**SMART FARMER - IOT ENABLED SMART FARMING APPLICATION**

**A PROJECT REPORT**

*Submitted by*

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*in partial fulfilment for the award of the degree*

*of*

**BACHELOR OF TECHNOLOGY**

**in**

**INFORMATION TECHNOLOGY**

**JERUSALEM COLLEGE OF ENGINEERING,**

(An Autonomous Institution, Affiliated to Anna University, Chennai)

**PALLIKARANI, CHENNAI-100**

**ANNA UNIVERSITY: CHENNAI 600 025**

**NOVEMBER 2022**

**SMART FARMER - IOT ENABLED SMART FARMING APPLICATION**

1. **INTRODUCTION**

The main aim of this project is to help farmers automate their farms by providing them with a Web App through which they can monitor the parameters of the field like Temperature, soil moisture, humidity and etc and control the equipment like water motor and other devices remotely via internet without their actual presence in the field.

* 1. **PROJECT OVERVIEW**

Smart Agriculture System based on Iot can monitor soil moisture and climatic conditions to grow and yield a good crop. The farmer can also get the real-time weather forecasting data by using external platforms like Open Weather API. Farmer will be provided a mobile app using which he can monitor the temperature, humidity and soil moisture parameters along with weather forecasting details. Based on all the parameter, farmer can water his crop by controlling the motor using the mobile application. Thus even if the farmer is not present near his crop he can water his crop by controlling the motors using the application from anywhere.

* 1. **PURPOSE**

By making farming more connected and intelligent, precision agriculture helps reduce overall costs and improve the quality and quantity of products, the sustainability of agriculture and the experience for the consumer. Increasing control over production leads to better cost management and waste reduction. The ability to trace anomalies in crop growth or livestock health, for instance, helps eliminate the risk of losing yields. Additionally, automation boosts efficiency. With smart devices, multiple processes can be activated at the same time, and automated services enhance product quality and volume by better controlling production processes

1. **LITERATURE SURVEY**
   1. **EXISTING PROBLEMS AND REFERENCES**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **SMART FARMING ( IoT ENABLED SMART FARMING APPLICATION ) - -LITERATURE SURVEY** | | | | |
| **S.NO** | **TITLE OF THE JOURNAL** | **AUTHOR NAME** | **JOURNAL NAME** | **DESCRIPTION** |
| 1. | Agri-IoT: A semantic framework for internet of Things-enabled smart farming applications | [Andreas Kamilaris](https://ieeexplore.ieee.org/author/37992827100);  [Feng Gao](https://ieeexplore.ieee.org/author/37711380500);  [Francesc X. Prenafeta-Boldu](https://ieeexplore.ieee.org/author/37086191168); | IEEE | Agri-IoT, a semantic framework for IoT-based smart farming applications, which supports reasoning over various heterogeneous sensor data streams in real-time. |
| 2. | A Low-Cost Information Monitoring System for Smart Farming Applications | Muhamamd saqib; Tarik Adnan Almohamad; Raja Majid Mehmood | MDPI | A low-cost, low-power, and low data-rate solution is proposed to fulfill the requirements of information monitoring for actual large-scale agricultural farms. a tree-based communication mechanism is deployed to extend the communication range by adding intermediate nodes. Each sensor node consists of a solar panel, a rechargeable cell, a microcontroller, a moisture sensor, and a communication unit. |
| 3. | Smart farming for improving agricultural management | [ElsayedSaid Mohamed](https://www.sciencedirect.com/science/article/pii/S1110982321000582" \l "!); [Mohamed BZahran](https://www.sciencedirect.com/science/article/pii/S1110982321000582" \l "!)[a](https://www.sciencedirect.com/science/article/pii/S1110982321000582" \l "!); | The Egyptian Journal of Remote Sensing and Space Science | The smart [irrigation system](https://www.sciencedirect.com/topics/earth-and-planetary-sciences/irrigation-system) included those sensors for monitoring water level, irrigation efficiency, climate, etc. Smart irrigation is based on smart controllers and sensors as well as some mathematical relations. |
| 4. | An Architecture model for Smart Farming | [Anna Triantafyllou](https://ieeexplore.ieee.org/author/37086945723);  [Dimosthenis C.Tsouros](https://ieeexplore.ieee.org/author/37086238216);  [Panagiotis Sarigiannidis](https://ieeexplore.ieee.org/author/37295396100);  [Stamatia Bibi](https://ieeexplore.ieee.org/author/37540569600) | IEEE | To guide the process of designing and implementing Smart farming monitoring systems, in this paper propose a generic reference architecture model, taking also into consideration a very important non-functional requirement, the energy consumption restriction. |
| 5. | Smart Farming – IoT in Agriculture | Rahul Dagar;  Subhranil Som;  Sunil Kumar Khatri | IEEE | In this paper they surveyed typical agriculture methods used by farmers these days and what are the problems they face, they visited poly houses for further more information about new technologies in farming. The proposed model is a simple architecture of IoT sensors that collect information and send it over the Wi-Fi network to the server, there server can take actions depending on the information. |
| 6. | Design and implementation of a connected farm for smart farming system | Minwoo Ryu;  Jaeseok Yun;  Ting Miao;  Il-Yeup Ahn;  Sung-Chan Choi; | IEEE | In this paper, we present a connected farm based on IoT systems, which aims to provide smart farming systems for end users. |
| 7. | Big Data in Smart Farming – A review | SjaakWolfert;  Marc-JeroenBogaardta | ELSEVIER | This review aims to gain insight into the state-of-the-art of Big Data applications in Smart Farming and identify the related socio-economic challenges to be addressed. |
| 8. | A Survey on the Role of IoT in Agriculture for the Implementation of Smart Farming | Muhammad Shoaib Farooq;  Kamran Abid; Muhammad Azhar Naeem | IEEE | The article presents many aspects of technologies involved in the domain of IoT in agriculture. It explains the major components of IoT based smart farming. A rigorous discussion on network technologies used in IoT based agriculture has been presented, that involves network architecture and layers, network topologies used, and protocols. |
| 9. | The Digitisation of Agriculture: a Survey of Research Activities on Smart Farming | ManlioBacco;  Massimiliano Ruggerib | ELSEVIER | In this work, they provide a survey of the most recent research activities, in the form of both research projects and scientific literature, with the objective of showing the already achieved results, the current investigations, and the still open challenges, both technical and non technical. |
| 10. | Experimental validation of a wireless system for the irrigation management in smart farming applications | Federico Viani | Microwave and Optical Technology Letters | The proposed system has been prototyped and experimentally validated in an apple orchard, close to the city of Trento, in the north of Italy. |

