IOT BASED SMART CROP PROTECTION SYSTEM FOR AGRICULTURE

IBM PROJECT REPORT

SUBMITTED BY

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IN

ELECTRONICS AND COMMUNICATION ENGINEERING

INTRODUCTION

1.1 Project Overview :

Animals like wild boars, buffaloes, cows, elephant, monkeys, birds etc. damages the crop lot which results in loss of production and so of farmer. It is very difficult for farmer to keep an eye on the field every time. Therefore it is very important to monitor the nearby presence of animals. Our main aim to design a system that can help to farmer to protect his farm from, animals.in this project we used microcontroller camera to detect the movement of animals send signal to the controller It diverts the animal by producing sound and signal further, transmitted to gsm which give an alert to the owner of the crop immediately.

1.2 Purpose :

In this project we used PIR and ultrasonic sensors to detect the movement of the animals and send the signal to the controller. It diverts the animals by producing sound and signal further, this signal is transmitted to GSM and which gives an alert to farmers and forest department immediately. A system that sounds when animal tries to enter into farm.So here we purpose automatic crop protection system from animals.

LITERATURE SURVEY

2.1 Existing problem

IOT have enabled major strides in agriculture and other agro based industries.IOT shift in agriculture ,such as in east timer cloud based IOTsupports motoring the illegal fishing activity,animal tracking IOT supports game parks management.Farming the pillar of support our country to the commercial development.but our productivity is extremely low as associated to world standar

2.2 References:

☞ Dr. Wilson, "ELECTRIC FENCE," Handbook of Texas, Project report published by the Texas State Historical Association. August 4, 2011.

☞ T. Day and R. Mac Gibbon, “Multiple-Species Exclusion Fencing and Technology for Mainland Sites.”, Project Report published by National Wildlife Research Centre, 2007.

☞ R. Padula and W. Head, “Fencing System” Project Report published by University of Minnesota, 2003.

☞ https://smartinternz.com/assets/docs/Smart%20Hom e% 20 Automation%20using%20 IBM%20cloud%20Service s%20(1).pdf

☞https://smartinternz.com/assets/docs/Smart%20Home% 20Automation%20using%20IBM%20cloud%20Service s%20(1).pdfc

☞ https://openweathermap.org/

☞ https://www.youtube.com/watch?v=cicTw4SEdxk

☞ https://smartinternz.com/assets/docs/Smart%20Home% 20Automation%20using%20IBM%20cloud%20Service s%20(1).pdf

2.3 Problem statement Definition:

A problem statement is a concise description of an issue to be addressed or a condition to be improved upon. it identifies the gap between the current state and desired state of a process or product.focusing on the facts,the problem statement should be designed to address the five ws .

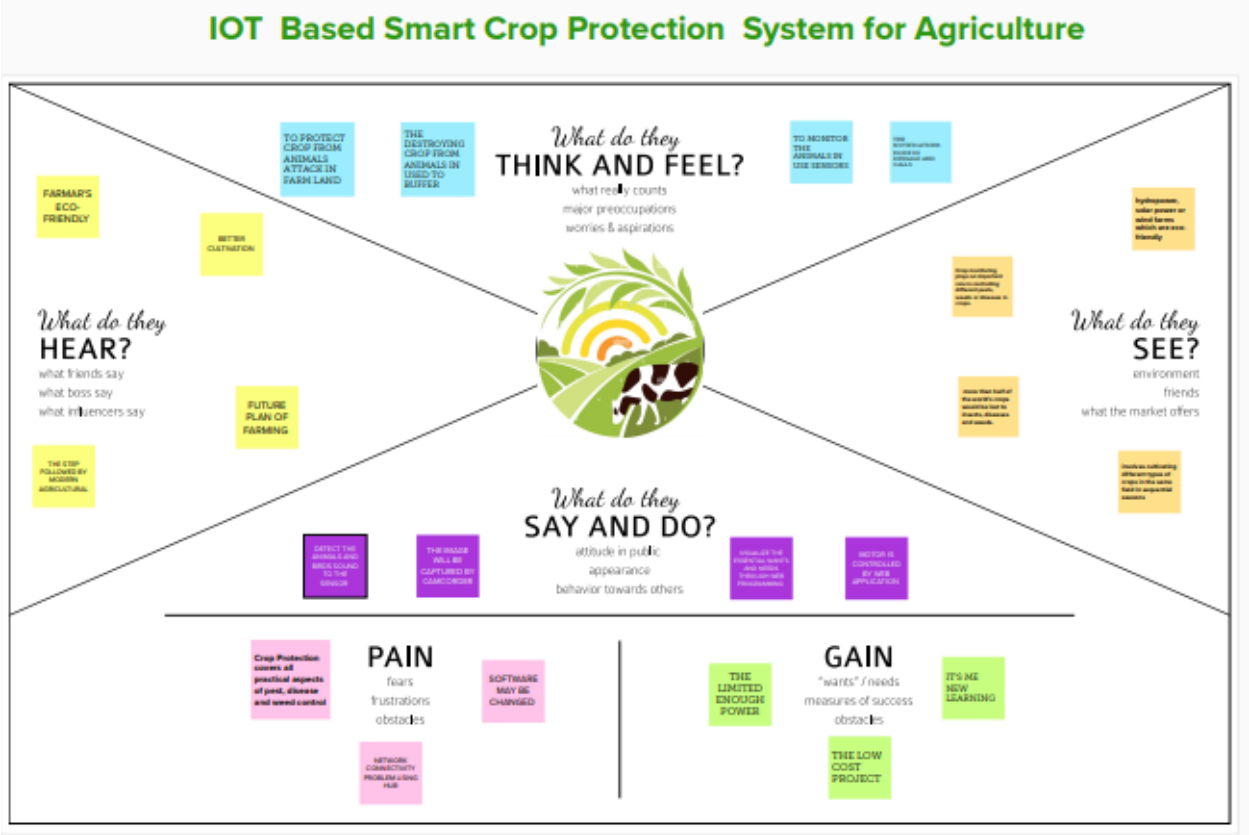
consider the following example of a problem statement employee turn over rate is up by 60% with most them leaving due to lack of support for growth opportunities.Agriculture is one of the Area which required urgent attention and advancement for high yield and efficient utilization of resources.

