PROJECT REPORT ON

IOT BASED CROP PROTECTION SYSTEM FOR AGRICULTURE

TEAM ID : PNT2022TMID24852

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TABLE OF CONTEXT

1)INTRODUCTION

1.1 PROJECT OVERVIEW:

Agriculture is the backbone of the economy but because of animal interference in agricultural lands, there will be huge loss of crops. This article provides a comprehensive review of various methods adopted by farmers to protect their crops.
IOT Based Crop Protection System against Birds and Wild Animal Attacks is smart crop protection system using Arduino Smart Crop Protection System from Animals and Fire using Arduino
Crops in farms are many times ravaged by local animals like buffaloes, cows, goats, birds etc. This leads to huge losses for the farmer. Due to over population, it occurs a deforestation this results in shortage of food, water and shelter in forest areas. So, animal's interference in residential areas is increasing day by day which affects human life and property causes human animal conflict but as per nature's rule every living creature on this earth has important role in eco-system. Elephants and other animals coming in to contact with humans, impact negatively in various means such as by depredation of crops, damaging grain stores, water supplies, houses and other assets, injuring and death of humans. Here we proposed crop protection system from animals and fire. This is arduino Uno based system using microcontroller. This system uses a motion sensor to detect wild animals approaching near the field and smoke sensor to detect the fire.
This system helps us to keep away such wild animals from the farmlands and it is also an automated Use GSM module for alerting the owner of the crop.
The problem of wild animal attacks on crop fields i.e. crop vandalization is becoming a very common phenomenon in the state of Himachal Pradesh.

1.2 PURPOSE:

Smart crop monitoring refers to the application of advanced technologies such as IoT for controlling the factors affecting the health of crops and leading to degradation in the crop production quality. The primary goal of the smart crop monitoring system is to ensure maximum efficiency for farmers. Moreover, due to the increasing demand for smart and digital agricultural practices, the global smart crop monitoring market is also growing constantly.
According to a new BIS Research report, the global smart crop monitoring market is expected to reach $3.95 billion by 2027 from a market value of $1.92 billion in 2021.The market is forecast to grow with a compound annual growth rate (CAGR) of 12.75% during the forecast period from 2022-2027.

Protection of crop yield is one of the most challenging concerns faced by farmers. Some of the factors that challenge crop protection are changing weather conditions, unplanned seed sowing, unpredicted locus attacks, and irregular irrigation. There is a high-level requirement for crop yield protection because of the increasing demand for quality food and the constantly increasing global population. It is becoming a crucial need for farmers to shift from conventional monitoring to smart crop monitoring (including advanced technology in farming methods like the Internet of Things) to provide quality production of food.

2)LITERATURE SURVEY

2.1 EXISTING PROBLEM:

Different strategies point just at observation which is fundamentally for human gatecrashers, however we will in general fail to remember that the fundamental foes of such farmer are the animals which literate the harvests. The issue of natural life assault on crops i.e., crop Canalization is getting extremely normal in the conditions of Tamil Nadu, Himachal Pradesh, Punjab, Haryana, Kerala and numerous different states. Wild creatures like monkeys, elephants, wild pigs, deer, wild canines, buffalo, nilgais, estray creatures like cows and wild oxen and even feathered creatures like parakeets cause a great deal of harm to crops by running over them eating and totally vandalizing them. This prompts helpless yield of harvests and huge monetary misfortune to the proprietors of the farmland. This issue is articulated to the point that occasionally the farmer choose to leave the territories barren due to such incessant animal attacks. This framework causes us to fend off such wild animals from the farm lands and it is additionally an mechanized relying upon the need so that there is no manual work, subsequently saving time and likewise forestalling the deficiency of harvests. Consequently the model aides in better treatment of the yields viable. The client gets a better comprehension of the different states of his field and can handle them over his gadget from anyplace on the planet.
Therefore we analyze which technology is suitable to protect the farm from animals.

2.2 REFERENCES:

1.Dr.M.Chandra,MohanReddy,KeerthiRajuKamakshiKodi, BabithaAnapalliMounikaPulla, “SMART CROP PROTECTION SYSTEM FROM LIVING OBJECTS AND FIRE USING ARDUINO”, Science, Technology and Development, Volume IX Issue IX ,pg.no 261-265,Sept 2020.
2.P.Rekha, T.Saranya, P.Preethi, L.Saraswathi, G.Shobana, “Smart AGRO Using ARDUINO and GSM”, International Journal of Emerging Technologies in Engineering Research (IJETER) Volume 5, Issue 3, March 2017.
3. A. Narayanamoorthya, P. Alli and R. Suresh,‖ How Profitable is Cultivation of Rainfed Crops? Some Insights from Cost of Cultivation Studies‖, Agricultural Economics Research Review Vol. 27 (No.2) July-December 2014, pp 233-241.
4. S.Sivagamasundari, S. Janani, “Home surveillance system based on MCU andGSM”, International journal ofcommunications and engineering, 2014, volume 06– no.6.
5. HarshalMeharkure,ParagYelore,heetalIsrani, “Application of IOT Based System for Advance Agriculture in India”, International Journal of Innovative Research in Computer and Communication Engineering(IJIRCCE) Vol. 3, Issue 11, pp. 10831-10837, 2015.

2.3 PROBLEM STATEMENT DEFINITION:

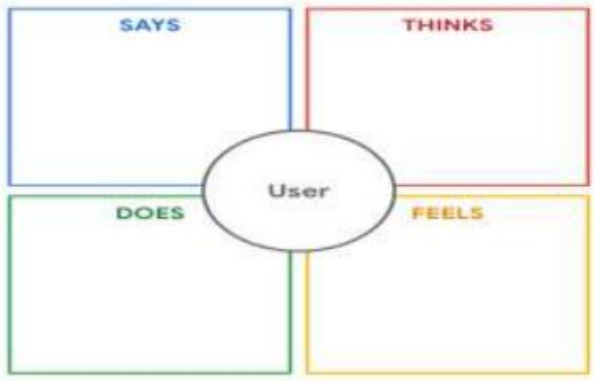
The traditional agriculture and allied sector cannot meet the requirements of modern agriculture which requires high-yield, high quality and efficient output. Thus, it is very important to turn towards modernization of existing methods and using the information technology and data over a certain period to predict the best possible productivity and crop suitable on the very particular land.

With the help of remote sensing technologies develop crop protection solution from wild animal attacks. Provide alerts on any crop damage in case animals destroy crops.
In Vidarbha region, Main Cash Crops such as Pigeon Pea, Green Gram, Black Gram, Jowar, Cotton, Soybean etc. present and are badly affected by wild animals like Deer, Rohi (Neel Gai), wild Pigs, Peacock etc. In few districts in Vidarbha crop loss is more than 35%. Main Wild animals attacking crops in region are Akola, Buldhana Washim etc.
Along with crop loss, landscape loss and due to wild animals-human conflicts, loss of lives of animals & human as well present.
From this literature survey we have seen lots of technology that help to farmer for to protect his farm. Specially IOT based system who can monitor the farm online. In above research papers they are not looking cost of System and so that didn't get affordable to every farmer. Hence we want implement a costless smart crop protection system .

