in the things themselves can additionally improve the intensity of the network by degenerating data preparing capacities to the edges of the network. At last, progresses smaller and smaller things to be able to associate and interface. A combination of these advancements will make an Internet of Things that associates the world's objects in both an intelligent and sensory way.

B. Motivation for the Project

We face a daily reality such that everything can be operated and controlled automatically, yet there are a couple of significant areas in our nation where automation has not been implemented or not been put to a full-edged use, maybe on account of a few reasons, one such reason is cost and one such field is farming. Agriculture has been one of the essential occupations of man since early civilizations and even today manual methods in cultivating are unavoidable. IoT is applied in most of the fields including agriculture. Agriculture is the main occupation in India. India's two-third of population is directly or indirectly dependent on agriculture. Agriculture's performance has a substantial impact on the economy of our country.

About 70 percent of population depends upon farming in India. Agriculture also provides large ample employment opportunities to the people. Development in agriculture sector is essential for the advancement of financial

state of the nation. Many farmers still use the traditional methods for cultivating which results in low yielding of harvests and organic products. Yet, wherever automation had been implemented and people had been replaced by automatic machines, the yield has been improved. Hence there is a need to implement technology and modern science in the agriculture sector for increasing the yield. Issues concerning agriculture have been always hampering the development of the country. Manual method of checking the parameters is the existing method and one of the oldest way in agriculture. In this method, the farmers themselves verify all the parameters and calculate the readings. It is high time to create and implement new methodologies using smart technologies for sustainable agriculture. In this era, a smarter approach of leading a life should be carried out and thus automation should be implemented. The only solution to this problem is to implement smart agriculture system by modernizing the current traditional methods of agriculture.

Automating the agriculture system is monitoring and controlling of the climatic parameters which directly or indirectly govern the plant growth and hence their produce. Monitoring the environmental factors is not the complete solution to increase the yield of crops. There are number of other different elements that decrease the productivity to a greater extent. Hence automation must be implemented in agriculture to overcome these problems.

The sensor technology is one of the fastest growing technologies in the smart world. Sensor networks have attracted in recent years. The potential applications of sensor networks are immense. Sensors have been used for various applications including agriculture. They are used for collecting and sensing the data. The wireless sensor network collects data from different sensors deployed at various nodes. Most of the papers signifies the use of wireless sensor network which collects the data from different types of sensors and then send it to main server using wireless protocol. The gathered information gives the data about various environmental factors which in turn helps farmer to monitor and control the system.

Monitoring environmental factors isn't sufficient and complete solution for improving the yield of the crops. There are number of different factors that influence the efficiency to greater extent. These factors include attack of insects and pests which can be controlled by spraying the crop with proper insecticide and pesticides. Secondly, attack of wild animals and birds when the crop grows up. So, in order to provide solutions to all such problems, it is necessary to develop integrated system which will take care of all factors affecting the productivity in every stages.

The agricultural productivity may be harmed mainly because of the problems like unplanned irrigation, intruder attacks. In agriculture, irrigation system plays an important role in getting the good yield. Traditional method of irrigation system is done manually which causes wastage of water. Crops may also be destroyed by the predators' attack which leads to production loss. The solution to this problem is making agriculture smart by using automation and IoT technologies. Hence this project aims at modernizing the current traditional methods of agriculture by making use of smart irrigation system by taking intelligent decisions based on the accurate field data. The intruders' problem can be overcome by monitoring the field and threatening the intruder. These can be made happened by using various sensors, GSM modem, Wi-Fi with microcontrollers.

The physical objects that are being associated will have at least one sensors. Each sensor will monitor a specific condition such as soil moisture level, temperature and humidity. In IoT, these sensors will connect to each other and to systems that can understand or present information from the sensors data feeds. In agriculture, irrigation is a basic procedure that influences crop production. Generally, farmers visit their agricultural fields periodically to check soil moisture level and dependent on the necessity, water is pumped by the motors to irrigate the fields. Automated irrigation system makes farmer work much easier.

