Industrial Internship Report on

”SMART AGRICULTURE”

Prepared by

Kaipa Rajeswari

Executive Summary
This report provides details of the Industrial Internship provided by upskill Campus and The IoT Academy in collaboration with Industrial Partner UniConverge Technologies Pvt Ltd (UCT). This internship was focused on a project/problem statement provided by UCT. We had to finish the project including the report in 6 weeks’ time. My project was (Tell about “smart agriculture”) This internship gave me a very good opportunity to get exposure to Industrial problems and design/implement solution for that. It was an overall great experience to have this internship.

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1 Preface

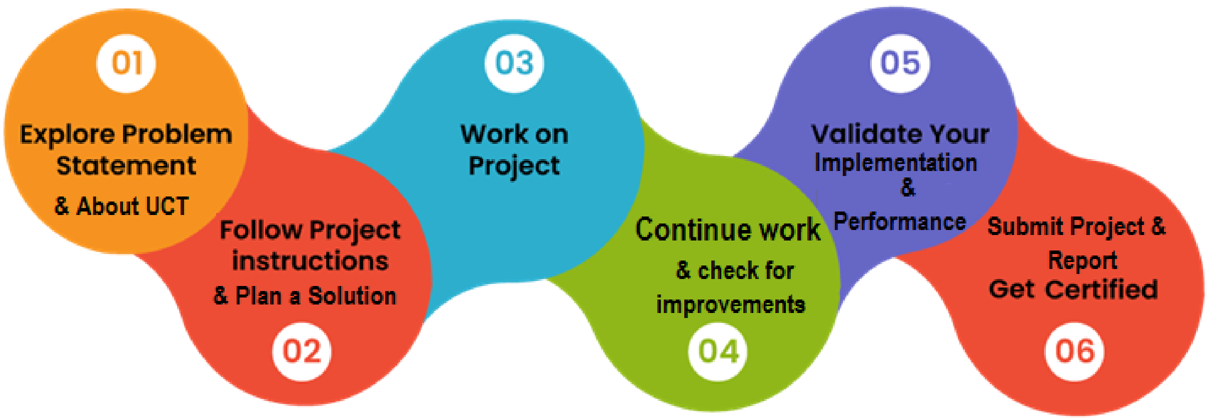
Summary of the whole 6 weeks' work.

About need of relevant Internship in career development.

Brief about Your project/problem statement.

Opportunity given by USC/UCT.

How Program was planned



Your Learnings and overall experience.

Thank to all (with names), who have helped you directly or indirectly.

Your message to your juniors and peers.

2 Introduction

2.1 About UniConverge Technologies Pvt Ltd

A company established in 2013 and working in Digital Transformation domain and providing Industrial solutions with prime focus on sustainability and RoI.

For developing its products and solutions it is leveraging various **Cutting Edge Technologies e.g. Internet of Things (IoT), Cyber Security, Cloud computing (AWS, Azure), Machine Learning, Communication Technologies (4G/5G/LoRaWAN), Java Full Stack, Python, Front end** etc.

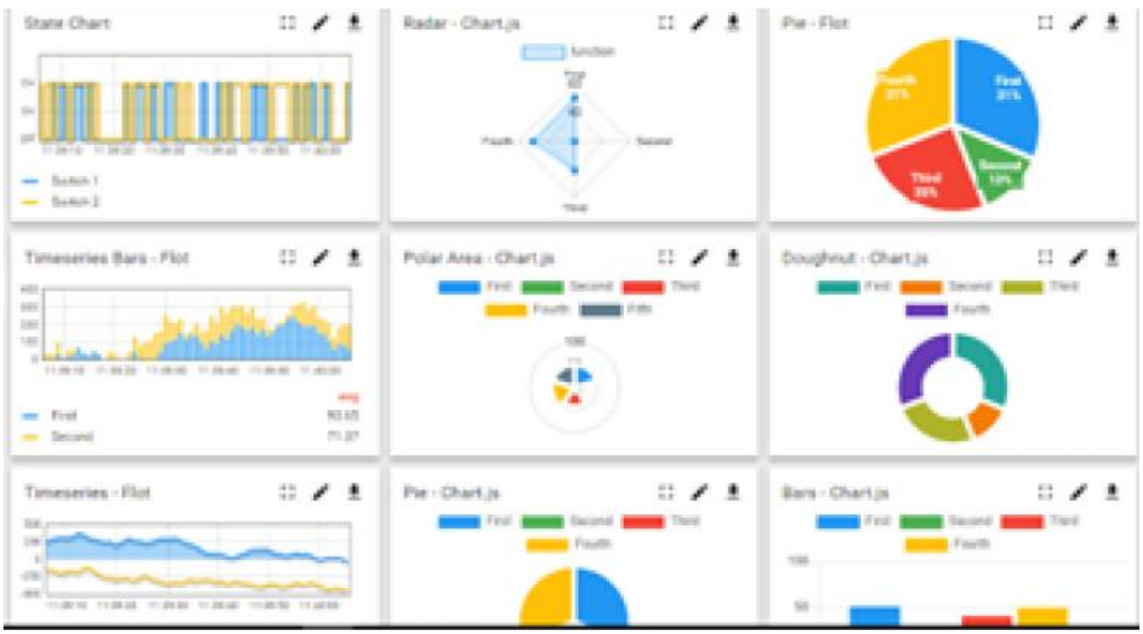
i. UCT IoT Platform (Insight)