3) IDEATION & PROPOSED SOLUTION

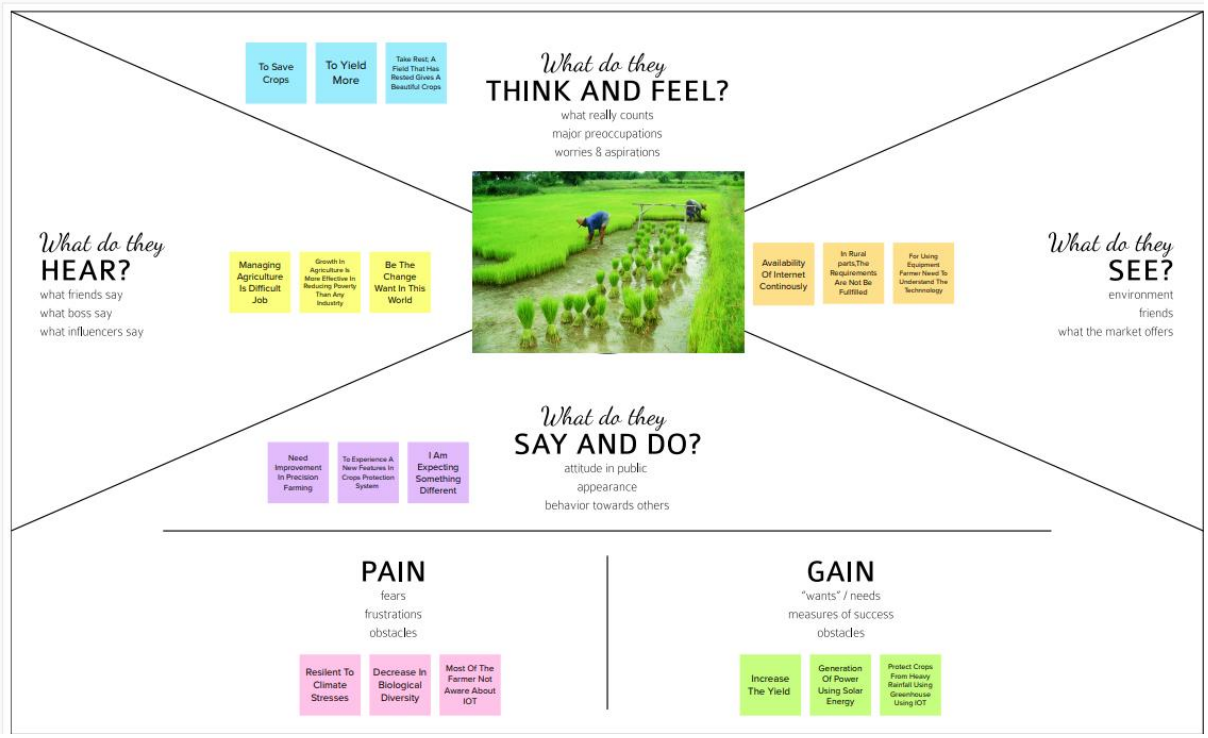
3.1 EMPATHY MAP CANVAS:

An empathy map is a simple, easy-to-digest visual that captures knowledge about a user's behaviours and attitudes. It is a useful tool to help teams better understand their users. Creating an effective solution requires understanding the true problem and the person who is experiencing it. Creating the empathy map helps participants consider things from the user's perspective along with his or her goals.



EMPATHY MAP CANVAS

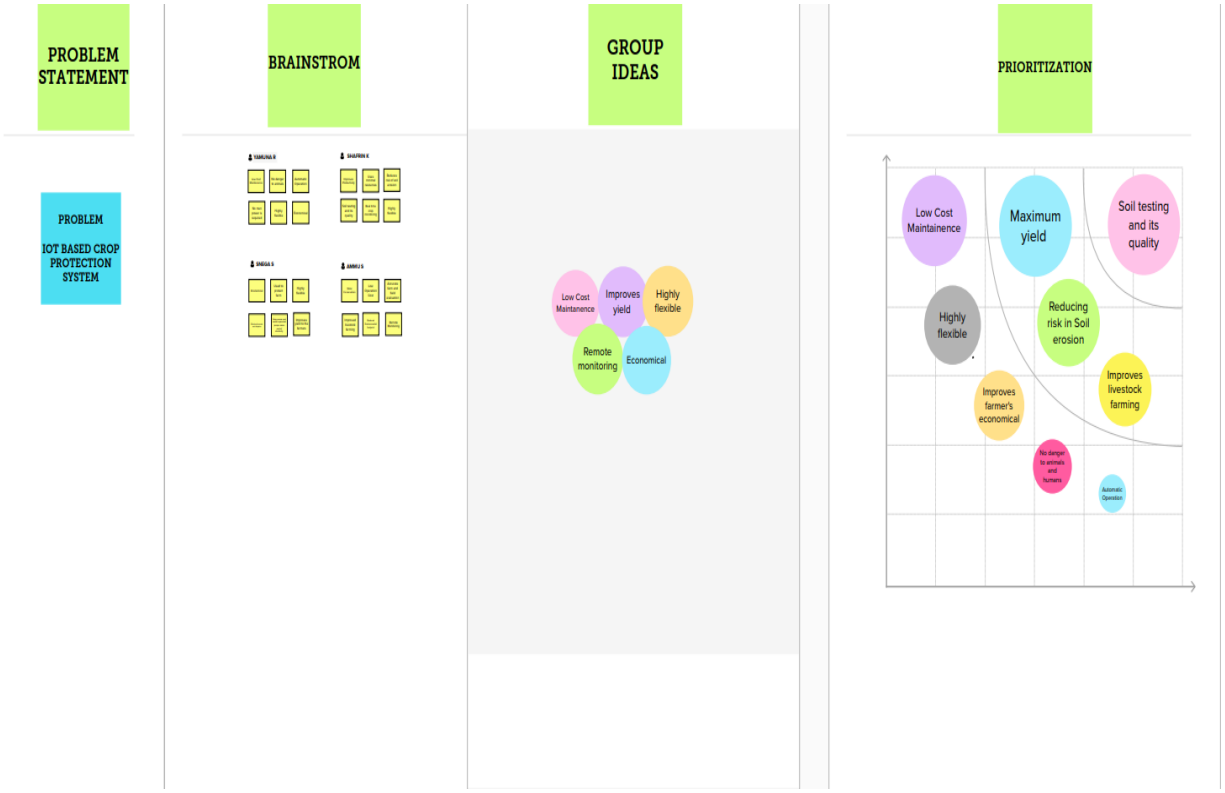
Build empathy and keep your focus on the user by putting yourself in their shoes.



3.2 IDEATION & BRAINSTORMING:

Ideation and Brainstorming are writing down ideas that comes to mind that addresses your problem statement.
The key rules of Brainstorming are:

- Defer Judgement
- Encourage Wild Ideas
- Build on the Ideas of Others
- Stay Focused on the Topic
- One Conversation at a Time
- Be visual
- Go for Quantity



3.3 PROPOSED SOLUTION:

Having a Solid grasp of the problem after doing a thorough investigation, a practical solution needs to be proposed or several approaches needs to be suggested for proper understanding and the rectification of issues. The ones that solve all these is a Proposed Solution.

NOVELTY:

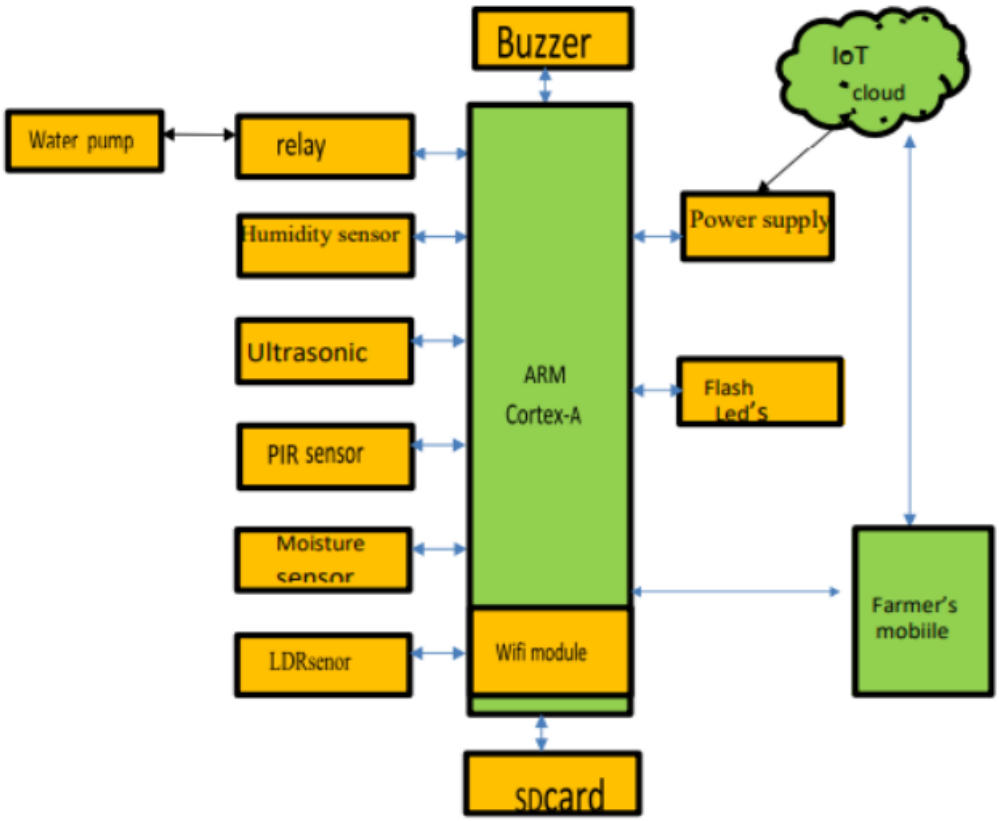
❖ IoT based intelligent system that can be used to prevent crop damage due to wild animals.

❖ Crops in farms are many times ravaged by local animals like buffaloes, cows, goats, birds, and fire etc. This leads to huge losses for the farmers.

