IoT BASED SMART CROP PROTECTION SYSTEM FOR AGRICULTURE

PROJECT REPORT

Submitted By

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IN

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TIRUCHENGODE

ANNA UNIVERSITY: CHENNAI 600 025

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CHAPTER 1

INTRODUCTION

1.1 Project Overview

- The device will detect the animals and birds using the Clarifai service.
- If any animal or bird is detected the image will be captured and stored in the IBM Cloud object storage.
- It also generates an alarm and avoid animals from destroying the crop .
- The image URL will be stored in the IBM Cloudant DB service.
- The device will also monitor the soil moisture levels, temperature, and humidity values and send them to the IBM IoT Platform.
- The image will be retrieved from Object storage and displayed in the web application.
- A web application is developed to visualize the soil moisture, temperature, and humidity values Users can also control the motors through web application.

1.2 Purpose

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.Here to solve this situation we are proposing a solution using IOT(Internet of Things) where we use various types of sensors to monitor the entire field and using the help of the internet we tend to send the message to the farmer or the person who is responsible for solving the crisis that is currently occurring. The types of sensors we use will also give the information of the humidity level in the field, the temperature of the field, and detection of animals using their thermal radiation and also we process the information and give them in the form of graphs and images to the farmers for easy understanding.

CHAPTER 2

LITERATURE SURVEY

2.1 Existing Problem

Most of the farmers are facing many problems nowadays due to many reasons. Our problem to solve is the invasion of various species such as birds and animals that harm the crops that are being cultivated. Various types of species such as birds and animals come to the cultivation field according to the crop that is being cultivated and also according to the season of cultivation. Some wild animals enter the fieldduring night times when the field is near a forest region or when the farm cultivates some fruits and other crops that attract animals. Some animals cross the field in search of food and water and also the birds enter the field for food and they damage all the crops. When the animals enter the field they not only eat food butthey also damage the entire field by walking upon the crops and also by spoiling the food crops. The birds, byentering the field they come to eat seeds of the crops and also they tend to drag the crops and ruin the entirefield. Some birds enter the field to eat the insects and pests in the field.

2.2 REFERENCES

Shishir Bagal , Krunal Mahajan , Riya Parate , Ekta Zade , Shubham Khante (2021) have investigated the title of “Smart Crop Protection System Using IOT” . The Smart protection system defines that this project help to farmer for the protection of a farm. We have designed this project for the only secure from animals but we this project have the provision to secure from the human begins also. This can achieve by the help of IOT device that we are discuss in this paper. The SCPS work on the battery so that this project can be easily portable and also we are add solar panels and converter modules this can help the battery to charge from solar energy. The IOT device is used to indicate the farmer by a message while someone enter into the farm and we are used SD card module that helps to store a specified sound to fear the animals.

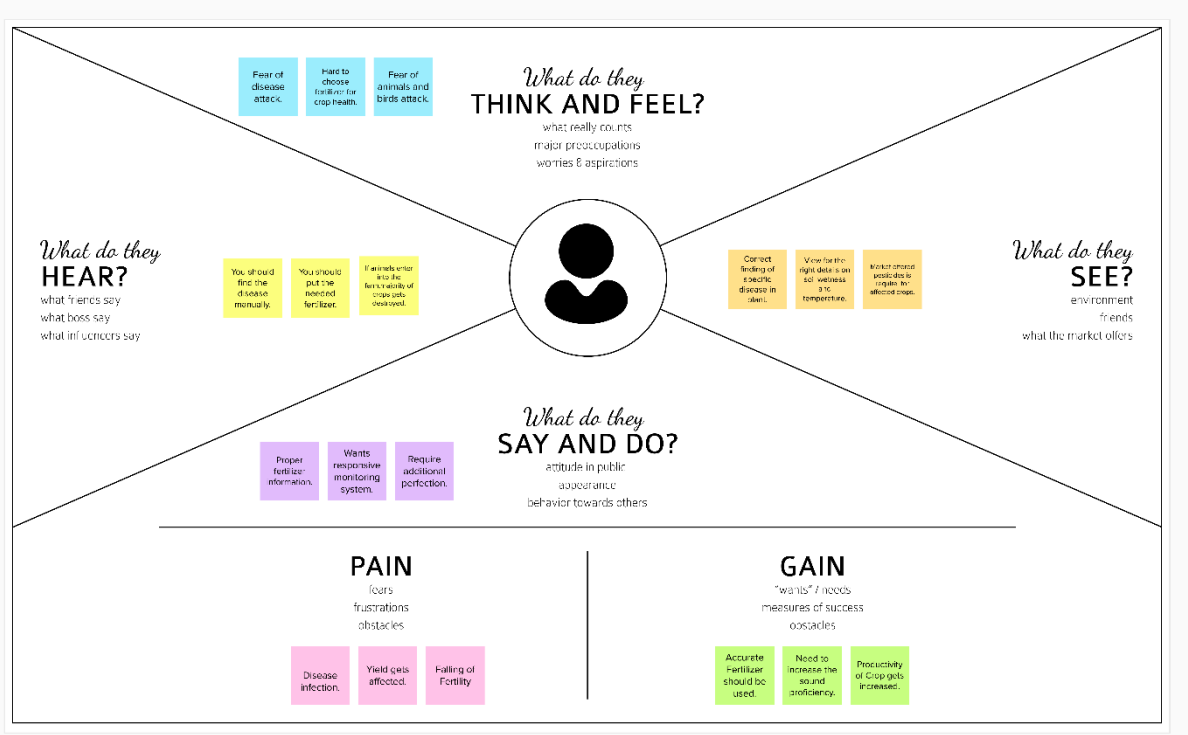
2.3 Problem Statement Definition

Most of the farmers are facing many problems nowadays due to many reasons. Our problem to solve is the invasion of various species such as birds and animals that harm the crops that are being cultivated. Various types of species such as birds and animals come to the cultivation field according to the crop that is being cultivated and also according to the season of cultivation. Some wild animals enter the fieldduring night times when the field is near a forest region or when the farm cultivates some fruits and other crops that attract animals.

CHAPTER 3

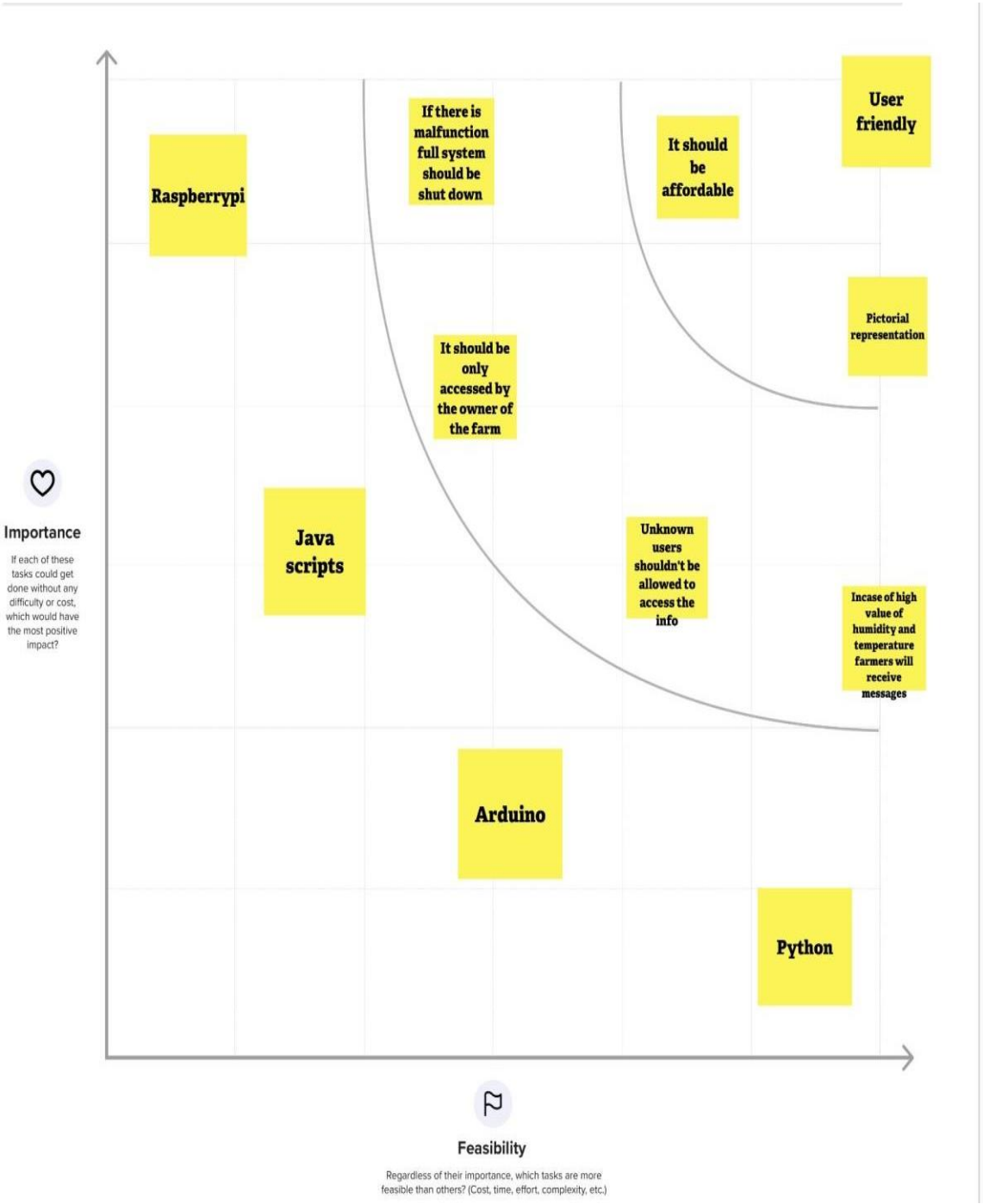
IDEATION AND PROPOSED SOLUTION

3.1 Empathy Map Canvas



3.2 Ideation &Brainstroming

Crops in farms are many times ravaged by local animals like buffaloes, cows, goats, birds, and fire etc. This leads to huge losses for the farmers. It is not possible for farmers to barricade entire fields or stay on field 24 hours and guard it. So here we propose automatic crop protection system from animals and fire. This is aarduino Uno based system using microcontroller. This system uses a motion sensor to detect wild animals approaching near the field and smoke sensor to detect the fire. In such a case the sensor signals the microcontroller to take action.If there is a smoke, it immediately turns ON the motor. This ensures complete safety of crops from animals and from fire thus protecting the farmer's loss. This is aarduino. Uno based system using microcontroller. This system uses a motion sensor to detect wild animals approaching near the field and smoke sensor to detect the fire. In such a case the sensor signals the microcontroller to take action.



