SELVAM COLLEGE OF TECHNOLOGY

IOT BASED SMART CROP PROTECTION SYSTEM FOR AGRICULTURE

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INTRODUCTION

PROJECT OVERVIEW

Today, technology has penetrated every part of human life. But the contribution of technology to the field of agriculture is considerably low when compared to the other sectors, which saw an incremental growth over the last decade.The domain of Agriculture contributes the most to the Indian economy and about1/3rd of India's population is directly dependent on agriculture for their source of income. Considering this, even a small improvement in this sector will make a huge impact on the Indian economy and on the lifeof farmers. This helps farmers and consumers equally as it is the consumers in the end, who get to enjoy low priced goods without deterioration in quality.To achieve this, we have to overcome the hurdles faced by farmers, which mostl yrevolve around crop disease, improper maintenance of crops, lack of details about the quality of soil and intervention of animals and birds. To overcome this, in this project we propose 'Anintelligent crop protection system', the main objective of which is to improve the yield andincrease the profit for farmers. An intelligent crop protection system uses data from moisture,motion, temperature, humidity sensors and updates the data in real time in IBM cross platformIOT cloud interface. The motors and the sprinkling system are activated based on the datafromthe sensors. Also when the motion sensor detects motion, the farmer is notified with thatthrough the mobile application. This helps the farmers in protecting the crop from the animalsand birds which destroy the crop.And also ease up the maintenance process. The historical data from sensors are storedin cloud, so this can also be used for soil evaluation and this also helps to plan, which type ofcrops are to be planted in the upcoming seasons so that the yield is high.

PURPOSE

A vast majority of the people are invariably affected by the production of crops.Farmers, for example, rely on them for their survival. The consumers, on the other hand,depend on the crops as it provides them with a multitude of utilities. It therefore, becomesessential to protect and maintain these crops. The project aims at improving the farmer situation by preventing them from incurring losses due to the damage of crops. Crop failure also deteriorates the quality of the yield thereby decreasing the quality of living.

LITERATURE SURVEY

EXISTING PROBLEM

In real time, it was learnt that the size of the animal is found out by using several PIR sensors. PIR sensors can be used to determine the height of the animals instead of using a camera for image processing. This reduces the processing time and power. The crop protection is majorly dependent on the moisture content of the soil, the temperature and humidity of the surrounding environment. Additionally, tracking of the damaged crops location is done and the camera is activated only at that instant in order to capture the image. From the literatures survey performed it is evident that image based animal intrusion identification is not necessary in all situations because it requires high computation power, and the cost of the installation will be high when compared to that of a typical sensor based intrusion identification.

PROBLEM STATEMENT

An intelligent crop protection system helps the farmers in protecting the crop from the animals and birds which destroy the crop. This system also helps farmers to monitor the soil moisture levels in the field and also the temperature and humidity values near the field. The motors and sprinklers in the field can be controlled using the mobile application. The significant problem which raises the requirement of this project was that the traditional agriculture method consumes time, manual labor work and is also not cost efficient. The detected signal from the soil moisture sensor is processed by a conditional comparator circuit corresponding to different levels of actual soil moisture content. A logic circuit follows the conditional circuit with its output signals used to activate a system of relaysthat control the power circuit of the motors used for water pumping. IOT is developing rapidly and widely applied in all wireless environments. In this paper, sensor technology and wireless networks integration of IOT technology has been studied and reviewed based on the actual situation of agricultural system. The problem is that the crops in the field cannot be continuously monitored by the farmer from animals, birds, temperature, humidity .We have to provide a solution to sage guard the crops from the animals ,birds and to continuously monitor the crops from the temperature,humidity and regular check of water level and soil moisture so that the crops don't get damagedand the productivity will be increased.

REFERENCES

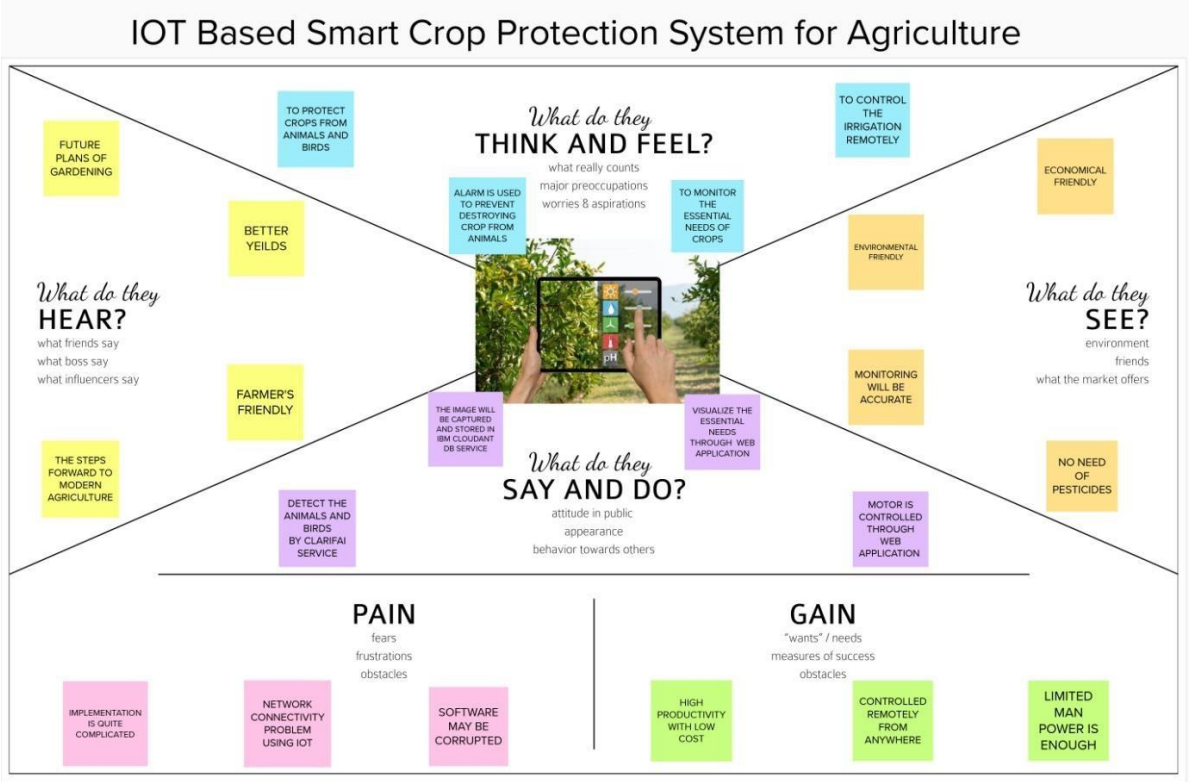
1 **A Literature Survey onSmartAgriculture Monitoring and ControlSystem Using IOT.**
by Abhilash Lad ,Sumitra , Krishna Raichurkar ,Sumit Zarkhande ,.Dr.Priya Charles.TTT.