❖ As an alternative to electrical fencing, the farmers keep vigil at night to keep the wild animals away. They use flashlights to ward them off. This is a very strenuous task and the lack of sleep adversely affects the farmers' work during the daytime. The damage caused by the animals to the crops affects the total yield of the harvest immensely and the farmers have to suffer a loss in their income because of this.

❖ This is Arduino- Uno based system using microcontroller. This system uses a motion sensor to detect wild animals approaching near the field. In such a case the sensor signals the microcontroller to take action. The system implements IoT technology along with simple sensors.

BUSINESS MODEL:



SOCIAL IMPACT:

DRONES:

It simplifies supervision tasks for farms by being able to cover hundreds of acres in one flight and a wide variety of information about the condition of the land, irrigation needs, crop growth, the existence of pathogens, and, in the case of cattle, the number of animals, their weight and possible anomalies such as lameness or unusual movements.

BLOCKCHAIN:

It makes it possible to monitor crops and cattle from growth until handover to suppliers, improving, for example, the traceability of the supply chain.

INTERNET OF THINGS:

It makes it possible to optimize the monitoring of farms, mainly through smart sensors capable of measuring everything from solar radiation to leaf moisture and stem diameter, or the temperature of each animal in the case of livestock, making it easier to make all sorts of management decisions.

BIG DATA:

It makes it possible to monitor crops and cattle from growth until handover to suppliers, improving, for example, the traceability of the supply chain. By using this technology, if an imported vegetable poisons consumers the source of the outbreak can be easily traced and only the affected products withdrawn, instead of prohibiting imports of vegetables from the entire country of origin.

ENVIRONMENTAL IMPACTS:

✓ Environmental impacts on production, productivity and product quality.

✓ Impacts of climate change on agriculture and post-harvest production.

✓ Ensuring a reliable supply of produce or commodity under climate change.

✓ Use of superior (in terms of yield/productivity, vigour and pest and disease resistance) and climate-smart crop varieties.

CLIMATE CHANGE IMPACTS:

✓ Physiological effects on crops, forests and livestock (quantity, quality) and availability of fodder and pastures.

✓ Changes in land, soil and water resources (quantity, quality). ✓ Increased weed and pest challenges.

✓ Shifts in spatial and temporal distribution of impacts.

✓ Sea level rise, changes to ocean salinity and Sea temperature rise causing fish to inhabit different ranges. and socio-economic impacts,

✓ Decline in yields and production, Reduced GDP from agriculture

FEASIBILITY OF IDEA:

❖ The purpose is to grant monitoring device for crop safety to animal outbreaks and environment circumstances. This supports to preserve stretch and cash by dipping the physical exertion, else obligatory if the cultivators themselves have to afford guard for their crops with their endless physical administration.

❖ Wildlife regularly with eminence crops, because of which annual manufacturing of vegetation reduces inflicting monetary victims to cultivators. Agriculturalist suicide is huge bother due to less harvest. This low harvest is circumstance of two most significant purposes (Crop wrecked via untamed animals and Crop wrecked by meteorological conditions). The ranchers will treasure these SMS containing location.

❖ The prime thing of this task is to furnish a great reply to this distress. Each time either the wild animal or species are identified through PIR sensor which stimulates the web camera and gives rise to alert the buzzer in the locality, associates to the farmer direct to the cloud. When the moisture content is inferior to a terrifying level the sensor planted makes the water pumps to turn on. This ensures the complete safety of crops from animals also as from the weather conditions thus prevent the farmers.

❖ With field, several sensors are prepared like a sensor which substances facts about moisture fabric with soil, Temperature - Humidity sensor, and digital camera for detecting features of the soil. Information serene from the sensors is accumulated and ship it to ARM Cortex-A by means of the ability of gadgets which can be wired or wireless.

SCALABILITY OF SOLUTION:

The recognition system can be used for wide range of applications. It can be extended to large scale implementations such as,

❖ IoT technologies allow developing systems that support different agricultural processes. Some of these systems are remote monitoring systems, decision support tools, automated irrigation systems, frost protection systems, and fertilization systems, among others.

❖ Smart farming is a management concept focused on providing the agricultural industry with the infrastructure to leverage advanced technology – including big data, the cloud and the internet of things (IoT) – for tracking, monitoring, automating and analysing operations. Also known as precision agriculture, smart farming is software-managed and sensor-monitored.

SENSORS:

✓ Sensors for soil scanning and water, light, humidity and temperature management.

TELECOMMUNICATION:

✓ Technologies such as advanced networking and GPS.

SATELLITES:

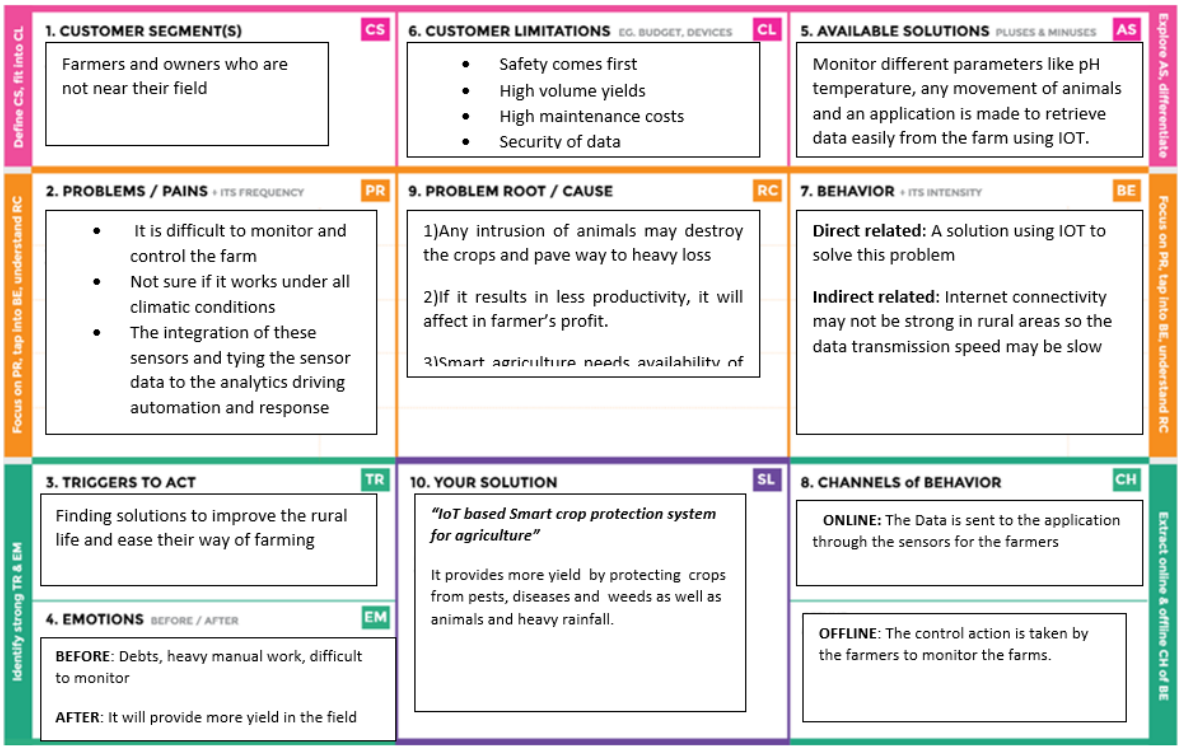
✓ Satellites and drones for gathering data around the clock for an entire field. This information is forwarded to IT systems for tracking and analysis to give an “eye in the field” or “eye in the barn” that makes remote monitoring possible.

DATA ANALYTICS:

✓ 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 applications, weather data, machinery and animal health continues to escalate.

3.4 PROBLEM SOLUTION FIT:

The Problem Solution Fit simply means that you have found a problem with your customer and that the solution you have realized for it actually solves the customer’s problem. It helps entrepreneurs, marketers and corporate innovators identify the behavioral patterns and recognize what would work and why



4)REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENT:

Functional Requirement define what a product must do, what its features and functions are. They, are Product features or functions that developers must implement to enable users to accomplish their tasks. Generally, functional requirements describe system behavior under specific conditions. Example: The system sends a confirmation email when a new user account is created.

Following are the Functional requirements of the proposed solution:

FR-NO	FUNCTIONAL REQUIREMENTS(EPIC)	SUB REQUIREMENT(STORY/ SUB TASK)
FR-1	**User Registration**	Install the app. Register through Gmail or phone number Creating a profile. Understand the guidelines.
FR-2	**User Confirmation**	Confirm through Gmail or phone number and verify the OTP
FR-3	**Web Application**	Web application must have availability of internet continuously
FR-4	**Interface sensor**	Connect the sensor and the application When animals enter the field , the alarm is generated.
FR-5	**Configure to device**	Send data from android device to google.
FR-6	**Mobile application**	It is used to control motors and field sprinklers.

