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IoT Enabled Smart Farming Application

Documentation

Table of Contents

1.INTRODUCTION

1.1 Project Overview

Plant monitoring is seen as one of the most important tasks in the farming or agriculture based environment. With the inception of Ambient systems, there have been a rise in ambient intelligent based devices. Integration of such an ambient intelligent system with plant monitoring makes farming easier.

1.2 Purpose

The purpose of this project is to give the customer a portal to view the information regarding the agiculture environment. The data will be analysed and information best gardening options for that particular plant will be provided to the user.

2. LITERATURE SURVEY

2.1 Existing Problem

Clever irrigation answers are the evolving trend in each day lives. the generation has finished a full circle via giving lower back to irrigation the modern- day developments and techniques which have been evolved. connectivity the usage of present wifi networks the use of the to be had hardwares is one important gain for clever agriculture.

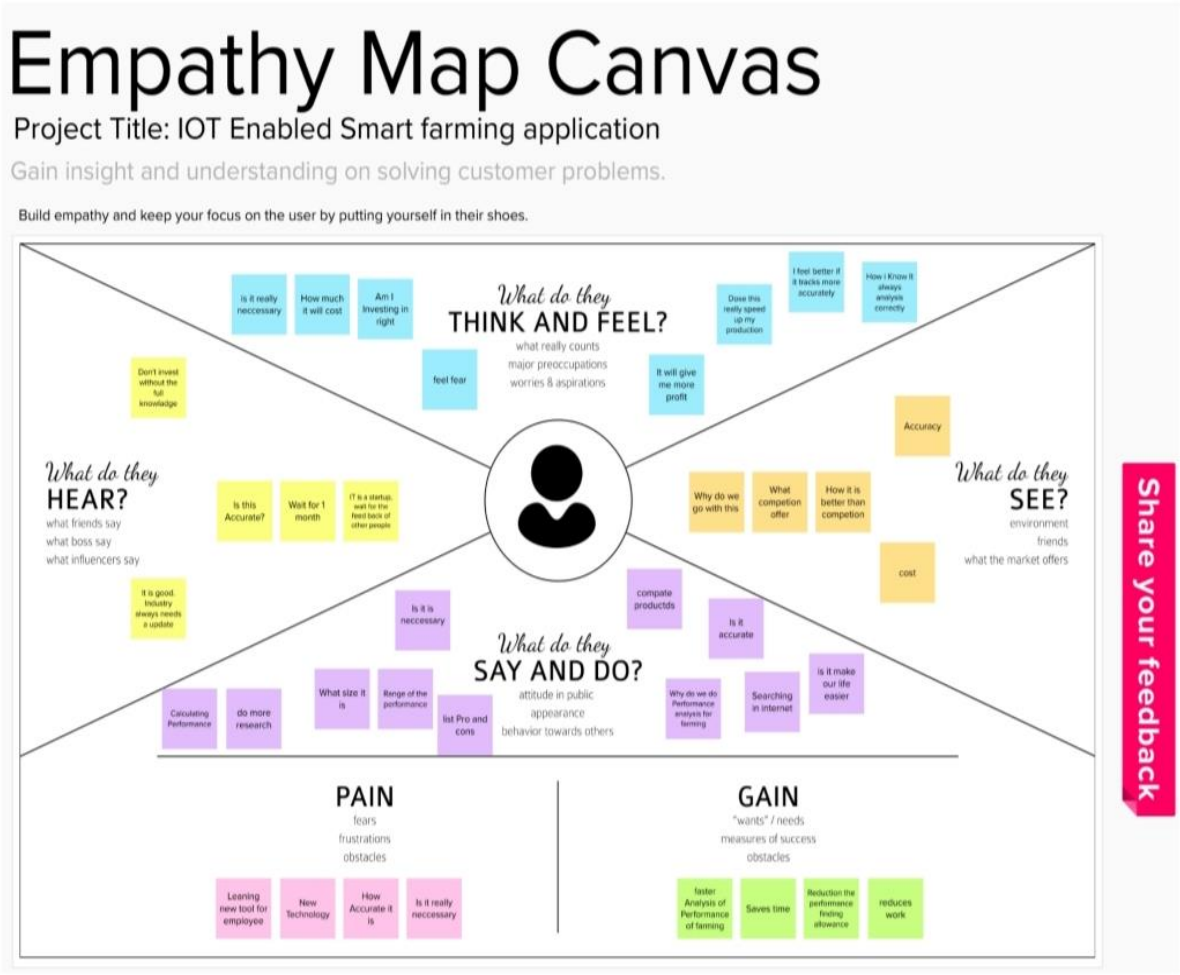
2.2 References

https://www.google.com/url?sa=t&source=web&rct=j&url=https://www.researchgate.net/publication/338458451_A_Literature_Survey_on_Internet_of_Things_IoT&ved=2ahUKEwjkwten07X7AhXTILcAHQsJDzkQFnoECAoQAQ&usg=AOvVaw3E-W9SedHxgpn-LaMIK3vF

