PROJECT REPORT

Smart Farmer - IoT Enabled Smart Farming Application

1. INTRODUCTION:

1.1 Project Overview

- This project is based on Internet Of Things (IoT), that can measure soil moisture, Humidity and temperature conditions for agriculture using Watson IoT services. IoT is network that connects physical objects or things embedded with electronics, software and sensors through network connectivitythat collects and transfers data using cloud for communication. Data is transferred through internet without human to human or human to computerinteraction.

- In this project we have not used any hardware. Instead of real soil moisture, Humidity and Temperature data obtained from sensors we make use of IBM IoT Simulator which can transmit these parameters as required.

1.2 Purpose

- IoT-based agriculture system helps the farmer in monitoring different parameters of his field like soil moisture, temperature, and humidity using some sensors.

- Farmers can monitor all the sensor parameters by using a web or mobile application even if the farmer is not near his field. Watering the crop is one of the important tasks for the farmers.

- They can make the decision whether to water the crop or postpone it by monitoring the sensor parameters and controlling the motor pumps from the mobile application itself.

2. LITERATURE SURVEY:

2.1 Existing Problem

- Agriculture is a field which forms the basis of our economy. Yet it faces a lot of problems in terms of availability of resources, Irrigation, increasing rate of Pesticides, Climatic disasters, Insects which ruin the crops and makes a huge loss this sector.
- In agriculture water is needed for the crops for their growth. If the Soil gets dry it is necessary to supply water. But sometime if the farmer doesn't visit the field it is not possible to know the condition of soil.
- Sometimes over supply of water or less supply of water affects the growth of crops.
- Sometimes if the weather/temperature changes suddenly it is necessary to take certain actions.
- Specific crops grow better in specific conditions, they may get damaged due to bad weather.

2.2 References

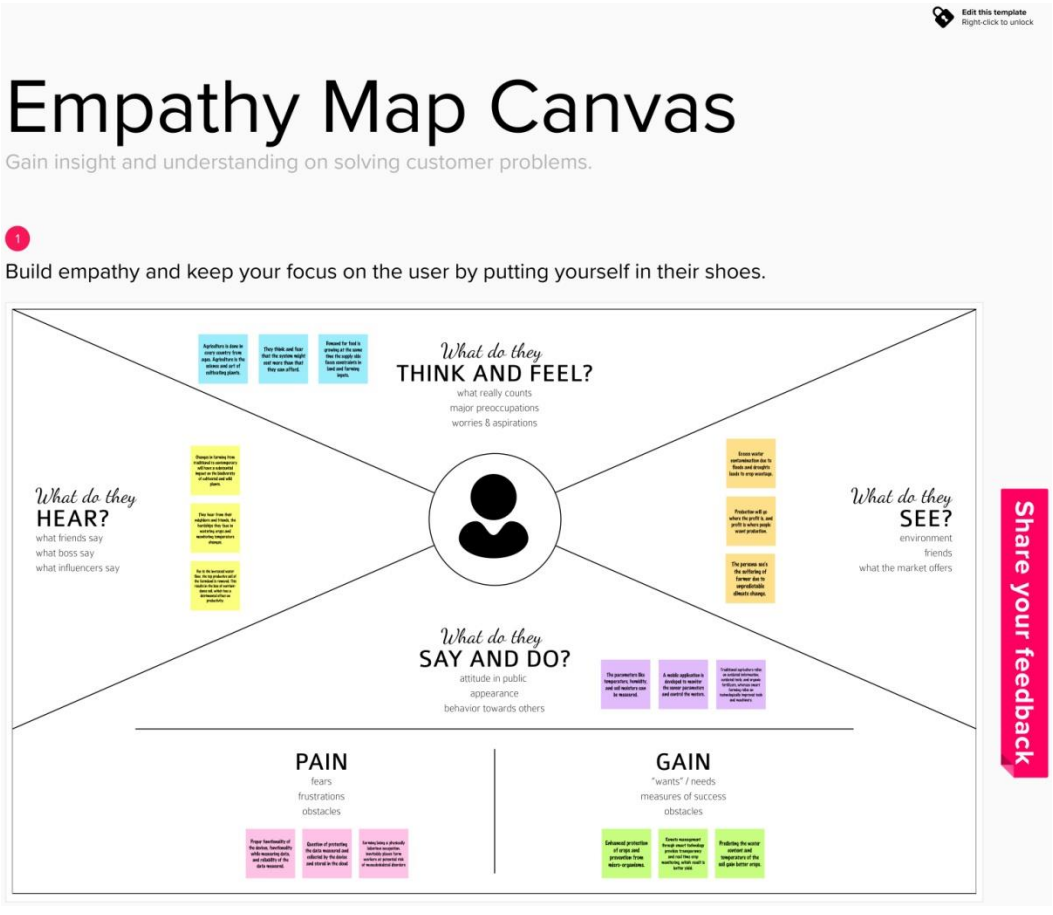
1. Mobile Integrated Smart Irrigation and Monitoring System Using IOT
   Date of Conference: 06-08 April 2017
   Publisher: IEEE
   Date Added to IEEE Xplore: 08 February 2018
   DOI:10.1109/ICCSP.2017.8286792
2. IoT Based Smart Irrigation Monitoring And Controlling System
   Date Added to IEEE Xplore: 15 January 2018
   ISBN Information: Electronic ISBN: 978-1-5090...
   Date of Conference: 19-20 May 2017
   INSPEC Accession Number: 17504411
3. Smart Waste Collection Monitoring and Alert System via IoT
   Date Added to IEEE Xplore: 24 June 2019
   DOI:10.1109/ISCAIE.2019.874376
   Print on Demand(PoD) ISBN: 978-1-5386-854