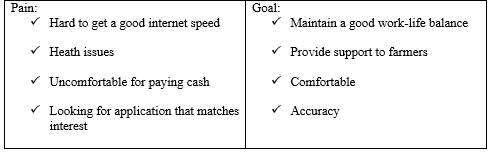
* 1. **PROBLEM DEFINITION STATEMENT**
* Farmer are to be present at form for its maintenance irrespective of the weather conditions.
* They have to ensure that the crops are well irrigated and the farm status is monitored by them physically.
* Farmer have to stay most of the time in field in order to get a good yield.
* In difficult times like in the presence of pandemic also they have to work hard in their fields risking their lives to provide food for the country.

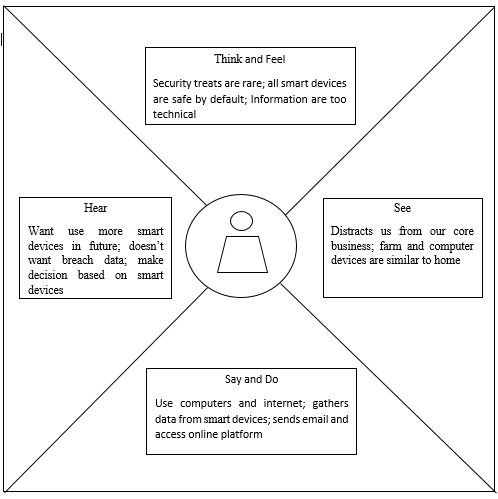
CUSTOMER PROBLEM STATEMENT

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Problem Statement (PS)** | **I am (Customer)** | **I’m trying to** | **But** | **Because** | **Which makes me feel** |
| PS-1 | Farmer | Control the farm from anywhere of the world | It doesn’t have any way for that | Internet bandwidth is low in villages | Frustrated |
| PS-2 | Farmer | Visualize the farm from home | It doesn’t have any way for that | It is expensive | wealthless |
| PS-3 | Farmer | Visualize, control and operate the farm from home or anywhere from the world | It doesn’t have any way for that | That facilities are not available in village and also for big farms | Restless and unhealthy |