Intruder scaring is also one of the beneficial works that can be done by using PIR sensors through IoT. Prevention of animal intrusion to secure the crops is the most important thing. This can be done by using radio frequency identification for detecting the entry of animals into the field. When any intrusion occurs, alert messages will be sent to the farmer. Thus by the using above methods, Smart Agriculture System can be achieved. Controlling of all these operations will be through any remote smart device or computer and the operations will be performed by interfacing sensors and actuators with micro-controller.

This project therefore proposes a system which is useful in monitoring the field data as well as controlling the field operations which provides the flexibility. The project aims at making agriculture smart using IoT technologies and automation.

II. LITERATURE SURVEY

Many countries like India, greater part of the population relies upon agriculture and its national income originates from agriculture. Despite this and even the cutting edge innovation is found all over the place, the farming area is following the old customary innovation. Our farmers still retreat to conventional techniques like manual distribution of seeds and ploughing, two harvests for each year design, informal frameworks of development. The monsoons are irregular, and unevenness of availability of water throughout the year poses a major problem. All this leads to inadequate yield and low productivity.

The newer scenario of drying up of tanks and rivers, unpredictable environment and decreasing water tables present an urgent need of proper utilization of water. The use of scientific methods in the agricultural field can bring about rapid changes in the productivity of crops, due to improved efficiency and accuracy in the farming methods. To cope up with this use of sensors like soil moisture sensor and temperature sensors at suitable locations for monitoring of crops is implemented. An algorithm developed with predefined threshold values of soil moisture and temperature can be programmed into a microcontroller based gateway to control water quantity.

After the research in the agricultural field, specialists found that the yield of agricultural productivity is diminishing day by day. However, utilization of modern technologies in the field of agriculture plays significant role in increasing the

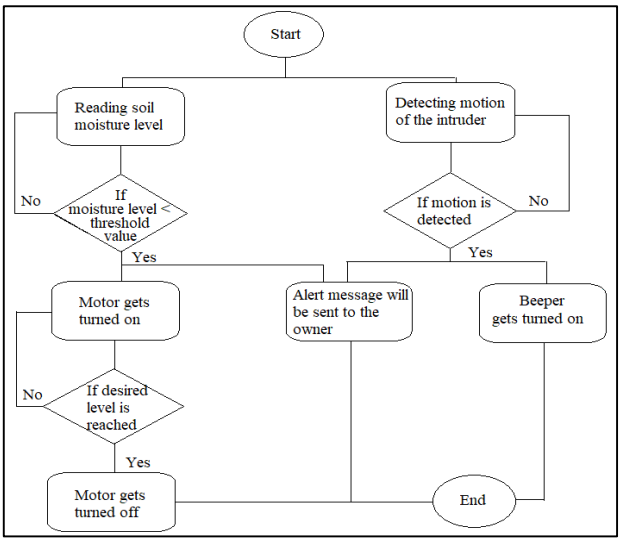
crop production and yield and decreasing the additional labour efforts. A portion of the research attempts are accomplished for the improvement of farmers which gives the system that use technologies helpful for increasing the agricultural yield. Of the various advantages that IoT brings to the table, its ability to innovate the current scenario of farming methods is absolutely ground-breaking. Mostly, we come across ideas that suggest a wireless sensor network that collects data from the various sensors present in the field and sends the data to the main central server. This method focuses on studying the environmental factors to improve crop yield. But it turns out, monitoring environmental factors alone are never adequate to increase productivity of crops since a lot of other factors have a role to play. This may include spraying of insecticides and pesticides to prevent invasion of pests and insects, monitoring the fields at all times to stay aware of attacks by animals and birds, and thefts of crops during the stages of harvesting.