2.3 Problem Statement Definition

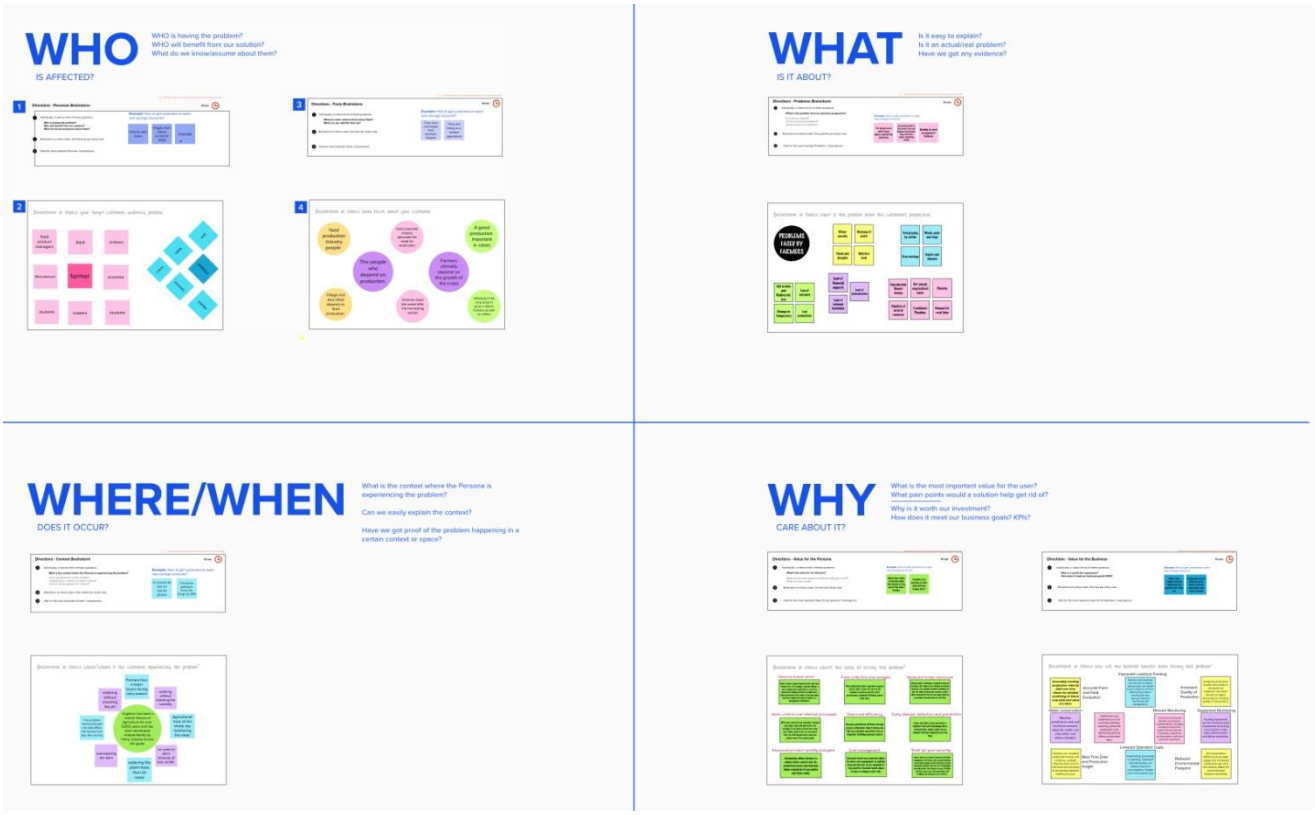
- Smart Farmer System based on IoT can monitor soil moisture and climatic conditions to grow and yield a good crop.
- The farmer can also get the real time weather forecasting data by using external platforms like Open Weather API.
- Farmer is provided a mobile app using which he can monitor the temperature, humidity and soil parameters along with weather forecasting details.
- Based on all the parameters he can water his crop by controlling the motors using the mobile application.
- Even if the farmer is not present near his crop he can water his crop by controlling the motors using the mobile application from anywhere.
- Here we are using the Online IoT simulator for getting the Temperature, Humidity and Soil Moisture values.

