| TEAM ID | PNT2022TMID23804 |
|---|---|
| TEAM MEMBERS | DEVA DHARSHINI E, BOOMIKA M, DEEPHA M, JYOTHINAGARAM SHALINI |


# IOT BASED CROP PROTECTION SYSTEM FOR AGRICULTURE


## ABSTARCT

Agriculture is considered to be the backbone of the economy. But nowadays agricultural lands are being destroyed by animals and also by natural calamities. This leads to huge losses to the farmers. It is not possible for the farmers to monitor the entire fields and guard it. So,we have proposed IoT based crop protection system for agriculture. This is an Arduino based system. This system uses some IoT based sensors to detect wild animals and also to protect the crops from natural calamities. In such a case the sensor signals the Arduino is taken to the action. This ensures complete safety of crops from animals as well as natural hazards thus protecting the farmer's loss. This paper provides a comprehensive review of various methods using IoT to help the farmers, to protect their crops and to prevent their loss.



*Keywords:* Agriculture, crop protection, Arduino, sensors, IoT


## 1. INTRODUCTION

IOT based smart crop protection system, In this crop protection system we protect the crops from both animals and human beings. It is used to protect the farm from the theft too. The main motive of our project is to help the farmers from the loss of their crops. This project will help the farmers from the loss. This project works on battery so that it can be easily portable. It is used to indicate the status of the farms by a message. Here we are using Arduino UNO, Nodemcu, LCD, temperature sensor, humidity sensor, motion detector, soil moisture sensor, Solar panel, solar charge converters and SD card. The whole project is work on 12v dc power supply. We are solar panel to charge the battery. NodeMCU is used to send the alert message to the respective mobile number(Farmer's mobile). Temperature sensor is used to measure the temperature of the animals or human beings. Humidity sensor is used to measure the humidity level of the atmosphere. Soil moisture sensor is used to measure the moisture content in the soil. Arduino UNO is used to process the sensor data. Solar panel is a renewable energy resources. Boost converter is used to provide constant voltage and current. SD module is used to store a specified sound to fear the animals. These are the components here we are using. We use the most commonly available in our project. We hope this project will help farmers to protect their farms from animals as well as from human beings.

## 2. LITERATURE SURVEY

A literature review is a survey of scholarly sources on a specific topic. It provides an overview of current knowledge, allowing you to identify relevant theories, methods and gaps in the existing research.

A good literature review doesn't just summarize sources but analyses, synthesizes and critically evaluates to give a clear picture of the state of knowledge on the subject.

### 2.1. Crop Protection From Animals Using Cnn

**Authors:** T. Sandeep , B. Manushree, S. Rahul, T. Bharath

**Year:** 2022

#### 2.1.1. Objective

The paper aims in implementation of Smart Plant protection to protect crops from pests.

#### 2.1.2. Proposed System

In this system, the most actively researched in smart farming are highly specialized sensor devices, automated machines and vehicles, remote sensing by artificial satellites, image analysis and data mining of legacy agricultural data. These research outcomes have been increasing rapidly in recent times. In our group as well, AI-driven smart plant protection technology including image analysis, drone work, utilization of satellite photographs, chemical composition analysis and genetic information analysis, are studied and developed for various diseases including citrus greening. On the other hand, biochemical research on pests, which is a conventional agricultural study, may be regarded as a sober and muddy work. However, as shown in this paper, the results of long-standing research will eventually be used as analytical data in smart agriculture. Accumulation of experimental data is increasingly needed and contributes to smart and innovative agriculture.

### 2.2. Development And Application Of An Intelligent Plant Protection Monitoring System

**Authors:** Shubo Wang, Peng Qi, Wei Zhang and Xiongkui He

**Year:** 2022

#### 2.2.1. Objective:

The paper is about need of modern agriculture to accurately grasp the information of farmland diseases and pests, this paper proposes an intelligent plant protection system.

#### 2.2.2. Proposed System:

The pest detection kit serves plant protection through “sensing AI” technology to realize the accurate collection and mobile monitoring of plant information and data. The equipment has been loaded with more than 500 users in Qinghai, Jiangxi, Anhui, Zhejiang, Shanxi, and other places in China. The suite provides users with tools and means for plant protection image and micro environment acquisition to help users implement more refined plant protection system. Through artificial intelligence to identify diseases and pests of crops, the plant protection operation is easier, more accurate, and more efficient, so anyone can have a plant protection expert with him. At this stage, this project only identifies the main diseases and pests of wheat, corn, rice, and other major field crops and continues to increase the sample types to realize more crop disease and pest monitoring, which is the further research direction of intelligent agricultural monitoring.

### 2.3. Smart Crop Protection Systsem

**Authors:**Mohit Korche , Sarthak Tokse , Shubham Shirbhate , Vaibhav Thakre, S. P. Jolhe

**Year:**2021

#### 2.3.1. Objective:

This article reviews smart crop protection system using sensors, microcontroller and GSM module.

#### 2.3.2. Proposed System:

The problem of crop damage by wild animals and fire has become a major social issue in now a days. It requires urgent attention as no effective solution exists till date for this problem. Thus, this project carries a great social initiative as it aims to address this problem. This project will help farmers in protecting theirs farms 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 help them in achieving better crop yields thus leading to their economic growth.

### 2.4.Smart Crop Protection System From Animals Using Pic

**Authors:**Mukesh Mahajan , Kiran Patil , Vishesh Geete , Prasad Kondhare

**Year:**2020

#### 2.4.1. Objective:

This paper aims at propose a automatic crop protection system from animals. This is a microcontroller based system using PIC microcontroller. This system uses a motion sensor to detect wild animals approaching near the field.