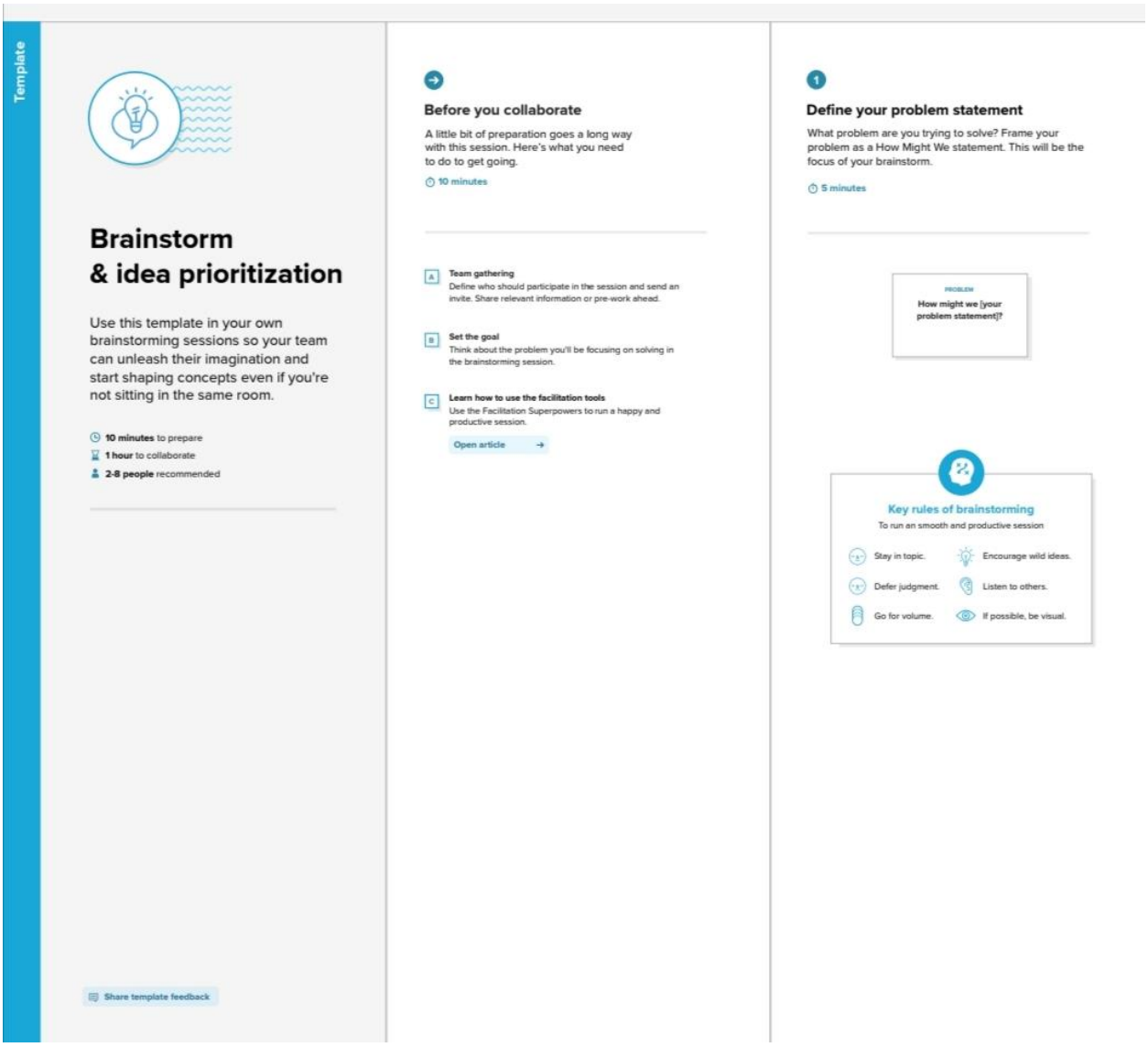
https://www.google.com/url?sa=t&source=web&rct=j&url=https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7070544/&ved=2ahUKEwjlj6Tn1LX7AhU0ELcAHQ9VCZYQFnoECCAQAQ&usg=AOvVaw14NcDbHoQFwleyJoe4Z6Ca

3.IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas



3.2 Ideation & Brainstorming



Template

Brainstorm & idea prioritization

Use this template in your own brainstorming sessions so your team can unleash their imagination and start shaping concepts even if you're not sitting in the same room.

10 minutes to prepare
1 hour to collaborate
2-8 people recommended

Share template feedback

Before you collaborate

A little bit of preparation goes a long way with this session. Here's what you need to do to get going.

10 minutes

Team gathering
Define who should participate in the session and send an invite. Share relevant information or pre-work ahead.

Set the goal
Think about the problem you'll be focusing on solving in the brainstorming session.

Learn how to use the facilitation tools
Use the Facilitation Superpowers to run a happy and productive session.

Open article →

Define your problem statement

What problem are you trying to solve? Frame your problem as a How Might We statement. This will be the focus of your brainstorm.

5 minutes

PROBLEM
How might we [your problem statement]?

Key rules of brainstorming
To run an smooth and productive session

- Stay in topic.
- Encourage wild ideas.
- Defer judgment.
- Listen to others.
- Go for volume.
- If possible, be visual.

2

Brainstorm

Write down any ideas that come to mind that address your problem statement.

10 minutes

TIP

You can select a sticky note and hit the pencil [switch to sketch] icon to start drawing!

TEAM LEAD

Member 1

Member 2

Member 3

3

Group ideas

Take turns sharing your ideas while clustering similar or related notes as you go. Once all sticky notes have been grouped, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you and break it up into smaller sub-groups.

20 minutes

TIP

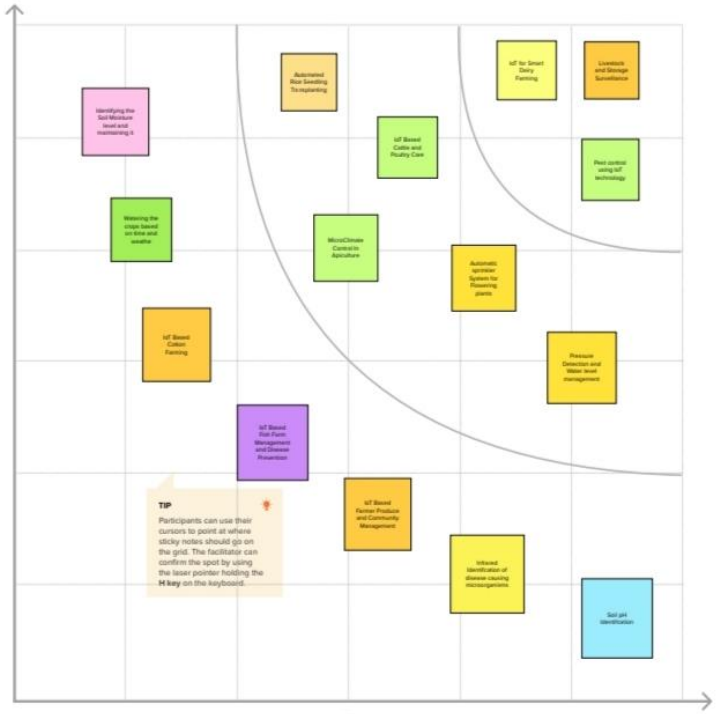
Add customizable tags to sticky notes to make it easier to find, browse, organize, and categorize important ideas as themes within your mural.

4

Prioritize

Your team should all be on the same page about what's important moving forward. Place your ideas on this grid to determine which ideas are important and which are feasible.