We need to implement an integrated system that will ensure increased levels of productivity, and crop monitoring at all stages of cultivation and harvesting. The real-time monitoring of environmental parameters is very important in farming. So an electronic system is proposed for the efficient monitoring and effective control of different environmental parameters related to the field. A remote detecting and control irrigation system using distributed wireless sensor network aiming for real time in field sensing, variable rate irrigation and controlling of a site specific precision linear move irrigation system to maximize the productivity with minimal use of water is developed.

The system designed describes details about the instrumentation and design of wireless sensor network, real time in field sensing, variable rate irrigation, and control by using appropriate software. The whole system is implemented using sensors which collects the data and sends the data to the arduino microcontroller where necessary actions are taken for controlling irrigation automatically according to the predefined threshold values. The system provides a low cost wireless solution as well as remote controlling for precision irrigation using IoT technologies. The aim of this system is to modernize farming innovation by using programming segments and construct the necessary parts for the framework. In the studies related to wireless sensor network technology, researchers' monitored soil related parameters such as temperature and humidity. Sensors were deployed below the soil which communicates with relay nodes by the use of effective communication protocol providing very low duty cycle and hence increasing the life time of soil monitoring system.

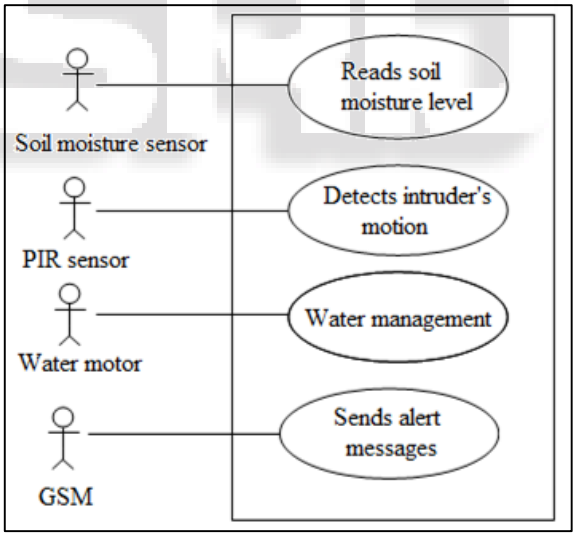
III. PROPOSED METHODOLOGY

A. Flow Diagram



– In the Figure, the soil moisture sensor measures the soil moisture level. The data values from this sensor is sent to the Arduino uno.
– Arduino computes the result and makes the water pump to turn off and on. • The PIR sensor detects motion of the object. If motion is detected, it sends signal to the Arduino uno. Then the buzzer will turn on.

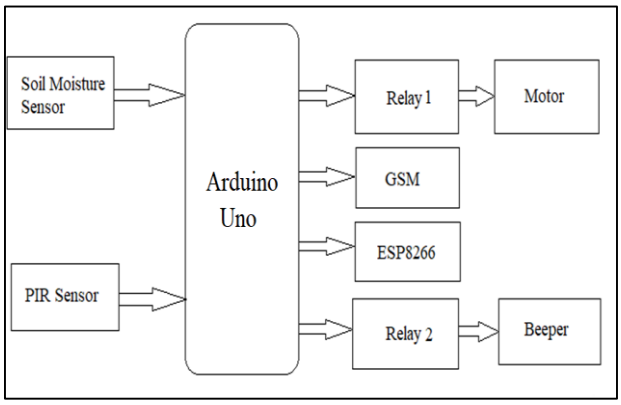
B. Use Case Diagram



An use case diagram is a graphical depiction of the interaction among the elements of a system as shown in the Figure. A use case is methodologies used in system analysis to identify, clarify and organize system requirements.