2 **Implementation of IOT basedsmart crop protectionand irrigation system.**
by Ipseeta Nanda , Sahithi , Chadalavada

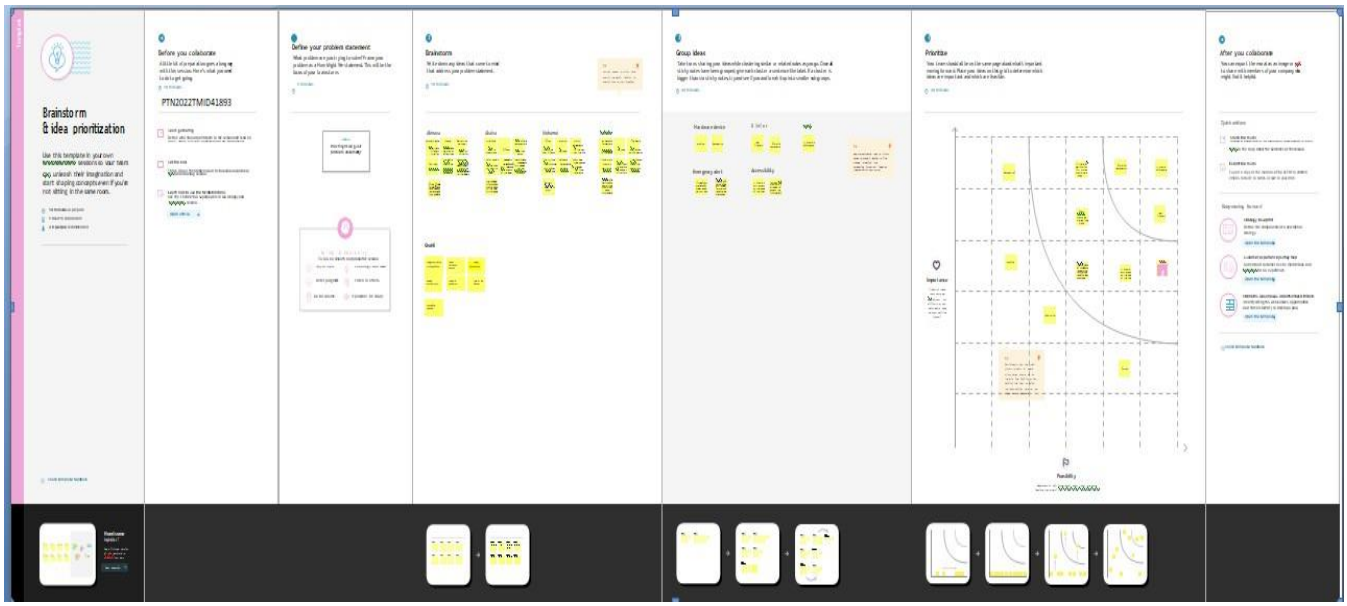
3 Smart agriculture using IOT by Priyanka Deotale, Prasad Lokulwar.
by Dr. V. Nagaveni

