

IBM PROJECT IOT BASED SMART CROP PROTECTION SYSTEM FOR AGRICULTURE

Batch: B11-5A1E

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1. INTRODUCTION:

1.1 Project Overview:

In this project very useful on HORTICULTURE in monitor and alert the user for crop growth without any dismay. In the web application, admins can view the sensor parameters integrate the buttons in the UI to control the motors by the need of crop protection.

1.2 Purpose:

To protect the farm from the theft in the horticulture and Min purpose of this project is to alert the farmer as well as fear the animals with getting harm to animals.

2. LITERATURE SURVEY:

2.1 Existing Problem:

The number of sensors and that position is unpredictable and improper to assess data analytics driving automation and response activities.

2.2 References:

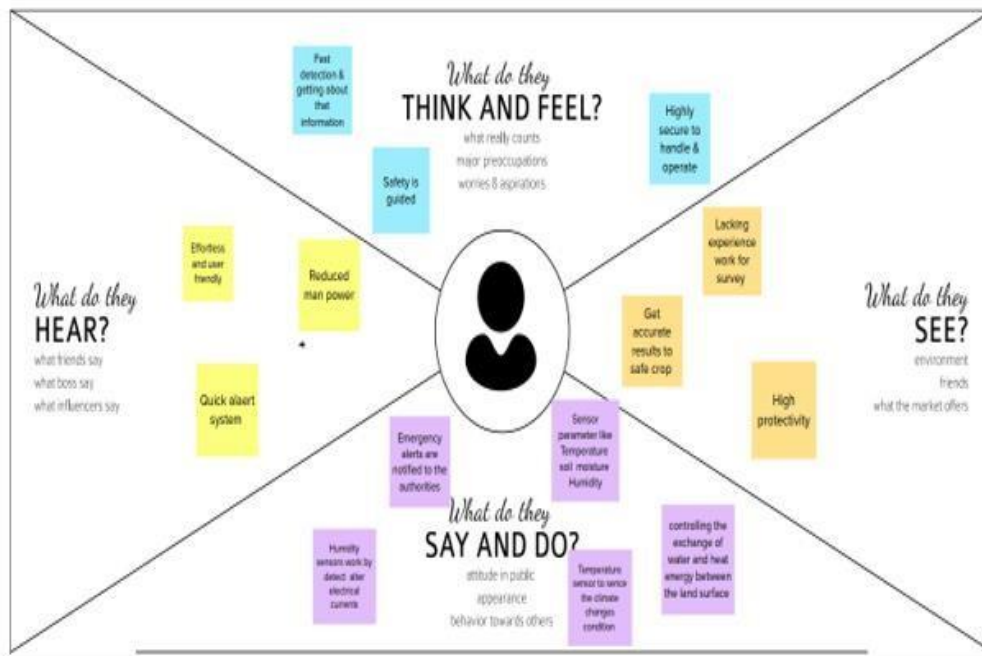
A. Tzounis, N. Katsoulas, T. Bartzanas, and C. Kittas, "Internet of things in agriculture, recent advances and future challenges," *Biosystems Engineering*, vol. 164, pp. 31–48, 2017.

2.3 Problem statement definition:

- * Since sensors is unpredictable secured in handling
- * Also the cost price of the products and the complications in installing the systems are high.
- * Climates changes to increased the maintenance of channel

3. IDEATION & PROPOSED SOLUTION:

3.1 Empathy Map Canvas:



3.2 Ideation & Brainstorming: Step:1

1

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 protect
 crop from being
 destroyed ?**

SIDHARTHINI KS

The smart protection system defines that this project help to Farmer for the protection of a farm.

The IoT device is used to indicate the farmer by a message while someone enter into the farm and we are used SD card module that helps to store a specified sound to fear the animals.

This whole project is work on 12V dc supply from battery. We used solar panel to charge the battery

This project contains Arduino UNO,node mcu,LCD display,Flame sensor,HIT sensor,SD card module,solar panel(solar charge converter)(boost converter)

ABARNA A

Sensors to detect if there is any disease

Realtime crop monitoring

Effective accuration and adaptive

Imroved livestock farming

KAYATHRI V

Ultrasonic sensors are used to detect the animal movement

Alarm to scare the small predator like birds so on

Send intimation message to user where there is any movement of animals activities