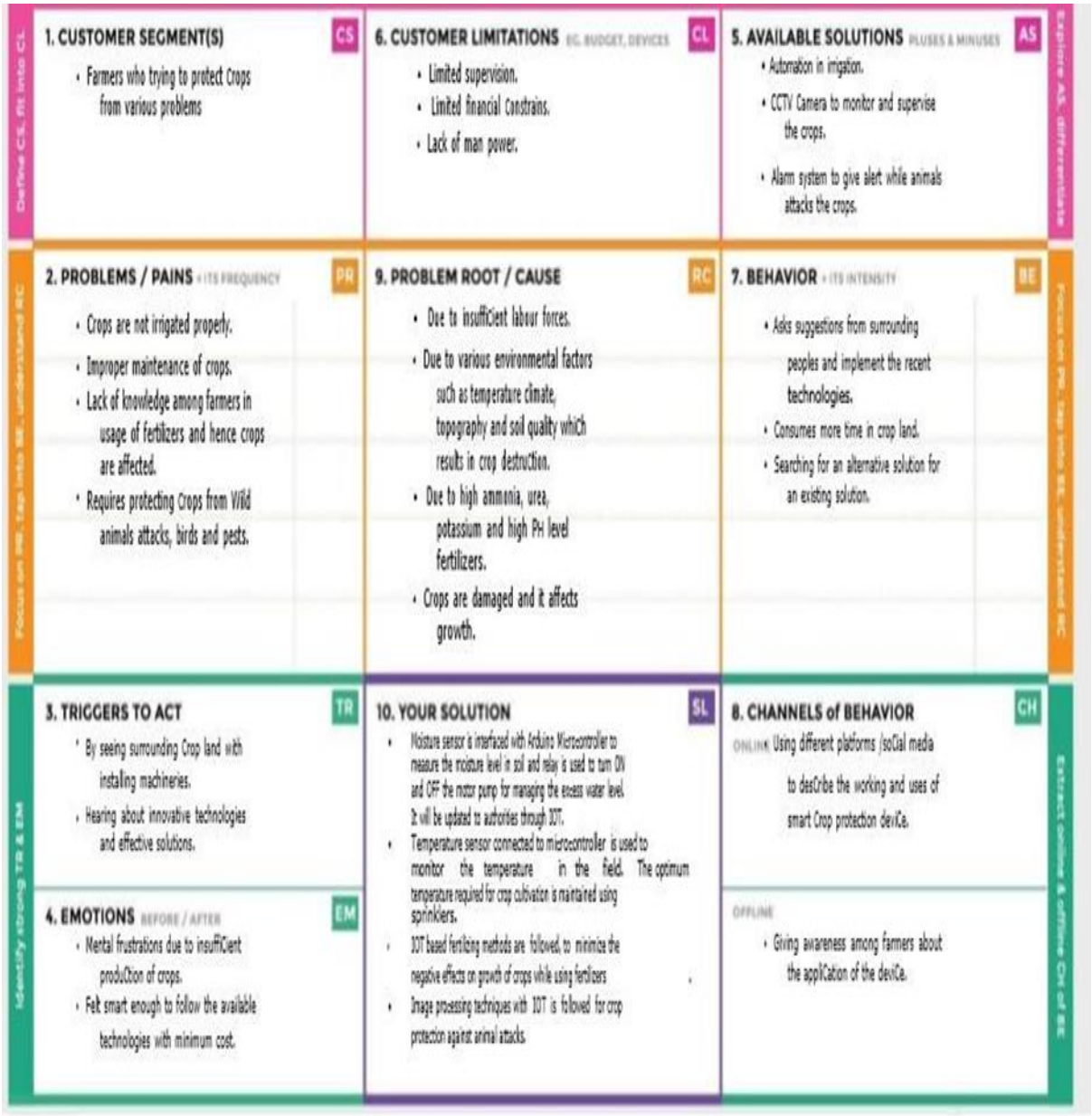
3.3 Proposed Solution

Moisture sensor is interfaced with Arduino Microcontroller to measure the moisture level in soil and relay is used to turn ON and OFF the motor pump for managing the excess water level. It will be updated to authorities through IOT. Temperature sensor connected to

microcontroller is used to monitor the temperature in the field. The optimum temperature required for crop cultivationis maintained using sprinklers. IOT based fertilizing methods are followed, to minimize the negative effects on growth of crops while using fertilizers.

The PIR sensor and UV sensors detect the motion of animals and birds for a particular arrange. The thermal radiation temperature of humans at different ages is fed to thesystemso there won't be any false alarm. If any invasion of animals is found, the camerafocuseson the region and the processed image is sent to the farmer . After seeing the imageof theanimal that entered, they can decide to take any actions. A fence is built aroundthefieldtoprevent large animals from entering where the sensors are placed at all the corners of thefield fully covering the entire region.

3.4 PROBLEM-SOLUTION FIT



CHAPTER 4

REQUIREMENT ANALYSIS

4.1Functional Requirement

Following are the functional requirements of the proposed solution.

- User Registration ,Registration through Form Registration through Gmail Registration through LinkedIN
- User Confirmation ,Confirmation via Email Confirmation via OTP

- Tracking Expense Helpful insights about money management
- Alert Message Give alert mail if the amount exceeds the budget limit Category This application shall allow users to add categories of their expenses

4.2Non Functional requirement

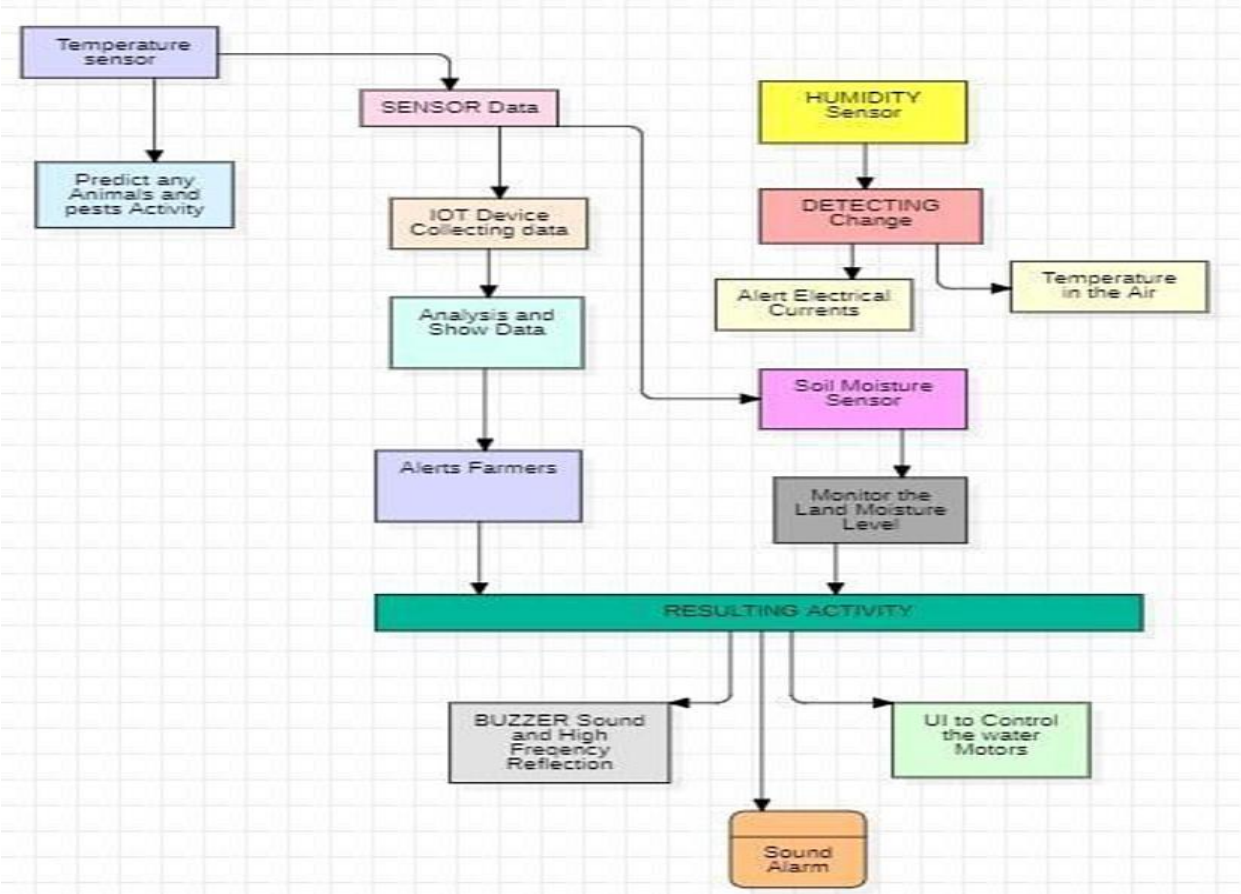
Following are the non-functional requirements of the proposed solution.

- Usability You will able to allocate money to different priorities and also help you to cut down on unnecessary spending
- Security More security of the customer data and bank account details.
- Reliability Used to manage his/her expense so that the user is the path of financial stability. It is categorized by week, month, and year and also helps to see more expenses made. Helps to define their own categories.
- NFR-4 Performance The types of expense are categories along with an option .Throughput of the system is increased due to light weight database support.
- NFR-5 Availability Able to track business expense and monitor important for maintaining healthy cash flow. NFR-6 Scalability The ability to appropriately handle increasing demands.

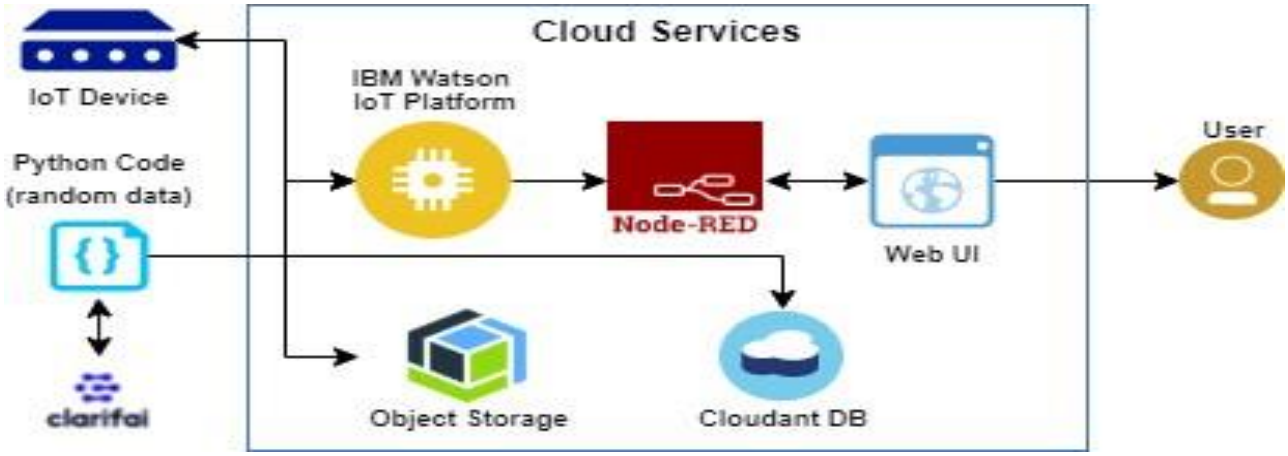
CHAPTER 5

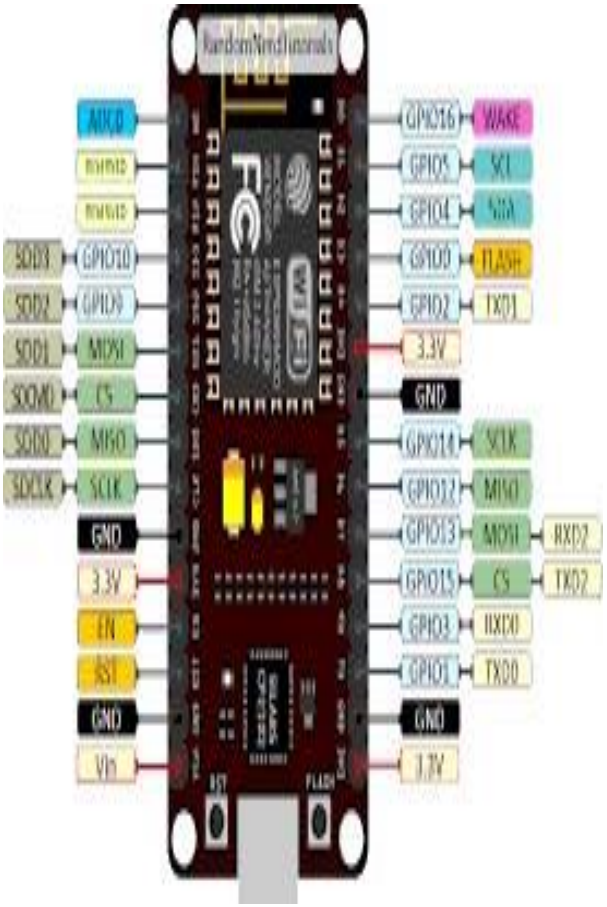
PROJECT DESIGN

5.1 DATA FLOW DIAGRAM



5.2 Technical Architecture




ADC0
GPIO16
WAKE
GPIO5
SCL
GPIO4
SDA
SDD3
GPIO10
GPIO0
FLASH
SDD2
GPIO9
GPIO2
TXD1
SDD1
MOSI
3.3V
SDCMD
CS
GND
SDD0
MISO
GPIO14
SCLK
SDCLK
SCLK
GPIO12
MISO
GND
GPIO13
MOSI
RXD2
3.3V
GPIO15
CS
TXD2
EN
GPIO3
RXD0
RST
GPIO1
TXD0
GND
GND
Vin
3.3V
RST
FLASH