### 2.4.2. Proposed System:

The problem of crop canalization by wild animals has become a major social problem in current time. It requires immediate attention as no effective solution exists till date for this problem. Thus this project carries a great social relevance as it aims to address this problem. This project will help farmers in protecting their 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 help them in achieving better crop yields.

## 3. HARDWARE DESCRIPTION

### 3.1. Arduino Uno

Here the arduino UNO is used to process the sensor data. Arduino UNO has 14 digital pins, 6 analog pins and power supply. It has one reset pin.

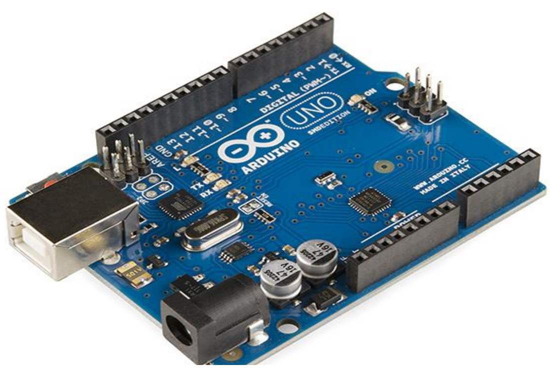


Fig. 3.1. Arduino Uno

### 3.1.1 Pin Description

- Vin – Input voltage pin. It is used to give input from an external device.
- 5v – The arduino UNO board normally use 5V power supply.
- GND – This is used to ground the Arduino UNO.
- DIGITAL PINS – PIN 0 – PIN 13 are digital pins. Used for digital input and digital output.

- ANALOG PINS – PIN A0 – PIN A5. Used for analog input and analog output.
- SERIAL PINS – UART pins are called as serial pins. Used for communication between arduino uno and other devices.

### 3.2. NodeMCU

NodeMCU is used to send the message to the cloud. It is an open source platform. It can connect objects and using wi-fi protocol the data can be transferred.

### 3.2.1. Pin Configuration

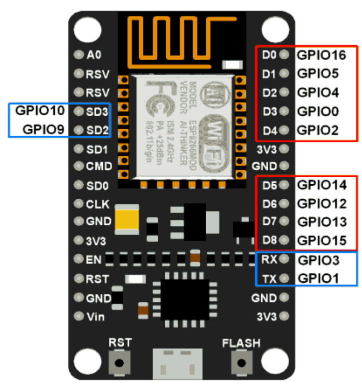


Fig. 3.2. NodeMCU

#### 3.2.1.1. Power Pin:

- MICRO-USB – USB port can power the Nodemcu.
- 3.3V – to power the board, 3.3v can regular be supplied.
- GND – ground pins
- Vin – External power supply

#### 3.2.1.2. Control Pins

EN & RX - The microcontroller can be reset by the pin and button.

#### 3.2.1.3. Analog Season:

A0 – Used to measure the Analog volage

#### 3.2.1.4. GPIO Pins

GPIO 1 TO GPIO 16 – There are 16 general input/output pins in nodemcu

#### 3.2.1.5. SPI Pins

SD1,CMD,SD0,CLK – Nodemcu has 4 pins available for SPI communication

#### 3.2.1.6. UART Pins

RXD0,TXD0,RXD2,TXD2 – Nodemcu has 2 UART interfaces. UART1(RXD0&TXD0) and UART2(RXD2&TXD2). UART1 is used to upload the program.

#### 3.2.1.7. I2C Pins:

NodeMCU has I2C functionality support but due to the internal functionality of these pins, you have to find which pin is I2C.

## 3.3. Temperature Sensor

Here, Temperature sensor is used to detect the temperature of human beings and animals. Temperature sensor works by providing readings via electric signal. It consists of two metals that will generate electric signal when the temperature changes occurs by measuring the voltages across the terminals. When the voltages increases, temperature also increases.

### 3.3.1. Pin Configuration

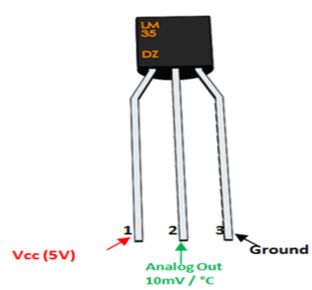


Fig. 3.3. Temperature sensor

#### 3.3.1.1 VCC

Input voltage

#### 3.3.1.2. Analog Out

There will be increase in 10mV for raise of every 1°C

#### 3.3.1.3. Ground

Connected to the ground

### 3.4. Humidity Sensor

Here, Humidity sensor is used to measure the humidity of the atmosphere. It will detect the changes that alter electrical current or temperature in the air.

Three basic types of humidity sensor:

1) Capacitive
2) Resistive
3) Thermal

These three will monitor the minute changes in the environment to calculate the humidity in the air.

#### 3.4.1. Pin Configuration

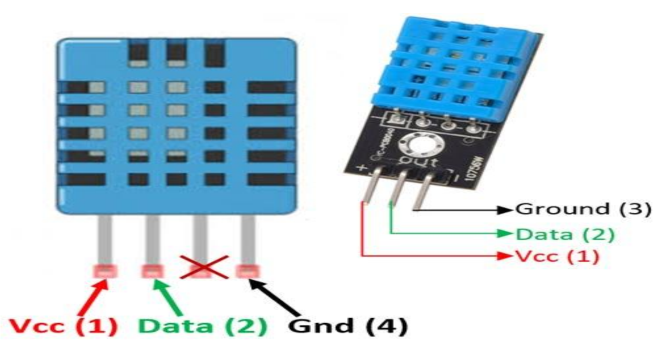


Fig 3.4. Humidity Sensor

#### 3.4.1.1. VCC

DC power supply between 3.3v to 5v.