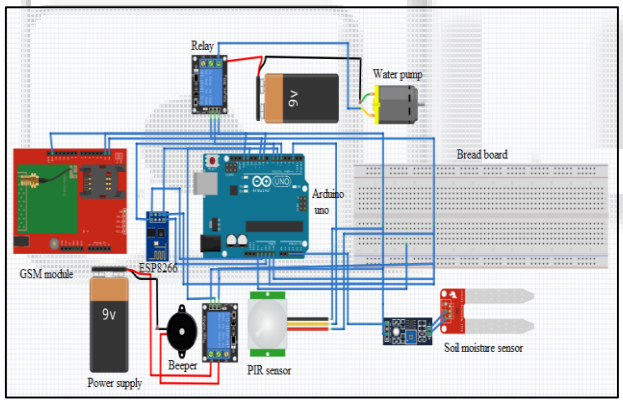
– Check the moisture level of the soil by soil moisture. • Water management can be done by water pump which is controlled by arduino. • Entering of intruder can be controlled by PIR sensor which is controlled by arduino.
– It sends the information in the form of message text with the help of the GSM modem that is controlled by arduino.

C. System Architecture



- The block diagram as shown in Figure contains soil moisture sensor, PIR sensor, Gsm module, motor, beeper, ESP8266 wifi module, relay one and two.
- Soil moisture sensor is an input device which sends the data about the moisture level of soil to Arduino uno.
- PIR sensor also an input device. If any motion is detected by the PIR, it sends the signal to the Arduino uno.
- Arduino uno is a heart of the system, it controls all component of the system based upon the program.
- Relay 1 acts as a switch to the water pump. Relay 2 acts as a switch for beeper.

D. Circuit Diagram



- Arduino board is connected with the hardware components like ESP8266 wifi module, PIR sensor, GSM module, Soil moisture sensor.
- Water pump motor is connected to the battery and to the relay which in turn is connected to the arduino board.
- Beeper is connected to the battery and to the relay which in turn is connected to the arduino board.
- All the ground pins of the components are connected to the ground pins of the arduino.
- All the VCC pins of the components are connected to the VCC pins of the arduino.

E. Methodology

Methodology of Smart Agriculture System involves soil moisture sensing along with automated irrigation system and intruders scaring. Smart Agriculture system is controlled automatically. The farmer will be informed about the situation of the farm even he is not present in the farm. This improved method includes no workers to control the farm manually and wastage of water is decreased.

Different sensors are deployed in the field like, moisture sensor and PIR sensor. The sensors play an important role in the IoT system as they are the whole and sole mechanism required for proper functioning of the system. These sensors collect real time data continuously from where it was placed. The data collected from these sensors are sent to the Arduino uno. In control section, that is in the Arduino uno the data from the sensors are received and the received data is then analyzed by the Arduino uno and then passes the signal to the devices which it was connected to.

Soil moisture sensor is deployed in to the soil and is connected to Arduino uno. This measures the moisture level continuously. If the moisture level in the soil is lower than the given threshold value, the Arduino sends signal to the motor to turn on, it will result in automatic smart irrigation system where the motor is turned on automatically and water is pumped to the soil. Similarly, if the soil moisture level value is less than the threshold value, then the Arduino sends the signal to the motor to turn off the motor.

The sensor has both analog and digital output. LED indicates whether the output is high or low. If the soil is dry, then the current will not pass through it and it will act as open circuit. Hence the output is said to be high. Similarly, if the soil is wet, then the current will pass from one terminal to the other terminal and here the circuit is said to be short. Hence the output is zero. Moisture sensor is platinum coated to increase the efficiency. The sensor has long life because of its anti-oxidant property. It is also easily affordable by farmers. When motor is turned on and off a text message is sent to the farmer's mobile using GSM module. SIM is inserted into the GSM modem and it works as same as the mobile phone.

The method of scaring the intruder is done by using PIR sensors. The farmland is deployed with PIR sensors. The PIR sensor is used to detect the object crossing the farmland. If any motion is detected by the PIR, it sends signal to the Arduino, the Arduino further sends signal to the other devices which it has been informed before, such as buzzer.

