SMART FARMER - AN IOT ENABLED SMART FARMING APPLICATION

A PROJECT REPORT

Submitted by

PRASANNA N (19EUEC101)
PRATEEK RAM RA (19EUEC102)
PREM KUMAR B(19EUEC105)
PRAVIN KUMAR P (19EUEC104)

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(An Autonomous Institution. Affiliated to Anna University, Chennai)
Kuniamuthur, Coimbatore - 641 008

BONAFIDE CERTIFICATE

Certified that this project report titled **"SMART FARMER- AN IOT ENABLED SMART FARMING APPLICATION"** is the Bonafede work of **PRASANNA N (19EUEC101) ., PRATEEK RAM RA (19EUEC102)., PREM KUMAR B (19EUEC105) ., PRAVIN KUMAR P (19EUEC104)** who carried out theproject work under my supervision.

SIGNATURE	**SIGNATURE**
Dr.K. SASI KALA RANI, M.E., Ph.D.,	**Mr. K. KARTHIK., M.E**
HEAD OF THE DEPARTMENT	**SUPERVISOR**

Department of Computer Science and
Engineering Sri Krishna College of Engineering
and TechnologyKuniamuthur, Coimbatore

Submitted for the Project viva-voce examination held on_____

INTERNAL EXAMINER	**EXTERNAL EXAMINER**

ABSTRACT

IoT is bringing revolution to almost every aspect of our lives by changing how we do things. The use of Smart IoT devices is on the rise with all the industries heavily investing in IoT. The main aims of investing in IoT are to improve operations efficiency, improve product quality, and reduce the costs of production. The Agricultural industry is among the industries seeking to reap the benefits of IoT. The use of IoT in agriculture is commonly referred to as Smart Farming or Smart Agriculture. It uses various IoT sensors to send the farm's data, like humidity, temperature, soil moisture, etc. to the cloud which can be monitored and controlled from anywhere in the world.

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PROJECT REPORT

1. INTRODUCTION

1.1 Project Overview

IoT is bringing revolution to almost every aspect of our lives by changing how we do things. The use of Smart IoT devices is on the rise with all the industries heavily investing in IoT. The main aims of investing in IoT are to improve operations efficiency, improve product quality, and reduce the costs of production. The Agricultural industry is among the industries seeking to reap the benefits of IoT.

Purpose

The use of IoT in agriculture is commonly referred to as Smart Farming or Smart Agriculture. It uses various IoT sensors to send the farm's data, like humidity, temperature, soil moisture, etc. to the cloud which can be monitored and controlled from anywhere in the world.

2. LITERATURE SURVEY

2.1 Existing problem

India is agriculture sector, on either side, is losing ground every day, affecting the ecosystem's output capacity. In order to restore vitality and put agriculture back on a path of higher growth, there is a growing need to resolve the issue. A large-scale agricultural system necessitates a great deal of upkeep, knowledge, and oversight. The IoT is a network of interconnected devices that can transmit and receive data over the internet and carry out tasks without human involvement. Agriculture provides a wealth of data analysis parameters, resulting in increased crop yields. The use of IoT devices in smart farming aids in the modernization of information and communication. For better crop growth moisture, mineral, light and other factors can be assumed. This research looks into a few of these characteristics for data analysis with the goal of assisting users in making better agricultural decisions using IoT. The technique is intended to help farmers increase their agricultural output.

1)Accidental deforestation
2) Soil erosion
3) High water usage
4) Energy wastage
5) Carbon emissions
6) Time consuming process
7) Poor outcomes of cultivation
8) Defense priority not customized to
Prevent intruding animals

2.2 References

1.Zuraida Muhammad, Muhammad Azri Asyraf Mohd Hafez, Nor Adni MatLeh, Zakiah Mohd Yusoff , Shabinar Abd Hamid [1] The term "Internet of Things" refers to the connection of objects, equipment, vehicles, and other electronic devices to a network for the purpose of data exchange (IoT). The Internet of Things (IoT) is increasingly being utilised to connect objects and collect data. As a result, the Internet of Things' use in agriculture is crucial

2.Divya J., Divya M.,Janani V. [2] Agriculture is essential to India's economy and people's survival. The purpose of this project is to create an embedded-based soil monitoring and irrigation system that will reduce manual field monitoring and provide information via a mobile app. The method is intended to help farmers increase their agricultural output. A pH sensor, a temperature sensor, and a humidity sensor are among the tools used to examine the soil. Based on the findings, farmers may plant the best crop for the land