BM Watson IoT

5.3 USER-STORIES

SPRINT	FUNCTIONAL REQUIREMENT	USER STORY NUMBER	USER STORY/TASK	STORY POINTS	PRIORITY
Sprint-1		US-1	Create the IBM Cloud services which are being used in this project.	7	high
Sprint-1		US-2	Create the IBM Cloud services which are being used in this project.	7	high
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
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
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
Sprint-3		US-3	Create a Node-RED service	8	high
Sprint-3		US-2	Develop a python script to publish random sensor data such as temperature, moisture, soil and humidity to the IBM IoT platform	6	medium
Sprint-3		US-1	After developing python code, commands are received just print the statements which represent the control of the devices.	8	high
Sprint-4		US-3	Publish Data to The IBM Cloud	5	high
Sprint-4		US-2	Create Web UI in Node- Red	8	high
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

CHAPTER 6

PROJECT PLANNING & SCHEDULING

6.1Sprint Planning & Estimation

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint1	SensorData (python script)	USN-1	The Data of sensor which are feed to the Raspberrypi.Here we areusingpython script to generatea random sensor data.	3	High	Jeya Surya (Teamleader)
Sprint1	Automation (python script)	USN-2	Some activities are made toautomation to overcome insufficientoflabour force in the field. Hence that also included in python script to implement automation .	5	High	Vigneshwaran (Team Member)
Sprint2	IBM IOT platform	USN-3	To sendtheraspberrypi data to IOT platform, we create an IBMIOT platform and connect the raspberry pi tothedevice created in IBM IOT.	5	High	Logamagesh (Team Member)
Sprint3	Node RED service	USN-4	To access the IBM IOT platform from external applicationor from externalUINode red service is established.	5	High	Vigneshwaran (Team Member)

Sprint3	API Key	USN-5	Toprotect the IBM IOT platform creating an API Key.		High	Damodharan (Team Member)
Sprint4	User Application	USN-6	Tomonitor and control the field sensors the User is provided with an User application created by MIT app inventor	8	High	Jeya Surya (Team Leader) Logamagesh (Team Member)

6.2 SPRINT DELIVERY SCHEDULE

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	8	6 Days	24 Oct 2022	29 Oct 2022	8	29 Oct 2022
Sprint-2	5	6 Days	31 Oct 2022	05 Nov 2022	5	05 Nov 2022
Sprint-3	8	6 Days	07 Nov 2022	12 Nov 2022	8	12 Nov 2022
Sprint-4	8	6 Days	14 Nov 2022	19 Nov 2022	8	19 Nov 2022

6.3 REPORT FROM JIRA

REQUIRED SOFTWARE

- **CLARIFAI**
- **IBMWATSONIOTPLATFORM**
- **PYTHONIDLE**

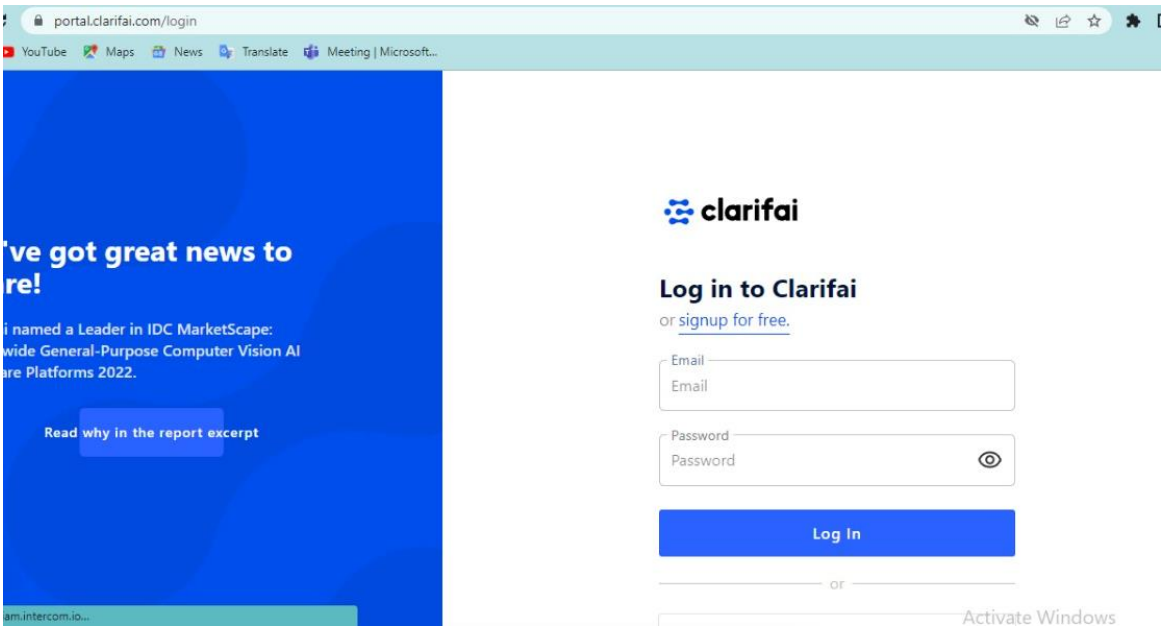
- **NODERED**
- **MITAPPINVENTOR**

CLARIFAI:

Clarifai provides an end-to-end platform with the easiest to use UI and API in the market. Clarifai Inc. is an artificial intelligence (AI) company that specializes in computer vision and uses machine learning and deep neural networks to identify and analyse images and videos. The company offers its solution via API, mobile SDK, and on-premise solutions.

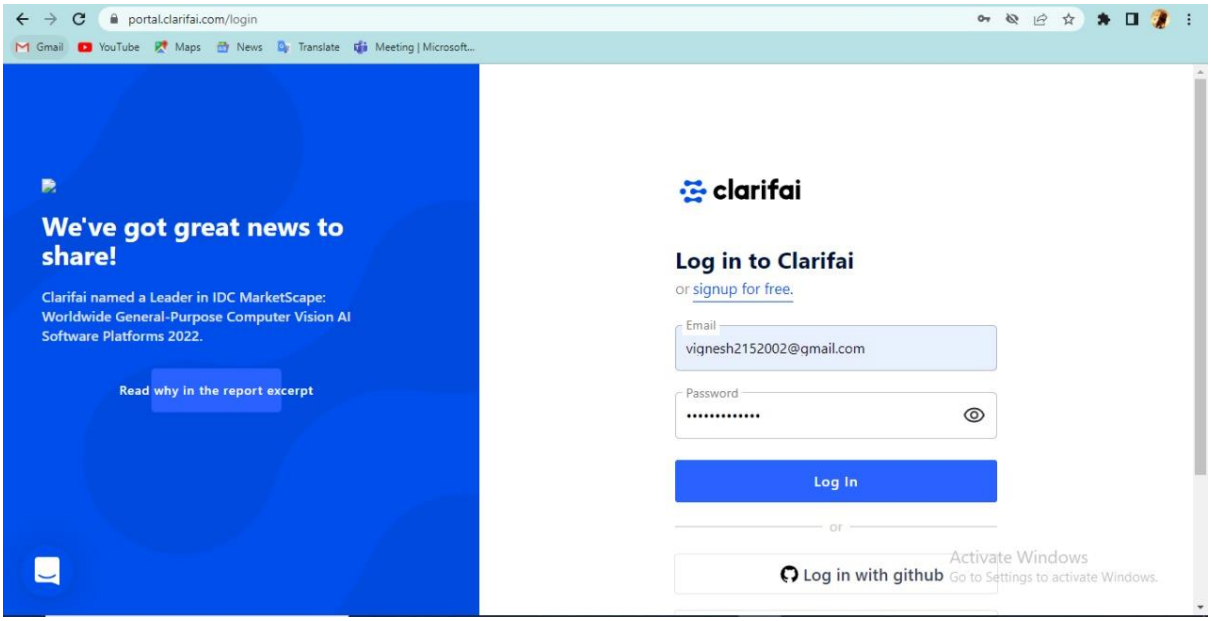
STEP 1:

- Open Clarifai portal in web browser.



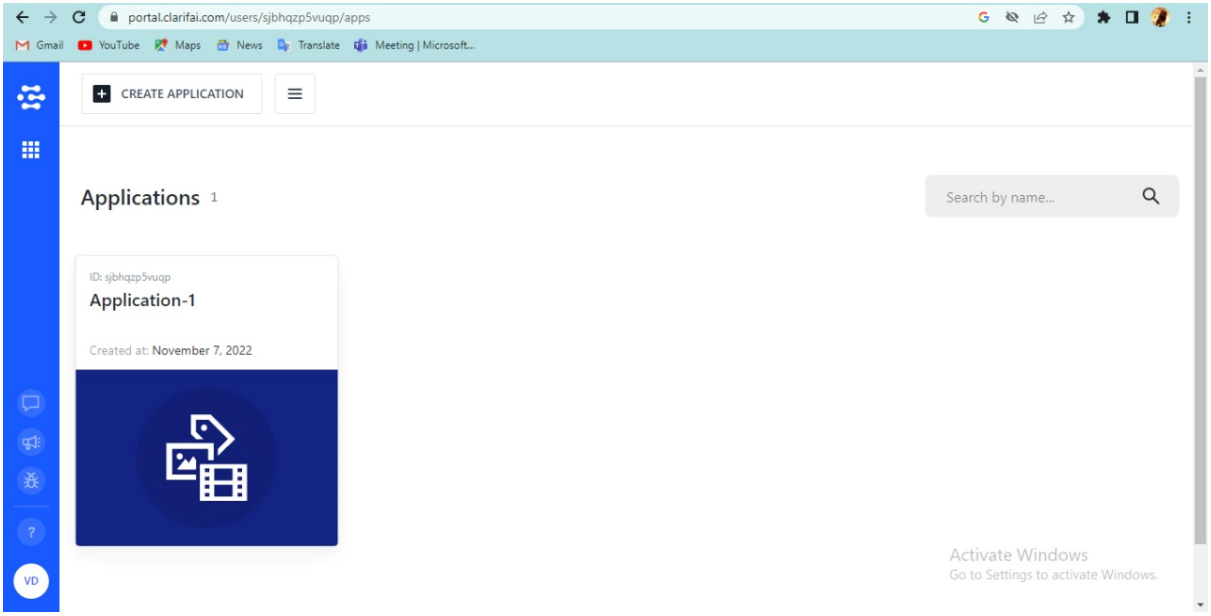
STEP 2:

- Signup using the required user mail and password.



