IoT BASED SMART CROP PROTECTION SYSTEM FOR AGRICULTURE

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A PROJECT REPORT

Submitted by

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BONAFIDE CERTIFICATE

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INTERNAL EXAMINER **EXTERNAL EXAMINER**

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ABSTRACT

The system will provide a complete technical solution to the destruction of crops by animals using internet of things to prevent crops from animals. Agriculture is the backbone of the economy but because of animal attacks, climate changes in agricultural lands there will be huge loss of crops. The feature of this paper includes the development of the system that can monitor Temperature, Humidity, Soil moisture and even the movement of animals which may destroy the crops in agricultural fields. The IoT based smart farming system being proposed via this report is integrated with Microcontroller mixed with different sensors and a wifi module producing live data feed that can be obtained online. The moisture contents in the soil sensed by using the moisture sensor and it will identify the amount of water supplied required to the crop and sends data to ARM cortex and enables sensor to supply water which automatically turn on the water source and turn off it when need is satisfied. PIR sensor used to detect whether a human has moved in or out of the sensors range. After processing the available information, if the human is not found the system raised the buzzer sound, to alert people about intrusion.

The system to monitor agricultural land is developed by using WSN. IoT monitored data is sent to cloud so that farmers can get the data easily. IoT enabled agriculture system is greatly beneficial to the farmers as it reduces the man power and harmful chemical for increasing the amount of the crops. Using IoT technology it helps the farmers to control their fields anywhere is simple and now it is cost effective .If any problem arises, the announcement sends to mobile of farmers. The farmers can rectify the problem by through mobile. IoT based smart farming is used to monitor the field in proper time by any time and being anywhere.

CHAPTER 1

1.INTRODUCTION

1.1Project Overview

IoT (Internet of Things) tendencies are often utilized in smart farming to boost the standard of agriculture. The moderate smart agriculture systems are utilized to afford the solution for moisture related issues like weather conditions such as temperature, humidity and moisture.

This system used to track and identify animals visually. The motion sensor will activate a buzzer or alarm if any unwanted motion is detected so that we can protect crop from animals.

1.2 Purpose

The main aim of our project is to protect crop from damage caused by animal. This leads to huge loss for farmers. It is not possible for farmers to barricade entire fields on 24 hours. So this system is designed to detect animal and send signal to controller. IoT based smart farming improves entire agriculture system by monitoring the field in real time. With the help of sensors and interconnectivity, the IoT agriculture has not only saved the time of farmers but also reduced the extravagant use of resources such as water and electricity.

CHAPTER 2

2. LITERATURE SURVEY

2.1 Existing Problem

- ➢ Lack of network connection in rural areas
- ➢ Cope with climate change, soil erosion
- ➢ Invest in farm productivity
- ➢ Adopt and learn new technologies

2.2 References

1. Ahmed, S.; Shekhawat, A.S.; Kumar, S.G.; Nair, M.K.; Kumar, V.
   (30 October 2016)“Intelligation”: An IOT based Framework for Smarter Irrigation. In Proceedings of the National Conference on Product Design (NCPD 2016), Banglore, India.
2. Jain, S. and Vani, K.S. (2018) A survey of the automated irrigation systems and the proposal to make the irrigation system intelligent. Int. J. Comput. Sci. Eng. 6, 357–360.
3. Saraf, S.B. and Gawali, D. H. (2017) ‘IoT based smart irrigation monitoring and controlling system’
4. Sukhadeve, V.; Roy, S. (2016) Advance agro farm design with smart farming, irrigation and rain water harvesting using internet of things.

Int. J. Adv. Eng. Management

2.3 Problem Statement Definition

A problem statement is a concise description of an issue to be addressed or a condition to be improved upon. It identifies the gap between the current (problem) state and desired (goal) state of a process or product.

I am	a farmer
I’m trying	to yield more crops by using sensors
But	lack of internet facility

CHAPTER 3

3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map

Empathy map is a collaborative tool teams can use to gain a deeper insight into their customers.

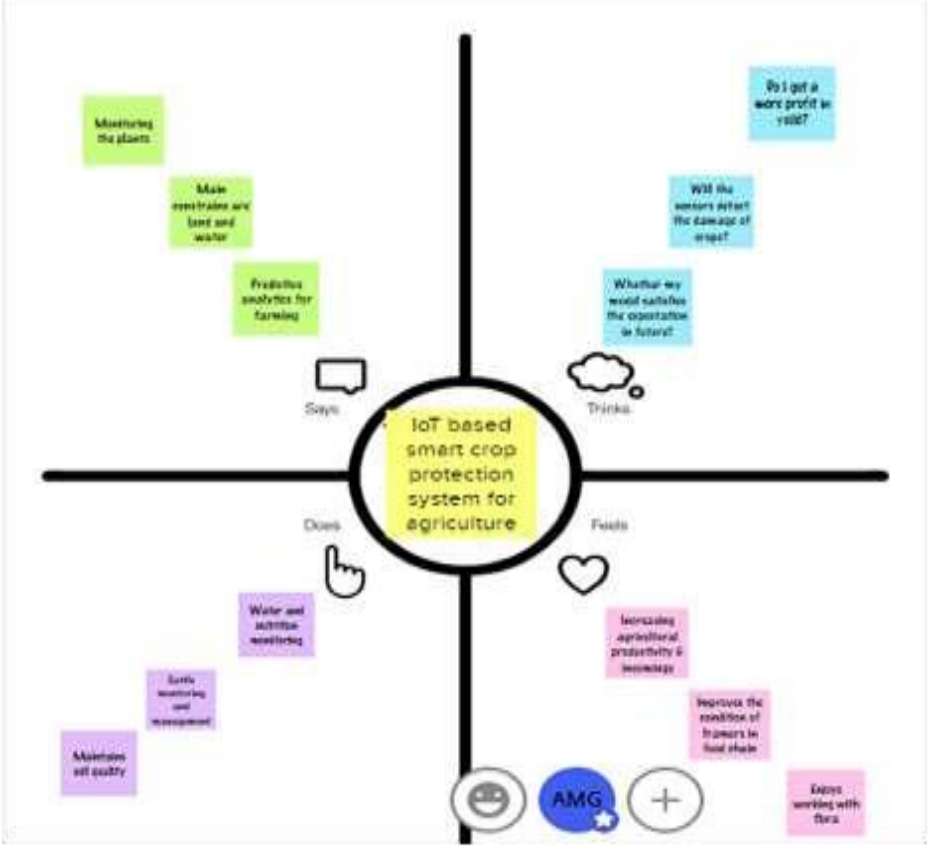


Fig 3.1.1

3.2 Ideation & Brainstroming

Brainstorming is a group problem-solving method that involves the spontaneous contribution of creative ideas and solution.

Step-1: Team Gathering, Collaboration and Select the Problem Statement

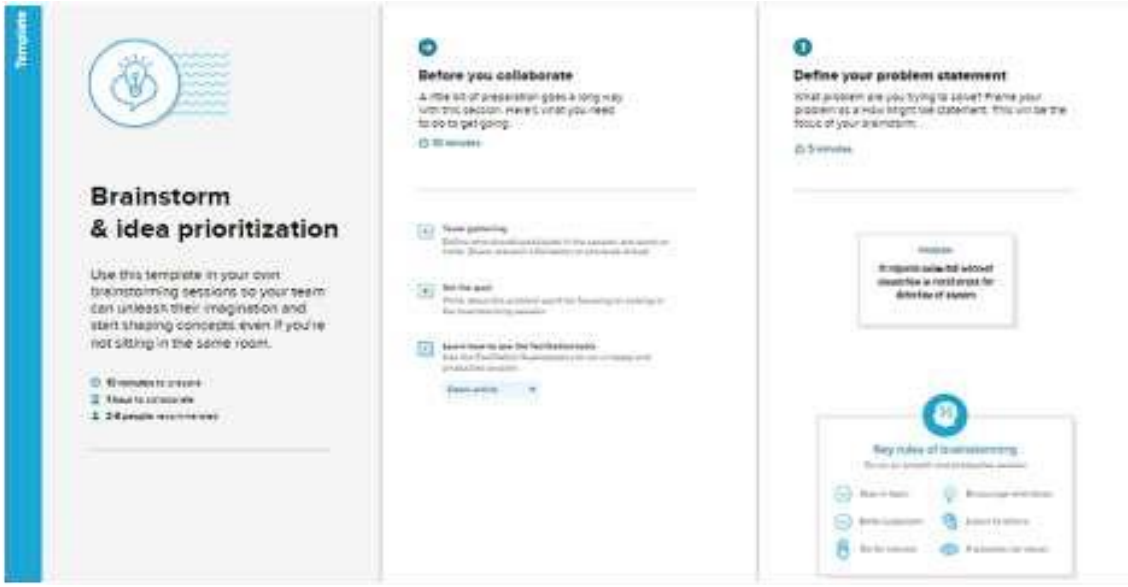


Fig 3.2.1

Step-2: Brainstorm, Idea Listing and Grouping

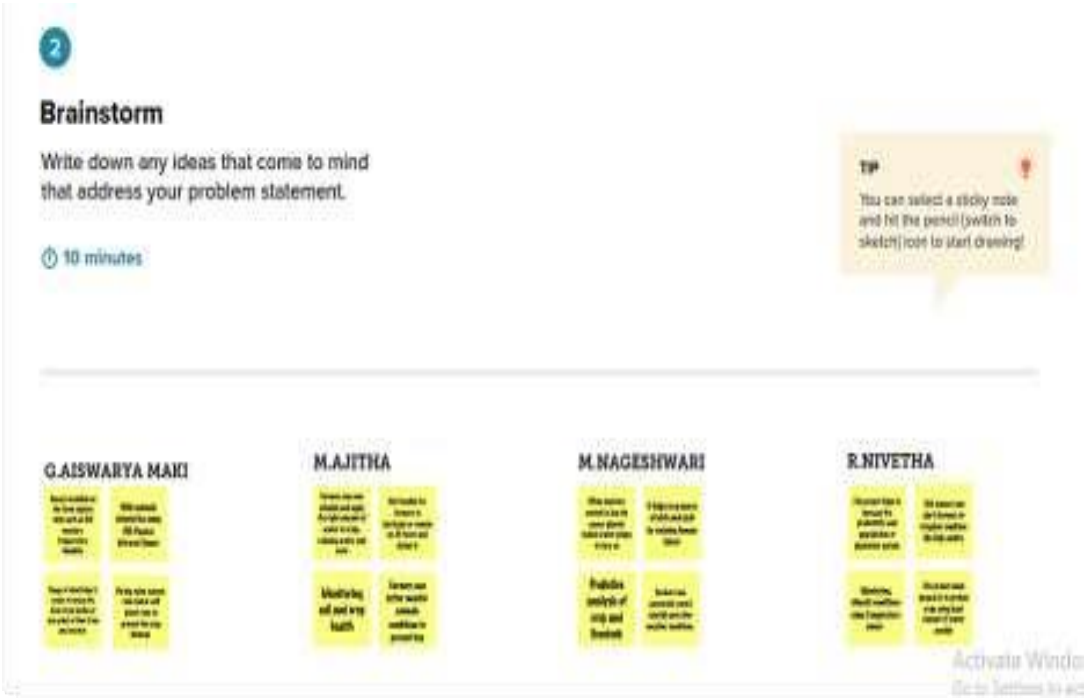


Fig 3.2.2

STEP-3: Idea Prioritization.

