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DEVELOPMENT OF SMART CROP MONITORING SYSTEM

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Abstract: This paper presents a farm monitoring system by using Smartphone application and Internet of Things. Using this system, farmers can remotely monitor farm for soil moisture,pH level in the soil, temperature and humidity in the environment,level of water using the sensors soil moisture sensor,ph sensor,temperature sensor and humidity sensor and microcontroller is used to control and automate the farm processes and The User or the farmer in this case registers himself in the system using the Android Application on his phone. The users fetch the data related to crop requirement as a whole which includes the number of acres registered by other farmers and the demand status for various crops. The information gets updated in real time so that farmers get to know which crops will be in demand and which crops will not be in demand. This is a predicted demand information that a farmer would get to make the right decision of crops.

Keywords:Internet of things,Temperature, Humidity, soil moisture,Arduino MEGA,GSM

1. INTRODUCTION

Agriculture has become a heartbreaking job. It is very important that farming be made an economically attractive process that youth will get engaged in farming. It will raise the standard of living in rural India. Organizing agriculture and bringing technology is very important to raise the agricultural standards. Over the previous year's data and correspondence innovations have been presented in horticulture, improving sustenance creation and transportation. In execution and appropriation of data and correspondence innovations, cost is additionally a main consideration. It is difficult to accomplish trade of data among gadgets and redesigning their usefulness while holding their expense to a sensible level. Thus, the normal end is that the security and observing frameworks must be in charge of transmitting information over the system, investigating the data and telling the client with ongoing data of the environment. This absence of data transmission and information investigating has been tackled by joining the web of things with as of now accessible security gadgets so as to accomplish effective sustenance protection and profitability.

The User or the farmer in this case registers himself in the system using the Android Application on his phone. The users fetch the data related to crop requirement as a whole which includes the number of acres registered by other farmers and the demand status for various crops. The information gets updated in real time so that farmers get to know which crops will be in demand and which crops will not be in demand. This is a predicted demand information that a farmer would get to make the right decision of crops. He then chooses the crop that has high demand in the market and registers the same on the server. Server updates the data and sends an acknowledgement to the user**.**

2. LITERATURE REVIEW

A literature survey in a task report speaks to the examination done to aid the culmination of an undertaking. A writing study likewise portrays an overview of the past existing material on a subject of the report. Exploring the writing is a basic part when composing scholarly papers that utilization look into discoveries for thoughts and focuses they attempt to make. It is likewise a necessity for the venture report.

Writing studies give brief reviews or a synopsis of the momentum inquired about on points. The structure composed requires to be such that it appears to be consistent. It needs to sequentially speak to an advancement of the thoughts in the field that is being looked into. The length of a writing overview depends much on whether the motivation behind the undertaking report is to finish a school task or submitting for dairy production. It can survey a couple of research papers on a point or be a full-length dialog on the huge work in the field until that date. A portion of the targets required is recorded as a hard copy of a writing overview incorporated for the comprehension of a portion of the basics of learning the definitions and ideas that will help in finding subjects that depend on past research.

Using technologies in farming is the need of the decade. There are many papers that say how we can use the available technologies in farming in various dimensions. Below are some of the papers and its summary.The authors in [1] propose intelligent agriculture service platform wireless network and LoRa communication technology. They propose the usage of environmental sensors for temperature, light and carbon dioxide monitoring. They also discuss the architecture for implementation and analyse the result for the system.

Low-control qualities have been utilized in military and space correspondence for a considerable length of time, yet LoRa is the principal minimal effort execution for business utilization[8]. Correspondence between end-gadgets and doors is spread out on various recurrence channels and information rates. The determination of the information rate is an exchange off between correspondence range and message length. Because of the spread range innovation, interchanges with various information rates don't meddle with one another and make a lot of "virtual" channels expanding the limit of the passage. LoRaWAN information rates run from 0.3 kbps to 50 kbps[9][10].

The authors in [2] suggest monitoring plant growth based on an image processing algorithm that helps for disease detection in plants. It also classifies the disease based on K Means Algorithm and Fuzzy C Means Algorithm. It aims to manage the crops from early stage to harvest stage.

