IOT BASED SMART CROP PROTECTION SYSTEM FOR AGRICULTURE

TEAM ID: PNT2022TMID21791

TEAM MEMBERS:

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1. INTRODUCTION:

1.1 PROJECT OVERVIEW:

Crops in farms are frequently devastated by local animals such as buffaloes, cows, goats, birds, and so on. This results in massive losses for the farmer. Deforestation happens as a result of overpopulation, resulting in a lack of food, water, and shelter in forest areas. As a result, animal interference in residential areas is increasing, threatening human life and property, leading to human-animal conflict. However, according to nature's rules, every living creature on this planet plays an important role in the eco-system. Elephants and other animals that come into touch with humans have a negative impact in a variety of ways, including agricultural depredation, damage to grain stores, water supply, dwellings and other assets, and human injury and death.

1.2 PURPOSE:

Electric Fences:

Electric fences were used to control livestock in the United States in the early 1930s, and electric fencing technology developed in both the United States and New Zealand. An early application of the electric fence for livestock control was developed in 1936–1937 by New Zealand inventor Bill Gallagher. One of the major disadvantages of having an electric fence installed is that it requires regular maintenance. Scarecrow:

Scarecrow genealogy is rooted in a rural life style. The Egyptians used the first scarecrows in recorded history to use to protect wheat fields along the Nile River from flocks of quail. Egyptian farmers installed wooden frames in their fields and covered them with nets. While traditional, motionless scarecrows do work against “pest birds” (e.g., crows and blackbirds), the effect is almost always temporary. Over time, the birds get used to stationary dummies and resume their destructive habits.

2. LITERATURE SURVEY:

2.1 EXISTING PROBLEM:

One of the major economic issues faced by the country is agriculture as this is the sector which is source of livelihood for about 54% of Indians till date. Still today this sector is not well developed and faces lots of problems resulting into low productivity of crops. As 43% of land in India, is used for farming but contributes only 18% of the nation’s GDP. The poor condition of agriculture in the country is the point of concern for Indians. The rural farmers in India suffer from poverty and most of them are illiterate so there is lack of good extension services. The problem of wild life attack on crops i.e., crop Vandalization is becoming very common in the states of Tamil Nadu, Himachal Pradesh, Punjab, Haryana, Kerala and many other states. Wild animals like monkeys, elephants, wild pigs, deer, wild dogs, bison, nilgais, estray animals like cows and buffaloes and even birds like parakeets cause a lot of damage to crops by running

over them, eating and completely vandalizing them. This lead to poor yield of crops and significant financial loss to the owners of the farmland. This problem is so pronounced that sometimes the farmers decide to leave the areas barren due to such frequent animal attacks Another major problem faced by Indian farmer is their dependency on nature and poorly maintained irrigation system. Current agricultural practice are neither economically nor environmentally sustainable and India's yields for many agricultural commodities are low. Poorly maintained irrigation system and almost universal lack of good extension service are among the factor responsible. Poor roads to market from village, rudimentary market infrastructure, and excessive regulation are few of the other concerned points for the agriculture sector in India. The low productivity in India is a result of the following factor:

2.2 REFERENCES:

[1] ArturFrankiewicz; RafałCupek.” Smart Passive Infrared Sensor - Hardware Platform “Year: 2013 IECON 2013 - 39th Annual Conference of the IEEE Industrial Electronics Society Pages: 7543 – 7547

[2] Discant, A. Rogozan, C. Rusu and A. Bensrhair, “Sensors for Obstacle Detection” 2007 30th International Spring Seminar on Electronics Technology (ISSE), Cluj-Napoca, 2007, pp. 100-105. doi: 10.1109/ISSE.2007.4432828 Volume:01 Pages:859-862, DOI:10.1109/ICCSNT.2015.7490876, IEEE Conference Publications.

[3] Mustapha, Baharuddin, AladinZayegh, and Rezaul K. Begg. “Ultrasonic And Infrared Sensors Performance in A Wireless Obstacle Detection System” Artificial Intelligence, Modelling and Simulation (AIMS), 2013 1st International Conference on. IEEE, 2013.

[4] Padmashree S. Dhake, Sumedha S. Borde, “Embedded Surveillance System Using PIR Sensor”, International Journal of Advanced Technology in Engineering and Science, www.ijates.com Volume No.02, Issue No. 03, March 2014

[5] Wang, Z., Wang, H., Liu, L., Song, W., & Lu, J. (2015, December). Community alarm system design based on MCU and GSM. In 2015 4th International Conference on Computer Science and Network Technology (ICCSNT) (Vol. 1, pp. 859-862). IEEE.

[6] Shende, P. Y., Raut, S. M., Ingale, P. S., Nagose, A. K., Katakpur, P. S., & Kathane, S. S. Solar Electric Fencing for Irrigation of Animal Man Conflict

[7] Mohammad, T. (2009). Using ultrasonic and infrared sensors for distance measurement. World Academy of Science, Engineering and Technology, 51, 293-299

[8]Volume:01 Pages:859-862, DOI:10.1109/ICCSNT.2015.7490876 , IEEE Conference Publications.

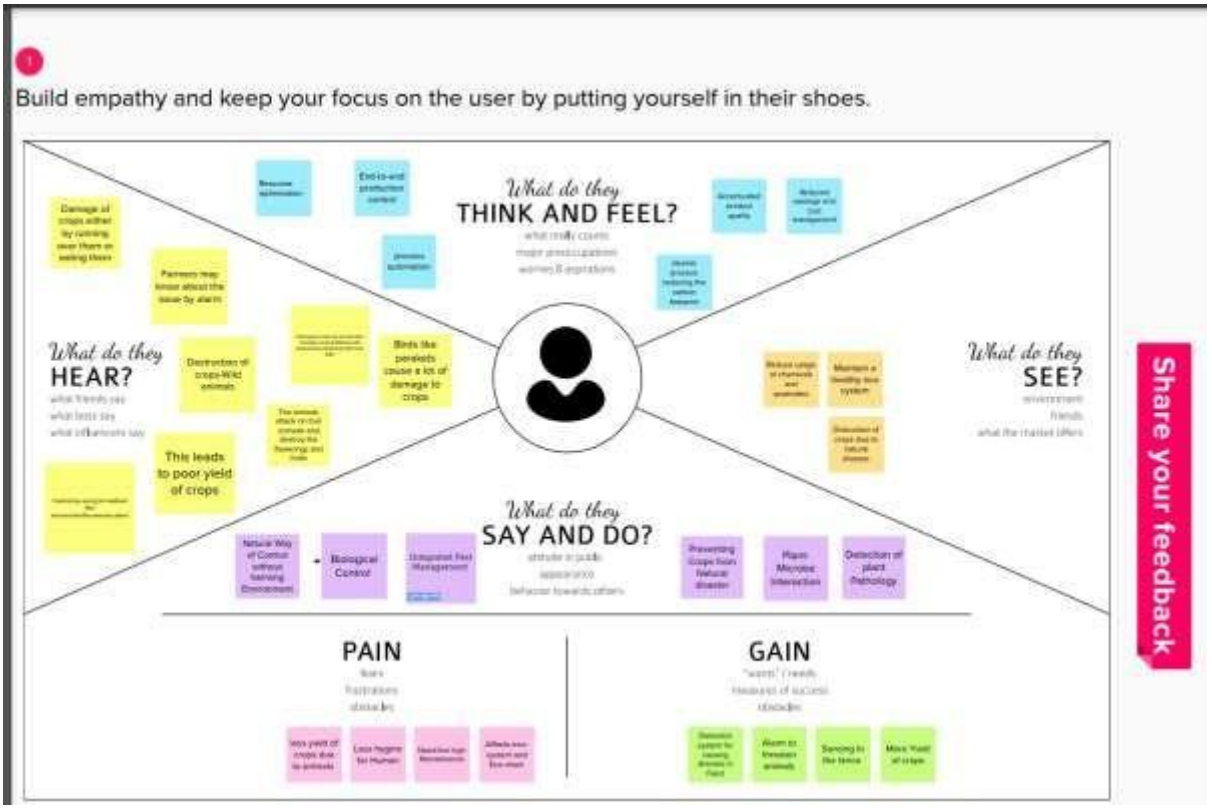
2.3 PROBLEM STATEMENT DEFINITION:

Problem Statement (PS)	**I am (Customer)**	**I'm trying to**	**But**	**Because**	**Which makesme feel**
PS-1 Develop a system for predicting cotton crop production and probable pest, disease, andinsect attacks (before at least 15 days and more). (Technology Bucket: Satellite images, Cloud computing,Big Data, In-field sensor data, drone imagery,	Cost effective, small size	To createan app-based forecasting system that can forecast potential pest, disease, and insect attacks on cotton crops.	More cost	Involves more requirements	Instead of using general recommendations, forecast the cotton crop yield production for farmers in the Vidarbha regionusing farm historical data, local terrain, weather scenarios, and numerous sensor inputs

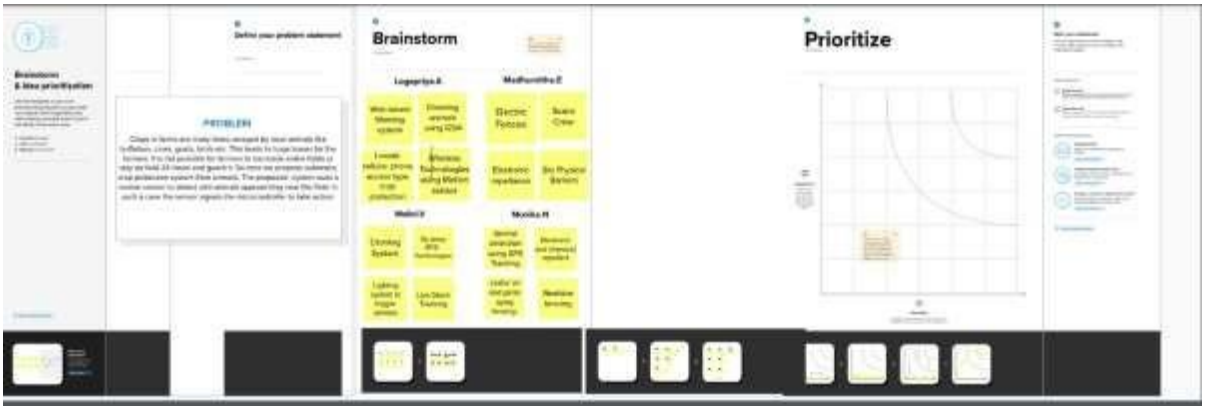
and other IoT data					
PS-2 Wild animals like elephant, wild pig,deer, wild dogs,bison may enter into the field which in turn destroy thecrop and reduce the yield in farming	Eco-friendly,customer satisfaction	1.Identifyand evaluate risk possessedby wild and domestic animals. 2.Monito r and document animal activity on the farm. 3.Conduct field assessment before harvest	Implementation is harder	Coverageareais larger	Crop protection needs particularly cautious approach

3. IDEATION & PROPOSED SOLUTION:

3.1 EMPATHY MAP CANVAS:



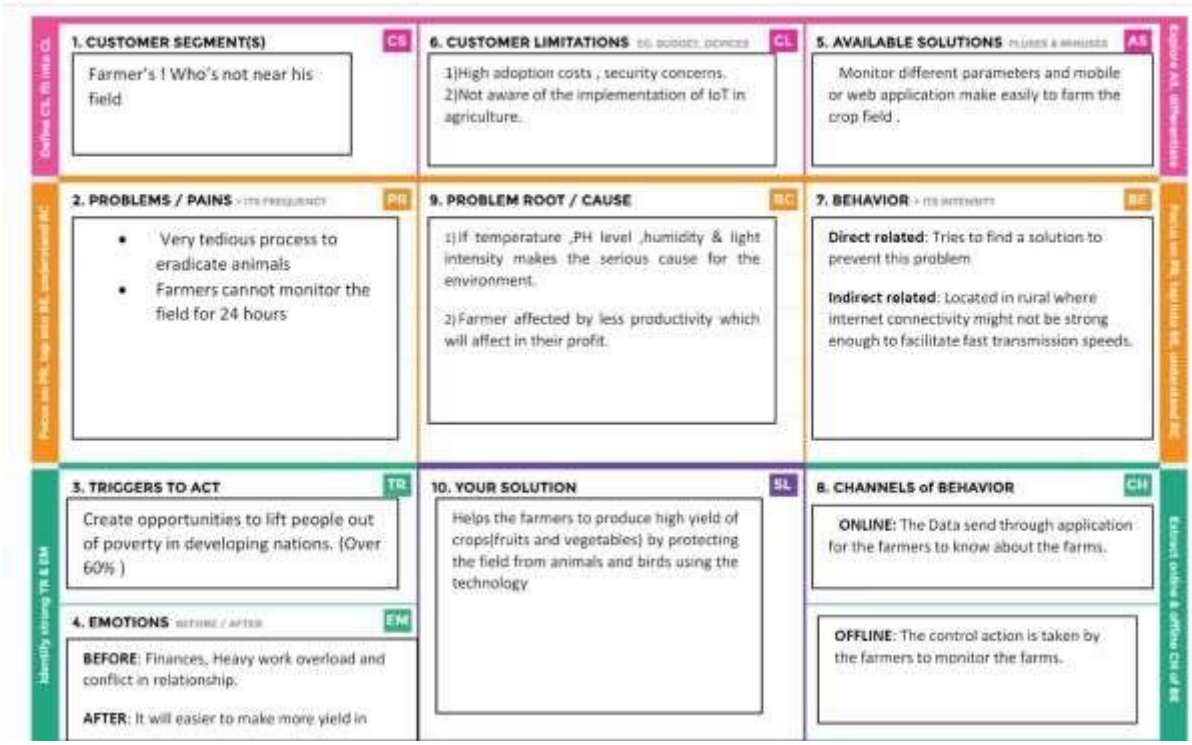
3.2 IDEATION AND BRAINSTROMING:



3.3 PROPOSED SOLUTION:

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Crop damage cost by animal and bird reduces the crop yield.Crops are mainly damaged by the local animals like buffaloes,cows,pigs,goats. Wild animals are the special challenge for the farmers throughout the world. Farmers with large area of agricultural land find it very tedious to irrigate their land.
2.	Idea / Solution description	An animal detection system to detect the presence of animals and it offers a warning and diverts the animal without any harm. The system will continuously check for any animal to enter the field. Sensors are used to detect animal movement and to give signal to the controller. Further the animals are being diverted by generating sound and signals.
3.	Novelty / Uniqueness	The signal is being transmitted to the GSM (Global System for Mobiles) and instantly give farmers warning. The difficulty and the availability to spot just in-case the animals do not show off by alarm
4.	Social Impact / Customer Satisfaction	The complete safety of crops was ensured by the system from animals thus protecting the animal farmers loss.
5.	Business Model (Revenue Model)	Gives raise to high yield of production. Farmers need not to stay on the field for 24 hours and protect it.
6.	Scalability of the Solution	This technology can be widen based on the area of the field that is used for protection.

3.4 PROBLEM SOLUTION FIT:



4. REQUIREMENT ANALYSIS:

4.1 FUNCTIONAL REQUIREMENT:

Following are the functional requirements of the proposed solution.

FR No	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Visibility	Sensen animals nearing the crop field and sounds alarm to woo them away as well assends SMS to farmer using cloud service.
FR-2	User Reception	The Data like values of Temperature, Humidity, Soil moisture sensors are received via SMS
FR-3	User Understanding	Based on the sensor data value to get the information about present of farming land
FR-4	User Action	The user needs take action like destruction of crop residues, deep plowing, crop rotation, fertilizers, strip cropping, scheduled planting

		operations.