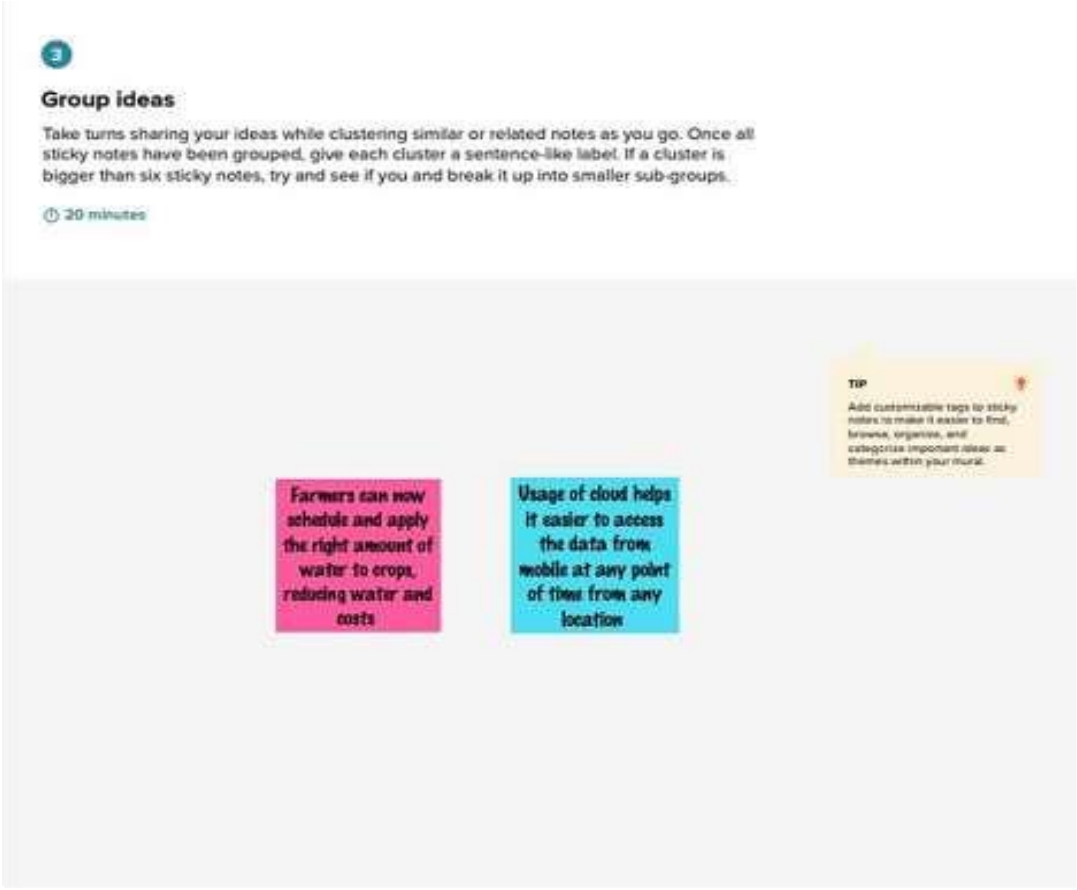


Fig3.2.3

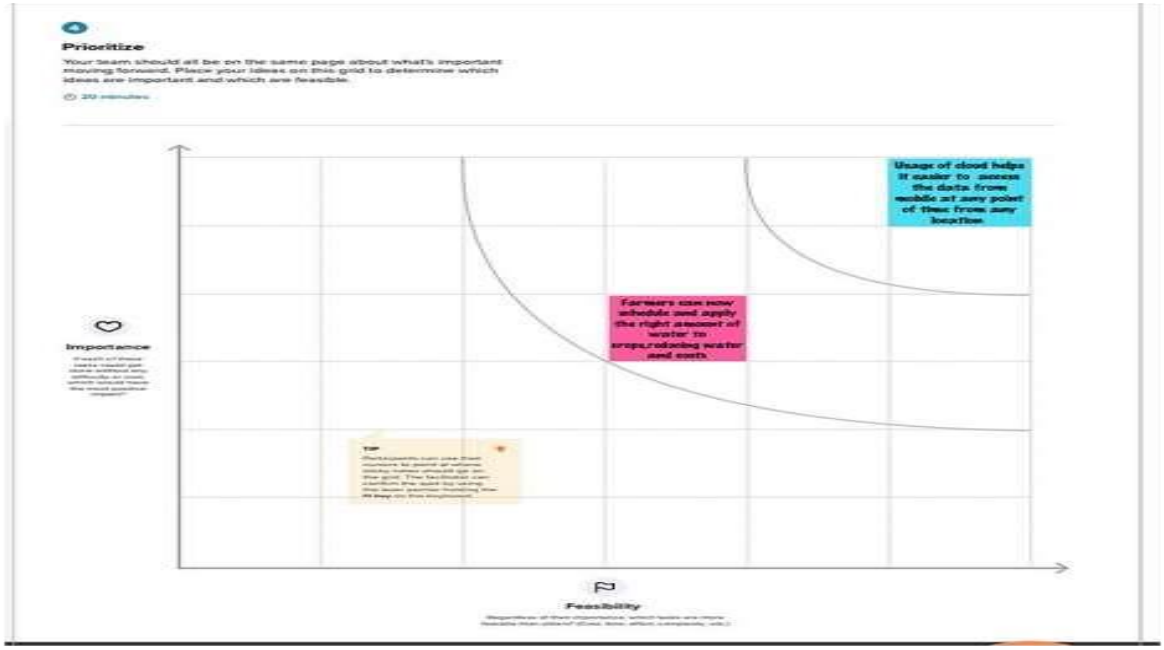


Fig3.2.4

S.NO	Parameter	Description
1	Problem statement (problem to be solved)	It requires unlimited internet connection in rural areas for better detection of sensors.
2	Idea/Solution description	Install new or existing internet lines such as fiber optics in our location.
3	Novelty/Uniqueness	Equipment usage water system control over android telephones.
4	Social Impact/customer satisfaction	The farmer will have an accurate crop yield.
5	Business Model (Revenue Model)	The merger and acquisition strategy helps both buyer and seller gets benefited.
6	Scalability of the solution	Installation of fiber optics is more expensive as special test equipment is usually required.

3.3 Proposed Solution

Proposed solution means the technical solution to be provided by the implementation agency in response to the requirements and the objectives of the project.

3.4 Problem Solution Fit

Problem solution fit- this occurs you have evidence that customers care about certain jobs, pains, gains.

<table>
<tr><td>1.Customer Segments:
Farmer is our customer.</td><td>6.Customer Constrains:
Low availability of improved or hybrid seed, lack of seed multiplication capacity, lack of irrigation and water constraints.</td><td>5.Available Solutions:
Install new or existing internet lines such as wifi and fiber optics in our location.
Invest more in farm productivity.
Adoption of new technologies better crop production.</td></tr>
<tr><td>2.Job-to-be-done/problems:
Protecting crops from animals by using PIR sensor.</td><td>9.Problem Root Cause:
climatic change, pollutants, irrigation problem, soil degradation, waste.</td><td>7.Behaviour:
The farmers must to know how to process seeds and prepare fields for planting. It can be done by better analysis of soil and plant conditions and provide actuate information about weather conditions.</td></tr>
<tr><td>3.Triggers:
Feeding a growing population, providing a livelihood for farmers,</td><td>10. Solution:
We can know the real-time status of the crops by capturing data from sensors, using</td><td>8.Channels of Behaviour:
Online:
By creating apps farmers can directly ask</td></tr>
<tr><td>protecting the environment.</td><td>predictive analysis, we can make better decisions related to harvesting. It uses modern technology to increase quantity and quality of agriculture products.</td><td>the question and query to the agriculture experts also they can watch their videos related to new technology this helps in improving crops and raising harvesting.
Offline:
By supporting local farmers, people will not only save money within the community and improve the economy in the area but they will also get better quality products at lower prices.</td></tr>
<tr><td colspan="3">4.Emotoins:Before/After:
Frustrated, disappointed, unfulfilled, anger, fear.</td></tr>
</table>

CHAPTER 4

4.REQUIREMENT ANALYSIS

4.1 Functional requirement

Functional requirements are product features or functions that developers must implement to enable users to accomplish their tasks.

FR NO.	Functional Requirement (Epic)	Sub Requirement(Story / Sub-Task)
FR-1	User classification	The user has to classify crops such as food 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 of defected 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 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 also predicts water level and moisture content in field.

CHAPTER 5

5.PROJECT DESIGN

5.1 Data Flow Diagrams

It is a graphical representation which is very easy to understand It helps visualize contents. Data flow diagram represent detailed and well explained diagram of system components.