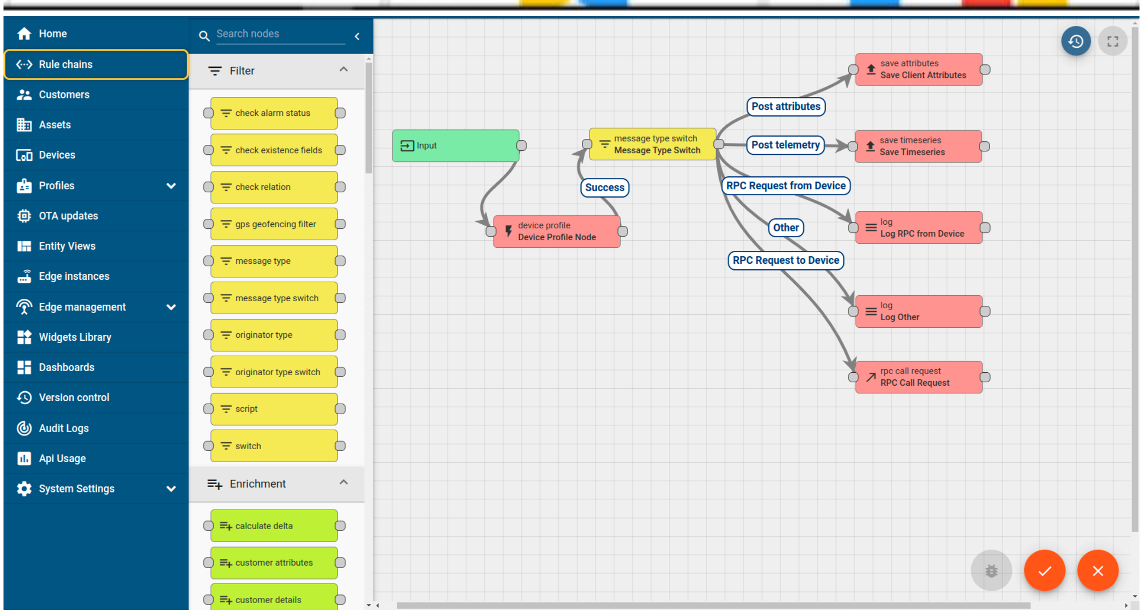
UCT Insight is an IOT platform designed for quick deployment of IOT applications on the same time providing valuable "insight" for your process/business. It has been built in Java for backend and ReactJS for Front end. It has support for MySQL and various NoSql Databases.

- It enables device connectivity via industry standard IoT protocols - MQTT, CoAP, HTTP, Modbus TCP, OPC UA
- It supports both cloud and on-premises deployments.

It has features to

• Build Your own dashboard
• Analytics and Reporting
• Alert and Notification
• Integration with third party application(Power BI, SAP, ERP)
• Rule Engine





ii. Smart Factory Platform (FACTORY WATCH)

Factory watch is a platform for smart factory needs.

It provides Users/ Factory

- with a scalable solution for their Production and asset monitoring
- OEE and predictive maintenance solution scaling up to digital twin for your assets.
- to unleased the true potential of the data that their machines are generating and helps to identify the KPIs and also improve them.
- A modular architecture that allows users to choose the service that they what to start and then can scale to more complex solutions as per their demands.

Its unique SaaS model helps users to save time, cost and money.

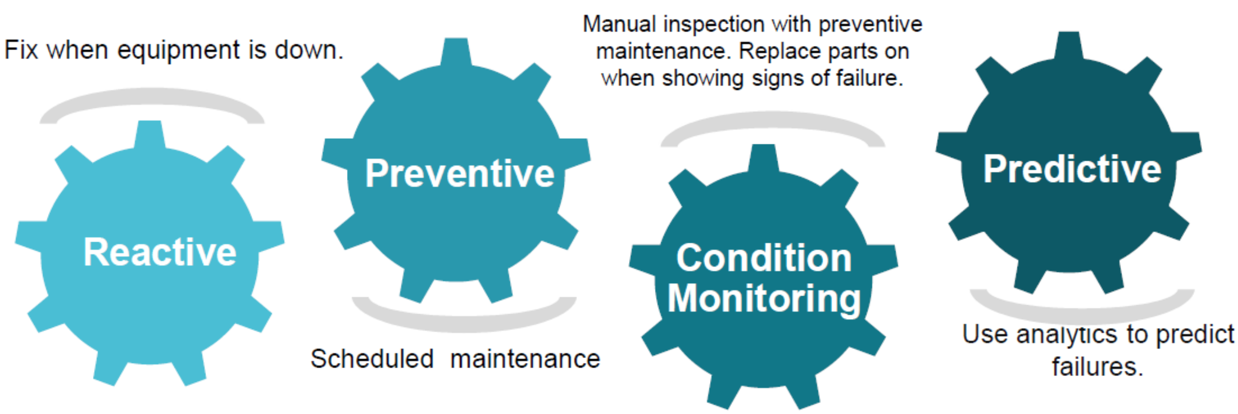
Machine	Operator	Work Order ID	Job ID	Job Performance	Job Progress		Output		Rejection	Time (mins)				Job Status	End Customer
					Start Time	End Time	Planned	Actual		Setup	Pred	Downtime	Idle		
CNC_S7_81	Operator 1	WO0405200001	4168	58%	10:30 AM		55	41	0	80	215	0	45	In Progress	i
CNC_S7_81	Operator 1	WO0405200001	4168	58%	10:30 AM		55	41	0	80	215	0	45	In Progress	i