20 minutes



After you collaborate

You can export the mural as an image or pdf to share with members of your company who might find it helpful.

Quick add-ons

A **Share the mural**
Share a view link to the mural with stakeholders to keep them in the loop about the outcomes of the session.

B **Export the mural**
Export a copy of the mural as a PNG or PDF to attach to emails, include in slides, or save in your drive.

Keep moving forward

Strategy blueprint
Define the components of a new idea or strategy.
Open the template →

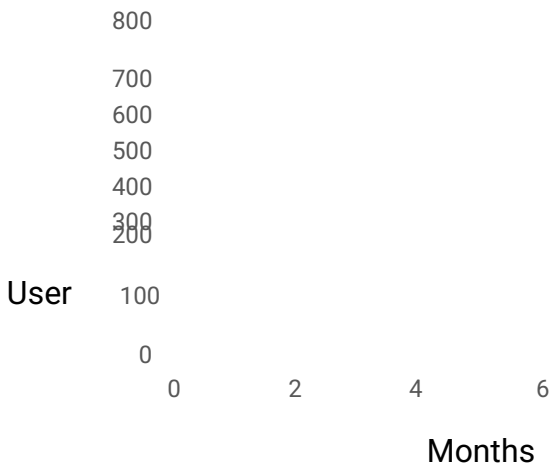
Customer experience journey map
Understand customer needs, motivations, and obstacles for an experience.
Open the template →

Strengths, weaknesses, opportunities & threats
Identify strengths, weaknesses, opportunities, and threats (SWOT) to develop a plan.
Open the template →

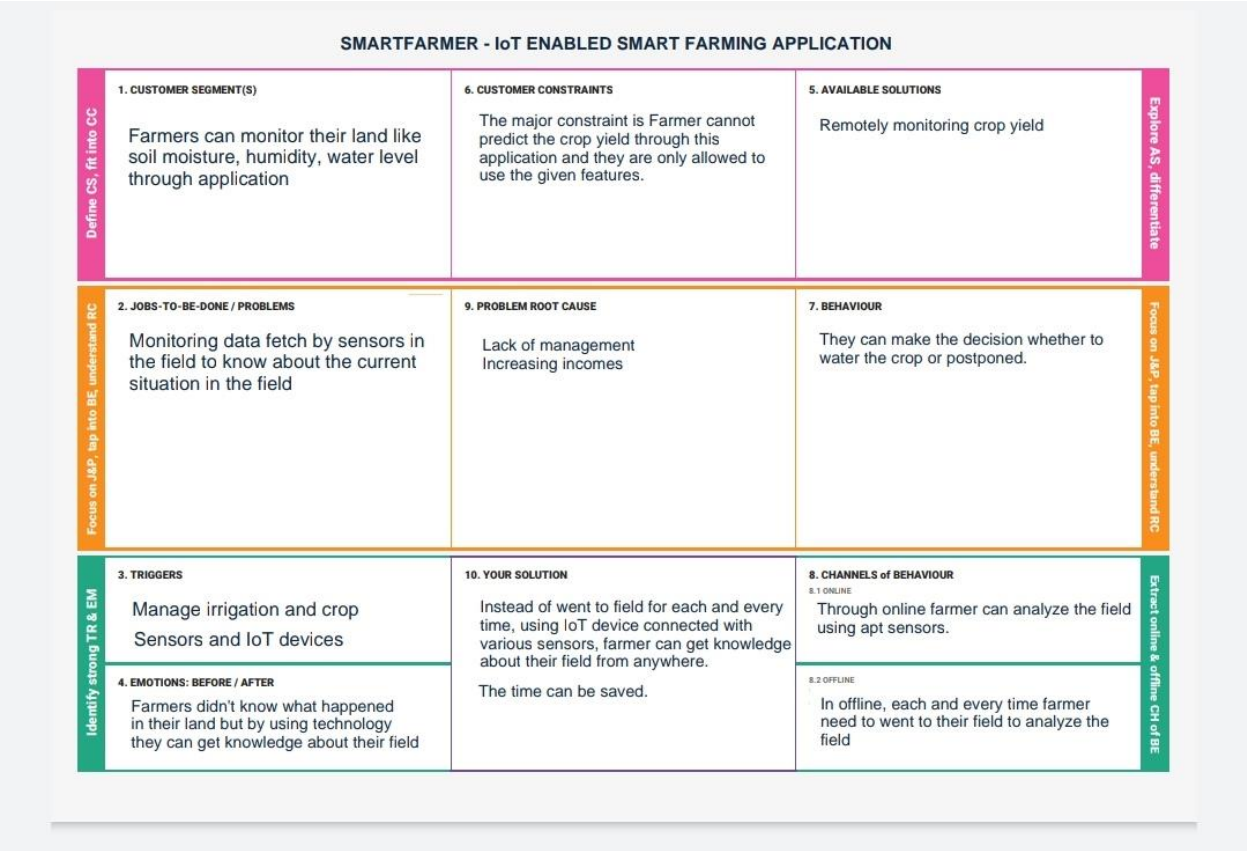
Share template feedback

3.3 Proposed Solution

S.No	Parameter	Description
1.	Problem Statement (Problem to be solved)	●The act of watering a field is challenging; farmers must wait in the field until the entire farm field is submerged inwater. ●One of the issues is the power supply. Power availability in Village Side may be variable. ●The IoT in Agriculture Faces the Following Major Challenges ● High Lack of Information, security, Cost, and Adoption,worries,etc.
2.	Idea / Solution description	● As with smart farming and precision agriculture ● Farmers are better able to keep an eye on their fields and adjust the humidity level as needed thanks to technology. ●The information gathered by sensors—which includes information on humidity, temperature, wetness, and dew detections—helps forecast the weather in farms. So, cultivation for suitable crops is carried out.
3.	Novelty / Uniqueness	**ALERT MESSAGE** – IoT sensor nodes gather data from the agricultural environment, including soil moisture, air humidity, temperature, the nutrients in the soil, pest images, and water quality, and then send the gathered information to IoT backhaul devices. **REMOTE ACCESS -** The farmer can control the motor from anyplace, which is helpful.
4.	Social Impact / Customer Satisfaction	●Reduces the pay for workers in the agricultural sector. ●It helps you save lots of time. ●By boosting the consumer experience overall, IoT can help strengthen customer relationships. ● Identify maintenance requirements quickly, create better products, provide tailored communications, and more. ● IoT may also boost sales and make e-commerce companies successful. It creates a prosperous society.

