Smart Farmer – IoT Enabled Smart Farming Application

IBM Nalaiya Thiran Project Report

Submitted by,

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Abstract:-

With the help of IoT enabled smart farming the farmers can easily monitor their land's moisture level and do the irrigation according. Through the end of the development of our project, we had couple of phases, where we worked as a team to bring our project to work.

In the Ideation phase, we did Literature Survey, Brainstorming and Empathy Mapping. In our Project Design Phase 1, we found the solution for our problem and made the Solution Architecture, and that Solution Architecture became our final project in working condition. In Project Design Phase 2, we prepared the Customer Journey Map, Data Flow Diagrams and User Stories, Solution Requirements and Technology Stack. And in our Project Planning Phase, we prepared the Milestone and Activity List and made the Sprint Delivery Plan. In our Project Development phase, we divided the whole development phase into four, which we call as Sprint 1, 2, 3, and 4.

Introduction:-

Internet of Things (IoT) technology has brought revolution to each and every field of common man's life by making everything smart and intelligent. IoT refers to a network of things which make a Self-configuring network. The development of Intelligent Smart Farming IoT based devices is day by day turning the face of agriculture production by not only enhancing it but also making it cost-effective and reducing wastage. The aim of this report is to propose IoT based Smart Farming System assisting farmers in getting Live Data (Temperature, Soil Moisture) for efficient environment monitoring which will enable them to increase their overall yield and quality of products. The IoT based Smart Farming System being proposed via this report is integrated with Arduino Technology mixed with different Sensors and a WiFi module producing live data feed that can be obtained online using MIT app inventor.

Literature Survey:-

Smart farm and monitoring system for measuring the Environment condition using wireless sensor network – IOT Technology in farming

Authors :-

- **Tharindu Madushan Bandara**
- **Wanninayaka Mudiyanselage**
- **Mansoor Raza**

Abstract :-

Internet of things (IoT) gives a new proportion of smart farming and agriculture territory. Because with the development of the current world, the internet of things field has peaked with modern technology and modern techniques. In the modern world, IoT is used in every domain like smart city, smart university, smart car park system, etc. This paper is about the implementation of the smart farm. IoT concept helps in costefficient farming activities like crop and other resource management. With a wireless sensor network, it is easy to connect with every sensor node placed in the farming environment. Page 2 of 5 Also, with the wireless sensor network, it can connect with long-distance ranges. With the help of a sensor network, it can collect the data from the farming environment and analyze it according to the pre-defined values. The proposed system used IoT sensors to collect the data are soil moisture sensors, temperature sensors, water volume sensors, etc. According to the existing system analysis, the proposed solution contains a smart farm environment and a real-time monitoring system with the wireless sensor network for node

connectivity. The proposed system provides a more reliable and flexible smart concept for the farmers, and it is a simple architecture that contains the IoT sensors that collect the data from the farm field and transfer those data through wireless sensor network to the central server and according to the input data, the primary server assigning the task to the particular devices.

Understanding IOT climate Data based Predictive Model for Outdoor Smart Farm

Authors :-

- **Juyoung Park**
- **Aekyung Moon**
- **Eunryung Lee**
- **Seunghan Kim**

Abstract :-

Internet of Things (IoT) solutions adopted by various time-sensitive application domains consist of fine-grained sensors to predict actionable knowledge more accurately. This paper presents the concept of IoT climate and IoT climate-based predictive models for future farming. Firstly, we consider an online agricultural forecasting service based on IoT data collected from weather stations in real-time. To demonstrate the effectiveness of our proposed platform, we designed a frost forecasting service and pest forecasting services on the IoT climate data collected from weather stations. Our system notifies the possibilities of frost for farmers so that they can protect crops against frost damage. And it also

sends several pests forecast messages to farmers using push services. The proposed model can effectively provide more precise agricultural forecasting services thus could potentially not only improve crop yield but also reduce unnecessary costs, such as the use of non-essential pesticides and fertilizers.