4.2 NON- FUNCTIONAL REQUIREMENT :

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

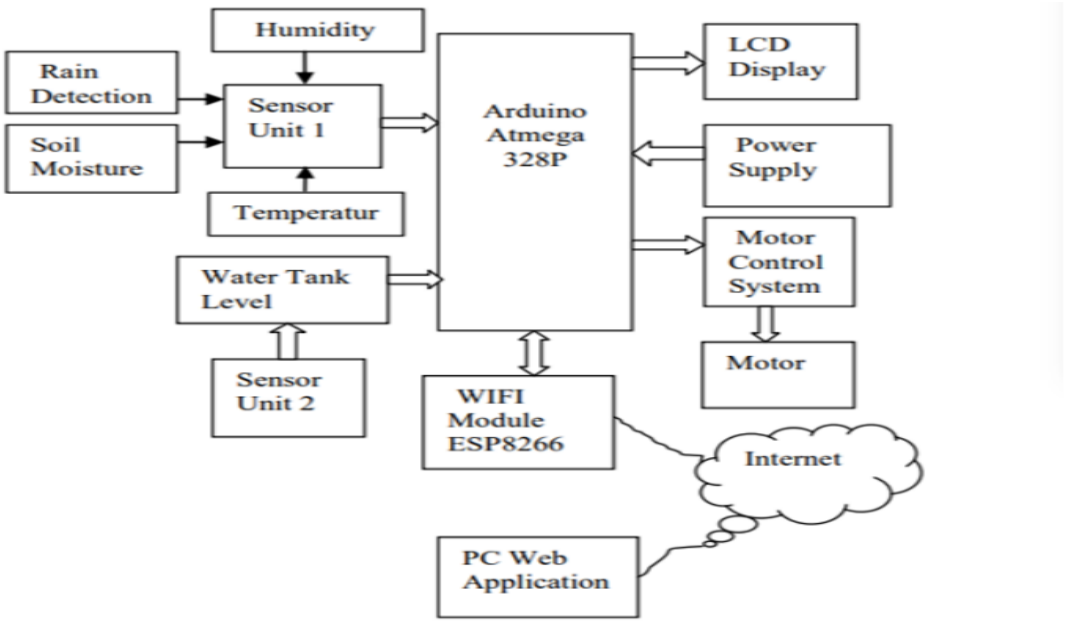
Nonfunctional Requirements, not related to the system functionality, rather define how the system should perform.

NFR NO	Non-functional Requirement	DESCRIPTION
NFR-1	**Usability**	This project contributes to farm protection through the smart protection system.
NFR-2	**Scalability**	This system's integration of computer vision algorithms with IBM cloudant services makes it more efficient to retrieve photos at scale, enhancing scalability
NFR-3	**Security**	It was created to protect the crops from animals
NFR-4	**Reliability**	Farmers are able to safeguard their lands by using this technology. They will also benefit from higher crop yields, which will improve our economic situation.
NFR-5	**Performance**	When animals attempt to enter the field, IOT devices and sensors alert the farmer via messages.
NFR-6	**Availability**	We can defend the crops against wild animals by creating and implementing resilient hardware and software.

5) PROJECT DESIGN

5.1 DATA FLOW DIAGRAMS :

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

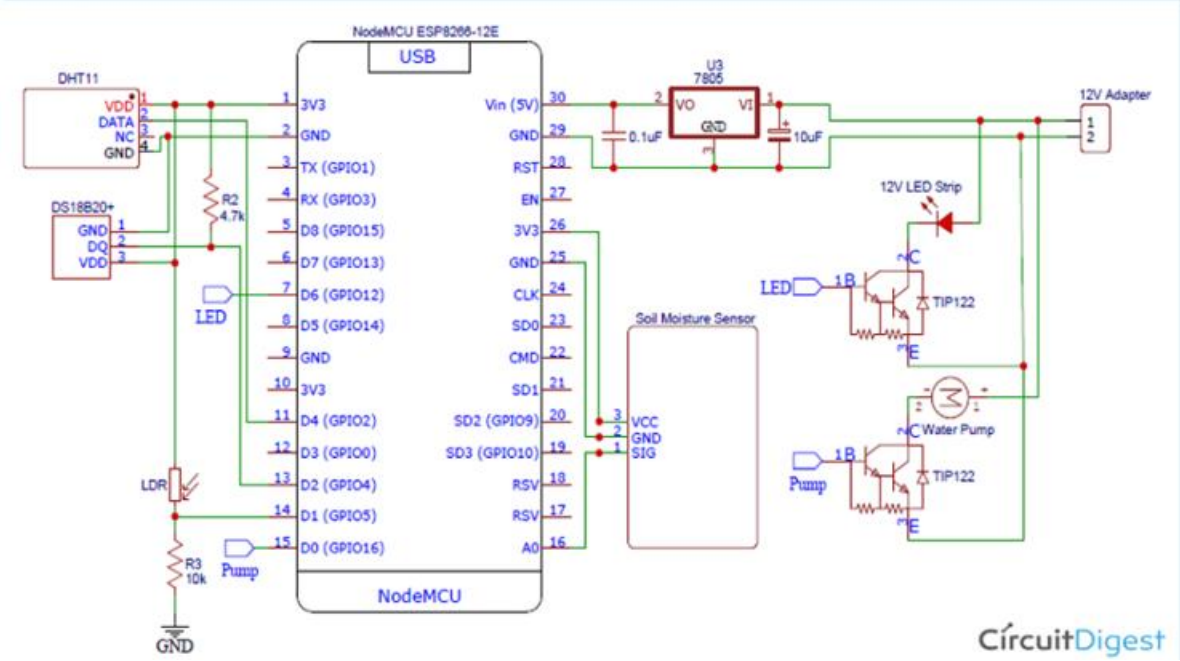


5.2 SOLUTION & TECHNICAL ARCHITECTURE :

SOLUTION ARCHITECTURE

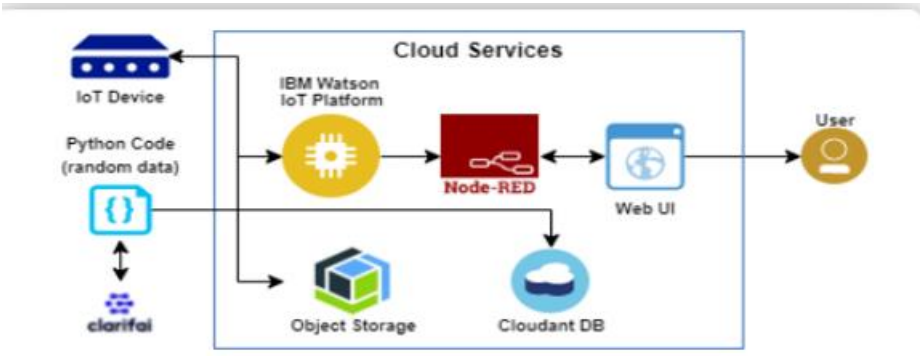
Smart Farming has enabled farmers to reduce waste and enhance productivity with the help of sensors (light, humidity, temperature, soil moisture, etc.) and automation of irrigation systems. Further with the help of these sensors, farmers can monitor the field conditions from anywhere. Internet of Things based Advanced Farming is highly efficient when compared with the conventional approach. The applications of intelligent Agriculture solutions not only target conventional, large farming. With operations, but could also be new levers to uplift other growing or common trends in agricultural like organic farming, family farming (complex or small spaces, particular cattle and/or cultures, preservation of specific or high-quality varieties, etc.), and enhance highly transparent Farming

CIRCUIT DESIGN:



TECHNICAL ARCHITECTURE

The Technical Architecture involves the development of a technical blueprint with regard to the arrangement, interaction and interdependence of all elements so that the system-relevant requirements are met. The Deliverable shall include the architectural diagram as below and the information as per the table1 & table 2



5.3 USER STORIES:

A user story is the smallest unit of work. It is not a feature, but an end goal that the user has when using the software. The user story will convey what the user wants to achieve and states into a simple, non-technical way.

Use the below template to list all the user stories for the product.