#### 3.4.1.2. Data

Digital output pin.

#### 3.4.1.3. GND

Ground

### 3.5. Soil Moisture Sensor

The soil moisture sensor is one kind of sensor used to gauge the volumetric content of water within the soil.

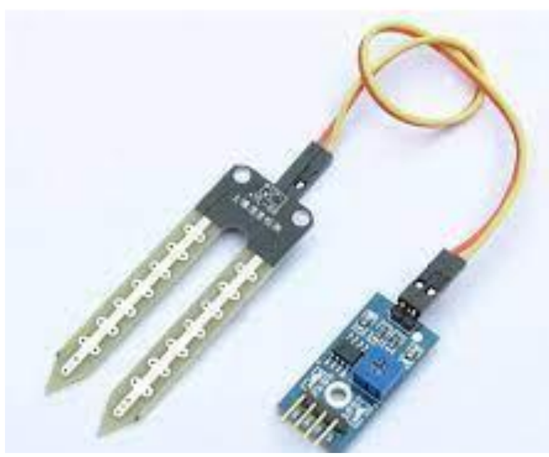

Fig. 3.5. Soil Moisture Sensor

### 3.6. Motion Detection Sensor

A passive infrared sensor detects body heat (infrared energy) by looking for changes in temperatures. This is the most-widely-used motion sensor in many security systems.

Fig. 3.6. PIR sensor

### 3.7. Solar Panel

Solar panels are those devices which are used to absorb the sun's rays and convert them into electricity or heat.

Fig. 3.6. Solar panel

### 3.8. SD Module

It is used to store the collected data. If motion is detected, a sound will be produced. That sound will be generated automatically every time using this SD module. This sound will be used to fear the animals, whenever they are entering the farm.

Fig. 3.7. SD Module

# 4. SOFTWARE DESCRIPTION

## 4.1. Python IDLE 3.7.0

Every Python installation comes with an Integrated Development and Learning Environment, which you'll see shortened to IDLE or even IDE. These are a class of applications that help you write code more efficiently. While there are many IDEs for you to choose from, Python IDLE is very bare-bones, which makes it the perfect tool for a beginning programmer.

Python IDLE comes included in Python installations on Windows and Mac. If you're a Linux user, then you should be able to find and download Python IDLE using your package manager. Once you've installed it, you can then use Python IDLE as an interactive interpreter or as a file editor.

### 4.1.1. How to Use the Python IDLE Shell 3.7 ?

The shell is the default mode of operation for Python IDLE. When you click on the icon to open the program, this is a blank Python interpreter window. You can use it to start interacting with Python immediately.

### 4.1.2. FEATURES:

The major features are

a. PEP 539, new C API for thread local storage
b. PEP 545, Python documentation translations
c. New documentation translations: Japanese, French & Korean
d. PEP 552, Deterministic pyc files
e. PEP 553,Built in breakpoints()
f. PEP 557, Data classes
g. PEP 560,Core support for typing module and generic types
h. PEP 562, Customization of access to module attributes
i. PEP 563, Postponed evaluation of annotations

j. PEP 564, Time functions with nanosecond resolution
k. PEP 565, Improved deprecation warning handling
l. PEP 567, Context variables
m. PEP 568, legacy C locale coercion
n. PEP 540, forced UTF-8 runtime mode
o. The insertion order preservation nature of dict objects is now an official part of the Python language spec.
p. Notable performance improvements in many areas.

In our project we use Python programming, So we use Python IDLE to run the code.

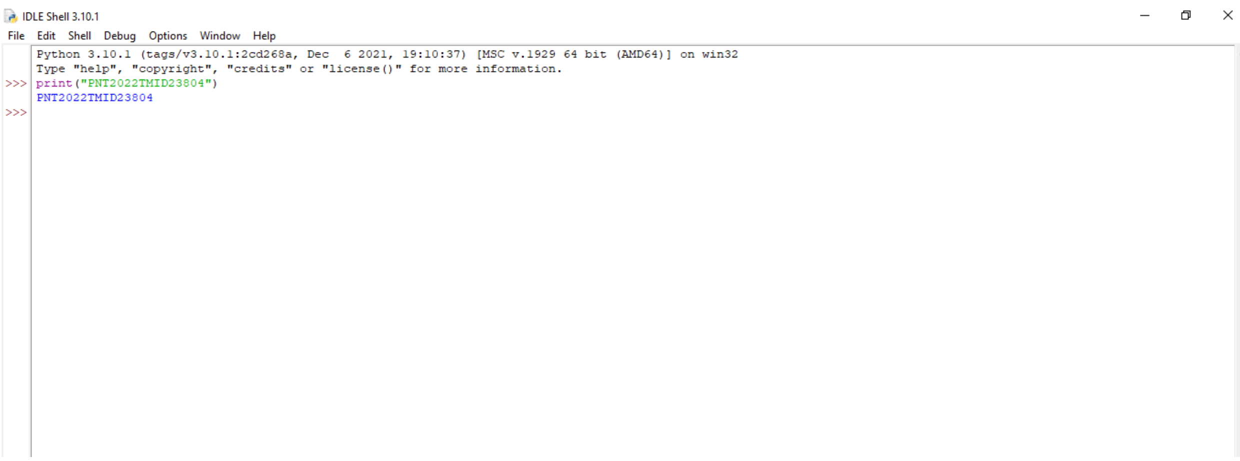


Fig. 4.1. Python IDLE

## 4.2. IBM cloud

Using cloud computing technique, large data packages generated by the IoT devices can be transported through the Internet. Here we have used IBM cloud. To do the project we need to have an IBM account. After creating the account successfully, it will be redirected to the dashboard page of the IBM cloud account. Then we need to login with various IBM IoT platforms.