Reduce the environmental footprints

MADHUMITHA A

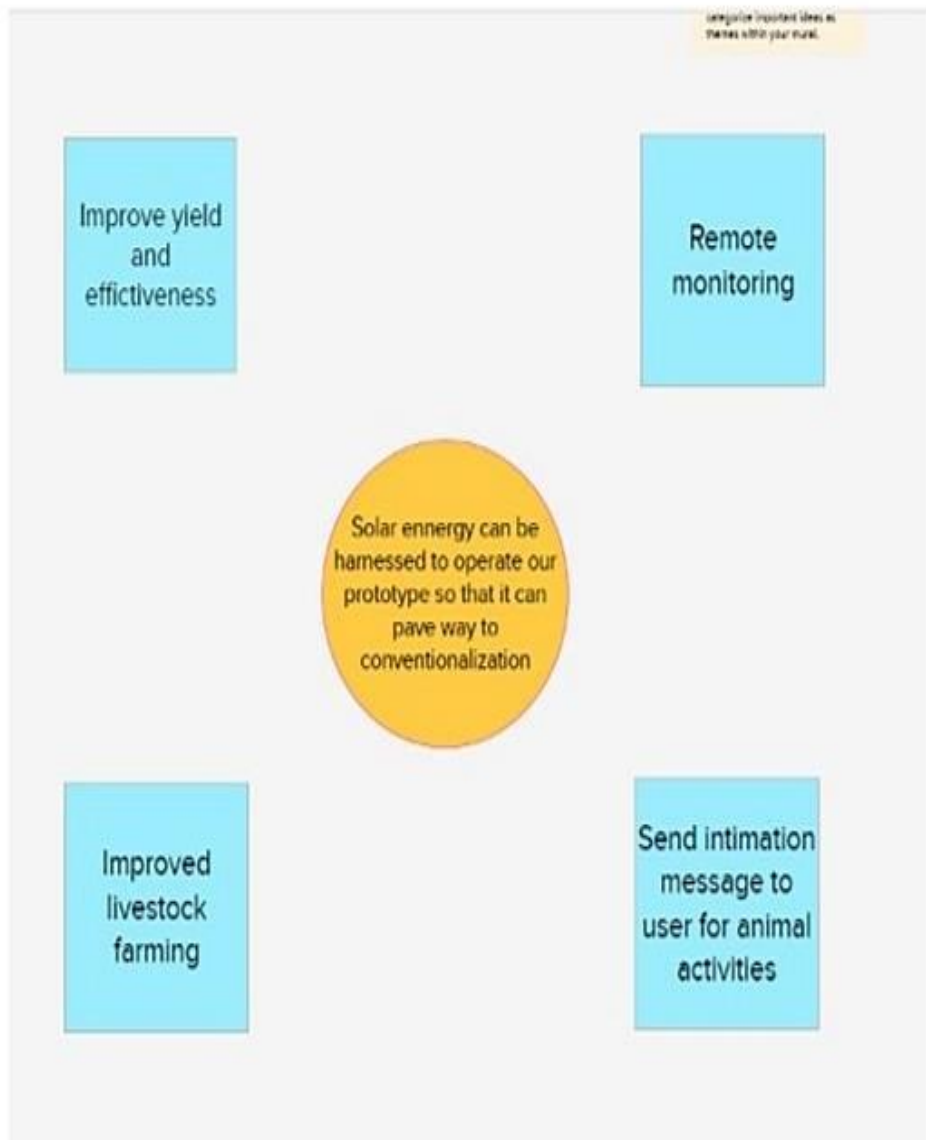
Necessary communication interface

Highly flexible and more accuration

Sensors to detect the any movement of the animals

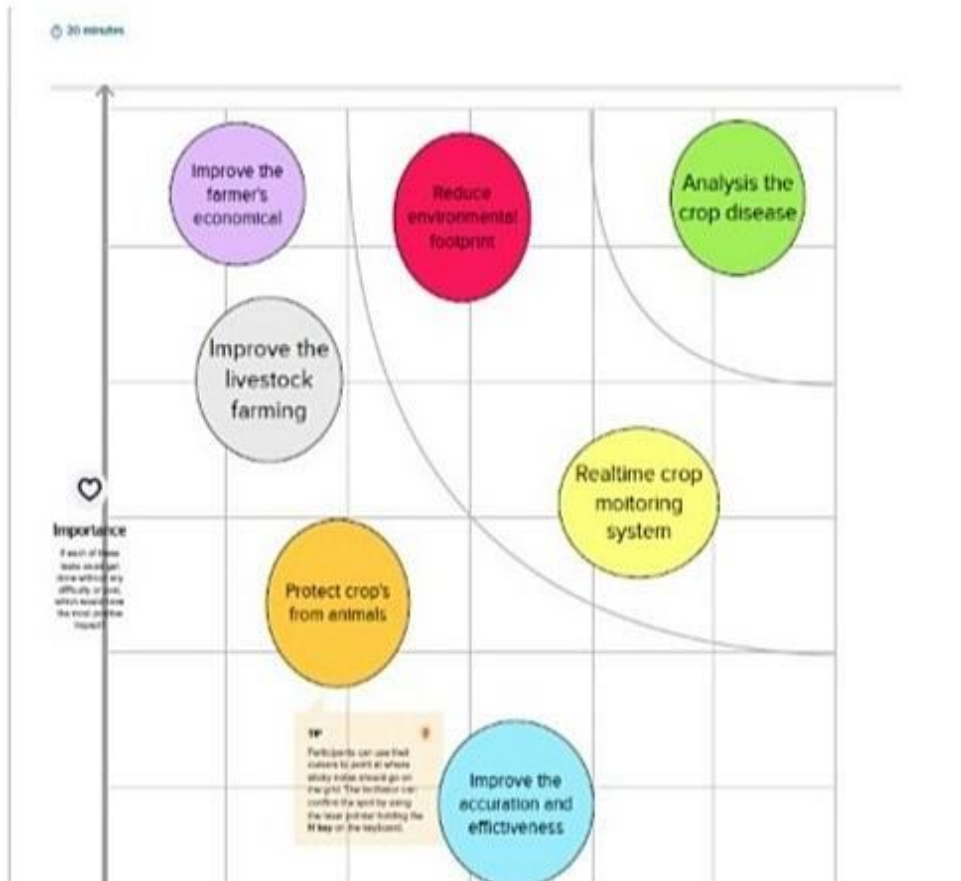
Local data acquisition

GROUP IDEAS:



Step:3

IDEA PRIORITIZATION:



3.3 Proposed Solution:

| S.NO | Parameter | Description |
|-------------|---|--|
| 1) | ProblemStatement(Problem to be solved) | Develop an efficient system &an application that can monitor and alert the users(farmers) |
| 2) | Idea/Solution description | <ul style="list-style-type: none"> ➤ This product helps the field in monitoringthe animals other disturbance. ➤ In several areas, the temperature sensorswill be integrated to monitor the temperature & humidity. ➤ If in any area feel dry or wetless is detected by admins, will be notified alongwith the location in the web application. |
| 3) | Novelty/Uniqueness | <ul style="list-style-type: none"> ➤ Fastest alerts to the farmers ➤ The increasing demand for quality food ➤ User friendly |
| 4) | Social Impact/Customer Satisfaction | <ul style="list-style-type: none"> ➤ As the product usage can be understood by everyone, it is easy for them to use it properly for their safest organization. ➤ The product is advertised all over the platforms. Since it is economical, even helps small scale farming land from disasters. |

| | | |
|----|--------------------------------|---|
| 5) | Business Model(Revenue Model). | <ul style="list-style-type: none"> ➤ As the product usage can be understood by everyone, it is easy for them to use it properly for their safest organization. ➤ The product is advertised all over the platforms. Since it is economical, even helps small scale farming land from disasters.. |
| 6) | Scalability of the Solution | <ul style="list-style-type: none"> ➤ Even when the interruption is more, the product sense the accurate location and alerts the farmers effectively |