3. **H.G.C.R. Laksiri, H.A.C. Dharmagunawardhana, J.V. Wijayakulasooriya** [3] Development of an effective loT-based smart irrigation system is also a crucial demand for farmers in the field of agriculture. This research develops a low-cost, weather-based smart watering system. To begin, an effective drip irrigation system must be devised that can automatically regulate water flow to plants based on soil moisture levels. Then, to make this water-saving irrigation system even more efficient, an IoT-based communication feature is added, allowing a remote user to monitor soil moisture conditions and manually adjust water flowH.G.C.R. Laksiri, H.A.C. Dharmagunawardhana, J.V. Wijayakulasooriya [3] Development of an effective loT-based smart irrigation system is also a crucial demand for farmers in the field of agriculture. This research develops a low-cost, weather-based smart watering system. To begin, an effective drip irrigation system must be devised that can automatically regulate water flow to plants based on soil moisture levels. Then, to make this water-saving irrigation system even more efficient, an IoT-based communication feature is added, allowing a remote user to monitor soil moisture conditions and manually adjust water flow

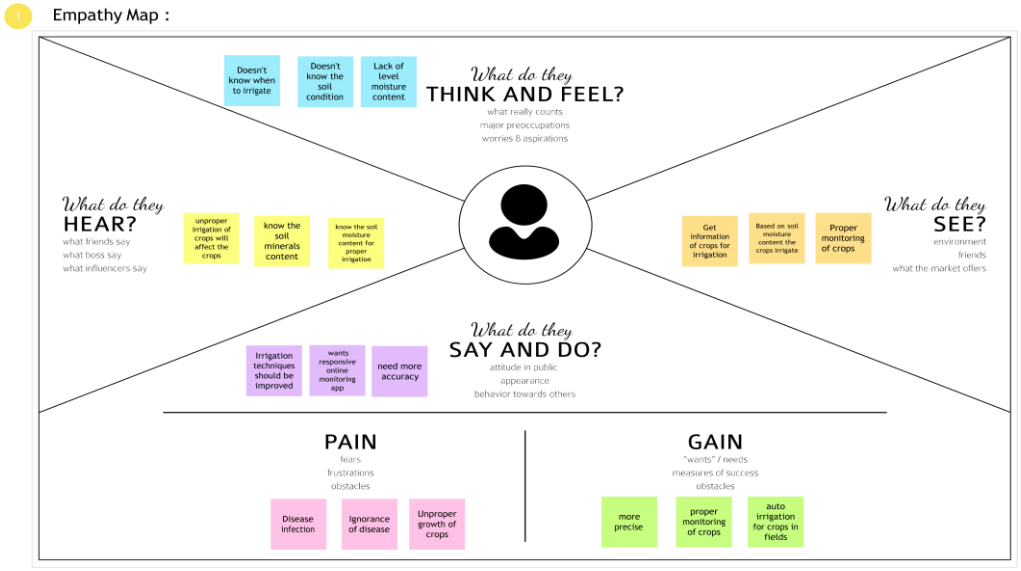
2.3 Problem Statement Definition

Mr. Arvind is a farmer with a background in engineering. Together with his father, he has ventured into agriculture. Since he is just starting out in farming, he needs someone to help him through the first few years. He also wants to incorporate technology into farming to cut down on work and labor, increase productivity, produce more, and get ideas for how to improve the soil and plant the next crop. He is actively looking into a few agricultural products that can help him. Many beginning and experienced farmers face these issues

- Who does the problem affect?
- What are the boundaries of the problem?
- What is the issue?
- When does the issue occur?
- Why is it important that we fix the problem?
- What solution to solve this issue?