In this paper an approach of smart crop monitoring is presented through Internet of things (IOT).

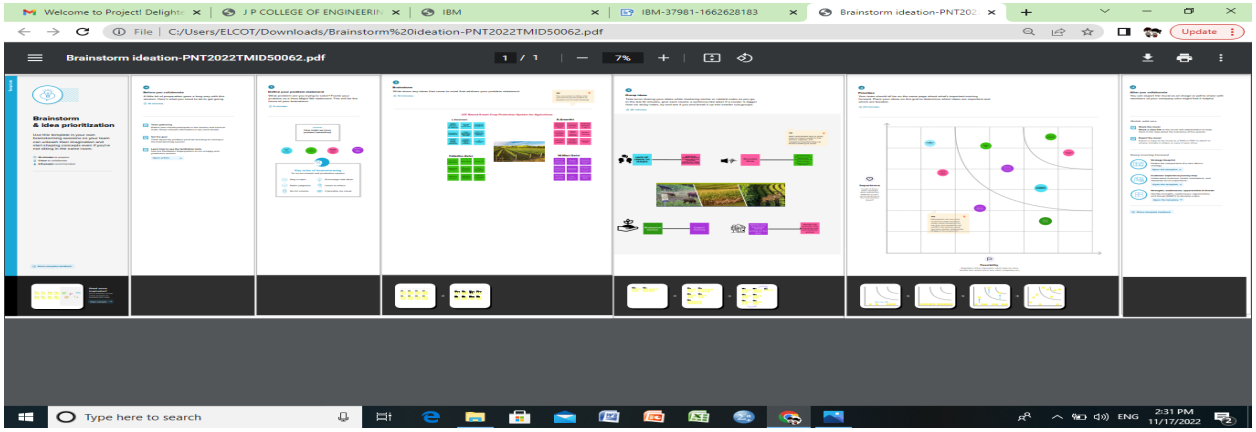
A 4 Level framework is proposed namely sensing devices, sensor data level, base station level, edge computing and cloud data level for smart crop monitoring. In this project, farm is going to get protected from humidity, temperature, and animals. With the help of IOT cloud module.

IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas :



3.2 Ideation & Brainstorming :



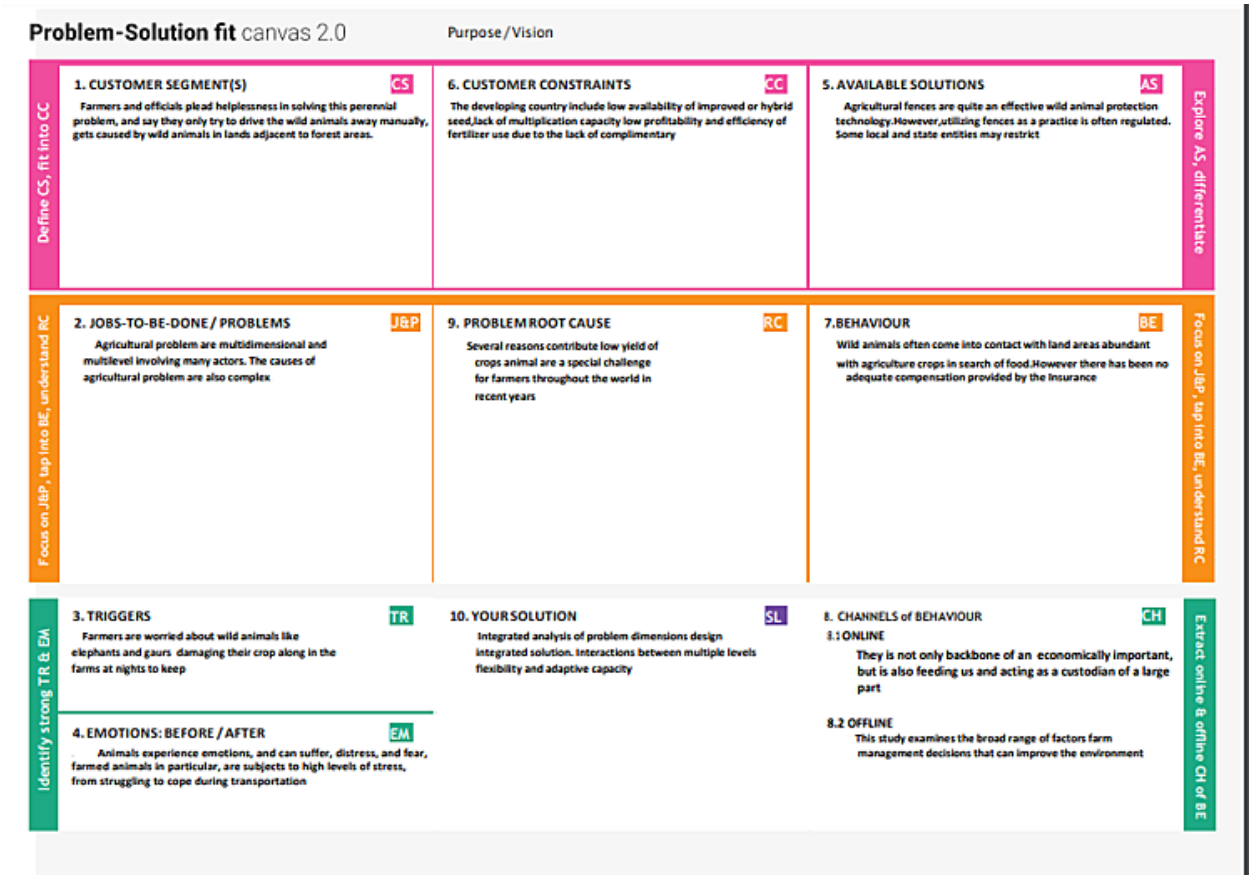
3.3 Proposed Solution:

Proposed Solution Template:

Project team shall fill the following information in proposed solution template.