3.4 Problem solution fit

| | | | | |
|---|---|---|---|---|
| Define CS, fit into CL | 1. CUSTOMER SEGMENT(S) CS Farmer's ! Who's not near his field | 6. CUSTOMER LIMITATIONS EG. BUDGET, DEVICES CL 1)High adoption costs , security concerns. 2)Not aware of the implementation of IoT in agriculture. | 5. AVAILABLE SOLUTIONS PLUSSES & MINUSES AS Monitor different parameters and mobile or web application make easily to farm the crop field . | Explore AS, differentiate |
| | 2. PROBLEMS / PAINS + ITS FREQUENCY PR <ul style="list-style-type: none">It's difficult to monitor and controlAin't known if the application doesn't work properly. | 9. PROBLEM ROOT / CAUSE RC 1)If temperature ,PH level ,humidity & light intensity makes the serious cause for the environment. 2)Farmer affected by less productivity which will affect in their profit. | 7. BEHAVIOR + ITS INTENSITY BE Direct related: Tries to find a solution to prevent this problem Indirect related: Located in rural where internet connectivity might not be strong enough to facilitate fast transmission speeds. | |
| Focus on PR, lap into BE, understand RC | 3. TRIGGERS TO ACT TR Create opportunities to lift people out of poverty in developing nations. (Over 60%) | 10. YOUR SOLUTION SL <i>"IoT based Smart crop protection system for agriculture" !!</i> It help farmers grow more food on less land by protection crops from pests, diseases and weeds as well as raising productivity per hectare. | 8. CHANNELS of BEHAVIOR CH ONLINE: The Data send through application for the farmers to know about the farms. | Focus on PR, lap into BE, understand RC |
| | 4. EMOTIONS BEFORE / AFTER EM BEFORE: Finances, Heavy work overload and conflict in relationship. AFTER: It will easier to make more yield in | | OFFLINE: The control action is taken by the farmers to monitor the farms. | |
| Identify strong TR & EM | | Extract online & offline CH of BE | | |

