Project Development Phase

Sprint -3

Date	17 November 2022
Team ID	PNT2022TMID34928
Project Name	IOT BASED SMART CROP PROTECTION SYSTEM

Python Code:

```
import time
import sys
import ibmiotf.application
import ibmiotf.device
import random
import cv2
import numpy as np
threatlst=["elephant","bear","tiger","horse","monkey"]
n=len(threatlst)
#Provide your IBM Watson Device Credentials
organization = "2ldaf5"
deviceType1 = "Sensor"
deviceId1 = "DHT"
authMethod = "token"
authToken1 = "NeVIAy2K16H)d9sXvz"

deviceType2 = "Sensor1"
deviceId2 = "Soil_moisture"
authToken2= "zwr247qk1Xca0w?QEs"
```

```
deviceType3 = "Actuator"
deviceId3 = "Water_pump"
authToken3= "Pze?D!@FjZeAtfMB4q"

deviceType4= "Sensor2"
deviceId4= "PIR"
authToken4= "i-yXXf?FnB011nEycG"

deviceType5= "Sensor3"
deviceId5="Ultrasonic"
authToken5="e&QzDxiHpQ4GaRyPGJ"

deviceType6="Detector"
deviceId6="Camera"
authToken6="f7LMx6-a(uhdnDcKa-"

deviceType7="Output"
deviceId7="LED"
authToken7="qJIBVJHP9@Ihl8@CK3"

deviceType8="Actuator"
deviceId8="Speaker"
authToken8="TitkHSlzaTy_gxEtve"

# Initialize GPIO
def myCommandCallback(cmd):
   print("Command received: %s \n" % cmd.data['command'])
   status=cmd.data['command']
   if status=="ON":
       print ("Water Pump is turned ON \n")
   else :
       print ("Water Pump is turned OFF \n")
def myCommandCallback1(cmd):
   print("Command received: %s \n" % cmd.data['command1'])
   status=cmd.data['command1']
   if status=="ON":
       print ("LED is turned ON \n")
   else :
       print ("LED is turned OFF \n")
def myCommandCallback2(cmd):
   print("Command received: %s \n" % cmd.data['command2'])
   status=cmd.data['command2']
   if status=="ON":
       print ("Speaker is turned ON \n")
   else :
       print ("Speaker is turned OFF \n")
#Automatically turning on/off led and speaker
def threat(x):
   print("LED is turned ON")
   print("Speaker is turned ON")
   data8= {'Threat' : str(x)}
   def myOnPublishCallback8():
       print ("Threat allert is send to IBM Watson")
   success8 = deviceCli8.publishEvent("Threat status", "json", data8, qos=0, on_publish=myOnPublishCallback8)
   if not success8:
       print("Not connected to IoTF")
   time.sleep(1)
```