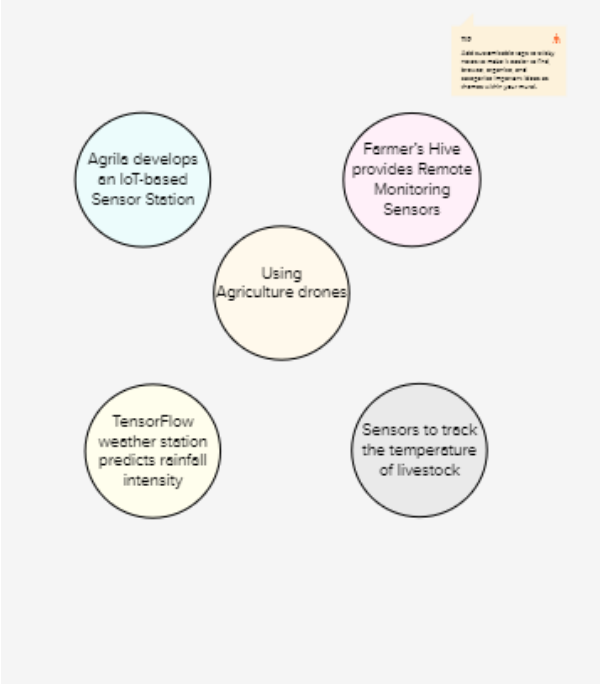
3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas



3.2 Ideation & Brainstorming

Ideation is the process where you generate ideas and solutions through sessions such as Sketching, Prototyping, Brainstorming, Brainwriting, Worst Possible Idea, and a wealth of other ideation techniques.



3.3 Proposed Solution

3.4 Problem Statement

Watering the field is a difficult process, Farmers have to wait in the field until the water covers the whole farm field. Power Supply is also one of the problems. In Village Side, the power supply may vary. The

Biggest Challenges Faced by IoT in the Agricultural Sector are Lack of Information, High Adoption, Cost and Security Concerns, etc

Idea / Solution description

As is the case of precision Agriculture Smart Farming Technique Enables Farmers better to monitor the fields and maintain the humidity level accordingly. The Data collected by sensors, In terms of humidity, temperature, moisture, and dew detections help in the weather pattern in Farms. So cultivation is done for suitable crops.

Novelty

It helps the farmer to operate the motor from anywhere.

3.5 Problem Solution fit

4. REQUIREMENT ANALYSIS

Functional Requirements:

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	EMAIL: Enter email address PASSWORD: Enter password
FR-2	User Confirmation	Confirmation via Email. Thanks for your email.
FR-3	Log in to system	Serve authenticated content
FR-4	Manage Modules	Manage System Admins Manage Roles of User Manage User permission
FR-5	Check whether condition	Temperature monitoring status Humidity monitoring Status
FR-6	Log out	Exit

Non-functional Requirements:

Following are the non-functional requirements of the proposed solution.

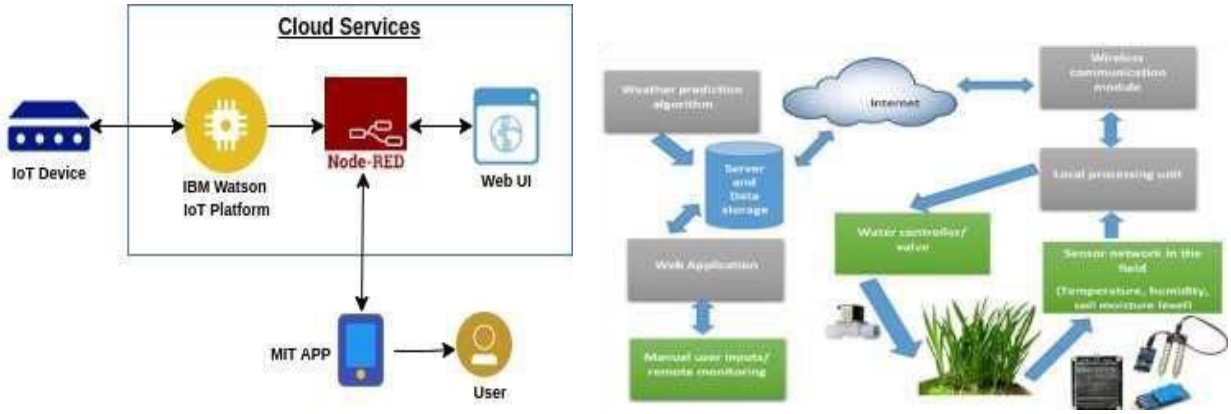
FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	Usability includes easy understanding and learn ability, efficiency in use,remember ability, lack of errors in operation and subjective pleasure.
NFR-2	**Security**	Sensitive and private data must be protected from their production until the decision-making and storage stages.
NFR-3	**Reliability**	The shared protection achieves a better trade-off between costs and reliability. The model uses dedicated and shared protection schemes to avoid farm service outages.