iii. LoRaWAN based Solution

UCT is one of the early adopters of LoRAWAN teschnology and providing solution in Agritech, Smart cities, Industrial Monitoring, Smart Street Light, Smart Water/ Gas/ Electricity metering solutions etc.

iv. Predictive Maintenance

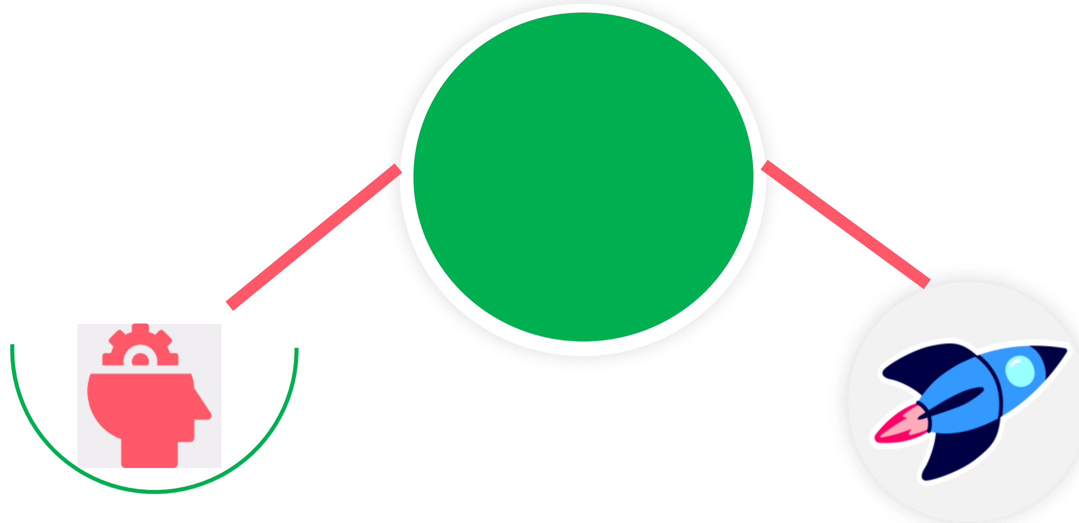
UCT is providing Industrial Machine health monitoring and Predictive maintenance solution leveraging Embedded system, Industrial IoT and Machine Learning Technologies by finding Remaining useful life time of various Machines used in production process.



2.2 About upskill Campus (USC)

upskill Campus along with The IoT Academy and in association with Uniconverge technologies has facilitated the smooth execution of the complete internship process.

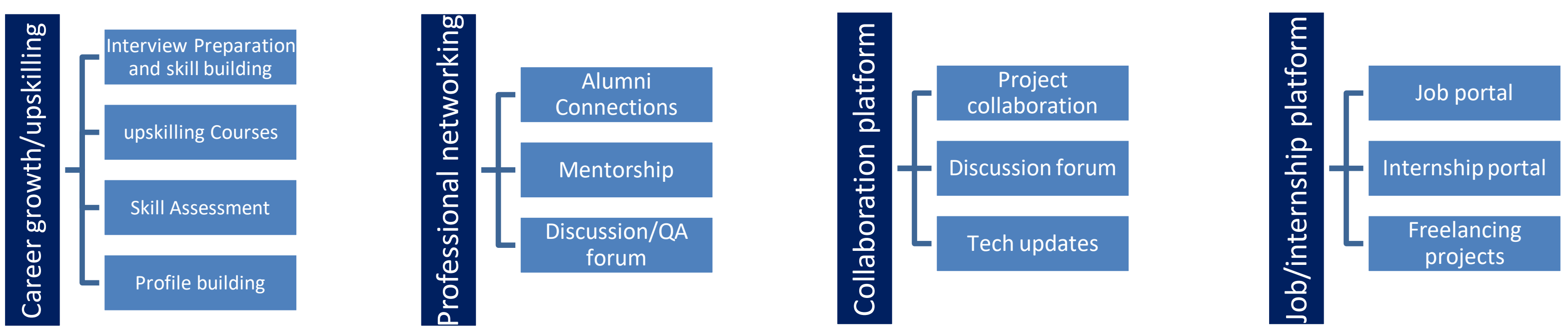
USC is a career development platform that delivers **personalized executive coaching** in a more affordable, scalable and measurable way.