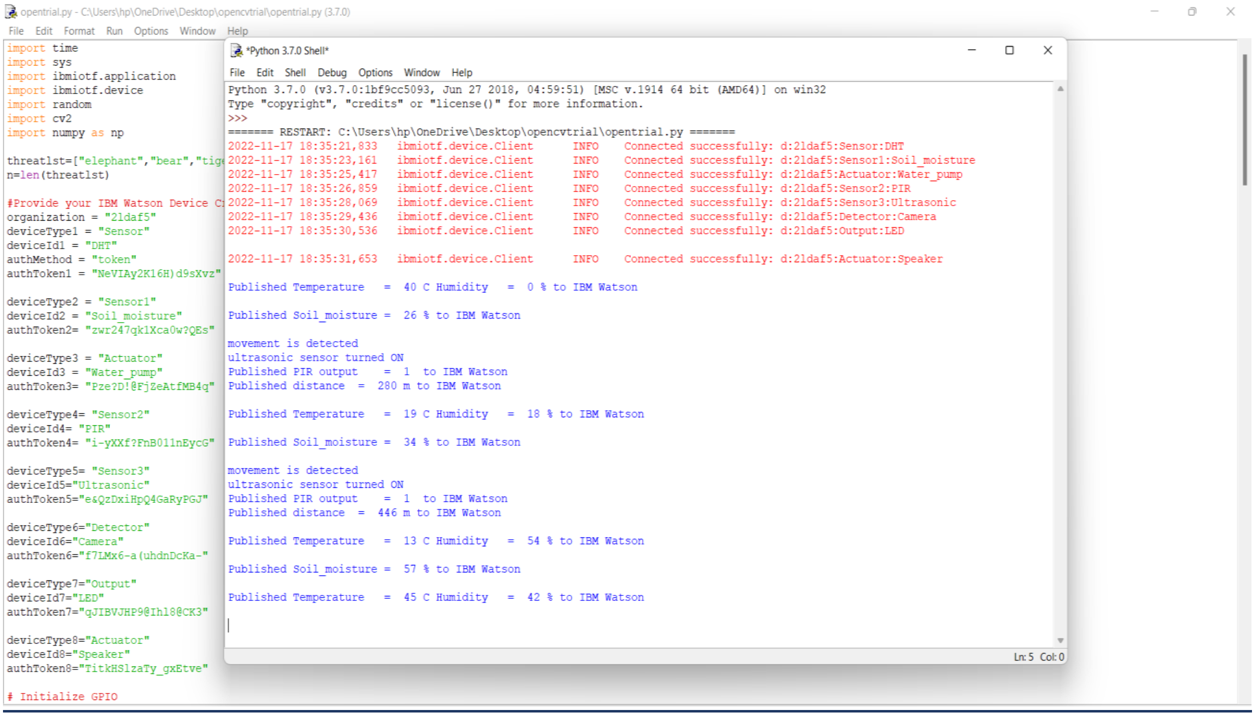
```
def cam():

net=cv2.dnn.readNet('C:/Users/hp/OneDrive/Desktop/opencvtrial/yolov3.weights','C:/User
s/hp/OneDrive/Desktop/opencvtrial/yolov3.cfg.txt')
  classes=[]
  with open('C:/Users/hp/OneDrive/Desktop/opencvtrial/coco.names','r') as f:
    classes=f.read().splitlines()
  cap=cv2.VideoCapture('blackbear.mp4')
  for i in range(50):
     _,img=cap.read()
     height,width,_=img.shape
     blob=cv2.dnn.blobFromImage(img,1/255,(416,416),(0,0,0),swapRB=True,crop=False)
#(img,reduction the pixels size,size of the image,rgb colour)
     net.setInput(blob)
     output_layers_names=net.getUnconnectedOutLayersNames()
     layeroutput=net.forward(output_layers_names)
     boxes=[]
     confidences=[]
     class_ids=[]
     for output in layeroutput:
        for detection in output:
           scores=detection[5:]
           class_id=np.argmax(scores)
           confidence=scores[class_id]
           if confidence > 0.5:
              center_x=int(detection[0]*width)
              center_y =int(detection[1]*height)
              w=int(detection[2]*width)
              h=int(detection[3]*height)
              x=int(center_x - w/2)
```

```
                 y=int(center_y - h/2)
                 boxes.append([x,y,w,h])
                 confidences.append((float(confidence)))
                 class_ids.append(class_id)
                 animal=classes[class_id]

     indexes=cv2.dnn.NMSBoxes(boxes,confidences,0.5,0.4)
     font=cv2.FONT_HERSHEY_COMPLEX
     colors=np.random.uniform(0,255,size=(len(boxes),3))
     for i in indexes.flatten():
         x,y,w,h=boxes[i]
         label=str(classes[class_ids[i]])
         confidence=str(round(confidences[i],2))
         color=colors[i]
         cv2.rectangle(img,(x,y),(x+w ,y+h),color,2)
         cv2.putText(img,label + " "+confidence,(x,y+20),font,2,(255,255,0),2)
     cv2.imshow('Target Image',img)
     key=cv2.waitKey(1)
     if key ==ord('q'):
         break
print("Alert! detected animal is "+str(animal))
for x in threatlst :
    if animal==x :
        status1="YES"
        threat(status1)
cap.release()
cv2.destroyAllWindows()
data6 = { 'Intruded_Animal' :  str(animal) }
def myOnPublishCallback6():
        print ("Published Intruded Animal is "+str(animal) ,"to IBM Watson")
    success6 = deviceCli6.publishEvent("Allert", "json", data6, qos=0, on_publish=myOnPublishCallback6)
    if not success6:
        print("Not connected to IoTF")
    time.sleep(1)


try:
    deviceOptions1 = {"org": organization, "type": deviceType1, "id": deviceId1, "auth-method": authMethod, "auth-token": authToken1}
    deviceCli1 = ibmiotf.device.Client(deviceOptions1)
    #.............................................
    deviceOptions2 = {"org": organization, "type": deviceType2, "id": deviceId2, "auth-method": authMethod, "auth-token": authToken2}
    deviceCli2 = ibmiotf.device.Client(deviceOptions2)
    #.............................................
    deviceOptions3 = {"org": organization, "type": deviceType3, "id": deviceId3, "auth-method": authMethod, "auth-token": authToken3}
    deviceCli3 = ibmiotf.device.Client(deviceOptions3)
    #.............................................
    deviceOptions4 = {"org": organization, "type": deviceType4, "id": deviceId4, "auth-method": authMethod, "auth-token": authToken4}
    deviceCli4 = ibmiotf.device.Client(deviceOptions4)
    #.............................................
    deviceOptions5 = {"org": organization, "type": deviceType5, "id": deviceId5, "auth-method": authMethod, "auth-token": authToken5}
    deviceCli5 = ibmiotf.device.Client(deviceOptions5)
    #.............................................
    deviceOptions6 = {"org": organization, "type": deviceType6, "id": deviceId6, "auth-method": authMethod, "auth-token": authToken6}
    deviceCli6 = ibmiotf.device.Client(deviceOptions6)
    #.............................................
```

```
  deviceOptions7 = {"org": organization, "type": deviceType7, "id": deviceId7, "auth-method": authMethod, "auth-token": authToken7}

  deviceCli7 = ibmiotf.device.Client(deviceOptions7)

  #............................................

  deviceOptions8 = {"org": organization, "type": deviceType8, "id": deviceId8, "auth-method": authMethod, "auth-token": authToken8}

  deviceCli8 = ibmiotf.device.Client(deviceOptions8)

  #.............................................

except Exception as e:

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

       sys.exit()

deviceCli1.connect()

deviceCli2.connect()

deviceCli3.connect()

deviceCli4.connect()

deviceCli5.connect()

deviceCli6.connect()

deviceCli7.connect()

deviceCli8.connect()

print("\n")

while (True):

    #Get Sensor Data from DHT11

    temp=random.randint(0,45)

    Humid=random.randint(0,100)

    data1 = { 'Temperature' : temp , 'Humidity': Humid}

    def myOnPublishCallback1():

      print ("Published Temperature  =  %s C" % temp, "Humidity  =  %s %%" % Humid, "to IBM Watson\n")

    success1 = deviceCli1.publishEvent("DHT Sensor", "json", data1, qos=0, on_publish=myOnPublishCallback1)

    if not success1:
      print("Not connected to IoTF\n")
    time.sleep(1)
    #Get Sensor Data from SOIL Moisture
    Soil_moisture=random.randint(0,100)
    data2 = { 'Soil_moisture' : Soil_moisture}
    def myOnPublishCallback2():
      print ("Published Soil_moisture =  %s %%" % Soil_moisture, "to IBM Watson\n")
    success2 = deviceCli2.publishEvent("Soil Moisture Sensor", "json", data2, qos=0, 
on_publish=myOnPublishCallback2)
    if not success2:
      print("Not connected to IoTF")
    time.sleep(1)
    #Automatically turning on/off water pump
    if Soil_moisture <= 20:
     print("Water pump is turned ON\n")
    deviceCli3.commandCallback = myCommandCallback
    #Get Sensor Data from PIR
    pir=random.randint(0,1)
    data4 = { 'PIR_output' : pir}
    #Movement detection by PIR
    if(pir==1):
      print("movement is detected\nultrasonic sensor turned ON")
      def myOnPublishCallback4():
        print ("Published PIR output    =  %s " % pir, "to IBM Watson")
      success4 = deviceCli4.publishEvent("PIR Sensor", "json", data4, qos=0, 
on_publish=myOnPublishCallback4)
      if not success4:
        print("Not connected to IoTF")
      time.sleep(1)
      #Get Sensor data from ultrasonic sensor
```