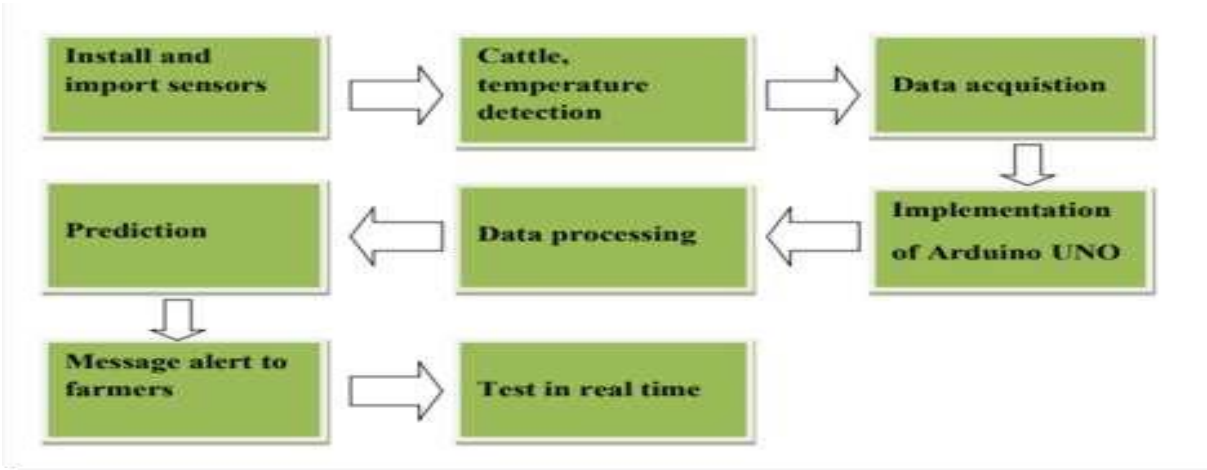


Fig 5.1.1

FLOW:

② We start collecting data from cloud services and collect a bunch of data from sensors.
② Save data in the form of numpy arrays.

③ We then implement arduino UNO with our stored data.

④ The number of sensors for the model is determined by us, if we increase the number of sensors, the accuracy increases. But it requires much more time for implementing more sensors.

⑤ Once detection is done, we can use this model for real time cattle detection and simultaneously used to detect water level and temperature in the field.

5.2 Solution & Technical Architecture

Solution Architecture

Solution architecture is the practice of designing, describing, and managing solution engineering to match it with specific business problems.

1. Customer Segment:

The farmer faces difficulty to maintain crops in larger area.

2. problems/pains:

➢ Cope with climatic change, soil erosion and biodiversity loss.

➢ When darkness falls across the farm cows, pigs, sheep, chickens entered into the farm and destroys the crop.

3. Triggers to act:

Feeding a growing population, providing a livelihood for farmers, protecting the environment.

4. Emotions:

The emotional effects of farmers are frustrated, disappointed, unfulfilled, anger, fear.

5. Available Solutions:

➢ Install new or existing internet lines such as wifi and fiber optics in our location.

➢ Invest more in farm productivity.

➢ Adoption of new technologies better crop production.

6. Limitation:

Farmer can afford the equipment but there is unavailability of electricity 24*7 in the village areas.

7.Existing System:

- ➢ Traditional agriculture is based on treating soil and plants with products which are not noxious not synthetically produced in laboratory.
- ➢ Organic agriculture is a holistic production management system which promotes and enhances agro ecosystem health, biological cycles, soil biological activity.
- ➢ Conservation Agriculture (CA) is a farming system that can prevent losses of arable land while regenerating degraded lands. It also improves irrigation production.

8.Customer behaviour:

- ➢ The farmers must to know how to process seeds and prepare fields for planting.
- ➢ It can be done by better analysis of soil and plant conditions and provide actuate information about weather conditions.

9.Problem Root/Cause:

- ➢ Irrigation is crucial for farm sector where large tracts of land still depend on monsoon rains.
- ➢ climatic change, pollutants, irrigation problem, soil degradation, waste.

10.Solution:

➢ We can know the real-time status of the crops by capturing data from sensors, using predictive analysis, we can make better decisions related to harvesting.

➢ It uses modern technology to increase quantity and quality of agriculture products.

11.Solution Architecture Diagram

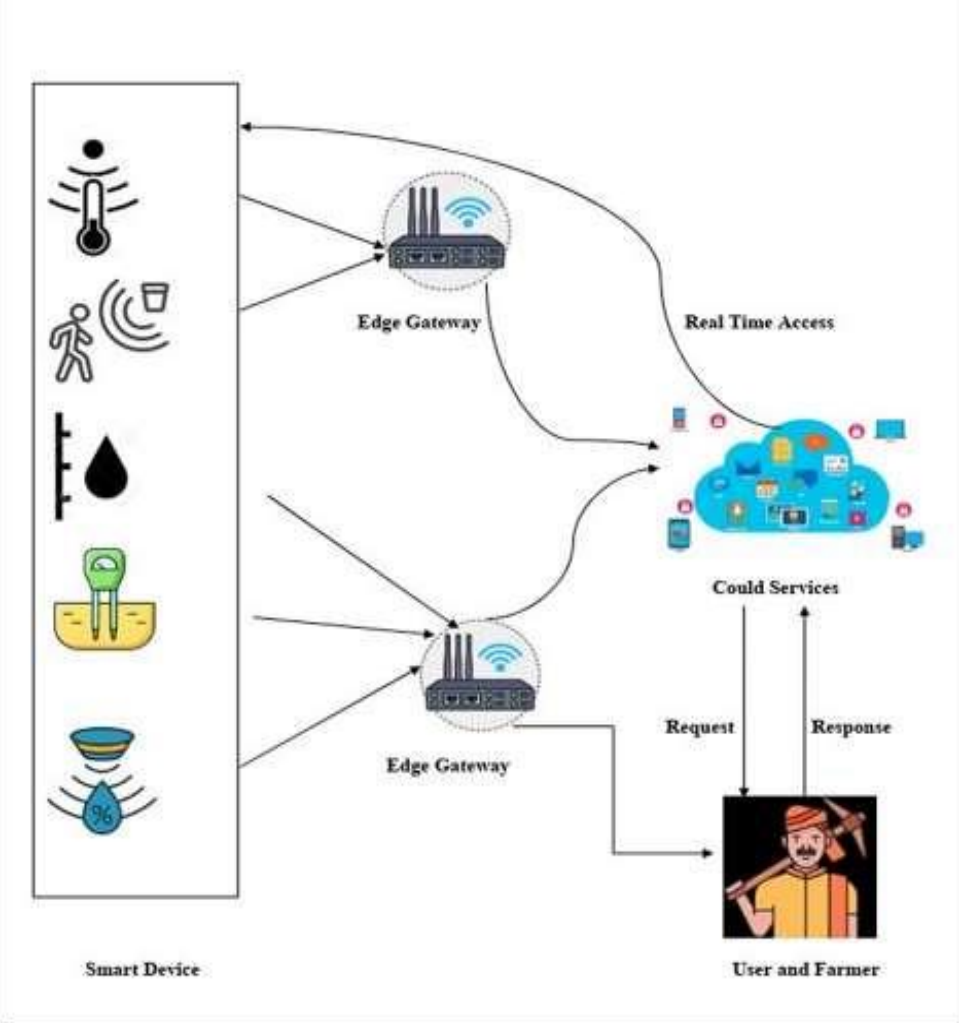


Fig 5.2.1

12. Technical Architecture

Technology Architecture is a more well defined version of solution architecture. It helps us analyze and understand various technologies that needs to be implemented in the project

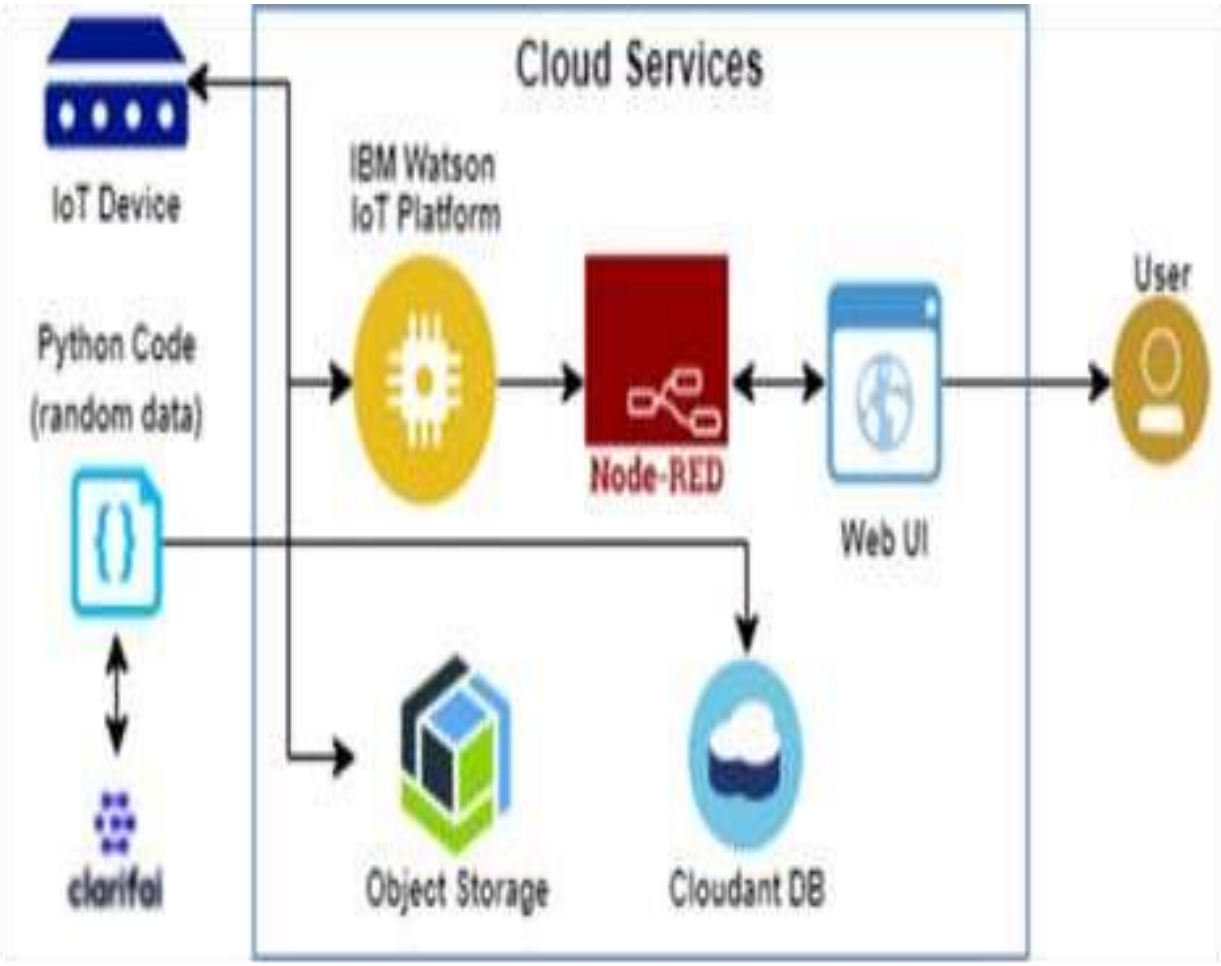


Fig5.2.2

Table-1: Components &Technologies

S.No	Component	Description	Technology
1.	User interface	How user interacts with the web UI	HTML,CSS, JavaScript / Angular Js / React Js etc.
2.	Application Logic-1	Logic for a process in the application	Python
3.	Application Logic-2	Logic for a process in the application	IBM Watson/node red
4.	Application Logic-3	Logic for a process in the application	IBM Watson/node red
5.	Database Data Type, Configurations etc.	MySQL	
6.	Cloud Database	Database	IBM Cloudant
7.	File Storage	File storage requirements	IBM Block Storage

