IOT BASED SMART CROP PROTECTION SYSTEM FOR AGRICULTURE

TEAM ID: PNT2022TMID44879

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INTRODUCTION:

ABSTRACT: — Farming is the backbone of agriculture , which makes a considerable contribution towards the GDP growth of a country. Owing to the disadvantages of traditional farming, Farming has been considered as a more sustainable method in recent times. This project aims to automate some of the processes of agriculture by monitoring the parameters that contribute to a healthy crop growth such as temperature, humidity and machine temperature and pH levels and automating them to stay within the optimal range, where possible, or alert the owner of the estate to take necessary action immediately. The sensor data is simulated using IBM IoT sensors and is sent to the cloud through IBM Bluemix. The data is transmitted to the Node-RED platform.A mobile application has been developed for the farm owner to access all details related to the statistics of parameters that are gathered by the sensor data and keep track of their farm from anywhere. In doing so, the farmer can facilitate agriculture without the need for excess manual labour.

PROJECT OVERVIEW:

Crops in farms are many times ravaged by local animals like buffaloes, cows, goats, birds etc. this leads to huge losses for the farmers. It is not possible for farmers to barricade entire fields or stay on field 24 hours and guard it.so here we propose automatic crop protection system from animals.

This is a IOT based system using node-red. The sound of an alarm to woo the animal away from the field as well as sends SMS to the farmer so that he may about the issue and come to the spot in case the animal don't turn away by the alarm. This ensures complete safety of crop from animals thus protecting farmers loss.

PURPOSE: Our main purpose of the project is to develop intruder alert to the farm, to avoid losses due to animal and fire. These intruder alert protect the crop that damaging that indirectly increase yield of the crop. The developed system will not harmful and injurious to animal as well as human beings. The Theme of the project is to design an intelligent security system for farmers.

LITERATURE SURVEY:

The existing system mainly provide the surveillance functionality. Also these system don't provide protection from wild animals, especially in such an application area. They also need to take actions based on the type of animal that tries to enter the area, as different methods are adopted to prevent different animals from entering restricted areas. The other commonly used method by farmer in order to prevent the crop vandalization by animals include building physical barriers, use of electric fences and manual surveillance and various such exhaustive and dangerous method.

REFERENCES:

S.NO	**PAPER TITLE**	**AUTHOR'S NAME**	**INFERENCE**	**AREA**
1	Self-powered, Real-Time NRF24L01 IoT based Could enabled Service for Smart Agriculture Decision-Making System(2002)	K.Lova Raju, V.Vijayaraghavan	IOT ThinkSpeak	Monitors the field using NRF24L01 module
2	Using IoT Innovation & Efficiency in Agriculture Monitoring System(2021)	Muhammad Awais, Wei Li, Muhammad Ajmal	IOT ,Artificial Itelligence , ThinkSpeak	Automatic Irrigation System & monitoring of crop parameters
3	Machine Learning Applications & Techniques (2021)	Abhinav Sharma, Arpit Jain, Prateek Gupta, V. Chowdary	Machine Learning, IOT	Soil Parameters Monitoring & Improving sustainable productivity
4	Scalable Privacy - Preserving Geo-distance Evaluation for Precision Agriculture IoT Systems (2021)	Qiben Yan, Miehet C.Vuran, Suat Irmak	Privacy preserving protocols , IOT	Computing distance among farms & sensors privately using security protocols (SPRIDE)
5	Precision Agriculture Techniques & Practices (2019)	Uferah Shafi, Rafia Mumtaz, Jose Garcia-Nieto., Smart IoT	Smart IOT	WSN based PA, Crop health real-time monitoring status.