STEP 3:

- Finally, Created an account



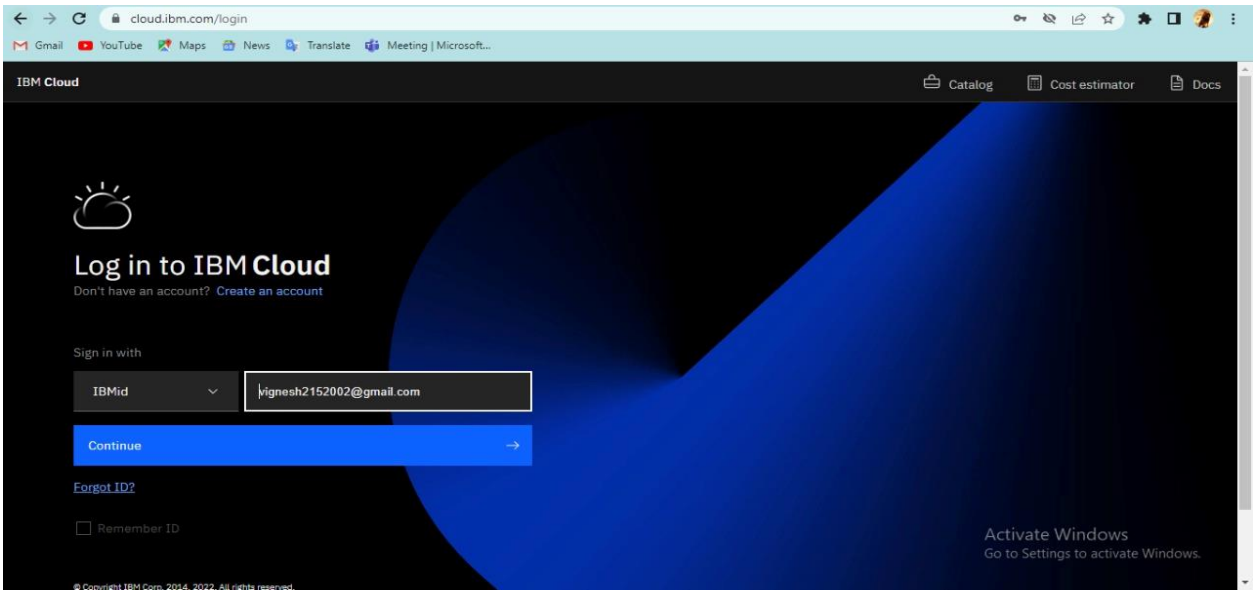
IBM WATSON IoT PLATFORM:

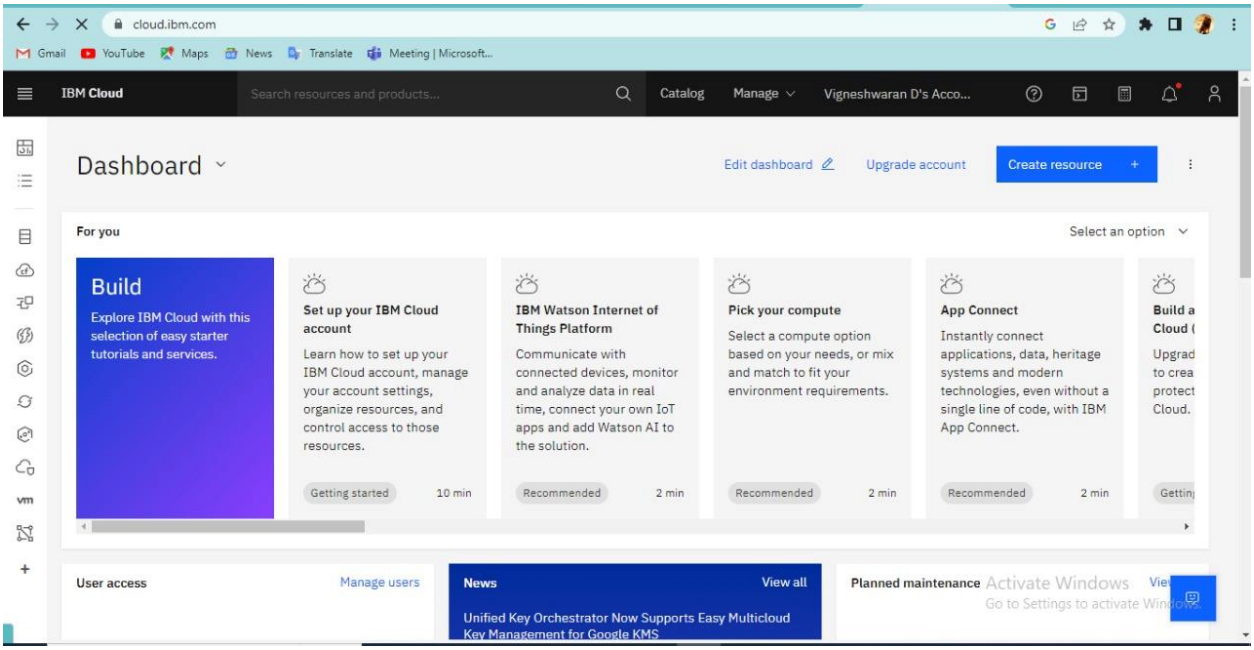
We need to have basic knowledge of the following cloud services:

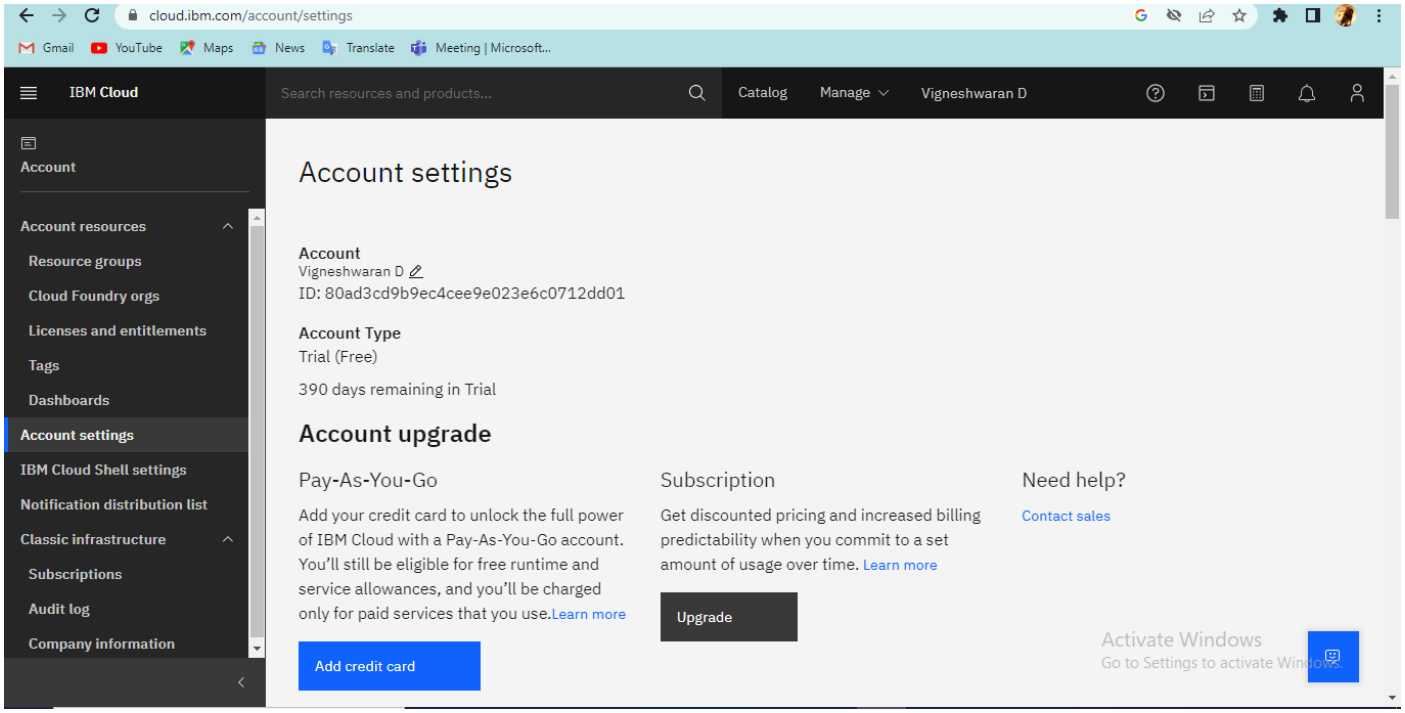
- IBM Watson IoT Platform
- Node-RED Service
- Cloudant DB

We need to create an IBM Cloud Account to complete this project.

LOGIN:


cloud.ibm.com/login
Gmail
YouTube
Maps
News
Translate
Meeting | Microsoft...
IBM Cloud
Catalog
Cost estimator
Docs
Log in to IBM Cloud
Don't have an account? Create an account
Sign in with
IBMid
vignesh2152002@gmail.com
Continue
Forgot ID?
Remember ID
Activate Windows
Go to Settings to activate Windows.


cloud.ibm.com
Gmail
YouTube
Maps
News
Translate
Meeting | Microsoft...
IBM Cloud
Search resources and products...
Catalog
Manage
Vigneshwaran D's Acco...
Dashboard
Edit dashboard
Upgrade account
Create resource
For you
Select an option
Build
Explore IBM Cloud with this selection of easy starter tutorials and services.
Set up your IBM Cloud account
Learn how to set up your IBM Cloud account, manage your account settings, organize resources, and control access to those resources.
Getting started
10 min
IBM Watson Internet of Things Platform
Communicate with connected devices, monitor and analyze data in real time, connect your own IoT apps and add Watson AI to the solution.
Recommended
2 min
Pick your compute
Select a compute option based on your needs, or mix and match to fit your environment requirements.
Recommended
2 min
App Connect
Instantly connect applications, data, heritage systems and modern technologies, even without a single line of code, with IBM App Connect.
Recommended
2 min
User access
Manage users
News
View all
Unified Key Orchestrator Now Supports Easy Multicloud Key Management for Google KMS
Planned maintenance
Activate Windows
Go to Settings to activate Windows.