IDEATION

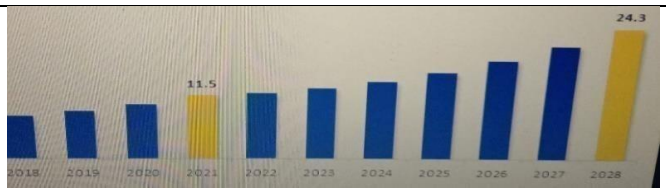
EMPATHY MAP CANVAS



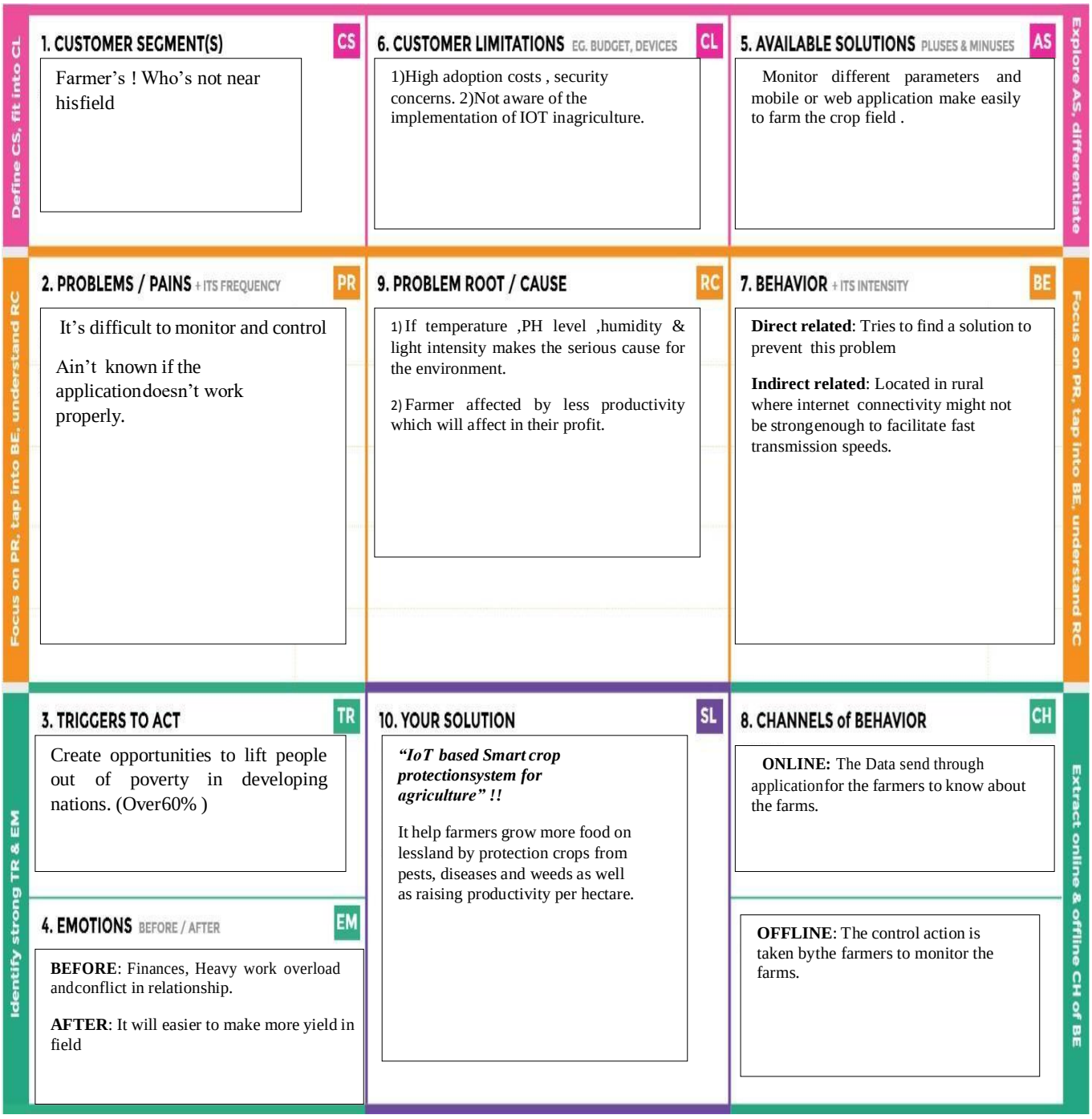
BRAINSTROMING



PROPOSED SOLUTION

S.No.	Parameter	Description
1.	Problem Statement (Problem tobe solved)	Usually crops in the fields are protected against birds and other unknown disturbances by humans. This take an enormous amount of time. Creating a smart automatic system will benefit the farmers in many different ways.
2.	Idea / Solution description	Smart Farming has enabled farmers to reduce wasteand enhance productivity with the help of sensors (light, humidity, temperature, soil moisture ,etc..).
3.	Novelty / Uniqueness	Role of SENSORS : IOT smart agriculture products are designed to help monitor crop fields using sensors and by automating irrigation systems. As a result, farmersand associated brands can easily monitor the field conditions from anywhere without any hassle.
4.	Social Impact / Customer Satisfaction	Water conservation . Saves lot of time . Increased quality of production. Real time data and production insight.Remote monitoring.
5.	Business Model (Revenue Model)	
6.	Scalability of the Solution	Scalability in smart farming refers to the adaptability of a system to increase the capacity , the number of technology devices such as sensors and fluctuators.

PROBLEM SOLUTION FIT



REQUIREMENT ANALAYSIS

4.1 FUNCTIONAL AND NON-FUNCTIONAL REQUIREMENTS

Functional Requirements:

- Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Need	The crop field requires protection from wild animal attacks, birds, and pests. The mobile application sends an SMS to the user when it detects animals entering the crop field.
FR-2	User Reception	The data collected from the mobile application are temperature, humidity, and moisture content of the soil, get observed.
FR-3	User understanding	The obtained data from the mobile application is to know the present condition of the field, and it's on the sensors used.
FR-4	User solution	The user must take some precautions from the user's understanding to save the field before it gets damaged.

Non-functional Requirements:

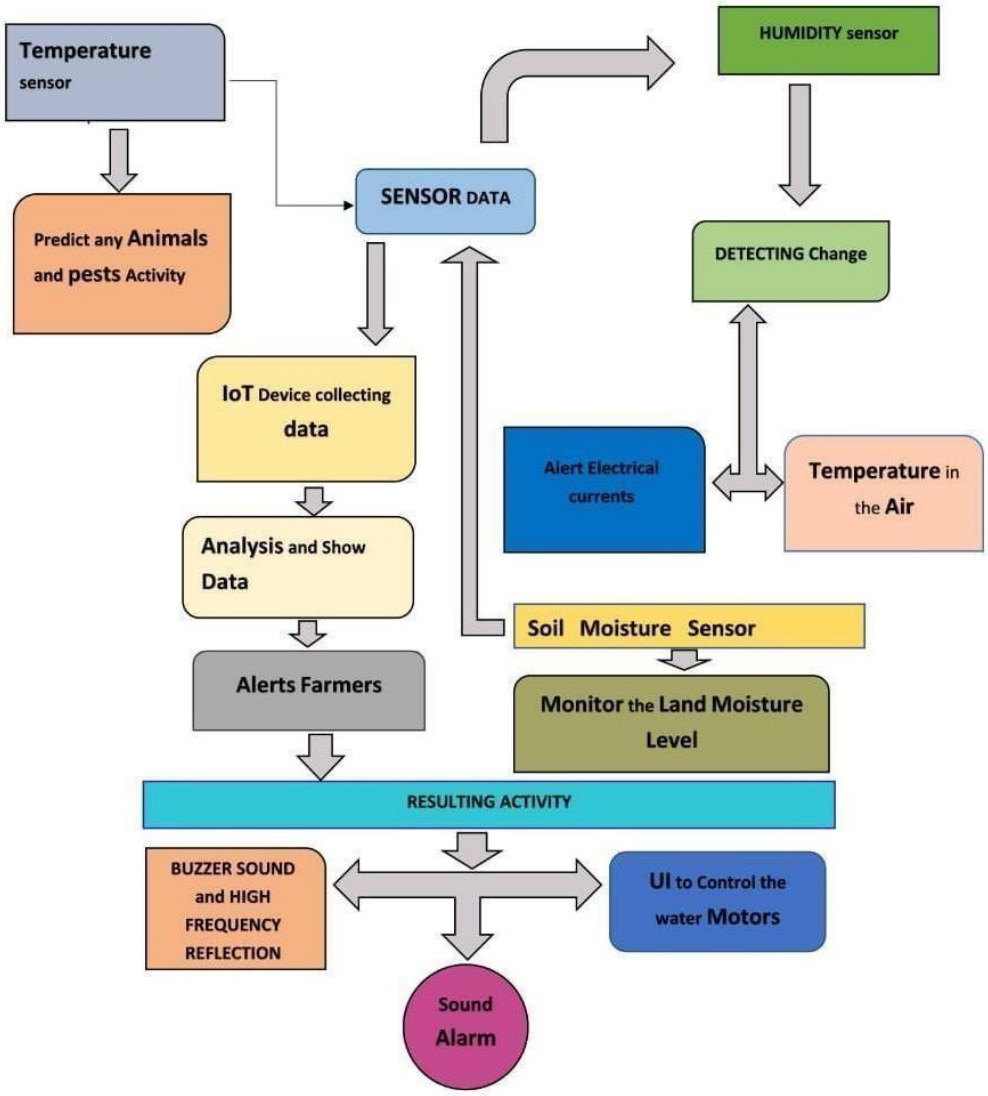
- Following are the non-functional requirements of the proposed solution.

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	Users can use the mobile application anywhere to know about the condition of the crop field.
NFR-2	**Security**	The data from the crop field requires secure access to information through the mobile application. And the mobile application will secure the data and sends it to the user.
NFR-3	**Reliability**	• The data from the application will detect when the animals enter the field through the alarm. • It will not harm any animals, and we can also protect the crop field. .
NFR-4	**Performance**	• With the help of sensors and data surveys, farmers can reduce water usage, energy consumption, and inputs like fertilizers. .
NFR-5	**Availability**	IoT solutions are necessary for this crop protection system. If the IoT

		solutions are going down, neither operations nor production gets affected.
NFR-6	**Scalability**	This type of system will not harm or injure animals as well as human beings.

PROJECT DESIGN

DATA FLOW DIAGRAM



SOLUTION ARCHITECTURE

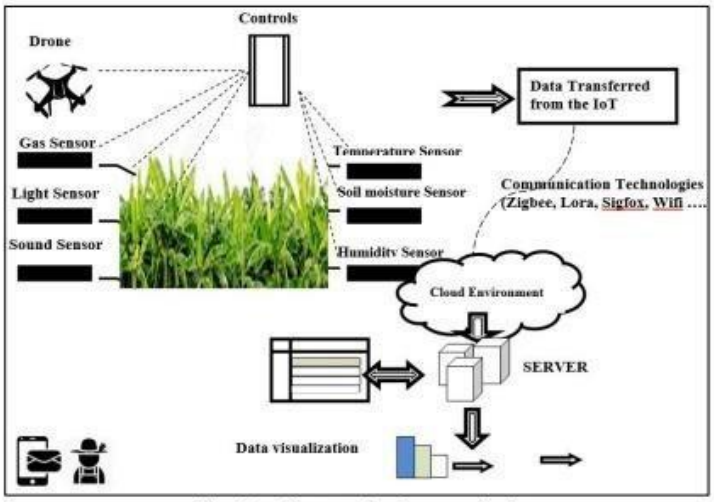
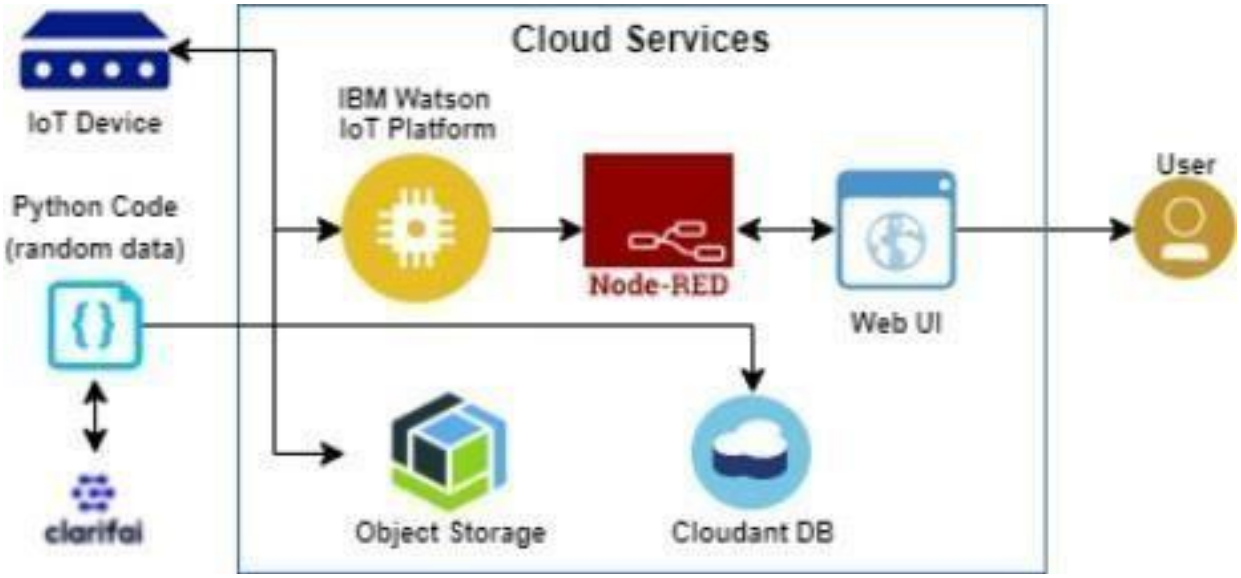