5.	Business Model (Revenue Model)	Revenue (No. of Users vs Months) 
6.	Scalability of the Solution	Scalability in smart farming refers to a system's ability to expand its capacity, such as the number of technological components like sensors and actuators, while allowing for prompt analysis.

3.4 Proposed Solution fit



4. REQUIREMENT ANALYSIS

4.1 Functional requirement

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form Registration through Gmail
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	Sensor Function for framing System	Measure the Temperature and Humidity Measure the Soil Monitoring Check the cropdiseases
FR-4	Manage Modules	Manage Roles of User Manage User permission
FR-5	Check whether details	Temperature detailsHumidity details
FR-6	Data Management	Manage the data of weather conditionsManage the data of crop conditions Manage the data of live stock conditions

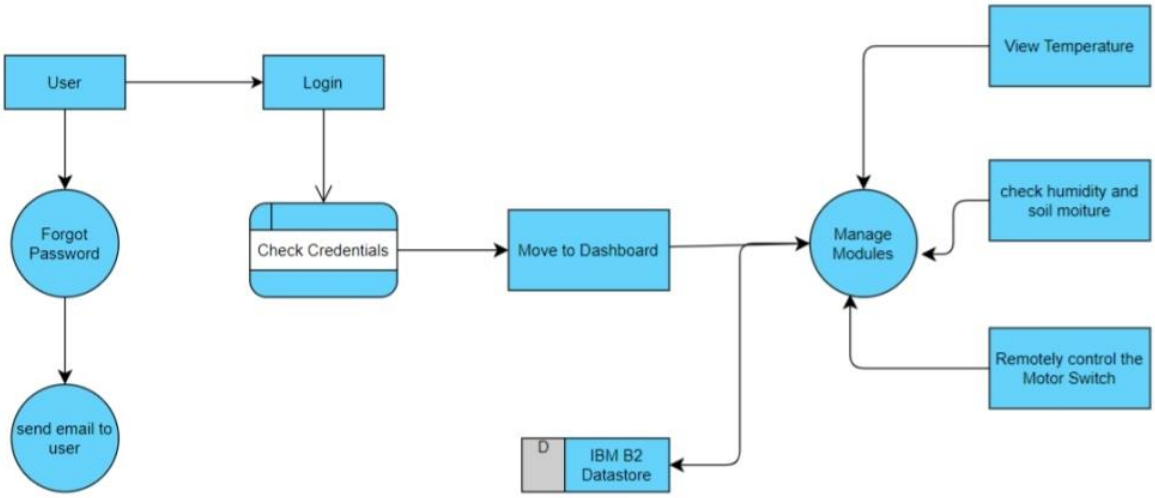
4.2 Non-Functional Requirements

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	✓ User friendly guidelines for users to avail the features. ✓ Most simplistic user interface for ease of use.
NFR-2	**Security**	✓ All the details about the user are protected from unauthorized access. ✓ Detection and identification of any misfunctions of sensors.
NFR-3	**Reliability**	✓ Implementing Mesh IoT Networks ✓ Building a Multi-layered defence for IoT Networks.
NFR-4	**Performance**	The use of modern technology solutions helps to achieve the maximumperformances thus resulting in better quality and quantity yields.
NFR-5	**Availability**	This app is available for all platforms
NFR-6	**Scalability**	Scalability refers to the ability to increase available resources and system capability without the need to go through a major system redesign or implementation.

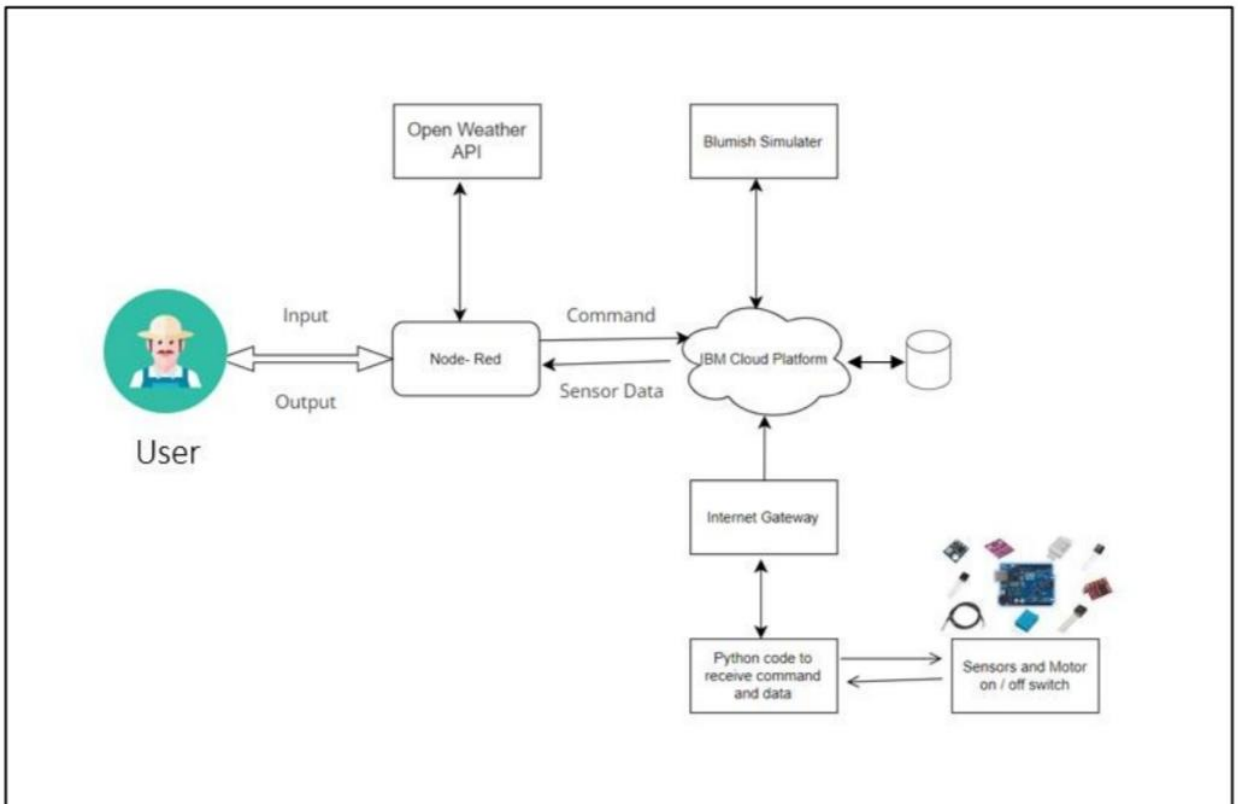
5.PROJECT DESIGN

5.1 Data flow diagrams

Data Flow Diagrams:



5.2 Solution & Technical Architecture



5.3 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 confirmingmypassword.	I can accessmy account /dashboard	High	Sprint-1

		USN-2	As a user, I will receive c onfirmation e mailonce I have registere d for the appli cation	I canrecei ve confir mationem ail& click confirm	High	Sprint-1
		USN-3	As a user, I ca n register for t he application through Gmail		Medium	Sprint-1
	Login	USN-4	As a user, I ca nlog into the applic ation byenteri ng email &passw ord		High	Sprint-1
Custome r (Webus er)	Dashboard	USN-5	As a User can view the dashboard, and this dashboard i nclude the chec kroles of access and then move to the mana gemodules.	I can view the dashboar din this smart farming application system.	High	Sprint 2
		USN-6	User canremotely access the motor switch	In the smart farming app	High	Sprint 3
Administr ator			As a useronce view the manage modules this describes the Manage system Admins andManage R oles of User andec			Sprint 2

6. PROJECT PLANNING & SCHEDULING

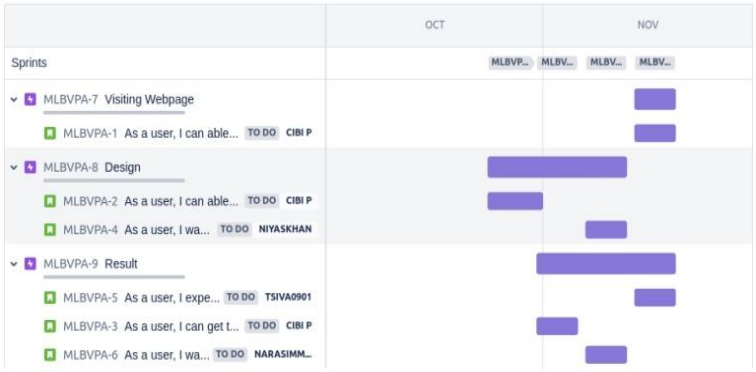
6.1 Sprint Planning & Estimation

Sprint	Functional Requirement(Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Simulation creation	USN-1	Connect Sensors and Arduino with python code	2	High	Poovarasan, Dillibabu
Sprint-2	Software	USN-2	Creating device in the IBM Watson IoT platform, workflow for IoT scenarios using Node-Red	2	High	Nivas, Poovarasan, Dillibabu
Sprint-3	MIT App Inventor	USN-3	Develop an application for the Smart farmer project using MIT App Inventor	2	High	Jayapandi, Nivas, Dillibabu
Sprint-3	Dashboard	USN-3	Design the Modules and test the app	2	High	Poovarasan, Nivas, Jayapandi
Sprint-4	Web UI	USN-4	To make the user to interact with software.	2	High	Dillibabu, Nivas

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		05 Oct 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022		12 Oct 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022		15 Oct 2022

6.3 Report from JIRA



7. CODING & SOLUTION

7.1 Feature 1

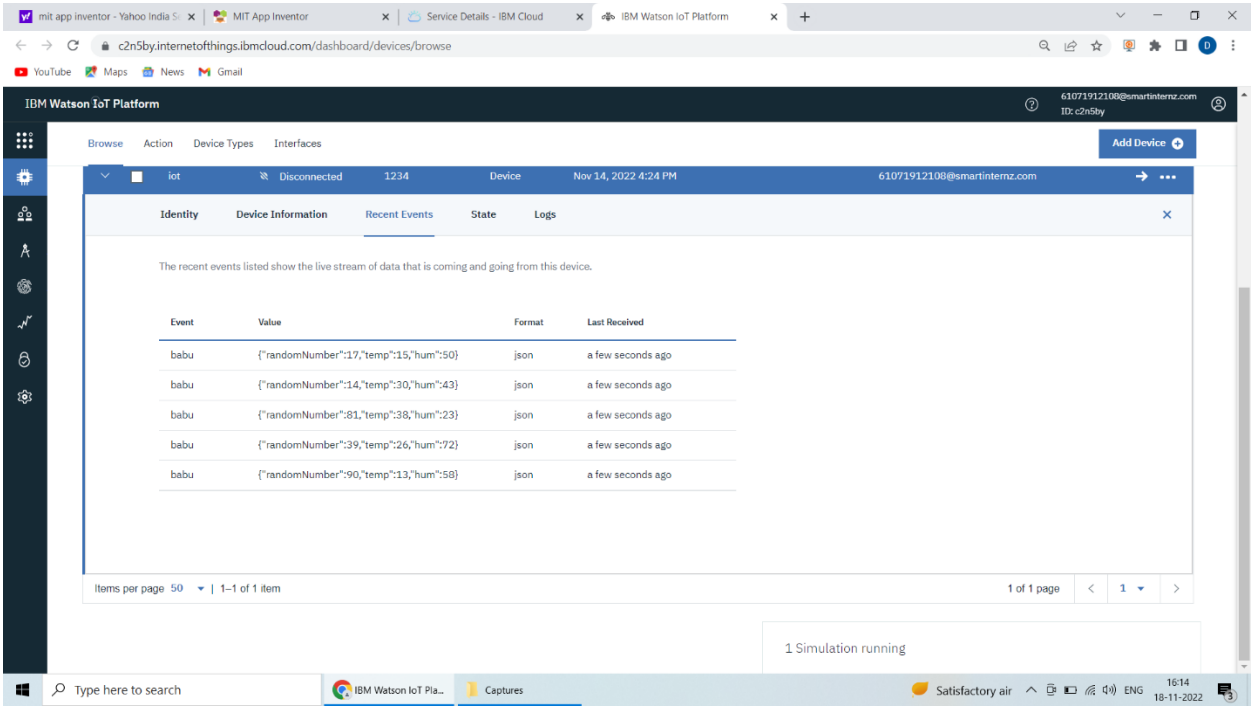
Created a interface for the user to view the farm environment information using the MIT app inventor.