**3. IDEATION AND PROPOSED SOLUTION**

**3.1 EMPATHY MAP CANVAS**

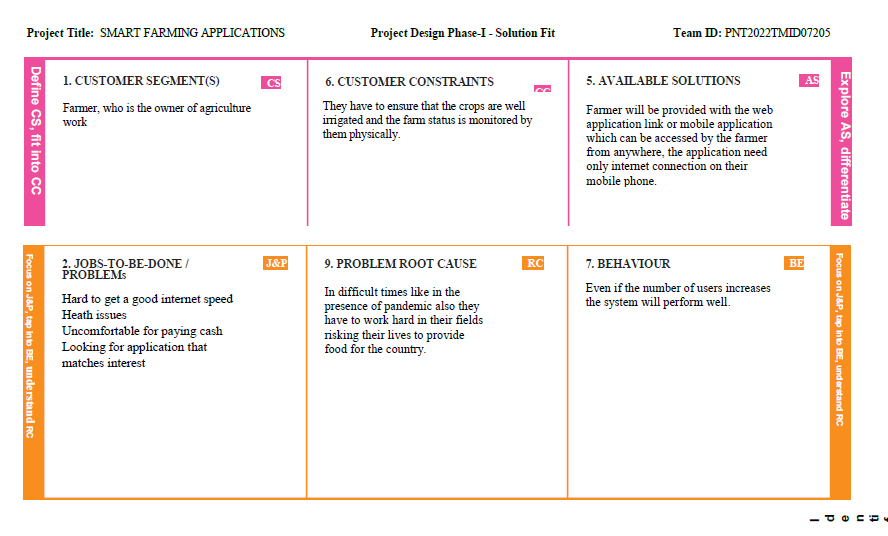


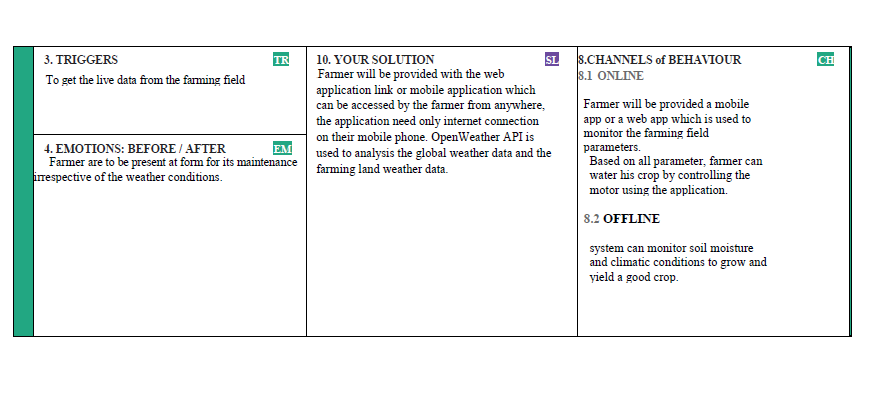


**3.2 PROPOSED SOLUTION**

|  |  |  |
| --- | --- | --- |
| **S.No.** | **Parameter** | **Description** |
|  | Problem Statement (Problem to be solved) | * Farmer are to be present at form for its maintenance irrespective of the weather conditions. * They have to ensure that the crops are well irrigated and the farm status is monitored by them physically. * Farmer have to stay most of the time in field in order to get a good yield. * In difficult times like in the presence of pandemic also they have to work hard in their fields risking their lives to provide food for the country. * Hence there is a need of **smart farming application** |
|  | Idea / Solution description | * This system can monitor soil moisture and climatic conditions to grow and yield a good crop. * This can also get the real time weather forecasting data by using external platforms like Open Weather API. * Farmer will be provided a mobile app or a web app which is used to monitor the farming field parameters. * Based on all parameter, farmer can water his crop by controlling the motor using the application. * Even in the absence of farmer near the field, Farmer can able to monitor the field using the application from anywhere. |
|  | Novelty / Uniqueness | * Farmer will be provided with the web application link or mobile application which can be accessed by the farmer from anywhere, the application need only internet connection on their mobile phone. * OpenWeather API is used to analysis the global weather data and the farming land weather data. |
|  | Social Impact / Customer Satisfaction | * The main aim of the project is to help farmers by providing them with a web or mobile application. * By using the application farmer can monitor all the parameters of the field such as temperature, humidity, soil moisture, etc… * And even they can be able to control the equipments the fields like water motors and other devices remotely via internet. |
|  | Scalability of the Solution | * Even if the number of users increases , the system will perform well. |

**3.4 PROBLEM SOLUTION FIT**





**4. REQUIREMENT ANALYSIS**

**4.1 FUNCTIONAL REQUIREMENT AND USER STORIES**

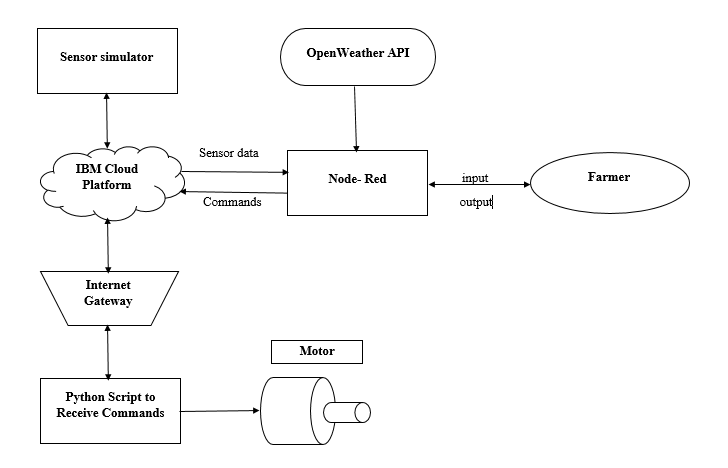
| **User Type** | **Functional Requirement (Epic)** | **User Story Number** | **User Story / Task** | **Acceptance criteria** | **Priority** | **Release** |
| --- | --- | --- | --- | --- | --- | --- |
| Customer (Mobile user) | Registration | USN-1 | As a user, I can register for the application by entering my email, password, and confirming my password. | I can access my account / dashboard | High | Sprint-1 |
|  |  | USN-2 | As a user, I will receive confirmation email once I have registered for the application | I can receive confirmation email & click confirm | High | Sprint-1 |
|  |  | USN-3 | As a user, I can register for the application through Mobile number | I can register & access the dashboard with mobile number Login | Low | Sprint-2 |
|  |  | USN-4 | As a user, I can register for the application through Gmail | I can register & access the dashboard with Gmail | Medium | Sprint-1 |
|  | Login | USN-5 | As a user, I can log into the application by entering email & password |  | High | Sprint-1 |
|  | Dashboard | USN-6 | As a user , I can know the parameters values through dashboard | , I can know the parameters values through dashboard | High | Sprint-1 |
|  | Access Motor Control | USN-7 | As a user , I can manipulate motor from anywhere | I can manipulate motor from anywhere | High | Sprint-1 |
| Customer (Web user) | Registration | USN-8 | As a user, I can register for the application by entering my email, password, and confirming my password. | I can access my account / dashboard | High | Sprint-1 |
|  |  | USN-9 | As a user, I will receive confirmation email once I have registered for the application | I can receive confirmation email & click confirm | High | Sprint-1 |
|  |  | USN-10 | As a user, I can register for the application through Mobile number | I can register & access the dashboard with mobile number Login | Low | Sprint-2 |
|  |  | USN-11 | As a user, I can register for the application through Gmail | I can register & access the dashboard with Gmail | Medium | Sprint-1 |
|  | Login | USN-12 | As a user, I can log into the application by entering email & password |  | High | Sprint-1 |
|  | Dashboard | USN-13 | As a user , I can know the parameters values through dashboard | , I can know the parameters values through dashboard | High | Sprint-1 |
|  | Access Motor Control | USN-14 | As a user , I can manipulate motor from anywhere | I can manipulate motor from anywhere | High | Sprint-1 |

**4.2 NON- FUNCTIONAL REQUIREMENTS**

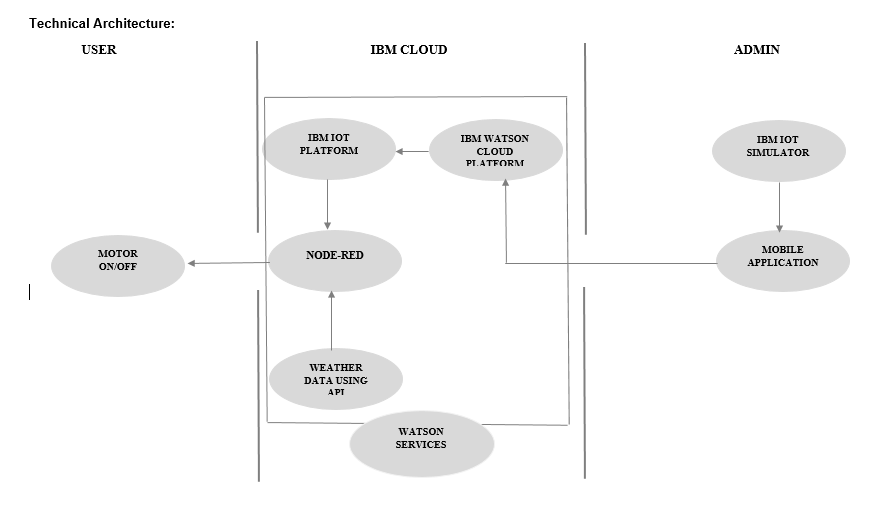
* Scalability and Multiplicity
* Security
* Privacy
* Interoperability
* Timelines or Real time
* Availability
* Ease of deployment, maintenance and use
* Spontaneous interaction,, Adaptability and flexibility

