INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

ISSN: 2454-132X
Impact Factor: 6.078
(Volume 7, Issue 3 - V7I3-1661)
Available online at: https://www.ijariit.com

Smart Agriculture with Internet of Things

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ABSTRACT

Now a days in market, the sensors used in agricultural sectors are not integrated together, they are individually available. So, we have developed a system where these sensors are integrated, and all the data is shown on a Mobile App. Some of the sensors used in our system are in house designed and fabricated. The system provided by us is more sensitive than some of the readymade sensors available in the market leading in precise values of the parameters of the agricultural land. And, the idea is to develop a multilingual mobile application which will communicate with on field hardware to show real-time data to user. The application will also show the trends and crop suggestions to farmer. With Animal intrusion detection system, farmers will be able to protect their crops from harm caused by wild animals. In the further part of the paper, the components and the software systems are discussed which were used in the development of the system, and at last, the challenges and future scope of "Smart Agriculture System".

Keywords— *Internet of Things, Precipitation Sensor, Soil Moisture Sensor, Raindrop Sensor Module, Animal Intrusion System, NPK Module*

1. INTRODUCTION

In the era of technological advancement, extension of technology is inescapable. Everyday new innovations are conceived to daily task efficient and simple. The scope of applications of these advancements range from big industrial applications to individual personalized solutions. Seamless integration of current framework of testing sensors is the functional value addition to the proposed system. These technological advancements are making mankind's life easier. There arises a need to apply technology in some aspects of human life to reduce effort. One such domain in our lives, needing such advancements is the Agriculture domain. We propose an agriculture monitoring system based on Internet of Things and Embedded systems which will manage some of the parameters of the field like soil moisture, precipitation, atmospheric temperature and atmospheric light in an efficient manner by providing it on a single screen of the mobile App.

Our product consists of compact smart box having various sensors some of which (i.e. Soil moisture, precipitation) are designed and manufactured by our team. The smart box containsa microcontroller development board which is also designed as per our needs. We intend to support the Make in India campaign started by our Prime Minister by manufacturing our product in the country itself and help the farmers become self-defendant (Atmanirbhar). Also, it contains a communication module (ESP-8266) which helps to store the data on the webserver. All this data of the parameters will be integrated and will be available to the users through a user-friendly mobile application build by us.

2. LITERATURE REVIEW

2.1 Existing System

The present device makes use of all of the guide work, wherein the farmers have to move bodily and look for the Agro store to reserve insecticides/fertilizers and seeds. In Manual Work the patron will visit a store and he's going to proportion the troubles with the shopkeeper whilst explaining the troubles they might not give an explanation for the precise trouble so the shopkeeper will recognize a few different issues and he's going to offer a few one-of-a-kind insecticides which isn't always appropriate for the diseased crop. So, to clear up this trouble we got here up with an answer this is an android utility on agriculture.

2.2 Proposed System

The utility which we're featuring is plenty less complicated to recognize with the aid of using consumer who's acquainted with using mobile. The alternatives to be had for customers is ordering of insecticides/fertilizers/seeds, consumer can discover ways to develop plants and consumer can get idea approximately their crop from skilled person. The utility is with very simple alternatives to be had; however, the utility has plenty of alternatives that may be more advantageous in future.

3. TECHNOLOGY IMPLEMENTATION

3.1 Sensor Module

In this smart box systems, basically the data which is going to be taken from the sensors like soil moisture sensor, precipitation sensor, LM 35 (Atmospheric Temperature) and LDR (Atmospheric light) will be first passing through the Microcontroller development board which uses Atmega 328 IC which is placed at the center of the block diagram. Then with the help of ESP – 8266 which is connected to the microcontroller development board is used to transfer the data to the ThingSpeak webserver which is an IoT analytic platform providing visualization and analysis of Live Data stream on the cloud. The FTDI loader is used on the microcontroller development board for the reason if there is some boot-loading issue on the board. Also, an I2C Oled Module is given in the system so that if due to some technical reason if there is a connectivity issue then the user can see the parameters values on that LED module. Also, this LED module is kept for debugging the issues.