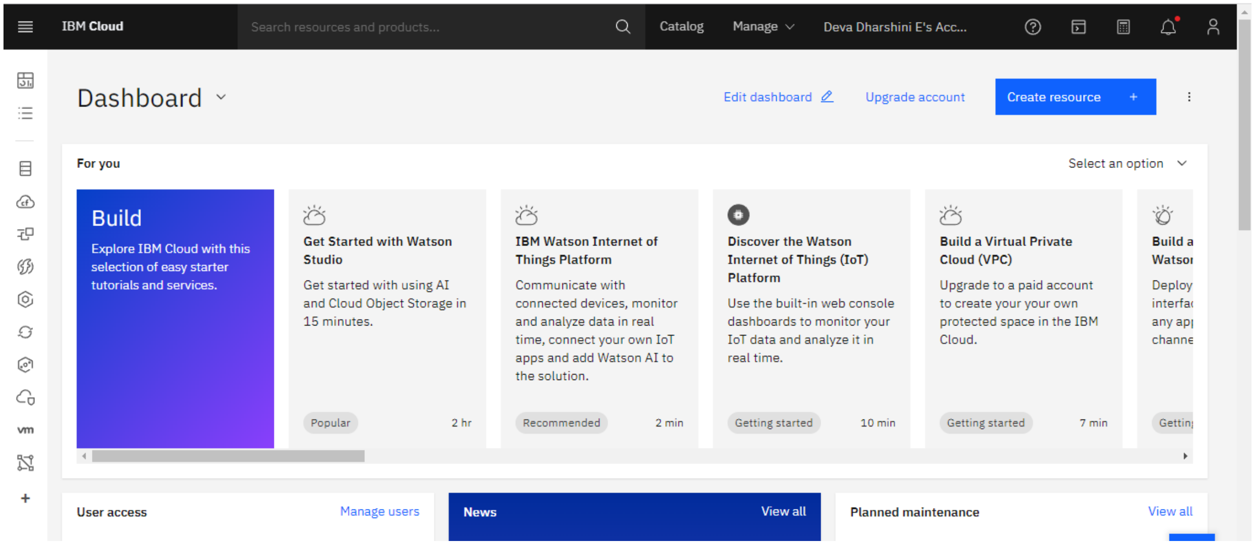


Fig. 4.2. IBM cloud page

### 4.2.1. IBM Watson IoT Platform

An IoT platform is a multilayer technology that integrates various technologies like device management, big data, machine learning, Complex Event Processing (CEP), Artificial Intelligence (AI) and provides a platform for rapid development of secured, scalable, reliable and sustainable IoT projects.

IBM Watson IoT platform is a fully managed, cloud-hosted service designed to make it simple to derive value from your Internet of Things devices. It provides capabilities such as device registration, connectivity, control, rapid visualization and storage of Internet of Things data. The IBM Watson Internet of Things Platform contains a device simulator that can be used to post data without a real device being connected. The simulator can be used to create data for multiple devices and device types, it can also post data for a real, registered device.

Here, we have created devices in IBM Watson IoT platform. The data collected from the IoT sensors will be displayed in the devics, which we have created in the Watson IoT platform.

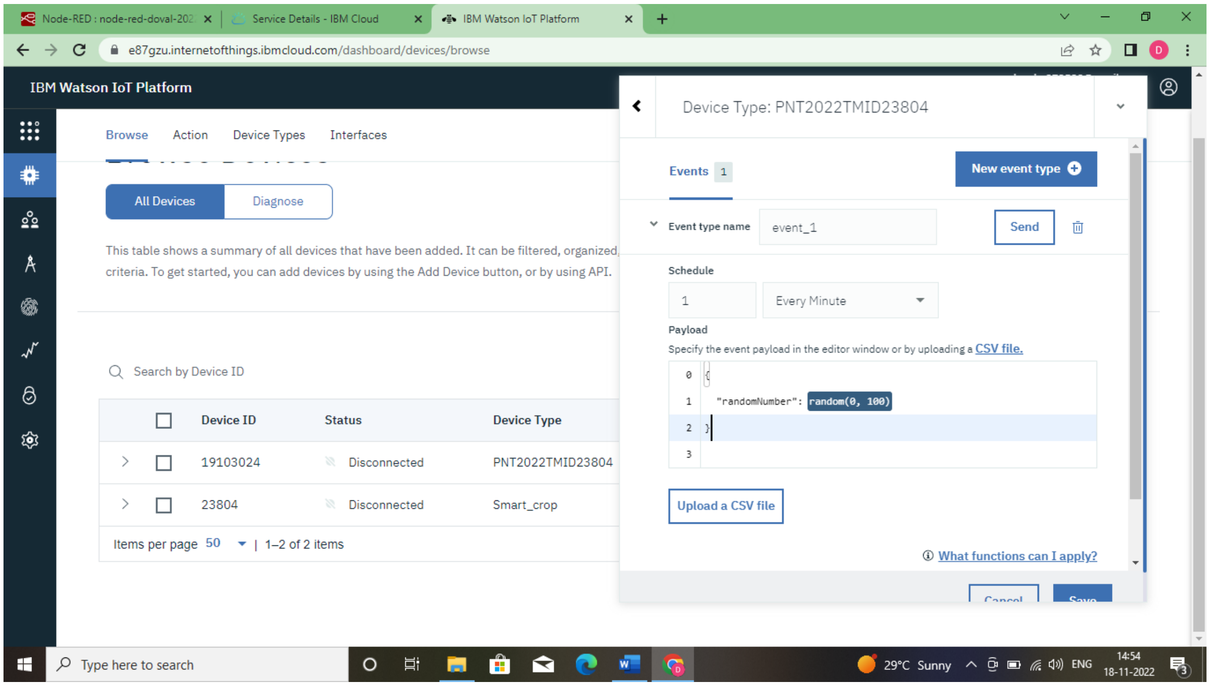


Fig. 4.3. IBM Watson IoT Platform

### 4.2.2. Watson Sensor simulator

The Watson Sensor simulator can be used to create data for multiple devices and device type, it can also post data for a real, registered device. The simulator is useful for testing when a real device is not available or for testing conditions which are difficult to replicate using a real device, such as fault conditions.