A Strategic Sensor Placement for a Smart Farm Water Sprinkler System: A Computational Model

Authors :-

- **Jinsuk Baek**
- **Munene W**
- **Kanampiu**

Abstract :-

Internet of Things (IoT) networking has attracted research with many emerging applications requiring remote control and automation. Effective deployment of IoT sensors is a major concern since it primarily determines the performance of the IoT network. Since multiple mobile sensors are generally involved, it is possible that the sensors are randomly distributed in a remote region at the initial phase then later relocated to some precomputed optimal location with their full autonomy enabled. In this paper, we propose a computation for the optimal location of water sprinkler sensors of an IoT smart farm network in terms of the relative physical distance between them. The resulting sensors locations ensure minimal overlap coverage area and no uncovered area exists in the candidate farming region. With the proposed strategic deployment of

smart water sprinklers sensors, farmers can be assured of the right water distribution for any given area of their farm.

Affordable Smart Farming Using IOT and Machine Learning

Authors :-

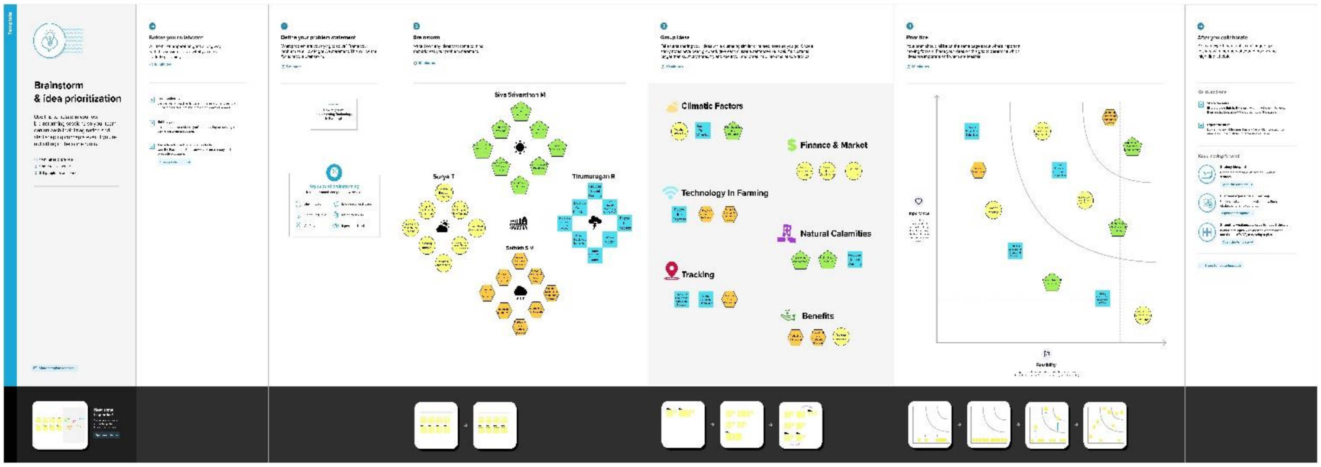
- **Reuben Varghese**
- **Smarita Sharma**

Abstract :-

Each year many crops go waste due to a lack of optimal climatic conditions to support crop growth. Losses to the tune of over 11 billion dollars are reported each year in India alone. In this paper, we develop an affordable system which when deployed will give an insight into the real time condition of the crop. The system leverages Internet of Things(IoT) and Machine learning to produce an affordable smart farming module. This system uses state-of-the-art methods in order to improve the accuracy of the results and automate the monitoring of crops thereby requiring minimal human intervention. IoT is used to connect the ground module which includes the sensors to the cloud infrastructure. In the cloud, machine learning based real-time analytics is performed to predict the future condition of the crops based on its past data.