Buzzer is also used in the system in case some unexpected value arises, the buzzer will turn on and indicate the farmer to investigate the problem. The microcontroller will take the data after every half an hour and it would be uploaded to the cloud and mobile Application at the same time.

To run this whole system a DC/AC source is required, hence if AC supply is given then it should be converted to DC that too a value which can be sustained by the Microcontroller and other sensors, hence a voltage regulation circuit is also provided.

3.2 Block Diagram

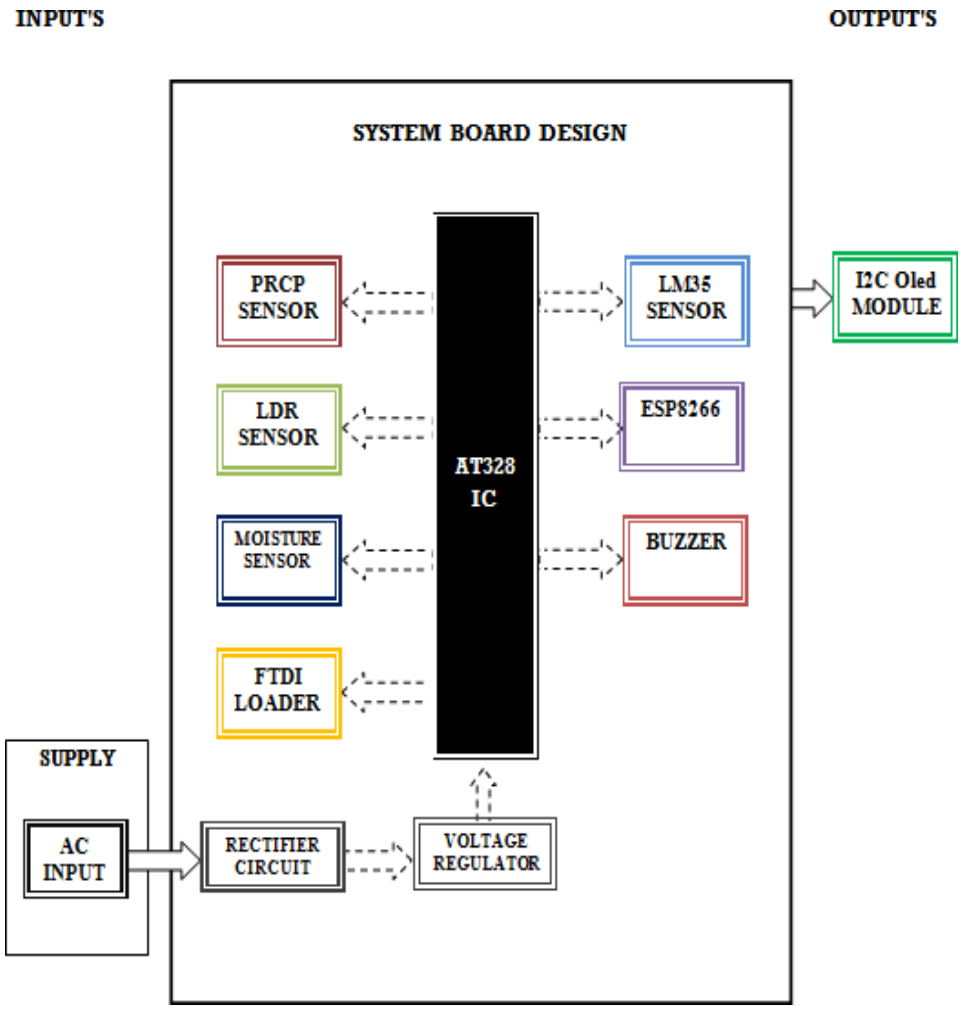

Fig-1: Block Diagram

3.3 Flow of Working

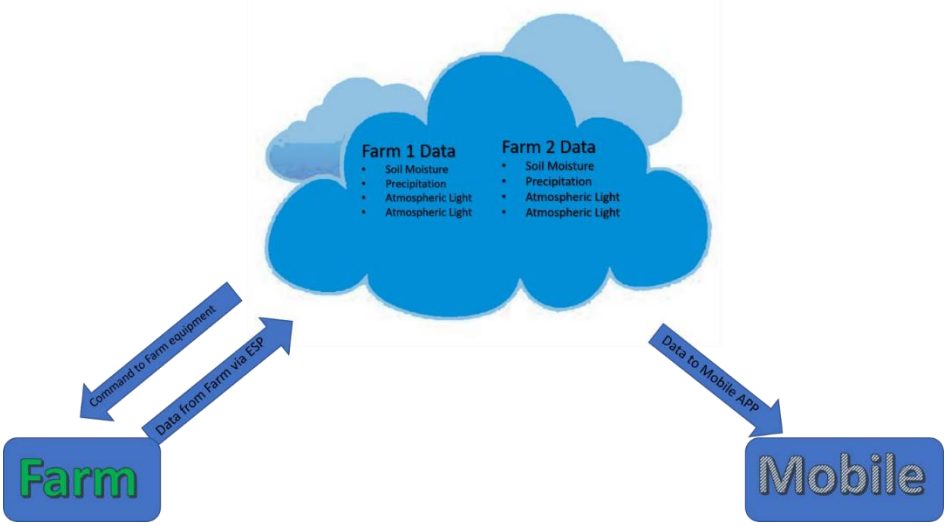

FIg-2: Flow of Working

The Data collected from the farm i.e., on the microcontroller development board is then uploaded to the cloud with the help of ESP-8266 to the ThingSpeaks server. Then the data from the ThingSpeaks server (cloud) will be show casted on the mobile application with the help of Android Studio.

4. SENSOR USED IN THE PROPOSED SYSTEM WITH MARKET SURVEY

1. Precipitation Sensor
2. Soil Moisture Sensor
3. LDR Sensor
4. NPK Module

4.1 Precipitation Sensor

Fig-3: Precipitation Sensor

Using capacitance and Timer circuit IC555, obtained a high precision and cheaper than sensor found in market.

4.2 Soil moisture sensor

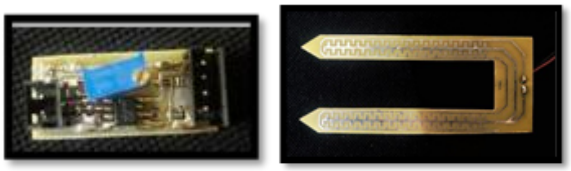

Fig-4: Soil Moisture Sensor

The Soil Moisture Sensor is used to degree the volumetric water content material of soil. The Soil Moisture Sensor makes use of capacitance to degree dielectric permittivity of the encircling medium. In soil, dielectric permittivity is a feature of the water content material. The sensor creates a voltage proportional to the dielectric permittivity, and consequently the water content material of the soil.