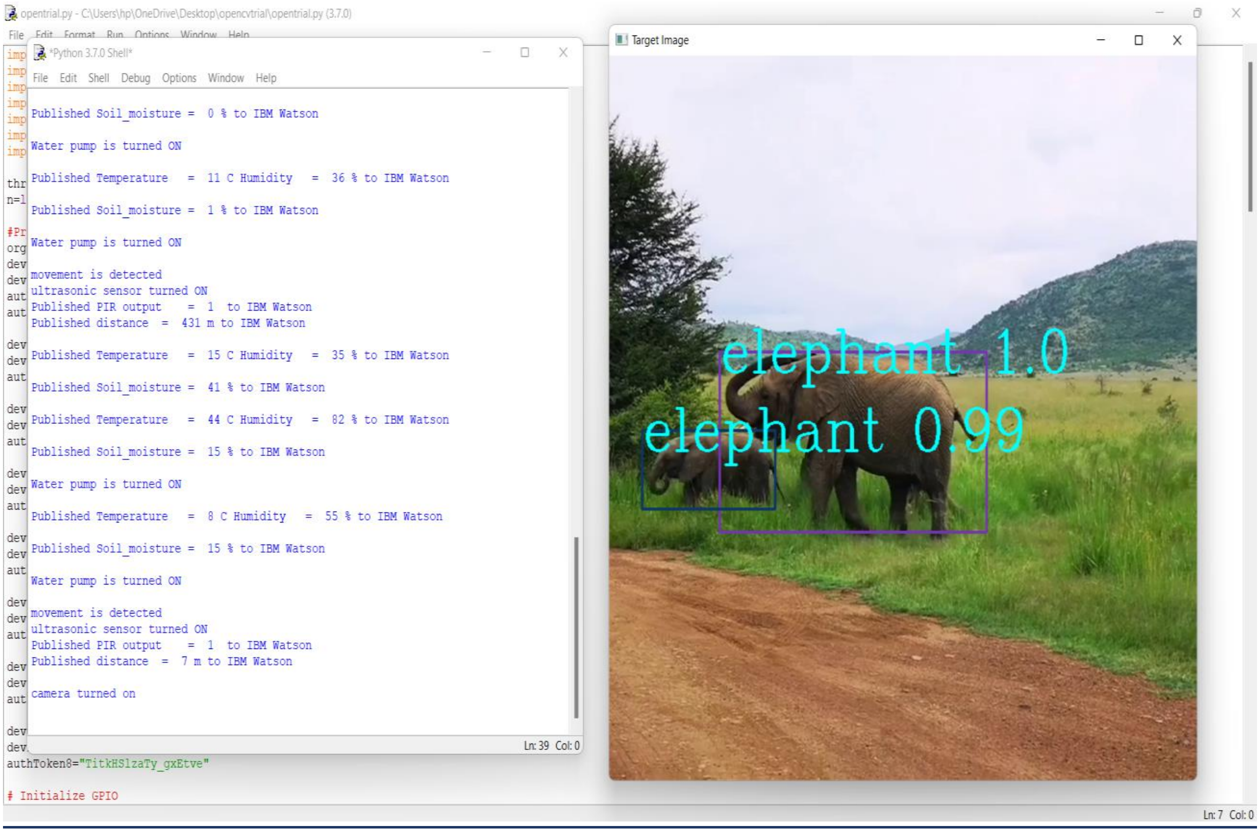
```
        distance=random.randint(0,500)

        data5 = { 'Distance:' : distance}

        def myOnPublishCallback5():

            print ("Published distance  =  %s m" % distance, "to IBM Watson\n")

        success5 = deviceCli5.publishEvent("Ultrasonic Sensor", "json", data5, qos=0,
on_publish=myOnPublishCallback5)

        if not success5:

            print("Not connected to IoTF")

        time.sleep(1)

        #turning on camera

        if(distance<=200):

            print("camera turned on\n")

            cam()

    deviceCli7.commandCallback = myCommandCallback1

    deviceCli8.commandCallback = myCommandCallback2

deviceCli1.disconnect()

deviceCli2.disconnect()

deviceCli4.disconnect()

deviceCli5.disconnect()

deviceCli6.disconnect()
```

Python Output :


opentrial.py - C:\Users\hp\OneDrive\Desktop\opencvtrial\opentrial.py (3.7.0)
File Edit Format Run Options Window Help
Python 3.7.0 Shell
File Edit Shell Debug Options Window Help
Ln: 5 Col: 0