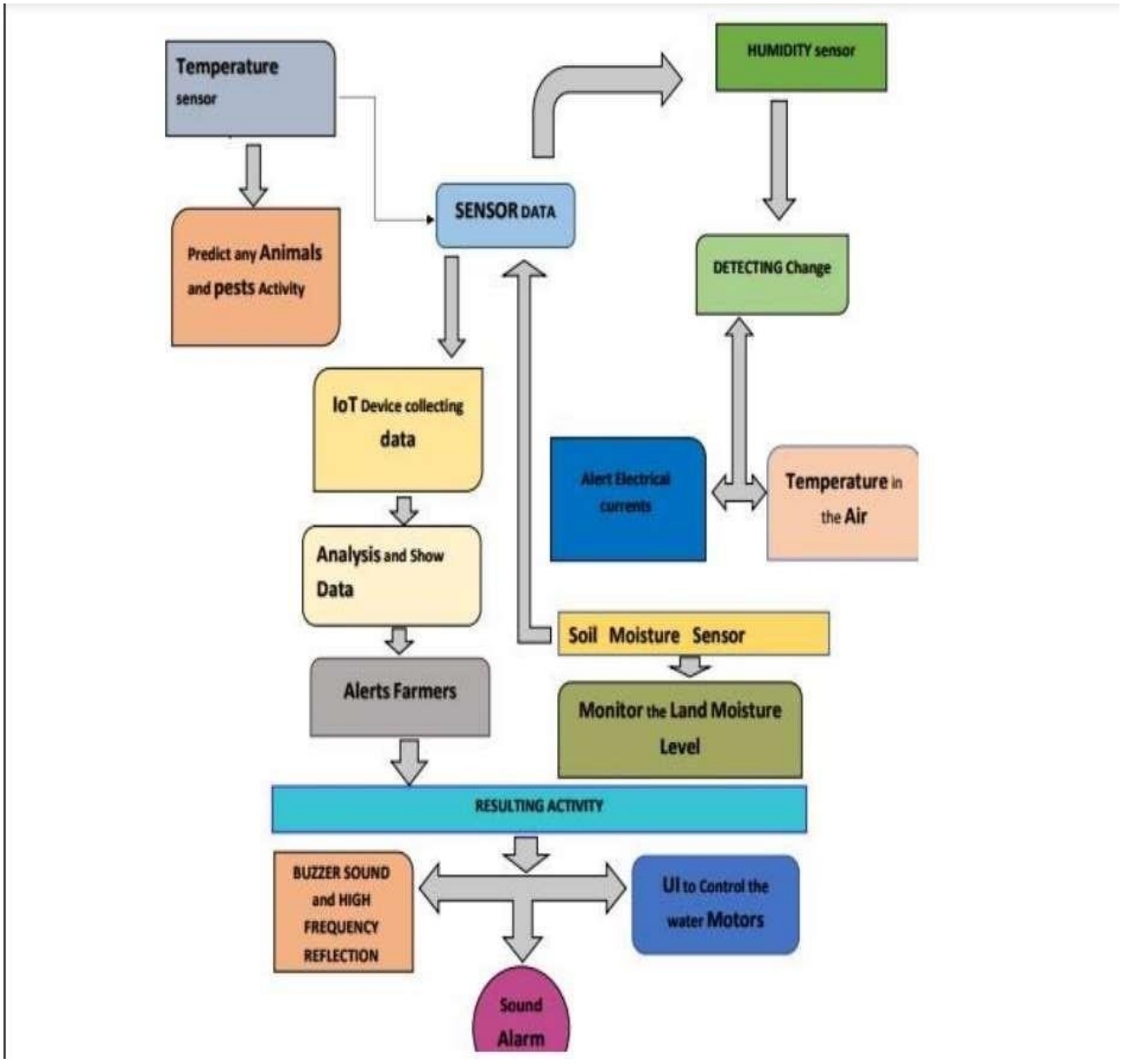
4.2 NON-FUNCTIONAL REQUIREMENTS:

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

FR No	Non-Functional Requirement	Description
NFR-1	Usability	Mobile support. Users must be able to interact in the same roles & tasks on computers & mobile devices where practical, given mobile capabilities.
NFR-2	Security	Data requires secure access to must register and communicate securely on devices and authorized users of the system who exchange information must be able to do.
NFR-3	Reliability	It has a capacity to recognize the disturbance nearthe field and doesn't give a false caution signal.
NFR-4	Performance	Must provide acceptable response times to users regardless of the volume of data that is stored andthe analytics that occurs in background. Bidirectional, near real-time communications mustbe supported. This requirement is related to the requirement to support industrial and device protocols at the edge.
NFR-5	Availability	IoT solutions and domains demand highly availablesystems for 24x7 operations. Isn't a *critical production* application, which means that operations or production don't go down if the IoT solution is down.
NFR-6	Scalability	System must handle expanding load and data retention needs that are based on the upscaling ofthe solution scope, such as extra manufacturing facilities and extra buildings.

5. PROJECT DESIGN:

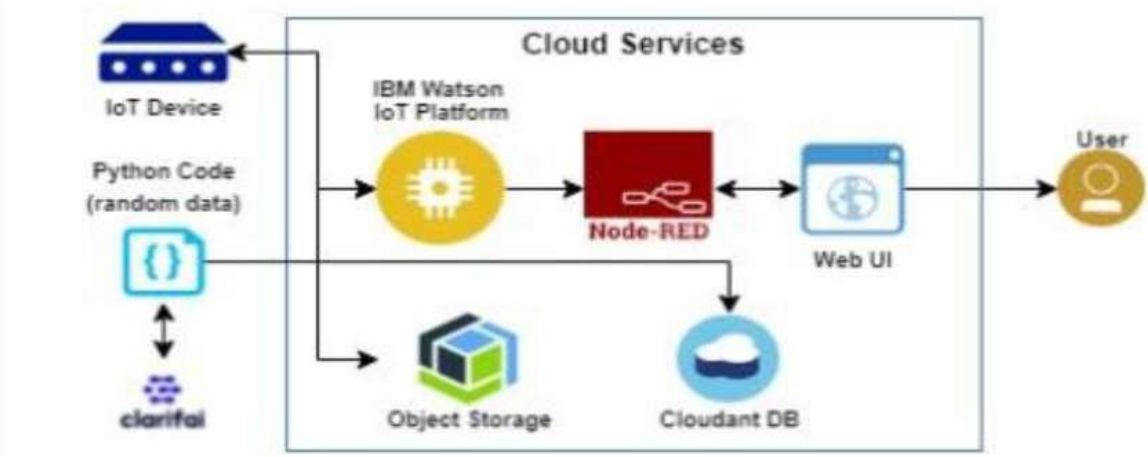
5.1 DATA FLOW DIAGRAM:



5.2 SOLUTION & TECHNICAL ARCHITECTURE:

TECHNICAL ARCHITECTURE:

The Deliverable shall include the architectural diagram as below and the information as per the table1 & table2.



COMPONENTS & TECHNOLOGIES:

S.No	Component	Description	Technology
1.	User Interface	How user interacts with the Web UI	App development
2.	Application Logic-1	Logic for a process in the application	Python Objecti ves
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	Node-RED service
5.	Database	Data Type	Database Cloudant DB

5.3 USER STORIES:

Use the below template to create product backlog and sprint schedule

Sprint	Functional Requirement (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	S.Logapriya, E.Madhumitha, N.Monika, V.Malini.

Sprint-1		US-2	Configure the IBM Cloud services which are being used in completing this project.	4	Medium	S.Logapriya, E.Madhumitha, N.Monika, V.Malini.
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	S.Logapriya, E.Madhumitha, N.Monika, V.Malini.
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.	5	High	N.Monika V.Malini S.Logapriya, E.Madhumitha,
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	N.Monika, V.Malini. S.Logapriya, E.Madhumitha,

Sprint	**Functional Requirement (Epic)**	**User Story Number**	**User Story / Task**	**Story Points**	**Priority**	**Team Members**
Sprint-3		US-2	Create a Node-RED service.	10	High	V.Malini S.Logapriya
Sprint-3		US-1	Develop a python script to publish random sensordata such as temperature, moisture, soil and humidity to the IBM IoT platform	7	High	E.Madhumitha S.Logapriya
Sprint-3		US-2	After developing python code, commands are received just print the statements which representthe control of the devices.	5	Medium	E.Madhumitha S. Logapriya
Sprint-4		US-3	Publish Data to The IBM Cloud	8	High	N.Monika V.Malini
Sprint-4		US-1	Create Web UI in Node- Red	10	High	S.Logapriya V.Malini
Sprint-4		US-2	Configure the Node-RED flow to receive data fromthe IBM IoT platform and also use Cloudant DB nodes to store the received sensor data in thecloudant DB	10	High	E.Madhumitha N.Monika

6. PROJECT PLANNING & SCHEDULING:

6.1 SPRINT PLANNING & ESTIMATION:

TITLE	DESCRIPTION	DATE
Literature Survey on TheSelected Project and Information Gathering	A literature survey is a comprehensive summary of previous research on a topic. The literature review surveys scholarly articles, books, and other sources relevant to a particular area of research.	3rd September 2022
Prepare Empathy Map	Empathy map is a collaborative tool teams can use to gain a deeper insightinto their customers.	10th September 2022
Ideation-Brainstorming	Brainstorming is a group problem-solving method that involves the spontaneous contribution ofcreative ideas and solution.	17th September 2022
Define Problem Statement	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 sate anddesired state of a process or product.	18th Semptember 2022
Proposed Solution	Proposed solution means the technical solution to be provided by the implementation agency in response to the requirementsand the objectives of the project.	24th Semptember 2022
Solution Architecture	Solution architecture is the practice of designing, describing, and managing solution engineering to match it with specific business problems.	1st October 2022