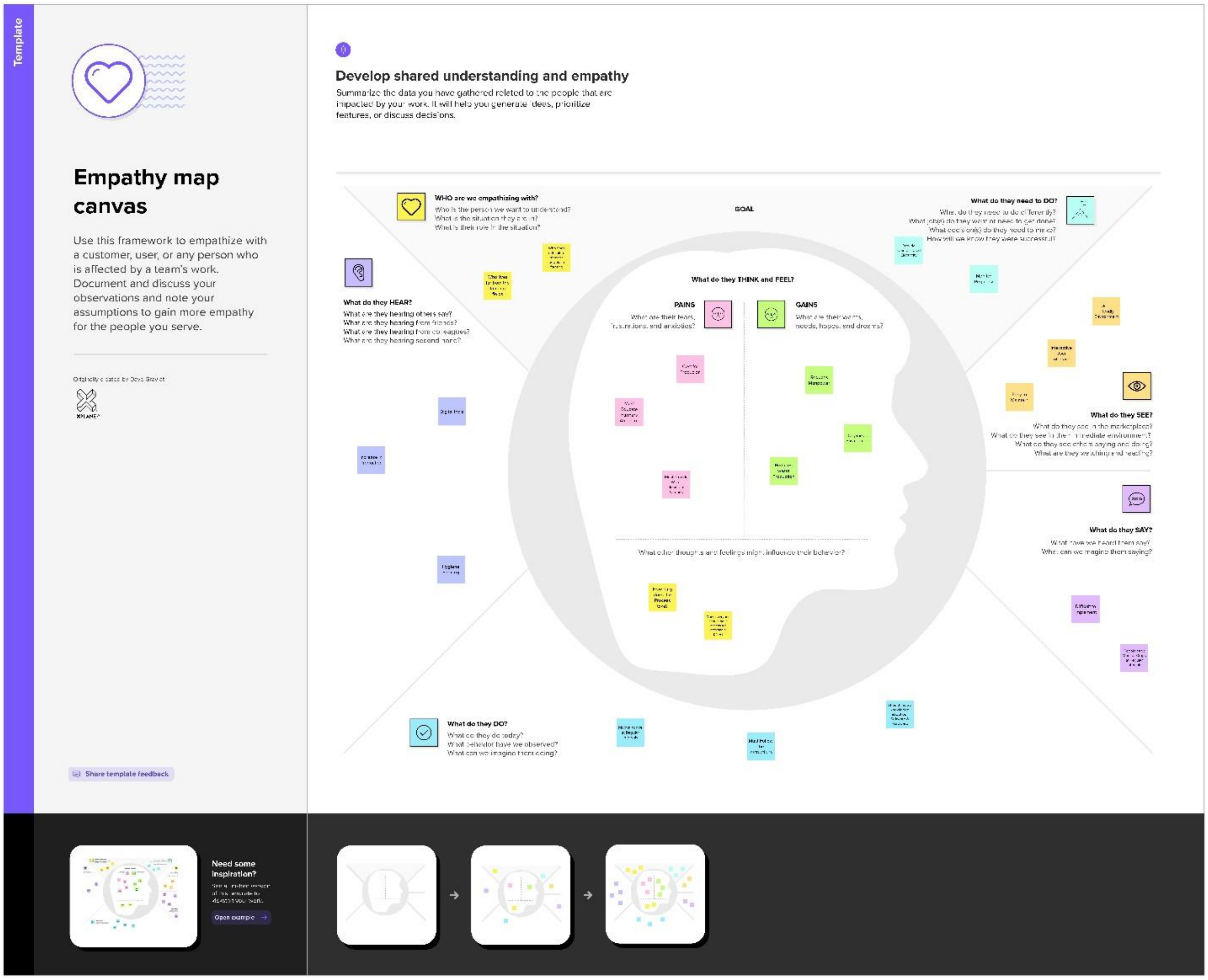
Ideation and Proposed Solution:-

Brainstorming:-



Ideation essentially refers to the whole creative process of coming up with and communicating new ideas. Ideation is innovative thinking, typically aimed at solving a problem or providing a more efficient means of doing or accomplishing something. It encompasses thinking up new ideas, developing existing ideas, and figuring out means or methods for putting new ideas into practice. Ideation is similar to a practice known as brainstorming.

Empathy Map:-



An empathy map is a collaborative tool teams can use to gain a deeper insight into their customers. Much like a user persona, an empathy map can represent a group of users, such as a customer segment. The empathy map was originally created by Dave Gray and has gained much popularity within the agile community.