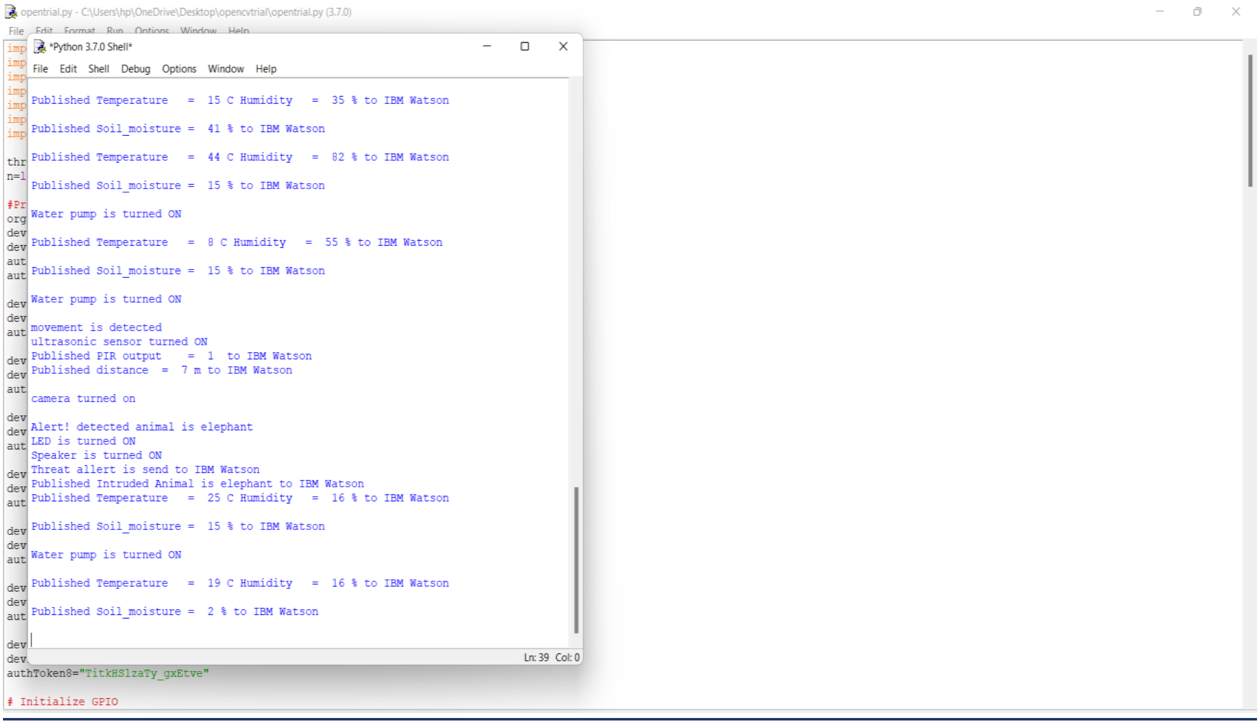
```
import time
import sys
import ibmiotf.application
import ibmiotf.device
import random
import cv2
import numpy as np

threatlst=["elephant","bear","tig
n=len(threatlst)

#Provide your IBM Watson Device C
organization = "21daf5"
deviceType1 = "Sensor"
deviceId1 = "DHT"
authMethod = "token"
authToken1 = "NeVIAy2K16H)d9sXvz"

deviceType2 = "Sensor1"
deviceId2 = "Soil_moisture"
authToken2= "zwr247qk1Xca0w?QEs"

deviceType3 = "Actuator"
deviceId3 = "Water_pump"
authToken3= "Pze?D!@FjZeAtfMB4q"

deviceType4= "Sensor2"
deviceId4= "PIR"
authToken4= "i-yXXf?FnB011nEycG"

deviceType5= "Sensor3"
deviceId5="Ultrasonic"
authToken5="e&QzDxiHpQ4GaRyPGJ"

deviceType6="Detector"
deviceId6="Camera"
authToken6="f7LMx6-a(uhdnDcKa-"

deviceType7="Output"
deviceId7="LED"
authToken7="qJIBVJHP9@Ih18@CK3"

deviceType8="Actuator"
deviceId8="Speaker"
authToken8="TitkHSlzaTy_gxEtve"

# Initialize GPIO
```

```
Python 3.7.0 (v3.7.0:1bf9cc5093, Jun 27 2018, 04:59:51) [MSC v.1914 64 bit (AMD64)] on win32
Type "copyright", "credits" or "license()" for more information.
>>>
======= RESTART: C:\Users\hp\OneDrive\Desktop\opencvtrial\opentrial.py =======
2022-11-17 18:35:21,833   ibmiotf.device.Client      INFO    Connected successfully: d:21daf5:Sensor:DHT
2022-11-17 18:35:23,161   ibmiotf.device.Client      INFO    Connected successfully: d:21daf5:Sensor1:Soil_moisture
2022-11-17 18:35:25,417   ibmiotf.device.Client      INFO    Connected successfully: d:21daf5:Actuator:Water_pump
2022-11-17 18:35:26,859   ibmiotf.device.Client      INFO    Connected successfully: d:21daf5:Sensor2:PIR
2022-11-17 18:35:28,069   ibmiotf.device.Client      INFO    Connected successfully: d:21daf5:Sensor3:Ultrasonic
2022-11-17 18:35:29,436   ibmiotf.device.Client      INFO    Connected successfully: d:21daf5:Detector:Camera
2022-11-17 18:35:30,536   ibmiotf.device.Client      INFO    Connected successfully: d:21daf5:Output:LED

2022-11-17 18:35:31,653   ibmiotf.device.Client      INFO    Connected successfully: d:21daf5:Actuator:Speaker

Published Temperature   =  40 C Humidity   =  0 % to IBM Watson

Published Soil_moisture =  26 % to IBM Watson

movement is detected
ultrasonic sensor turned ON
Published PIR output    =  1  to IBM Watson
Published distance  =  280 m to IBM Watson

Published Temperature   =  19 C Humidity   =  18 % to IBM Watson

Published Soil_moisture =  34 % to IBM Watson

movement is detected
ultrasonic sensor turned ON
Published PIR output    =  1  to IBM Watson
Published distance  =  446 m to IBM Watson

Published Temperature   =  13 C Humidity   =  54 % to IBM Watson

Published Soil_moisture =  57 % to IBM Watson

Published Temperature   =  45 C Humidity   =  42 % to IBM Watson
```


opentrial.py - C:\Users\hp\OneDrive\Desktop\opencvtrial\opentrial.py (3.7.0)
File Edit Format Run Options Window Help
Python 3.7.0 Shell
File Edit Shell Debug Options Window Help
Ln: 39 Col: 0
Target Image
elephant 1.0
elephant 0.99
Ln: 7 Col: 0

```
Published Soil_moisture =  0 % to IBM Watson

Water pump is turned ON

Published Temperature   =  11 C Humidity   =  36 % to IBM Watson

Published Soil_moisture =  1 % to IBM Watson

Water pump is turned ON

movement is detected
ultrasonic sensor turned ON
Published PIR output    =  1  to IBM Watson
Published distance  =  431 m to IBM Watson

Published Temperature   =  15 C Humidity   =  35 % to IBM Watson

Published Soil_moisture =  41 % to IBM Watson

Published Temperature   =  44 C Humidity   =  82 % to IBM Watson

Published Soil_moisture =  15 % to IBM Watson

Water pump is turned ON

Published Temperature   =  8 C Humidity   =  55 % to IBM Watson

Published Soil_moisture =  15 % to IBM Watson

Water pump is turned ON

movement is detected
ultrasonic sensor turned ON
Published PIR output    =  1  to IBM Watson
Published distance  =  7 m to IBM Watson

camera turned on
```

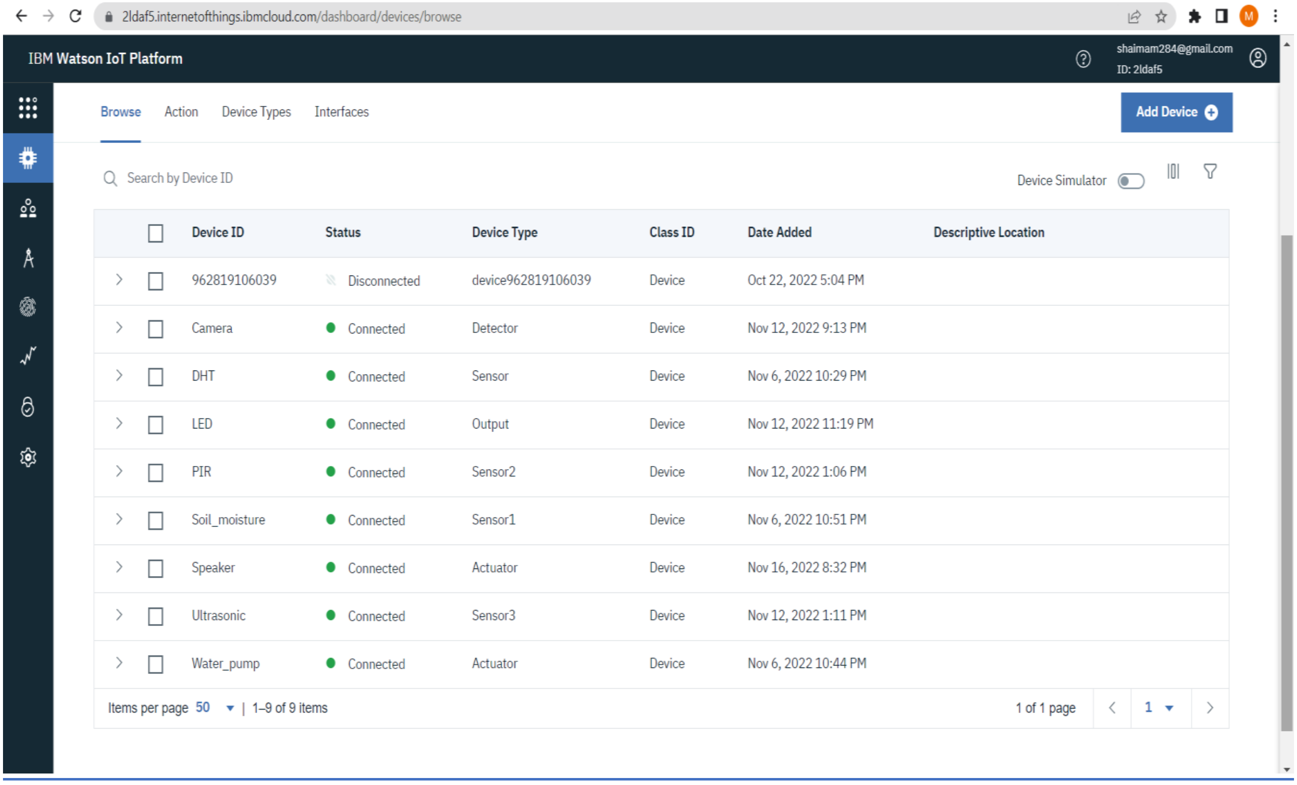
```
authToken8="TitkHSlzaTy_gxEtve"

# Initialize GPIO
```