Farmland is deployed with PIR sensors. PIR sensor stands for passive infrared sensor. The main component of a PIR sensor is the pyroelectric sensor. The pyroelectric sensor is actually divided into two halves. When there is no motion, both halves receive the same amount of IR radiations from the surrounding. However, when a target crosses the sensor, the IR radiation level received at one half is more than the radiation at the other half. The PIR reacts to this change and makes the output HIGH. The range of detection goes up to 6-10 meters.

When any motion is detected by the PIR sensor, it automatically turns on the buzzer. When the motion is detected an alert message is also sent to the farmer. The alert messages are sent using GSM module. SIM is inserted into the GSM modem and it works as same as the mobile phone. Soil moisture content will be passed to the 'ThingsSpeak' server where the graph will be displayed accordingly. Similarly, motion detection graph will be displayed in the 'ThingsSpeak' server which shows fluctuations whenever the motion is detected.

GSM stands for Global System for Mobile. GSM is an open and digital cellular technology used for transmitting

mobile data service, operates at the 850MHz, 900MHz, 1800MHz and 1900MHz frequency bands.

F. Software Components required for the Project

The software requirements specification is a description of a software system to be developed. The software requirements are

1) Arduino IDE

The Arduino Integrated Development Environment or Arduino Software contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus as shown in the Figure.

2) Writing Sketches

Programs written using Arduino Software (IDE) called sketches. These sketches are written in the text editor and are saved with the file collision. The editor has features for cutting, pasting and for searching, replacing text. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino Software (IDE), including complete error messages and other information. The bottom right hand corner of the window displays configured board and serial port. The tool-bar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor.

3) Libraries

Libraries provide extra functionality for use in sketches, e.g. working with hardware or manipulating data. To use a library in a sketch, select it from the Sketch Import Library menu. Because libraries are uploaded to the board with your sketch, they increase the amount of space it takes up.

4) ThingsSpeak Server

ThingSpeak is an IoT analytics platform service that allows you to aggregate, visualize and analyse live data streams in the cloud. ThingSpeak provides instant visualizations of data posted by your devices to ThingSpeak. With the help of ThingSpeak server we can perform online analysis and processing of the data as it comes in. ThingSpeak is often used for prototyping and proof of concept IoT systems that require analytics. Some of the key capabilities of ThingSpeak include the ability to: Easily configure devices to send data to ThingSpeak using popular IoT protocols. Visualize your sensor data in real-time. Aggregate data on-demand from third-party sources. Run your IoT analytics automatically based on schedules or events. Prototype and build IoT systems without setting up servers or developing web software.

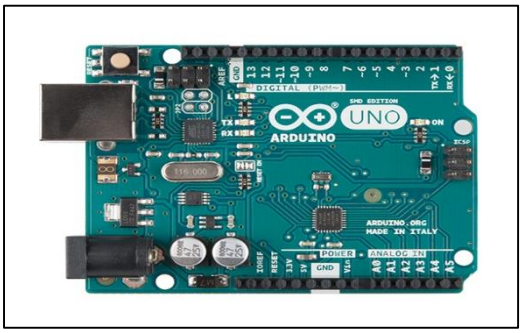
G. Hardware components required for the project

1) GSM modem

GSM Modem can acknowledge any GSM organize administrator SIM card and act simply like a cell phone with one of a kind telephone number. Favourable position of utilizing this modem will be that it can utilize its RS232 port to convey and create implanted applications. Applications like SMS Control, information exchange, remote control and logging can be grown effectively utilizing GSM as appeared in Figure. It can likewise be utilized in GPRS mode to associate with web and do numerous applications for information logging and control. In GPRS mode can likewise interface with any remote FTP server and transfer files for information logging.