Customer Journey	A customer journey is a toolthat helps markets understand the series of connected experiences that customers desire and needs-whether that be completing a desired task or traversing the end-to-end journey from prospect to customer to loyal advocate.	8th October 2022
Functional Requirement	Functional requirements are product features or functions that developers must implement to enable users to accomplish their tasks.	15th October 2022
Data Flow Diagrams	It is a graphical representation which is very easy to understands it helps visualize contents. Data flow diagram represent detailed and well explained diagram of system components.	15th October 2022

Technology Architecture	Technology Architecture is a more well defined version of solution architecture. It helps us analyze and understand various technologies that needs to be implemented in the project	15th October 2022
Prepare Milestone & Activity	A milestone is a specific point within a project's life cycle used to measure the progress toward the ultimate goal.	22nd October 2022

Sprint Delivery Plan	Sprint planning is an event in the scrum framework where the team determines the product backlog items they will work on during that sprint and discusses their initial plan for completing those product backlog items.	19th November 2022

6.2 SPRINT DELIVERY SCHEDULE:

Use the below template to create product backlog and sprint schedule

Sprint	Functional Requirement (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	S.Logapriya, E.Madhumitha, N.Monika, V.Malini.
Sprint-1		US-2	Configure the IBM Cloud services which are being used in completing this project.	4	Medium	S.Logapriya, E.Madhumitha, N.Monika, V.Malini.
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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	N.Monika, V.Malini. S.Logapriya, E.Madhumitha,

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Sprint-3		US-2	After developing python code, commands are received just print the statements which representthe control of the devices.	5	Medium	E.Madhumitha S. Logapriya
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Sprint-4		US-2	Configure the Node-RED flow to receive data fromthe IBM IoT platform and also use Cloudant DB nodes to store the received sensor data in thecloudant DB	10	High	E.Madhumitha N.Monika

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	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

7. CODING AND SOLUTIONING:

7.1 FEATURE 1:

```
import random

import

ibmiotf.application

import ibmiotf.device

from time import sleep

import sys

#IBM Watson Device Credentials.

organization = "66gns9"

deviceType = "abcd"

deviceId = "123"

authMethod = "token"

authToken =

"23456789"

def myCommandCallback(cmd):

 print("Command received: %s" %

 cmd.data['command'])

 status=cmd.data['command']

 if status=="sprinkler_on":

   print ("sprinkler is

 ON")else :

   print ("sprinkler is

OFF")#print(cmd)

try:
```

```
deviceOptions = {"org": organization, "type": deviceType, "id": deviceId, "auth-method":
authMethod,"auth-token": authToken}

deviceCli =

ibmiotf.device.Client(deviceOptions)except

Exception as e:

   print("Caught exception connecting device: %s" %

str(e))sys.exit()


 #Connecting to IBM watson.

deviceCli.connect

()while True:

 # Getting values from sensors.

temp_sensor = round(

random.uniform(0,80),2)PH_sensor =

round(random.uniform(1,14),3)

camera = ["Detected","Not Detected","Not Detected","Not Detected","Not Detected","Not

Detected",]camera_reading = random.choice(camera)

flame = ["Detected","Not Detected","Not Detected","Not Detected","Not Detected","Not

Detected",]flame_reading = random.choice(flame)

moist_level =

round(random.uniform(0,100),2)

water_level =

round(random.uniform(0,30),2)

 # Storing the sensor data to send in json format to cloud.

temp_data = { 'Temperature' :

temp_sensor }PH_data = { 'PH Level' :
```

```
PH_sensor }

camera_data = { 'Animal attack' :

camera_reading}flame_data = { 'Flame' :

flame_reading } moist_data = { 'Moisture

Level' : moist_level} water_data = { 'Water

Level' : water_level}

 # publishing Sensor data to IBM Watson for every 5-10 seconds.

success = deviceCli.publishEvent("Temperature sensor", "json", temp_data,

qos=0)sleep(1)

if success:

  print (" .....publish ok. ..... ")

print ("Published Temperature = %s C" % temp_sensor, "to IBM Watson")

success = deviceCli.publishEvent("PH sensor", "json", PH_data,

qos=0)sleep(1)

if success:

  print ("Published PH Level = %s" % PH_sensor, "to IBM Watson")

success = deviceCli.publishEvent("camera", "json", camera_data,

qos=0)sleep(1)

if success:

  print ("Published Animal attack %s " % camera_reading, "to IBM

Watson") success = deviceCli.publishEvent("Flame sensor", "json",

flame_data, qos=0)sleep(1)

if success:

  print ("Published Flame %s " % flame_reading, "to IBM Watson")

success = deviceCli.publishEvent("Moisture sensor", "json", moist_data,

qos=0)sleep(1)
```

```
success = deviceCli.publishEvent("PH sensor", "json", PH_data,
 qos=0)sleep(1)
 if success:
   print ("Published PH Level = %s" % PH_sensor, "to IBM Watson")
 success = deviceCli.publishEvent("camera", "json", camera_data,
 qos=0)sleep(1)
 if success:
   print ("Published Animal attack %s " % camera_reading, "to IBM
 Watson") success = deviceCli.publishEvent("Flame sensor", "json",
 flame_data, qos=0)sleep(1)
 if success:
   print ("Published Flame %s " % flame_reading, "to IBM Watson")
 success = deviceCli.publishEvent("Moisture sensor", "json", moist_data,
 qos=0)sleep(1)
 if success:
    print ("Published Moisture Level = %s " % moist_level, "to IBM
Watson") success = deviceCli.publishEvent("Water sensor", "json",
water_data, qos=0)sleep(1)
 if success:
   print ("Published Water Level = %s cm" % water_level, "to IBM
 Watson")print ("")
  # Automation to control sprinklers by present temperature and to send alert message to IBM
 Watson.
if (temp_sensor > 35):
   print("sprinkler-1  is
   ON")
```

```
 success = deviceCli.publishEvent("Alert1", "json",{ 'alert1' : "Temperature(%s) is high,
sprinkerlers areturned ON" %temp_sensor }

, qos=0)

 sleep(1

 )

 if success:

   print( 'Published alert1 : ', "Temperature(%s) is high, sprinkerlers are turned ON"
%temp_sensor,"toIBM Watson")

 print(""

)else:

 print("sprinkler-1 is

 OFF")print("")

 #To send alert message if farmer uses the unsafe fertilizer to crops.

if (PH_sensor > 7.5 or PH_sensor < 5.5):

   success = deviceCli.publishEvent("Alert2", "json",{ 'alert2' : "Fertilizer PH level(%s) is not
safe,useother fertilizer" %PH_sensor } ,

qos=0)

 sleep(1

 )

 if success:

   print('Published alert2 : ' , "Fertilizer PH level(%s) is not safe,use other fertilizer"
%PH_sensor,"to IBMWatson")

 print("")

 #To send alert message to farmer that animal attack on crops.

if (camera_reading == "Detected"):

   success = deviceCli.publishEvent("Alert3", "json", { 'alert3' : "Animal attack on crops
detected" },qos=0)

 sleep(1)
```

```
if success:

print('Published alert3 : ' , "Animal attack on crops detected","to IBM Watson","to IBM

Watson")print("")

   # To send alert message if flame detected on crop land and turn ON the splinkers to take immediate
   action.

  if (flame_reading == "Detected"):

    print("sprinkler-2 is ON")

  success = deviceCli.publishEvent("Alert4", "json", { 'alert4' : "Flame is detected
crops are indanger,sprinklers turned ON" }, qos=0)

  sleep(1)

  if success:

    print( 'Published alert4 : ' , "Flame is detected crops are in danger,sprinklers turned
ON","to IBMWatson")

   #To send alert message if Moisture level is LOW and to Turn ON Motor-1 for irrigation.

  if (moist_level < 20):

    print("Motor-1 is ON")

  success = deviceCli.publishEvent("Alert5", "json", { 'alert5' : "Moisture level(%s) is low,
Irrigationstarted" %moist_level }, qos=0)

  sleep(1)

  if success:

    print('Published alert5 : ' , "Moisture level(%s) is low, Irrigation started"
%moist_level,"to IBMWatson" )

  print("")

  #To send alert message if Water level is HIGH and to Turn ON Motor-2 to take water out.

  if (water_level > 20):

    print("Motor-2 is ON")

  success = deviceCli.publishEvent("Alert6", "json", { 'alert6' : "Water level(%s) is high, so motor
is ON totake water out "
```

```
%water_level }, qos=0)

 sleep(1)

 if success:

   print('Published alert6 : ' , "water level(%s) is high, so motor is ON to take water out "
%water_level,"to IBM

   Watson" )print("")

 # Command received at farmer end

deviceCli.commandCallback = myCommandCallback

  # Disconnecting  the device and application from the cloud

deviceCli.disconnect()import

randomimport

ibmiotf.application

import

ibmiotf.device from

time import sleep

import sys

#IBM Watson Device Credentials.

organization = "66gns9"

deviceType = "abcd"

deviceId = "123"

authMethod = "token"

authToken =

"23456789"

def myCommandCallback(cmd):

 print("Command received: %s" %

 cmd.data['command'])
```

```
status=cmd.data['command']
if
  status=="sprinkler_on
  ":print ("sprinkler is
  ON")
else :
  print ("sprinkler is OFF")

#print(cm
d)try:
deviceOptions = {"org": organization, "type": deviceType, "id": deviceId, "auth-method":
authMethod,"auth-token": authToken}
deviceCli =
ibmiotf.device.Client(deviceOptions)except
Exception as e:
  print("Caught exception connecting device: %s" %
str(e))sys.exit()
#Connecting to IBM watson.
deviceCli.connect()

while True:
  #Getting values from sensors.
temp_sensor = round(
random.uniform(0,80),2)PH_sensor =
round(random.uniform(1,14),3)
camera = ["Detected","Not Detected","Not Detected","Not Detected","Not Detected","Not
Detected",]camera_reading = random.choice(camera)
```