**5. PROJECT DESIGN**

**5.1 DATA FLOW DIAGRAMS**



**5.2 SOLUTION & TECHNICAL ARCHITECTURE**



**6. PROJECT PLANNING & SCHEDULING**

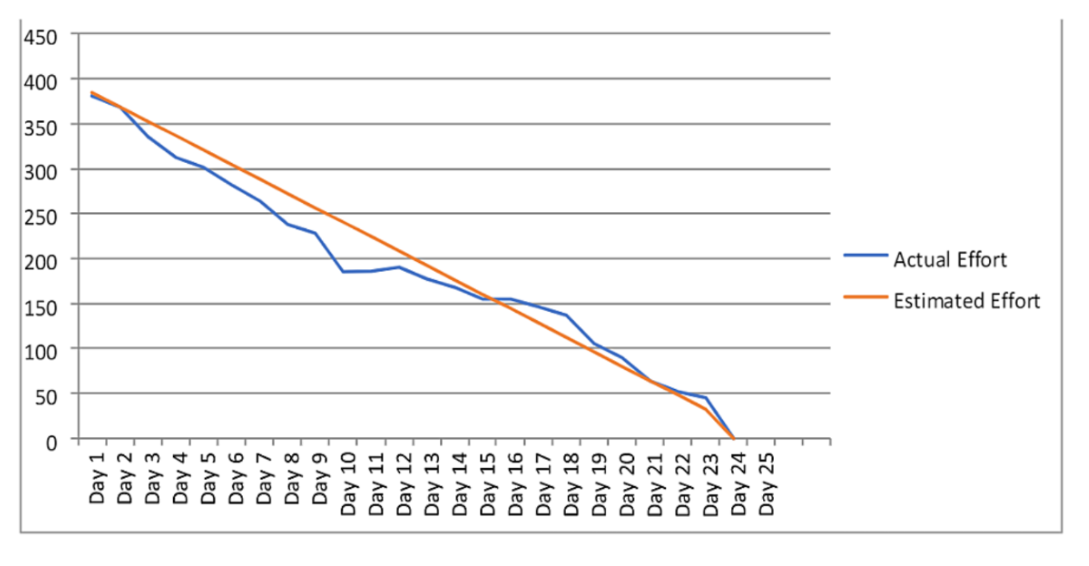
**6.1 SPRINT PLANNING & ESTIMATION**

| **User**  **Type** | **Functional Requirement (Epic)** | **Milestone** | **Activity List** | **Activity Acceptance criteria** | **Activity Priority** |
| --- | --- | --- | --- | --- | --- |
| Customer (Mobile user) | Registration | Milestone -1 | As a user, I can register for the application by entering my email, password, and confirming my password. | I can access my account / dashboard | High |
|  |  | Milestone -2 | As a user, I will receive confirmation email once I have registered for the application | I can receive confirmation email & click confirm | High |
|  |  | Milestone -3 | As a user, I can register for the application through Mobile number | I can register & access the dashboard with mobile number Login | Low |
|  |  | Milestone -4 | As a user, I can register for the application through Gmail | I can register & access the dashboard with Gmail | Medium |
|  | Login | Milestone -5 | As a user, I can log into the application by entering email & password |  | High |
|  | Dashboard | Milestone -6 | As a user , I can know the parameters values through dashboard | , I can know the parameters values through dashboard | High |
|  | Access Motor Control | Milestone -7 | As a user , I can manipulate motor from anywhere | I can manipulate motor from anywhere | High |
| Customer (Web user) | Registration | Milestone -8 | As a user, I can register for the application by entering my email, password, and confirming my password. | I can access my account / dashboard | High |
|  |  | Milestone -9 | As a user, I will receive confirmation email once I have registered for the application | I can receive confirmation email & click confirm | High |
|  |  | Milestone -10 | As a user, I can register for the application through Mobile number | I can register & access the dashboard with mobile number Login | Low |
|  |  | Milestone -11 | As a user, I can register for the application through Gmail | I can register & access the dashboard with Gmail | Medium |
|  | Login | Milestone -12 | As a user, I can log into the application by entering email & password |  | High |
|  | Dashboard | Milestone -13 | As a user , I can know the parameters values through dashboard | , I can know the parameters values through dashboard | High |
|  | Access Motor Control | Milestone -14 | As a user , I can manipulate motor from anywhere | I can manipulate motor from anywhere | High |

**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 | 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 |

**6.3 REPORTS FROM JIRA**



**7. CODING & SOLUTIONING** (Explain the features added in the project along with code)

**7.1 CODE**

import time

import sys

import ibmiotf.application

import ibmiotf.device

organization = "98gm4o"

deviceType = "iotdevice"

deviceId = "qwerty321"

authMethod = "token"

authToken = "qwerty123"

def myCommandCallback(cmd):

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

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

print("MOTOR ON IS RECEIVED")

time.sleep(1)

print("MOTOR STARTED")

elif cmd.data['command']=='OFF':

print("MOTOR OFF IS RECEIVED")

time.sleep(1)

print("MOTOR STOPPED")

elif cmd.data['command']=='runfor30minutes':

print("MOTOR RUNS FOR 30 MINUTES")

print("MOTOR STARTED")

for i in range(1,31):

print("%d minutes to stop"%(30-i)) # use time.sleep(60) for delay of one minute

time.sleep(2)

print("MOTOR STOPPED")