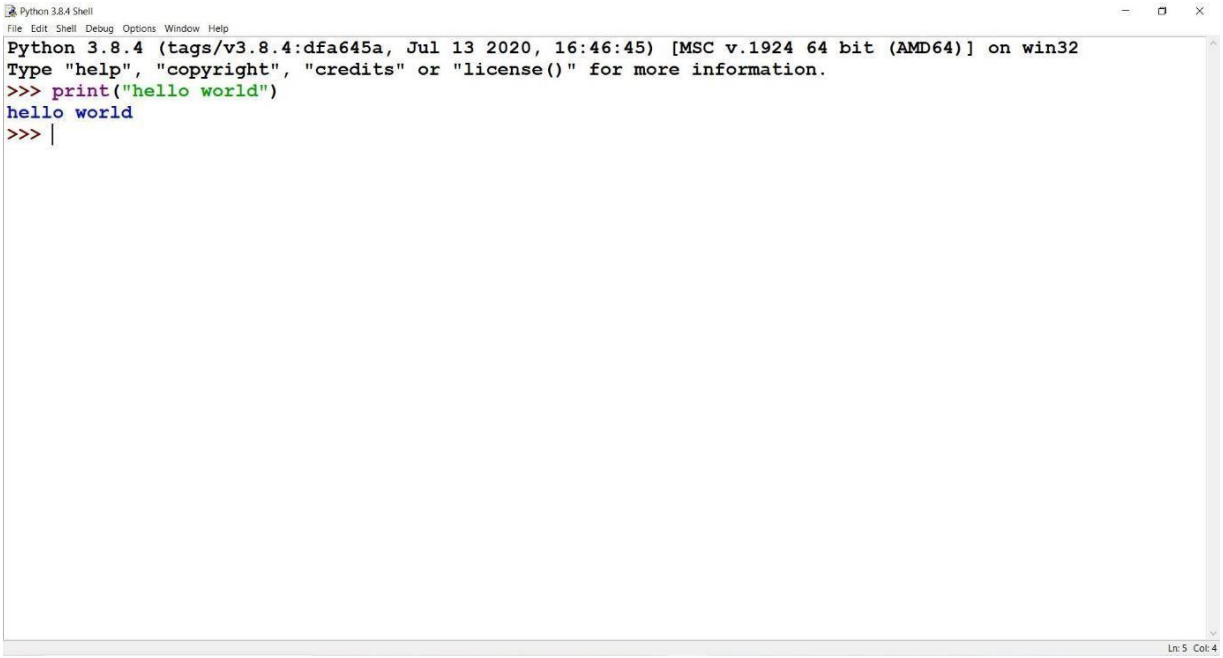


PYTHON IDLE INSTALISATION

Python is a computer programming language often used to build websites and software, automate tasks, and conduct data analysis. Python is a generalpurpose language, meaning it can be used to create a variety of different programs and isn't specialized for any specific problems.

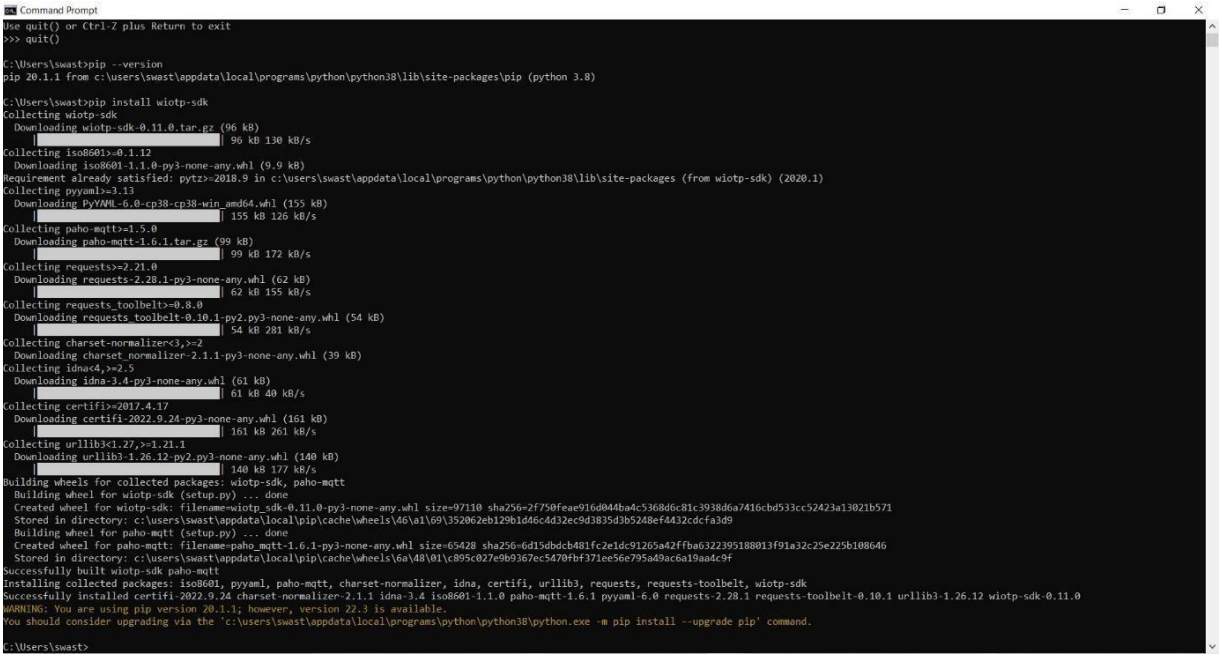
STEP 1:

- Python is installed successfully

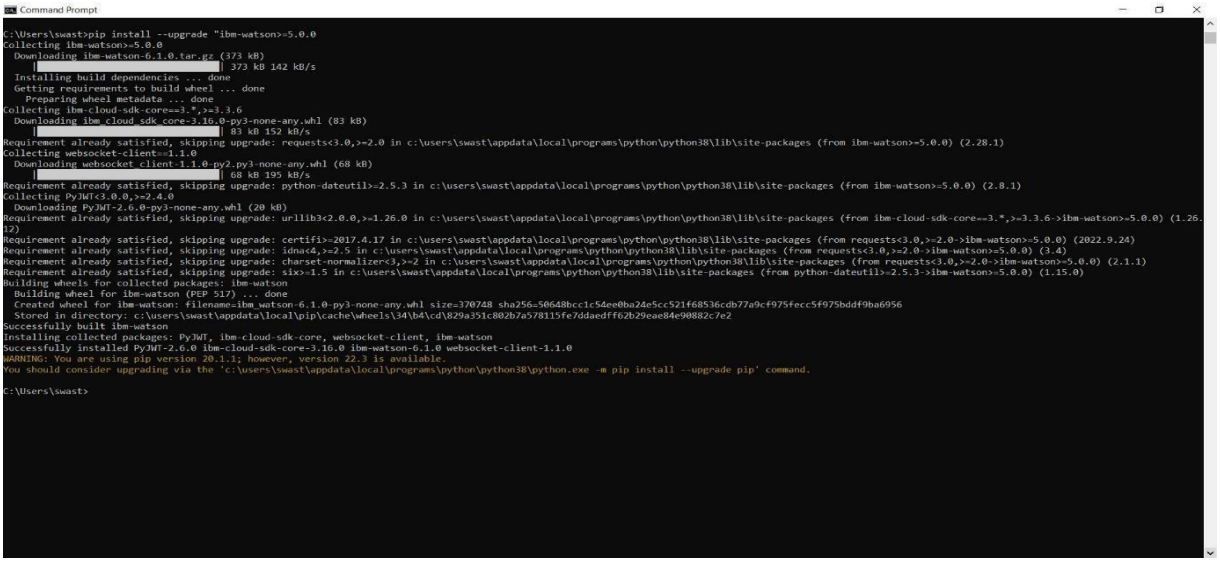


STEP 2:

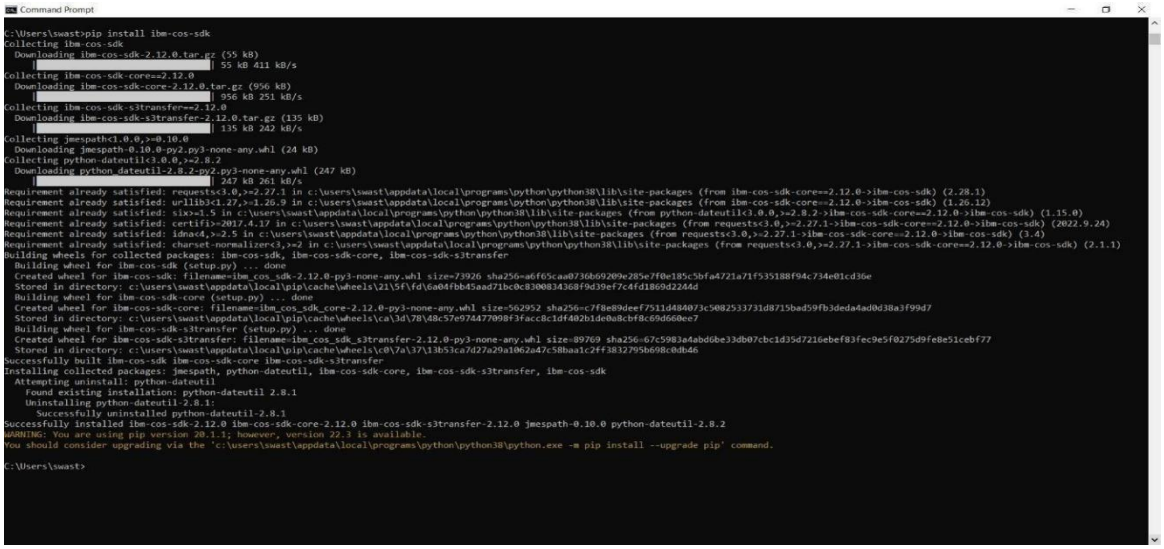
- The required python libraries are installed.
- Watson IoT Python SDK to connect to IBM Watson IoT Platform using python code is installed
- pip install wiotp-sdk



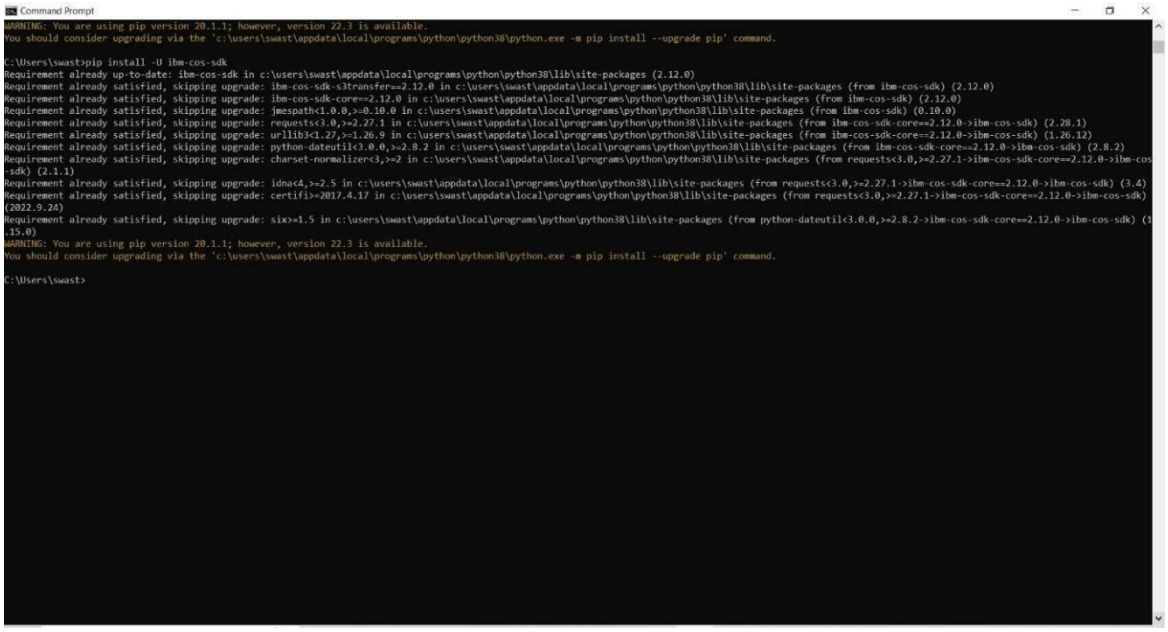
- Python client library for IBM Text to Speech is installed
- pip install --upgrade "ibm-watson>=5.0.0