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Develop smart & affordable solution to protect crop from wild animals. It is not possible to stay 24 HOUR in the farm to guard the crops. This system shall also include remote monitoring and control of pump to avoid the farmer to visit the farm in nighttime.
2.	Idea / Solution description	Such sensor can identify sick animals so that farmers can separate them from the herd and avoid contamination. Simple solution to suite the farmer community.
3.	Novelty / Uniqueness	The uses a motion sensor to detect wild animals approaching near the field and smoke in the animals.
4.	Social Impact / Customer Satisfaction	During analysis if gets better result of the combination of the data gathered from the various sensor then those data to all the volunteer for further use.
5.	Business Model (Revenue Model)	The direct access to farmers has e Emerged to encourage new practices, contractual engagement for input and output marketplaces, and credit lending agreements.
6.	Scalability of the Solution	Our ambitious scaling positive agriculture project aims to transform global food system by maximizing the potential of agriculture as a solution for climate,nature and farmers.

3.4 Problem Solution Fit:



REQUIREMENT ANALYSIS

4.1 Functional Requirements:

Functional Requirements:

Following are the functional requirements of the proposed solution.

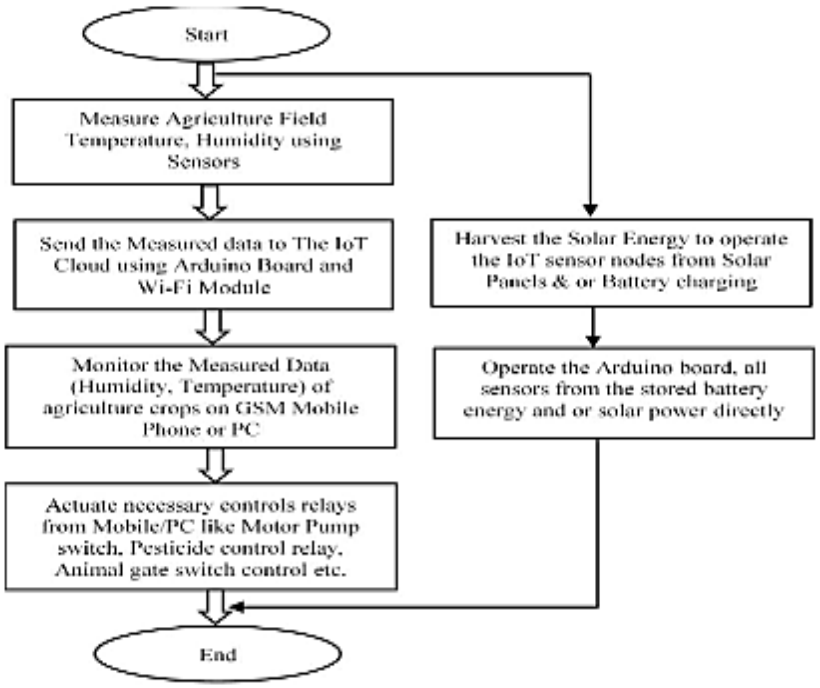
FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form Registration through Gmail Registration through LinkedIN
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	Web Application	web-based application must have a continuous internet connection to function.
FR-4	Configure to Device	sends data from Android devices to Google.
FR-5	Database	store, and manage data within an organization.
FR-6	Python Script	IBM iot platform