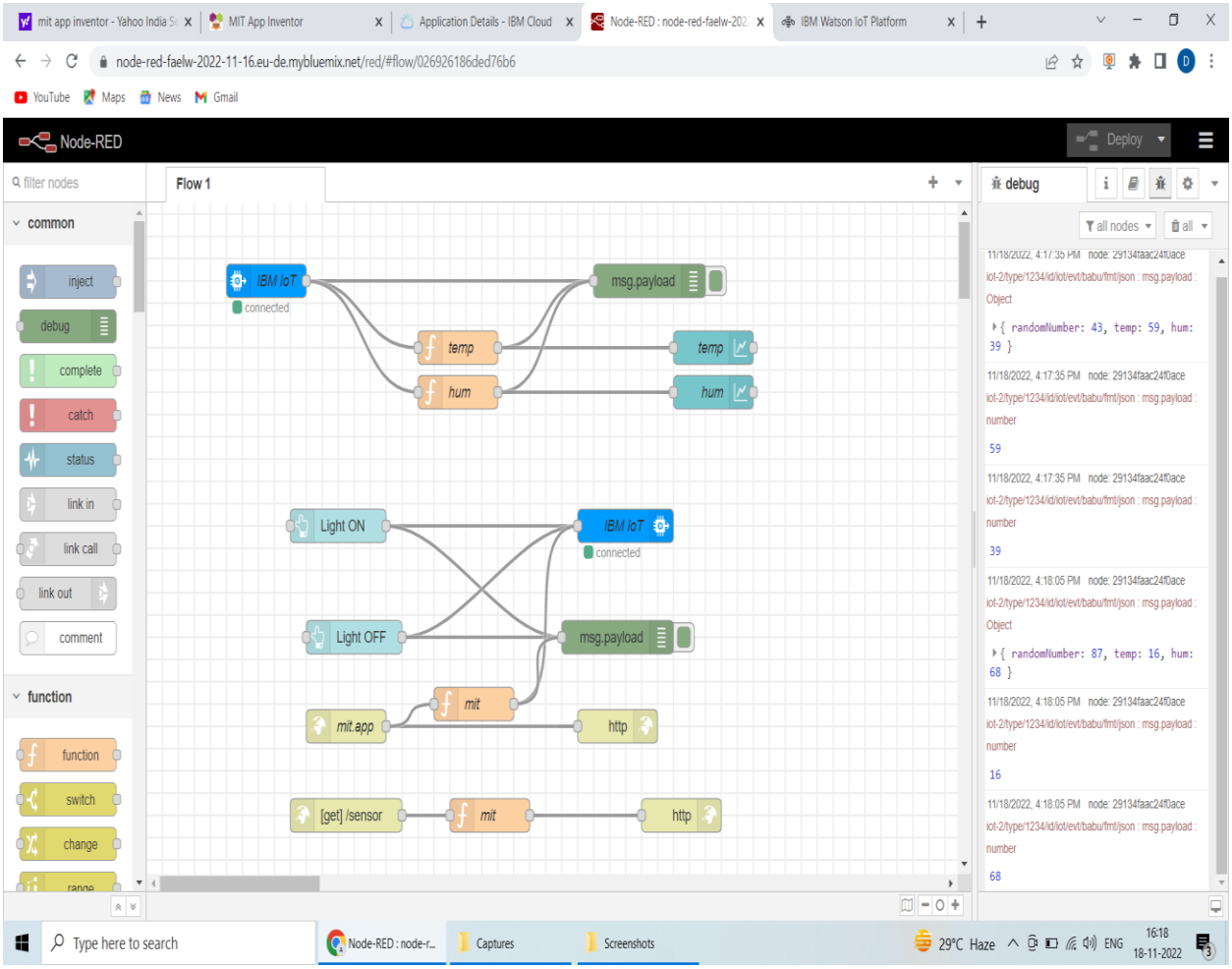
7.2 Feature 2

implementation of the model integrated with cloud.