Using this simulator in Bluemix IBM Watson IoT platform a developer can simulate new designed devices or existing already registered devices.

## 4.3. Node-RED

Node-RED is a programming tool for wiring together hardware devices, APIs and online services in new interesting ways. It provides a browser-based editor that makes it esy to wire together flows using the wide range of nodes in the palette that can be deployed to its runtime in a single click. A built-in library allows us to save useful functions, templates or flows for re-use.

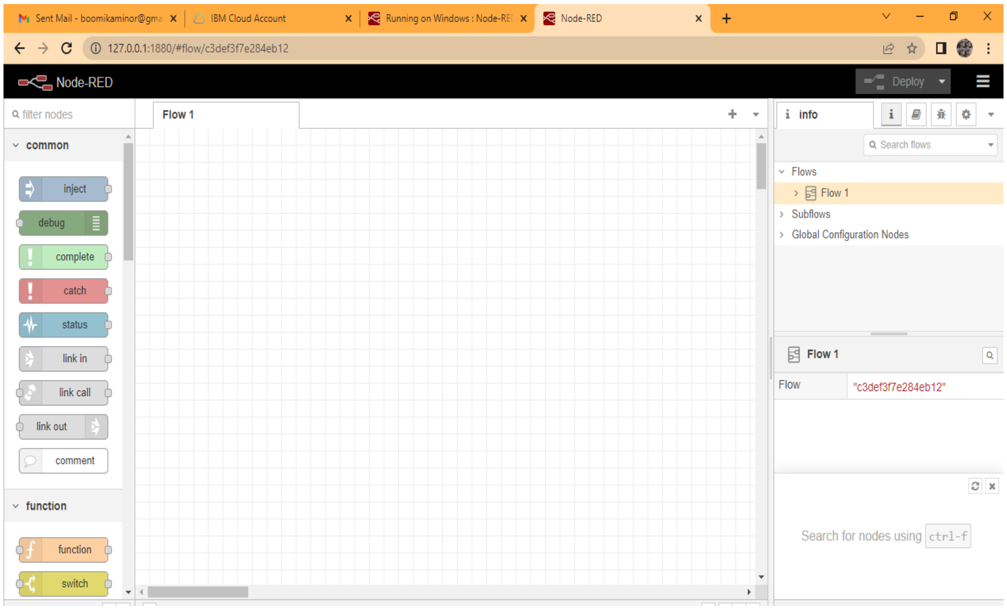


Fig. 4.4. Node-RED

## 4.4. MIT APP Inventor

MIT App Inventor is an intuitive, visual programming environment that allows to build fully functional apps for smart phones and tablets.

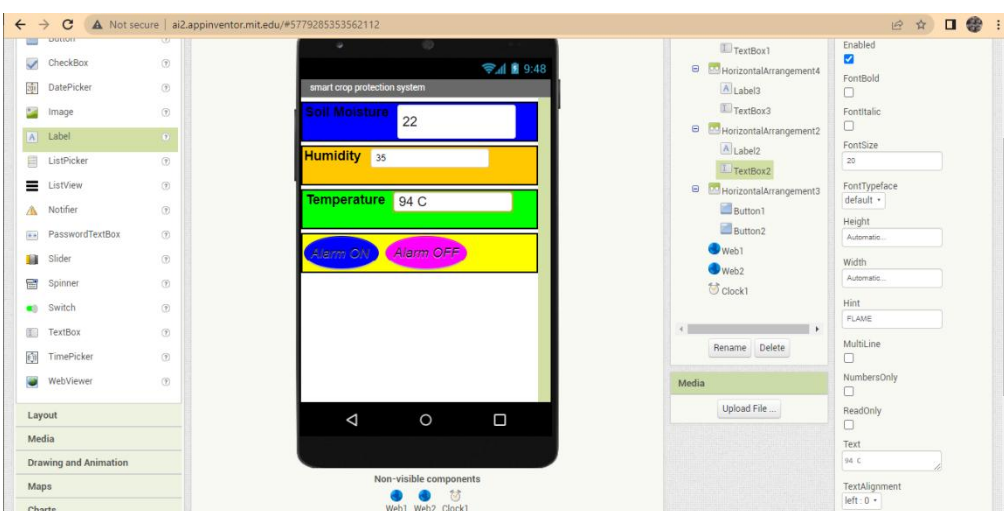


Fig. 4.5. MIT APP Inventor

## 5. SIMULATION

### 5.1. Block diagram explanation

Here, Arduino is used as microcontroller. The sensors like temperature sensor, humidity sensor, PIR sensor, soil moisture sensor have been used. The sensed data will be sent to the microcontroller. Solar panel is connected, which acts as the energy source. Boost converter is connected for energy conversion. Node-MCU is used to send the sensed data to the cloud.

Using these sensed data, the farms will be monitored. If anything in the farm is wrong, then the farmers will be known that thing and hence the crops in the farm will be protected.