Seeing need of upskilling in self paced manner along-with additional support services e.g. Internship, projects, interaction with Industry experts, Career growth Services

upSkill Campus aiming to upskill 1 million learners in next 5 year

https://www.upskillcampus.com/



2.3 The IoT Academy

The IoT academy is EdTech Division of UCT that is running long executive certification programs in collaboration with EICT Academy, IITK, IITR and IITG in multiple domains.

2.4 Objectives of this Internship program

The objective for this internship program was to

☛ get practical experience of working in the industry.

☛ to solve real world problems.

☛ to have improved job prospects.

☛ to have Improved understanding of our field and its applications.

☛ to have Personal growth like better communication and problem solving.

2.5 Reference

[1] Ritaban et al. 2014. Development of an intelligent environmental knowledge system for sustainable agricultural decision support. Environ.

[2] Tien JM.2013. Big Data: unleashing information.J. Syst. Sci. Syst. Eng. 22. pp. 127-151.

[3] Wolfert et al. 2014. A Future Internet Collaboration Platform for Safe and Healthy Food from Farm to Fork, Global Conference (SRII), 2014.Annual SRII IEEE, San Jose, CA, USA.pp. 266-273.

2.6 Glossary

Terms	Acronym

3 Problem Statement

- In agriculture water is needed for the crops for their growth. If the Soil gets dry it isnecessary to supply water. But sometime if the farmer doesn't visit the field it is notpossible to know the condition of soil.
- Sometimes over supply of water or less supply of water affects the growth ofcrops.
- Sometimes if the weather/temperature changes suddenly it is necessary to take certain actions.
- Specific crops grow better in specific conditions, they may get damaged due to badweather.

4 Existing and Proposed solution

- Soil Moisture can be checked by using the sensors that can sense the soil condition andsend the moisture content in the soil over the cloud services to the web application.
- The supply of water can be controlled from any where by controlling the motor state (ON/OFF), using web application.
- Surrounding temperature can also be sensed by the sensors and displayed on theapplication.
- Real time weather conditions can also be known by using different weather API's from different websites and displayed on our Application.

4.1 CodesubmissionGithublink):

[upskillcampus/BankinginformationSystem.python.py at main · Kaiparajeswari/upskillcampus (github.com)]

4.2 Report submission (Github link) : first make placeholder, copy

upskillcampus/BankinginformationSystem_Rajeswari_USC_UCT.pdf at main · Kaiparajeswari/upskillcampus (github.com)

5 Proposed Design/ Model

Here's a proposed high-level design model for a smart agriculture system using Node-RED and IBM Cloud:

Components:

1. **Sensor Devices**: Various sensors for monitoring environmental conditions like soil moisture, temperature, humidity, and light intensity.
2. **Node-RED**: A flow-based development tool for visual programming, which will serve as the core logic engine.
3. **IBM Cloud Services**:
   - **Watson IoT Platform**: To manage and connect IoT devices securely, allowing bidirectional communication between devices and applications.
   - **Cloudant Database**: A scalable NoSQL database for storing sensor data and other application data.
   - **Node-RED on IBM Cloud**: Host Node-RED flows on IBM Cloud for scalability, reliability, and ease of integration with other cloud services.

4. **Actuators**: Devices for performing actions based on sensor data, such as irrigation systems, actuators for adjusting greenhouse vents, etc.

Design Model:

1. **Data Acquisition**:

o Sensor devices collect environmental data.

o Data is transmitted to the Watson IoT Platform securely over MQTT or other protocols.

2. **Data Processing**:

o Node-RED receives data from Watson IoT Platform.

o Node-RED flows process the incoming data, applying logic for decision-making, such as determining when to trigger irrigation based on soil moisture levels.

3. **Decision Making**:

o Node-RED evaluates incoming sensor data against predefined thresholds and rules.

o If conditions warrant action (e.g., low soil moisture), Node-RED triggers appropriate responses (e.g., activating irrigation).

4. **Action Execution**:

o Node-RED sends commands to actuators via Watson IoT Platform to execute actions based on decisions made.

o Actuators perform tasks such as activating irrigation systems, adjusting greenhouse parameters, etc.

5. **Data Storage and Analysis**:

o Sensor data and system events are stored in Cloudant Database.

o Historical data is analyzed for trends, patterns, and predictive insights using IBM Cloud services like Watson Analytics or IBM Watson Studio.

6. **Monitoring and Control**:

o Administrators can monitor system performance, view real-time data, and adjust system parameters through a web-based dashboard.

o Alerts are generated for abnormal conditions or system failures.