3. IDEATION & PROPOSED SOLUTION:

3.1 Empathy Map Canvas



3.2 Ideation & Brain Storming

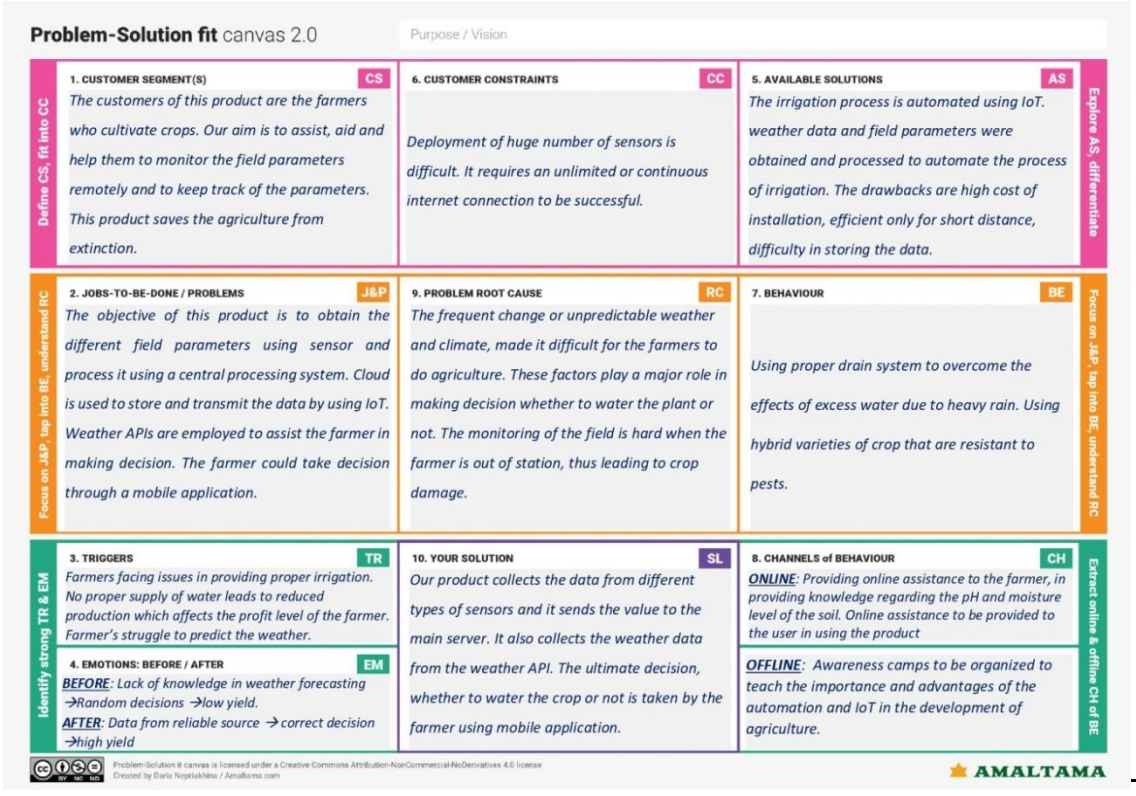


Brainstorming:

3.3 Proposed Solution

S.No.	Parameter	Description
1.	Problem Statement (Problem to besolved)	To provide efficient decision support systemusing wireless sensor network which handle different activities of farm and gives useful information related to farm. Information related to Soil moisture, Temperature andHumidity content. Due to the weather condition, water level increasing Farmers getlot of distractions which is not good for Agriculture.
2.	Idea / Solution description	Smart Agricultural System solutions providean integrated IoT platform in agriculture thatallows farmers to leverage sensors, smartgateways and monitoring systems to collect information, control various parameters on their farms and analyse real-time data in order to make informed decisions.
3.	Novelty / Uniqueness	Various eminent researchers have been making efforts for smart farming by using IoT concepts in agriculture. But, a bouquet of unfolded challenges is still in a queue for their effective solution. This study makessome efforts to discuss past research and open challenges in IoT based agriculture.
4.	Social Impact / Customer Satisfaction	Reduces the wages for labors who work in the agricultural field. It saves a lot of time. IoT can help improve customer relationships by enhancing the customer's overall experience.
5.	Business Model (Revenue Model)	A monthly subscription is charged to farmers for prediction and suggesting theirrigation timing based on sensors