The authors in [3] suggest wireless sensor and actuator network for Agriculture Support System. Implementation in [3] includes rain sensor, moisture sensor, light sensor and PIR sensor that collects the data and sends the data to the master node for further analysis. Remote sensor and on-screen character systems (WSANs) allude to a gathering of sensors and entertainers connected by remote medium to perform dispersed detecting and activation undertakings.

Sensors accumulate data about the physical world, while entertainers make choices and after that perform proper activities upon the earth, which permits remote, robotized communication with nature. An actuator is a device to change over an electrical control sign to a physical movement, and builds up the segment by which an administrator follows up on the physical condition .

While sensor centers are nearly nothing, shabby devices with obliged distinguishing, count and remote correspondence limits, on-screen characters are normally resource rich contraptions outfitted with better planning capacities, more grounded transmission powers and longer battery life. In WSANs, depending upon the application there may be a need to rapidly respond to sensor input. Moreover, to give right exercises, sensor data ought to regardless be considerable at the period of acting.

The issue of constant correspondence is noteworthy in WSANs since exercises are performed on the earth in the wake of identification. The amount of sensor center points sent in analyzing a marvel may be in the solicitation of hundreds or thousands. In any case, such a thick sending isn't crucial for on-screen character center points as a result of the various considerations essentials and physical association procedures for acting tasks. In this way, in WSANs the amount of on-screen characters is much lower than the amount of sensors. So as to give successful detecting and acting, a disseminated nearby coordination component is vital among sensors and on-screen characters .

The authors in [4] develop applications that suggest crops for farmers to meet the demand in the market based on previous years data, temperature, rainfall, market prices etc. They use data mining techniques for analysis. They use text to speech conversion techniques to provide information to the farmers in their regional language.

The authors in [5] use various sensors like pH, temperature and humidity sensors and Wi- Fi connectivity to analyze various parameters of the environment and intervene to maintain its adequacy. Various actions are performed based on the sensor results like switching on the pump, fan, shutter etc. to maintain the required environment for the growth of plants.

3. PROPOSED SYSTEM

Farmers are utilizing sensors to figure out what to develop, when and where to develop it, and what to do so as to expand yields. The pattern is a piece of the ongoing development of exactness agribusiness innovation by the horticultural business, which uses sensors to make a bank of huge information that will guarantee greatest advantages from the dirt. Better comprehend the chances of and asset reserve funds on utilizing remote sensors and remotely observing gadgets on your homestead. Channel and analyze IoT

Ag information stage sellers and cautioning administrations [6][7].Android application on the phone lists the various crops, the expected demand for each crop, the amount of acres that have already been registered throughout the State for each crop. The business logic resides in the server on cloud. It has the crop demand information for each crop. This information is obtained by the complex analysis of demand performed by the Central Government for every crop in order to assign import and export duties for each crop. This information is sent in an understandable way to farmers. The farmer can check the data and register his decision in the app. Every time a farmer registers a crop, the demand for the crop is reduced by the number of acres that he decides to grow. Indirectly every farmer is exchanging his crop information with every other farmer so that only the required amount of crops will be grown at any point of time. The demand and supply of crops is thus highly stable.

Microcontroller based circuits analyze the data from sensors. Different sensors are put in the field to gather natural parameters like temperature, mugginess, soil dampness and intruder detector. These sensor data are sent to the microcontroller that analyses and actions on the data. Microcontroller is given GSM connectivity to send notifications to the user phone on any action performed by the microcontroller.

4. METHODOLOGY

The system works on the basis of communication between the mobile phone of the farmer and a Microcontroller of the system.Android application on the phone lists the various crops, the expected demand for each crop, the amount of acres that have already been registered throughout the State for each crop. The business logic resides in the server on cloud. It has the crop demand information for each crop.Farmer can choose the crop he wants to grow and update the same in the application. Once he updates, the demand of the crop (in acres) will be reduced by the area (in acres) that he registered for that crop.