4. REQUIREMENT ANALYSIS

4.1Functional Requirement:

| FR No | Function Requirement(Epic) | Sub Requirement (Story / Sub-Task) |
|-------|----------------------------|------------------------------------|
|-------|----------------------------|------------------------------------|

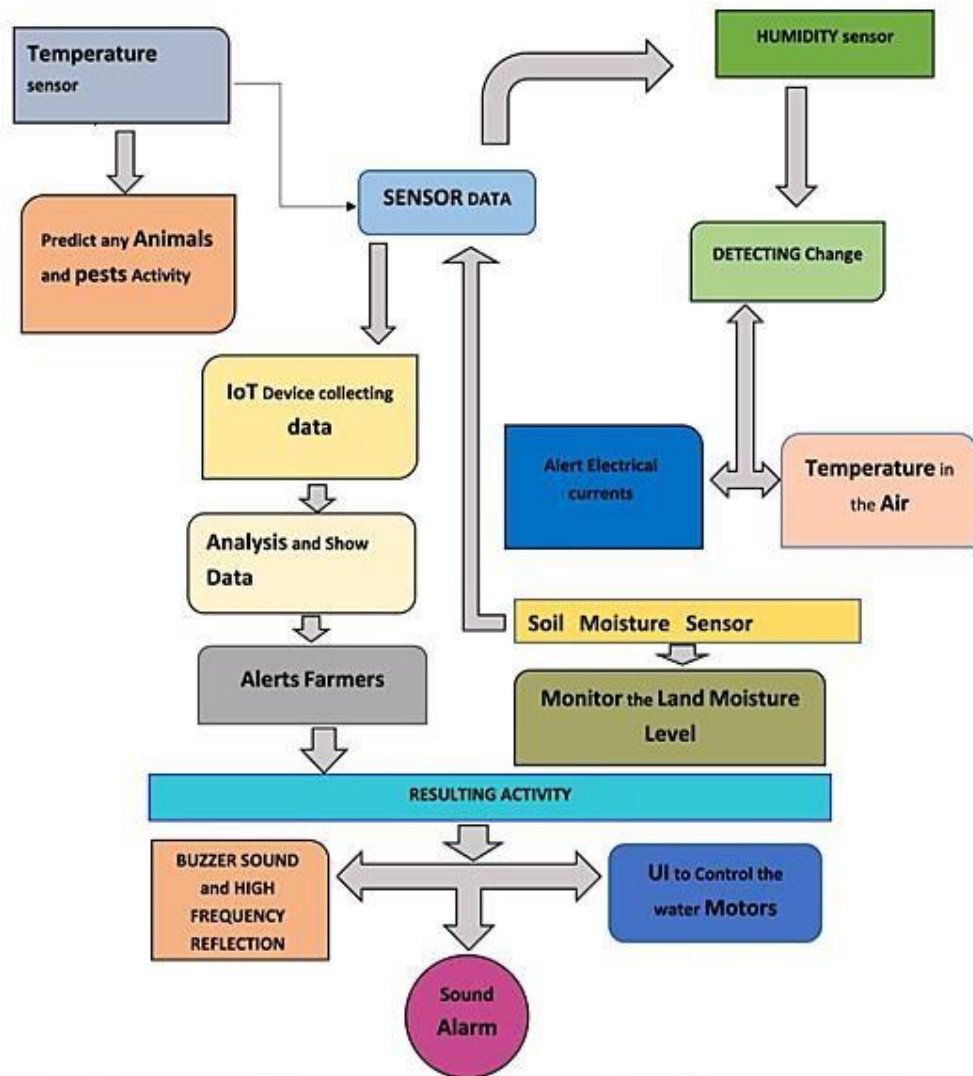
| | | |
|-------------|---------------------------|--|
| FR-2 | User Visibility | Sense animals nearing the crop field and sounds alarm to woo them away as well as sends SMS to farmer using cloud service |
| FR-2 | User Reception | Sense animals nearing the crop field and sounds alarm to woo them away as well as sends SMS to farmer using cloud service |
| FR-3 | User Understanding | Based on the sensor data value to get the information about present of farming land |
| FR-4 | User Action | The user needs take action like destruction of crop residues, deep plowing, crop rotation, fertilizers, strip cropping, scheduled planting operations |