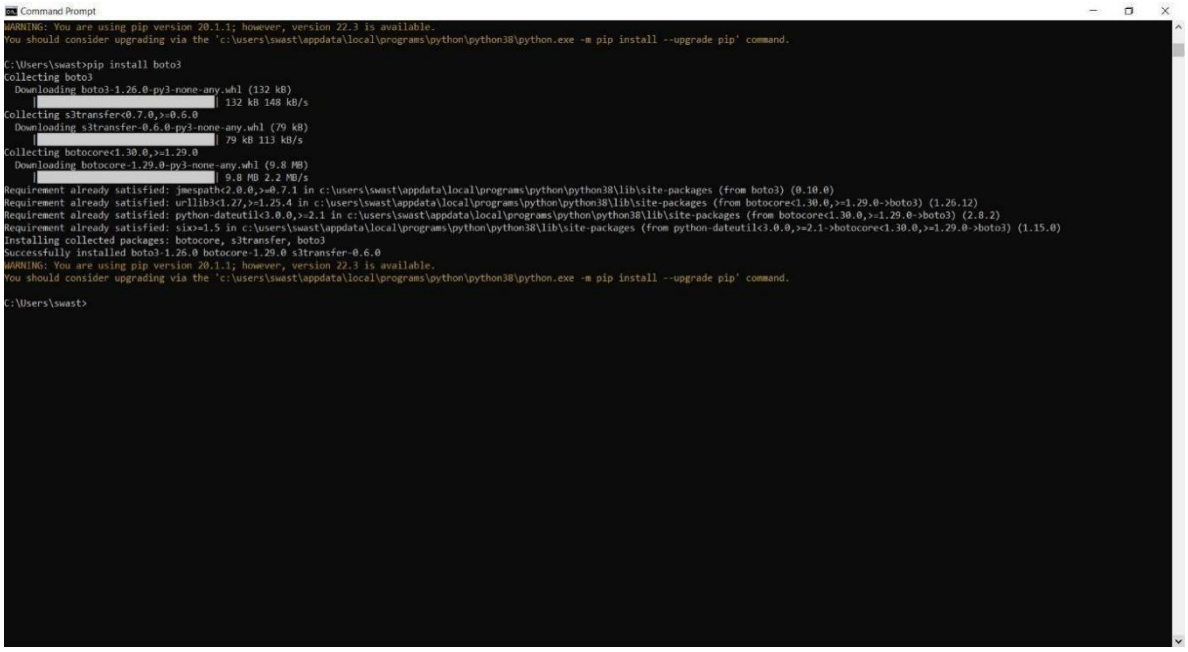
- Required Libraries for cloud object storage is installed
- pip install ibm-cos-sdk