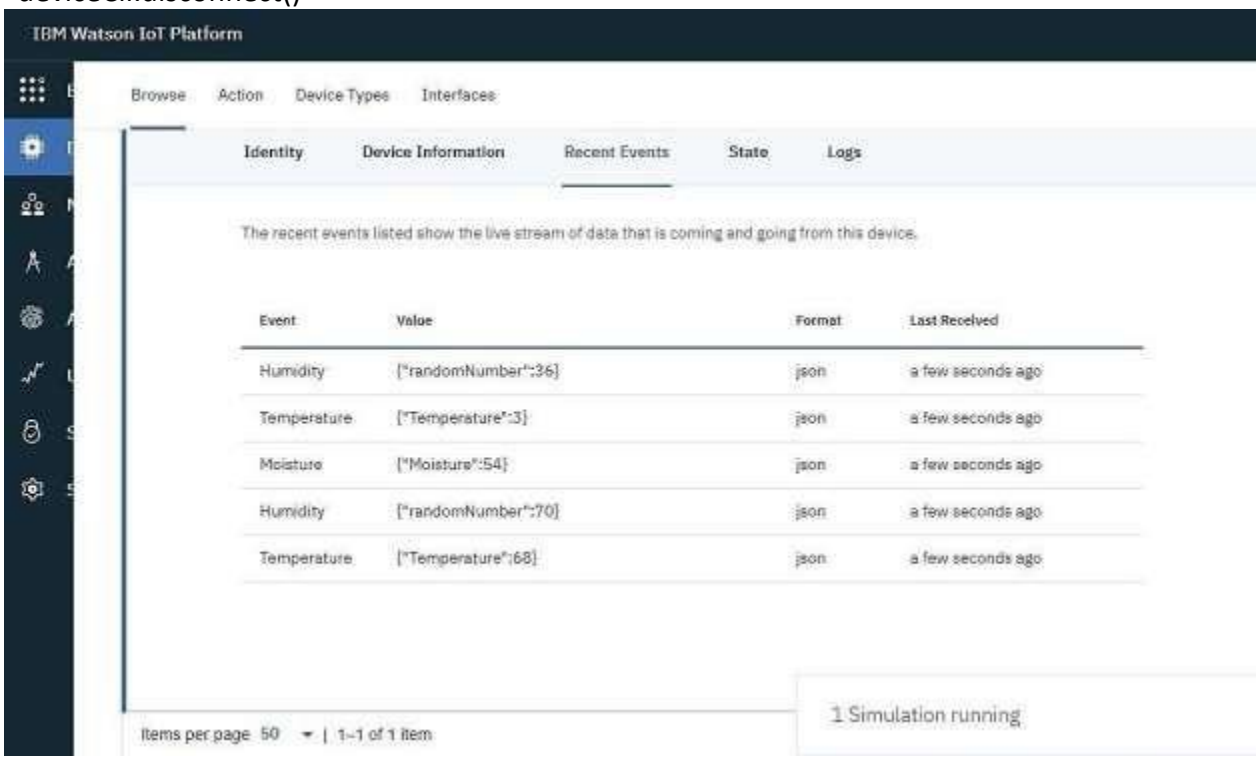
```
flame = ["Detected","Not Detected","Not Detected","Not Detected","Not Detected","Not

Detected",]flame_reading = random.choice(flame)

moist_level =

round(random.uniform(0,100),2)

water_level =

round(random.uniform(0,30),2)

 # Storing the sensor data to send in json format to cloud.

temp_data = { 'Temperature' :

temp_sensor }PH_data = { 'PH Level' :

PH_sensor }

camera_data = { 'Animal attack' :

camera_reading}flame_data = { 'Flame' :

flame_reading } moist_data = { 'Moisture

Level' : moist_level}
```

```
water_data = { 'Water Level' : water_level}
   # publishing Sensor data to IBM Watson for every 5-10 seconds.
  success = deviceCli.publishEvent("Temperature sensor", "json", temp_data,
  qos=0)sleep(1)
  if success:
    print (" .....publish ok. ..... ")
  print ("Published Temperature = %s C" % temp_sensor, "to IBM
  Watson")success = deviceCli.publishEvent("PH sensor", "json",
  PH_data, qos=0) sleep(1)
  if success:
    print ("Published PH Level = %s" % PH_sensor, "to IBM Watson")
  success = deviceCli.publishEvent("camera", "json", camera_data,
  qos=0)sleep(1)
  if success:
    print ("Published Animal attack %s " % camera_reading, "to IBM
  Watson") success = deviceCli.publishEvent("Flame sensor", "json",
  flame_data, qos=0)sleep(1)
  if success:
    print ("Published Flame %s " % flame_reading, "to IBM Watson")
 success = deviceCli.publishEvent("Moisture sensor", "json", moist_data,
 qos=0)sleep(1)
  if success:
     print ("Published Moisture Level = %s " % moist_level, "to IBM
  Watson") success = deviceCli.publishEvent("Water sensor", "json",
  water_data, qos=0)sleep(1)
```

```
if success:
   print ("Published Water Level = %s cm" % water_level, "to IBM
Watson")print ("")
  #Automation to control sprinklers by present temperature and to send alert message to IBM Watson.if
 (temp_sensor > 35):
   print("sprinkler-1 is ON")
success = deviceCli.publishEvent("Alert1", "json",{ 'alert1' : "Temperature(%s) is high,
sprinkerlers areturned ON" %temp_sensor }
, qos=0)
sleep(1
)
if success:
   print( 'Published alert1 : ', "Temperature(%s) is high, sprinkerlers are turned ON"
%temp_sensor,"toIBM Watson")
print(""
)else:
print("sprinkler-1 is
OFF")print("")
  # Sending alert message if farmer uses the unsafe fertilizer to crops.
if (PH_sensor > 7.5 or PH_sensor < 5.5):
   success = deviceCli.publishEvent("Alert2", "json",{ 'alert2' : "Fertilizer PH level(%s) is not
safe,useother fertilizer" %PH_sensor } ,
qos=0)
sleep(1
)
if success:
   print('Published alert2 : ' , "Fertilizer PH level(%s) is not safe,use other fertilizer"
%PH_sensor,"to IBMWatson")
```

```
 print("")
 # Sending alert message to farmer that animal attack on crops.if
(camera_reading == "Detected"):
   success = deviceCli.publishEvent("Alert3", "json", { 'alert3' : "Animal attack on crops
detected" },qos=0)
 sleep(1)
 if success:
   print('Published alert3 : ' , "Animal attack on crops detected","to IBM Watson","to IBM
 Watson")print("")
  # Sending alert message if flame detected on crop land and turn ON the splinkers to take immediate
  action.
 if (flame_reading == "Detected"):
   print("sprinkler-2 is ON")
 success = deviceCli.publishEvent("Alert4", "json", { 'alert4' : "Flame is detected
crops are indanger,sprinklers turned ON" }, qos=0)
 sleep(1)
 if success:
   print( 'Published alert4 : ' , "Flame is detected crops are in danger,sprinklers turned
ON","to IBMWatson")
 #Sending alert message if Moisture level is LOW and to Turn ON Motor-1 for irrigation.
 if (moist_level < 20):
   print("Motor-1 is ON")
 success = deviceCli.publishEvent("Alert5", "json", { 'alert5' : "Moisture level(%s) is low,
Irrigationstarted" %moist_level }, qos=0)
 sleep(1)
 if success:
   print('Published alert5 : ' , "Moisture level(%s) is low, Irrigation started"
%moist_level,"to IBMWatson" )
 print("")
```

```
#Sending alert message if Water level is HIGH and to Turn ON Motor-2 to take water out.

if (water_level > 20):

  print("Motor-2 is ON")

success = deviceCli.publishEvent("Alert6", "json", { 'alert6' : "Water level(%s) is high, so motor is ON to take water out "

%water_level }, qos=0)

sleep(1)

if success:

  print('Published alert6 : ' , "water level(%s) is high, so motor is ON to take water out "
%water_level,"to IBM Watson" )

  print("")

#command received by farmer

deviceCli.commandCallback = myCommandCallback

# Disconnect the device and application from the cloud

deviceCli.disconnect()
```