User Type	Functional requirement (Epic)	User Story Number	User Story/Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	USN-1	As a User, we 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 monitoring value	I can view the data given by the device	High	Sprint 2
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	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 Buzzer/Sound Alarm when the disturbance will occur on field	I can solve the issues when someone fails to understand the procedures	High	Sprint 4
Customer care Executive	Action	USN-1	User solve the problem when some faces any usage issues	I can solve the issues when someone fails to understand the procedures	High	Sprint 4
Administration	Administration.	USN-1	User store every information	I can store the gained	High	Sprint 4

6) PROJECT PLANNING AND SCHEDULING

6.1 SPRINT PLANNING AND ESTIMATION:

Product Backlog, Sprint Schedule, and Estimation

Sprint	User Story Number	Functional Requirement (Epic)	User Story / Task	Story Point	Priority	Team Members
Sprint-1	USN-1		Create the IBM Cloud services which are being used in this project.	**6**	High	YAMUNA, Shafrin, Snega, Ammu
Sprint-1	USN-2		Configure the IBM Cloud services which are being used in completing this project.	**4**	Medium	YAMUNA, Shafrin, Snega, Ammu
Sprint-2	USN-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	YAMUNA, Shafrin, Snega, Ammu
Sprint-2	USN-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	YAMUNA, Shafrin, Snega, Ammu
Sprint-3	USN-1		Configure the connection	**10**	High	YAMUNA, Shafrin,

			security and create API keys that are used in the Node-RED service for accessing the IBM IoT Platform			Snega, Ammu
Sprint-3	USN-2		Create a Node-RED service	**10**	High	YAMUNA, Shafrin, Snega, Ammu
Sprint-3	USN-1		Develop a python script to publish random sensor data such as temperature, moisture, soil and humidity to the IBM IoT platform	**7**	High	YAMUNA, Shafrin, Snega, Ammu YAMUNA, Shafrin, Snega, Ammu
Sprint-3	USN-2		After developing python code, commands are received just print the statements which represent the control of the devices.	**5**	Medium	YAMUNA, Shafrin, Snega, Ammu
Sprint-4	USN-3		Publish Data to The IBM Cloud	**8**	High	YAMUNA, Shafrin, Snega, Ammu
Sprint-4	USN-1		Create Web UI in Node-Red	**10**	High	YAMUNA, Shafrin, Snega, Ammu

Sprint-4	USN-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	YAMUNA, Shafrin, Snega, Ammu

Project Tracker, Velocity & Burndown Chart:

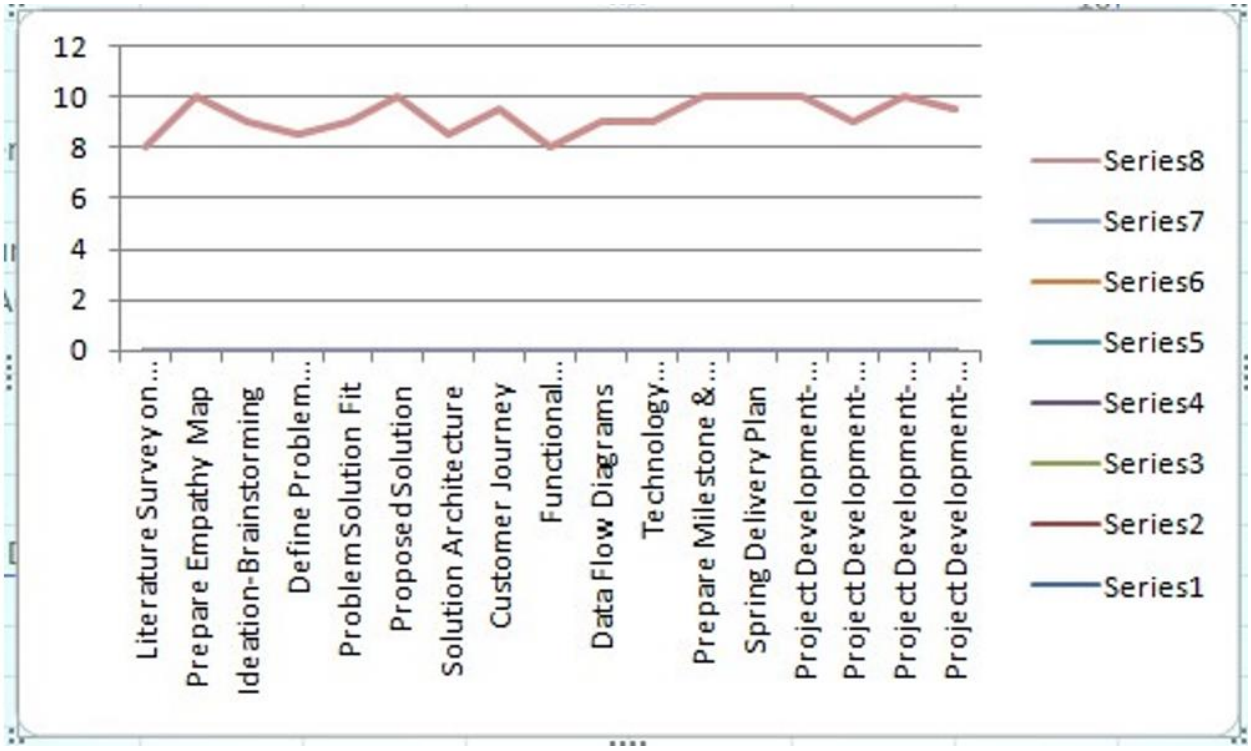
Sprint	**Total Story Points**	**Duration**	**Sprint Start Date**	**Sprint End Date (Planned)**	**Story Points Completed (as on Planned End Date)**	**Sprint Release Date (Actual)**
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-3	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 burndown chart is a graphical representation of work left to do versus time. However, burndown charts can be applied to any project containing measurable progress overtime.



6.2 SPRINT DELIVERY SCHEDULE:

IDEATION PHASE

TITLE	DESCRIPTION	DATE
Literature survey information Gathering	Literature survey on the selected project & gathering information by referring the, technical papers, research publications etc.	03 sep 2022

Prepare Empathy Map	Prepare Empathy Map Prepare Empathy Map Canvas to capture the user Pains & Gains, Prepare list of problem statements	10 sep 2022
Problem Statement	List of problem in this project	10 sep 2022
Brainstorm And Idea Prioritization	List the by organizing the brainstorming session and prioritize the top 3 ideas based on the feasibility & importance.	17 sep 2022

PROJECT DESIGN PHASE-1

Proposed solution	Prepare the proposed solution document, which includes the novelty, feasibility of idea, business model, social impact, scalability of solution, etc.	24 sep 2022
Problem Solution Fit	Prepare problem - solution fit document	01 oct 2022

PROJECT DESIGN PHASE-2

Customer journey	Prepare the customer journey maps to understand the user interactions & experiences with the application (Entry to exit).	08 sep 2022
Functional Requirement	Prepare the functional requirement document.	15 oct 2022
Data Flow Diagrams	Draw the data flow diagrams and submit for review.	15 oct 2022
Technical Architecture	Prepare the Technical architecture diagram	15 oct 2022

PROJECT PLANNING PHASE

Prepare Project Planning & Sprint Delivery Plan	Prepare the Product Backlog, Sprint Planning, Stories, and Story points.	22 oct 2022
Prepare Milestone & Activity List	Prepare the milestones active list of the project	22 oct 2022

PROJECT DEVELOPMENT PHASE

Project Development - Delivery of Sprint-1, 2, 3 & 4	Develop & submit the developed code by testing it.	29 oct 2022

PREREQUISITES

Cloud Account	To create a cloud account	29 oct 2022
Cloud Clarifai	The cloud account clarifaied	03 Nov 2022

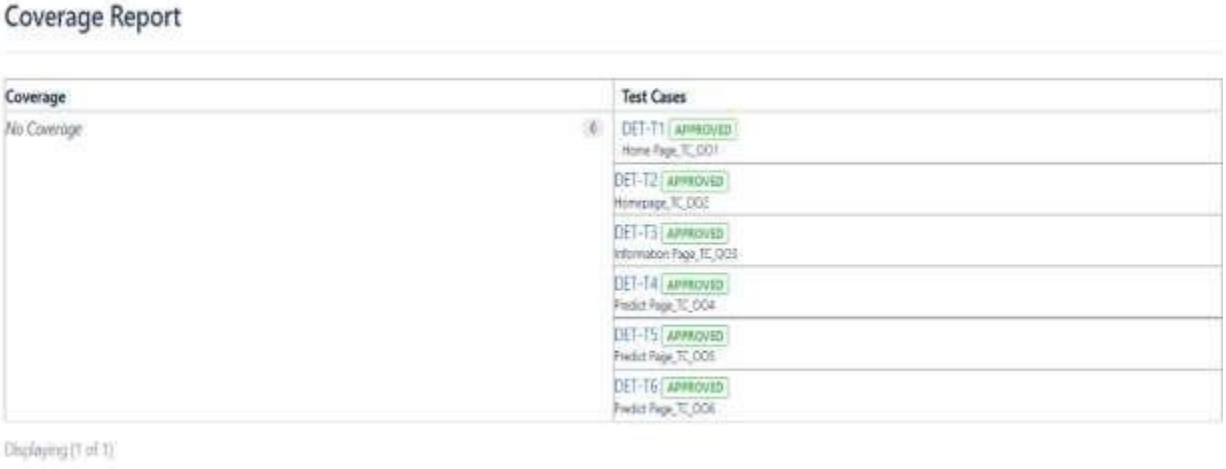
Python code	To create a idle python code	03 Nov 2022