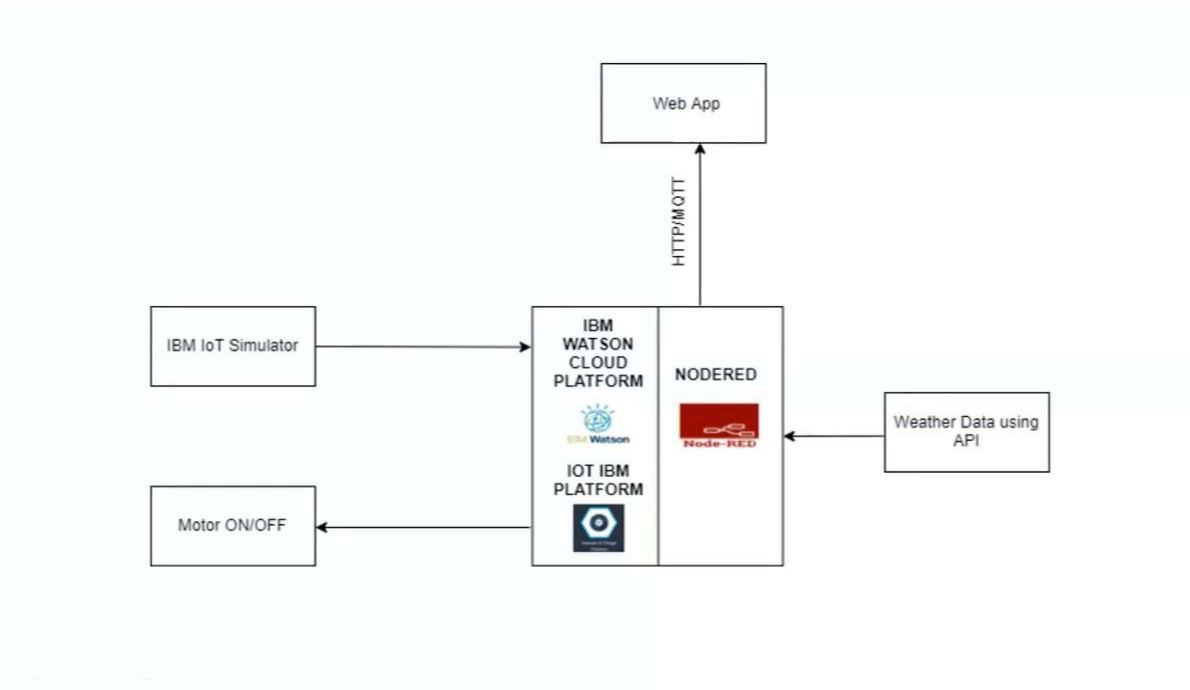
Integration Points:

- **Sensor Integration**: Connect sensor devices to the Watson IoT Platform for data transmission.
- **Actuator Integration**: Interface with actuators through the Watson IoT Platform to execute actions.
- **Cloud Services Integration**: Utilize various IBM Cloud services like Cloudant Database for data storage and analysis.

Security Considerations:

- Ensure secure communication between devices and the cloud using encryption and authentication mechanisms.
- Implement access controls and permissions to restrict unauthorized access to sensitive data and system functionalities.