Output: Digital pulse high (3V) when triggered (motion detected) digital low when idle (no motion detected). Pulse lengths are determined by resistors and capacitors on the PCB and differ from sensor to sensor. Power supply: 5V-12V input voltage for most modules (they have a 3.3V regulator),but 5V is ideal in case the regulator has different specs.

BUZZER

Specifications

- RatedVoltage : 6V DC
- Operating Voltage : 4 to 8V DC
- Rated Current*: ≤30mA
- SoundOutput at 10cm* : ≥85dB
- Resonant Frequency : 2300 ±300Hz
- Tone: Continuous A buzzer is a loud noise maker.

Most modern ones are civil defense or air- raid sirens, tornado sirens, or the sirens on emergency service vehiclessuch as ambulances, police cars and fire trucks. There are two general types, pneumatic and electronic.

7.2 FEATURE 2:

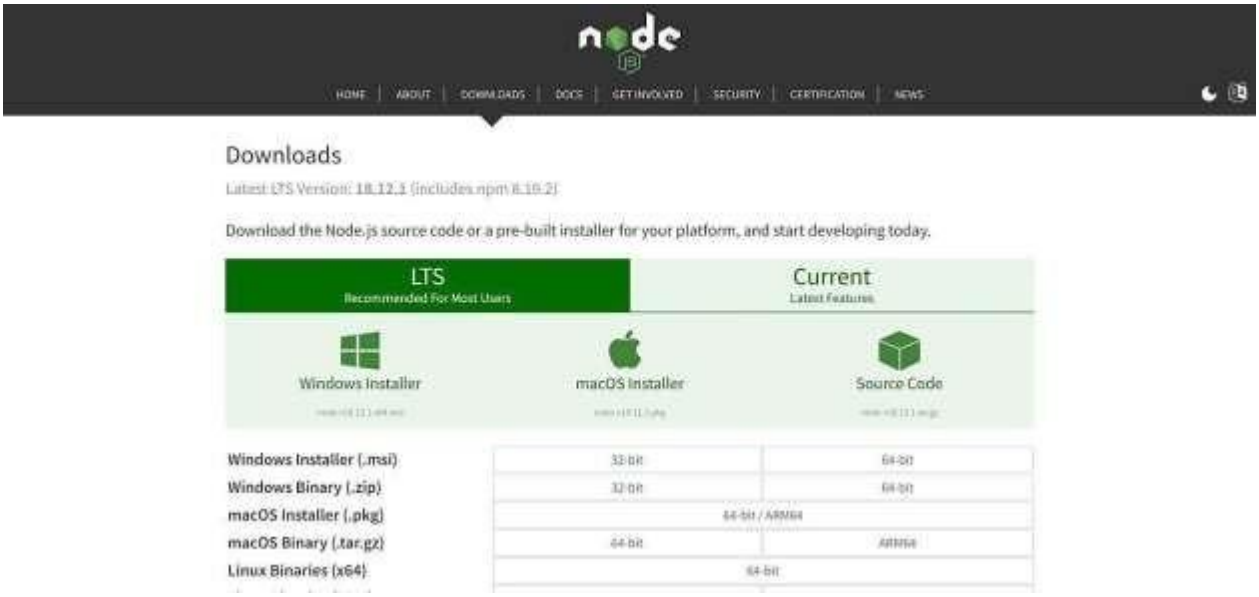
- Good sensitivity to Combustible gas in wide range .
- Highsensitivity to LPG, Propane and Hydrogen .
- Longlife and low cost.
- Simpledrive circuit

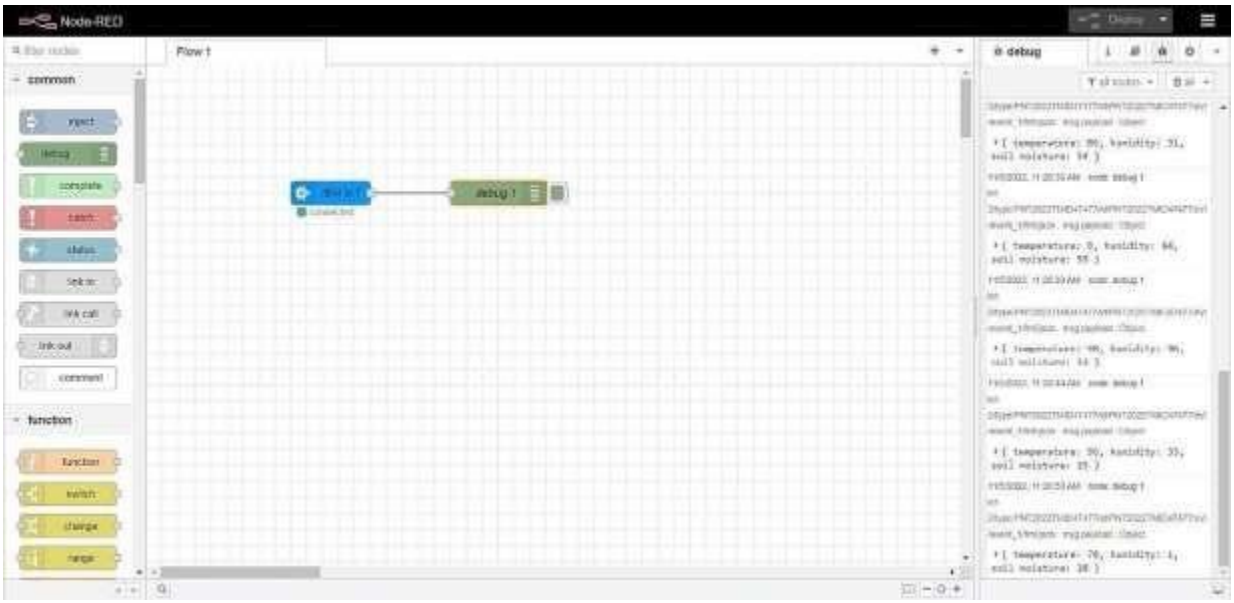
8. TESTING:

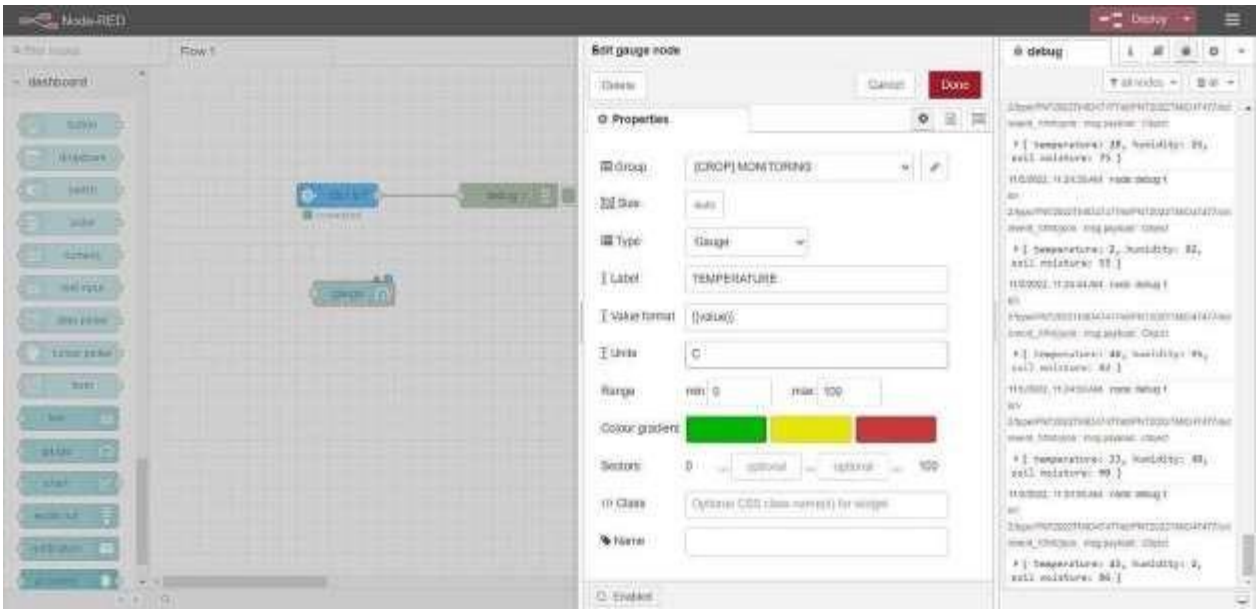
8.1 TEST CASES:

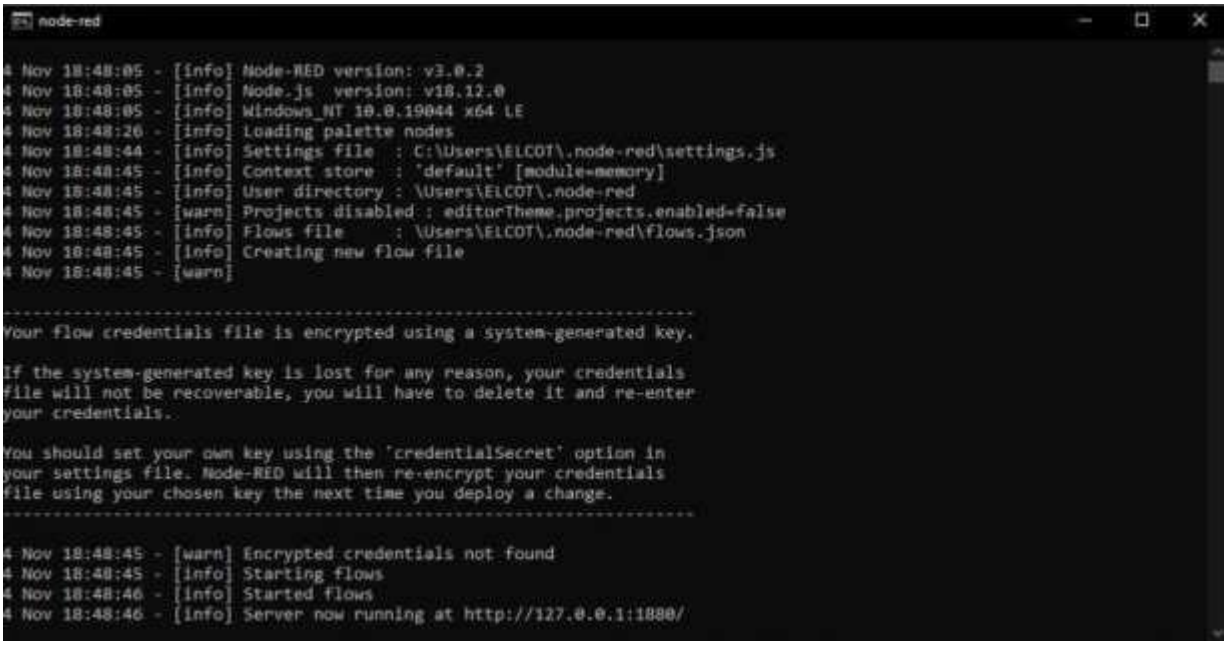
sno	parameter	Values	Screenshot
1	Model summary	-	
2	accuracy	Training accuracy-95% Validation accuracy-72%	
3	Confidence score	Class detected-80% Confidence score-80%	

8.2 USER ACCEPTANCE TESTING:






Node-RED
Deploy
Flow 1
dashboard
Edit gauge node
Delete
Cancel
Done
Properties
Group
[CROP] MONITORING
Size
Type
Gauge
Label
TEMPERATURE
Value format
{{value}}
Units
C
Range
min 0
max 100
Colour gradient
Sectors
0
100
Class
Name
Enabled
debug


node-red
4 Nov 18:48:05 - [info] Node-RED version: v3.0.2
4 Nov 18:48:05 - [info] Node.js version: v18.12.0
4 Nov 18:48:05 - [info] Windows_NT 10.0.19044 x64 LE
4 Nov 18:48:26 - [info] Loading palette nodes
4 Nov 18:48:44 - [info] Settings file : C:\Users\ELCOT\.node-red\settings.js
4 Nov 18:48:45 - [info] Context store : 'default' [module=memory]
4 Nov 18:48:45 - [info] User directory : \Users\ELCOT\.node-red
4 Nov 18:48:45 - [warn] Projects disabled : editorTheme.projects.enabled=false
4 Nov 18:48:45 - [info] Flows file : \Users\ELCOT\.node-red\flows.json
4 Nov 18:48:45 - [info] Creating new flow file
4 Nov 18:48:45 - [warn]
Your flow credentials file is encrypted using a system-generated key.
If the system-generated key is lost for any reason, your credentials
file will not be recoverable, you will have to delete it and re-enter
your credentials.
You should set your own key using the 'credentialSecret' option in
your settings file. Node-RED will then re-encrypt your credentials
file using your chosen key the next time you deploy a change.
4 Nov 18:48:45 - [warn] Encrypted credentials not found
4 Nov 18:48:45 - [info] Starting flows
4 Nov 18:48:46 - [info] Started flows
4 Nov 18:48:46 - [info] Server now running at http://127.0.0.1:1880/

9.RESULTS:

The problem of crop vandalization by wild animals andfire has become a major social problem in current time.

It requires urgent attention as no effective solution existstill date for this problem. Thus this project carries a greatsocial relevance as it aims to address this problem. This project will help farmers in protecting their orchards and fields and save them from significant financial losses and will save them from the unproductive efforts that they

endure for the protection their fields. This will also helpthem in achieving better crop yields thus leading to their economic wellbeing.

10.ADVANTAGES & DISADVANTAGES:

ADVANTAGE:

The main advantage is that it protects the crops in farm area from animals. It mainly detects the soil moisture, humidity and temperature ultrasonic sensor detects the birds entering in the fields.This system will continuously check for soil characteristics inside the field.

DISADVANTAGE:

Controllable food supply. you might have droughts or floods, but if you are growing the crops and breeding them to be hardier, you have a better chance of not straving. It allows farmers to maximize yields using minimum resources such as water,fertilizers.

11.CONCLUSION:

Farmers encounter severe threats in rural parts of India LIKE damage done by birds and animals. Hence, to overcome this issue we have designed a system in which sound is played to scare the animals and birds, so that it will automatically run away.Therefore, the designed system is affordable and useful to the farmers. The designed system won't be harmful to animals and person , and it protects the farm areas.

12.FUTURE SCOPE:

In the future, there will be a large scope for this system. The IR sensors and Ultrasonic sensors are used to collect the information and transmitted ithrough GSM. This project is further enhanced by wireless sensor network.The type of sensors like finding the moisture content of the soil, growth of the crop and nutrition content in the soil. These sensors gather informations which is useful to the farmers and able to conscious of the farm land from anyplace in the world.