Non-functional Requirements:

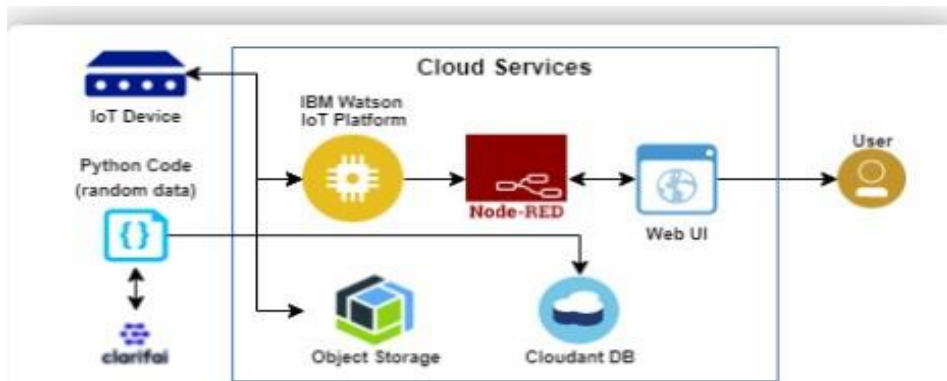
| FR No | Non-Functional Requirement | Description |
|----------------------------------|---|--|
| NFR-1 | Usability | Mobile support. Users must be able to interact in the same roles & tasks on computers & mobile devices where practical, given mobile capabilities. |
| NFR-2 NFR-3 | Security Reliability | Data requires secure access to must register and communicate securely on devices and authorized users of the system who exchange information must be able to do. It has a capacity to recognize the disturbance near the field and doesn't give a false caution signal. |
| NFR-4 | Performance | Must provide acceptable response times to users regardless of the volume of data that is stored and the analytics that occurs in background. Bidirectional, near real-time communications must be |

| | | |
|-------|--------------|---|
| | | supported. This requirement is related to the requirement to support industrial and device protocols at the edge. |
| NFR-5 | Availability | IoT solutions and domains demand highly available systems for 24x7 operations. Isn't a <i>critical production</i> application, which means that operations or production don't go down if the IoT solution is down. |
| NFR-6 | Scability | System must handle expanding load and data retention needs that are based on the upscaling of the solution scope, such as extra manufacturing facilities and extra buildings. |

5.1 Data Flow Diagrams:



5.2 Solution & Technical Architecture:



User-Stories:

| User Type | Functional requirement (Epic) | User Story Number | User Story/Task | Acceptance criteria | Priority | Release |
|-----------------------|-------------------------------|-------------------|--|--|----------|----------|
| Customer(Mobile user) | Registration | USN-1 | User can enter into the web application | I can access my account /dashboard | High | Sprint 1 |
| | | USN-2 | User can register their credentials like email id and password | I can receive confirmation email & click confirm | High | Sprint 1 |
| | Login | USN-3 | User can log into the application by entering email & password | I can login to my account | High | Sprint 1 |
| | Dashboard | USN-4 | User can view the temperature | I can view the data given by the device | High | Sprint 2 |
| | | USN-5 | User can view the level of sensor | I can view the data | High | Sprint 2 |

| | | | | | | |
|-------------------------|----------------|-------|--|---|------|----------|
| | | | monitoring value | given by the device | | |
| Customer(Web user) | Usage | USN-1 | User can view the web page and get the information. | I can view the data given by the device | High | Sprint 3 |
| Customer | Usage | USN-1 | User can view the web page and get the information | I can view the data given by the device | High | Sprint 3 |
| Customer | Working | USN-1 | User act according to the alert given by the device | I can get the data work according to it | High | Sprint 3 |
| | | USN-2 | User turns ON the water motors/Buzzer/Sound Alarm when occur the disturbance on field. | I can get the data work according to it | High | Sprint 4 |
| Customer care Executive | Action | USN-1 | User solve the problem when some faces any usage issues | I can get the data work according to it | High | Sprint 4 |
| Administration | Administration | USN-1 | User store every | I can store the gained information | High | Sprint 4 |