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))

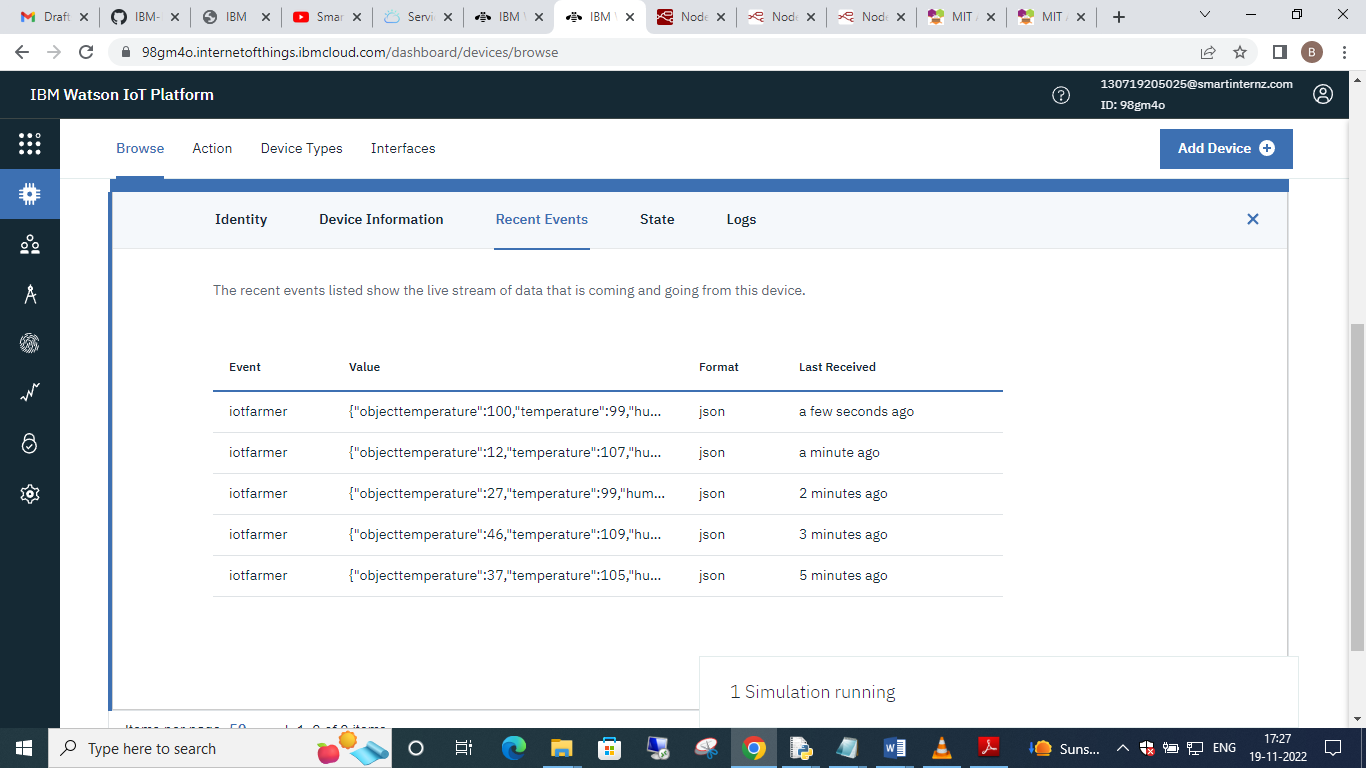
sys.exit()

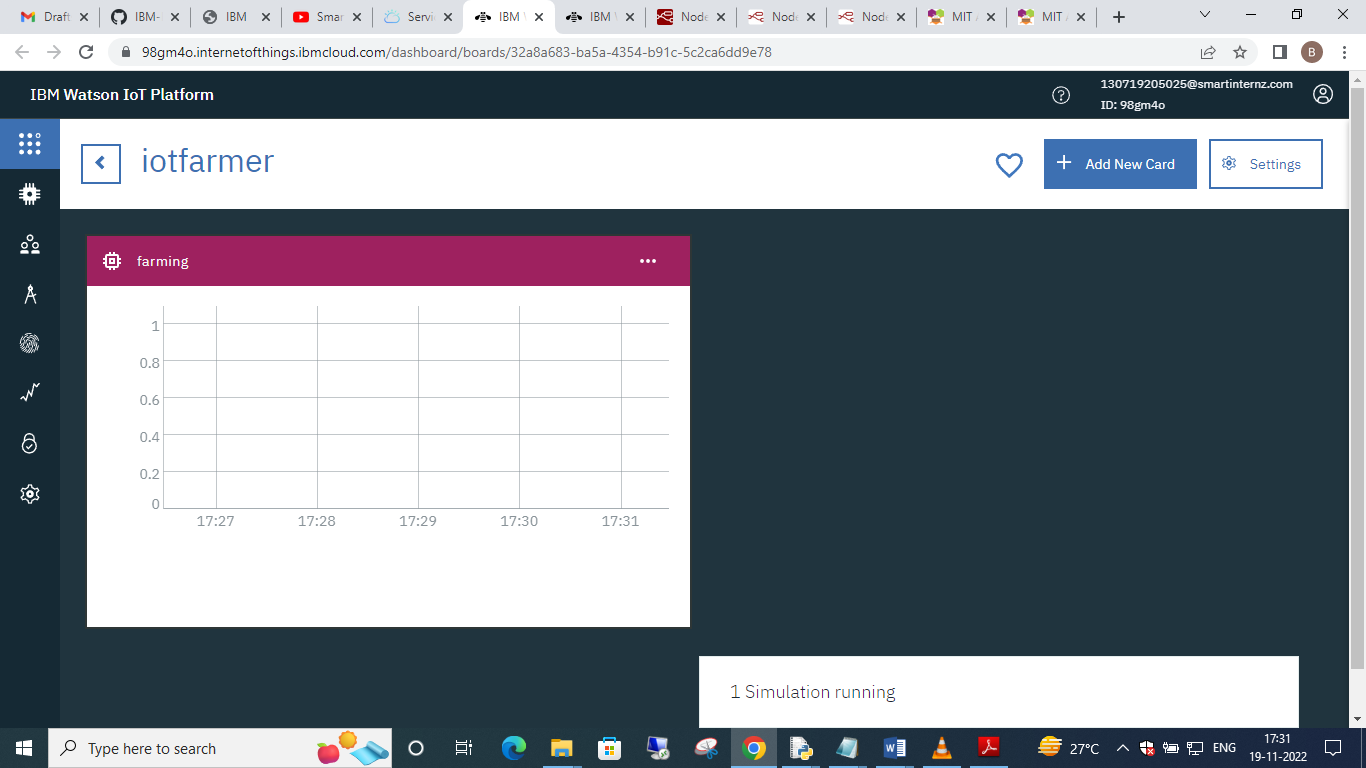
deviceCli.connect()