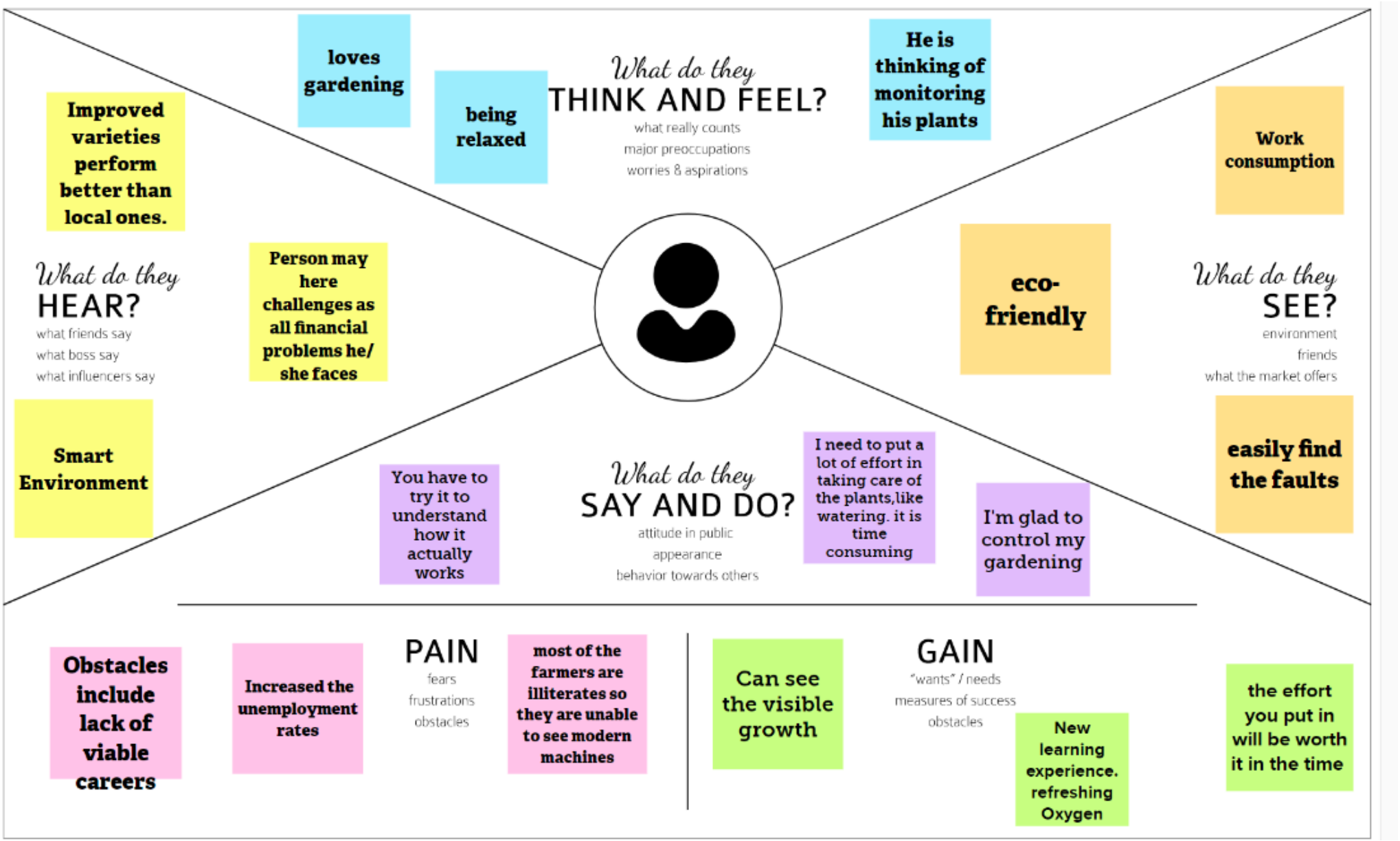
PROBLEM STATEMENT : IOT enabled micro irrigation and farming land health logging system

DEFINITION STATEMENT:

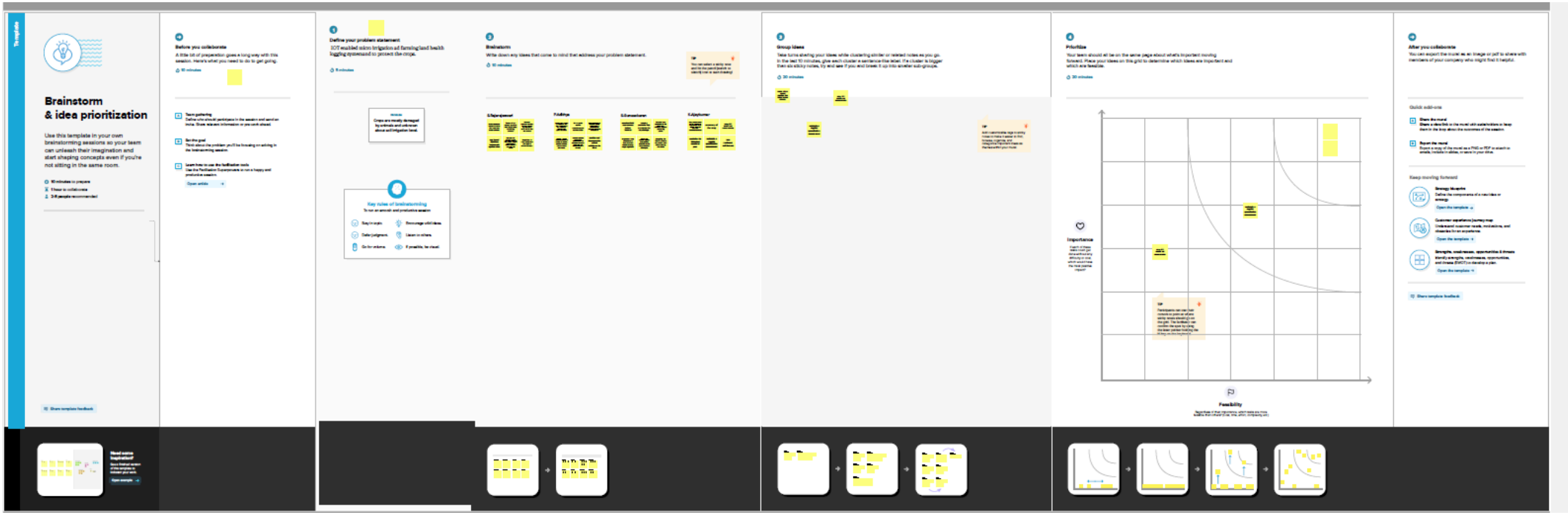
History-based soil health parameters like soil moisture, pH level, temperature etc. are very essential of organic cultivation. IoT applications may assist in controlling the irrigation pump, opening and closing water flowing gates and also data logging the soil health conditions for present and future purpose. Further, with the help of IoT applications, provision for live guidance based on stored date of soil health from professional/experts to farmers in remote locations may be available.

3.IDEATION AND PROPOSED SOLUTION:

3.1 Empathy map



3.2 IDEATION &BRAINSTORMING:



3.3 PROPOSED SOLUTION:

Project team shall fill the following information in proposed solution template.

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	IOT Enabled micro irrigation and farming landhealth logging system
2.	Idea / Solution description	The aim of the proposed work is to develop an IoT device for smart crop field monitoring system and automated irrigation system using the wireless sensor networks(WSN). .To create an IoT device for monitoring the crop field using sensors(soil moisture, temperature, Humidity. ● To analyse the sensors data and provideinformation to the farmers. ● To automate the irrigation by comparing thelevel of soil moisture with the threshold value.
3.	Novelty / Uniqueness	Daily update about the condition of the land send to the farmers via mail.
4.	Social Impact / Customer Satisfaction	Cost effective to the society. Modernization to the society. High Protection and High yield
5.	Business Model (Revenue Model)	Outcome based modelData based model Platform based model
6.	Scalability of the Solution	Start small and build out