PROPOSED SOLUTION:-

Sometimes, during the rainy days the soil of the fertile land will be wet. At that time, the farmer is unable to predict, how much water should be supplied for the plants, if surplus water is supplied there will be a higher chance for the plant to get spoiled. This issue can be solved using the sensor which is integrated with the processing unit.

Smart Farming has enabled farmers to use the resources precisely with the help of some sensors such as, humidity, temperature, soil moisture, etc. Using the smart farming based on IoT the farmers can access and monitor the farm from anywhere in the world.

IoT smart agriculture systems are designed to help the farmers to monitor their crops, fields, weather conditions using different sensors. Farmers and associated franchise can easily monitor the field conditions from anywhere in the world without any hassle.

Scalability in smart farming refers to the adaptability of a system to increase the number of technology devices such as sensors and actuators.

Project Devlepoment Phase:-

CODING AND SOLUTIONS:-

Python code:-

- For connecting IBM Cloud
- For Node-Red
- For MIT app inventor

Python code:-

```
import ibmiotf.device

import ibmiotf.application

import time

import sys

import random

# Watson Device Credentials

organization = "85xp9o"

deviceType = "IoT"

deviceId = "0423"

authMethod = "token"

authToken = "123456789"

def myCommandCallback():

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 the cloud as an event of type "greeting" 10 times

devicecli.connect()

while True:

temp = random.randint(0, 100)

humid = random.randint(0, 100)

moisture = random.randint(0, 1)


data = {"Temperature": temp, "Humidity": humid, "Moisture": moisture}

if(moisture < 1):

motorStatus = "Motor is ON"

else:

motorStatus = "Motor is OFF"


def myOnPublishCallBack():

print("Published Temperature = %s C" % temp, "Humidity = %s %%" % humid, "Moisture = %s%%" % moisture*100,

"Motor Status = %s" % motorStatus,  "to IBM Watson")


success = devicecli.publishEvent("event", "json", data, qos=0,  on_publish=myOnPublishCallBack)

if not success:

print("Not Connected to IoTF")

time.sleep(1)

# Disconnect the device and application from the cloud

devicecli.disconnect()

myCommandCallback()
```

File Edit Format Run Options Window Help

```python
import time
import sys
import ibmiotf.application
import ibmiotf.device
import random
#Provide your IBM Watson Device Credentials
organization = "85xp9o" # repalce it with organization ID
deviceType = "IoT" #replace it with device type
deviceId = "0423" #repalce with device id
authMethod = "token"
authToken = "123456789"#repalce with token
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()
deviceCli.connect()
while True:
        T=random.randint(0,100)
        H=random.randint(0,100)
        M=random.randint(0,1)
        data = { 'Temperature' : T, 'Humidity': H, 'Moisture': M}
        #print data
        def myOnPublishCallback():
            print (data, "to IBM Watson")
        if(M<1):
            print("Motor is ON")
        else:
            print("Motor is OFF")
        success = deviceCli.publishEvent("event", "json", data, qos=0, on_publish=myOnPublishCallback)
        if not success:
            print("Not connected to IoTF")
        time.sleep(1)
# Disconnect the device and application from the cloud
deviceCli.disconnect()
```