NFR-4	**Performance**	The idea of implementing integrated sensors with sensing soil and environmental parametersin farming will be more efficient.
NFR-5	**Availability**	Automatic adjustment of farming equipment made possible by linking information like crops/weather and equipment to auto-adjust temperature, humidity, etc.
NFR-6	**Scalability**	Scalability is a major concern for IoT platforms. It has shown that different architectural choices of IoT platforms affect system scalability,real time decision-making is feasible in an environment composed of dozens of thousand.

5. PROJECT DESIGN

5.1 Data Flow Diagrams

A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.



- The different soil parameters temperature, soil moistures and then humidity are sensed using different sensors and obtained value is stored in the IBM cloud.
- Arduino UNO is used as a processing Unit that process the data obtained from the sensors and whether data from the weather API.
- NODE-RED is used as a programming tool to write the hardware, software, and APIs. The MQTT protocol is followed for the communication.
- All the collected data are provided to the user through a mobile application that was developed using the MIT app inventor.
- The user could plan through an app, weather to water the crop or not depending upon the sensor values. By using the app, they can remotely operate to the motor switch.

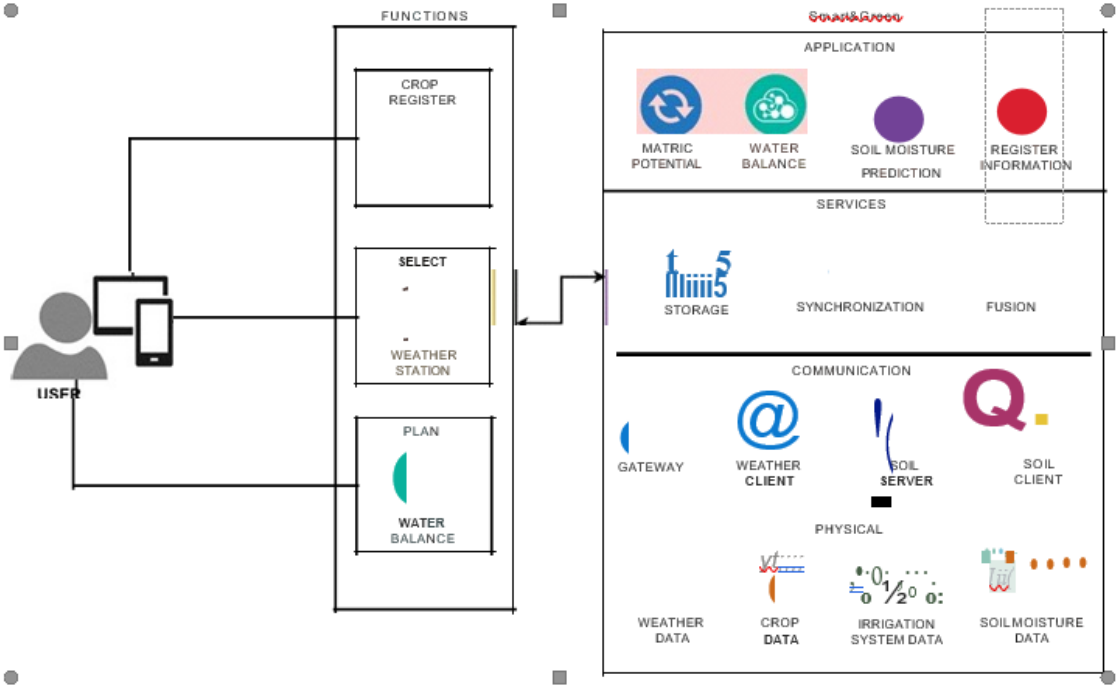
5.2 Solution & Technical Architecture:

Solution Architecture:

Solution architecture is a complex process – with many sub-processes – that bridges the gap between business problems and technology solutions. Its goals are to:

- Find the best tech solution to solve existing business problems.
- Describe the structure, characteristics, behavior, and other aspects of the software to project stakeholders.
- Define features, development phases, and solution requirements.
- Provide specifications according to which the solution is defined, managed, and delivered.