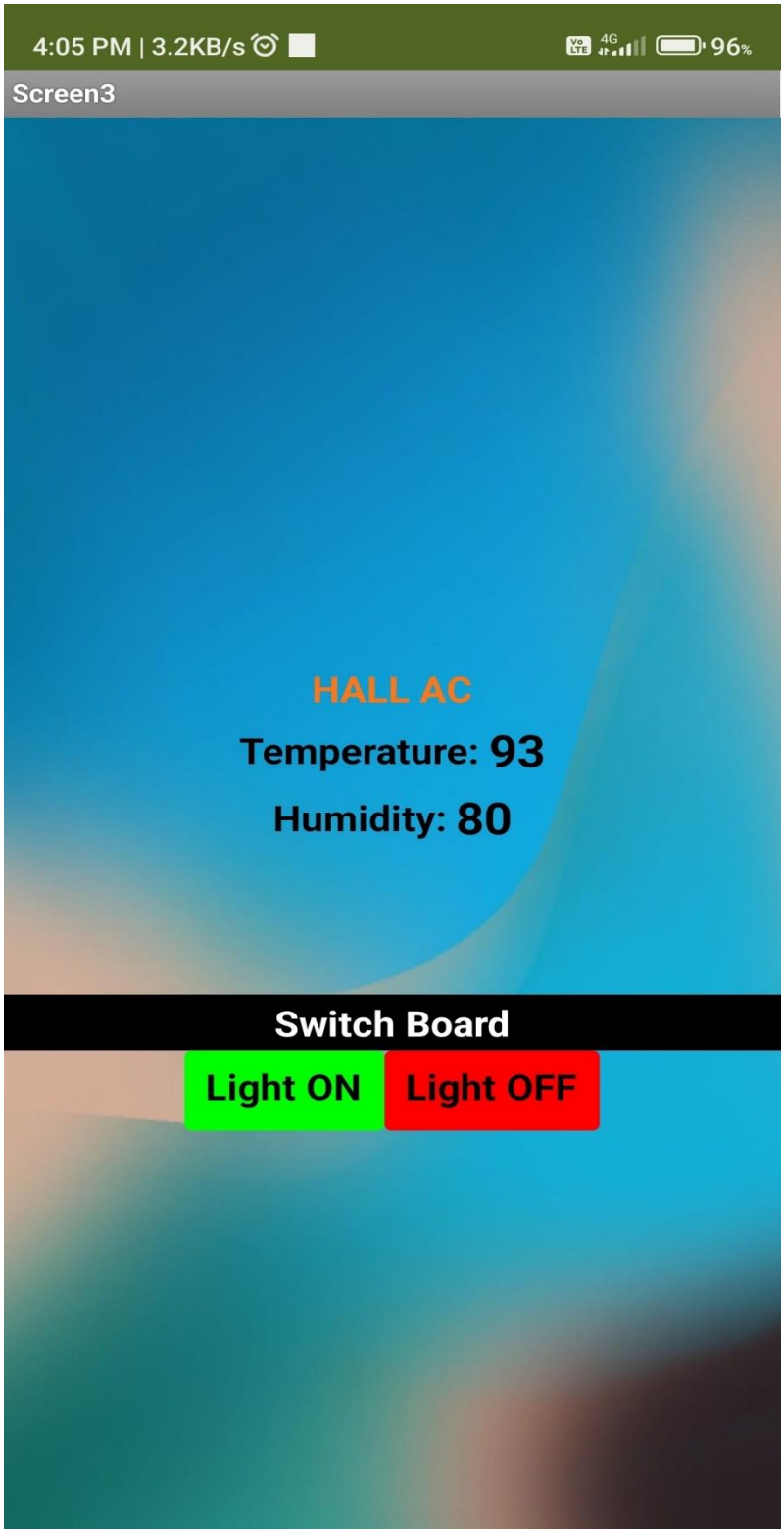
8. TESTING

8.1 Test Cases



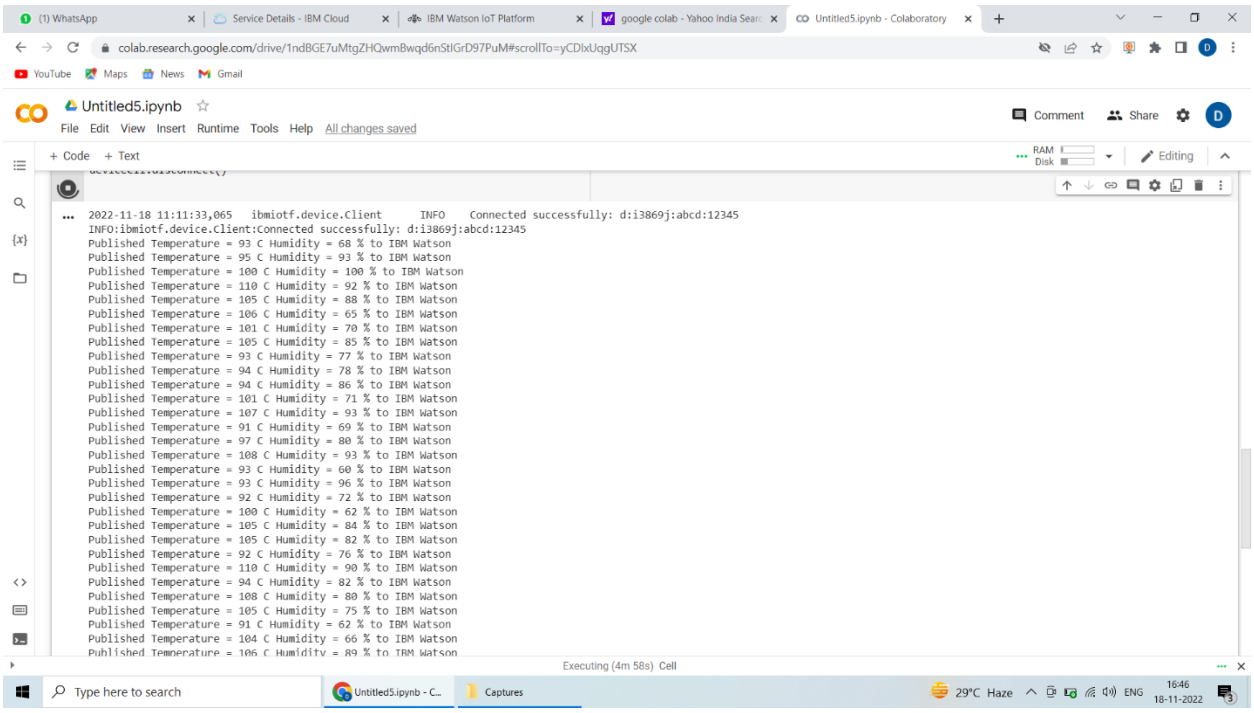

mit app inventor - Yahoo India S
MIT App Inventor
Application Details - IBM Cloud
Node-RED : node-red-faelw-202
IBM Watson IoT Platform
node-red-faelw-2022-11-16.eu-de.mybluemix.net/red/#flow/026926186ded76b6
YouTube
Maps
News
Gmail
Node-RED
Deploy
filter nodes
Flow 1
common
inject
debug
complete
catch
status
link in
link call
link out
comment
function
function
switch
change
IBM IoT
connected
msg.payload
temp
hum
Light ON
Light OFF
mit app
mit
http
[get] /sensor
debug
all nodes
all
11/18/2022, 4:17:35 PM node: 29134faac24f0ace
iot-2/type/1234/id/iot/evt/babu/fmt/json : msg.payload : Object
{ randomNumber: 43, temp: 59, hum: 39 }
11/18/2022, 4:17:35 PM node: 29134faac24f0ace
iot-2/type/1234/id/iot/evt/babu/fmt/json : msg.payload : number
59
11/18/2022, 4:17:35 PM node: 29134faac24f0ace
iot-2/type/1234/id/iot/evt/babu/fmt/json : msg.payload : number
39
11/18/2022, 4:18:05 PM node: 29134faac24f0ace
iot-2/type/1234/id/iot/evt/babu/fmt/json : msg.payload : Object
{ randomNumber: 87, temp: 16, hum: 68 }
11/18/2022, 4:18:05 PM node: 29134faac24f0ace
iot-2/type/1234/id/iot/evt/babu/fmt/json : msg.payload : number
16
11/18/2022, 4:18:05 PM node: 29134faac24f0ace
iot-2/type/1234/id/iot/evt/babu/fmt/json : msg.payload : number
68
Type here to search
Node-RED : node-r...
Captures
Screenshots
29°C Haze
ENG
16:18
18-11-2022