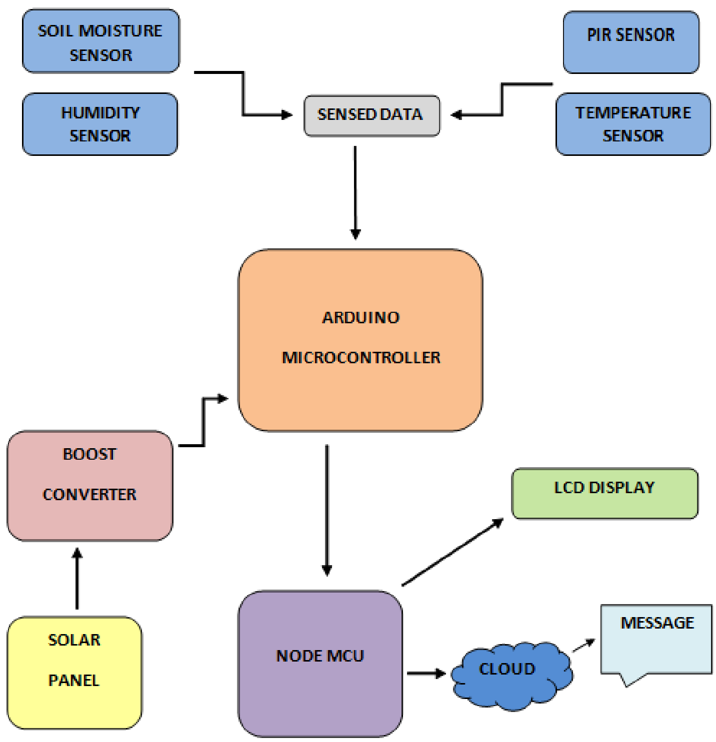


Fig. 5.1. Block diagram

### 5.2 Simulation in Node-RED

First, we need to created Node-RED using IBM app development. Then we have linked our devices, which are created in the IBM Watson IoT platform to the Node-RED.