SOFTWARE FOR SMART AGRICULTURE



5.3 User Stories

User Type	Functional Requirement	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
	Permission	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
Customer (Web user)	Login	USN-3	As a user, I can log into the application by entering email & password.	I can register & access the dashboard with Login	High	Sprint-2
	Check credentials	USN-4	As a user, I can register for the application through mobile application	Temperature and Humidity details	Medium	Sprint-1
	Dashboard	USN-5	As a user can view the dashboard and this dashboard include the check roles of access and then move to the manage modules.	I can view the dashboard in this smart farming application system.	Medium	Sprint-1
Customer care Executive	MIT app	USN-6	To make the user to interact with the software.	Database to store in cloud services.	High	Sprint-1
Administrator	IOT devices	USN-7	As a user once view the manage modules this describes the manage system admins and Manage Roles of user and etc..,		Medium	Sprint-1
	Log out	USN-8	Exit	Sign out	High	Sprint-1

5.PROJECT PLANNING & SCHEDULING

5.1 Sprint Planning & Estimation

Product Backlog, Sprint Schedule, and Estimation

Sprint	Functional Requirement (Epic)	User Story Number	User Story /Task	Story Points	Priority	Team Member
Sprint-1	Registration (Farmer Mobile User)	UNS-1	As a user, I can register for the application by entering my email, password, and confirming my password.	2	High	PRATEEK RAM RA (Leader)
Sprint-1	Login	UNS-2	As a user, I will receive confirmation email once I have registered for the application	1	High	PRASANNA N (Member 1)

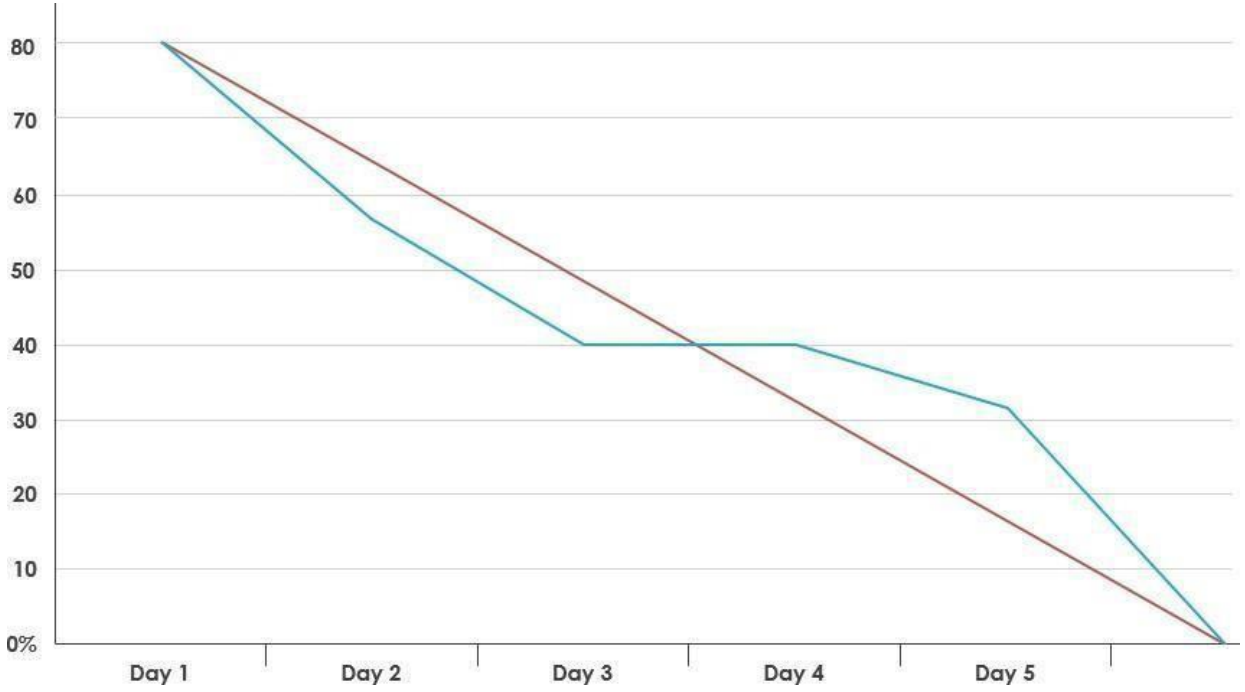
Sprint-2	User Interface	UNS-3	As a user, I can register for the application through Facebook	3	Low	PREMKUMAR (Member 2)
Sprint-1	Data Visualization	UNS-4	As a user, I can register for the application through GMAIL	2	Medium	PRAVIN KUMAR P (Member 3)
Sprint-3	Registration (Farmer -Web User)	USN - 1	As a user, I can log into the application by entering email and password	3	High	PRATEEK RAM RA (Leader)
Sprint - 2	Login	USN - 2	As a registered user, I need to easily login log into my registered account via the web page in minimum time	3	High	PRASANNA N (Member 1)
Sprint - 4	Web UI	USN - 3	As a user, I need to have a friendly user interface to easily view and access the resources	3	Medium	PREM KUMAR B (Member 2)
Sprint - 1	Registration (Chemical Manufacturer - Web user)	USN - 1	As a new user, I want to first register using my organization email and create a password for the account.	2	High	PRAVIN KUMAR P (Member 3)