4.3 LDR Sensor

Fig-5: LDR Sensor

The sensor that may be used to come across mild is an LDR. It's inexpensive, and you may purchase it from any nearby electronics keep or online. The LDR offers out an analog voltage while linked to VCC (5V), which varies in significance in direct share to entered mild depth on it.

4.4 LM35 Sensor

LM35 is a temperature sensor that outputs an analog signal which is proportional to the instantaneous temperature. The output voltage can easily be interpreted to obtain a temperature reading in Celsius.

4.5 NPK Module

Fig-6: NPK Sensor

Helps provide a healthy growing environment**,** measures sunlight, soil fertility, soil moisture, and soil pH**.** Three stainless steel probes**.** Product specifically designed to be used only in soil**.** No batteries required.

5. PCB DESIGNS and SCHEMATICS

Printed circuit board is a chunk of art. The overall performance of a digital circuit relies upon the format and layout of PCB. The PCB layout of the circuit operation must be very unique to paintings it properly. The soldered factor must be small sufficient in order that any stray among those factors must now no longer exist. Also, excessive package deal density of additives can produce stray which must be averted with the aid of using right circuit designing and factor must be unfold in one of these manners that two-additives produce minimal stray. Also, the tune of the PCB, soldering factors and additives mounting must be very accurate and, in an effort, to be of first-rate assist to achievement the project.