Table-2:Application Characteristics

S.NO	Characteristics	Description	Technology
1.	Open-Source frameworks	The open-source frameworks used	Software
2.	Security implementations	List all the security/access controls implemented	Encryption process
3.	Scalable architecture	Justify the scalability of architecture(3-tier, micro-services)	Software
4.	Availability	Justify the availability of applications (eg. use of load balancers, distributed servers etc)	Software
5.	Performance	Design consideration for the performance of the application	Software

5.3 User Stories

User Type	Functional Requirement (Epic)	User Story Number	User Story/Task	Acceptance Criteria	Range	Sprint
Developer	System Building	USN-1	Collect dataset	I can collect dataset	High	Sprint-1
		USN-2	Collecting data from sensors	I can collect data from sensors	High	Sprint-1
		USN-3	Implementing arduino UNO from data collection		High	Sprint-2
		USN-4	Message alert to farmers	I can receive message	High	Sprint-3

		USN-5	Farmers identify the problem and resolve it by using mobile application	I can identify the problem and I try to resolve it	Medium	Sprint-3
customer (web user)	Adoption	USN-1	Adopting new technology for boosting production	I can adopt new technology	Low	Sprint-1
	Detection	USN-2	Detect the ratio of defected crops on land	I can detect the defected crops	High	Sprint-2

CHAPTER 6

6. PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

A sprint estimation shows how much effort a series of tasks require. It's based on assumptions, requirements, and dependencies of a project.

SPRINT-1:

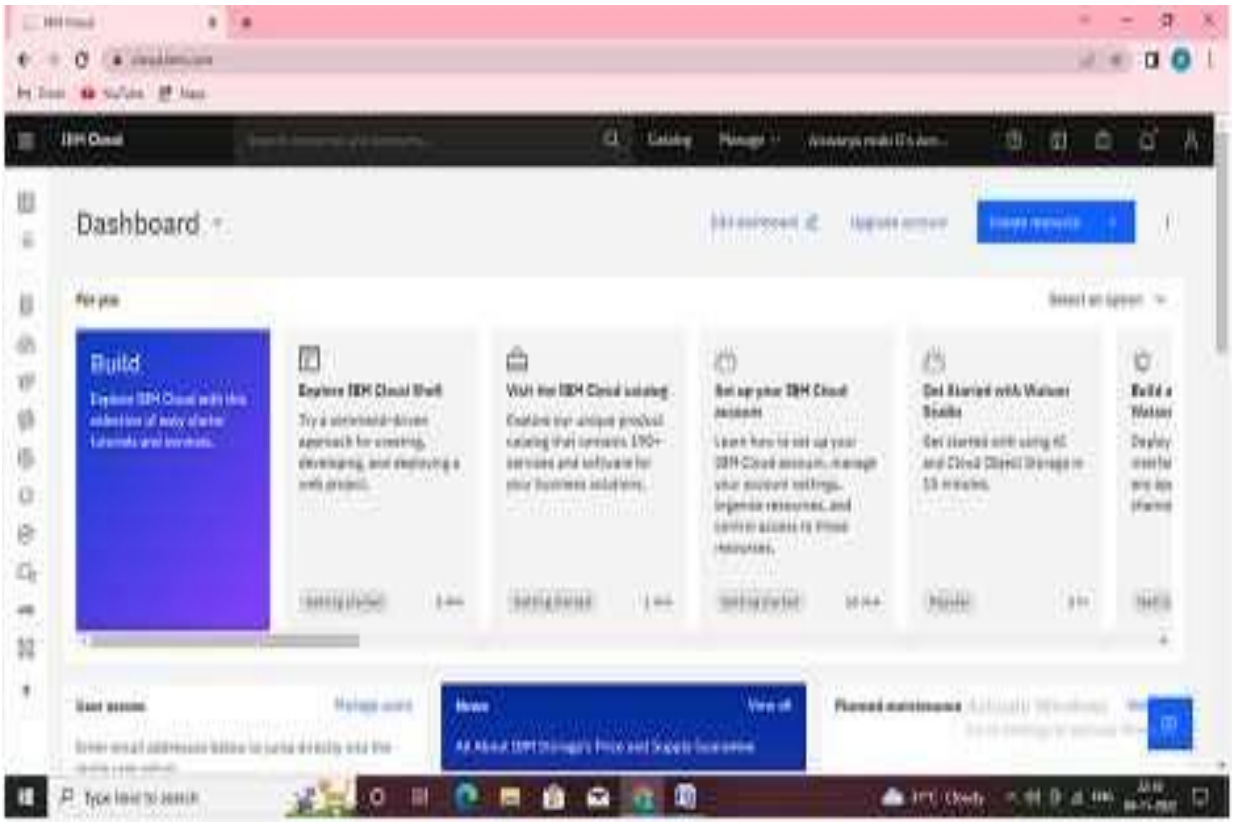


Fig 6.1.1

SPRINT-2

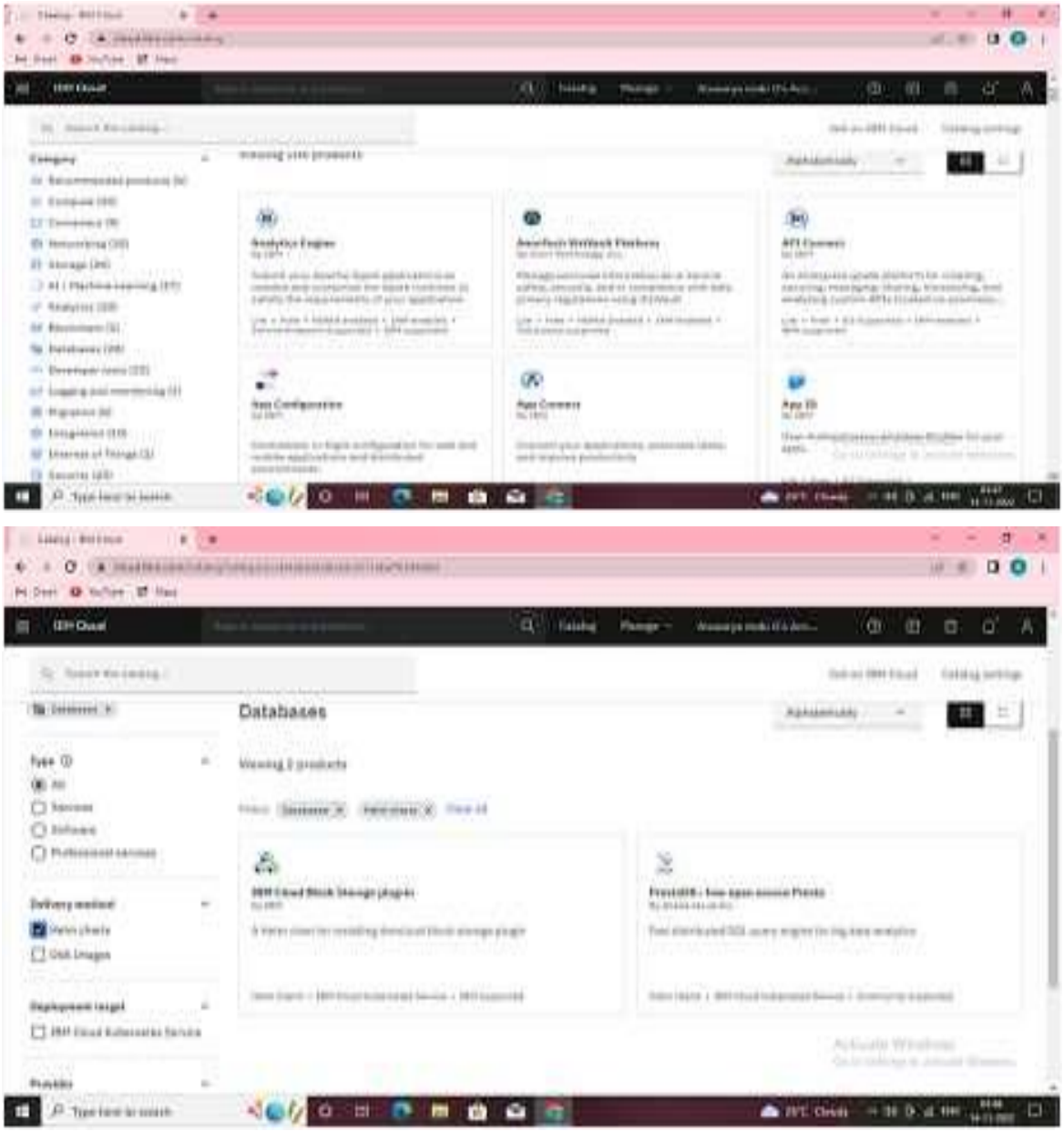


Fig 6.2.2

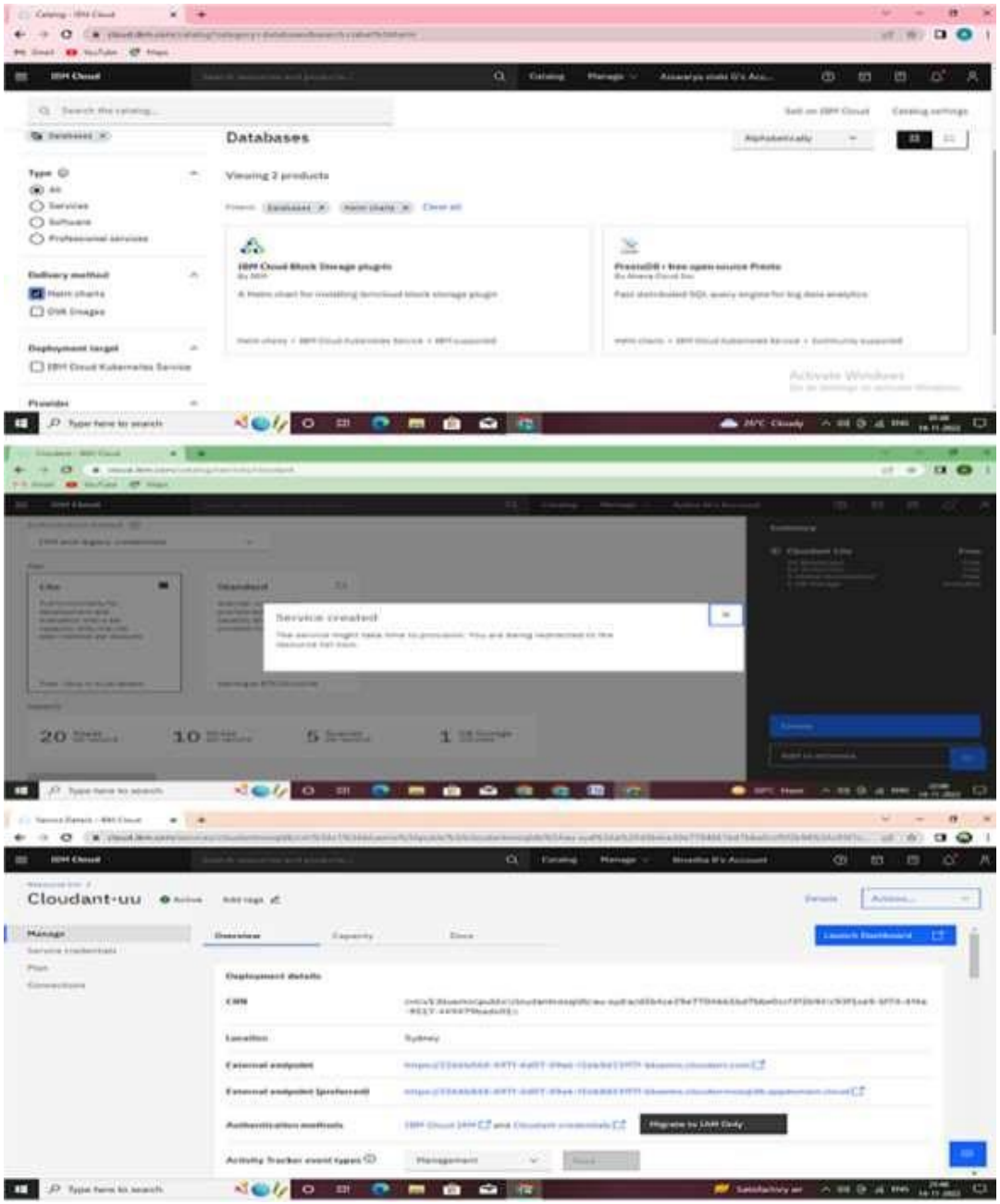
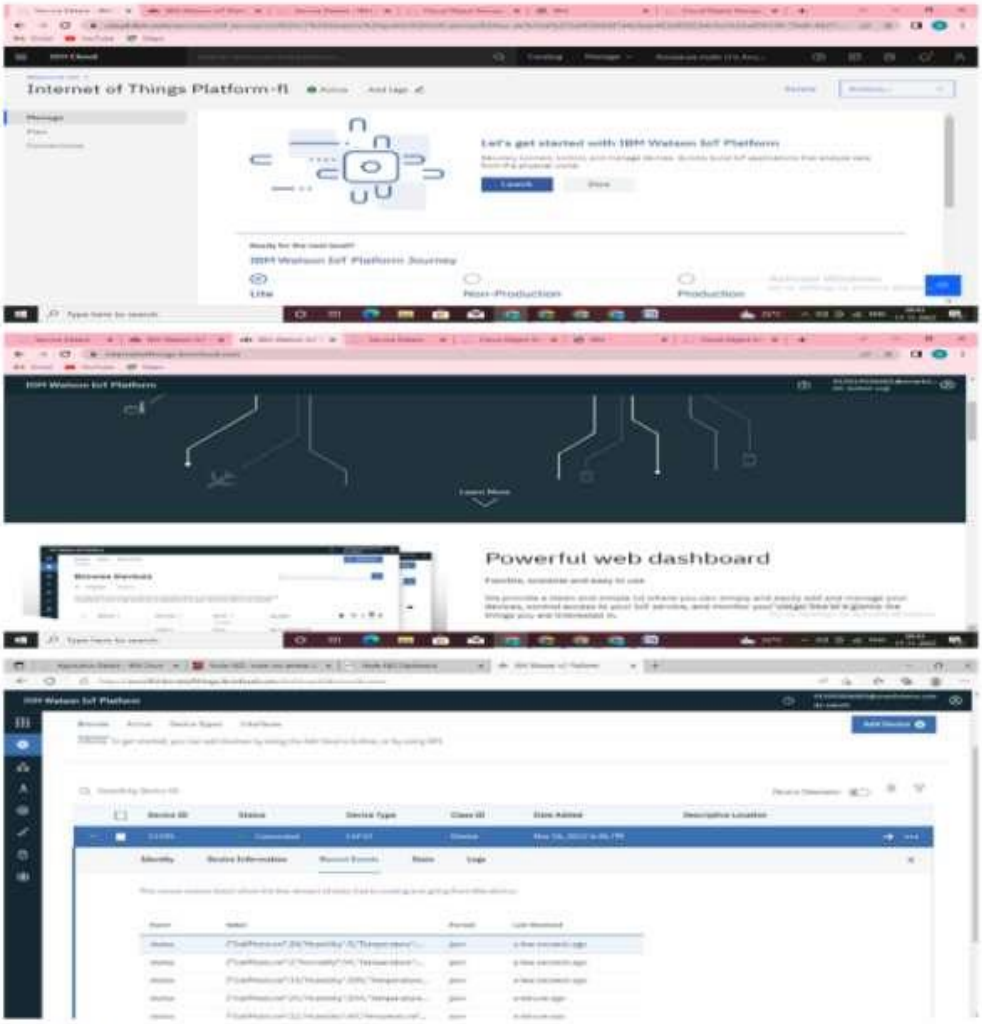


Fig 6.2.3



SPRINT – 3:

Fig 6.2.4

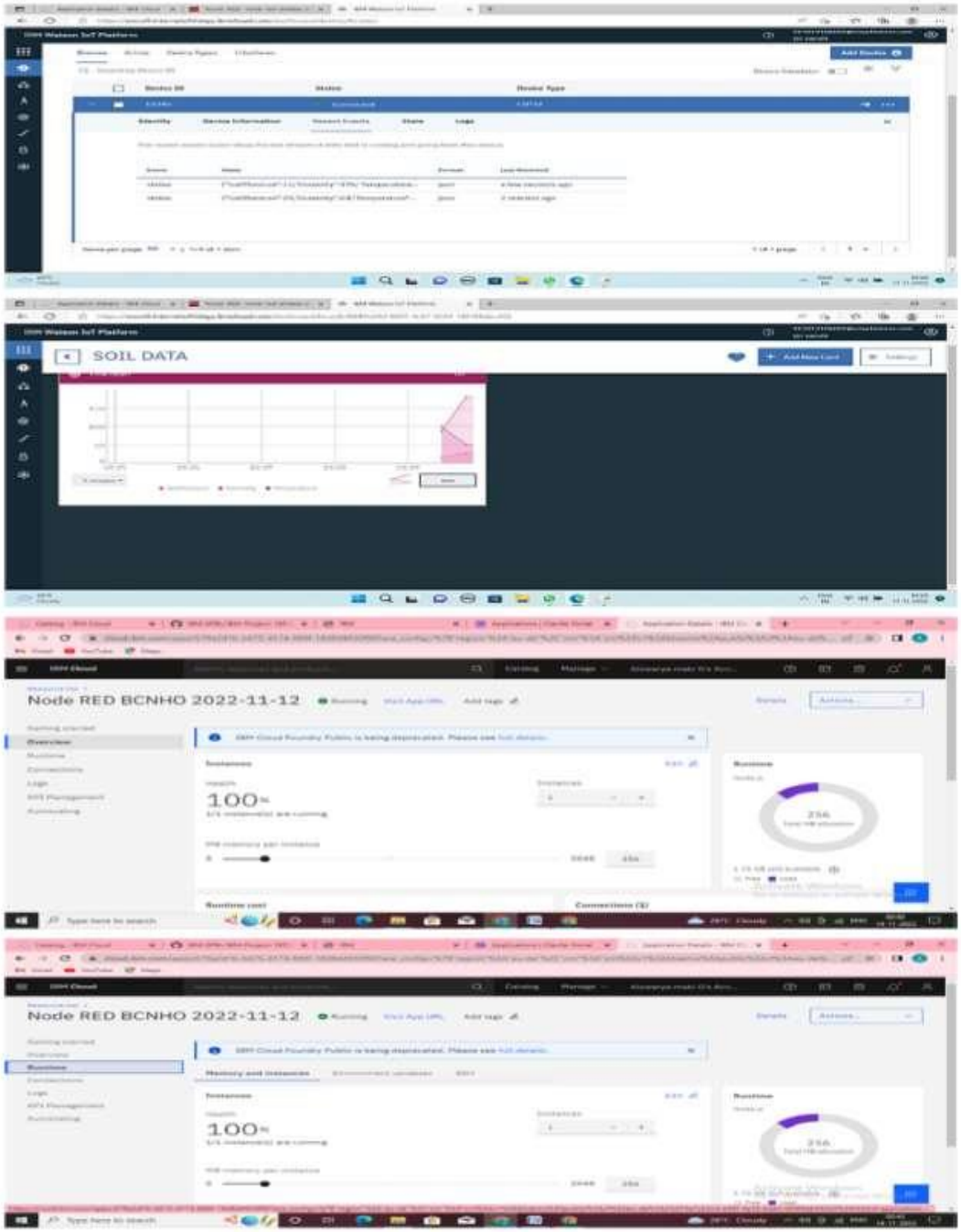

SOIL DATA
Node RED BCNHO 2022-11-12
100%
Node RED BCNHO 2022-11-12
100%

Fig 6.2.5

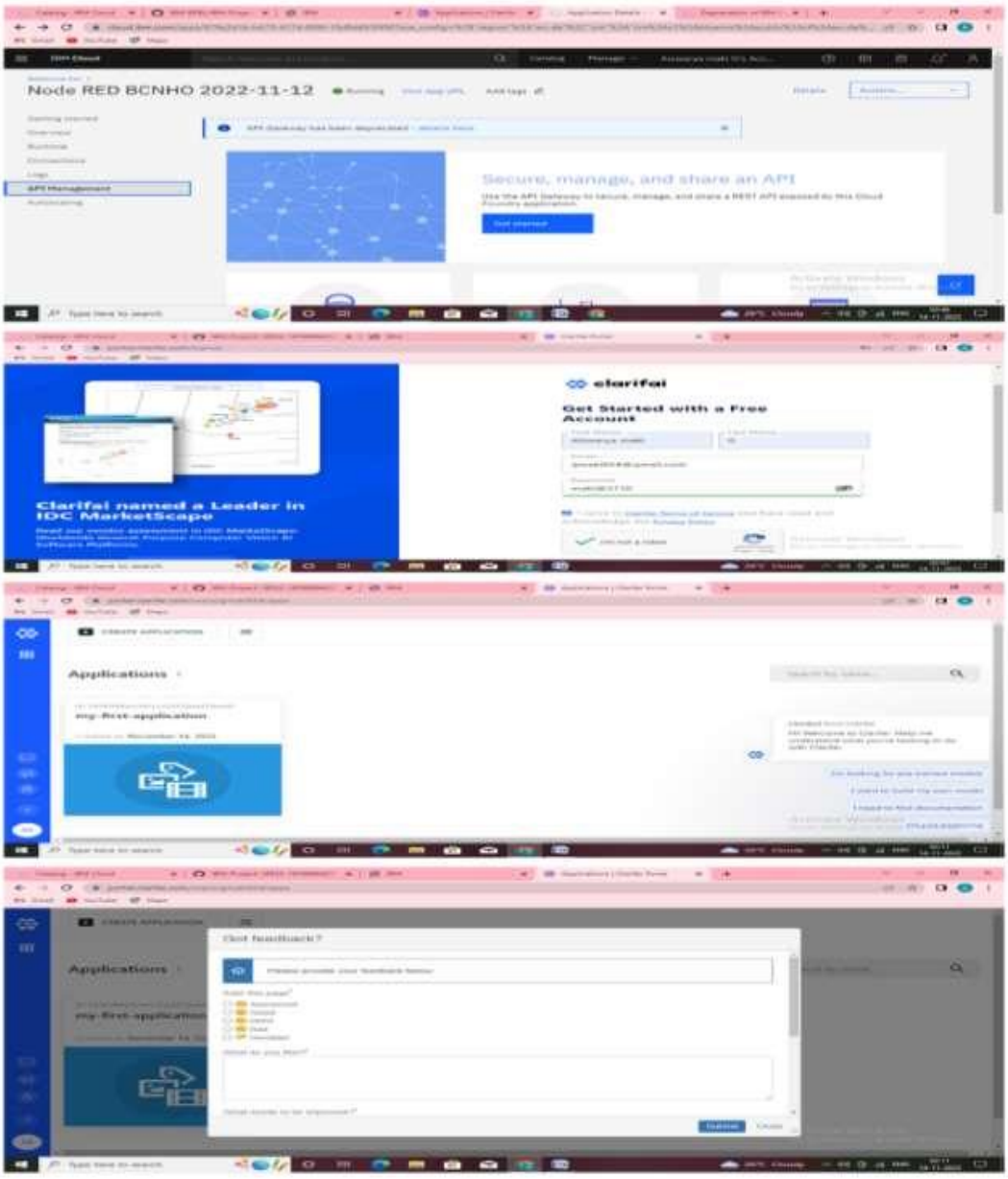

Node RED BCNHO 2022-11-12
Secure, manage, and share an API
clarifai
Get Started with a Free Account
Clarifai named a Leader in IDC MarketScape
Applications
my-first-application
Applications
my-first-application

Fig 6.2.6

PROGRAM:

```
import numpy as np

import wiot.sdk.device

import playsound

import random

import time

import datetime

import ibm_boto3

from ibm_botocore.client import Config, ClientError



#CloudantDB

from cloudant.client import Cloudant

from cloudant.error import CloudantException

from cloudant.result import Result, ResultByKey

from clarifai_grpc.channel.clarifai_channel import
ClarifaiChannel

from clarifai_grpc.grpc.api import service_pb2_grpc

stub =
service_pb2_grpc.V2Stub(clarifaiChannel.get.grpc_channel())

from clarifai_grpc.grpc.api import service_pb2, resource_pb2

from clarifai_grpc.grpc.api.status import status_code_pb2
```

```
#This is how you authenticate

metadata = (('authorization', 'key 5797d941-433e-436a-a480-
680d9080a990'),)

COS_ENDPOINT = "https://s3.tok.ap.cloud-object-
storage.appdomain.cloud"

COS_API_KEY_ID = "v9n8Zn4r5VpcMVz_HyRY0DrS13jSzph2IEFioVj4-vmT"

COS_AUTH_ENDPOINT = "https://iam.cloud.ibm.com/identity/token"

COS_RESOURCE_CRN = "crn:v1:bluemix:public:cloud-object-
storage:global:a/3f060ee770d94e20a88f49f3da641d6d:f301cab2-2e94-
48a1-a8a0-5b4968527c54::"

clientdb = cloudant("apikey-
_pIeLXPoaPpnOZ7SMoVKd6tZdsjf54X9LwkFEWB1a0T6", "0165dca6-1176-
4aa5-b0fe-81473e50e35d", url="https://47643860-3553-4211-ba2a-
d8e26dd17c08-bluemix.cloudantnosqldb.appdomain.cloud")

clientdb.connect()



#Create resource



cos = ibm_boto3.resource("s3",

                         ibm_api_key_id=COS_API_KEY_ID,


ibm_service_instance_id=COS_RESOURCE_CRN,

                       ibm_auth_endpoint=COS_AUTH_ENDPOINT,


config=Config(signature_version="oauth"),
```

```
                    endpoint_url=COS_ENDPOINT

                )

def = multi_part_upload(bucket_name, item_name, file_path):

    try:

        print("Starting file transfer for {0} to bucket:
{1}\n".format(item_name, bucket_name))

        #set 5 MB chunks

        part_size = 1024 * 1024 * 5

        #set threadhold to 15 MB

        file_threshold = 1024 * 1024 * 15

        #set the transfer threshold and chunk size

        transfer_config                                    =
ibm_boto3.s3.transfer.TransferConfig(

            multipart_threshold=file_threshold,

            multipart_chunksize=part_size

            )

        #the  upload_fileobj  method  will  automatically
execute a multi-part upload

        #in 5 MB chunks size

        with open(file_path, "rb") as file_data:

            cos.Object(bucket_name,
item_name).upload_fileobj(

                Fileobj=file_data,
```

```
                Config=transfer_config

                )

        print("Transfer               for               {0}
Complete!\n".format(item_name))

    except ClientError as be:

        print("CLIENT ERROR: {0}\n".format(be))

    except Exception as e:

        print("Unable   to   complete   multi-part   upload:
{0}".format(e))



def myCommandCallback(cmd):

    print("Command received: %s" % cmd.data)

    command=cmd.data['command']

    print(command)

    if(commamd=="lighton"):

        print('lighton')

    elif(command=="lightoff"):

        print('lightoff')

    elif(command=="motoron"):

        print('motoron')

    elif(command=="motoroff"):
```

```
        print('motoroff')

myConfig = {

    "identity": {

        "orgId": "chytun",

        "typeId": "NodeMCU",

        "deviceId": "12345"

        },

    "auth": {

        "token": "12345678"

        }

    }

client    =    wiot.sdk.device.DeviceClient(config=myConfig,
logHandlers=None)

client.connect()



database_name = "sample"

my_database = clientdb.create_database(database_name)

if my_dtabase.exists():

    print(f"'(database_name)' successfully created.")

cap=cv2.VideoCapture("garden.mp4")

if(cap.isOpened()==True):
```

```
    print('File opened')

else:

    print('File not found')



while(cap.isOpened()):

    ret, frame = cap.read()

    gray = cv3.cvtColor(frame, cv2.COLOR_BGR@GRAY)

    imS= cv2.resize(frame, (960,540))

    cv2.inwrite('ex.jpg',imS)

    with open("ex.jpg", "rb") as f:

        file_bytes = f.read()

    #This is the model ID of a publicly available General
model. You may use any other public or custom model ID.

    request = service_pb2.PostModeloutputsRequest(

        model_id='82eaf1c767a74869964531e4d9de5237',


inputs=[resources_pb2.Input(data=resources_pb2.Data(image=
resources_pb2.Image(base64=file_bytes))

                                    )])

    response        =        stub.PostModelOutputs(request,
metadata=metadata)

    if response.status.code != status_code_pb2.SUCCESS:

        raise Exception("Request failed, status code: " +
str(response.status.code))
```

```
    detect=False
    for concept in response.outputs[0].data.concepts:
        #print('%12s: %.f' % (concept.name, concept.value))
        if(concept.value>0.98):
            #print(concept.name)
            if(concept.name=="animal"):
                print("Alert! Alert! animal detected")
                playsound.playsound('alert.mp3')

picname=datetime.datetime.now().strftime("%y-%m-%d-%H-%M")
                cv2.inwrite(picname+'.jpg',frame)
                multi_part_upload('Umamaheswari',
picname+'.jpg', picname+'.jpg')

json_document={"link":COS_ENDPOINT+'/'+'Umamaheswari'+'/'+
picname+'.jpg'}
                new_document                                =
my_database.create_document(json_document)
                if new_document.exists():
                    print(f"Document           successfully
created.")
                time.sleep(5)
                detect=True
    moist=random.randint(0,100)
```

```
    humidity=random.randint(0,100)


myData={'Animal':detect,'moisture':moist,'humidity':humidi
ty}

    print(myData)

    if(humidity!=None):


client.publishEvent(eventId="status",msgFormat="json",
daya=myData, qos=0, onPublish=None)

        print("Publish Ok..")

    client.commandCallback = myCommandCallback

    cv2.imshow('frame',imS)

    if cv2.waitKey(1) & 0xFF == ord('q'):

        Break

client.disconnect()

cap.release()

cv2.destroyAllWindows()
```