Sprint - 4	Login	USN - 2	As a registered user, I need to easily log in using the registered account via the web page.	3	High	PRATEEK RAM RA (Leader)
Sprint - 3	Web UI	USN - 3	As a user, I need to have a user friendly interface to easily view and access the resources.	3	Medium	PRASANNA N (Member 1)
Sprint - 1	Registration (Chemical Manufacturer - Mobile User)	USN - 1	As a user, I want to first register using my email and create a password for the account.	1	High	PREM KUMAR B (Member 2)
Sprint - 1	Login	USN - 2	As a registered user, I need to easily log in to the application.	2	Low	PRAVIN KUMAR P (Member 3)

Project Tracker, Velocity & Burndown Chart:

Sprint	**Total Story Points**	**Durati on**	**Sprint Start Date**	**Sprint End Date (Planned)**	**Story Points Completed (ason Planned End Date)**	**Sprint Release Date (Actual)**
Sprint-1	12	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	6	6 Days	31 Oct 2022	05 Nov 2022	20	30 OCT 2022
Sprint-3	6	6 Days	07 Nov 2022	12 Nov 2022	20	6 NOV 2022
Sprint-4	6	6 Days	14 Nov 2022	19 Nov 2022	20	7 NOV 2022

Burndown Char



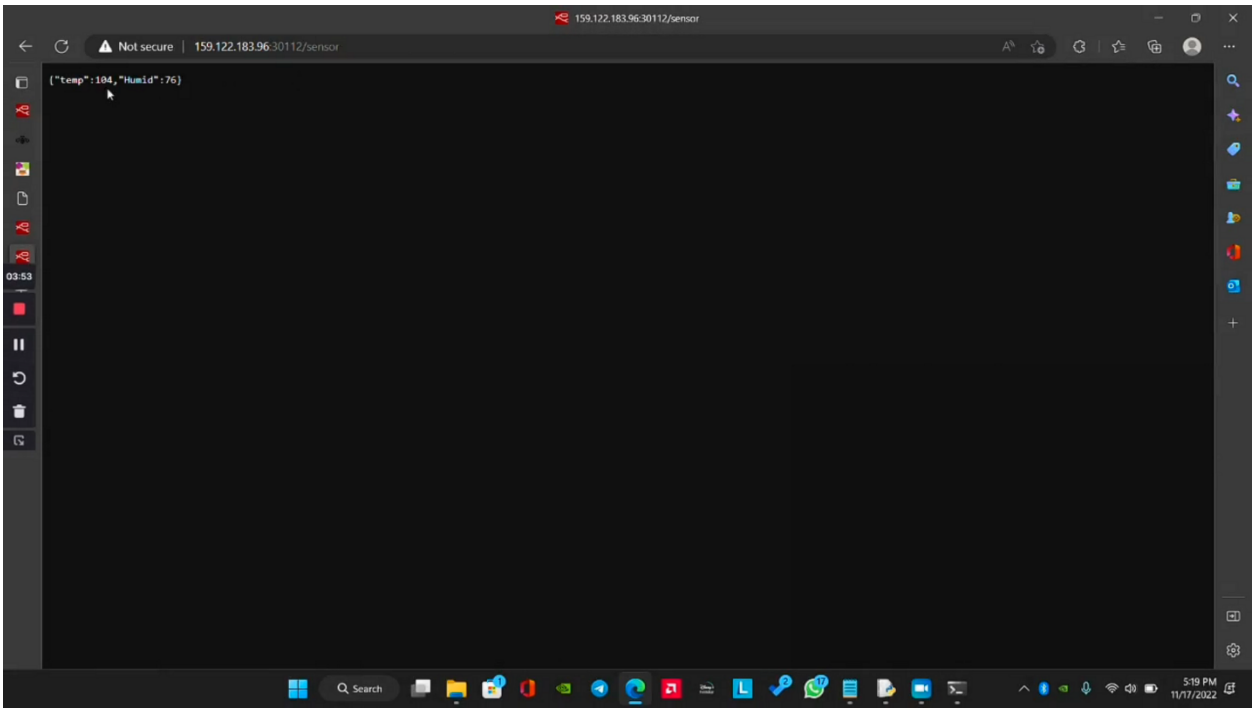
6. CODING & SOLUTIONING (Explain the features added in the project along with code)