4.2 Non Functional Requirement:

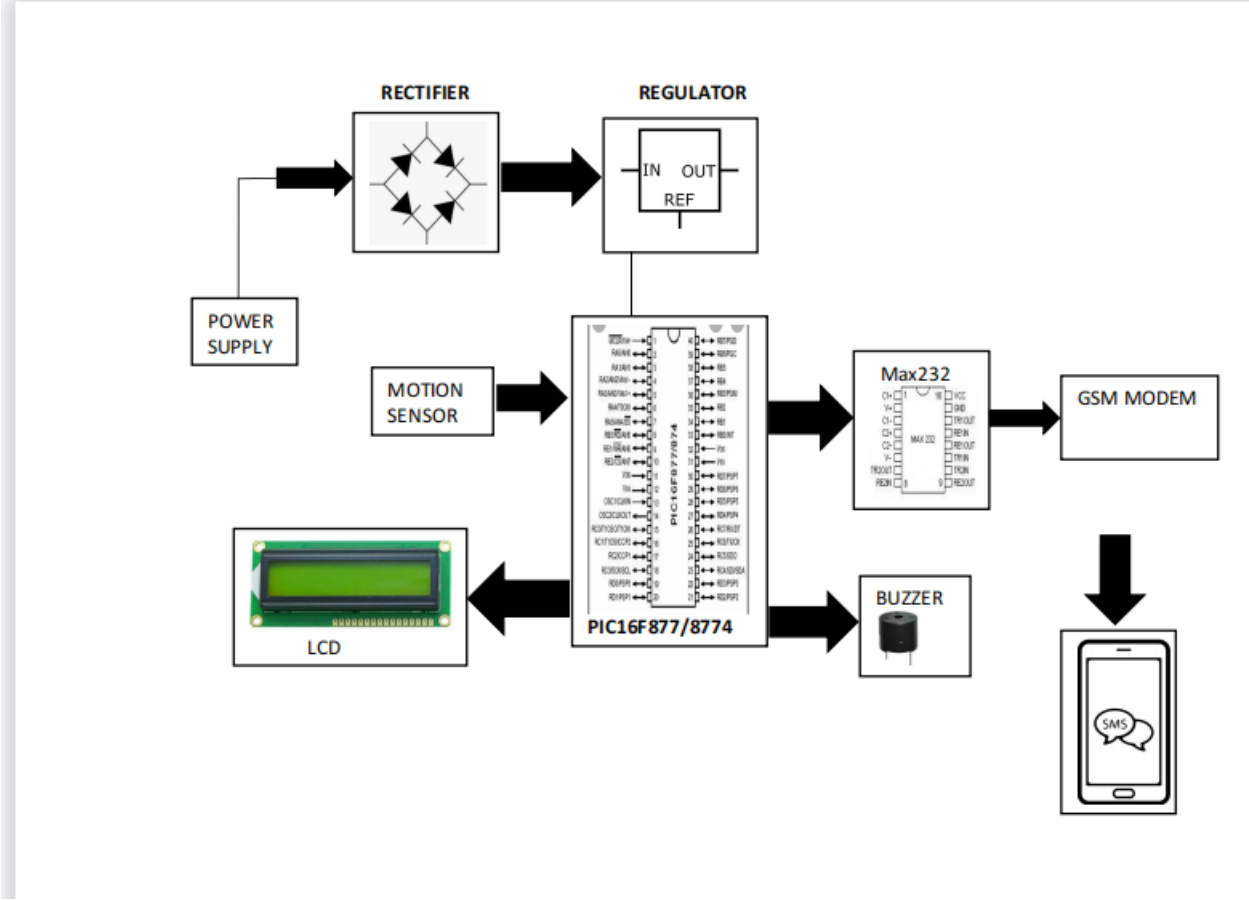
FR No.	Non-Functional Requirement	Description
NFR-1	Usability	the extent to which a system, product, or service can be used by specified users to achieve specified goals with effectiveness, efficiency.
NFR-2	Security	a discipline of cyber security dedicated to securing cloud computing systems
NFR-3	Reliability	measure of the probability that the cloud delivers the services it is designed
NFR-4	Performance	effectively monitor your cloud resources, to ensure all components communicate seamlessly
NFR-5	Availability	time that the data center is accessible or delivers the intend IT service as a proportion of the duration for which the service is purchased

PROJECT DESIGN

5.1 Data Flow Diagram:



5.2 Solution Architecture:



Technical Architecture:

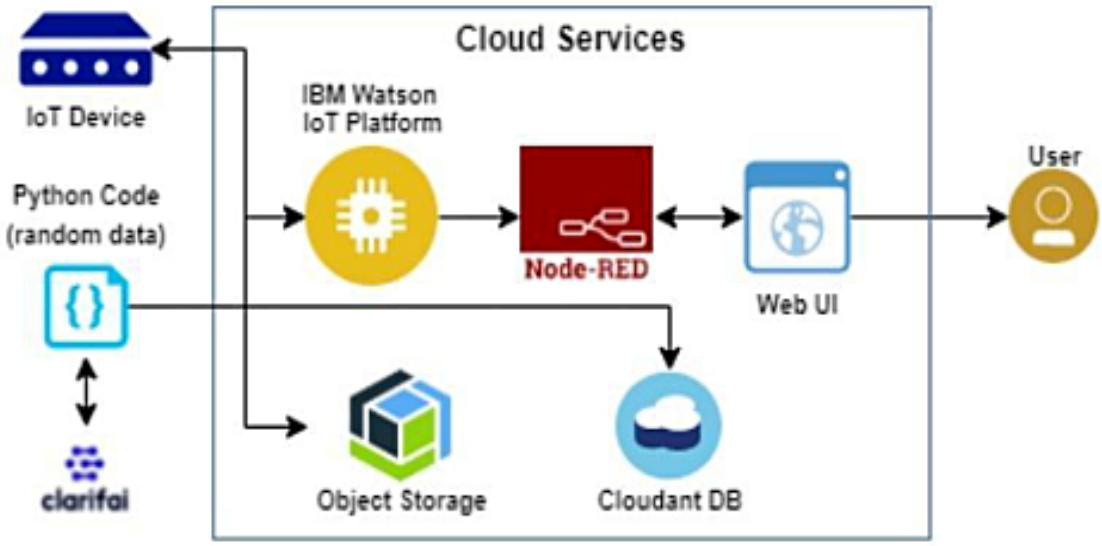


Table-1 : Components & Technologies:

S.No	Component	Description	Technology
1.	User Interface	The point of human-computer interaction and communication in a device **(E.g) Display screen**	SMTP email , IP network protocol
2.	Application Logic-1	The logic governing what a computer program is trying to accomplish	High -level programming include **C++,Java ,Python**
3.	Application Logic-2	Since application logic is user-facing,any glitches will directly affect consumers	E commerce application Technology
4.	Application Logic-3	research and product development;demonstration and market validation; and commercialization	GPS technology
5.	Database	an organized collection of structured information, or data, typically stored electronically in a computer system	solarwinds database,DbVisualizer
6.	Cloud Database	its a digital data visualization tool connected to sensors placed around the farm and software that makes sense of the information they gather	monitor and optimize
7.	File Storage	a hierarchical storage methodology used to organize and store data on a computer hard drive	facilitates the storage of unstructured data
8.	External API-1	Agricultural practices that use high amounts of external-inputs,such as inorganic fertilizers,pesticides and other amendments	Utilization of drones
9.	External API-2	Increased dependency on high cost external inputs in agriculture also made farmers to depend on external credit on a regular basis	,Minichromosome technology
10.	Machine Learning Model	a file that has been trained to recognize certain types of patterns	Machine learning in cybersecurity and Deep Neural Networks
11.	Infrastructure (Server / Cloud)	The agriculture infrastructure sector is important to enhance the productivity and to reduce the post-harvest losses	3G and 4G cellular networks

Table-2: Application Characteristics:

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	a template for software development that is designed by a social network of software developers	GNU/Linux and Android
2.	Security Implementations	The farm security method which is right now going that is more unplanned typical way adopted time consuming and as well as laborious	RFID Technology
3.	Scalable Architecture	a system,network, or process that is designed to handle a workload that may change in scope	supports higher workloads without any fundamental changes to it
4.	Availability	he assurance that an enterprises IT infrastructure has suitable recoverability and protection from system failures,natural disasterst	the quality or state of being available
5.	Performance	considering all these aspects within an industrial segment ends up becoming a complicated practice	Remote sensing technologies and Tele-metrics positioning technologies

5.3 User Stories:

SPRINT	FUNCTIONAL REQUIREMENT	USER STORY NUMBER	USER STORY/TASK	STORY POINTS	PRIORITY	TEAM NUMBERS
Sprint-1		US-1	Create the IBM Cloud services which are being used in this project.	7	high	Kalaimani Abitha Selvi Ananthi Mariselvi
Sprint-1		US-2	Create the IBM Cloud services which are being used in this project.	7	high	Kalaimani Abitha Selvi Ananthi Mariselvi
Sprint-2		US-3	IBM Watson IoT platform acts as the mediator to connect the web application to IoT devices, so create the IBM Watson IoT platform.	5	medium	Kalaimani Abitha Selvi Ananthi Mariselvi
Sprint-2		US-4	In order to connect the IoT device to the IBM cloud, create a device in the IBM Watson IoT platform and get the device credentials	6	high	Kalaimani Abitha Selvi Ananthi Mariselvi

Sprint-3		US-1	Configure the connection security and create API keys that are used in the Node-RED service for accessing the IBM IoT Platform.	10	high	Kalaimani Abitha Selvi Ananthi Mariselvi
Sprint-3		US-3	Create a Node-RED service	8	high	Kalaimani Abitha Selvi Ananthi Mariselvi
Sprint-3		US-2	Develop a python script to publish random	6	medium	Kalaimani Abitha Selvi Ananthi Mariselvi

			sensor data such as temperature, moisture, soil and humidity to the IBM IoT platform			Ananthi Mariselvi
Sprint-3		US-1	After developing python code, commands are received just print the statements which represent the control of the devices.	8	high	Kalaimani Abitha Selvi Ananthi Mariselvi
Sprint-4		US-3	Publish Data to The IBM Cloud	5	high	Kalaimani Abitha Selvi Ananthi Mariselvi
Sprint-4		US-2	Create Web UI in Node- Red	8	high	Kalaimani Abitha Selvi Ananthi Mariselvi

Sprint-4		US-1	Configure the Node RED flow to receive data from the IBM IoT platform and also use Cloudant DB nodes to store the received sensor data in the cloudant DB	6	high	Kalaimani Abitha Selvi Ananthi Mariselvi

PROJECT PLANNING AND SCHEDULING

6.1 Sprint planning & Estimation:

Project Tracker, Velocity & Burndown Chart: (4 Marks)

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

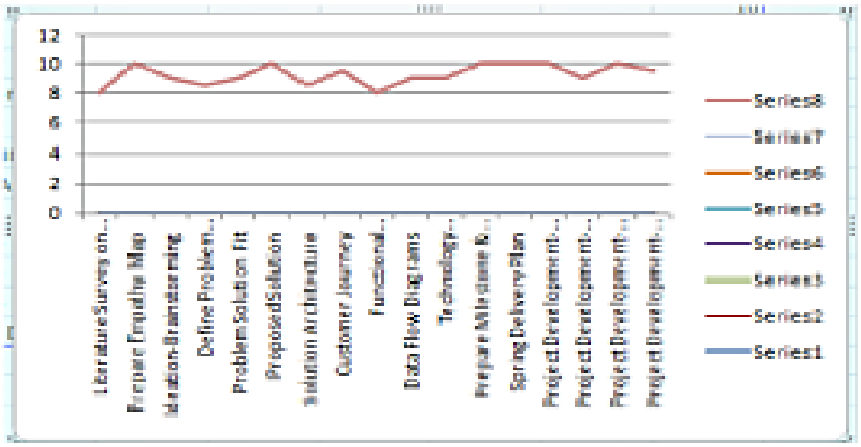
Velocity:

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

$$AV = Sprint\ duration / velocity = 20/10$$

Burndown Chart:

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



CODING & SOLUTIONING

7.1 Feature 1:

ARDUINO UNO:

ATmega328 is a single chip microcontroller created by Atmel in the mega AVR family. The Atmel 8-bit AVR RISCbased microcontroller combines 32 kB ISP flash memory with read-while-write capabilities, 1 kB EEPROM, 2 kB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts. The device achieves throughput approaching 1 MIPS per MHz

PASSIVE INFRARED SENSOR:

PIR sensors allow you to sense motion, almost always used to detect whether a human has moved in or out of the sensors range. They are small, inexpensive, low-power, easy to

use and don't wear out. For that reason they are commonly found in appliances and gadgets used in homes or businesses. PIRs are basically made of a pyroelectric sensor, which can detect levels of infrared radiation. Everything emits some low level radiation, and the hotter something is, the more radiation is emitted. The sensor in a motion detector is actually split in two halves. The reason for that is that we are looking to detect motion (change) not average IR levels. The two halves are wired up so that they cancel each other out. If one half sees more or less IR radiation than the other, the output will swing high or low.

DC MOTOR:

Motor is a device that creates motion, not an engine; it usually refers to either an electrical motor or an internal combustion engine. In most common DC motors (and all that BEAMers will see), the external magnetic field is produced by high-strength permanent magnets. The stator is the stationary part of the motor - this includes the motor casing, as well as two or more permanent magnet pole pieces. The rotor (together with the axle and attached commutator) rotate with respect to the stator. The rotor consists of windings (generally on a core), the windings

being electrically connected to the commutator.The above diagram shows a common motor layout -- with the rotor inside the stator (field) magnets.