3.4 PROBLEM SOLUTION FIT

Project Title: IOT Based Smart Crop Protection System for Agriculture

Team ID:**PNT2022TMID44879**

	1. CUSTOMER SEGMENT(S) *Sensors for soil scanning and water, light, humidity and temperature management. *Telecommunication technologies such as advanced networking and GPS. *Hardware and software for specialized application and for enabling IOT based solution, robotics and automation. *Data analytics tools for decision making and prediction ,data collection is a significant part of smart farming as the quantity of data available from crop yields, soil mapping, climate change, fertilizer ,application, weather data, machinery and animal health continues to escalate.	**6. CUSTOMER CONSTRAINTS** Production constraints have been identified that contribute to explaining by the yield gap, i.e. limited water availability, limited nutrient availability, inadequate crop production, insufficient or inadequate.	**5. AVAILABLE SOLUTIONS** IOT in agriculture uses robots, drones, remote sensors and computer imaging combined with continuously progressing machine learning and analytical tools for monitoring crops, surveying and mapping the fields and providing data to farmers for rational farm management plans to save both time and money.	
	2. JOBS-TO-BE-DONE / PROBLEMS Customers job to be done is to monitor agricultural land, temperature , soil moisture etc ,.....	**9. PROBLEM ROOT CAUSE** There are increasing pressure from climate change, soil erosion and biodiversity loss and concerns about how it is produced. Andthe natural world that farming works with – plants, pests and diseases-continue to pose their own challenges.	**7. BEHAVIOUR** Condition is an important indicator helping farmers decide on the optimal planting, and crop gathering time. With IOT sensors performing soil condition monitoring, farmers get instantly alerted of soil moisture and salinity. Others metrics include soil temperature and air temperature: estimating them correctly enables farmers to plan watering times and know Soil when to expect pests.	Focus on J&P, tap into BE, under

3. TRIGGERS

Smart farming reduces the ecological footprint of farming. Minimized or site-specific application of inputs, such as fertilizers and pesticides, in precision agriculture systems will mitigate leaching problems as well as the emission of greenhouse gasses**.**

4. EMOTIONS: BEFORE / AFTER

Before:

Doubt full

After:

Easy to access

10. YOUR SOLUTION

- Sensors to monitor and track the status ofcrops and insects.
- Drones for monitoring the livestock such ashens.
- Machines for performing route operations andensuring proper functioning of systems.
- Managing and tracking locations using GPS.
- The information collected from sensors aresent to IOT based cloud platforms for data analytics.

8. CHANNELS of BEHAVIOUR

8.1 ONLINE

online customer buying behavior is the displayed by customers in searching for ,purchasing

using and evaluating of product or service that the expect will satisfy their needs through web media

8.2 OFFLINE

where as buying behavior refers to the buying behavior ofthe ultimate consumer who prefers to.

4.REQUIREMENTANALYSIS:

4.1 Functional Requirements:

Following are the functional requirements of the proposed solution.

FR NO.	Functional Requirement (Epic)	Sub Requirement(Story / Sub-Task)
FR-1	User classification	The user has to classify crops such asfood crops like rice, wheat and industrial crops like cotton, tobacco.
FR-2	User adoption	The user has to adopt new technology for boosting production.
FR-3	User detection	The user has to detect the ratio ofdefected crops on land.

4.2 NON-FUNCTIONAL REQUIREMENTS:

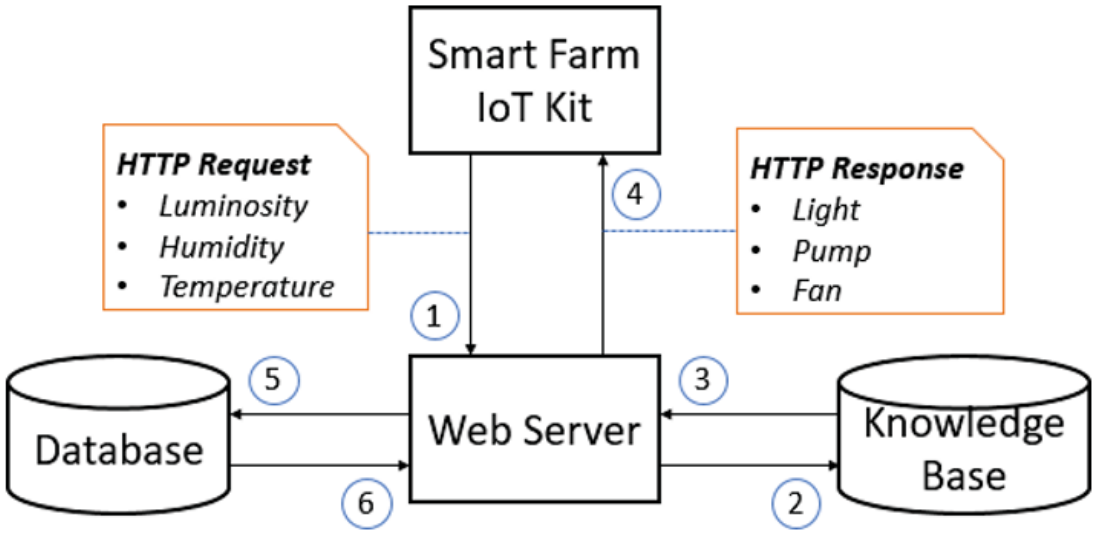
Following are the non-functional requirements of the proposed solution.