5.0 High Level Diagram (if applicable)



5.1 Interfaces (if applicable)

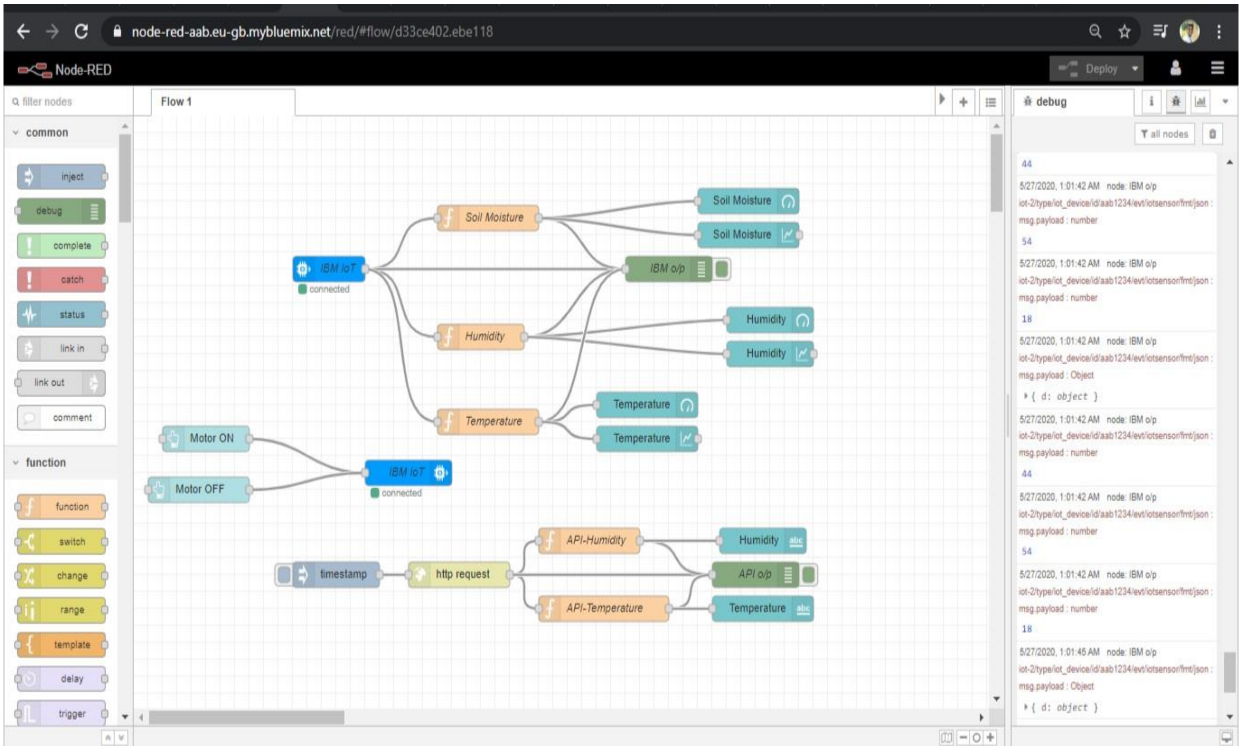


Fig: Node-red flow chart

6 Performance Test

This is very important part and defines why this work is meant of Real industries, instead of being just academic project.

Here we need to first find the constraints.

How those constraints were taken care in your design?

What were test results around those constraints?

Constraints can be e.g. memory, MIPS (speed, operations per second), accuracy, durability, power consumption etc.

In case you could not test them, but still you should mention how identified constraints can impact your design, and what are recommendations to handle them.

6.1 Test Plan/ Test Cases

Objective: Ensure that the system accurately measures soil moisture levels and triggers irrigation when the moisture falls below a certain threshold.

Test Case Steps:

1. **Setup**:

o Set up the Node-RED flow on IBM Cloud.

o Configure the Node-RED flow to receive sensor data from soil moisture sensors installed in the agricultural field.

2. **Simulate Normal Conditions**:

o Simulate normal conditions by sending simulated data indicating optimal soil moisture levels (e.g., 50-60%).

o Verify that the system does not trigger any alerts or irrigation actions.

3. **Simulate Low Soil Moisture**:

o Simulate low soil moisture conditions by sending simulated data indicating moisture levels below the threshold (e.g., <30%).

o Verify that the system detects the low moisture levels.

o Ensure that the system triggers an alert indicating low soil moisture.

4. **Simulate Irrigation Action**:

o Simulate the irrigation action triggered by the low soil moisture alert.

o Verify that the irrigation system activates and delivers water to the field.

o Ensure that the system records the irrigation event.

5. **Verify Recovery**:

o Simulate the return to normal conditions by sending simulated data indicating moisture levels are back to optimal.

o Verify that the system detects the return to normal conditions.

o Ensure that the irrigation system deactivates.

6. **Check Reporting and Logging**:

o Check the logs and reports generated by the system.

o Ensure that all events, including alerts, irrigation actions, and sensor data, are accurately recorded and timestamped.

7. **Test Edge Cases**:

o Test edge cases such as rapid changes in moisture levels or sensor malfunctions.

o Verify that the system handles these situations gracefully, providing appropriate alerts or error messages.

8. **Performance Testing**:

o Perform load testing by sending a large volume of simulated sensor data to the system.

o Verify that the system can handle the load without significant delays or failures.

9. **Security Testing**:

o Perform security testing to ensure that the system is protected against common vulnerabilities such as injection attacks or unauthorized access.

o Verify that sensitive data is encrypted during transmission and storage.

10. **Documentation Review**:

- Review the documentation provided for the Node-RED flow and IBM Cloud services.
- Ensure that the documentation is clear, comprehensive, and up-to-date.

11. **User Acceptance Testing**:
- Involve stakeholders or end-users in testing the system.
- Gather feedback on usability, functionality, and performance.

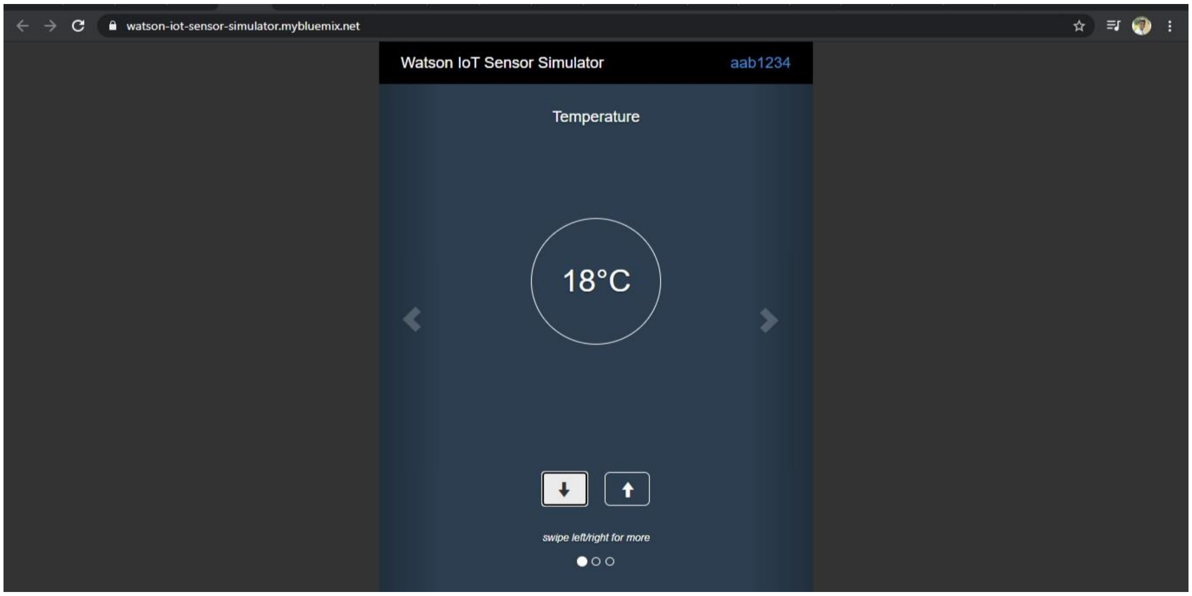
12. **Regression Testing**:
- After any updates or changes to the system, perform regression testing to ensure