opentrial.py - C:\Users\hp\OneDrive\Desktop\opencvtrial\opentrial.py (3.7.0)
File Edit Format Run Options Window Help
Python 3.7.0 Shell
File Edit Shell Debug Options Window Help
Ln: 39 Col: 0

```
Published Temperature   =  15 C Humidity   =  35 % to IBM Watson

Published Soil_moisture =  41 % to IBM Watson

Published Temperature   =  44 C Humidity   =  82 % to IBM Watson

Published Soil_moisture =  15 % to IBM Watson

Water pump is turned ON

Published Temperature   =  8 C Humidity   =  55 % to IBM Watson

Published Soil_moisture =  15 % to IBM Watson

Water pump is turned ON

movement is detected
ultrasonic sensor turned ON
Published PIR output    =  1  to IBM Watson
Published distance  =  7 m to IBM Watson

camera turned on

Alert! detected animal is elephant
LED is turned ON
Speaker is turned ON
Threat allert is send to IBM Watson
Published Intruded Animal is elephant to IBM Watson
Published Temperature   =  25 C Humidity   =  16 % to IBM Watson

Published Soil_moisture =  15 % to IBM Watson

Water pump is turned ON

Published Temperature   =  19 C Humidity   =  16 % to IBM Watson

Published Soil_moisture =  2 % to IBM Watson
```

```
authToken8="TitkHSlzaTy_gxEtve"

# Initialize GPIO
```

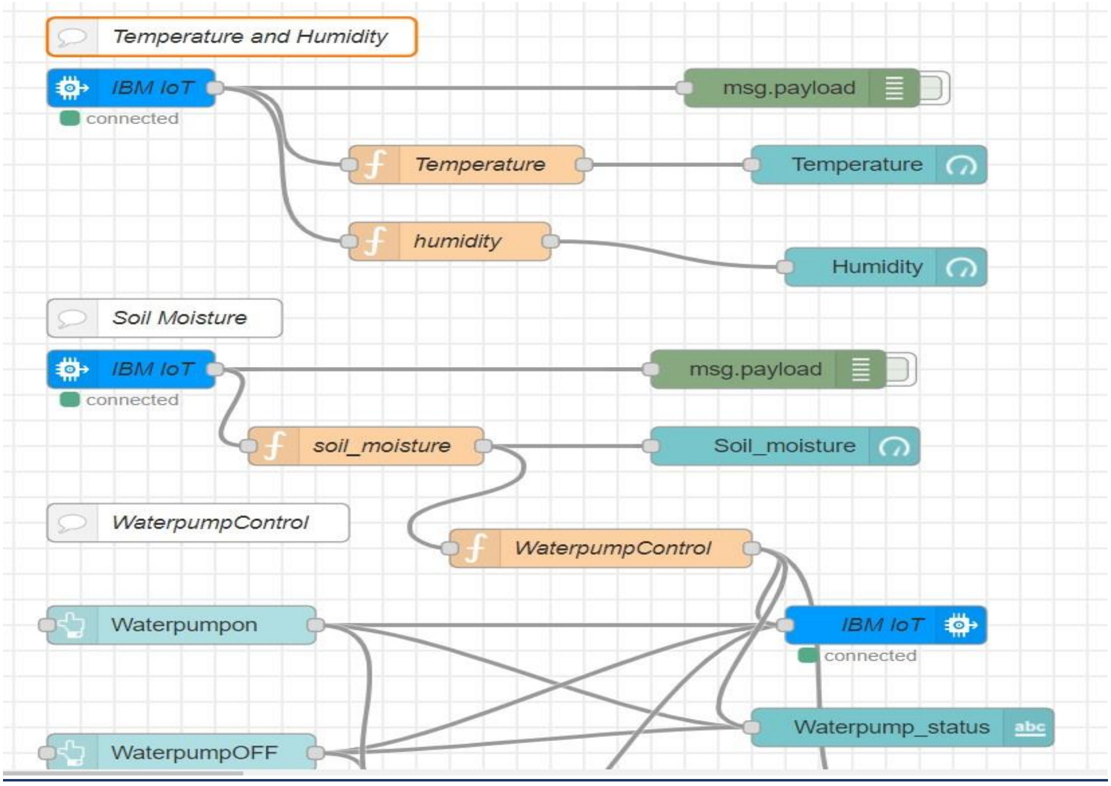
IBM Watson Output:

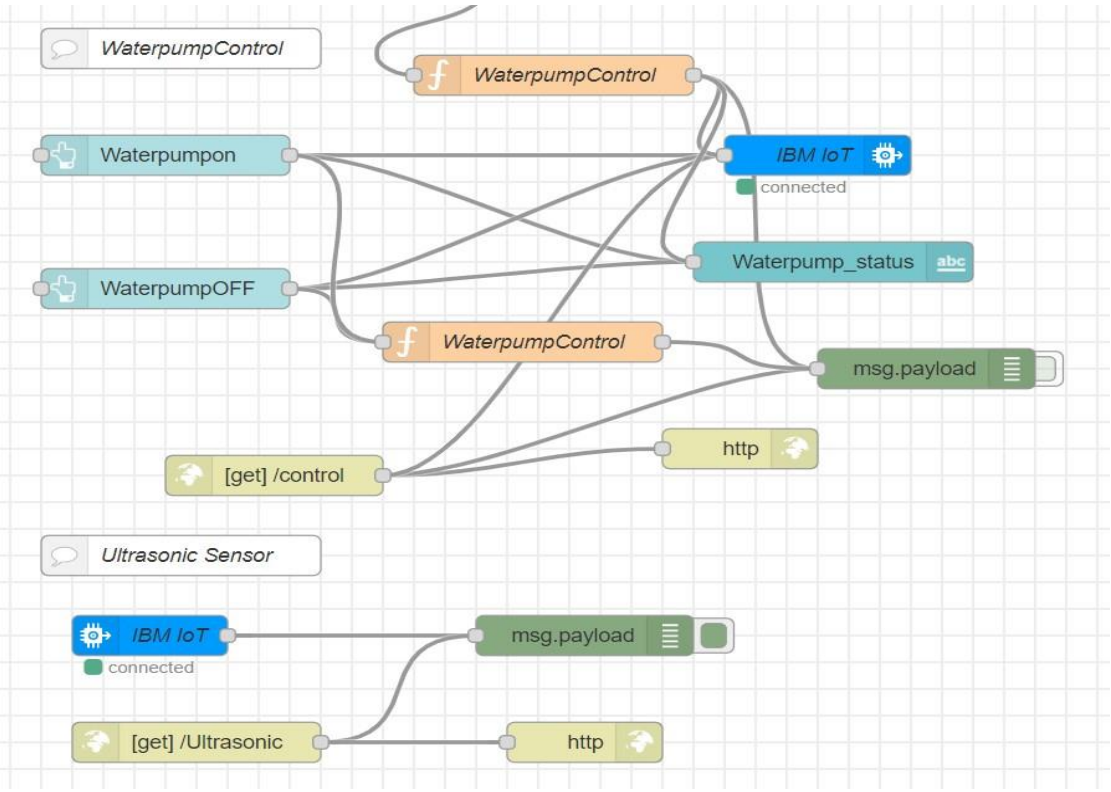


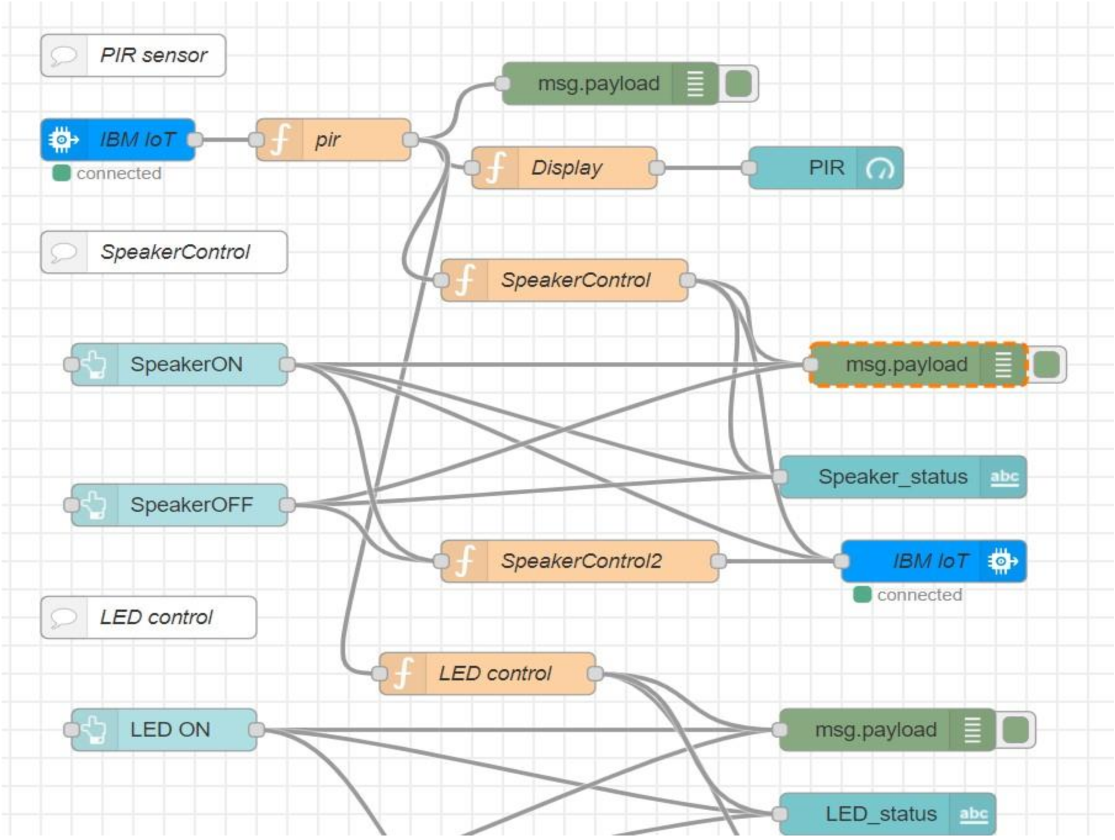
	Device ID	Status	Device Type	Class ID	Date Added	Descriptive Location
□	962819106039	Disconnected	device962819106039	Device	Oct 22, 2022 5:04 PM	
□	Camera	● Connected	Detector	Device	Nov 12, 2022 9:13 PM	
□	DHT	● Connected	Sensor	Device	Nov 6, 2022 10:29 PM	
□	LED	● Connected	Output	Device	Nov 12, 2022 11:19 PM	
□	PIR	● Connected	Sensor2	Device	Nov 12, 2022 1:06 PM	
□	Soil_moisture	● Connected	Sensor1	Device	Nov 6, 2022 10:51 PM	
□	Speaker	● Connected	Actuator	Device	Nov 16, 2022 8:32 PM	
□	Ultrasonic	● Connected	Sensor3	Device	Nov 12, 2022 1:11 PM	
□	Water_pump	● Connected	Actuator	Device	Nov 6, 2022 10:44 PM	