Fig. 1: Architecture for farm monitoring

TECHNICAL ARCHITECTURE



Components & Technologies

S.No	Component	Description	Technology
1.	User Interface	How user interacts with application e.g., Mobile Application	HTML, CSS, JavaScript / Angular JS /Node Red.
2.	Application Logic-1	Logic for a process in the application	Java / Python
3.	Application Logic-2	Logic for a process in the application	IBM Watson STT service
4.	Application Logic-3	Logic for a process in the application	IBM Watson Assistant
5.	Database	Data Type, Configurations etc.	MySQL, NoSQL, etc.
6.	Cloud Database	Database Service on Cloud	IBM DB2.
7.	File Storage	File storage requirements	IBM Block Storage or Other Storage Service or Local File system
8.	External API-1	Purpose of External API used in the application	IBM Weather API, etc.
9.	IoT Model	Purpose of IoT Model is for integrating the sensorswith a user interface.	IBM IoT Platform
10.	Infrastructure (Server / Cloud)	Application Deployment on Local System / CloudLocal Server Configuration: Cloud Server Configuration :	Local, Cloud Foundry, Kubernetes, etc.

USER STORIES

Stages	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5
Purpose	Motivation	Edge	Assurance	Necessity	Community Benefits
Requirements	Detection and management of threats to farm land to prevent losses.	Despite the dearth of resources, managing farmlands in terms of crop safety.	Connection to the system with sensor through app will corn their trust.	Management of increasing demand of food with minimal resources	To increase the quality of farm produce with maximum utilisation of resources and low cost
Components	Prevent damages of crops while minimizing use of pesticides and dealing with droughts.	User-friendly and robust.	Should be robust and immune to the possible threats.	Being a user-friendly interface which can be operated easily.	Cooperative farming using this mechanism can improve crop yield.
Emotions	Intrigued	Gained Credibility	Gets out of dilemma regarding practical feasiblity	Impressed at positive outcomes generated.	Thinks about collaboration to benefit the entire farming community
Outcomes	Apps and devices are connected through IOT.	Devices connected ia sensors.	Buzzer sounds, notifications in mobile app.	Succesful in repelling threats and intimating farmer if threat is beyond control.	Building farmer resilience to calamities and minimum support prices for crops.
Beneficaries	Farmers	Horticulturalists and Farmers.	Farmers with lands.	Farmers even with larger lands.	Farmers nationwide

PROJECT PLANING AND SCHEDULEING

SPRINT PLAN AND DELIVERY SCHEDULE

Sprint	Functioal Requirment(Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1		US-1	Create the IBM Cloud services which are being used in this project.	6	High	Abinaya, Akalya, Mohanraj, Sanjay, Shahil
Sprint-1		US-2	Configure the IBM Cloud services which are being used in completing this project.	4	Medium	Abinaya, Akalya, Mohanraj Sanjay, Shahil,

Sprint	Functional Requirement(Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-2		US-3	IBM Watson IoT platform acts asthe mediator to connect the web application to IoT devices, so create the IBM WatsonIoT platform.	5	Medium	Abinaya, Akalya, Mohanraj, Sanjay, Shahil
Sprint-2		US-4	In order to connect the IOT deviceto the IBM cloud, create a device in the IBM Watson IOT platform and get the devicecredentials.	5	High	Abinaya, Akalya, Mohanraj, Sanjay, Shahil
Sprint-3		US-1	Create a Node-RED service.	10	High	Abinaya, Akalya, Mohanraj, Sanjay, Shahil

Sprint-3		US-1	Develop a python script to publish random sensor data such as temperature, moisture, soil and humidity to the IBM IOT platform	7	High	Abinaya, Akalya, Mohanraj, Sanjay, Shahil

Sprint-4		US-1	Create Web UI in Node-Red	10	High	Abinaya, Akalya, Mohanraj, Sanjay, Shahil
Sprint-4		US-2	Configure the Node-RED flow to receive data from the IBM IOT platform and also use Cloud ant DB nodes to store thereceived sensor data in the cloud ant DB	10	High	Abinaya, Akalya, Mohanraj, Sanjay, Shahil