Sensor Technologies are gaining popularity. We use various sensors, microcontrollers and GSM technology to reduce the labor work in farming.A GSM modem connects the Arduino board to which the Arduino transmitter is connected to the GSM modem receiver and the Arduino transmittor is connected to the GSM modem transmitter. The GSM modem works just like a mobile phone when we say on the GSM modem number it responds back and can be operated using microcontroller coding. The sensor for soil humidity and temperature are connected to an Arduino board analogue pins. Power from the USB cable connected by the Arduino board is generated from 5v. First of all, the GSM module is initialized and waits until it connects to the network.12v power supply is scheduled to the GSM module through adapter. The red light indicator illustrates GSM/GPRS is ON. The data sensed by soil moisture sensor and temperature sensor is transmitted to the microcontroller. Initially threshold values are set to an Arduino board. The sensor values are thus compared to the threshold values. If the readings from the sensor are more than the threshold value and the soil moisture reading is lesser than the threshold value. Then an SMS alert is sent to the user by the GSM module.

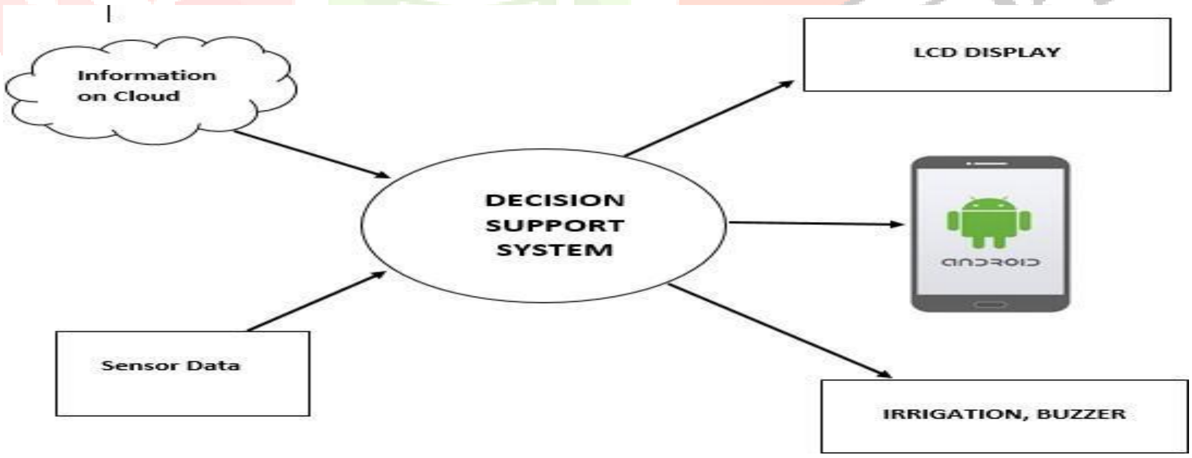


Figure 4.1 Architecture of the proposed system

Figure 4.1 shows the architecture of the proposed system. The information on the cloud and the sensor data acts as input to the system. The output is provided through LCD Display, Android phone and activities like irrigation, buzzer sound etc. The support system includes a microcontroller based circuit that is programmed to act on the sensor data. Information on the cloud is directly passed to the android phone whenever a user requests for fetch or update of data. Here the Information in the cloud and the sensor data acts as input devices.The activities performed by the business logic based on the input is the output. The LCD Device, the irrigation activity, buzzer and Android device are the output devices.

The functionality is divided into three sections for easy understanding.

1. Pre-production Support
2. Maintenance Support
3. Communication

1.Pre-production Support

The farming pre-production subsystem incorporates every single different office, which gives creation material and administration for farming. The principle errands incorporate the production and maintenance of homestead apparatuses and other rural offices; the creation of substance items, for example, manures what's more, pesticides, the generation of rural development materials, and advantageous materials, and the creation of farming transportation offices, the preparing of seeds and feed; the course, transportation, data and fund administration, and so forth.

Pre-production support involves helping farmers to make the right decision of crops based on crop demand. The information collected from the survey agencies is updated on the cloud server. The User or the farmer in this case registers himself in the system using the Android Application on his phone. The users fetch the data related to crop requirement as a whole which includes the number of acres registered by other farmers and the demand status for various crops. He then chooses the crop that has high demand in the market and registers the same on the server. Server updates the data and sends an acknowledgement to the user.