13. APPENDIX:

SOURCE CODE:

```
import time importsys import ibmiotf.application # toinstallpipinstall ibmiotf importibmiotf.device



# Provide your IBM Watson Device Credentials organization = "8gyz7t" # replace the ORG ID deviceType = "weather_monitor" #replace the Device type deviceId = "b827ebd607b5" # replace Device ID authMethod = "token" authToken = "LWVpQPaVQ166HWN48f" # Replace the authtoken



def myCommandCallback(cmd): # function for Callbackif



cm.data['command'] == 'motoron':



print("MOTOR ON IS RECEIVED")

elif cmd.data['command'] == 'motoroff':print("MOTOR OFF IS RECEIVED")if cmd.command == "setInterval":



else:



if 'interval' not in cmd.data:

print("Error - command is missing requiredinformation: 'interval'")

interval = cmd.data['interval']elif cmd.command == "print":

if 'message' not in cmd.data:

print("Error - commandis missing requiredinformation: 'message'")else:output = cmd.data['message']
```

```
print(output)
try:

deviceOptions = {"org": organization, "type": deviceType, "id": deviceId,"authmethod":authMethod,
"auth-token": authToken}            deviceCli
= ibmiotf.device.Client(deviceOptions)#
.....


exceptException as e:
print("Caught exception connecting device: %s" % str(e))sys.exit()


# Connect and send a datapoint "hello" with value "world" into the cloud as an event oftype "greeting" 10 times
deviceCli.connect()


while True:
deviceCli.commandCallback = myCommandCallback


# Disconnect the device and application from the cloud deviceCli.disconnect()
```

SENSOR.PY

```
import time import sysimport
ibmiotf.application
importibmiotf.device
```

```
import random

# Provide your IBM Watson Device Credentials organization = "8gyz7t" # replace the ORG ID deviceType =
"weather_monitor" #replace the Device type deviceId = "b827ebd607b5" # replace Device ID authMethod = "token"
authToken = "LWVpQPaVQ166HWN48f" # Replace the authtoken

def myCommandCallback(cmd):

print("Command received: %s" % cmd.data['command'])print(cmd)

try:

deviceOptions = {"org": organization, "type": deviceType, "id": deviceId,

"auth-method": authMethod, "auth-token": authToken}deviceCli = ibmiotf.device.Client(deviceOptions)

#.....

exceptException as e:

print("Caught exception connecting device: %s" % str(e))sys.exit()

# Connect and send a datapoint "hello" with value "world" into the cloud as an event oftype "greeting" 10 times

deviceCli.connect()

while True:

temp=random.randint(0,1

00)

pulse=random.randint(0,100) soil=random.randint(0,100)
```

data = { 'temp' : temp, 'pulse': pulse ,'soil':soil}#print data def

myOnPublishCallback():

print ("Published Temperature = %s C" % temp, "Humidity = %s %%" %pulse,"Soil Moisture = %s %%" % soil,"to IBM Watson")

success = deviceCli.publishEvent("IoTSensor", "json", data, qos=0,on_publish=myOnPublishCallback) if not success: print("Not connected to

IoTF")time.sleep(1)

deviceCli.commandCallback = myCommandCallback

Disconnect the device and application from the cloud deviceCli.disconnect()

Node-RED FLOW :

[

{

"type":"ibmiotout", "z":"630c8601c5ac3295","eventCommandType":"data", "format":"json",

"data":"data", "qos":0, "name":"IBM IoT", "service":"registered","x":680, "y":220,

"wires":[]

},

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"name":"",

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"width":"0",

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"passthru":false, "label":"MotorON",

"tooltip":"",

"color":"",

"bgcolor":"",

"className":"",

"icon":"", "payload":"{\"command\":\"motoron\"}","payloadType":"str",

"topic":"motoron",

"topicType":"str","x":360,

"y":160, "wires":[["625574ead9839b34"]]},

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"width":"0",

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"tooltip":"",

"color":"",

"bgcolor":"",

"className":"",

"icon":"", "payload":"{\"command\":\"motoroff\"}","payloadType":"str",

"topic":"motoroff",

"topicType":"str","x":350,

"y":220, "wires":[["625574ead9839b34"]]},

"name":"weather_monitor","keepalive":"60","serverName":"",
"cleansession":true,"appId":"",
"shared":false},
{"id":"716e956.00eed6c",
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"name":"Form", "tab":"7e62365e.b7e6b8","order":1,
"disp":true,
"width":"6", "collapse":false},
{"id":"7e62365e.b7e6b8",
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"name":"contorl","icon":"dashboard","order":1,
"disabled":false,
"hidden":false}
]

[
{
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"inputType":"evt", "logicalInterface":"", "ruleId":"", "deviceId":"b827ebd607b5","applicationId":"",
"deviceType":"weather_monitor",

"eventType":"+",

"commandType":"",

"format":"json",

"name":"IBMIoT", "service":"registered", "allDevices":"", "allApplications":"", "allDeviceTypes":"",
"allLogicalInterfaces":"","allEvents":true, "allCommands":"", "allFormats

":"",

"qos":0,

"x":270,

"y":180,

"wires":[["50b13e02170d73fc","d7da6c2f5302ffaf","a949797028158f3f","a71f164bc3 78bcf1"]]

},

{

"type":"function",

"z":"03acb6ae05a0c712","name":"Soil Moisture",

"func":"msg.payload = msg.payload.soil;\nglobal.set('s',msg.payload);\nreturn msg;", "outputs":1,

"noerr":

0,

"initialize":"",

"finalize":"",

"libs":[],

"x":490,

"y":120,

"wires":[["a949797028158f3f","ba98e701f55f04fe"]]

},

{

"name":"Humidity",

"func":"msg.payload = msg.payload.pulse;\nglobal.set('p',msg.payload)\nreturn msg;",

"outputs":1,

"noerr":

0,

"initialize":"",

"finalize":"",

"libs":[

],

"x":

48

0,

"y":260, "wires":[["a949797028158f3f","70a5b076eeb80b70"]]

},

{ "id":"a949797028158f3f",

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"statusVal":"",

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"y":180,

"wires":[]

},

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"height":"0",

"gtype":"gage",

"title":"Humidity",

"label":"Percentage(%)",

"format":"{{value}}

","min":0,

"max":"100", "colors":["#00b500","#e6e600","#ca3838"], "seg1":"", "seg2":"",

"className":"","x":86 0,

"y":260,

"wires":[]

},

{

"id":"a71f164bc378bcf1","type":"function","z":"03acb6ae05a0c712", "name":"Temperature",

"func":"msg.payload=msg.payload.temp;\nglobal.set('t',msg.payload);\nreturn msg;","outputs":1, "noerr":

0,

"initialize":"",

"finalize":"",

"libs":[

],

"x":

49

0, "y":360,

"wires":[["8e8b63b110c5ec2d","a949797028158f3f"]]

},

{

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"width":"0",

"height":"0",

"gtype":"gage", "title":"Temperature", "label":"DegreeCelcius","format":"{{value}}", "min":0,

"max":"100", "colors":["#00b500","#e6e600","#ca3838"],"seg1":"", "seg2":"",

"className":"",

"x":790,

"y":360,

"wires":[]

},

{

"id":"ba98e701f55f04fe", "type":"ui_gauge", "z":"03acb6ae05a0c712", "name":"", "group":"f4cb8513b95c98a4", "order":1,

"width":"0",

"height":"0",

"gtype":"gage",

"title":"Soil Moisture", "label":"Percentage(%)",

"format":"{{value}}

","min":0,

"max":"100", "colors":["#00b500","#e6e600","#ca3838"],"seg1":"", "seg2":"",

"className":"",

"x":790,

"y":120,

"wires":[]

},

{

"id":"a259673baf5f0f98","type":"httpin", "z":"03acb6ae05a0c712","name":"",

"url":"/sensor",

"method":"get", "upload":fals e, "swaggerDoc"

:"","x":370,"y":500,

"wires":[["18a8cdbf7943d27a"]]

},

{

"id":"18a8cdbf7943d27a","type":"function","z":"03acb6ae05a0c712", "name":"httpfunction",

"func":"msg.payload{\"pulse\":global.get('p'),\"temp\":global.get('t'),\"soil\":global.get('s')};\nreturn

msg;",

"outputs":1,

"noerr":0,

"initialize":"",

"finalize":"","li

bs

```
":[
],
"x":
63
0,
"y":500, "wires":[["5c7996d53a445412"]]
},
{ "id":"5c7996d53a445412",
"type":"httpresponse",
"z":"03acb6ae05a0c712","name":"",
"statusCode":"",
"headers":{},
"x":870,
"y":500,
"wires":[]
},
{
"id":"ef745d48e395ccc0", "type":"ibmiot", "name":"weather_monitor","keepalive":"60",
"serverName":"",
"cleansession":true,"appId":"",
"shared":false},
{

"id":"f4cb8513b95c98a4","type":"ui_group","name":"monitor",
"tab":"1f4cb829.2fdee8","order":2,
"disp":
true, "width":"6",

"collapse":false, "className":""
},
{
```

"id":"1f4cb829.2fdee8",

"type":"ui_tab",

"name":"Home",

"icon":"dashboard","order":3, "disabled":false, "hidden":false }

GitHub & Project Demo Link

https://drive.google.com/file/d/1_fSZY20_bUqBUSd86MjQ_LQInSsUC72F/view?usp=share_link

IBM-EPBL/**IBM-Project-13225-1659514627**