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (ason Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

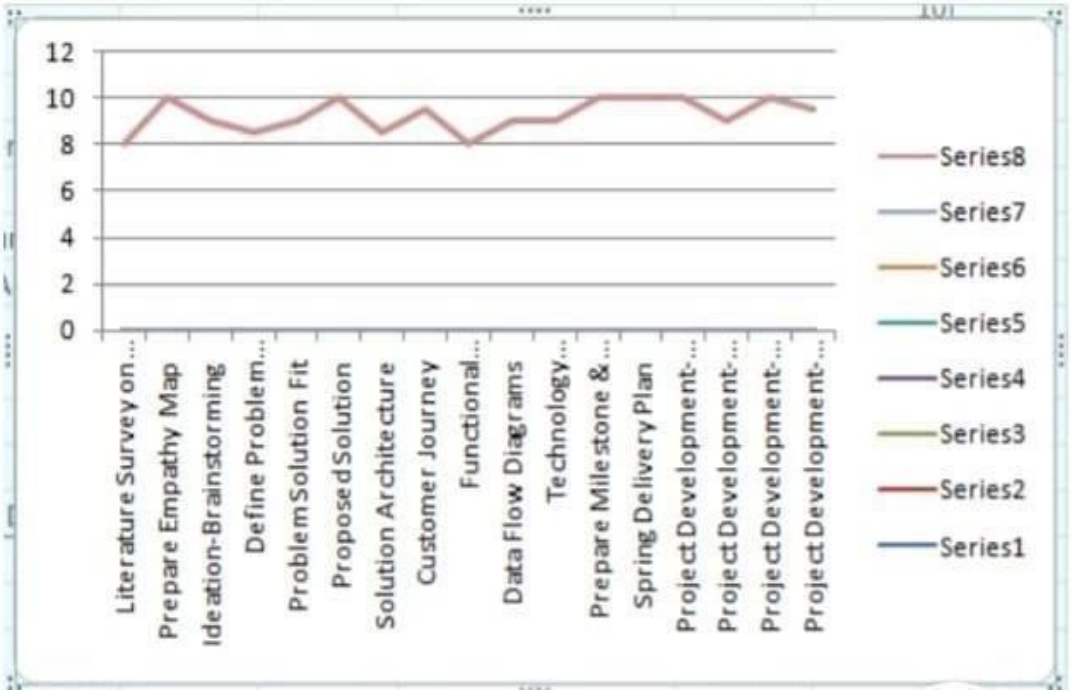
Velocity:

Imagine we have a 10-day sprint duration, and the velocity of the team is 20 (points per sprint). Let's calculatethe team's average velocity (AV) per iteration unit (story points per day)

$$AV = \frac{sprint\ duration}{velocity} = \frac{20}{10} = 2$$

BurndownChart:

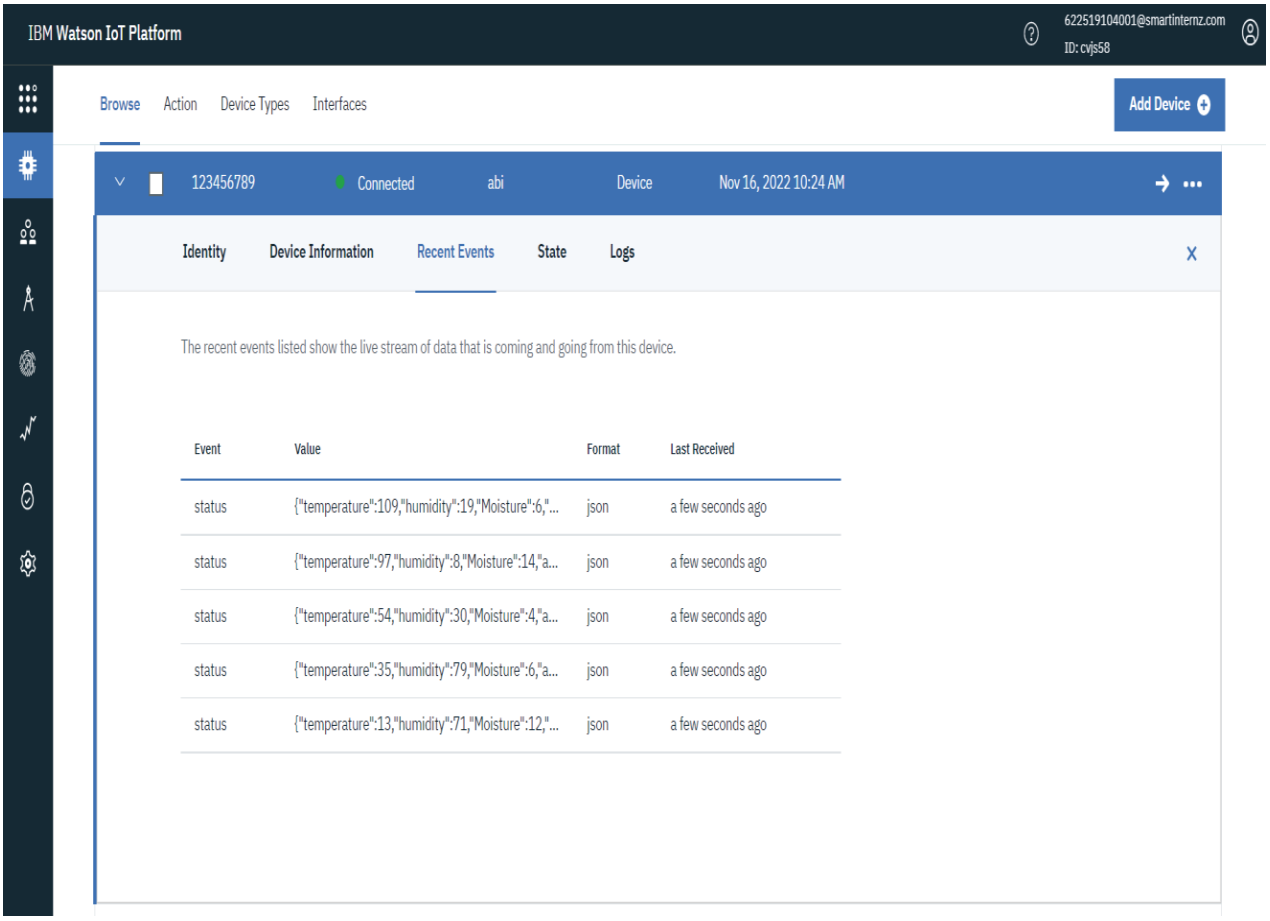
A burndown chart is a graphical representation of work left to do versus time However, burndown charts can be applied to any project containing measurableprogress overtime.