5.1 Microcontroller Development Board

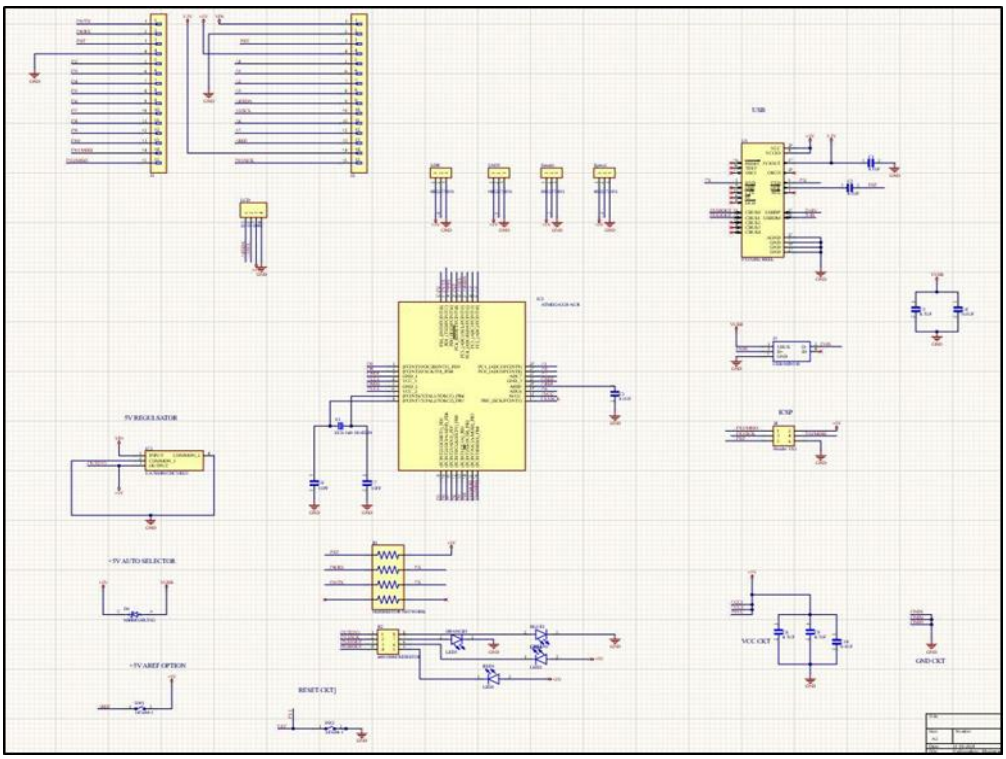

Fig-7: Microcontroller Development Board

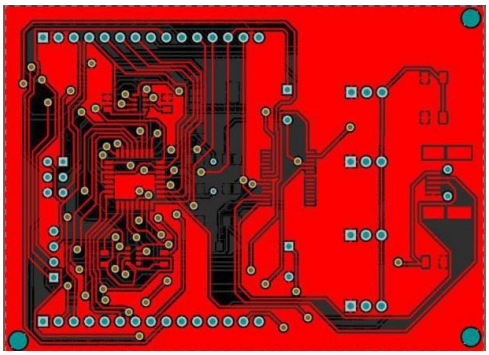

Fig-8: Top layer PCB Layout

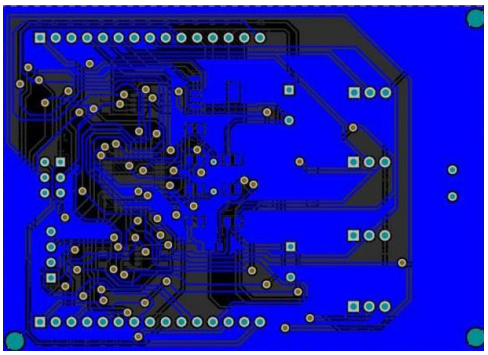