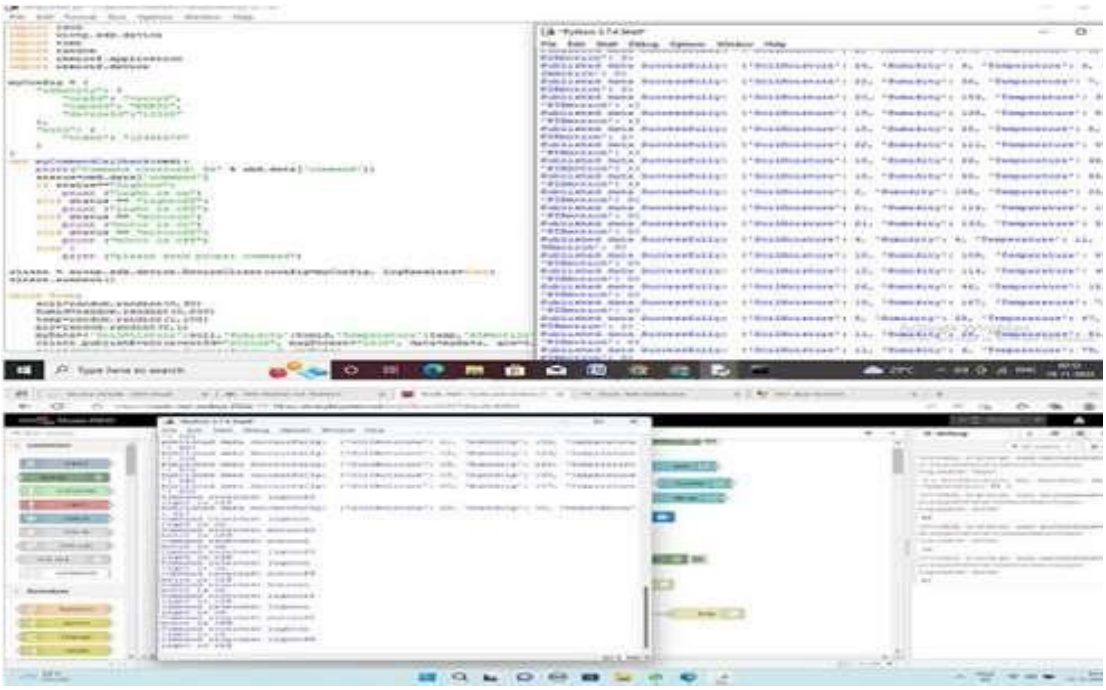


Fig 6.2.7

Fig 6.2.8

6.3 Sprint Delivery Schedule

Sprint planning is an event in the scrum framework where the team determines the product backlog items they will work on during that sprint and discusses their initial plan for completing those product backlog items.

Sprint-3		US-1	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.	10	High	Aiswarya maki Ajitha Nageshwari Nivetha
Sprint-3		US-2	Create a Node-RED service.	10	High	Aiswarya maki Ajitha Nageshwari Nivetha,
Sprint-3		US-1	Create an account in clarifai	7	High	Aiswarya maki Ajitha Nageshwari Nivetha
Sprint-4		US-2	Develop a python script to publish random sensor data such as temperature, moisture, soil and humidity to the IBM IoT platform.	5	Medium	Aishwarya maki Ajitha Nageshwari Nivetha
Sprint-4		US-3	Publish Data to The IBM Cloud	8	High	Aishwarya maki Ajitha Nageshwari Nivetha
Sprint-4		US-1	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	Aishwarya maki Ajitha Nageshwari Nivetha

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

Fig 6.3.1

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.

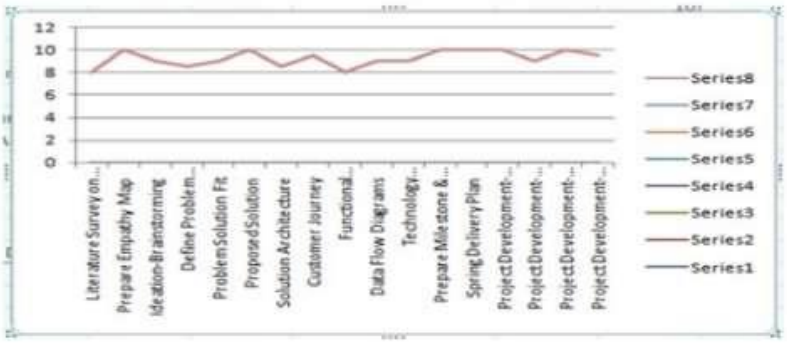


Fig 6.3.2

6.4 Report from JIRA

JIRA is a very effective and easy to use tool for project management using agile methodologies. Each work item can be linked to a change set of the code delivered.

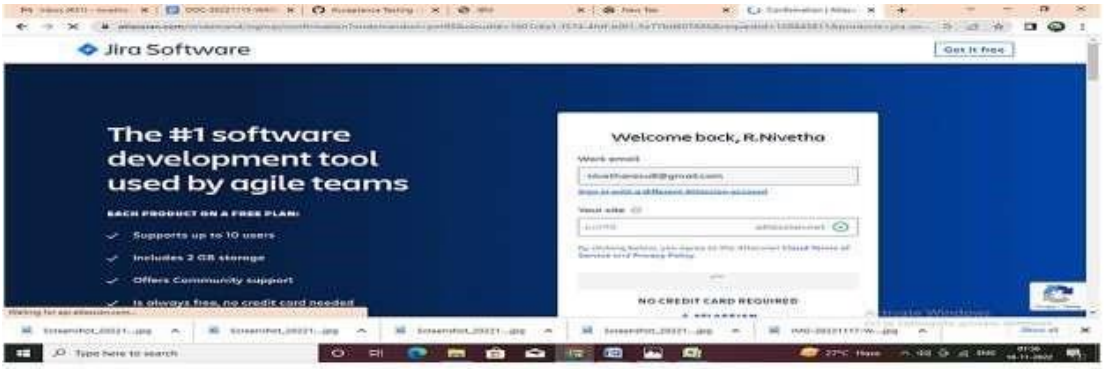


Fig 6.4.1

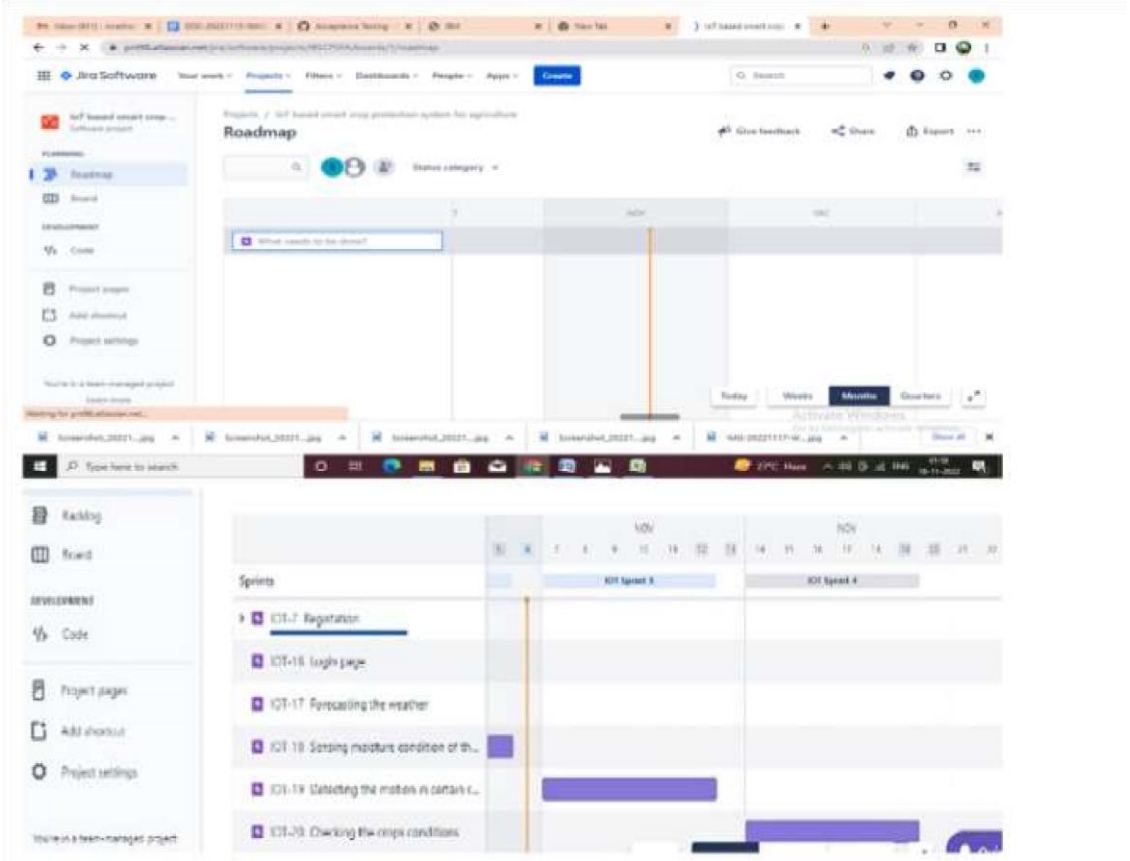


Fig 6.4.2

CHAPTER 7

7.CODING & SOLUTIONING :

7.1 Feature 1

The moisture contents in the soil sensed by using the moisture sensor and it will identify the amount of water supplied required to the crop and sends data to ARM cortex and enables sensor to supply water which automatically turn on the water.