IBM CLOUD SERVICES

Cloud Object	To create a cloud object for IOT	03 Nov 2022
Database cloudant	Add the database cloudant in IOT	06 Nov 2022
IBM Watson Iot Platform	To create a IBM watson IOT platform and simulation	10 Nov 2022
IBM node services	To create a account and do the simulation for node red	11 Nov 2022

6.3 REPORTS FROM JIRA:

(I)COVERAGE REPORT



(II) TRACEABILITY MATRIX

7)CODING AND SOLUTIONING

7.1 FEATURE 1:

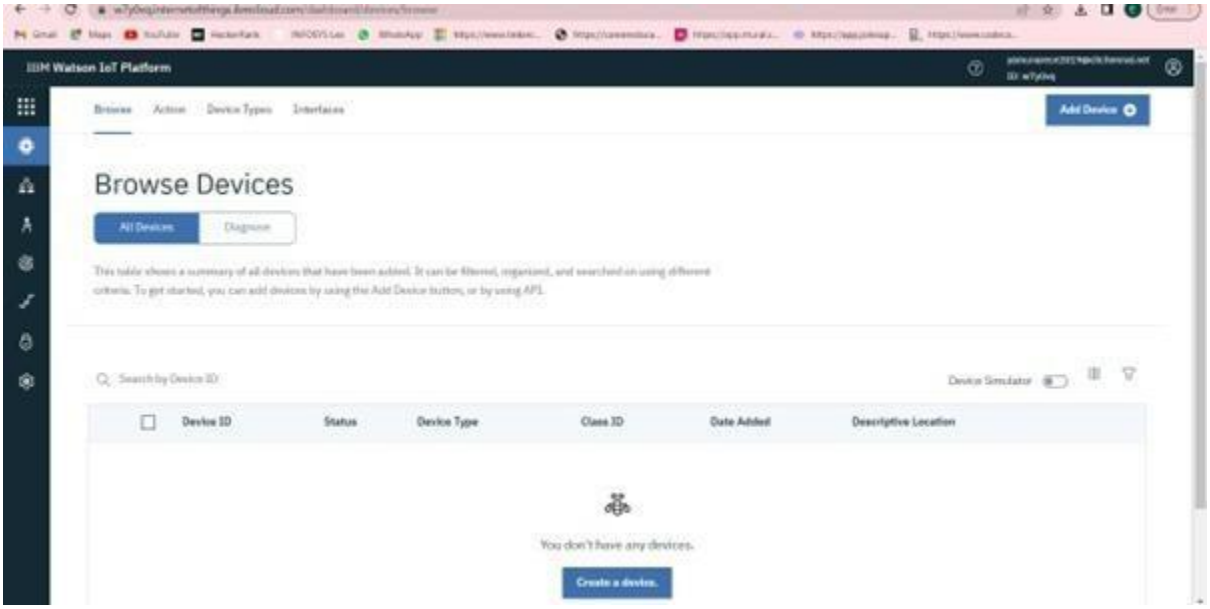
A Web Application is built which consists of,

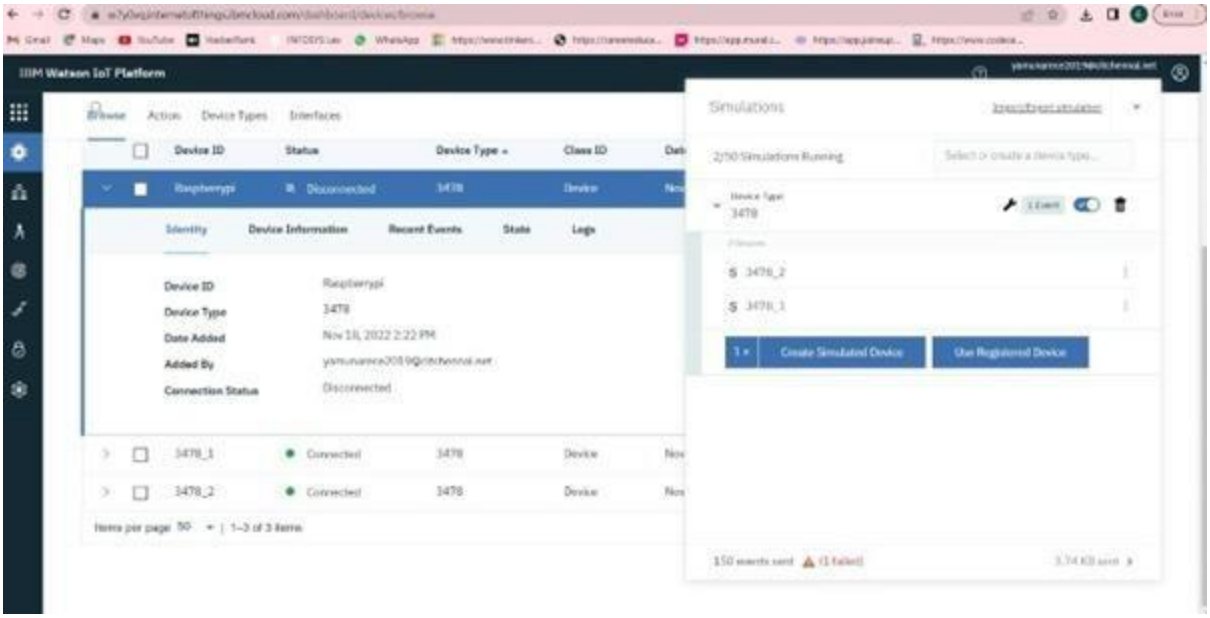
- Graphical representation of Humidity, Temperature and Soil Moisture
- Motor ON and Motor OFF Step 1: Generate random values of Humidity, Temperature, Soil Moisture are generated from events in the Watson IOT platform. These sensor values are generated using random functions from the events that is used in the device which was created.

Step 1:

Generate random values of Humidity, Temperature, Soil Moisture are generated from events in the Watson IOT platform. These sensor values are generated using random functions from the events that is used in the device which was created

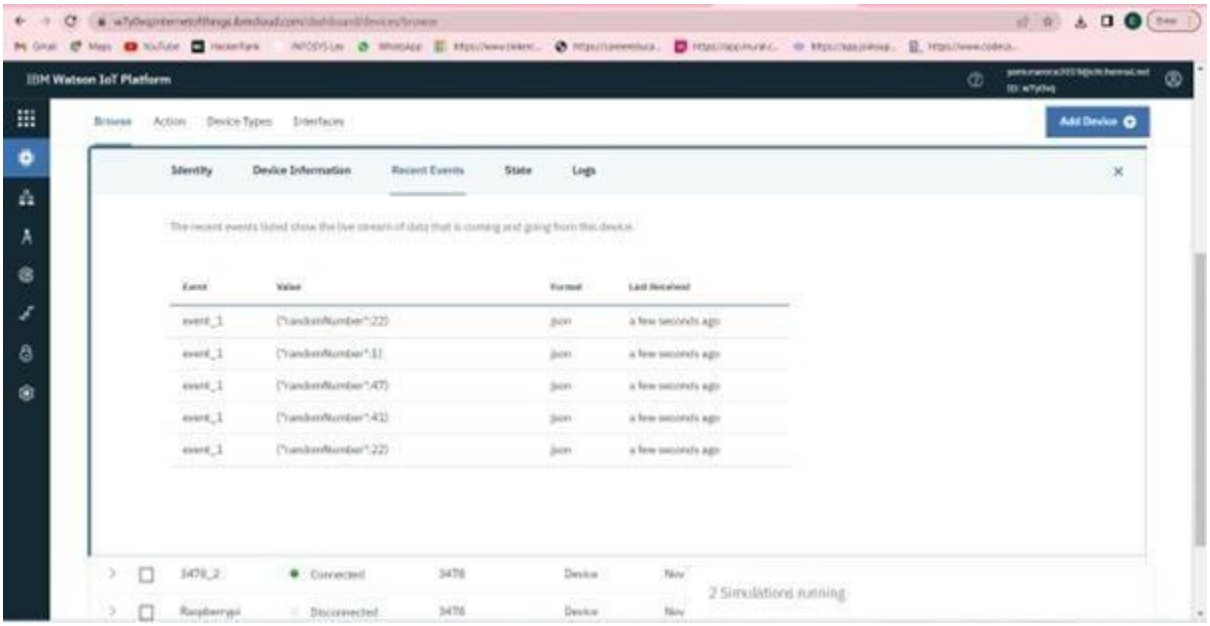
PAYLOADS	SENSORS
Temp	Temperature
Hum	Humidity
Moist	Moisture