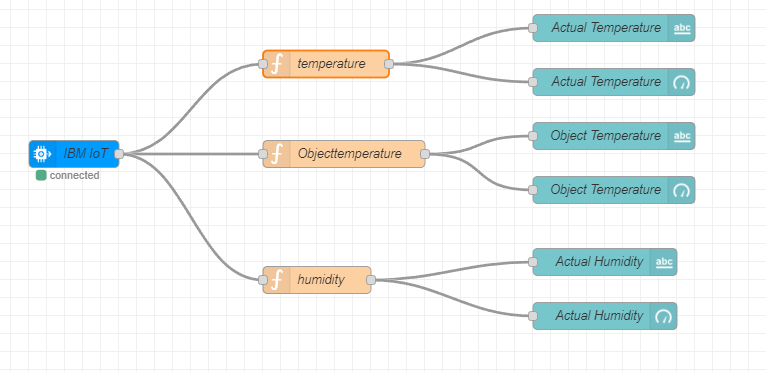
while True:

deviceCli.commandCallback = myCommandCallback

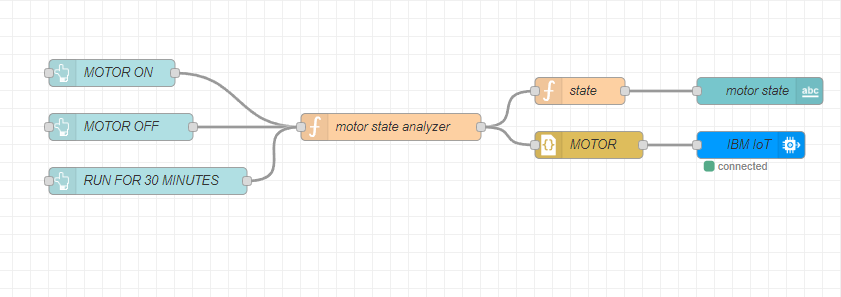
deviceCli.disconnect()