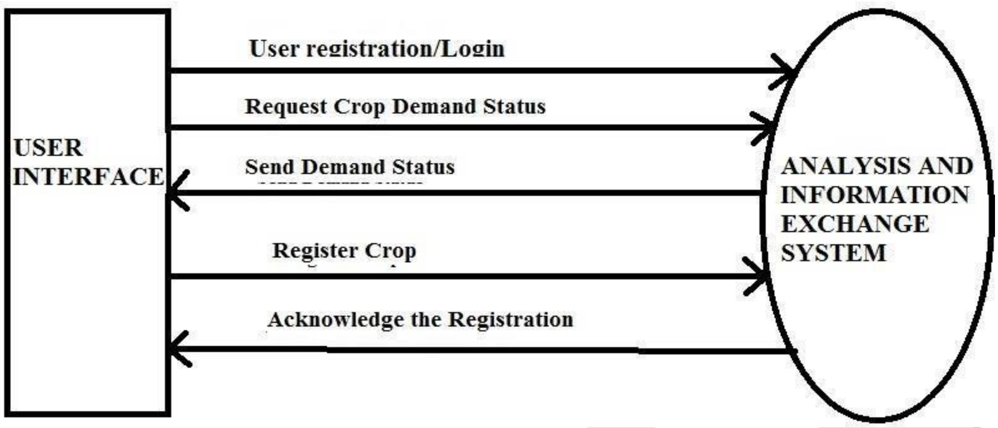


Figure 4.2 Data Flow Diagram for Preproduction Support

Figure 4.2 shows Data Flow Diagram for the pre-production Support. User Interface is provided through Android Application on a smartphone. The Analysis and Information Exchange System contains business logic that resides on the Server in Cloud.

2.Maintenance Support for Agriculture

Maintenance Support is provided by using various sensors and programming the microcontroller to action on the sensed data. An LCD Display is used to display notifications on the sensed data in the farm. Buzzer is placed in the farm to give an alarming sound if an intruder is detected.

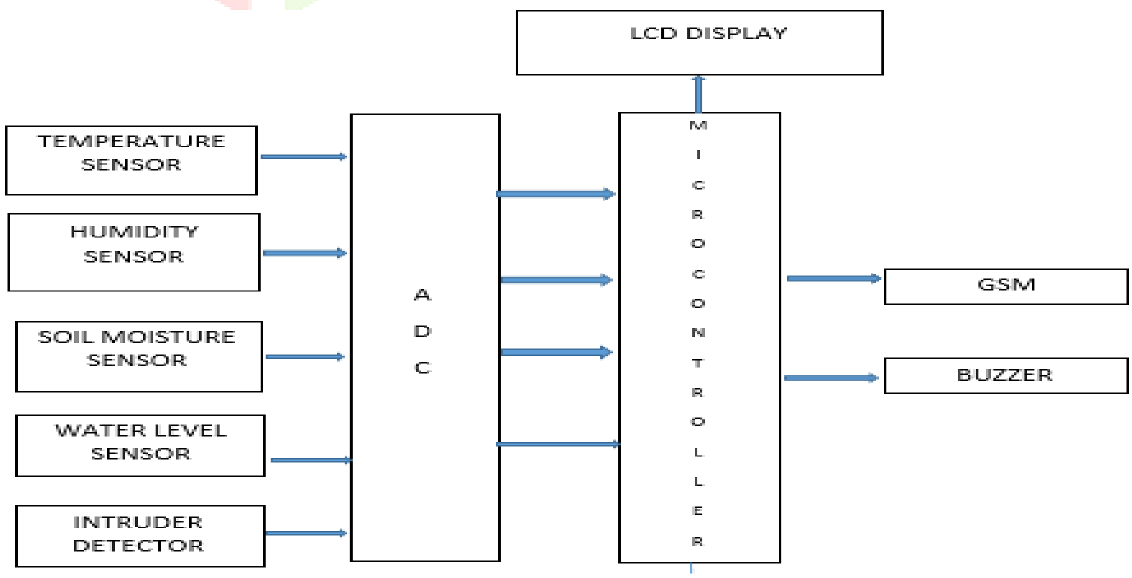


Figure 4.3: Maintenance support using sensors and microcontroller

Figure 4.3 shows the Maintenance support provided using sensors and microcontroller for automating various tasks in the field. The microcontroller is programmed to sense data from various sensors and perform predefined actions based on the data. Microcontroller is connected to GSM to send notifications to the user on his mobile. Various sensors monitor the environmental parameters and send messages to the farmer's mobile if they cross the threshold. The wet-dry sensor checks for the wetness and dryness of soil and starts irrigation if soil is dry and sends the notification to the user's mobile. Water Level Sensor starts the pump if water level is low in the tank and shuts off once the tank is full. Intruder detector checks if there are any movements near the sensor. If it finds any, a buzzer will make an alarming sound in the field and send a notification to the user's mobile.