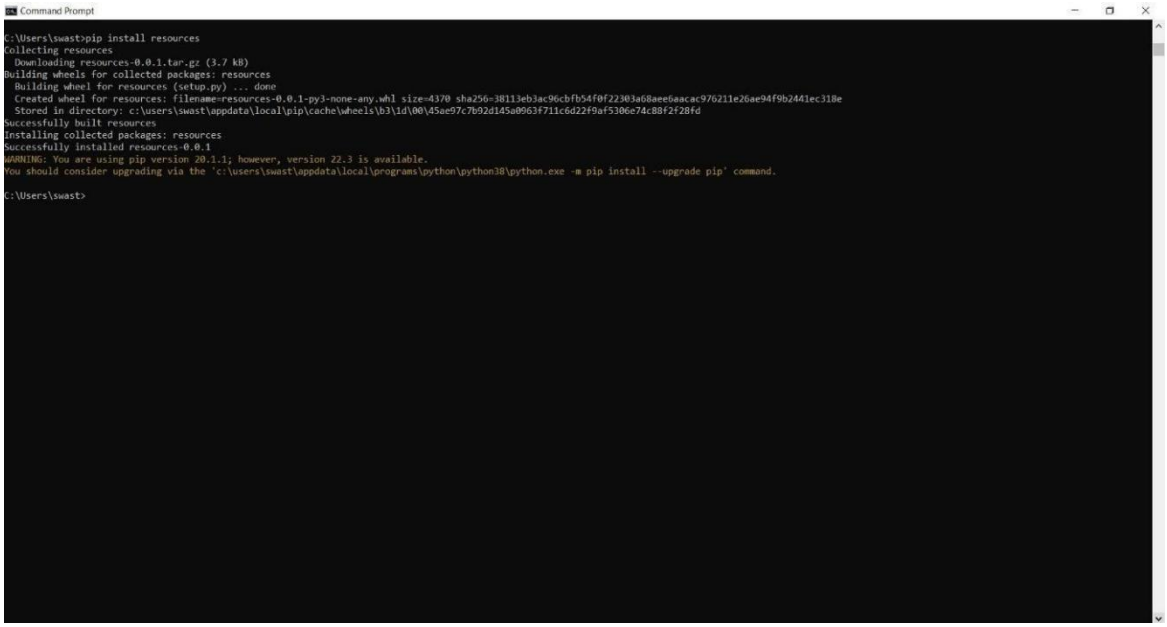
- pip install -U ibm-cos-sdk



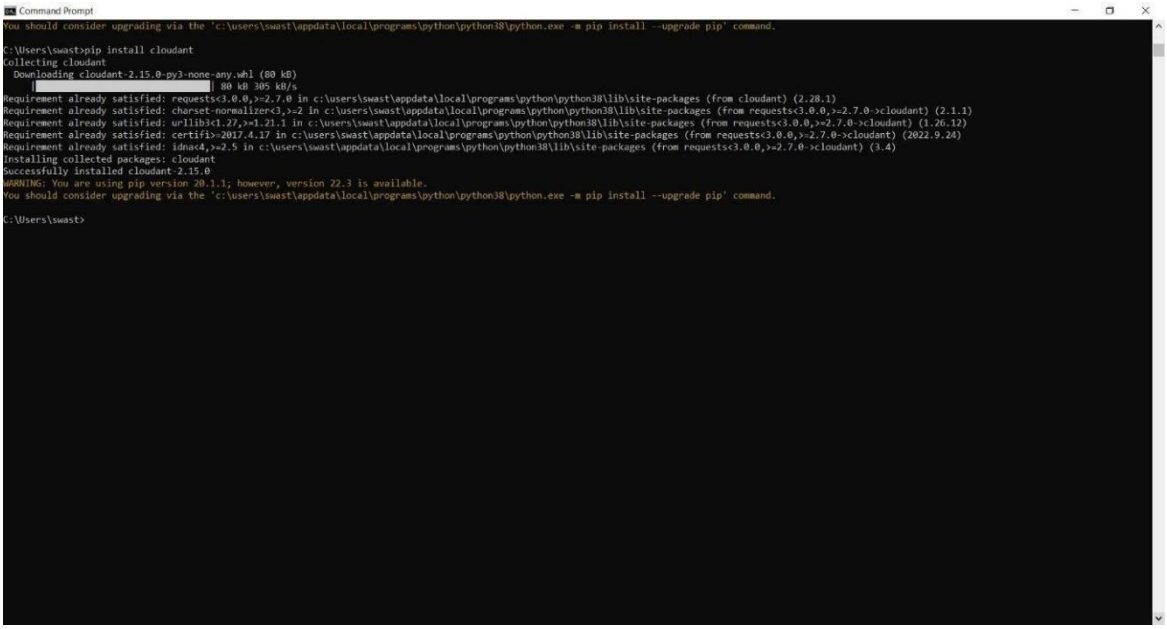
- pip install boto3



- pip install resources

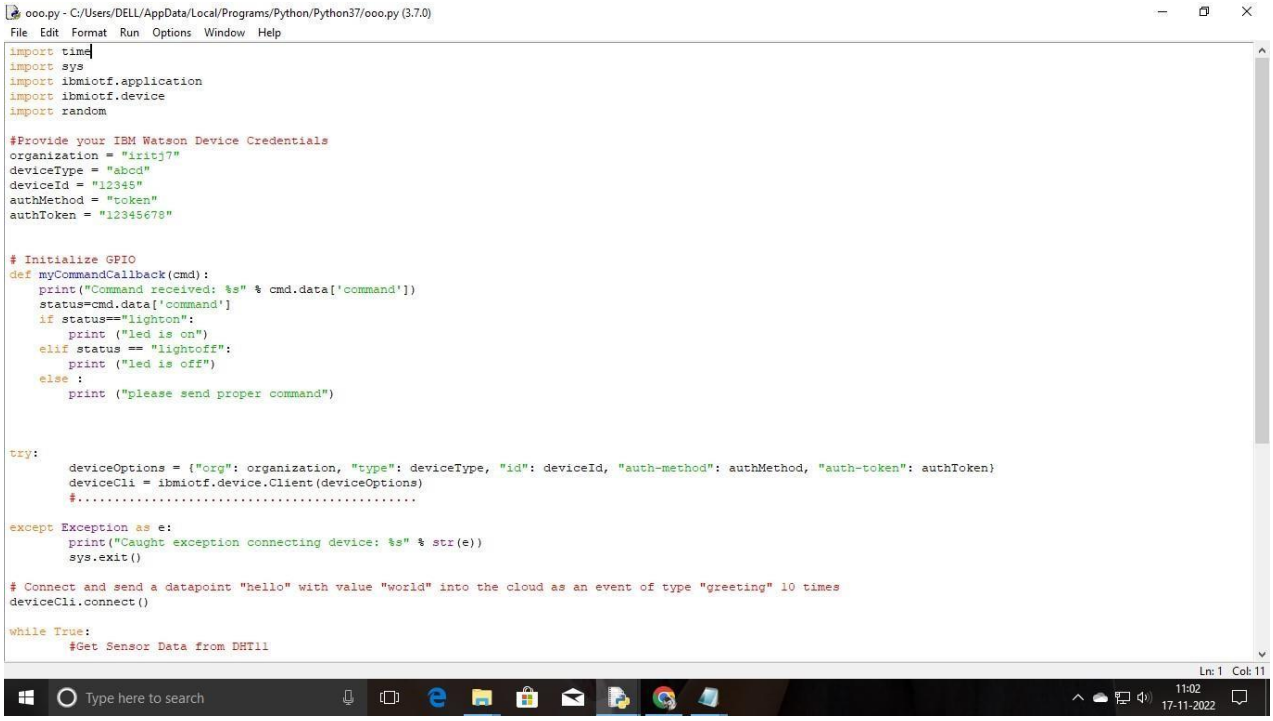


- pip install cloudant

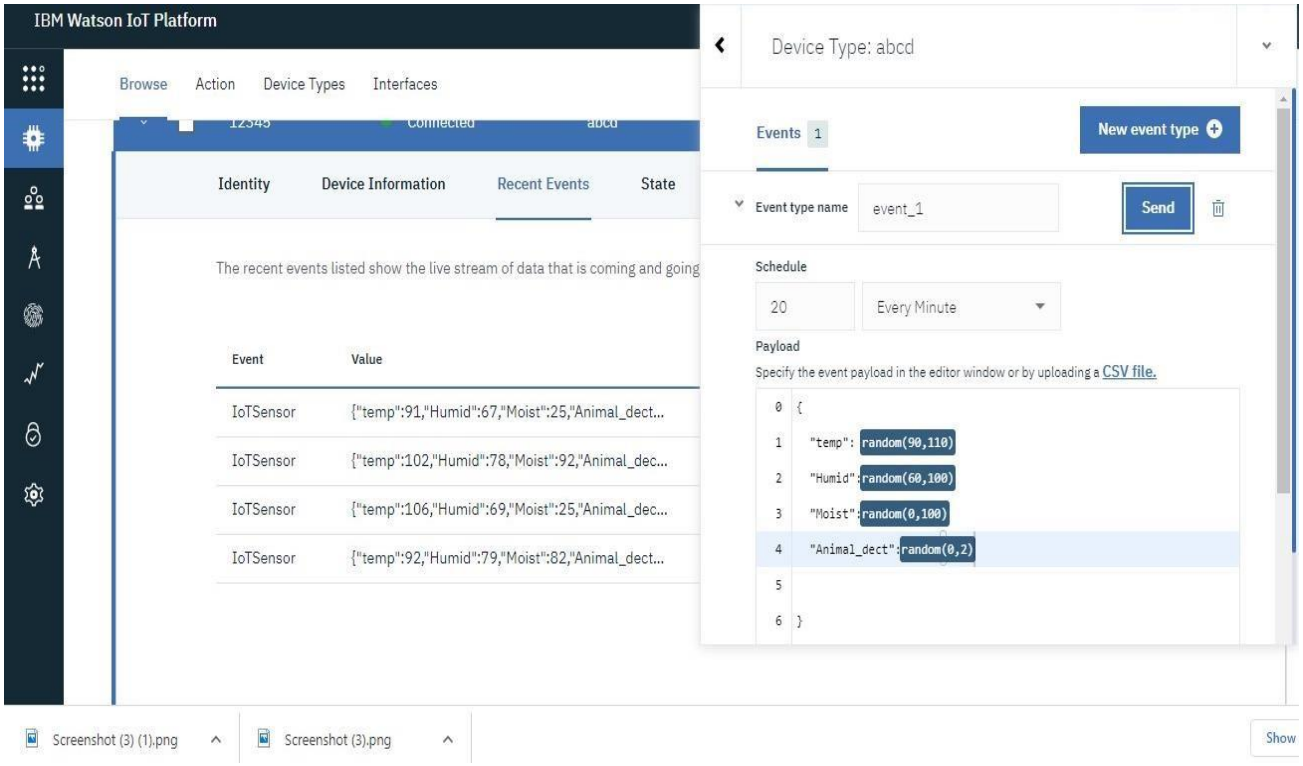


PROJECT DEVELOPMENT

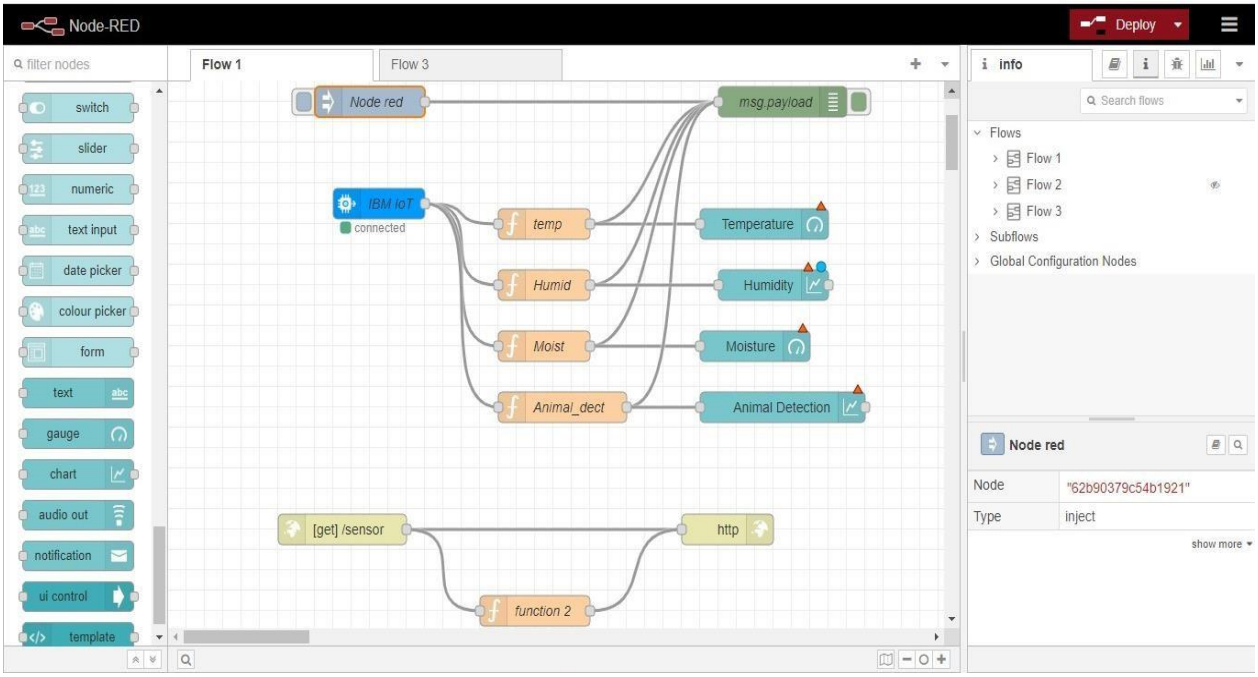
STEP 1: Write a python code for randomize Soil Moisture ,Temperature, Humidity and Animal detection.



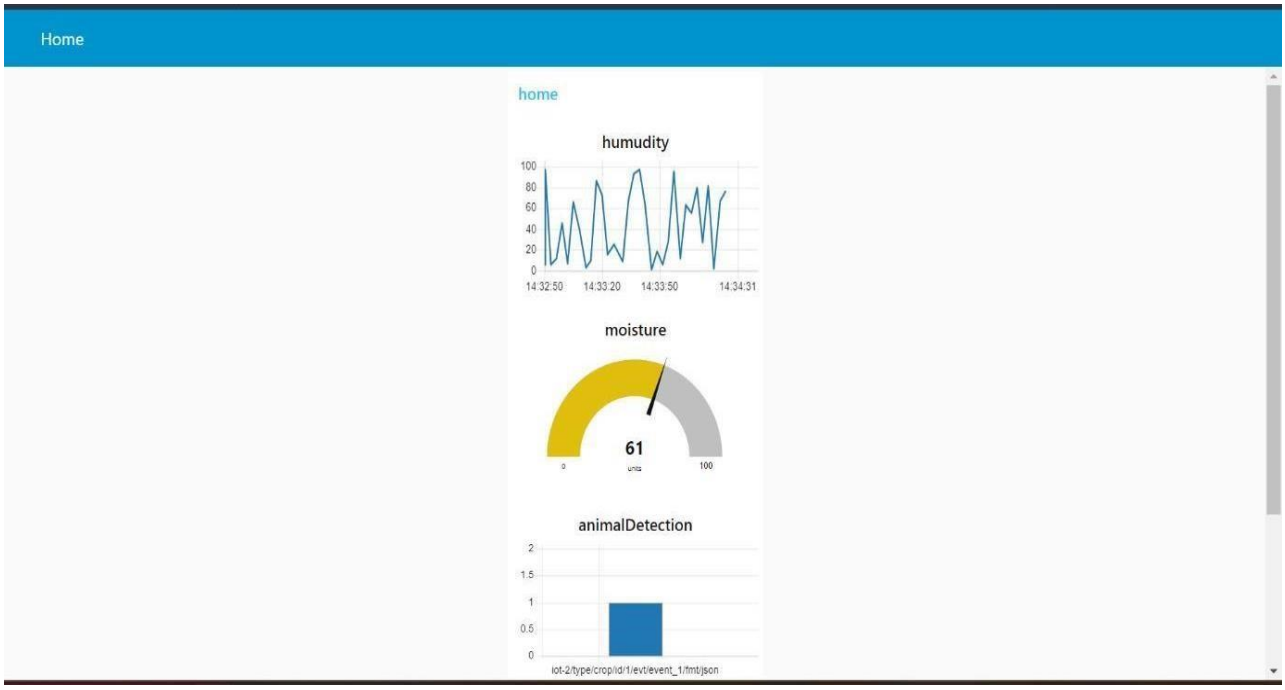
STEP 2: Run the python code it send data to IBM IoT Watson Platform.



STEP 3: Open Node-RED flow dashboard.



STEP 4: Open Node-RED user interface to show the Soil Moisture, Humidity and Temperature value in gauge.



CHAPTER 7
CODING AND SOLUTIONS

7.1 FEATURE

Python code to generate random data and pass it to IBM Watson IoT platform

Source Code:

```
import time import sys
import ibmiotf.application import
ibmiotf.device import random
#Provide your IBM Watson Device
Credentialsorganization = "wu5b55"
deviceType = "crop1" deviceId = "1234"
authMethod =
"token" authToken = "1234567890"


# Initialize GPIOtry:
```

```
                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()


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


      temp=random.randint(0,
      100)
      Hum=random.randint(0,1
      00)
      moisture=random.randint
      (0,100)


      data = { 'temperature' : temp, 'Humidity': Hum, 'Moisture':moisture }
def myOnPublishCallback():
          print ("Temperature = " + str(temp)+" C Humidity = " +
    str(hum)+ " moisture = " +str(moisture) + "to IBM Watson")


      success = deviceCli.publishEvent("IoTSensor",
    "json", data, qos=0,on_publish=myOnPublishCallback) if not
      success:
        print("Not connected to IoTF")time.sleep(10)
        deviceCli.commandCallback = myCommandCallback
    # Disconnect the device and application from the
    clouddeviceCli.disconnect()
```

7.2 FEATURE 2

Source code is deployed on IBM Watson IoT platform to generate sensor data.SourceCode:

{

"temperature": random(0, 100),

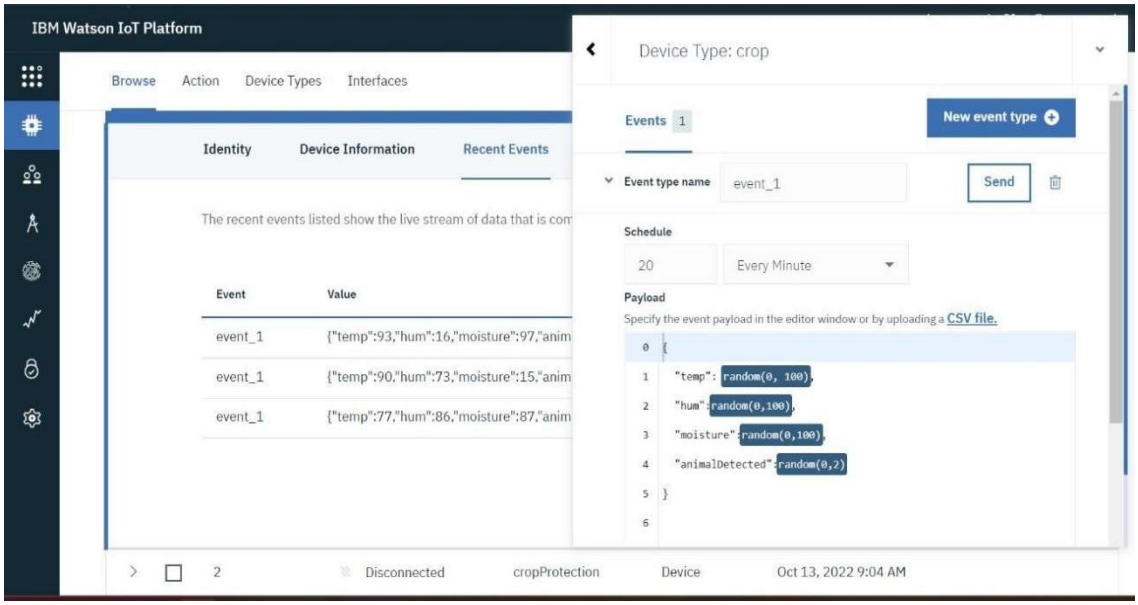
"humidity": random(0, 100),

"moisture": random(0, 100),

“animalDetected”:random(0,2)