2) Arduino board

The Arduino UNO is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 Digital pins, 6 Analog pins, and programmable with the Arduino IDE (Integrated Development Environment) via a type B USB cable. It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts. It is also similar to the Arduino Nano and Leonardo. The hardware reference design is distributed under a Creative Commons Attribution Share-Alike 2.5 license and is available on the Arduino website. Layout and production files for some versions of the hardware are also available. The word ”uno” means one in Italian and was chosen to mark the initial release of the Arduino Software. The Uno board is the first in a series of USB-based Arduino boards, and it and version 1.0 of the Arduino IDE were the reference versions of Arduino, now evolved to newer releases. The ATmega328 on the board comes preprogramed with a bootloader that allows uploading new code to it without the use of an external hardware programmer.



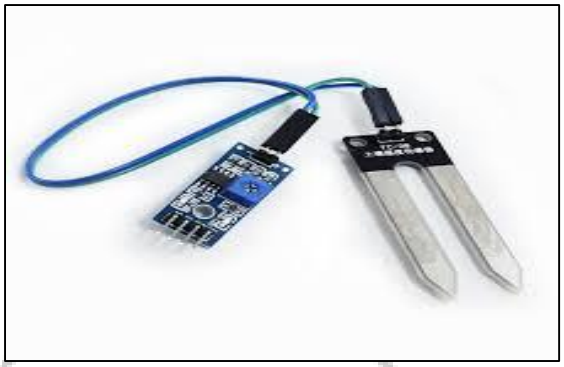
3) Soil Moisture Sensor

The soil moisture sensor comprises of two probes which are utilized to gauge the volumetric substance of water as appeared in the Figure 4.4. The two probes enable the current to go through the dirt and after that it gets the opposition incentive to gauge the dampness esteem.

At the point when there is more water, the dirt will direct greater power which implies that there will be less obstruction. Thusly, the dampness level will be higher. Dry soil conducts power ineffectively, so when there will be less water, at that point the dirt will lead less power which implies

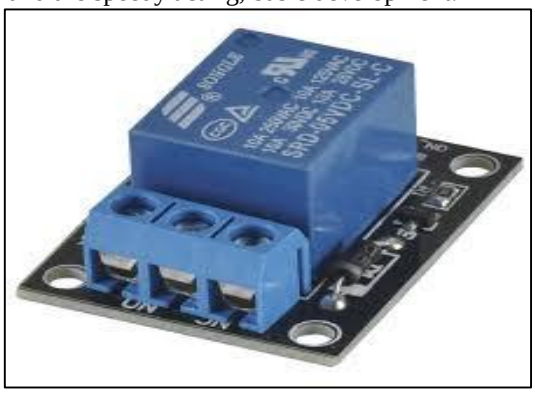
that there will be more opposition. In this manner, the dampness level will be lower. This sensor takes input voltage of 3.3V to 5V and gives yield voltage of 0-4.2V.

The soil dampness sensor needs the current of 35mA and this has the span of 60*20*5mm. The estimations of the dirt dampness sensor ranges from 0-300 dry soil, 300-700 moist soil and 700-950 in water. In this sensor 2 tests are to be utilized to dunked into the dirt according to the dampness it gives simple yield varieties from 0.060V to 5V. This sensor gives straightforward strategy for estimations and conveys the outcomes right away. It is lower cost and it offers exact outcomes. It is usable more than a few seasons with appropriate consideration and nonstop estimations at same area.



4) Relay

Relays are most normally utilized exchanging gadget in hardware. It has curl end 1 and loop end 2, common (COM), Normally Close (NC), Normally Open(NO). These coil end 1 and 2 are utilized to trigger (On/Off) the Relay as appeared in Figure 4.5. Typically one end is associated with 5V and the opposite end to ground. Normal is associated with one End of the Load that will be controlled. The opposite end of the heap is either associated with NO or NC. Whenever associated with NC the heap stays associated before trigger. The opposite end of the heap is either associated with NO or NC. Whenever associated with NO the heap stays disengaged before trigger. Relay has a greatest admissible power of 800 VAC/240W and furthermore permissible voltage of 250 VAC/110VDC. Hand-off loop voltage is 5V DC. Working time is 10 msec Release time is 5msec. Hand-off can be reset quick and are speedy acting, basic development.