Fig-9: Bottom Layer PCB Layout

5.2 Precipitation Sensor

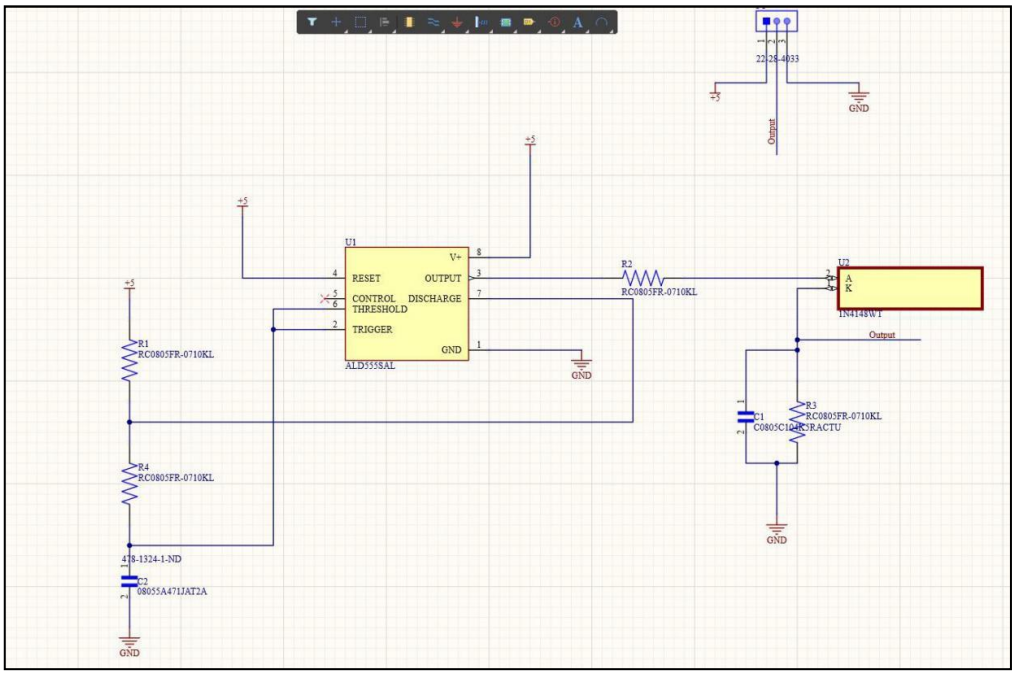

Fig-10: Schematic Precipitation Sensor

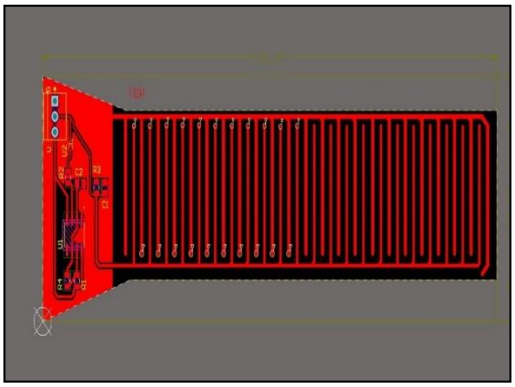

Fig-11: PCB Layout [Top Layer]