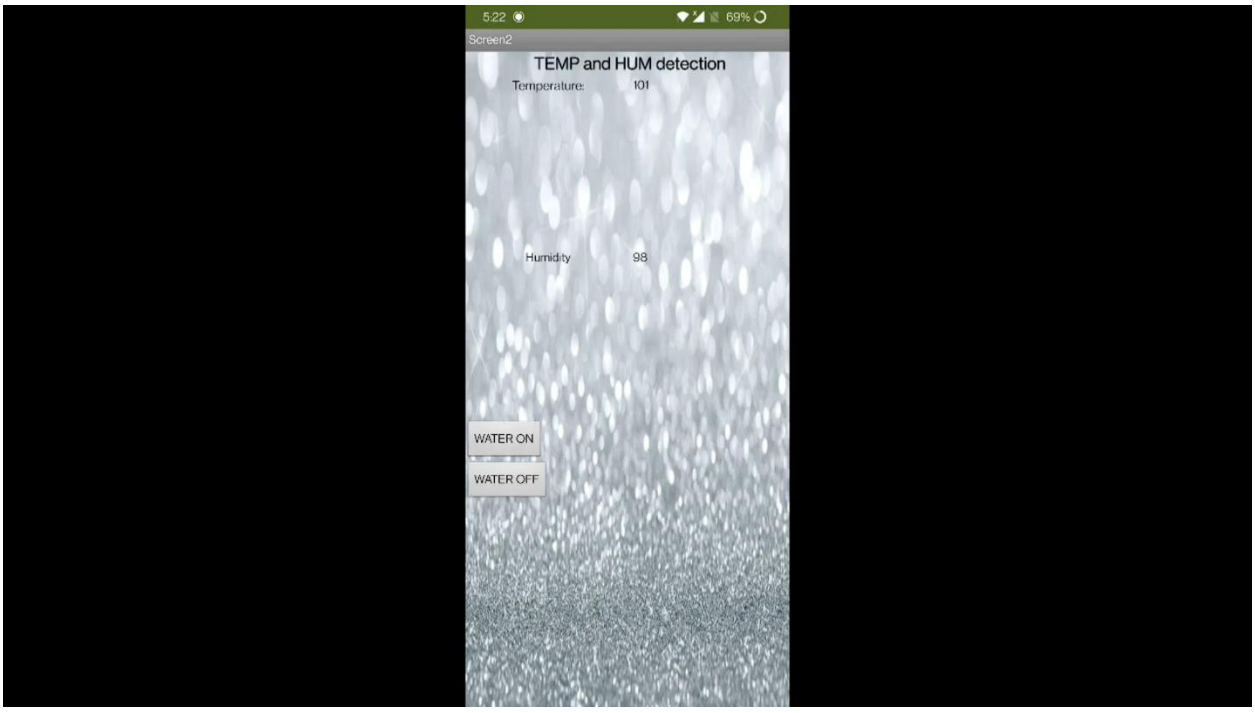
```
import time
import sys
import ibmiotf.application
import ibmiotf.device
import random

#Provide your IBM Watson Device Credentials
organization = "f8aafw"
deviceType = "project"
deviceId = "8838547703"
authMethod = "token"
authToken = "FeSqFNuDt5S_O6nq3l"

# Initialize GPIO
def myCommandCallback(cmd):
    print("Command received: %s" % cmd.data['command'])
    status=cmd.data['command']
    if status=="water on ":
        print ("water is on")
    elif status == "wateroff":
        print ("water 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()
```