6.2 Test Procedure

Hardware / Software Designing

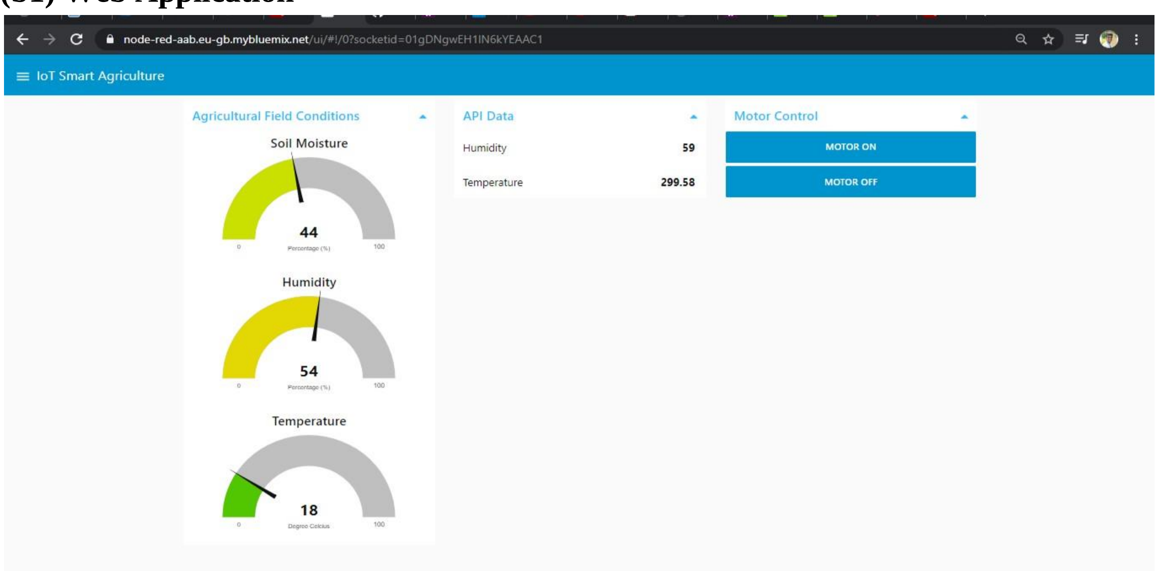
1. Create a device in IBM Colud.
2. Connect the device to IBM Simulator to get the weather conditions.
3. Build Node-RED flow to build a web application to display the weather conditions andcontrol the devices.
4. Get the real time weather condition data from openweathermap and integrate it in the Node-RED.
5. Control the working of the web application to the devices by python coding.