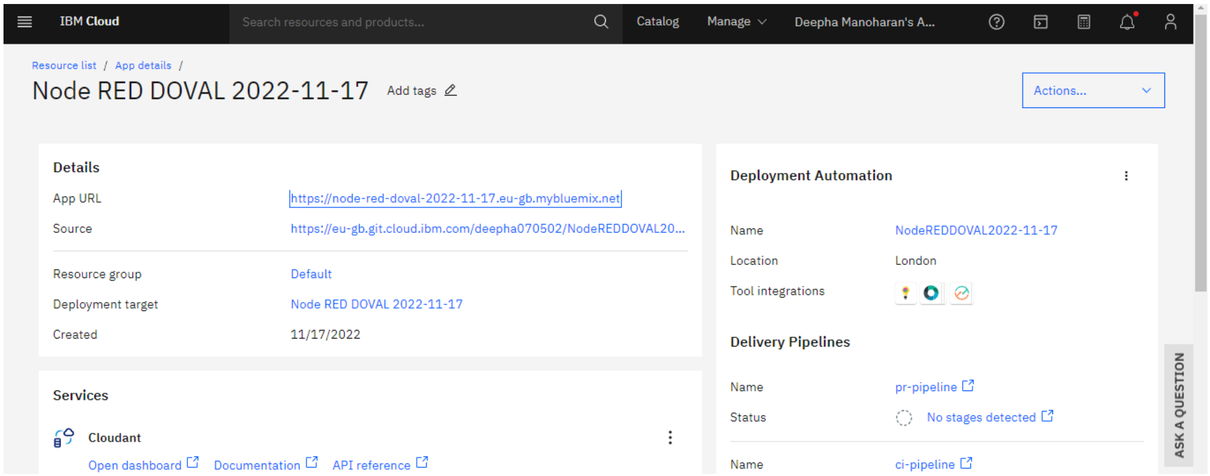


Fig. 5.2. creation of Node-RED

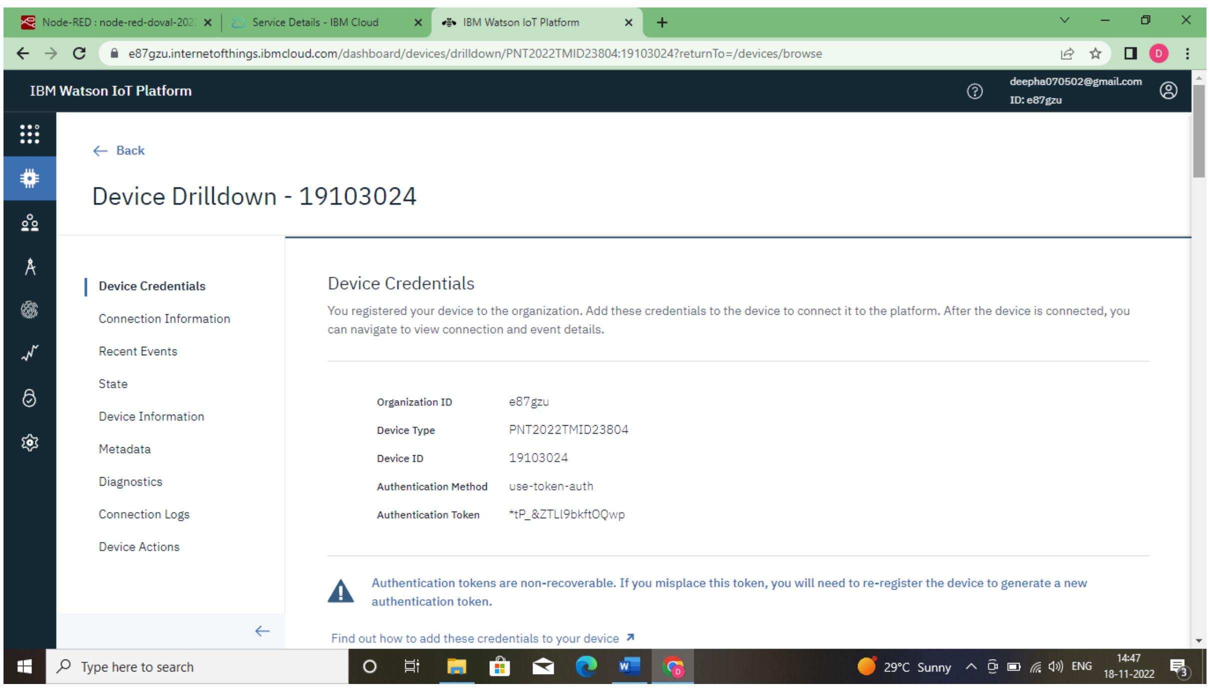


Fig. 5.3. Device credentials

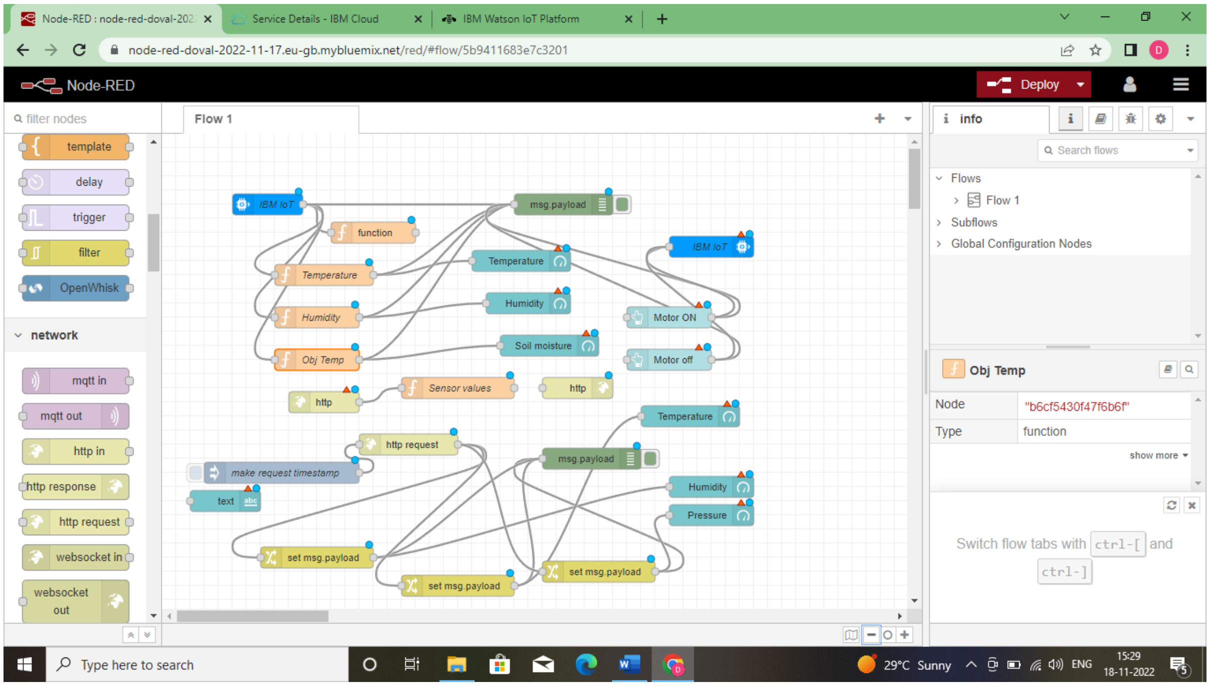


Fig. 5.4. Flow diagram

## 5.3. Simulation in python IDLE

We need python code for simulation. For that, we are using python IDLE software.

*untitled*

File Edit Format Run Options Window Help

```
import ibmiotf
import time
import sys
import ibmiotf.device
organization = "23804"
deviceType = "PNT2022TMID23804"
deviceId = "19103024"
authMethod = "token"
authToken = "RVc_rdmvj1Nns27@1a"
def myCommandCallback(cmd):
    print("Command received: %s" % cmd.data)
    if cmd.data['command']=='motoron':
        print("MOTOR ON IS RECEIVED")
    elif cmd.data['command']=='motoroff':
        print("MOTOR OFF IS RECEIVED")
    if cmd.command == "setInterval":
        print("Error - command is missing required information: 'interval'")
    else:
        interval = cmd.data['message']
    print(output)
    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()
        an event of type "greeetings" 10 times
        deviceCli.connect()
        while True:
        deviceCli.disconnect()
```