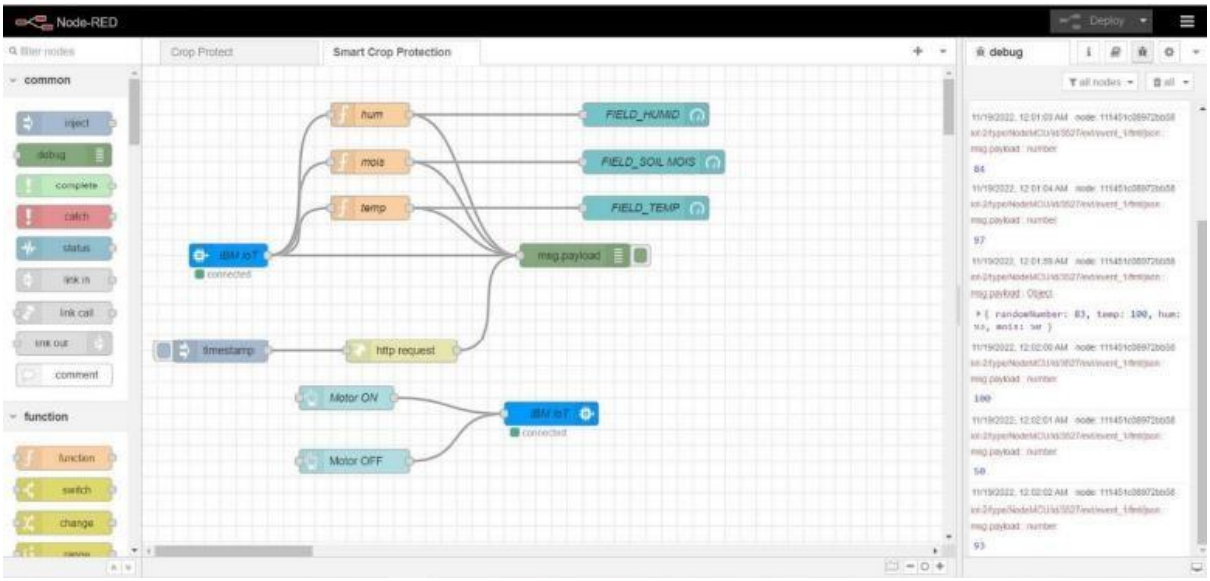
Step 2:

The values are generated for every minute as payload from events in the form of json format in the recent events of the device created in Watson Platform



Step 3:

Node-RED is an editor used to create the flow between the nodes and has to be deployed once the flow has been made. Once deployment is done sensor values can be viewed in detail



Step 4:

The Smart Crop dashboard is viewed once the deployment is completed where we can able to view,

1. Moisture in the form of gauge

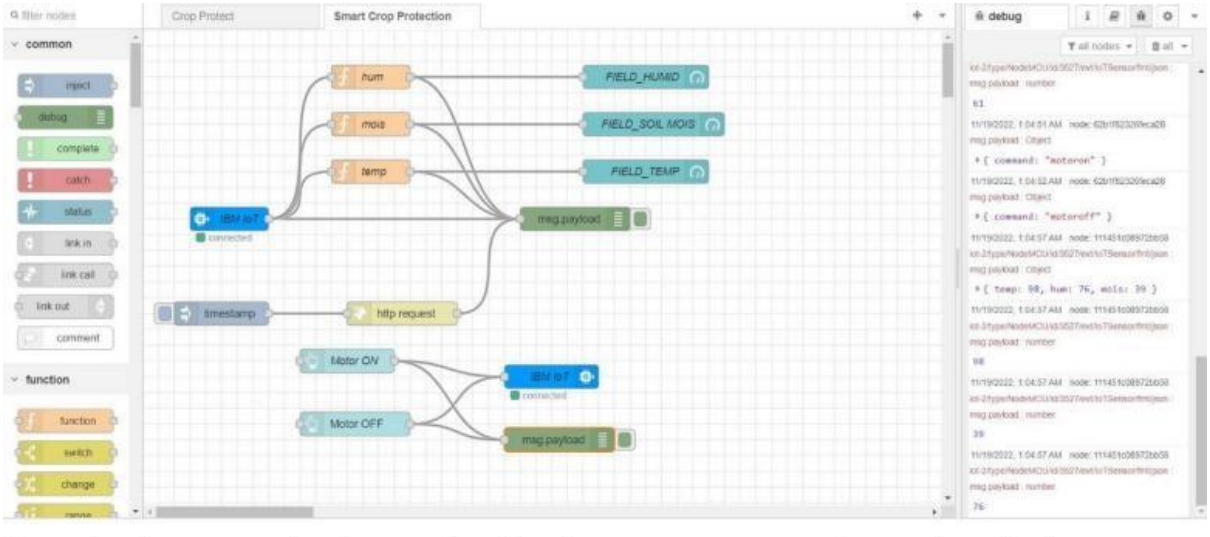
2. Temperature and Humidity in the form of gauge 3. MOTOR ON and MOTOR OFF buttons

Details:

1. Dashboard is named as Smart Crop
2. Section is named as Field In the section of Field, the sensors values are represented and motor control buttons are also given

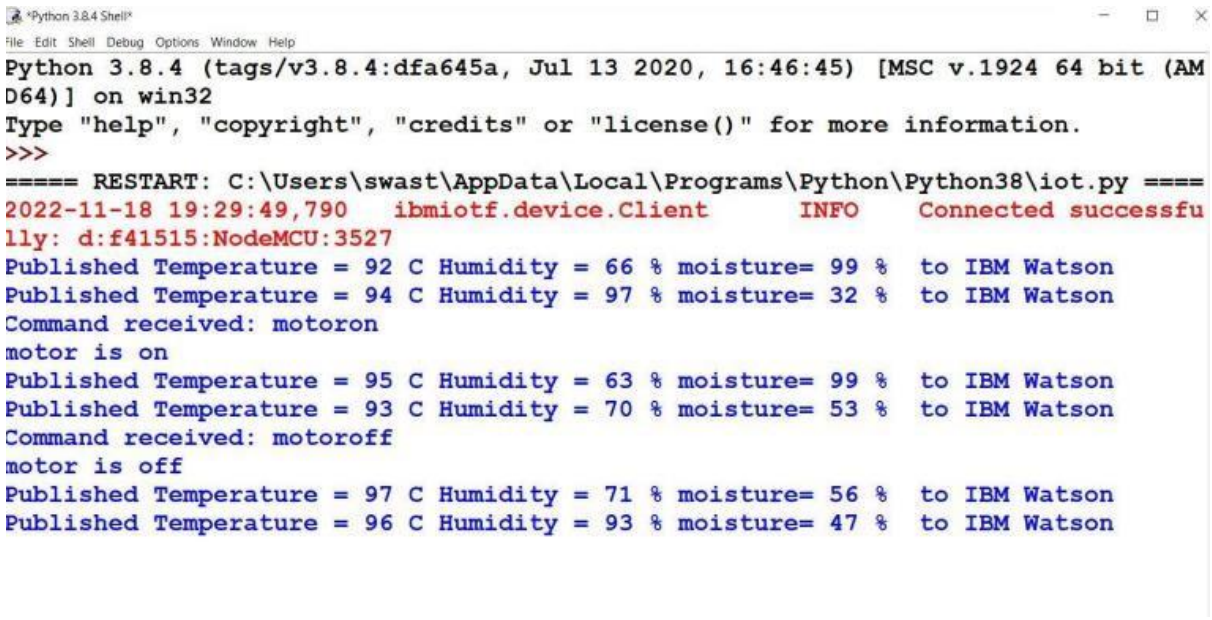
Step 5:

When the Motor ON button is clicked the we receive the output as “motoron” and Motor OFF button is clicked we receive the output as “motoroff”. And these outputs are received in the debug section of the editor



Step 6:

The output is also received in the python code editor when the buttons are clicked in the dashboard and random values are also generated. Device id is used to connect to IBM Watson.



7.2 FEATURE 2:

The system developed in the study leverages Histogram of Oriented Gradients (HOG) image descriptor for analyzing the drawing patterns of both spiral and wave sketches respectively.