6. PROJECT PLANNING AND SCHEDULING

6.1 Sprint Planning & Estimation:

| Sprint | Functional Requirement (Epic) | User Story Number | User Story / Task | Story Points | Priority | Team Members |
|----------|-------------------------------|-------------------|---|--------------|----------|--|
| Sprint-1 | | US-1 | Create the IBM Cloud services which are being used in this project. | 6 | High | Sidharthini KS Abarna A Kayathri V Madhumitha A |
| Sprint-1 | | US-2 | Configure the IBM Cloud services which are being used in completing this project. | 4 | Medium | Sidharthini KS Abarna A Kayathri V Madhumitha A |
| Sprint-2 | | US-3 | IBM Watson IoT platform acts as the mediator to connect the web application to IoT devices, so create the IBM Watson IoT platform. | 5 | Medium | Sidharthini KS Abarna A Kayathri V Madhumitha A |
| Sprint-2 | | US-4 | In order to connect the IoT device to the IBM cloud, create a device in the IBM Watson IoT platform and get the device credentials. | 5 | High | Sidharthini KS Abarna A Kayathri V Madhumitha A |
| Sprint-3 | | US-1 | Configure the connection security and create API keys that are used in the Node-RED service for accessing the IBM IoT Platform. | 10 | High | Sidharthini KS Abarna A Kayathri V Madhumitha A |
| Sprint-3 | | US-2 | Create a Node-RED service. | 10 | High | Sidharthini KS Abarna A Kayathri V Madhumitha A |
| Sprint-3 | | US-1 | Develop a python script to publish random sensor data such as temperature, moisture, soil and humidity to the IBM IoT platform | 7 | High | Sidharthini KS Abarna A Kayathri V Madhumitha A |
| Sprint-3 | | US-2 | After developing python code, commands are received just print the statements which represent the control of the devices. | 5 | Medium | Sidharthini KS Abarna A Kayathri V Madhumitha A |
| Sprint-4 | | US-3 | Publish Data to The IBM Cloud | 8 | High | Sidharthini KS Abarna A Kayathri V Madhumitha A |
| Sprint-4 | | US-1 | Create web UI in node red | 10 | High | Sidharthini KS Abarna A Kayathri V Madhumitha A |

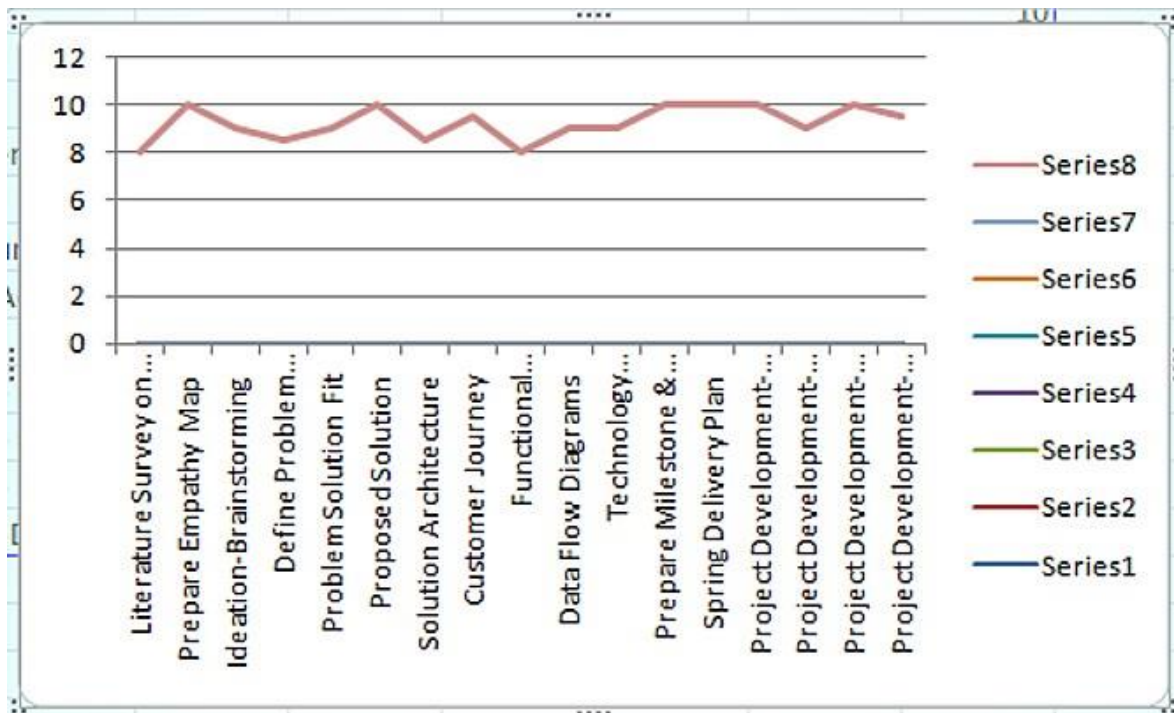
| | | | | | | |
|-----------------|--|-------------|--|-----------|-------------|--|
| Sprint-4 | | US-2 | Configure the Node-RED flow to receive data from the IBM IoT platform and also use Cloudant DB nodes to store the received sensor data in the cloudant DB | 10 | High | Sidharthini KS Abarna A Kayathri V Madhumitha A |
|-----------------|--|-------------|--|-----------|-------------|--|