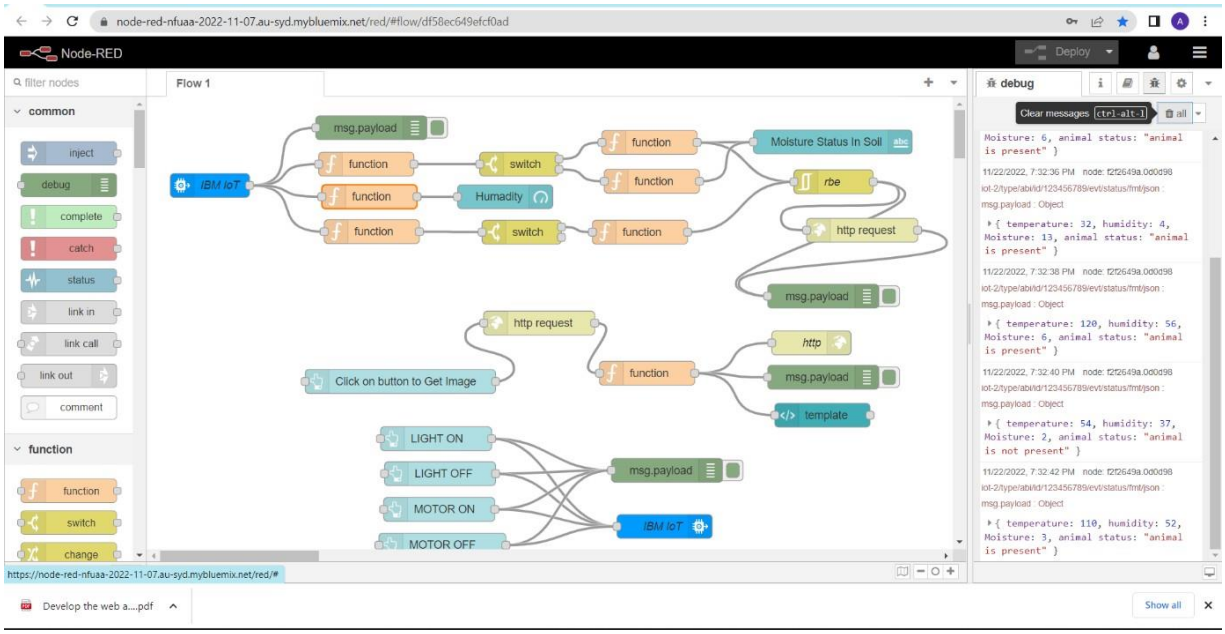
PYTHON SCRIPT

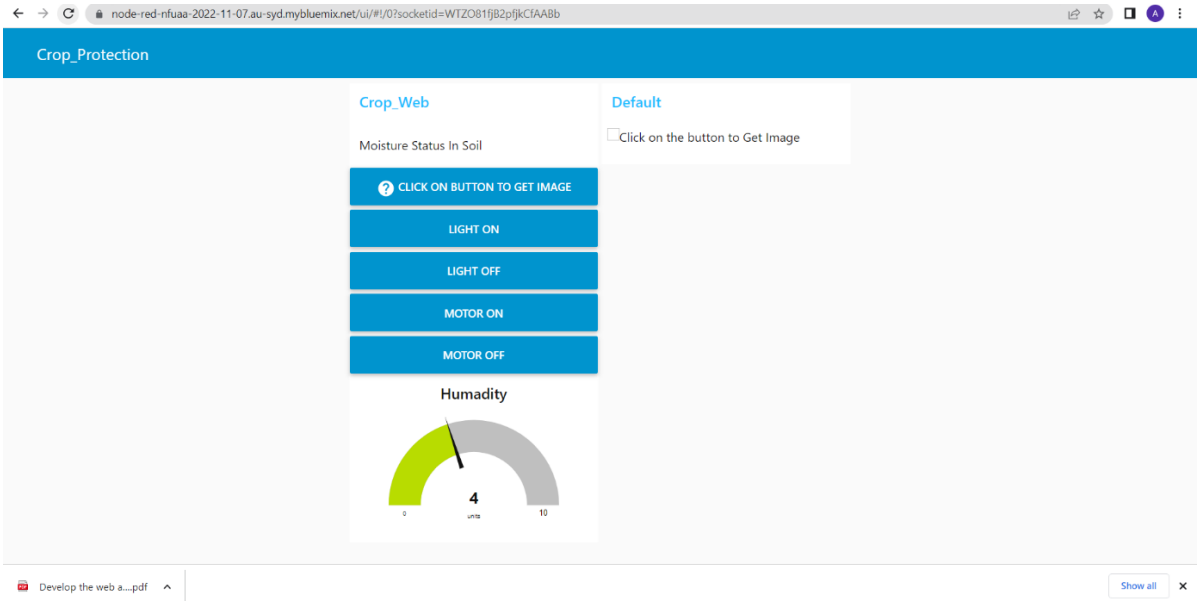
```
import
wiotp.sdk.de
vice import
time
import
random
myConfig
={
"identity":
{ "orgId":
"cvjs58",
"typeId": "abi",
"deviceId":"12
3456789"},
"auth": {
"token": "622519104001"
}}
def myCommandCallback(cmd):
print("Message received from IBM IoT
Platform: %s" % cmd.data['command'])
m=cmd.data['command']
if(m=="motoron"):
 print("Motor is
switched on")
elif(m=="motoroff
"):
   print("Motor is
   switched off")
   print(" ")
client =
wiotp.sdk.device.DeviceClient(config=myC
onfig, logHandlers=None) client.connect()
while True:
temp=random.rand
int(-20,125)
hum=random.randi
nt(0,100)
moist=random.ran
dint(0,14)
animal=random.ra
ndint(0,1)
if(animal>0.5):
 an="animal is
present" else:
   an="animal is not present"
myData={'temperature':temp, 'humidity':hum,
'Moisture':moist,"animal status":an}
```

```
client.publishEvent(eventId="status", msgFormat="json",
data=myData, qos=0, onPublish=None) print("Published data
Successfully: %s", myData)
client.commandCallback =
myCommandCallback time.sleep(2)
  client.disconnect()
```