3.4 Problem Solution Fit



4. REQUIREMENT ANALYSIS:

4.1 Functional Requirements

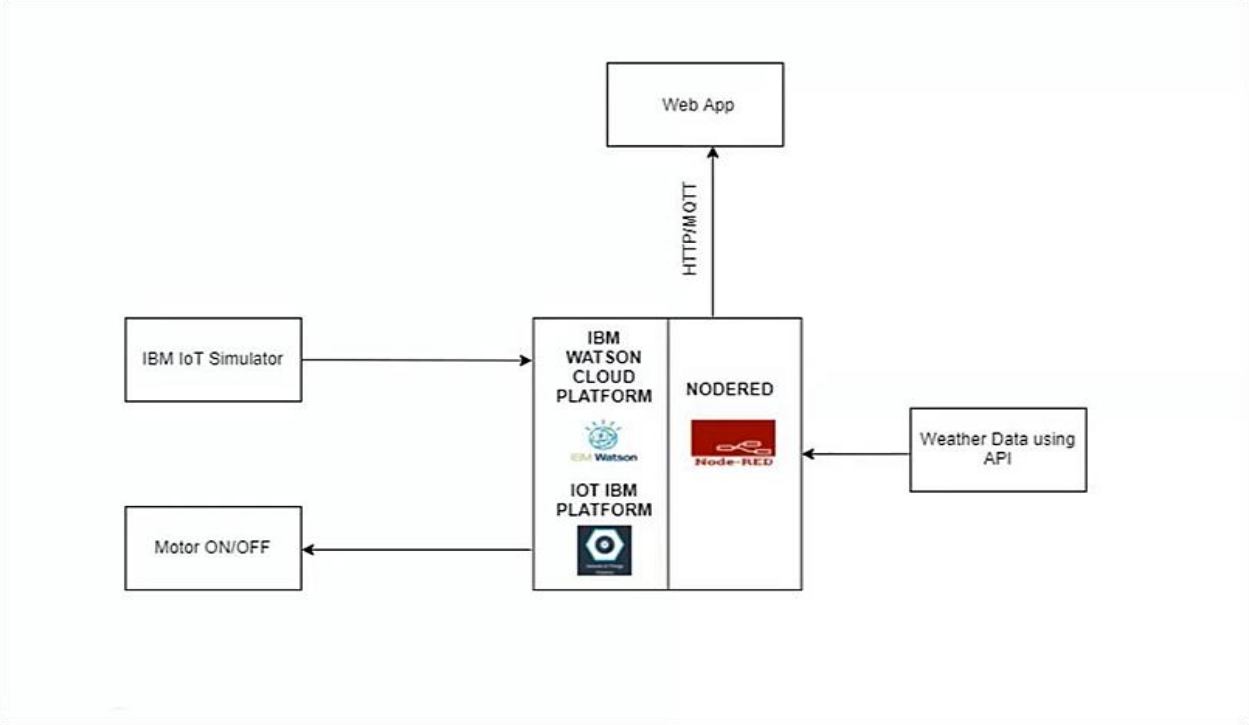
FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Gmail
FR-2	User Confirmation	Confirmation via EmailConfirmation via OTP
FR-3	User sign in	Check Credentials Check Roles of Access.
FR-4	Monitoring	Monitor temperature, humidity and etc.,
FR-5	Analysis	Analysing different environment parameters.
FR-6	Processing	If environment parameters (temperature, humidity) exceeds its threshold value suggest the solutions like ifwater level is low means turn on the Water pump.

4.2 Non Functional Requirements

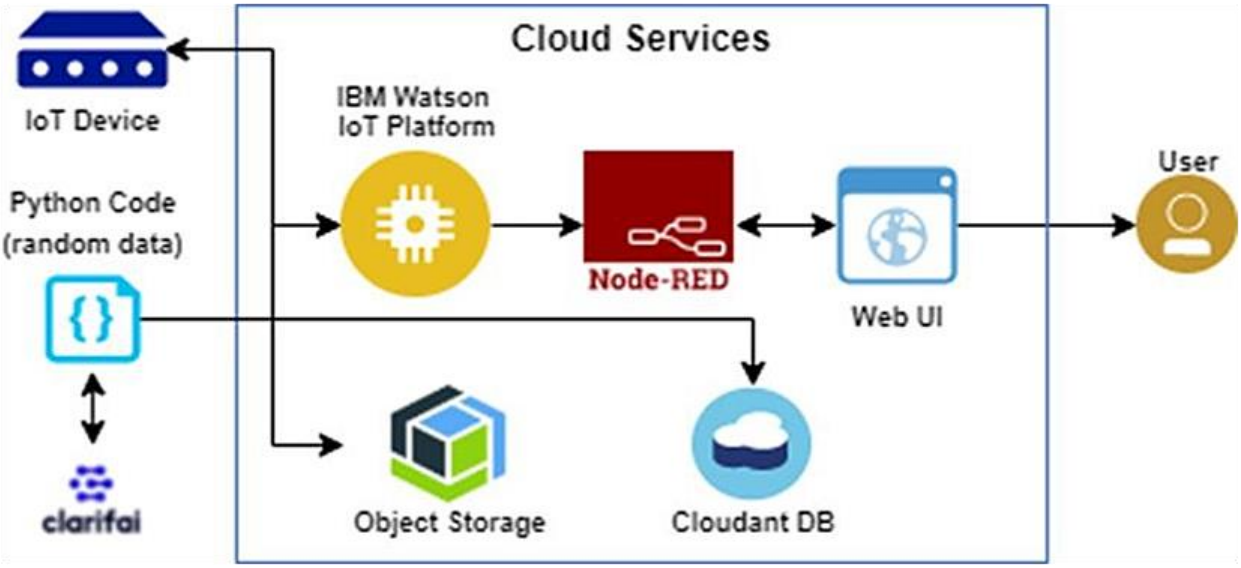
FR No.	Non-Functional Requirement	Description
NFR-1	Usability	Farmers can monitor their land even them not neartheir field.
NFR-2	Security	OTP verification while login their account for usersecurity.
NFR-3	Reliability	Environmental parameters are accurately monitored.
NFR-4	Performance	Improving yield compare to manual monitoring.
NFR-5	Availability	Can be accessed at anytime from anywhere withfeasible internet facility.
NFR-6	Scalability	Scalability in smart farming refers to the adaptability of a system to increase the capacity of yield.