**8. TESTING**



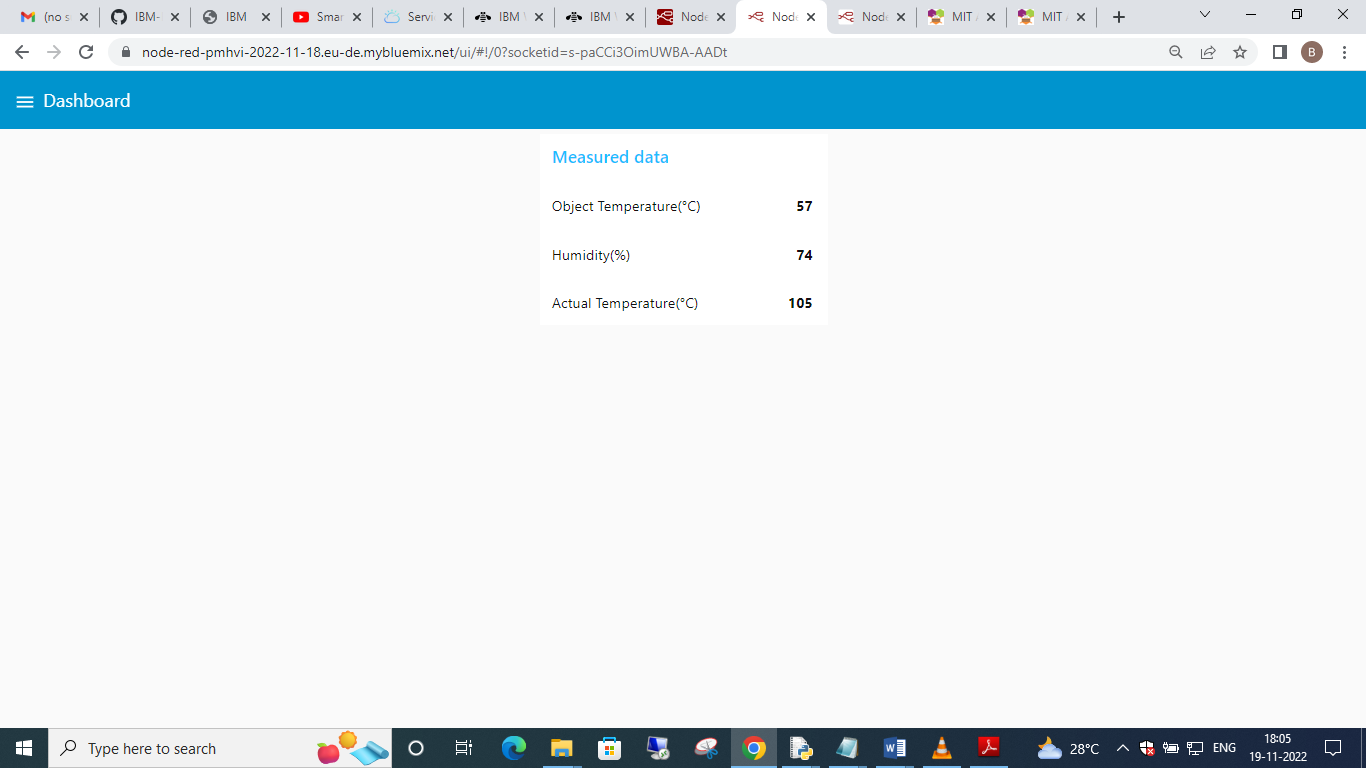


***Nodes connected in following manner to get each reading separately***

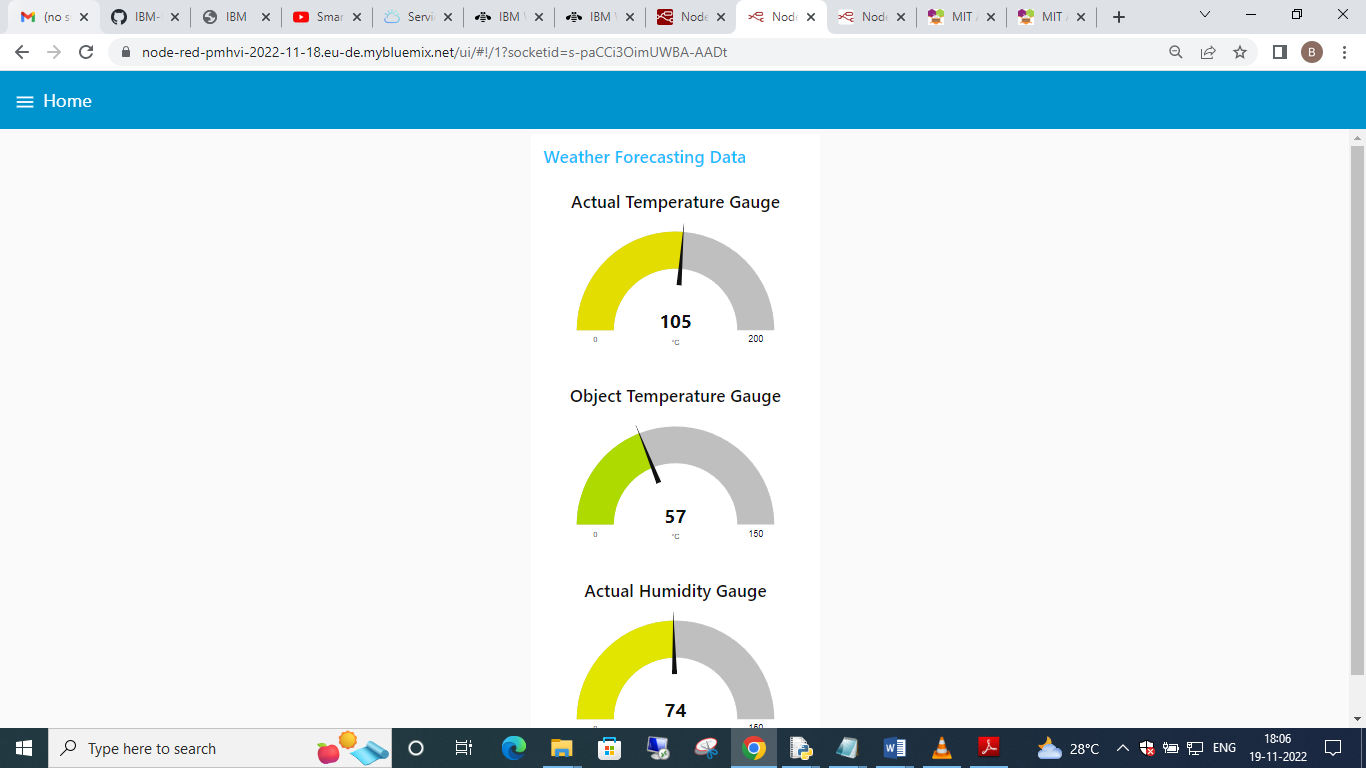
******

***This program flow for sending commands to cloud***

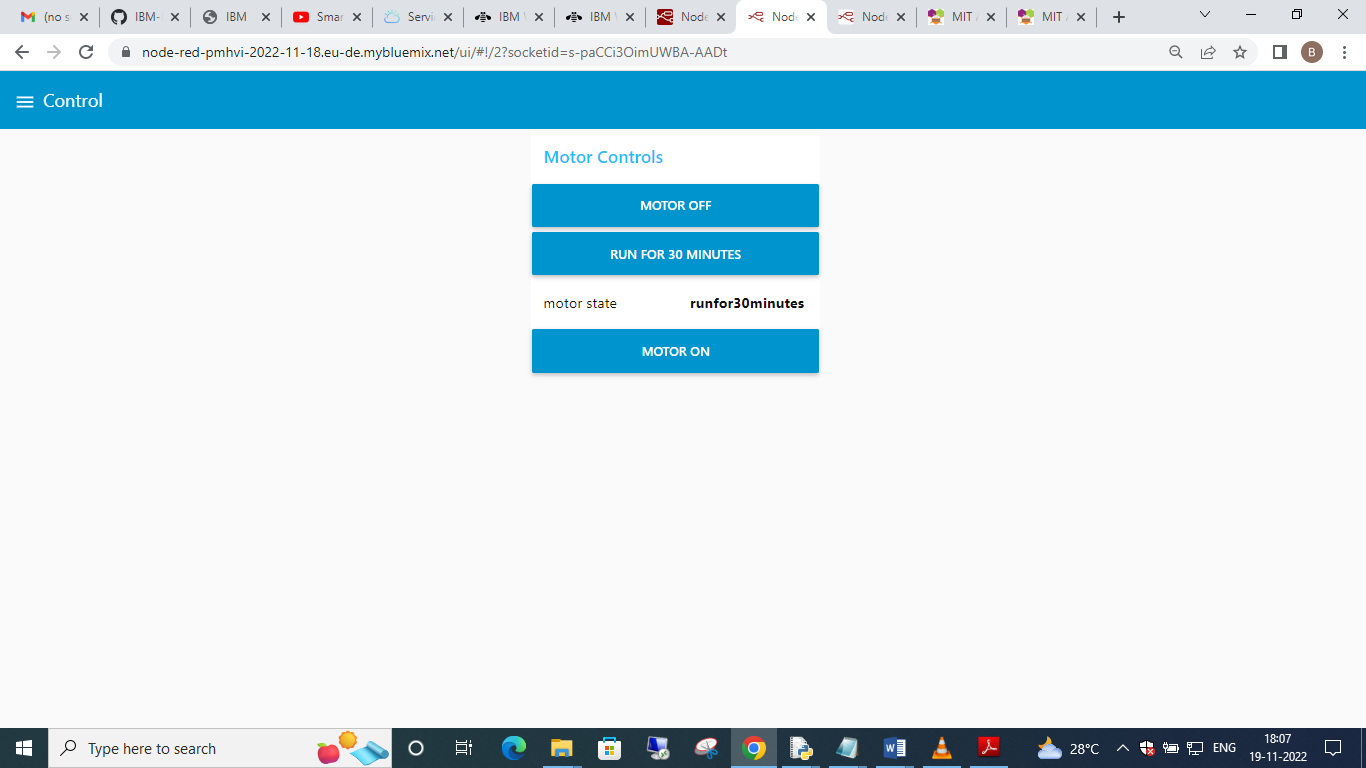
**9. RESULTS**



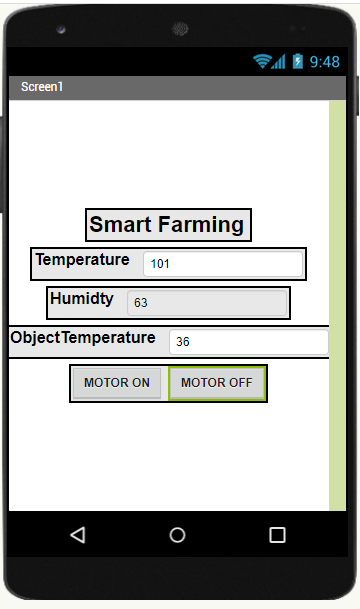
*This page will show the measured value of the simulator*



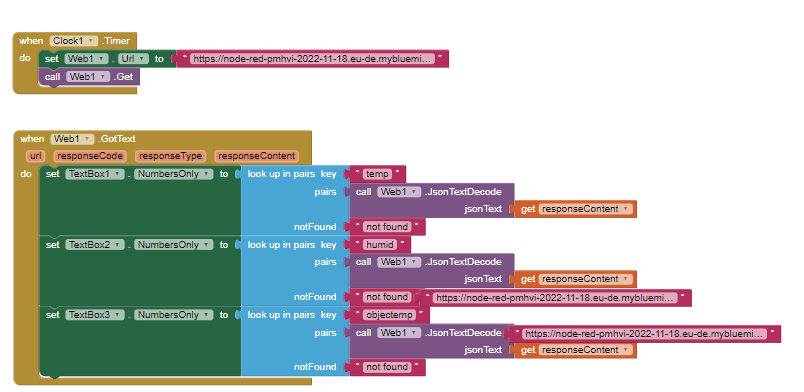
*This page is for general weather forecasting data*



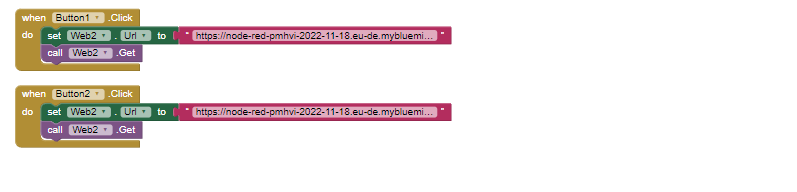
*This page is for controlling the motor*



*This is the complete layout of the mobile app*



*This is the functions runs behind the textbox*



*This is the functions runs behind the button*



*The Actual Output of the smart farming in python console*

**10. ADVANTAGES AND DISADVANTAGES**

**10.1 ADVANTAGES**

* Farms can be monitored and controlled remotely.
* Increase in convenience to farmers.
* Less labour cost.
* Better standards of living.

**10.2 DISADVANTAGES**

* Lack of internet/connectivity issues.
* Added cost of internet and internet gateway infrastructure.
* Farmers wanted to adapt the use of WebApp/MobileApp.

**11. CONCLUSION**

Thus the objective of the project to implement an IoT system in order to help farmers to control and monitor their farms has been implemented successfully.