5) PIR Sensor

The pyroelectric sensor is actually divided into two halves. When there is no motion, both halves receive the same amount of IR radiations from the surrounding. When a target crosses the sensor, the IR radiation level received at one half is more than the radiation at the other half. This shows that the motion is detected. Then the output will be high. The range of the PIR sensor goes upto 6 to 10 meters. An input voltage of 3 to 5 volts is provided in 1 pin and the digital output is obtained from another pin.

6) ESP8266 Wi-Fi module

ESP8266 is Wi-Fi enabled system on chip (SoC) module developed by Espressif system. It is mostly used for development of IoT (Internet of Things) embedded applications. ESP8266 comes with capabilities of 2.4 GHz Wi-Fi (802.11 b/g/n, supporting WPA/WPA2), general-purpose input/output (16 GPIO), Inter-Integrated Circuit (IC) serial communication protocol, analog-to-digital conversion (10-bit ADC), Serial Peripheral Interface (SPI) serial communication protocol, IS (Inter-IC Sound) interfaces with DMA(Direct Memory Access) (sharing pins with GPIO), UART (on dedicated pins, plus a transmit-only UART can be enabled on GPIO2), and pulse-width modulation (PWM).

IV. Results and Discussion

The project uses sensors like soil moisture sensor and PIR sensor which are connected to the arduino uno. The sensors give input to the controller and according to that microcontroller controls the devices in auto mode. For soil moisture sensor, threshold value is defined at the beginning of the procedure. The soil moisture sensor takes the moisture content level from the place where the sensor is deployed and the soil moisture sensor sends the input data to the microcontroller.

The microcontroller computes the result depending on the program. If the moisture level in the soil is lower than the given threshold value, then automatic smart irrigation system is implemented where the motor is turned on automatically and water is pumped to the soil. Similarly if the value of the soil moisture level reaches a certain threshold value, then the motor is turned off automatically. Similarly an alert message will be sent to the farmer. Controlling actions will be taken by relay which is connected to the output side.

Motion is detected using PIR sensor. PIR sensor sends the input data to the microcontroller. The microcontroller computes the result depending on the program. The PIR sensor absorbs the IR radiation emitted by the body. Once the motion is detected by the PIR, the buzzer gets on which will scare the intruders off. Also an alert message will be sent to the farmer when motion is detected.

In this project serial monitor acts as a output device. It displays current soil moisture level and status of motion detection. This serial monitor can communicate with Arduino at 9600 baud rate communication. Soil moisture content will be passed to the 'ThingsSpeak' server where the graph will be displayed accordingly. Similarly, motion detection graph

will be displayed in the 'ThingsSpeak' server which shows fluctuations whenever the motion is detected.

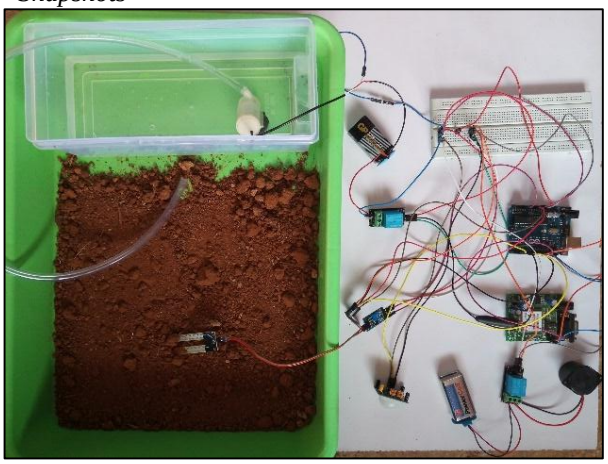
Test case ID	Action	Expected output	Actual output	Result
1	When the soil moisture is high	Motor is turned off	Same as expected	Pass
2	When the soil moisture is low	Motor is turned on	Same as expected	Pass

This table shows action and response of the soil moisture level detection. Soil moisture level can be controlled using water pump. This table contains 2 events, based upon these events the motor can be controlled to maintain optimal moisture level in the soil. If the soil moisture level is low, then automatically motor will be turned on and when the moisture level reaches the threshold value, the motor will be turned off automatically. An alert message will be sent to the farmer using GSM. If the soil moisture level is high, then the motor will remain turned off.