5. PROJECT DESIGN:

5.1 Data Flow Diagram



5.2 Solution & Technical Architecture



5.3 User Stories

User Type	Function Requirement (EPIC)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	1	Can register for the application by enteringmy email, password, and confirming my password.	Can access my account/ dashboard	High	Sprint-1
		2	Will receive confirmation email once I have registered for the application	Receive confirmation email & click confirm	High	Sprint-1
		3	Can register for the application through Facebook	Can register & access the dashboard with Facebook Login	Low	Sprint-2
		4	Can Register for the application throughGmail		Medium	Sprint-1
	Login	5	Can Log into the application by enteringemail & password		High	Sprint-1
	Dashboard					
Customer (Web user)						
Customer CareExecutive						
Administrator						

6. PROJECT PLANNING& SCHEDULING:

6.1 Sprint Planning & Estimation

S.NO	ACTIVITY TITLE	ACTIVITYDESCRIPTION	DURATION
1	Understanding the project	Assign the team members after thatcreate repository in the GitHub and then assign task to eachmember and guide them how to access the GitHub while submitting the assignments	1 week
2	Staring The Project	Team Members to Assign All the Tasks Based on Sprints and Work on it Accordingly.	1 week
3	Completing Every Task	Team Leader should ensure that whether every team member have completed the assigned task or not	1 week
4	Stand Up Meetings	Team Lead Must Have a Stand-Up Meeting with The Team and Work on The Updates and Requirement Session	1 week
5	Deadline	Ensure that team members are completing every task within the deadline	1 week
6	Budget and Scope of project	Analyze the overall budget which must be in certain limit it should be favorable to every person	1 week

6.2 Sprint Delivery Schedule

Product Backlog, Sprint Schedule, and Estimation

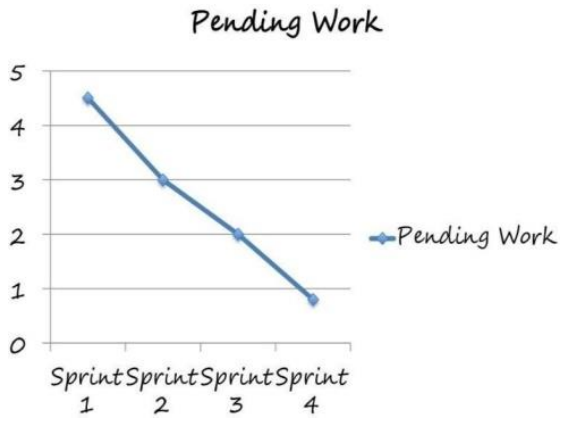
Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Simulation Creation	USN-1	Connect Sensors and Arduino with python code	2	High	Pranav Thirekha Srivatsan
Sprint-2	Software	USN-2	Creating device in the IBM Watson IoT platform, workflow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

Project Tracker, Velocity & Burndown Chart:

Sprint	Total Story Points	Duration	Sprint StartDate	Sprint EndDate (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

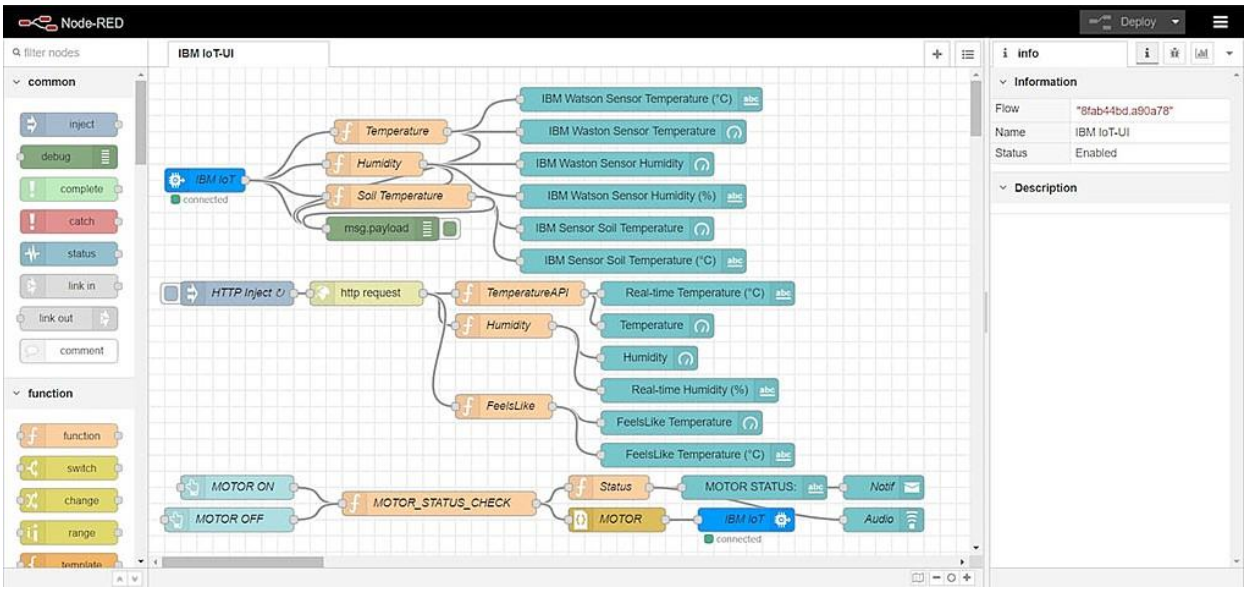
Velocity:

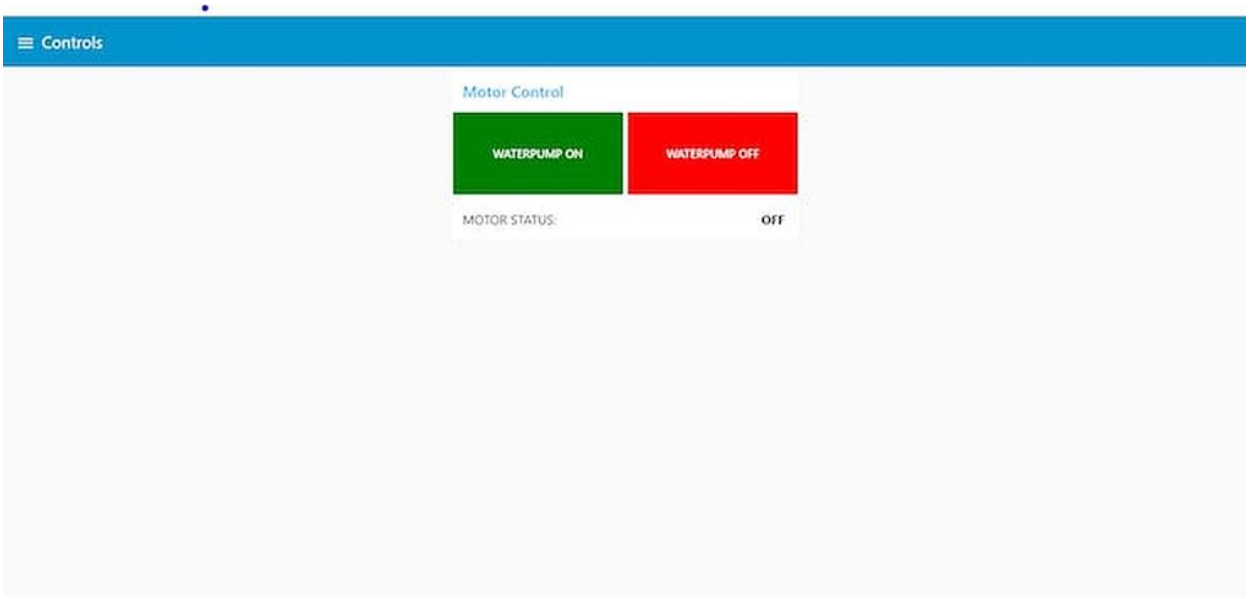
AV for sprint 1= Sprint Duration /velocity =12/6=2
AV for sprint 2= Sprint Duration/Velocity=6/6=1
AV for Sprint 3=Sprint Duration/Velocity=6/6=1
AV for Sprint 4=Sprint Duration/Velocity=6/6=1