LIQUID CRYSTAL DISPLAY:

Liquid crystal display is a type of display which used in digital watches and many portable computers. LCD displays utilize two sheets of polarizing material with a liquid crystal solution between them. An electric current passed through the liquid causes the crystals to align so that light cannot pass through them. Each crystal, therefore, is like a shutter, either allowing light to pass through or blocking the light. The liquid crystals can be manipulated through an applied electric voltage so that light is allowed to pass or is blocked. By carefully controlling where and what wavelength (color) of light is allowed to pass, the LCD monitor is able to display images. A back light provides LCD monitor's brightness. Other advances have allowed LCD's to greatly reduce liquid crystal cell response times. Response time is basically the amount of time it takes for a pixel to "change colors". Inreality response time is the amount of time it takes a liquid crystal cell to go from being active to inactive.

7.2 Feature 2:

```
from sklearn.datasets import load_files
from keras.utils import np_utils
import numpy as np
from glob import glob

tar=6
path="./validation"
# define function to load train,test, and validation datasets
def load_dataset(path):
    data = load_files(path)
    files = np.array(data["filenames"])
    targets = np_utils.to_categorical(np.array(data["target"]), tar)
    return files,targets

# load train, test, and validation datasets
train_files, train_targets = load_dataset(path)

test_files=train_files
test_targets = train_targets

# get the burn classes
# we only take the characters from a starting position to remove the path
#burn_classes = [item[11:-1] for item in sorted(glob(path))]
burn_classes = [item[12:-1] for item in sorted(glob("./validation/*/"))]
print(burn_classes)
# print statistics about the dataset
print("There are %d total categories." % len(burn_classes))
print(burn_classes)
print("There are %s total burn images.\n" % len(np.hstack([train_files, test_files])))
print("There are %d training images." % len(train_files))
print("There are %d test images."% len(test_files))

for file in train_files: assert(".DS_Store" not in file)



from keras.preprocessing import image
from tqdm import tqdm
```

TESTING

8.1 Test Cases:

Defect Analysis

This report shows the number of resolved or closed bugs at each severity level, and how they were resolved

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	11	4	2	2	19
Duplicate	1	1	2	0	4
External	2	3	0	1	6
Fixed	10	2	3	20	35
Not Reproduced	0	0	2	0	2
Skipped	0	0	2	1	3
Won't Fix	0	5	2	1	8
Totals	24	15	13	25	77

Security	3	0	0	3
Outsource Shipping	2	0	0	2
Exception Reporting	11	0	2	9
Final Report Output	5	0	0	5
Version Control	3	0	1	2

RESULT:

Thus the IOT based Smart Crop Protection has been build successfully with the help of MIT app, Node . Js, and node red. And the output has been tested and verified .

ADVANTAGE:

➢ Sensors in Agriculture invented to meet the increasing demand for food with minimum resources such water, fertilizers and seeds.

➢ They are easy to operate and use and easy to maintain.

➢ Sensors are cheaper in price and best in quality.

➢ They can used for measuring pollution and global warming for their fields and crops.

DISADVANTAGE:

➢ Farms are located in remote areas and are far from access to the internet.

➢ A farmer needs to have access to crop data reliably at any time from any location, so connection issues would cause an advanced monitoring system to be useless.

➢ High Cost: Equipment needed to implement IoT in agriculture is expensive.

CONCLUSION:

IoT smart agriculture products are designed to help monitor crop fields using sensors and by automating irrigation systems. As a result, farmers and associated brands can easily monitor the field conditions from anywhere without any hassle.

FUTURE SCOPE:

IoT smart agriculture products are designed to help monitor crop fields using sensors and by automating irrigation systems. As a result, farmers and associated brands can easily monitor the field conditions from

anywhere without any hassle.In the future,there will be very large scope, this project can be made based on Image processing in which wild animal and fire can be detected by cameras and if it comes towards farm then system will be directly activated through wireless networks. Wild animals can also be detected by using wireless networks such as laser wireless sensors and by LIQUID CRYSTAL

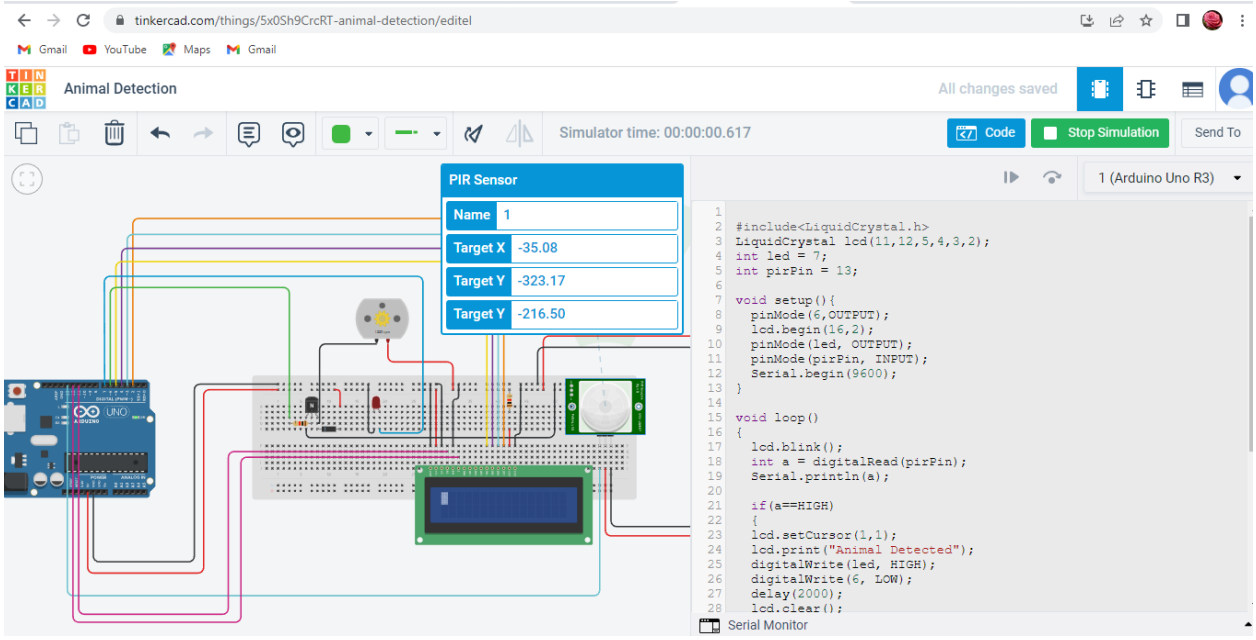
DISPLAY:

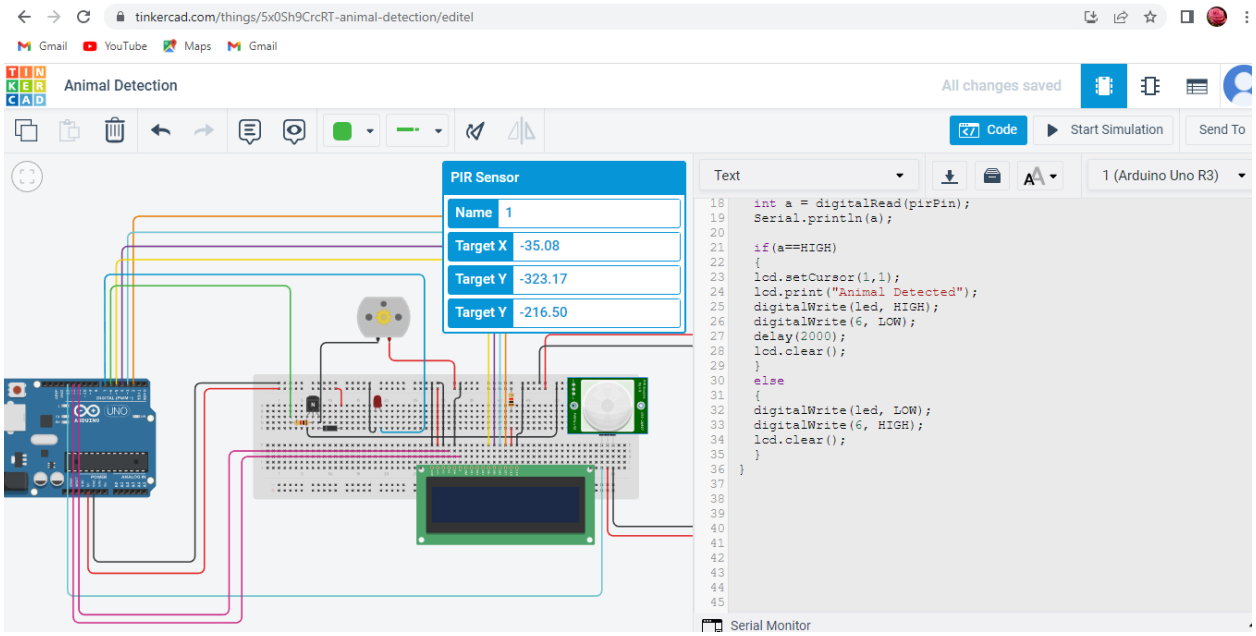
Liquid crystal display is a type of display which used in digital watches and many portable computers. LCD displays utilize two sheets of polarizing material with a liquid crystal solution between them. An electric current passed through the liquid causes the crystals to align so that light cannot pass through them. Each crystal, therefore, is like a shutter, either allowing light to pass through or blocking the light.The liquid crystals can be manipulated through an applied electric voltage so that light is allowed to pass or is blocked. By carefully controlling where and what wavelength (color) of light is allowed to pass, the LCD monitor is able to display

images. A back light provides LCD monitor’s brightness. Other advances have allowed LCD’s to greatly reduce liquid crystal cell response times. Response time is basically the amount of time it takes for a pixel to “change colors”. Inreality response time is the amount of time it takes a liquid crystal cell to go from being active to inactive.

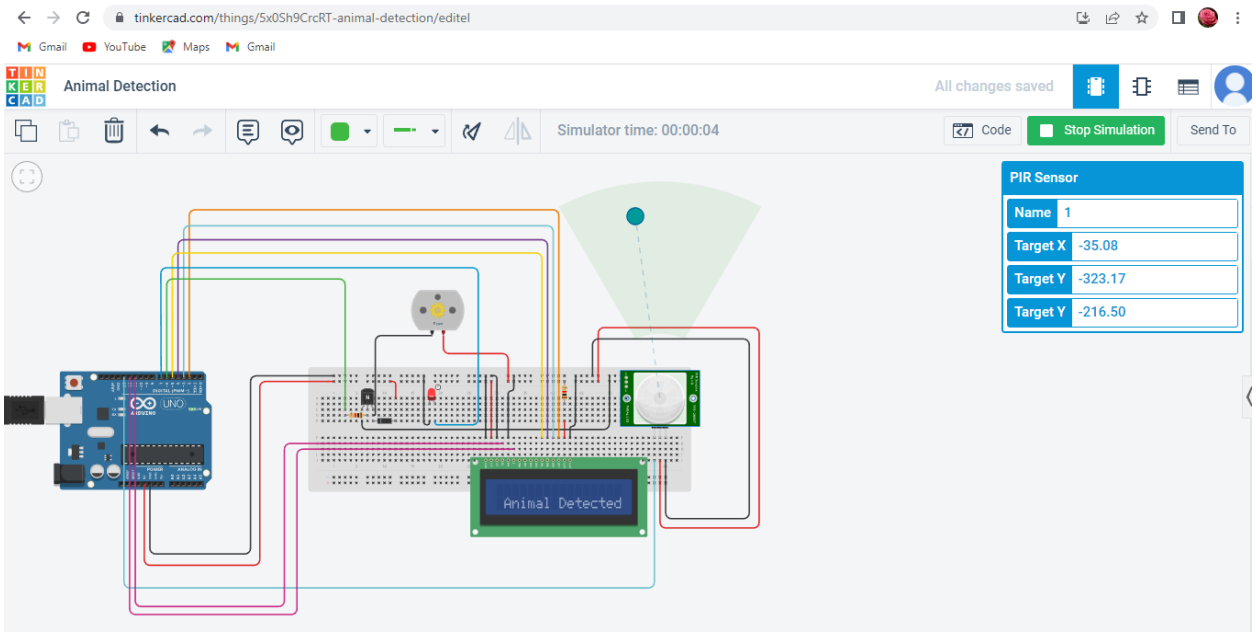
APPENDIX :