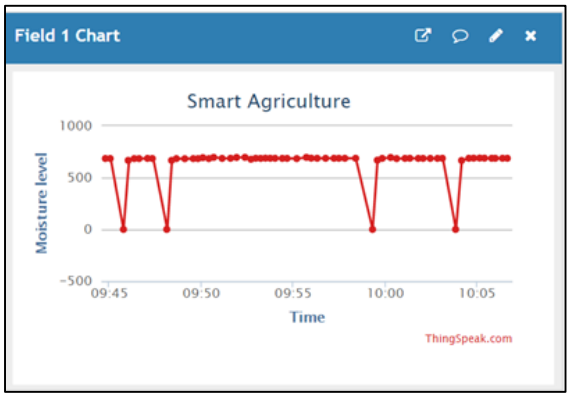
Test case ID	Action	Expected output	Actual output	Result
1	When the motion is detected	Buzzer and LED is turned on	Same as expected	Pass
2	When there is no motion	Buzzer and LED is turned off	Same as expected	Pass

This table shows the results of motion detection and control. This table shows action and response of motion detection. Motion is detected using PIR sensor. The PIR sensor absorbs the IR radiation emitted by the body. Once the motion is detected by the PIR, the buzzer gets turned on which will scare the intruders. An alert message is also sent to the farmer using GSM when motion is detected. If the motion is not detected then the buzzer will remain turned off.

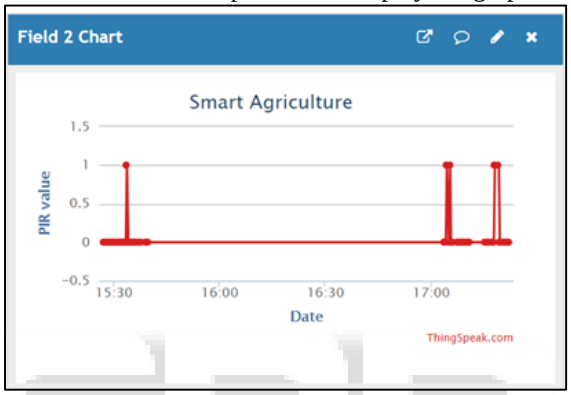
1) Snapshots



This is the snapshot of our smart agriculture model. The hardware components are connected to each other as shown.



The above figure shows the graph in which the moisture level vs time is represented. This graph is represented in the ThingSpeak server. The ThingSpeak server takes the data from the input data to display the graph.



The above figure shows the graph in which the motion detection vs time is represented. This graph is represented in the ThingSpeak server. The ThingSpeak server takes the data from the input data to display the graph.

V. CONCLUSION

Better improvement of production in crop is a major requirement in the countries like India, where the majority people depend on agriculture for their livelihood. Implementing smart agriculture system using IoT in the field can definitely help to improve the yield of the crops and overall production. The system also provides cost effective method which can be carried out by the farmers easily. The system also consumes less power and reduces water consumption to a great extent. So this is very useful in areas where the water availability is a major problem. The system also provides a method for intruder detection which is a primary reason for reduction in crops.

A. Direction for Future Work

- The intrusion detection system implemented in the project just detects the intruder's motion. This can be made more accurate and reliable by capturing the image of the intruder using a camera and sending that to the owner whenever intrusion is detected.
- PIR sensor ranges upto 10 meters which is fine for the project purpose. This can be overcome by using any advanced device in the farmland which has a longer range than PIR sensor.

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