}

Output:



7.3 DATABASE SCHEMA

PYTHON CODE TO IBM:

import time import sys
import ibmiotf.application
import ibmiotf.device import random
#Provide your IBM Watson Device Credentials organization
= "wu5b55" deviceType = "crop1" deviceId = "1234"
authMethod = "token" authToken = "1234567890"
# Initialize GPIO
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()

```
# Connect and send a datapoint "hello" with value "world" into thecloud as an event of type "greeting" 10 times
deviceCli.connect()
while True:

        #Get Sensor Data from DHT11


        temp=random.randint(0,100) Hum=random.randint(0,100)
        moisture=random.randint(0,100)
        data = { 'temperature' : temp, 'Humidity': Hum, 'Moisture':moisture }

#print data def myOnPublishCallback():

            print ("Temperature = " + str(temp)+" C Humidity = " + str(hum)+ " moisture = " + str(moisture) + "to IBM Watson")
        success = deviceCli.publishEvent("IoTSensor", "json", data,qos=0, on_publish=myOnPublishCallback) if not success:

            print("Not connected to IoTF")
        time.sleep(10)


        deviceCli.commandCallback = myCommandCallback


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

CHAPTER 8
TESTING

8.1 TEST CASES

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	10	4	2	3	20
Duplicate	1	0	3	0	4
External	2	3	0	1	6
Fixed	11	2	4	20	37
Not Reproduced	0	0	1	0	1
Skipped	0	0	1	1	2
Won't Fix	0	5	2	1	8
Totals	24	14	13	26	77

8.2 USER ACCEPTANCE TESTING

This report shows the number of test cases that have passed, failed, and untested

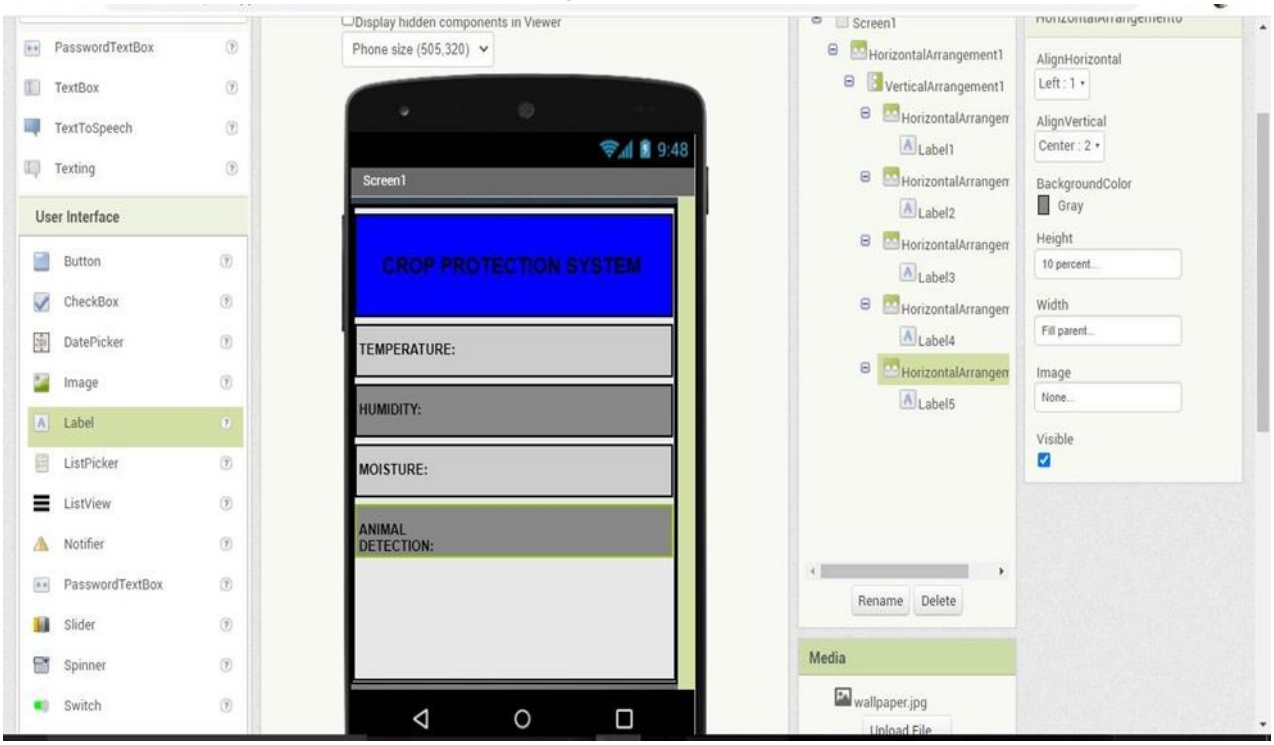
Section	Total Cases	Not Tested	Fail	Pass
Print Engine	7	0	0	7
Client Application	51	0	0	51
Security	2	0	0	2
Outsource Shipping	3	0	0	3
Exception Reporting	9	0	0	9
Final Report Output	4	0	0	4
Version Control	2	0	0	2

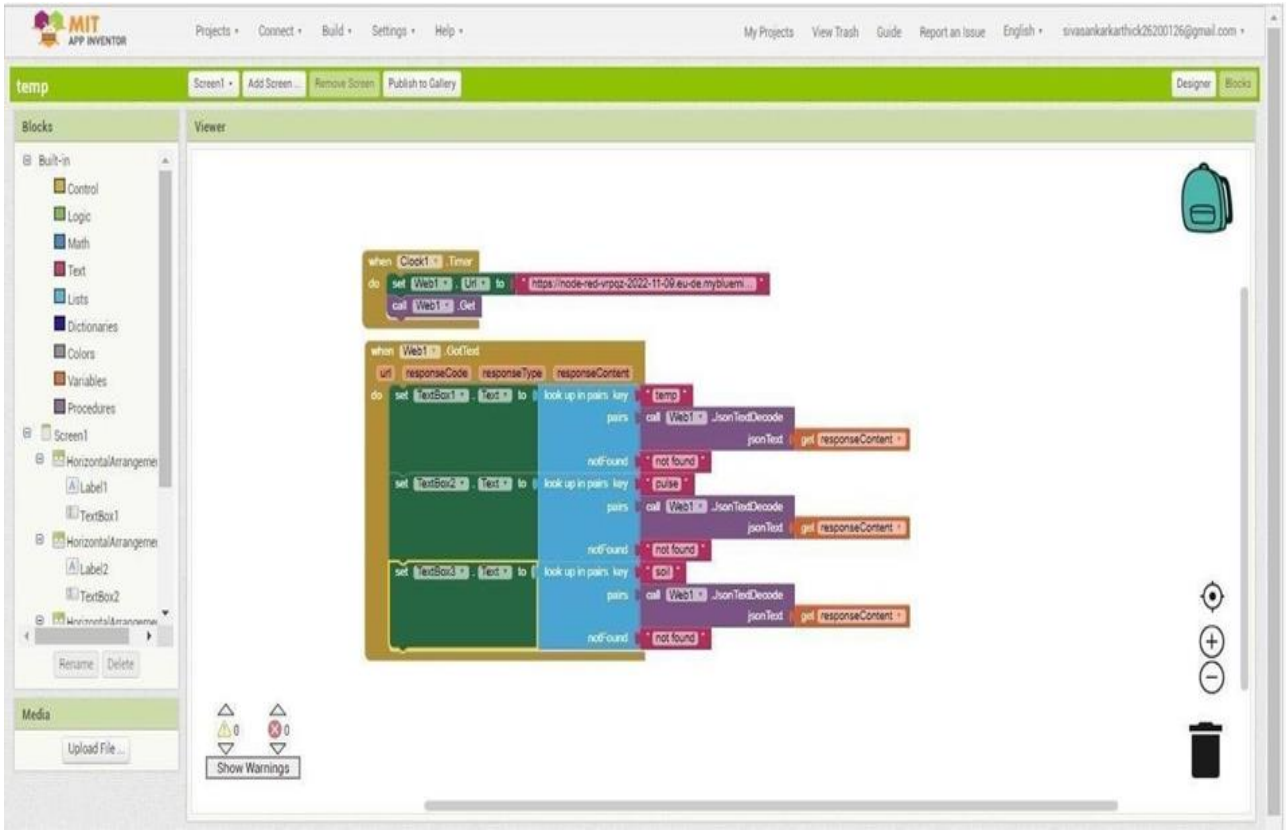
CHAPTER 9
RESULT

9.1 PERFORMANCE METRICS

MIT APP INVENTOR:

STEP 1: MIT APP inventor to design the APP.





STEP 2: Customize the App interface to Display the Values.


Screen1
CROP PROTECTION SYSTEM
TEMPERA
TURE:41
HUMIDITY:
80
MOISTURE
:61
ANIMAL
DETECTIO
N:0

CHAPTER 10
ADVANTAGES AND DISADVANTAGES

Advantages:

- Farmers can monitor the health of farm animals closely, even if they are physically distant.
- Smart farming systems reduce waste, improve productivity and enable management of a greater number of resources through remote sensing.
- High reliance.
- Enhanced Security.

Disadvantages:

- 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.

APPLICATIONS:

- Monitoring the crop field with the help of sensors (light, humidity, temperature, soil moisture, etc.)
- Automating the irrigation system
- Soil Moisture Monitoring (including conductivity and pH)

CHAPTER 11

CONCLUSION

AS a result of this system, we can detect the changes in the field easily and intimate the farmers about it and also we can take precautions and do remedies accordingly. Here we use very low power consuming highly efficient components that give us accurate results and also they perform at low data rate conditions without any lag and help in finding the remedies. This crop protection system helps in detection of all kinds of external dangers and it saves time and money to the farmers before any loss that may occur. With the help of this system the farmers can be in a peaceful environment at ease without any pressure.

CHAPTER 12

FUTURE SCOPE

Study and analysis of the developed Crop protection systems for its costeffectiveness with the development of Arduino based variable frequency Ultrasonic birddeterrent circuit. outline of the crop damage caused by a particular Wild animal if thebehavioral features of the With the reduced cost in the smart phones.

CHAPTER 13

APPENDIX

13.1SOURCE CODE

The source code has been uploaded in github. To refer the final sourse code click "SOURCE CODE"

13.2 GITHUB & PROJECT DEMO LINK

GITHUB LINK

The github link :"GITHUB LINK"

PROJECT DEMO LINK

The Project Demo link: "DEMO LINK"

CHAPTER 14

REFERENCE

[1]Priyanka Deotale, Prasad Lokulwar (2021) have presented the paper titled “Smart Crop Protection System from Wild animals Using IoT” . Crops in the agricultural land are destroyed by the domestic animals and wild animals ,it is one of the reason for low productivity . Farmers can't be there for entire 2 hours so we have make use of IOT to control the animals destroying the field . Once the animal is detected the system will larm and start lightning in the corner of the farm . It will not harm any animals and we can also protect the crops.

[2] N.S. Gogul Dev , K.S. Sreenesh , P.K. Binu (2019) has presented a paper titled “IoT Based Automated Crop Protection System” . Low productivity of crops is one of the main problems faced by the farmers in our country. This can be because of two main reasons. Crops destroyed by wild animals and because of bad weather condition. This paper provides a solution to the destruction of crops by animals. This system will provide a complete technical solution using the Internet of things (IOT) to the farmers to prevent their crops from wild animals and provide information to the farmers to maximize their production. Animals are detected using PIR sensors and cameras where animals are identified using TensorFlow image processing Techniques. Raspberry PI is used as the processing unit of the system and sound buzzers are used to emit the ultrasound frequencies