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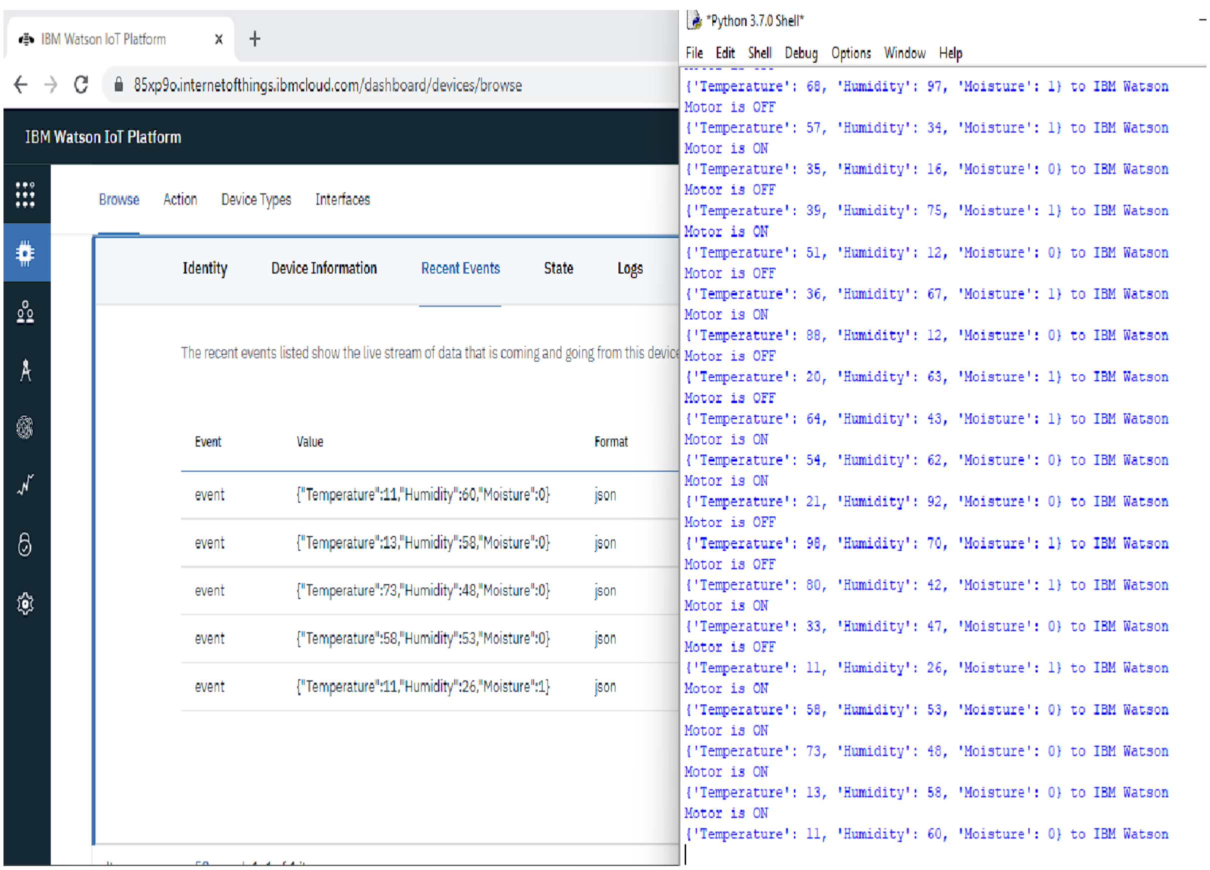