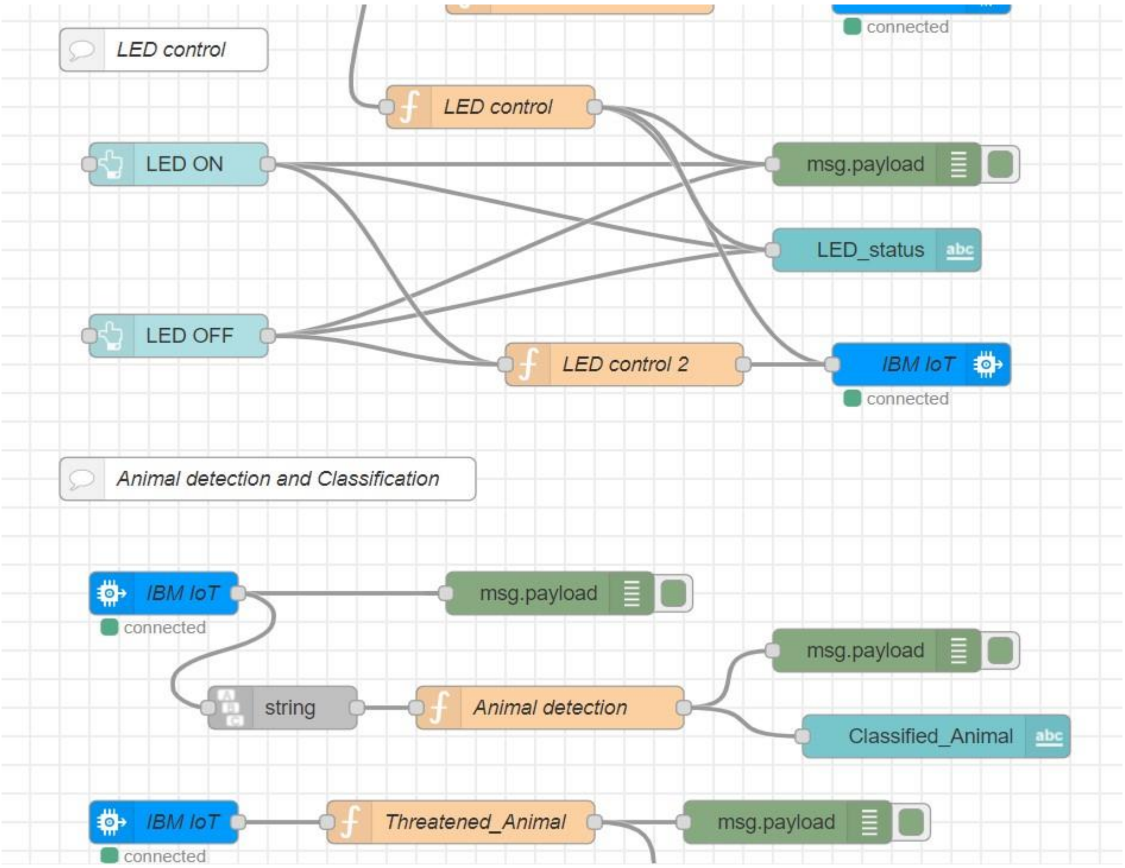
Items per page 50 | 1–9 of 9 items 1 of 1 page 1

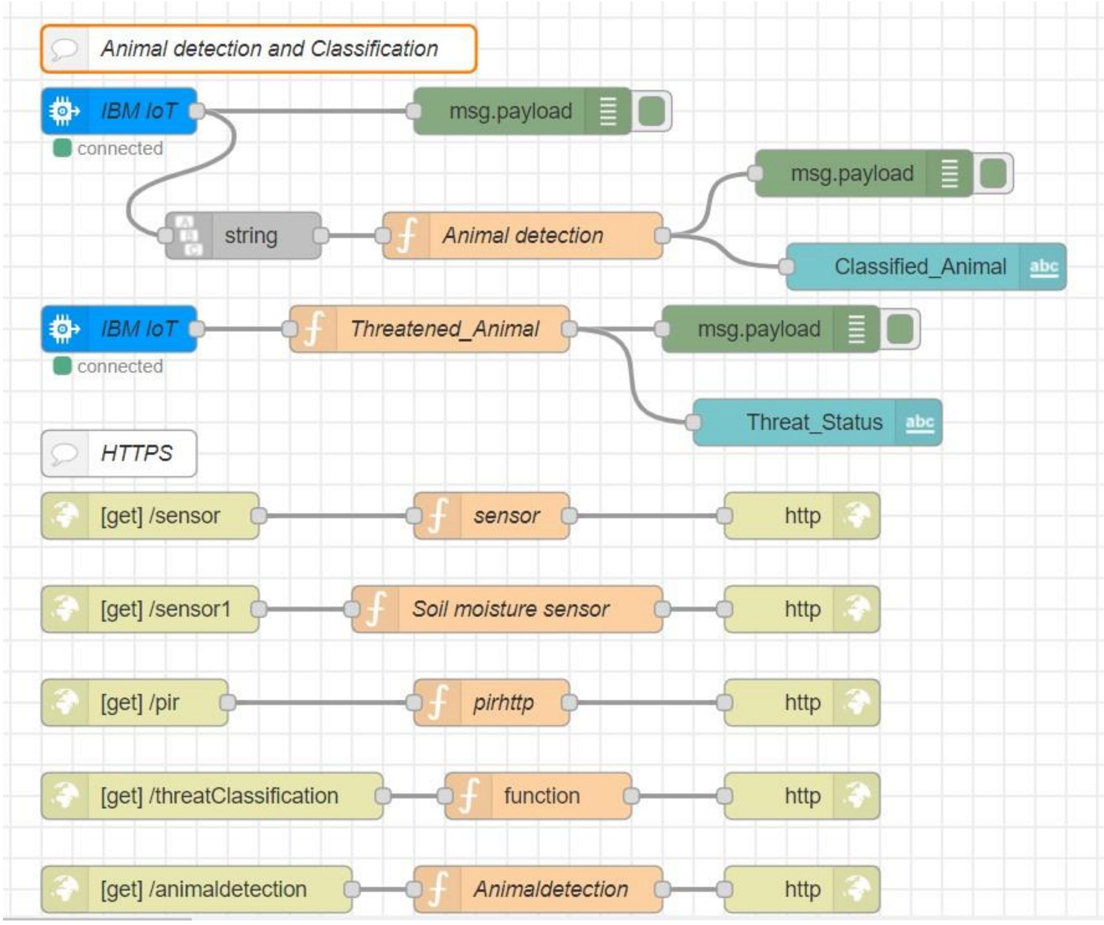
Node Red Flow:

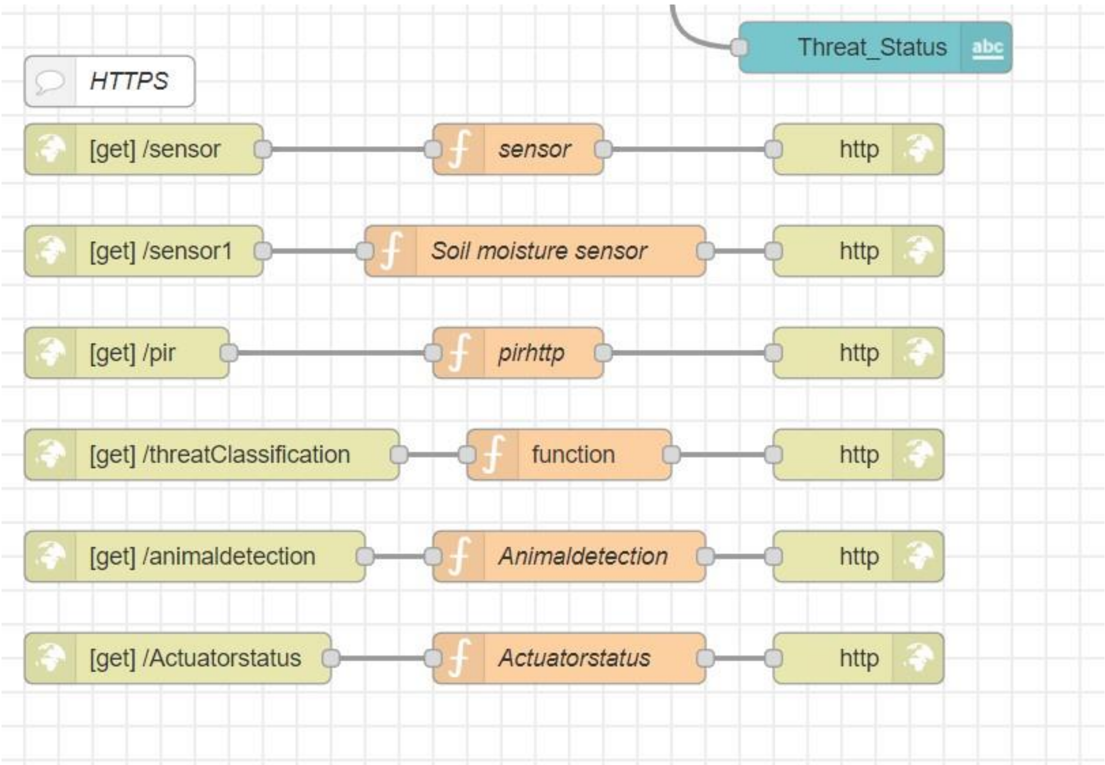




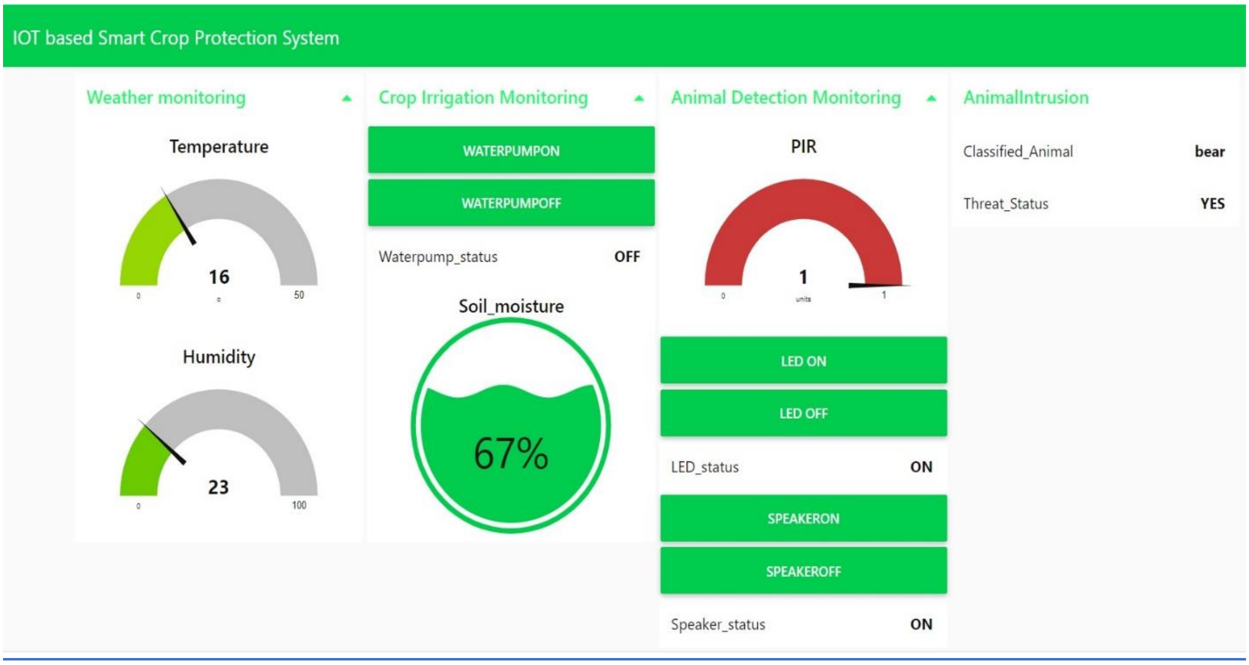

PIR sensor
msg.payload
IBM IoT
connected
pir
Display
PIR
SpeakerControl
SpeakerControl
SpeakerON
msg.payload
Speaker_status
abc
SpeakerOFF
SpeakerControl2
IBM IoT
connected
LED control
LED control
LED ON
msg.payload
LED_status
abc


connected
LED control
LED control
LED ON
msg.payload
LED_status
abc
LED OFF
LED control 2
IBM IoT
connected
Animal detection and Classification
IBM IoT
connected
msg.payload
msg.payload
string
Animal detection
Classified_Animal
abc
IBM IoT
connected
Threatened_Animal
msg.payload


Animal detection and Classification
IBM IoT
connected
msg.payload
string
Animal detection
msg.payload
Classified_Animal
abc
IBM IoT
connected
Threatened_Animal
msg.payload
Threat_Status
abc
HTTPS
[get] /sensor
sensor
http
[get] /sensor1
Soil moisture sensor
http
[get] /pir
pirhttp
http
[get] /threatClassification
function
http
[get] /animaldetection
Animaldetection
http


Threat_Status
abc
HTTPS
[get] /sensor
sensor
http
[get] /sensor1
Soil moisture sensor
http
[get] /pir
pirhttp
http
[get] /threatClassification
function
http
[get] /animaldetection
Animaldetection
http
[get] /Actuatorstatus
Actuatorstatus
http

Node Red Web UI :



IOT based Smart Crop Protection System

Weather monitoring

Crop Irrigation Monitoring

Waterpump_status OFF

Animal Detection Monitoring

LED_status ON

Speaker_status ON

AnimalIntrusion

Classified_Animal bear

Threat_Status YES