FR NO.	Non-Functional Requirement	Description
NFR-1	**Usability**	The sensors used in agriculture provides data that helps farmers to monitor and

		optimize crops with environmental conditions and challenges.
NFR-2	**Security**	The system is to promote more permanent and viable farming operations over the long term by strengthening the farming community's sense of security in land use and the right to farm.
NFR-3	**Reliability**	The system is highly reliable. They are easy to operate and increasing demand for food with minimum resources such as water and seeds.
NFR-4	**Performance**	Sensors empower farmers to react quickly and dynamically maximize crop performance. It is cost effective and efficient.
NFR-5	**Availability**	The system is simple and easy understand by farmers to improve crop production.so it is used by all countries with different equipments.
NFR-6	**Scalability**	The usage of temperature sensor predicts accurate weather conditions. It alsopredicts water level and moisture content in field.

5.PROJECT DESIGN:

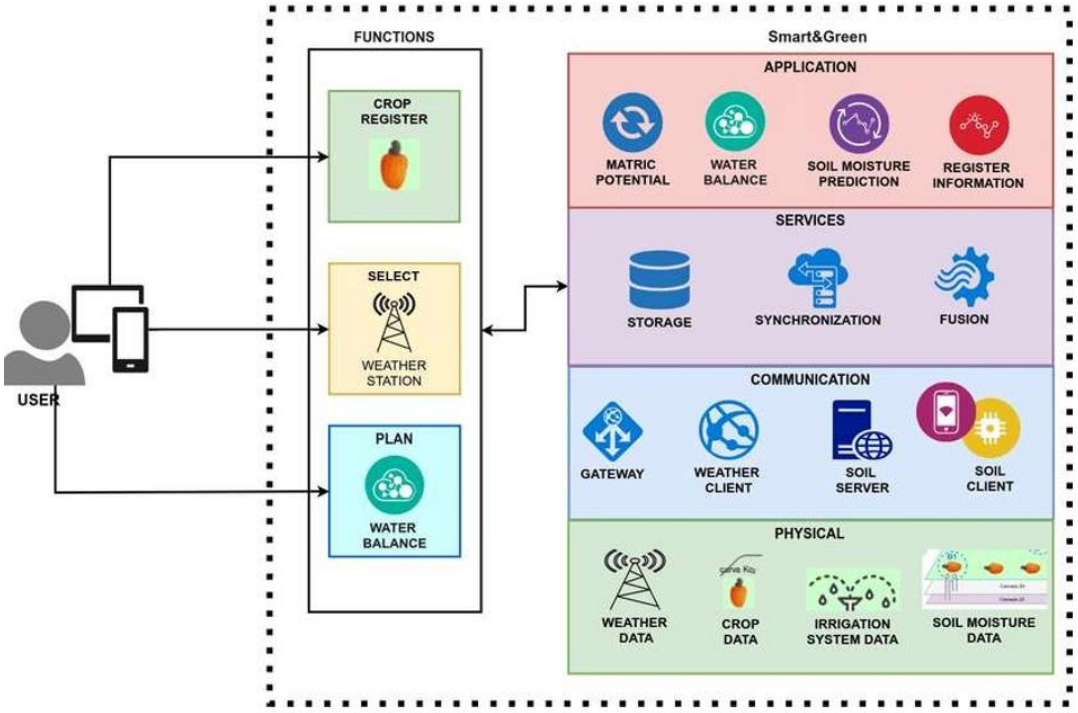
5.1 DATA FLOW DIAGRAM:



5.2 SOLUTION ARCHITECTURE:

Irrigation is one of the most water intensive agricultural activities in the world which has been increasing over time. Choosing the optimal irrigation management plan depends on having available data in the monitoring field .A smart agriculture system gathers data from several sources .However ,the data are not guaranteed to be free of discrepant values which can damage the precision of irrigation management . furthermore ,data from different sources must fit into the same temporal window required for irrigation management and the data pre-processing must be dynamic and automatic to benefit users of the irrigation management plan. In this smart irrigation such as data monitoring ,pre-processing ,fusion synchronization , storage and irrigation management enriched by the prediction of soil moisture.

Example : solution architecture diagram



User stories:

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer	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
Customer	Registration	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
Administrator	Login page	USN-3	As a user, entering the username and password which is already existing.	Redirecting to user account	Medium	Sprint-1
Weather station	Forecasting the correct weather	USN-4	As a user, we can monitor the weather fundamentals like (humidity, wind	Notified about weather conditions.	High	Sprint-1

			speed, wind direction and rainfall).			
Controlling theMotor Pump	Controlling	USN-5	It is used to control motors and field sprinklers.	Switching on and off the motor pump manually via mail (or)some other mobile applictaion.	High	Sprint-2
Fencing	Detecting the motion in certainrange	USN-6	Fetching system are helpful in providing security against unauthoriz ed access of human and animal	I can receive notification prevention has been taken.	High	Sprint-3
Warehouse manageme nt	Collecting database of crops	USN-7	Here farmer need to update about expire dateof fertilizer and seeds.	Generate the popup message about expire date and stocks and offers	High	Sprint-4

6. PROJECT PLANNING &SCHEDULIN-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	S.Rajarajeswari P.Adithya S.Gunasekaran K.Ajaykumar
Sprint-1		US-2	Configure the IBM Cloud services which are being used in completing this project.	4	Medium	S.Rajarajeswari P.Adithya S.Gunasekaran K.Ajaykumar
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	S.Rajarajeswari P.Adithya S.Gunasekaran K.Ajaykumar
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	S.Rajarajeswari P.Adithya S.Gunasekaran K.Ajaykumar
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	S.Rajarajeswari P.Adithya S.Gunasekaran K.Ajaykumar
Sprint-3		US-2	Create a Node-RED service.	10	High	S.Rajarajeswari P.Adithya S.Gunasekaran K.Ajaykumar
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	S.Rajarajeswari P.Adithya S.Gunasekaran K.Ajaykumar
Sprint-3		US-2	After developing python code, commands are received just print the statements which represent the control of the devices.	5	Medium	S.Rajarajeswari P.Adithya S.Gunasekaran K.Ajaykumar

Sprint-4		US-3	Publish Data to The IBM Cloud	8	High	S.Rajarajeswari P.Adithya S.Gunasekaran K.Ajaykumar
Sprint-4		US-1	Create Web UI in Node- Red	10	High	S.Rajarajeswari P.Adithya S.Gunasekaran K.Ajaykumar
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	S.Rajarajeswari P.Adithya S.Gunasekaran K.Ajaykumar

Project Tracker, Velocity & Burndown Chart: (4 Marks):