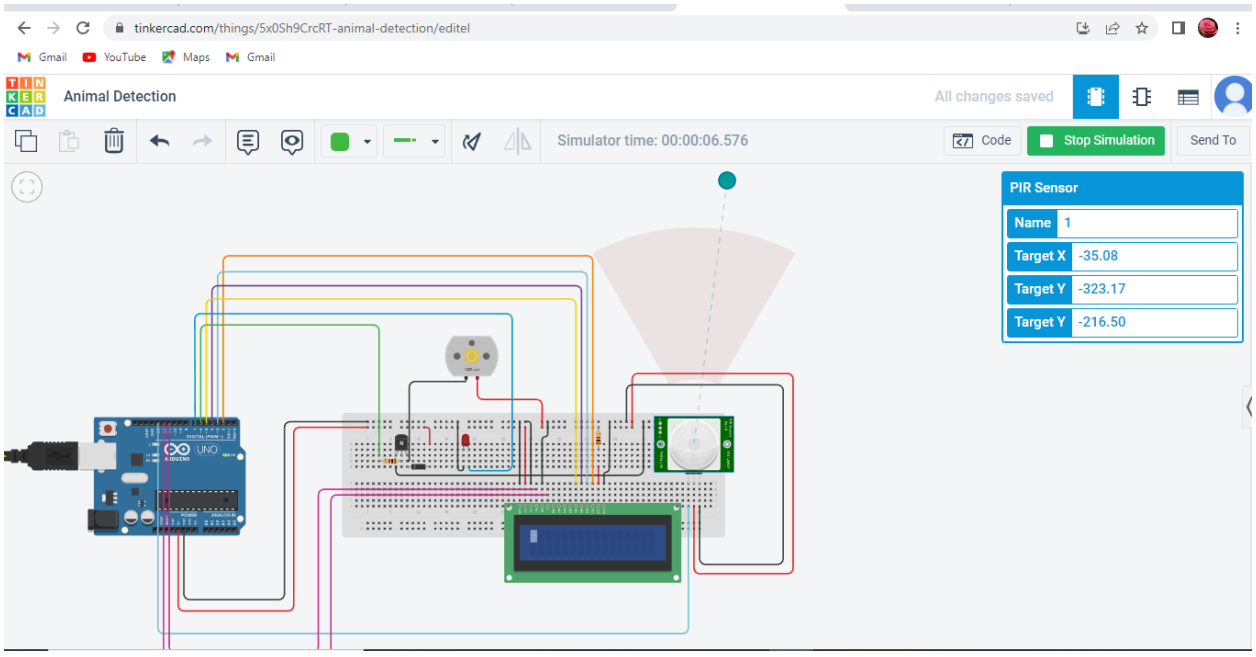
Simulation codes:


tinkercad.com/things/5x0Sh9CrcRT-animal-detection/editel
Gmail
YouTube
Maps
Gmail
Animal Detection
All changes saved
Simulator time: 00:00:00.617
Code
Stop Simulation
Send To
PIR Sensor
Name 1
Target X -35.08
Target Y -323.17
Target Y -216.50
1 (Arduino Uno R3)
#include<LiquidCrystal.h>
LiquidCrystal lcd(11,12,5,4,3,2);
int led = 7;
int pirPin = 13;
void setup(){
pinMode(6,OUTPUT);
lcd.begin(16,2);
pinMode(led, OUTPUT);
pinMode(pirPin, INPUT);
Serial.begin(9600);
}
void loop()
{
lcd.blink();
int a = digitalRead(pirPin);
Serial.println(a);
if(a==HIGH)
{
lcd.setCursor(1,1);
lcd.print("Animal Detected");
digitalWrite(led, HIGH);
digitalWrite(6, LOW);
delay(2000);
lcd.clear();
Serial Monitor


tinkercad.com/things/5x0Sh9CrcRT-animal-detection/editel
Gmail
YouTube
Maps
Gmail
Animal Detection
All changes saved
Code
Start Simulation
Send To
PIR Sensor
Name 1
Target X -35.08
Target Y -323.17
Target Y -216.50
Text
1 (Arduino Uno R3)
int a = digitalRead(pirPin);
Serial.println(a);
if(a==HIGH)
{
lcd.setCursor(1,1);
lcd.print("Animal Detected");
digitalWrite(led, HIGH);
digitalWrite(6, LOW);
delay(2000);
lcd.clear();
}
else
{
digitalWrite(led, LOW);
digitalWrite(6, HIGH);
lcd.clear();
}
}
Serial Monitor

Simulation Output:





GitHub Link:

IoT Based Smart Crop Protection System for Agriculture

https://github.com/IBM-EPBL/IBM-Project-37981-1660366496 :

Demo Video Link:

IoT Based Smart Crop Protection System for Agriculture:
https://drive.google.com/file/d/11Vix_ScjuZ4MpR0QdWE9kM1SM51geyya/view?usp=drivesdk

THANK YOU