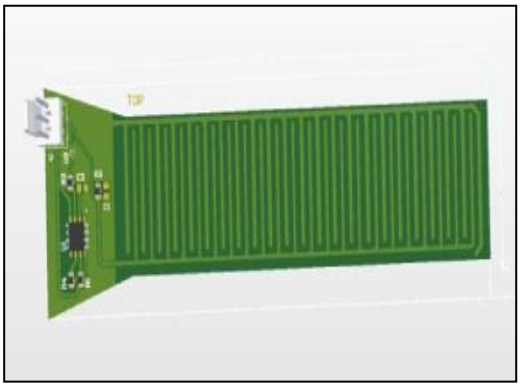

Fig-12: 3D View

5.3 Soil Moisture Sensor

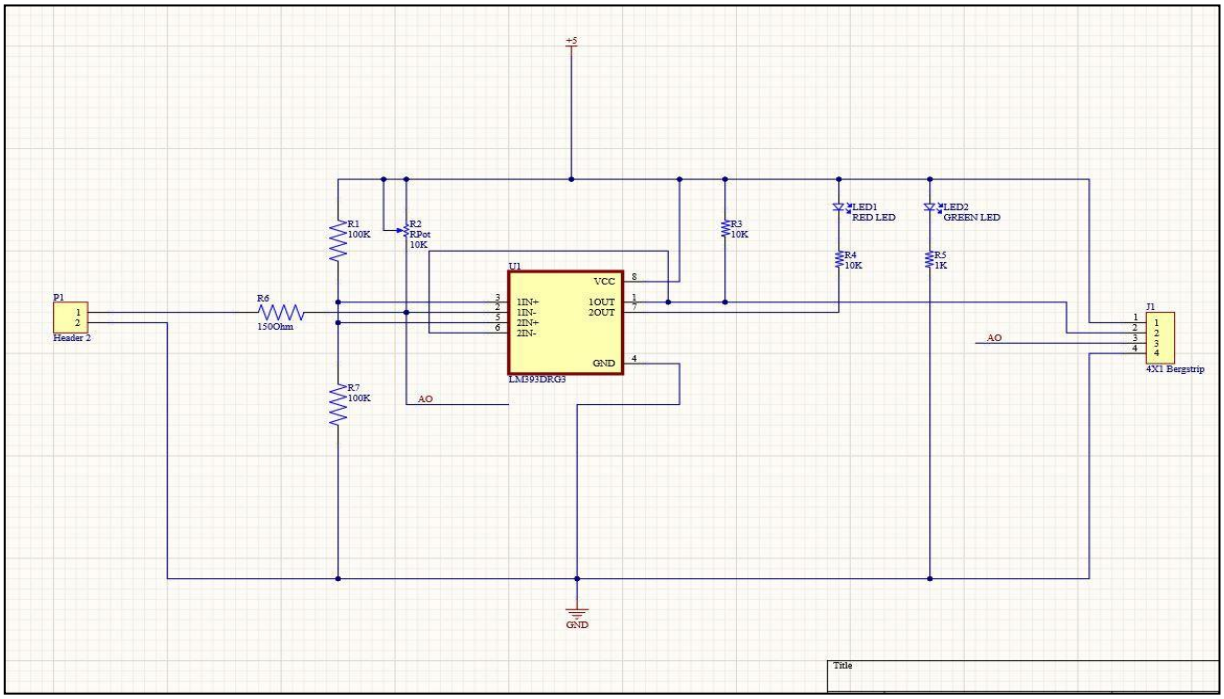

Fig-13: Schematic Soil Moisture sensor

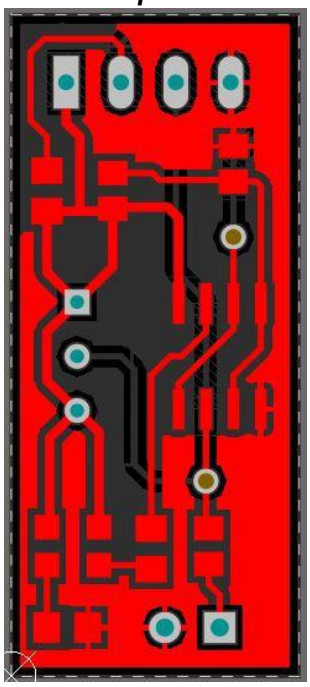

Fig-14: PCB Top Layer

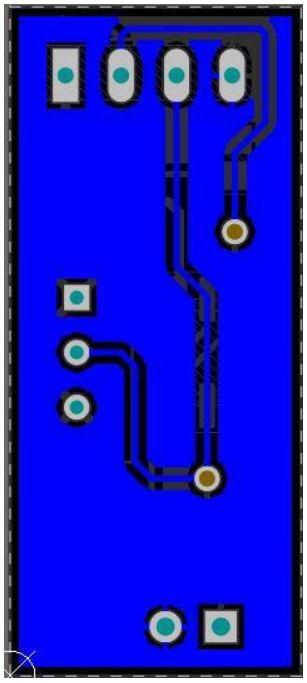

Fig-15: PCB Bottom Layer

6. ANIMAL INTRUSION SYSTEM

Anti- animal intruder system is provided to help protect the cultivated crop. The above one is built because now-a-days the importance/need of crop is too much and due to the intruders, a lot of crops are damaged so to prevent wild animals entering and damaging the crops. We have built the above system.