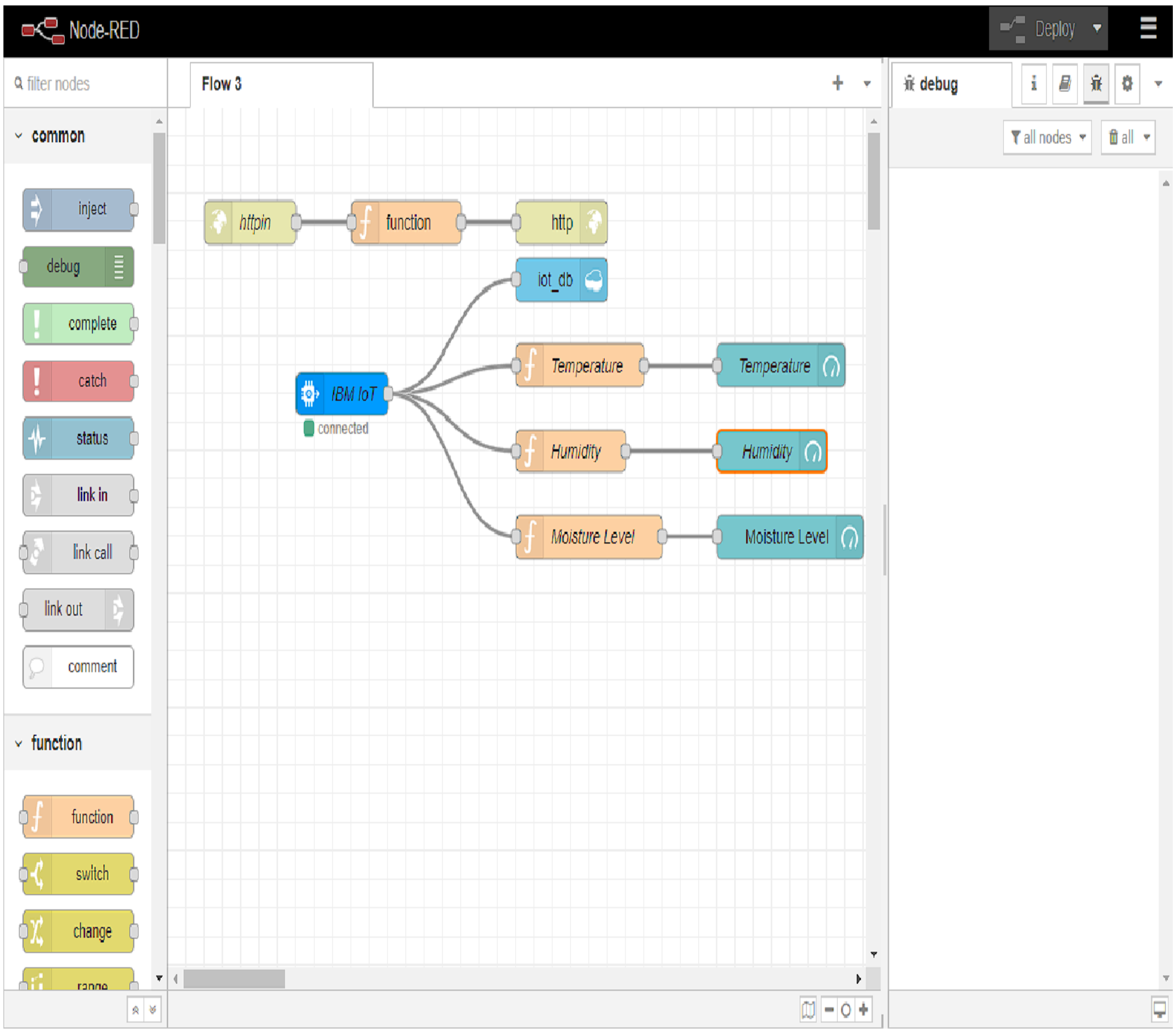
Texting and Results:-

Node-Red Flow Connections:

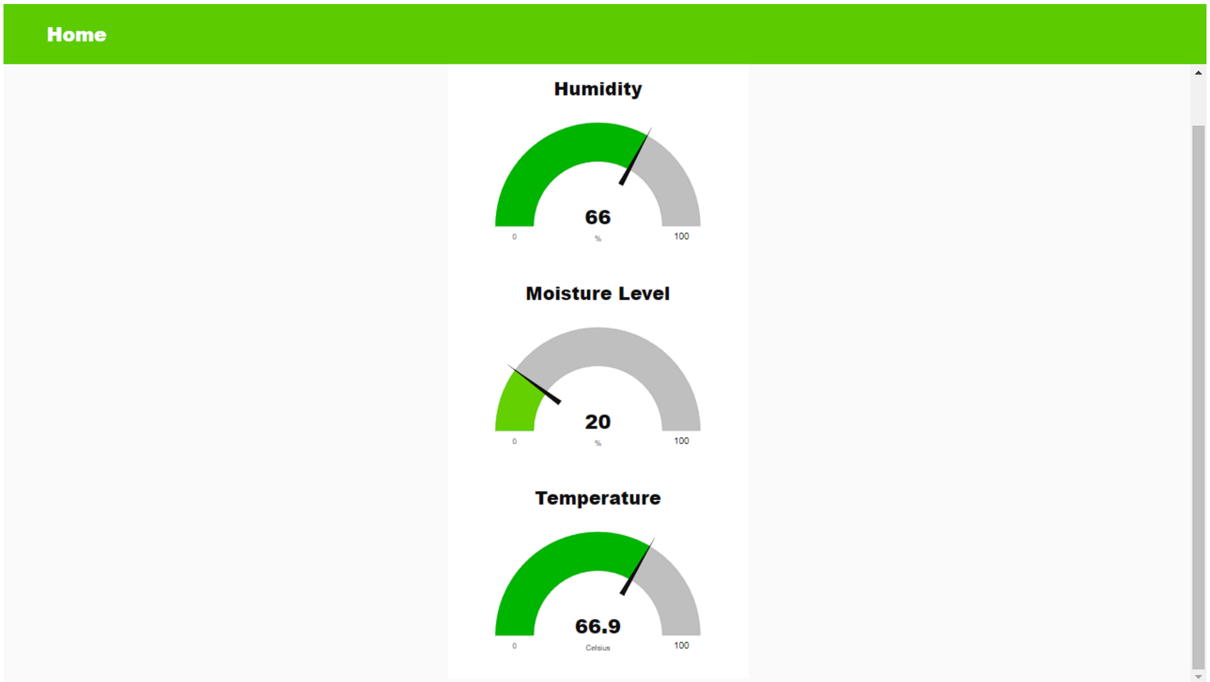
Interfacing IBM cloud

Interfacing ad getting sensor data

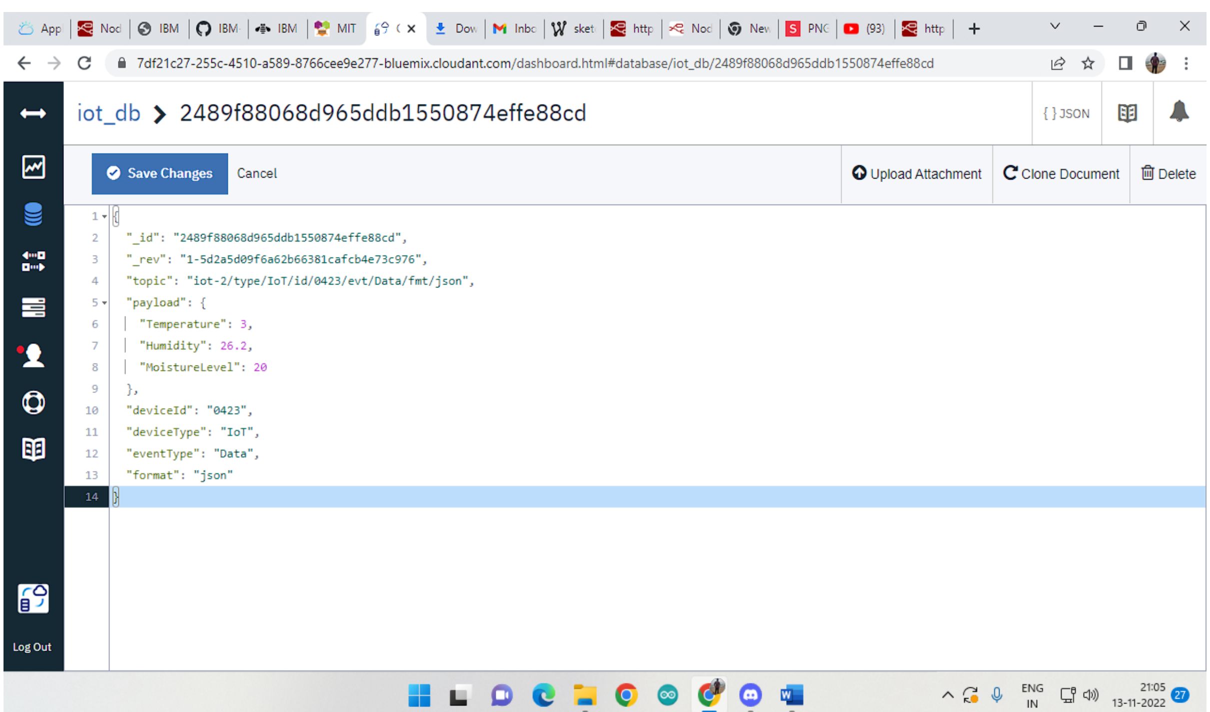
Connecting MIT App Inventor



Web UI Output:



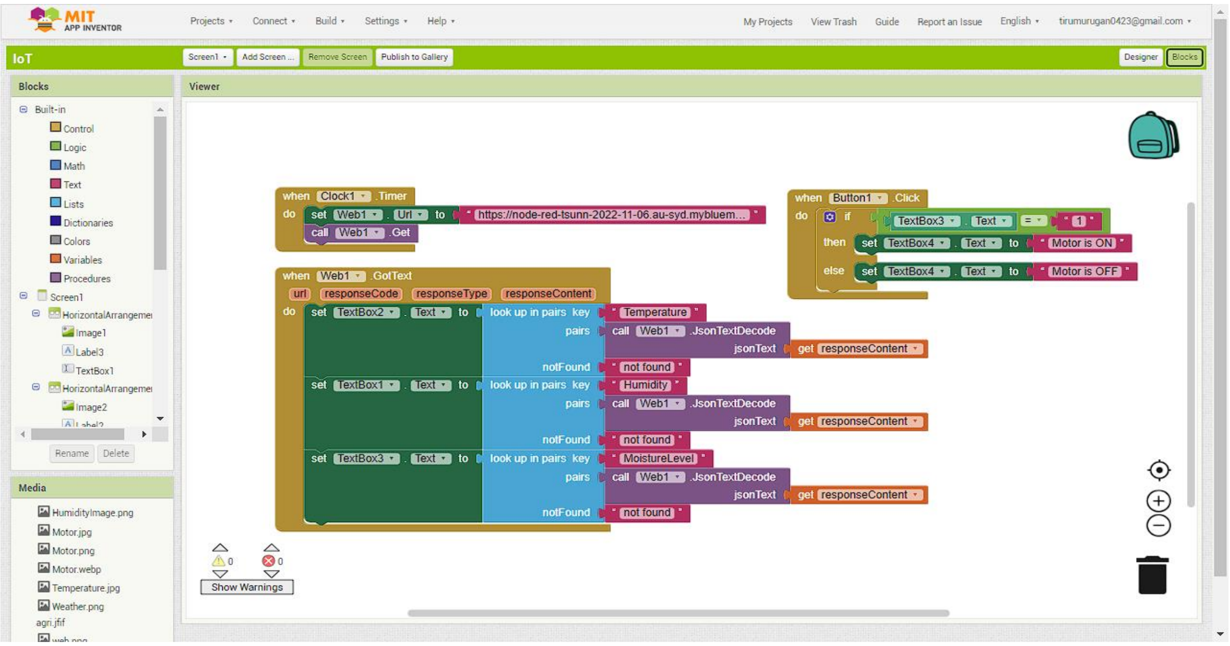
IBM Watson IoT Platform Device connect and Live Data:



MIT APP INVENTOR:

- Login into MIT App Inventor
- Create your user interface by using the preset tools

Backend Process:



ADVANTAGES & DISADVANTAGES

Advantages:-

A remote control system can help in working irrigation system valves dependent on schedule. Irrigating remote farm properties can be exceptionally troublesome and labour intensive. It gets hard to comprehend when the valves were started and whether the ideal measure of water was distributed. For situations where a quick reaction required, manual valve actuation may not be conceivable constantly. Thus, remote observing and control of irrigation systems, generators or wind machines or some other motor- driven hardware become the next logical step. Various sensors will help to increase the productivity and customers can be benefitted.

Disadvantages:-

Cost, Reliability, Increased Channel maintenance.

Conclusions:-

IoT based SMART FARMING SYSTEM for Live Monitoring of temperature and Soil Moisture has been proposed using Arduino and Cloud Computing. The System has high efficiency and accuracy in fetching the live data of temperature and soil moisture. The IoT based smart farming System being proposed via this report will assist farmers in increasing the agriculture yield and take efficient care of food production as the System will always provide helping hand to farmers for getting accurate live feed of environmental temperature and soil moisture with more than 99% accurate results.

Future Scope:-

Future work would be focused more on increasing sensors on this system to fetch more data especially with regard to Pest Control and by also integrating GPS module in this system to enhance this Agriculture IoT Technology to full-fledged Agriculture Precision ready product