Project Tracker, Velocity & Burndown Chart:

| 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-1 | 20 | 6 Days | 31 Oct 2022 | 05 Nov 2022 | 20 | 05 Nov 2022 |
| Sprint-1 | 20 | 6 Days | 07 Nov 2022 | 12 Nov 2022 | 20 | 12 Nov 2022 |
| Sprint-1 | 20 | 6 Days | 14 Nov 2022 | 19 Nov 2022 | 20 | 19 Nov 2022 |

6.3 Reports From JIRA:

[Jira report](#)



7. CODING AND SOLUTIONING:

7.1 Feature 1(Node Red Output

The screenshot displays the Node-RED web interface in a browser. The top navigation bar shows several open tabs, including 'IBM', 'Applications | Cl...', 'IBM Cloud', '(22) WhatsApp', 'IBM-Project-586', 'Create NODE REI', 'Node-RED', and 'IBM Watson IoT'. The address bar shows the URL '127.0.0.1:1880/#flow/cc2ab69b4ca14f3a'. The Node-RED interface itself has a 'Deploy' button in the top right. On the left, there is a 'filter nodes' search bar and a sidebar with node categories: 'common' (inject, debug, complete, catch, status, link in, link call, link out, comment) and 'function' (function, switch, change). The main workspace, titled 'Flow 1', contains a flow diagram. It starts with an 'IBM IoT' node (connected) feeding into a 'msg.payload' node. This node then branches into two parallel paths: one through a 'TEMPERATURE NODE' function node to a 'TEMPERATURE' output node, and another through a 'HUMIDITY NODE' function node to a 'HUMIDITY' output node. Below this, there are two HTTP endpoints: '[get]/SENSOR' and '[get]/control'. The '[get]/SENSOR' endpoint connects to an 'httpfunctionnode' function node, which then connects to an 'http' output node. The '[get]/control' endpoint connects to a 'command function node' function node, which also connects to an 'http' output node. At the bottom of the flow, there are two 'Light on' and 'Light off' nodes. The 'Light on' node connects to a 'msg.payload' node, which then connects to an 'IBM IoT' node (connected). The 'Light off' node also connects to the same 'msg.payload' node. The right sidebar shows a 'debug' tab with a list of messages. The messages are JSON objects containing temperature, humidity, and soil moisture data. The bottom of the screen shows a Windows taskbar with a search bar, several application icons, and a system tray showing the date and time as 12:39 on 17-11-2022.