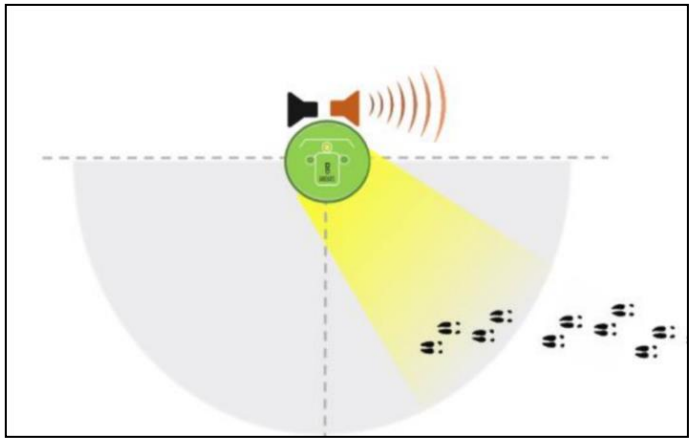

Fig-16: Animal Intrusion

6.1 Solution to animal intrusion system:

Approach 1: To build a sound system which will prevent the wild animals entering the field.

Approach 2: To build a fire cracker type system which will release a type of fire in the air due to which animal will not enter the field.

In both the approaches we have provided a temporary shutdown system when the farmer is present in the field.

Sensor used: Ultrasound sensor/ Laser/ PIR /camera

7. ANDROID APPLICATION

- Multi-lingual App to cater diversified languages of India.
- Real-time data presentation
- Farmer Friendly
- Secure

7.1 Application User Interface

- Welcome Page which comes when opens the application.
- Registration or sign up for new customer.
- Login Page user has to log in for further process.
- Forgot Password page for the user who lost or forgot his login/password.
- Home Page it is the Main page where user can select the required menu or options.
- Data Page user can see the data of the selected field.

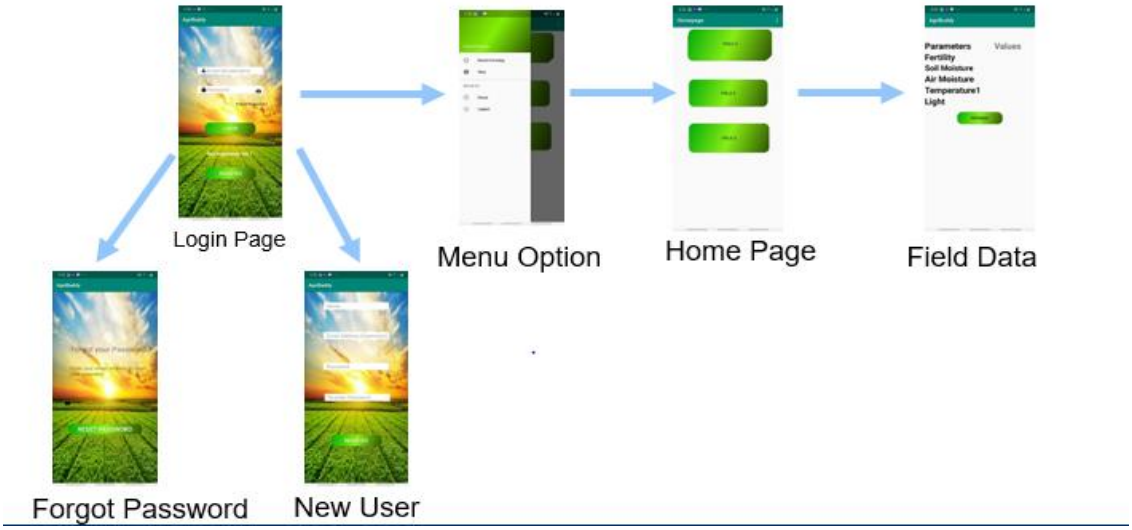

Fig-17: Android Application User Interface

8. CONCLUSION AND FUTURE SCOPE

By keeping numerous sensors statistics on cloud, person can get right of entry to or manage over his farm activities. Extensible characteristic of sensors we are able to upload as consistent with our crop particular need. We can upload movement sensors for tracking conduct of animals. Solar powered clever box, might be made in future. Marketing and taking part with the Government schemes reaping benefits the farmers. We are imposing a choice guide device for tracking specific farm activities. Using tracking statistics farmer can get right of entry to or manage his farm activities. It enables to growth a crop yield and decreases wastage of water. Our device is value powerful and person friendly.

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