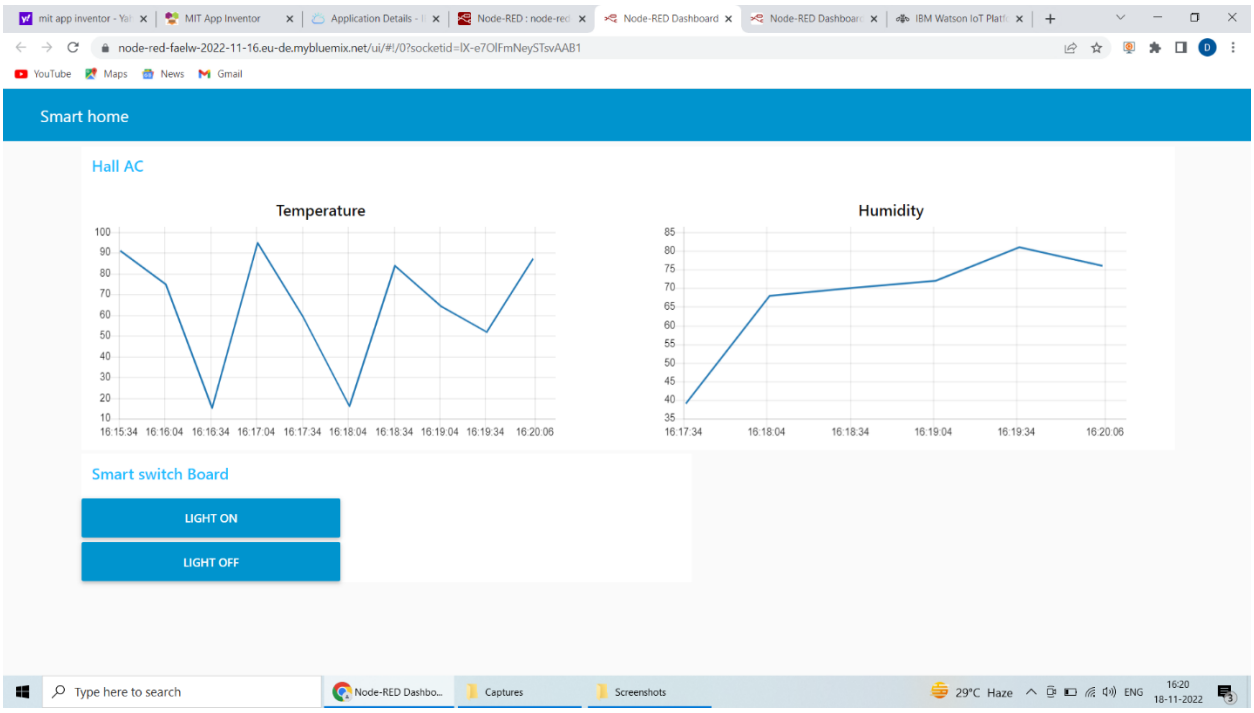
8.2 User Accepting Testing



9.RESULTS

9.1 Performance Metrics





10. ADVANTAGES & DISADVANTAGES

Advantages

1.One of the main benefits of IoT systems in irrigation is associated with the lower water consumption.

2.Also, most of the work related to irrigation is automated through such an approach, only the required amount of water is utilized for the irrigation process and lesser wastage takes place.

Disadvantages

1.The primary disadvantage associated with a smart irrigation is the expense.
2.These systems can be quite costly depending on the size of the property.
3.Furthermore, portions of the lawn will have to be dug up to install pipework and attach it to the plumbing system of the home.

11.CONCLUSION

Hence, the paper proposes an concept of mixing the state-of-the-art generation into the rural field to show the conventional methods of irrigation to modern methods for that reason making easy effective, and cost-effective cropping. some extent of automation is brought permitting the idea of tracking the sphere and the crop situations within a few lengthy-distance tiers using cloud offerings. the benefits like water saving and hard work-saving are initiated the usage of sensors that work automatically as they're programmed. Peoples are busy, they fail to spend time on them i.e what plant need like how much water is need for growth. this concept of modernization of agriculture is easy, low-cost and operable. for this reason, the paper proposes an idea of combining the modern generation into the agricultural subject to show the conventional strategies of irrigation to trendy strategies therefore making clean productive, and within your budget cropping. A few quantity of automation is added permitting the concept of tracking the sphere and the crop situations inside some lengthy-distance degrees using cloud offerings. the advantages like water saving and labor-saving are initiated the usage of sensors that paintings automatically as they're programmed. this concept of modernization of agriculture is easy, inexpensive and operable.Through this project it can be concluded that there can be considerable development in farming with use of IoT and automation.Thus,the system is a potential solution to the problems faced in the existing manual and cumbersome process of irrigation by enabling efficient utilization of water resources.

12. FUTURE SCOPE

Large ability of our indian agriculture is but untapped and we still have miles to tour in this arena of studies as we've specific soil textures in different areas of our kingdom. farmers may be benefitted through the real implementation of this projected software. real demanding situations that had been faced and which can be but to be triumph over in fact are the inter- networking of the nodes in an agricultural area and in designing a user pleasant software this is without difficulty comprehensible for the farmers.

13. APPENDEX

Source code

```
import time
import sys
import ibmiotf.application
import ibmiotf.device
import random

#Provide your IBM Watson Device Credentials
organization = "c2n5by"
deviceType = "1234"
deviceId = "iot"
authMethod = "token"
authToken = "12345678"

# Initialize GPIO
def myCommandCallback(cmd):
    print("Command received: %s" % cmd.data['command'])
    status=cmd.data['command']
    if status=="lighton":
        print ("led is on")
    elif status == "lightoff":
        print ("led is off")
    else :
        print ("please send proper command")

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:
        #Get Sensor Data from DHT11
```

```
        temp=random.randint(90,110)
        Humid=random.randint(60,100)

        data = { 'temp' : temp, 'Humid': Humid }
        #print data
        def myOnPublishCallback():
            print ("Published Temperature = %s C" % temp, "Humidity = %s %%" % Humid, "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()
```

Github Link

https://github.com/IBM-EPBL/IBM-Project-30121-1660140340

Demo Link

https://youtu.be/qpvt_O9geYk