Develop A Web Application Using Node Red





RESULT

PERFORMANCE METRICS

This system performance is good and it helps in protecting the crops from animals and weather.this inreases the food production and also increases the yield.

ADVANTAGES AND DISADVANTAGES

ADVANTAGES

- All the data like climatic conditions and changes in them, soil or crop conditions everything can be easily monitored.
- Risk of crop damage can be lowered to a greater extent.
- Many difficult challenges can be avoided making the process automated and the quality of crops can be maintained.
- The process included in farming can be controlled using the web applications from anywhere, anytime.

DISADVANTAGES

- Smart Agriculture requires internet connectivity continuously, but rural parts cannot fulfill this requirement.Any faults in the sensors can cause great loss in the agriculture, due towrong records and the actions of automated processes.
- IoT devices need much money to implement.The use of technology in farming and agriculture making it smart agriculture, is of course, a good initiative and a much-needed one with the present increasing demand in the food supply.
- In the case of equipment computer-based intelligence for running the devices, it is highly unlikely that a normal farmer will be able to possess this knowledge or even develop them.

APPLICATIONS

- Precision Farming that is farming processes can be made more controlled and accurate.
- Live monitoring can be done of all the processes and the conditions on the agriculturalfield.
- All the controls can be made just on the click.
- Quality can be maintained.

CONCLUSION

Smart farming is a modern farming management concept with IoT technology to increase the productivity in agriculture.With the use of smart farming, users can effectively monitor the crop field the qualityand quantity of their crops.

Users cannot be physically present on the field 24 hours a day. In addition, the farmersmay not have the knowledge to use different tools to measure the ideal environmentalconditions for their crops.

IoT provides them with the automated system, which can function without any human supervision and can notify them to make proper decision to deal with different kind of problems they may face during farming.

It has the capability to reach and notify the farmer even if farmer is not on the field,which can allow farmer to manage more farmland, thus improving their production.Thus, we can conclude that this IoT based smart crop protection system will definitely help users in farmland to effectively monitor their crops with the user-friendly platforms and alert the farm.

FUTURE SCOPE

The proposed work system is a successful working prototype that fulfils to protect crops from the intrusion of animals and birds.

This system will helps the users to monitor the temperature and to notify the weather conditions.This system assuredly assists the users to know about the soil moisture level. And the IoT based smart crop protection system implemented here brings a naval approach crop protection system from animals.

This assures the early detection and prevention of incurring losses due to the damage of crops.The following suggestions may be carried out in future implementation of the system;the smart crop prediction may be also carried out by considering the various factors like NPK content of the soil, UV radiation along with the tracking of the crop field location using GPSmodule system.

The automated pest traps also be introduced using image recognition techniques and neural networks in smart protection system.

SOURCE CODE

```
import wiotp.sdk.device
import time
import random
myConfig={
 "identity": {
 "orgId": "67n9bf",
 "typeId": "udaya",
 "deviceId":"123456"},
 "auth": {
 "token": "622519106052"
}}
def myCommandCallback(cmd):
 print("Message received from IBM IoT Platform: %s" %
cmd.data['command'])
 m=cmd.data['command']
 if(m=="motoron"):
  print("Motor is switched on")
 elif(m=="motoroff"):
  print("Motor is switched off")
  print(" ")
client = wiotp.sdk.device.DeviceClient(config=myConfig, logHandlers=None)
client.connect()
while True:
 temp=random.randint(-20,125)
 hum=random.randint(0,100)
 moist=random.randint(0,14)
 animal=random.randint(0,1)
 if(animal>0.5):
  an="animal is present"
 else:
  an="animal is not present"
 myData={'temperature':temp, 'humidity':hum, 'Moisture':moist,"animal
status":an}
 client.publishEvent(eventId="status", msgFormat="json", data=myData,
qos=0, onPublish=None)
 print("Published data Successfully: %s", myData)
 client.commandCallback = myCommandCallback
 time.sleep(2)
client.disconnect()
```

Project Demo link - https://youtu.be/T0lZ07QGuk4