Node-RED interface showing a flow for temperature and humidity monitoring. The flow includes nodes for IBM IoT, msg.payload, TEMPERATURE NODE, HUMIDITY NODE, TEMPERATURE, HUMIDITY, [get]/SENSOR, httpfunctionnode, http, [get]/control, command function node, Light on, Light off, and another msg.payload node. The right sidebar displays debug messages showing JSON payloads with temperature, humidity, and soil moisture data.

```
soil moisture: 23 }
11/17/2022, 12:39:22 PM node: msg.payload
iot-
2/type/PNT2022TMD47477/Id/PNT2022TMD47477/evt
/event_1/fmt/json : msg.payload : Object
{ temperature: 71, humidity: 62,
soil moisture: 27 }
11/17/2022, 12:39:25 PM node: msg.payload
iot-
2/type/PNT2022TMD47477/Id/PNT2022TMD47477/evt
/event_1/fmt/json : msg.payload : Object
{ temperature: 54, humidity: 89,
soil moisture: 95 }
11/17/2022, 12:39:30 PM node: msg.payload
iot-
2/type/PNT2022TMD47477/Id/PNT2022TMD47477/evt
/event_1/fmt/json : msg.payload : Object
{ temperature: 84, humidity: 54,
soil moisture: 57 }
11/17/2022, 12:39:32 PM node: msg.payload
iot-
2/type/PNT2022TMD47477/Id/PNT2022TMD47477/evt
/event_1/fmt/json : msg.payload : Object
{ temperature: 4, humidity: 61,
soil moisture: 31 }
```

```
Python 3.7.0 Shell
File Edit Shell Debug Options Window Help

Python 3.7.0 (v3.7.0:1bf9cc5093, Jun 27 2018, 04:59:51) [MSC v.1914 64 bit (AMD64)] on win32
Type "copyright", "credits" or "license()" for more information.
>>>
== RESTART: C:/Users/Latha/AppData/Local/Programs/Python/Python37/ibmiot.py ==
2022-11-13 22:01:48,939 ibmiotf.device.Client INFO Connected successfully: d:8osflk:cropprotection99:cropprotection99
Published Temperature=9 C Humidity=50 % to IBMWatson
Published Temperature=37 C Humidity=55 % to IBMWatson
Published Temperature=96 C Humidity=60 % to IBMWatson
Published Temperature=4 C Humidity=11 % to IBMWatson
Published Temperature=67 C Humidity=49 % to IBMWatson
Published Temperature=79 C Humidity=13 % to IBMWatson
Published Temperature=93 C Humidity=7 % to IBMWatson
Published Temperature=68 C Humidity=70 % to IBMWatson
Published Temperature=69 C Humidity=68 % to IBMWatson
Published Temperature=61 C Humidity=36 % to IBMWatson
Published Temperature=20 C Humidity=76 % to IBMWatson
Published Temperature=3 C Humidity=93 % to IBMWatson
Published Temperature=41 C Humidity=98 % to IBMWatson
Published Temperature=31 C Humidity=96 % to IBMWatson
Published Temperature=78 C Humidity=22 % to IBMWatson
Published Temperature=65 C Humidity=75 % to IBMWatson
Published Temperature=16 C Humidity=89 % to IBMWatson
Published Temperature=87 C Humidity=95 % to IBMWatson
Published Temperature=7 C Humidity=35 % to IBMWatson
Published Temperature=17 C Humidity=85 % to IBMWatson
Published Temperature=32 C Humidity=74 % to IBMWatson
|
```

8. TESTING:

8.1 [Test cases](#)

8.2 [User Acceptance Testing](#)

9. RESULTS:

9.1 [Performance Metrics](#)

10. ADVANTAGES AND

DISADVANTAGESAdvantages:

- ☆ Farmers can monitor the health of farm animals closely, even if they physically distant
- ☆ Also possible to monitor the pregnancy of these animals and identify which of them are sick.
- ☆ Real-time updates.
- ☆ Ensure worker's health.
- ☆ Get immediate alerts.
- ☆ Reduce waste, improve productivity and enable management of a greater number of resources through remote sensing.
- ☆ Data analytics for improved decisions

Disadvantages:

- ☆ Chances where the data might get wrong at time.
- ☆ Farms are located in remote areas and are far from access to the internet.
- ☆ A farmer needs to have access to crop data reliably at any time from any location, so connection issues would cause an advanced monitoring system to be useless.

11. CONCLUSION:

Agriculture irrigation control stays unique of the determined significant interests in agriculture .The simulation result describes the aqua utilization according to the field parameters in the cultivation field. Guideline of horticultural water system stays restrictive to the set up significant interests of farming.. In the field of IoT, we proposed an integrative way to deal with brilliant horticulture at modern level, zeroed in on low-power crusades and arising causes. This field of this effort remains towards withdraw to monitor the system for crop security conflicting to subconscious occurrences and meteorological conditions.

12. FUTURE SCOPE:

- ◇ IoT enabled device are likely to be all-pervasive, from industry to households.
- ◇ The future scope of IoT is bring and varied , and it is only a matter of time before the above applications of the technology are realized.

13. APPENDIX:

Source Code:

[Python code](#)

GitHub and Project Demo Link:

[GitHub link](#)

[Project Demo Link](#)