Hardware Components:

Arduino Microcontroller: Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (6 for PWM output), 6 analogue inputs, 16 MHz ceramic resonator, USB, power jack, ICSP plug and a button for resetting. It contains everything needed to support the microcontroller; simply use the USB cable or power it with an AC-to-DC adapter or battery connected to a computer.

Temperature Sensor: LM35 IC has been utilized for detecting the temperature. It is a coordinated circuit sensor that can be utilized to quantify temperature with an electrical yield relative to the temperature (in degree centigrade).

Humidity Sensor: SY-HS-220 has been utilized for detecting the mugginess. The moistness perusing is regularly advised to the client with the goal that the client can almost certainly realize the field conditions from anyplace.

LCD Display: A solitary HD44780U displays one 8-character line or two 8-character lines.

Power Supply: An AC to DC connector has been utilized to get DC contribution for the motherboard. LM7805 is utilized for 5V directed supply.

Intruder Detector: IR SENCE VER-2 has been used that can detect any object in its vicinity.

Water Level Sensor: It has a small plastic ball that floats on water that gives two readings low and high specifically designed for demonstration purposes.
Buzzer: A small buzzer is connected to a microcontroller and is programmed to buzz when an intruder is detected by the Intruder Detector.

SIM800C GSM/GPRS MODEM: SIM800C GSM/GPRS RS232 electronic equipment (DB9), the most recent addition to rhydoLABZ GSM/GPRS modem, helps to feature wireless property to your project victimisation RS232 UART interface.

Soil Moisture Sensor: To measure the volumetric water content of the soil the soil moisture sensor is used. It measures moisture loss over time due to evaporation and uptake of the plants and assesses the optimum soil humidity content for different plant species.

5. RESULTS

Figure 5.1 shows a list of the total demand and registration information for each crop. Users can check the demands for various crops and choose the one with high demand to get maximum profit and user can change language.

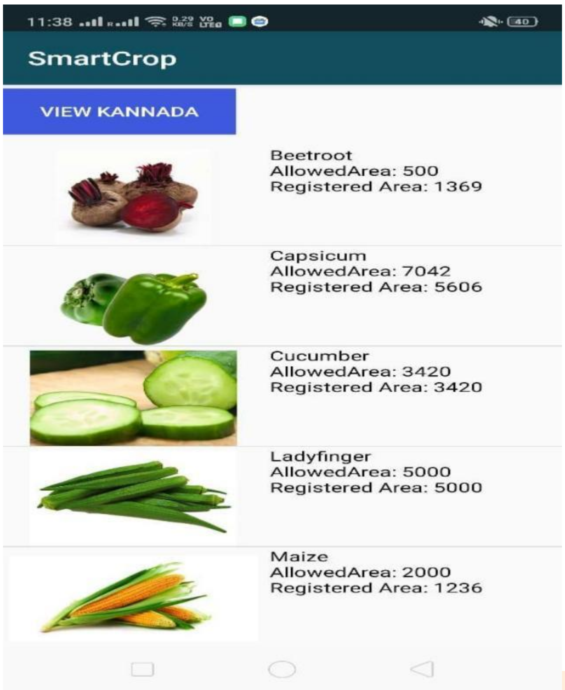


Figure 5.2 shows the android page where The User or the farmer in this case demands for the crop in the number of acres himself in the system using the Android Application on his phone.