Fig. 5.5. Python code in Python DLE

# 6. RESULT

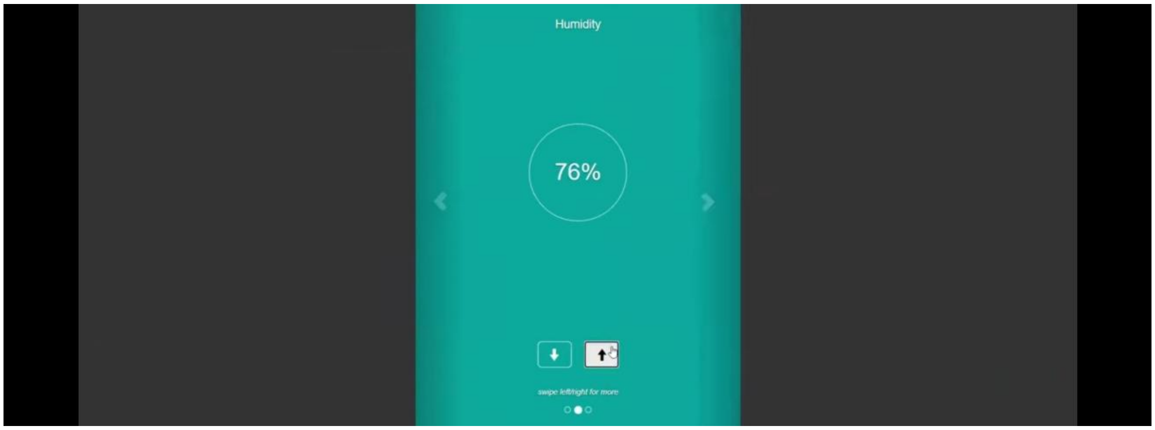


Fig. 6.1. Humidity

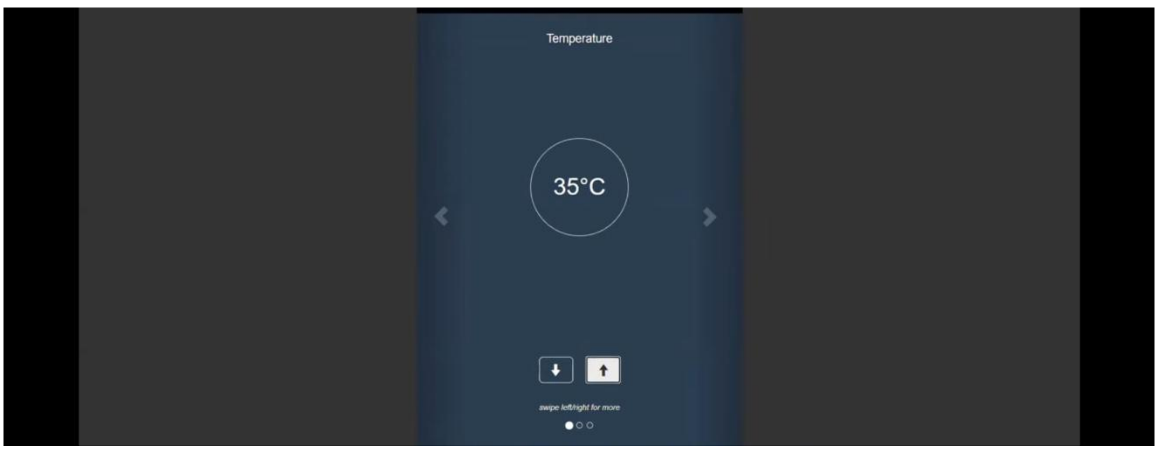


Fig. 6.2. Temperature

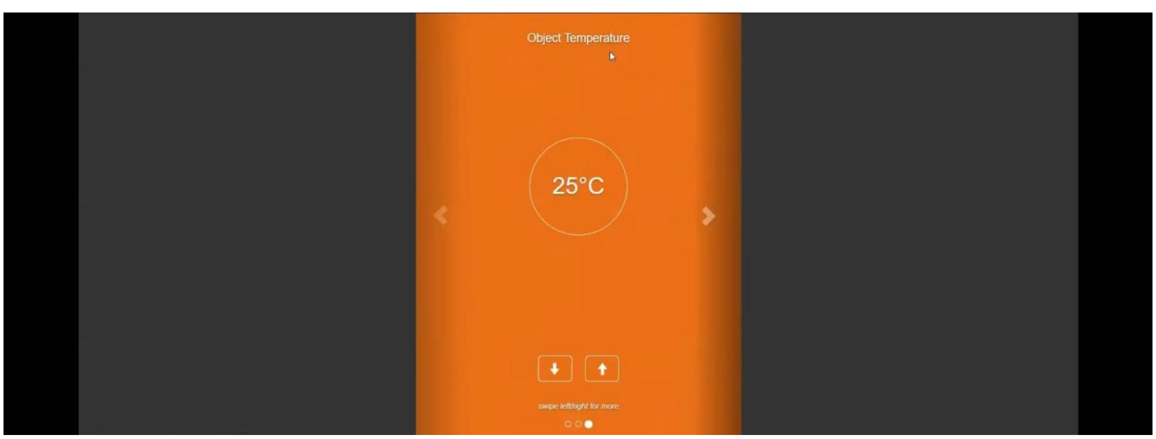


Fig. 6.3. Soil moisture/ object temperature


Fig. 6.4. Result

## 7. PYTHON CODE

```
import ibmiotf

import time

import sys

import ibmiotf.device

organization = "23804"

deviceType = "PNT2022TMID23804"

deviceId = "19103024"

authMethod = "token"

authToken = "RVc_rdmvj1Nns27@1a"

def myCommandCallback(cmd):

    print("Command received: %s" % cmd.data)

    if cmd.data['command']=='motoron':

        print("MOTOR ON IS RECEIVED")
```

```
    elif cmd.data['command']=='motoroff':
        print("MOTOR OFF IS RECEIVED")
    if cmd.command == "setInterval":
        print("Error - command is missing required information: 'interval'")
    else:
        interval = cmd.data['message']
    print(output)
    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()
        an event of type "greeetings" 10 times
        deviceCli.connect()
        while True:
        deviceCli.disconnect()
```

## 8. CONCLUSION

This is how we have designed our project using arduino microcontroller, temperature sensor, humidity sensor, soil moisture sensor, PIR sensor, node-MCU and the softwares like I cloud, IBM Watson IoT platform, Watson sensor simulator and python IDLE. We hope this project will help the farmers to monitor their farm and also to protect their crops from animals as well as from natural calamities.