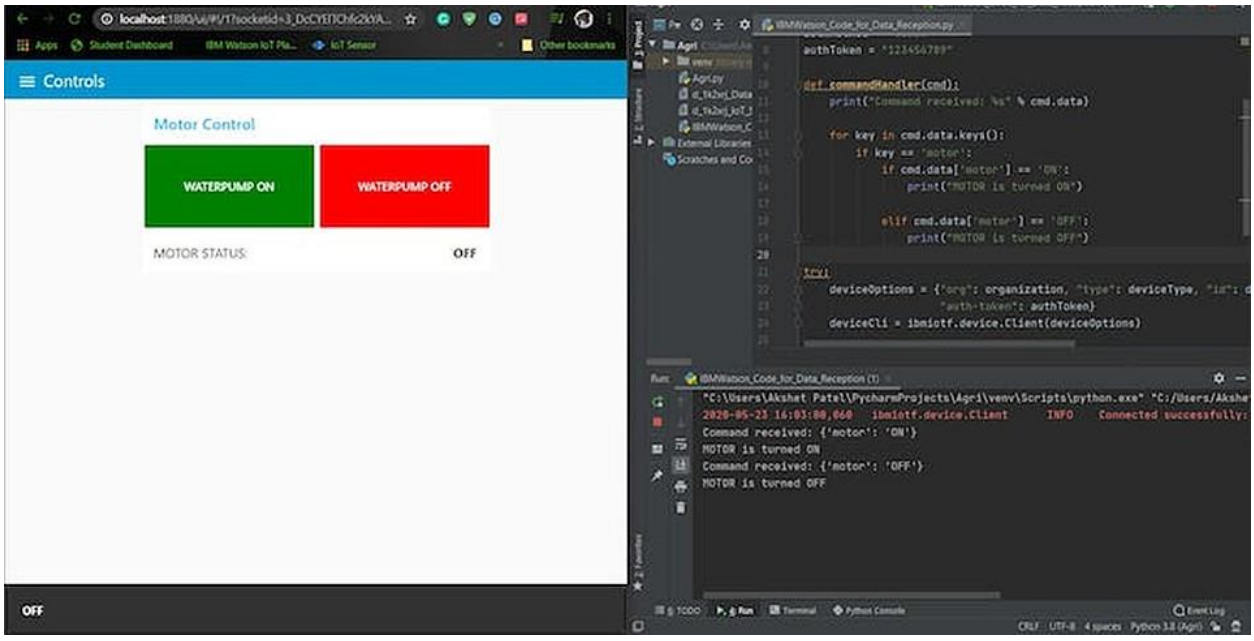


7. CODING & SOLUTIONING:

7.1 Feature 1



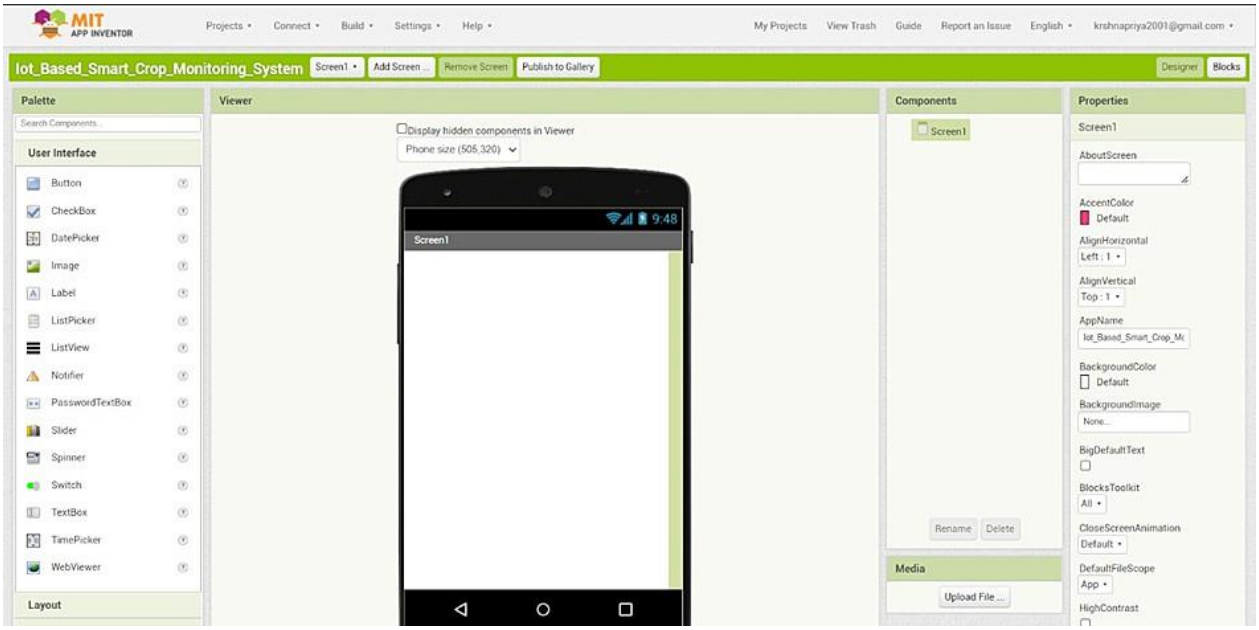



Controls
Motor Control
WATERPUMP ON
WATERPUMP OFF
MOTOR STATUS:
OFF
OFF
authToken = "123456789"
def commandHandler(cmd):
print("Command received: %s" % cmd.data)
for key in cmd.data.keys():
if key == 'motor':
if cmd.data['motor'] == 'ON':
print("MOTOR is turned ON")
elif cmd.data['motor'] == 'OFF':
print("MOTOR is turned OFF")
try:
deviceOptions = {"org": organization, "type": deviceType,
"auth-token": authToken}
deviceCli = ibmiotf.device.Client(deviceOptions)
Command received: {'motor': 'ON'}
MOTOR is turned ON
Command received: {'motor': 'OFF'}
MOTOR is turned OFF