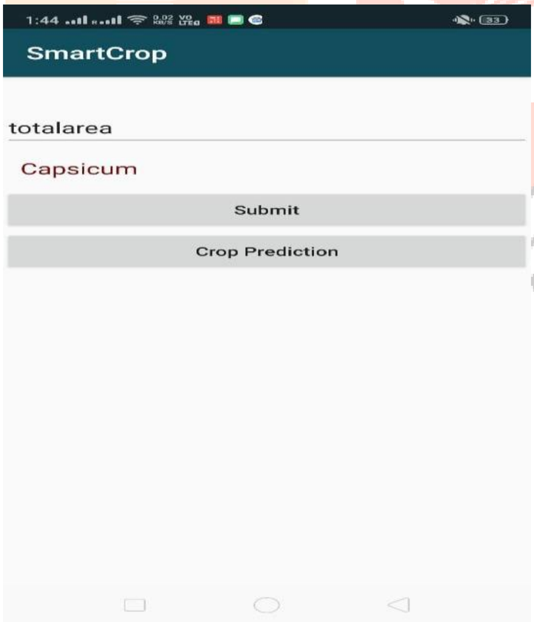
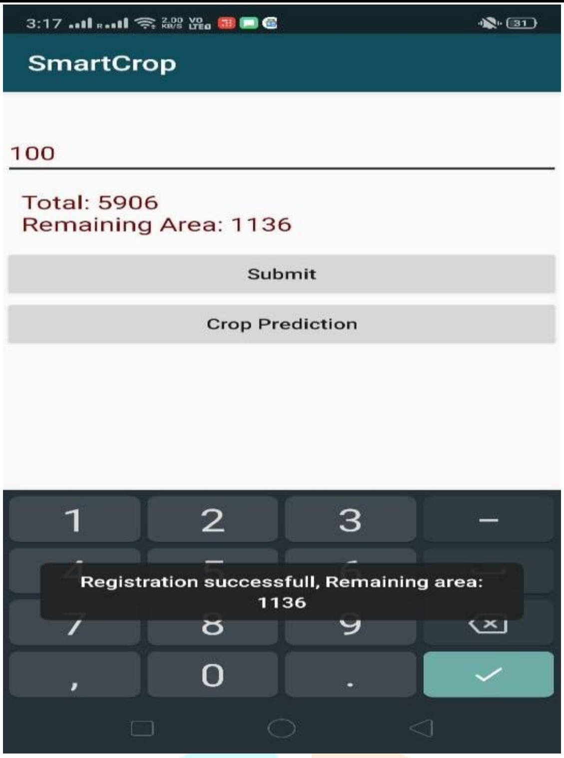


Figure 5.3 shows the successful registration and The crop registered (in acres) will be subtracted from the total demand of the crop and Figure 7.7 shows the crop prediction page which helps the users to achieve a successful growth



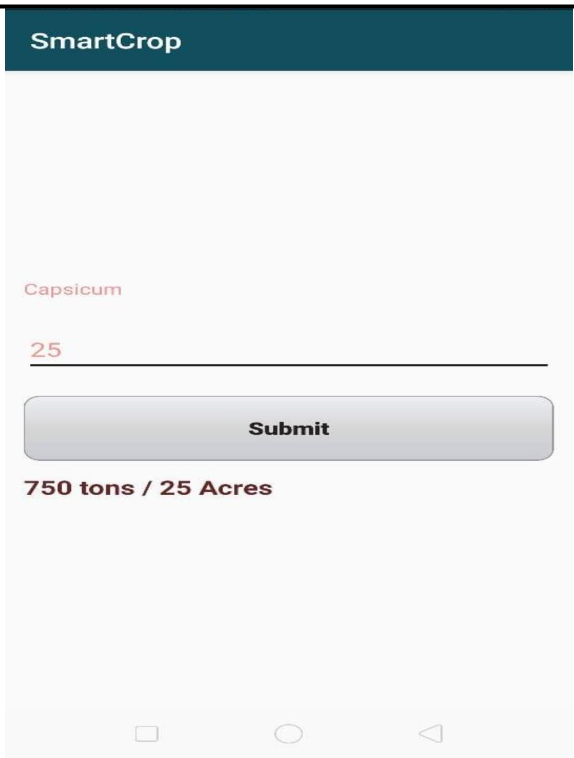
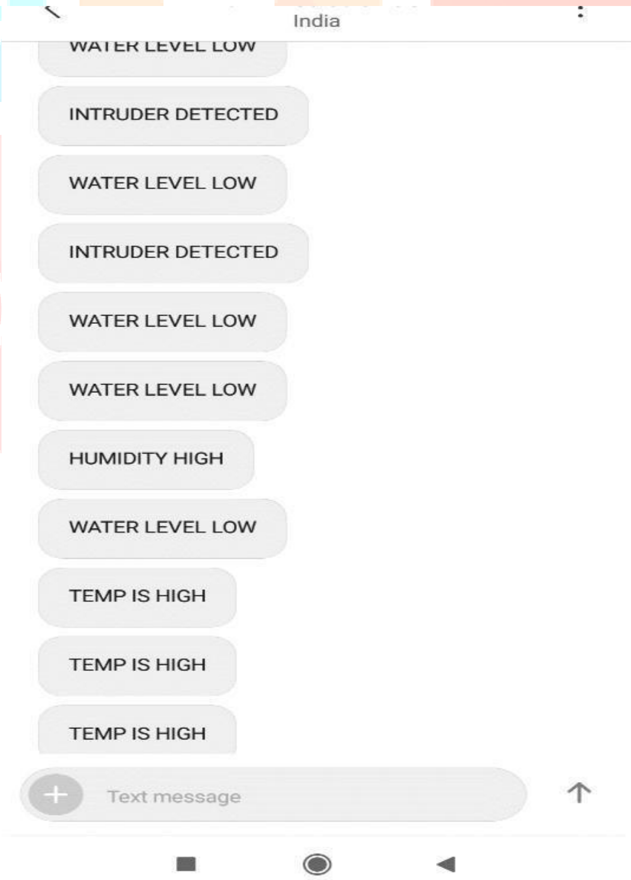