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

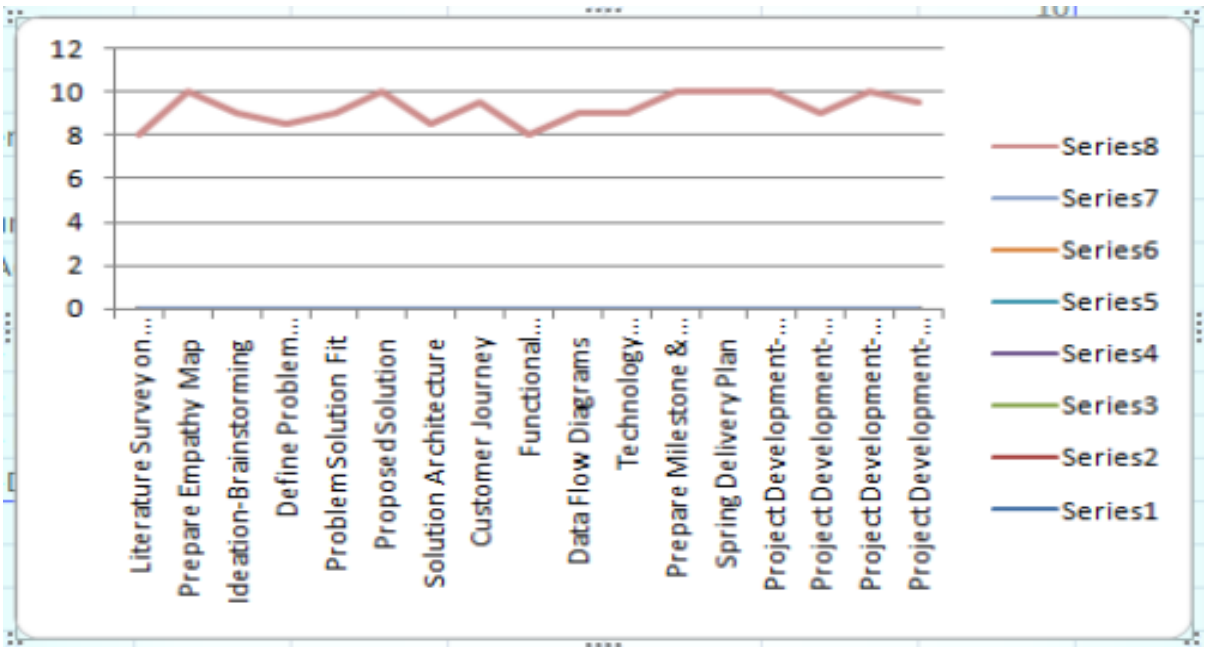
Velocity:

Imagine we have a 10-day sprint duration, and the velocity of the team is 20 (points per sprint). Let's calculate the team's average velocity (AV) per iteration unit (story points per day)

$$AV = \frac{sprint\ duration}{velocity} = \frac{20}{10} = 2$$

Burndown Chart:

A burn down chart is a graphical representation of work left to do versus time. It is often used in agile software development methodologies such as Scrum. However, burn down charts can be applied to any project containing measurable progress over time.



9. RESULTS

The problem of crop vandalization by wild animals andfire has become a major social problem in current time.

It requires urgentattention as no effective solutionexiststill date for this problem. Thus this project carries a greatsocial relevance as it aims to address this problem. This project will help farmers in protecting their orchards and fields and save them from significant financial losses andwill save them from the unproductive efforts that they

endure for the protection their fields. This will also helpthem in achieving better crop yields thus leading to their economic wellbeing.

10. ADVANTAGES AND DISADVANTAGES:

Advantage:

Controllable food supply.you might have droughts or floods, but ify ou are growing the crops and breeding them to be hardier, you have a better chance of not straving . It allows farmers to maximize yields using minimum resources such as water, fertilizers.

Disadvantage : The main disadvantage is the time it can take to process the information.in order to keep feeding people as the population grows you have to radically change the environment of the planet.

11.CONCLUSION:

A IoT Web Application is built for smart agricultural system using WatsonIoTplatform, Watson simulator, IBM cloud and Node-RED

12. FUTURE SCOPE

In the future, there will be very large scope, this project can be made based on Image processing in which wild animal and fire can be detectedby cameras and if it comes towards farm then system will be directly activated through wireless networks. Wild animals can also be detected by using wireless networks such as laser wireless sensors and by sensing this laser or sensor's security system will be activated.

13 APPENDIX

SOURCE CODE:

GitHup link:

https://github.com/IBM-EPBL/IBM-Project-40659-1660632605

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