Coding explanation is done in demo video link

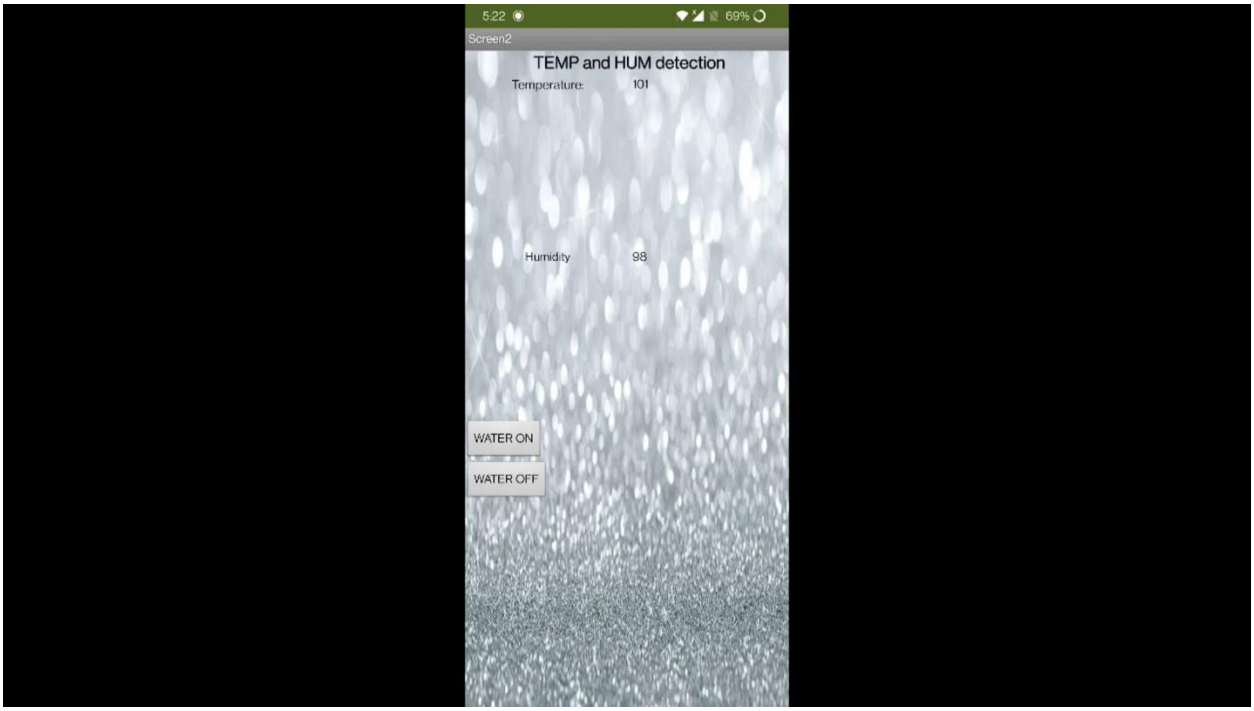
7.TESTING


159.122.183.96:30112/sensor
Not secure | 159.122.183.96:30112/sensor
{"temp":104,"Humid":76}
03:53
Search
5:19 PM
11/17/2022


5:22
69%
Screen2
TEMP and HUM detection
Temperature:
101
Humidity
98
WATER ON
WATER OFF

7. RESULTS

7.1 Performance Metrics



8. ADVANTAGES & DISADVANTAGES

All the data like climatic conditions and changes in them, soil or crop conditions everything can be easily monitored.

ϖ Risk of crop damage can be lowered to a greater extent. ϖ Many difficult challenges can be avoided making the process automated and the quality of crops can be maintained.

ϖ The process included in farming can be controlled using the web applications from anywhere, anytime.

DISADVANTAGES:

Smart Agriculture requires internet connectivity continuously, but rural parts cannot fulfil this requirement.

ϖ Any faults in the sensors can cause great loss in the agriculture, due to wrong records and the actions of automated processes.

ϖ IOT devices need much money to implement.

9. CONCLUSION:

An IOT based smart agriculture system using Watson IOT platform, Watson simulator, IBM cloud and Node-RED are developed by this project which becomes the conclusion of the project.

10. FUTURE SCOPE

In future due to more demand of good and more farming in less time, for betterment of the crops and reducing the usage of extravagant resources like electricity and water IOT can be implemented in most of the places.

11. APPENDIX

Source Code:

Github link : https://github.com/IBM-EPBL/IBM-Project-24599-1659945476

Demo video link:

https://drive.google.com/file/d/1qiSvdGLnYB7staI4lVV2zYvlDhqa8QVe/view?usp=sharing