It shows invariance to geometric and photometric changes and is used for extracting essential features and shapes of a particular object within an image such as sketches and patterns. HOG can be used to detect small-scaled images with less computational power.

8) TESTING

8.1 TEST CASES:

• Verify if the user is able to see the Homepage when they click on the link
• Verify the UL elements in Homepage
1. Home icon
2. Information icon
3. Predict icon
• Verify if the Information and the predict icons functions properly
• Verify if the user is able to view the upload file option and its function
• Verify if the user is able to choose the file from the local file system and click on predict to find the predicted result
• Verify if the user is able to select the invalid file formats

8.2 USER ACCEPTANCE TESTING:

In UAT design phase, test engineers are preparing UAT testcases as per the business requirements. AT test coverage should be with Alpha and beta testing. After having complete idea about business requirements and have a discussion with BA or Product Owner one can proceed with UAT Test case design/mapping to UAT test suite.

- UAT Test scenarios & Testcases prepared based on business needs in both functional and non-functional aspects
- UAT Testcases can be set of existing testcases and maintained as a separate UAT Test suite.
- UAT Test scenarios & cases once designed should be reviewed by BA or Product Owner.
- UAT Testcases target is customer environment based in-terms of Test data and Servers

1.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	7	2	2	3	14
Duplicate	1	0	3	0	4
External	2	4	0	1	7
Fixed	15	2	5	18	40
Not Reproduced	0	0	1	0	1
Skipped	0	0	1	3	4
Won'tFix	0	7	2	1	10
Totals	25	15	14	26	80

2.TEST CASE ANALYSIS:

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

Section	Total Cases	Not Tested	Fail	Pass
Temperature and Humidity Sensor	25	0	0	25
Soil Moisture	10	0	0	10
Transmission of data to IBM Cloud	3	0	1	2
User login in Node RED	10	0	0	10
Accessing the Parameters in IoT Watson	15	0	2	13
Clarifai service will detect the animals and birds .	2	0	0	2
Alerting the User from Animal Detected using Text to Speech Watson	1	0	0	1
Viewing the parameters in the Node RED	5	0	0	5
Controlling the Motor from Node RED	3	0	0	3

8.3 PERFORMANCE TESTING:

Project team shall fill the following information in model performance testing template

NFT - Risk Assessment

S.No	Project Name	Scope/feature	Functional Changes	Hardware Changes	Software Changes	Load/Volume Changes	Risk Score	Justification
1	Motor ON/OFF	Existing	Moderate	No Changes	Moderate	>10 to 30%	ORANGE	Changes occurs less
2	Sensor values	Existing	Moderate	No Changes	Moderate	>10 to 30%	ORANGE	Some changes occurs

NFT - Detailed Test Plan

S.No	Project Overview	NFT Test approach	Approvals/SignOff	Assumptions/Dependencies/Risk
1	Python script	Python coding		Depend on the delivered code
2	Node Red	Sensor & command values		Sensor values
3	MIT App Inventor	Motor control/Sensors notification		Notifications
4	Claritai	To detect animals and birds		Detection

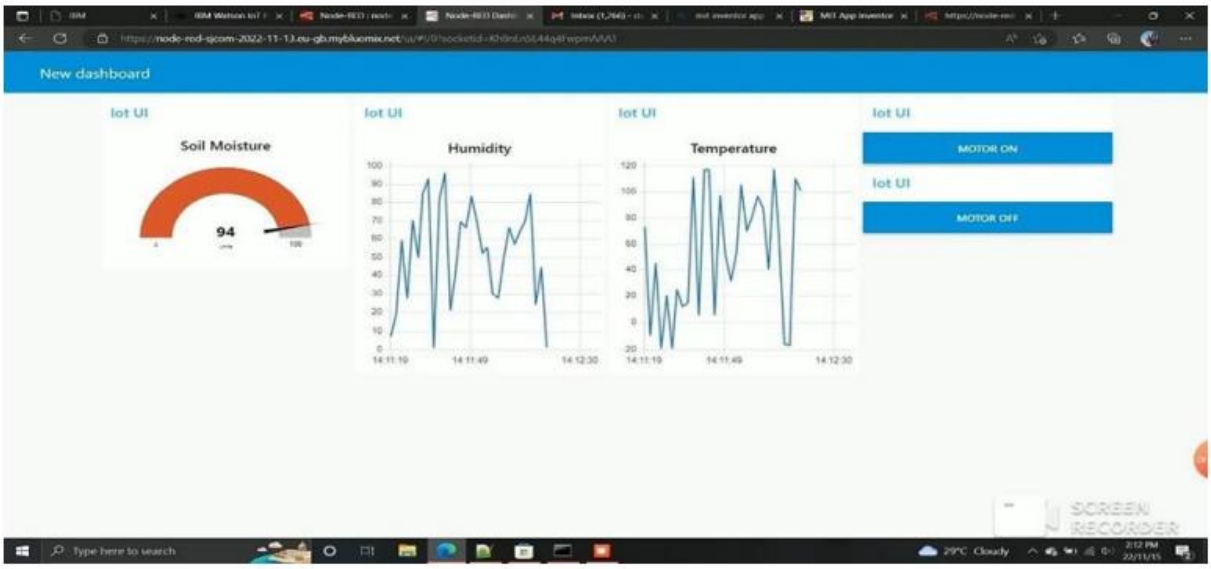
End Of Test Report

S.No	Project Overview	NFT Test approach	NFR - Met	Test Outcome	GO/NO-GO decision	Identified Defects (Detected/Closed/Open)	Recommendations	Approvals/SignOff
1	Python Code	Python coding	Met	Pass	GO	Closed	Efficient code	
2	Node Red	Sensor&command values	Met	Pass	GO	Closed	Sensing the values perfectly	
3	MIT App Inventor	Motor control/Sensors notification	Met	Pass	GO	Closed	Notifies the users at correct time	
			Met	Pass	GO	Closed	Detects animal and alert user	

9) RESULTS

9.1 PERFORMANCE METRICS:

The following images can be studied to understand the performance of our system.



10) ADVANTAGES & DISADVANTAGES

ADVANTAGES:

- Allows farmers to maximize their yields using minimum resources such as water,seeds ,etc.
- It delivers high quality crop production.
- It ensures complete safety of crops from animals and from fire thus protecting the farmer's loss.
- Lowered Operation costs.
- Improved livestock farming.

DISADVANTAGES:

- The smart crop protection system needs available continuously. Rural part of most of developing countries do not fulfil this requirement.
- Lack of infrastructure and security.
- High costs.
- There could be wrong analysis of Weather conditions.

11)CONCLUSION

- To conclude, adopting a smart crop protection system is one the most helpful developments for farmers in standing against the growing global population's increasing demand for quality food.
- The adoption of a smart crop monitoring system gives farmers a variety of important benefits and will also help in generating better revenue compared to traditional monitoring systems.
- The problem of crop vandalization by wild animals has become a major social problem in current time. It requires urgent attention as no effective solution exists till date for this problem. Thus this project carries a great social 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 and will save them from the unproductive efforts that they endure for the protection their fields. This will also help them in achieving better crop yields thus leading to their economic well being.

12)FUTURE SCOPE

- IoT helps us meet our food needs by reducing environmental hazards, such as extreme weather and climatic transitions.

- The harvesters and tractors were both mechanical inventions that work in agriculture since the 20th century. The agriculture industry is heavily dependent on innovative ideas because of the increasing demand for food.
- The Industrial IoT has aided increased agricultural productivity with a lower cost, so, over the next few years, smart systems based on IoT will be more common in agricultural operations.
- A recent estimate shows that the agricultural industry will experience a compound annual growth rate (CAGR) of 20% due to IoT system installations.
- In addition, the number of linked agricultural devices will increase from 13 million in 2014 to 225 million by 2024.By tracking the field in real-time, IoT-based Smart Farming strengthens the whole Agriculture system. Farmers can save time and use IoT sensors in agriculture and interconnectivity to make the Internet of Things work for them. It has also reduced energy waste like electricity and water. It provides a clear, real-time view of various variables, including temperature, humidity, and soil.

- As a result, data analytics allows for better decision-making through technological advances.

13)APPENDIX

SOURCE CODE:

```
Import time import sys import
import ibmiotf.application import
ibmiotf.device import random
#Provide your IBM Watson Device Credentials
organization = "f41515" deviceType = "abcd"
deviceId = "6880" authMethod = "token"
authToken = "12345678"
# Initialize GPIO
def myCommandCallback(cmd): print("Command received:
%s" % cmd.data['command']) status=cmd.data['command'] if
status=="motoron": print ("motor is on") else :
print ("motor is off")
#print(cmd) 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(90,100)
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-46087-1660737257