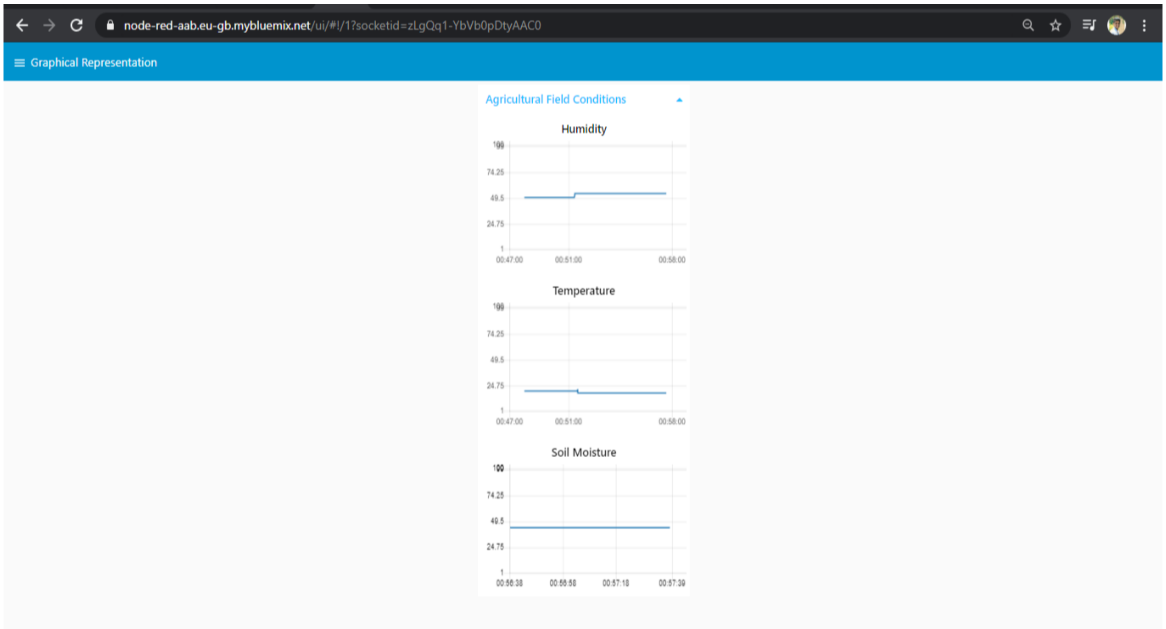
6.3 Performance Outcome



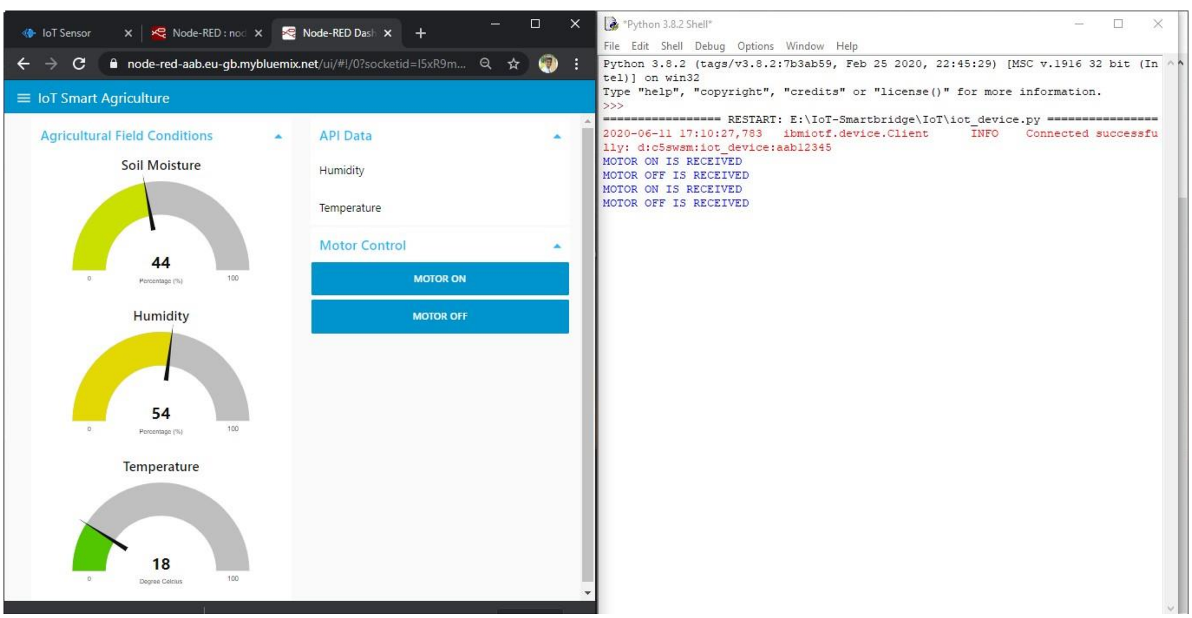
fig(a) Waston IOT simulator

fig(b1) Web Application





fig(b2) Web Application - Tab 2



fig(c) Device Control Action

7 My learnings

- In week 1. I learned about Rise of IOT and Embedded systems , and IOT devices , Raspberry pi, Raspberry pi is a very cheap computer it is the advance version of Arduino board and it provides a set of GPIO pins allowing you to control electronics components for physical computing and explore the IOT. And I learned Node-Red and MQTT. Node-Red flow is designed to create a moisture content dashboard for smart farming applications. MQTT protocol is used for cloud connectivity and to improve the security and used for machine -to-machine communication
- In week 2. I learned about facing of SMART AGRICULTURE challenges. As this technique uses both hardware and software. The cost of labor for managing IOT devices and the cost -of- service registration are included in the system operational cost. The main objective of smart agriculture is increasing the quality and quantity of the crops while optimizing the human labor used. Lack of standardization in devices and communication protocols makes it difficult to integrating and exchanging data between systems.
- In week 3. I understand the problem statement of SMART AGRICULTURE. Agriculture is often in remote areas where network coverage can be limited making it difficult to ensure reliable connectivity and continuous monitoring, energy harvesting, automatic irrigation, and disease prediction. High upfront of IOT equipment, continuing operating costs, and the financial burden on farmers, especially those in low- income environment.
- In week 4. I worked on data analytics of "smart agriculture"

❖ Thanks upskills for giving this opportunity. I learned lot of things from this internship and mentors also help me to do this project thanks for all for this amazing opportunity.

8 Future work scope

In future due to more demand of good and more farming in less time, for betterment ofthe crops and reducing the usage of extravagant resources like electricity and water IoTcan be implemented in most of the places. It is very useful for farmers in future