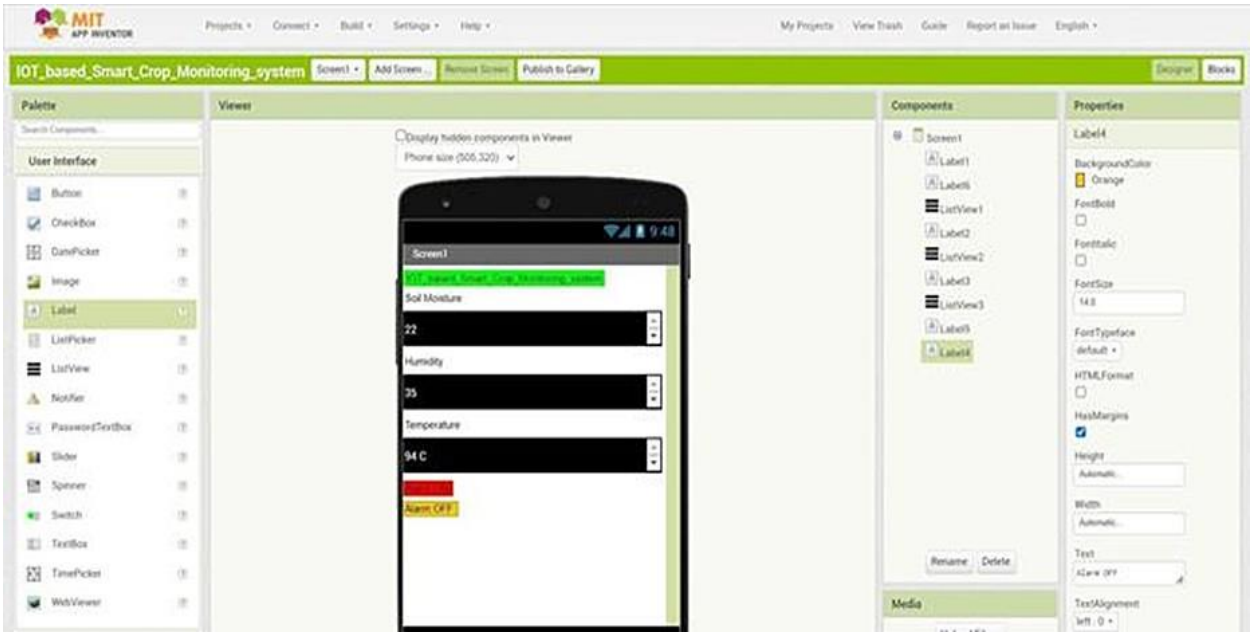

IBM Watson
IBM Watson Sensor Temperature (°C) 15
IBM Watson Sensor Humidity (%) 75
IBM Sensor Soil Temperature (°C) 24
Realt-time Weather
Real-time Temperature (°C) 31
Real-time Humidity (%) 70
FeelsLike Temperature (°C) 34.82
IBM Sensor Soil Temperature
24
Temperature
31
IBM Waston Sensor Temperature
15
FeelsLike Temperature
34.82
IBM Waston Sensor Humidity
75
Humidity
70

7.2 Feature 2

MIT APP inventor to design the APP



Customize the App interface to Display the Values



8. TESTING:

Defect Analysis

This report shows the number of resolved or closed bugs at each severity level, and how they were resolved

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	11	4	2	2	19
Duplicate	1	1	2	0	4
External	2	3	0	1	6
Fixed	10	2	3	20	35
Not Reproduced	0	0	2	0	2
Skipped	0	0	2	1	3
Won't Fix	0	5	2	1	8
Totals	24	15	13	25	77

Test Case Analysis

This report shows the number of test cases that have passed, failed, and untested

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	5	0	1	4
Client Application	47	0	2	45
Security	3	0	0	3
Outsource Shipping	2	0	0	2
Exception Reporting	11	0	2	9
Final Report Output	5	0	0	5
Version Control	3	0	1	2

9. RESULT:

We have successfully built an IOT Based Smart Farming System for Agriculture and integrated all the services using Node-RED.

10. ADVANTAGES & DISADVANTAGES:

10.1 Advantages

- All the data like climatic conditions and changes in them, soil or crop conditions everything can be easily monitored.
- Risk of crop damage can be lowered to a greater extent.
- Many difficult challenges can be avoided making the process automated and the quality of crops can be maintained.
- The process included in farming can be controlled using the web applications from anywhere, anytime.

10.2 Disadvantages

Smart Farmer system requires internet connectivity continuously, butrural parts can not fulfill this requirement.

- Any faults in the sensors can cause great loss in the agriculture, due towrong records and the actions of automated processes.
- IoT devices need much money to implement.

11. CONCLUSION:

IoT based smart Farming System for Live Monitoring of Temperature and Soil Moisture and to control motor remotely has been proposed using Node Red and IBM Cloud Platform. 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 project 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. Therefore, the project proposes a thought of consolidating the most recent innovation into the agrarian field to turn the customary techniques for water system to current strategies in this way making simple profitable and temperate trimming.

12. 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 implementedin most of the places.

13. APPENDIX:

GITHUB LINK: https://github.com/IBM-EPBL/IBM-Project-31033-1660194711

SOURCE CODE: https://github.com/IBM-EPBL/IBM-Project-31033-1660194711

DONE BY:

Pranav Aadhithya.K.B
Thirekha.M
Srivathsan.V.M
Elakiya.G.J