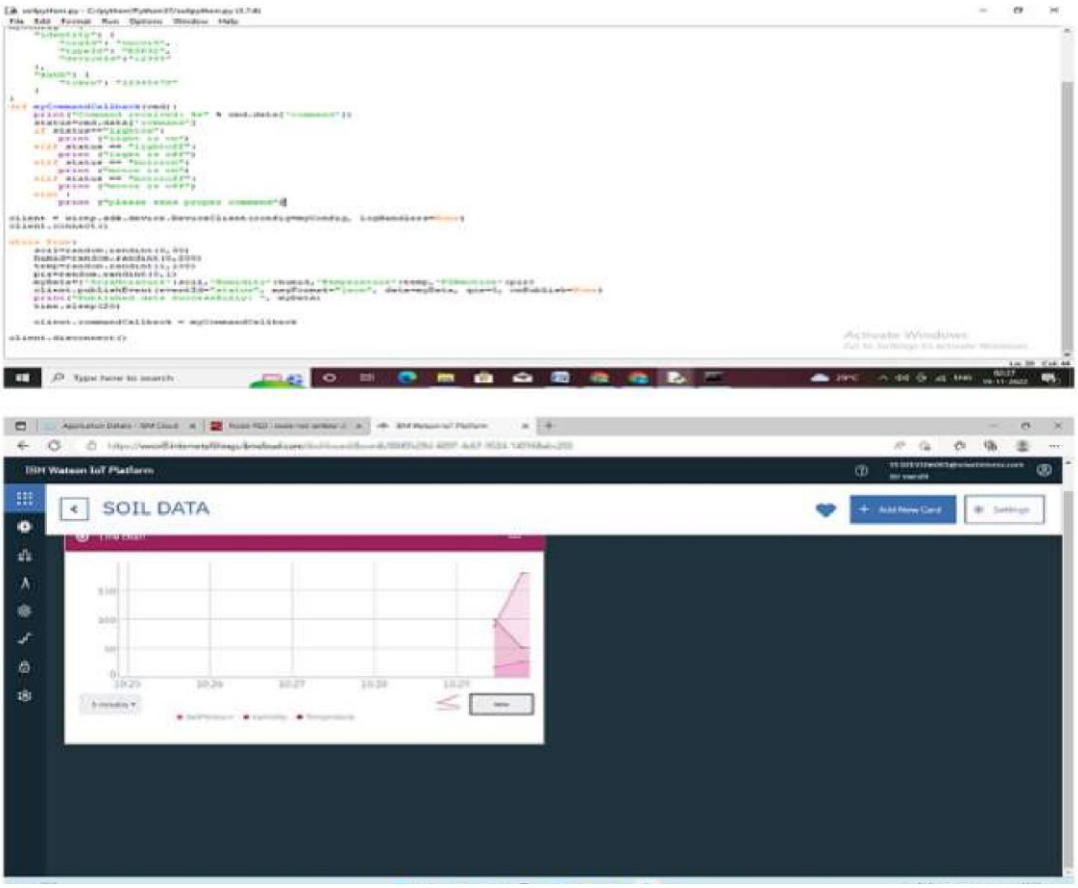


Fig 7.1.1

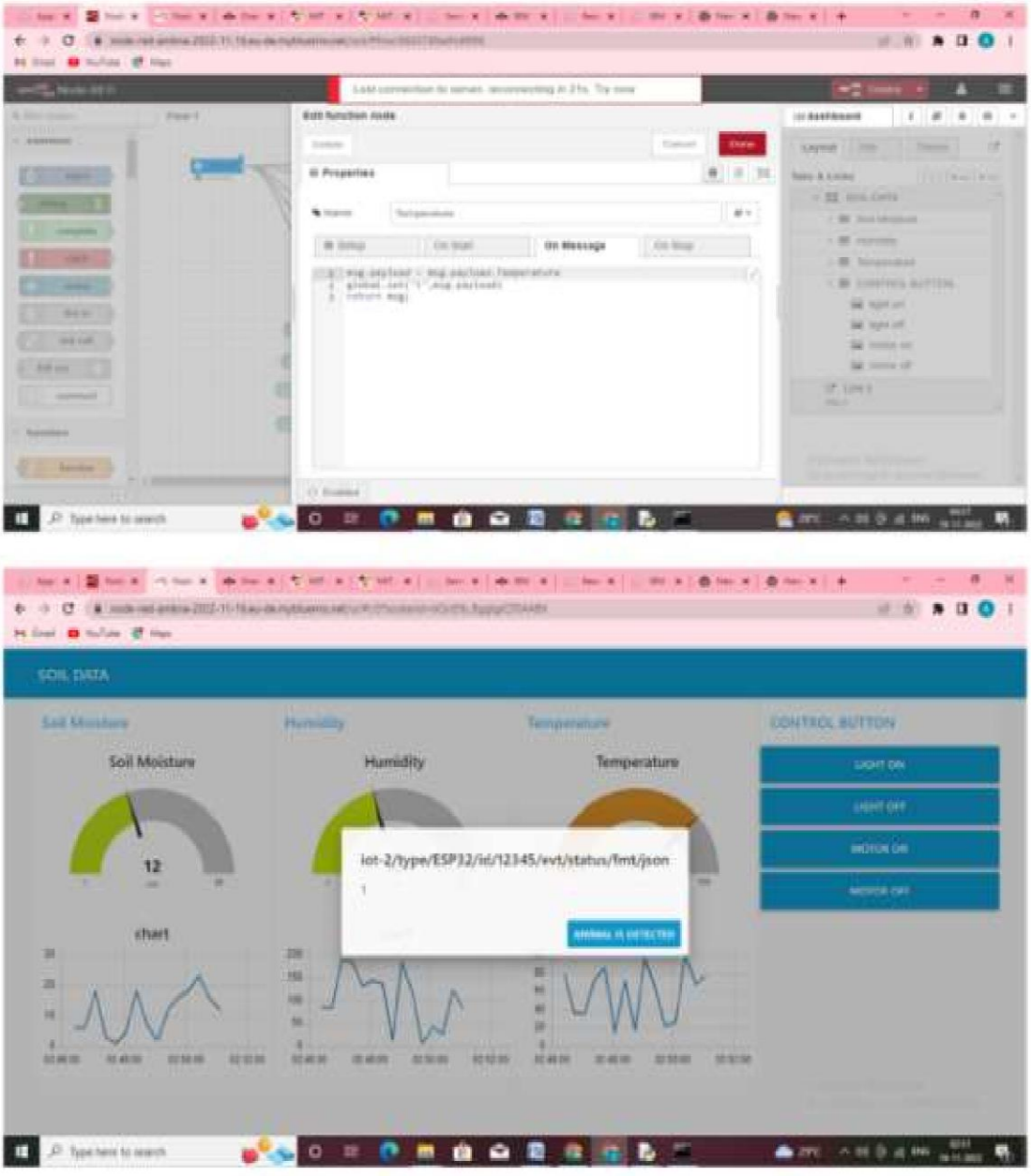

SOIL DATA
Soil Moisture
Humidity
Temperature
CONTROL BUTTON
Soil Moisture
12
Humidity
Temperature
iot-2/type/ESP32/id/12345/evt/status/fmt/json
chart

Fig 7.1.2

7.2 Feature 2

PIR sensor used to detect whether a human has moved in or out of the sensors range. After processing the available information, if the human is not found the system raised the buzzer sound, to alert people about intrusion.

CHAPTER 8

8. TESTING

8.1 Test Cases

A test cases is a specification of the inputs, execution conditions, test and procedure, and expected results that define test to be executed to achieve a particular software testing objective, such as to exercise a particular program path or to verify compliance with a specific requirement.

8.2 User Acceptance Testing

User Acceptance Testing(UAT) also called application testing or end-user testing, is a phase of software development in which the software is tested in the real world by it’s intended audience.

1. Purpose of Document

The purpose of this document is to briefly explain the test coverage and open issues of the [ProductName] project at the time of the release to User Acceptance Testing (UAT).

2. 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	9	5	3	2	19
Duplicate	1	1	3	1	6
External	2	3	1	1	7
Fixed	10	2	3	18	33
Not Reproduced	1	1	2	1	5
Skipped	1	1	2	1	5
Won't Fix	1	4	3	1	9
Totals	25	17	17	25	84

CHAPTER 9

9. RESULTS

9.1 Performance Metrics

Performance testing comes under quality assurance checks of software / application in which speed, capacity and stability are the major checks.

Fig 9.1.1

10. ADVANTAGES & DISADVANTAGES ADVANTAGES

- They are easy to operate and use and easy to maintain.
- Sensors are cheaper in price and best in quality.
- Automating processes in planting, treatment and harvesting can reduce consumption, human error and overall cost.
- It is cost effective method.
- It delivers high quality crop production.

DISADVANTAGES

- The smart agriculture needs availability of internet continuously. Rural part of most of the developing countries do not fulfil this requirement.
  Moreover internet connection is over.
- The smart farming based equipments require farmers to understand and learn the use of technology. This is major challenge in adopting smart agriculture farming at large scale across the countries.

11. CONCLUSION

By using IoT, we can increase the crop yield in agriculture farms. With this IoT platform, we can monitor the weather conditions like Humidity and Temperature. There is an urgent need for a system that makes the agricultural process easier and burden free from the farmer's side. The proposed system can be used to turn ON / OFF the water spray according to Soil Moisture levels thus making the irrigation process one of the most time-consuming agricultural activities. Agriculture is one of the biggest uses of water.

12. FUTURE SCOPE

The number of challenges and limitations considers the most IoT-based devices for smart agriculture. The main focus is cost effectiveness in the IoT devices in the reduction of hardware and software cost with compromising precision system output. The standardization of data format for the process will also provide improved device consistency and execution time.