**12. FUTURE SCOPE**

Smart farming is certainly a leading enabler in producing more food with less for an increasing world population. In particular, smart farming enables increased yield through more efficient use of natural resources and inputs, and improved land and environmental management.

**13. APPENDIX**

**SOURCE CODE**

import time

import sys

import ibmiotf.application

import ibmiotf.device

organization = "98gm4o"

deviceType = "iotdevice"

deviceId = "qwerty321"

authMethod = "token"

authToken = "qwerty123"

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time.sleep(1)

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elif cmd.data['command']=='runfor30minutes':

print("MOTOR RUNS FOR 30 MINUTES")

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for i in range(1,31):

print("%d minutes to stop"%(30-i)) # use time.sleep(60) for delay of one minute

time.sleep(2)

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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:

deviceCli.commandCallback = myCommandCallback

deviceCli.disconnect()

**GITHUB LINK:**

[**https://github.com/IBM-EPBL/IBM-Project-15419-1659598497**](https://github.com/IBM-EPBL/IBM-Project-15419-1659598497)

**DEMO LINK:**

[**https://drive.google.com/drive/folders/1uyaUM-OPfj\_7PVaMP1pZARMBkfMwj8Pe**](https://drive.google.com/drive/folders/1uyaUM-OPfj_7PVaMP1pZARMBkfMwj8Pe)