Figure 5.4 shows the notification received on phone for various parameters and activities in land.



6. CONCLUSION & FUTURE SCOPE

The proposed model makes farming more attractive. It provides the necessary assistance to decide on crops, maintain their land and sell crops for proper price. If farmers make use of the available technologies they can make attractive money while working at ease. However, the Government and General Public should come forward to bring awareness to farmers about the existing technologies and train them on the same. One time investment is required to set up infrastructure to maintain the farm remotely.

The applications can be made in regional languages with voice input and output to make them farmer friendly. For automating maintenance softwares should be customized as per the individual's requirement.

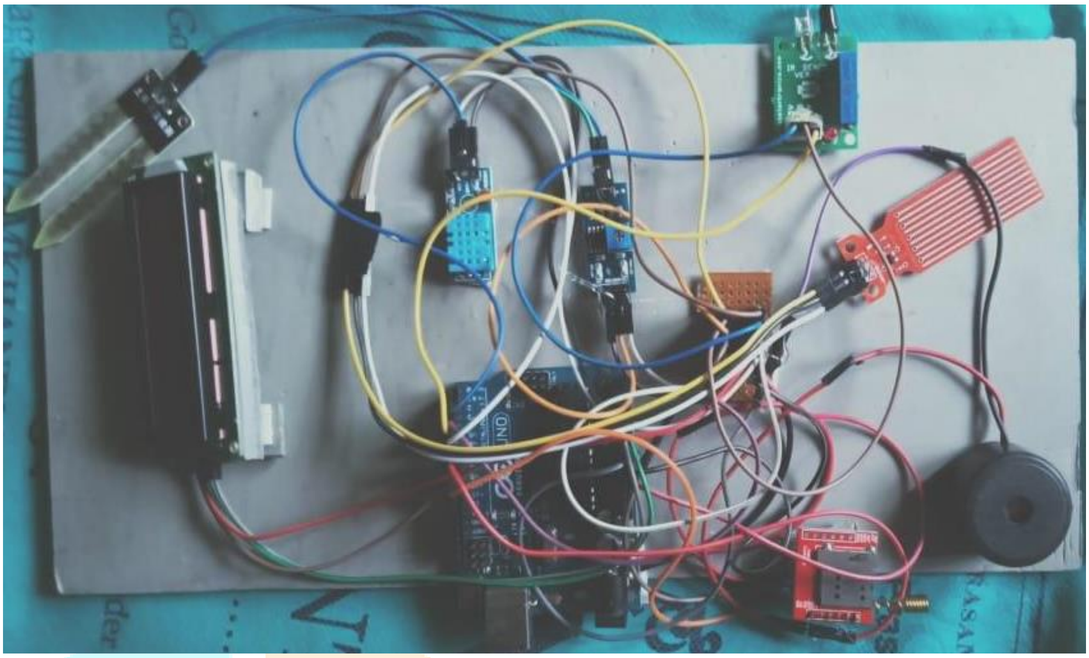


Figure 6.1: Proposed Prototype

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