Industrial Internship Report on

”Smart Queue Management with Token System”

Prepared by

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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 (Smart Queue Management with Token System) 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

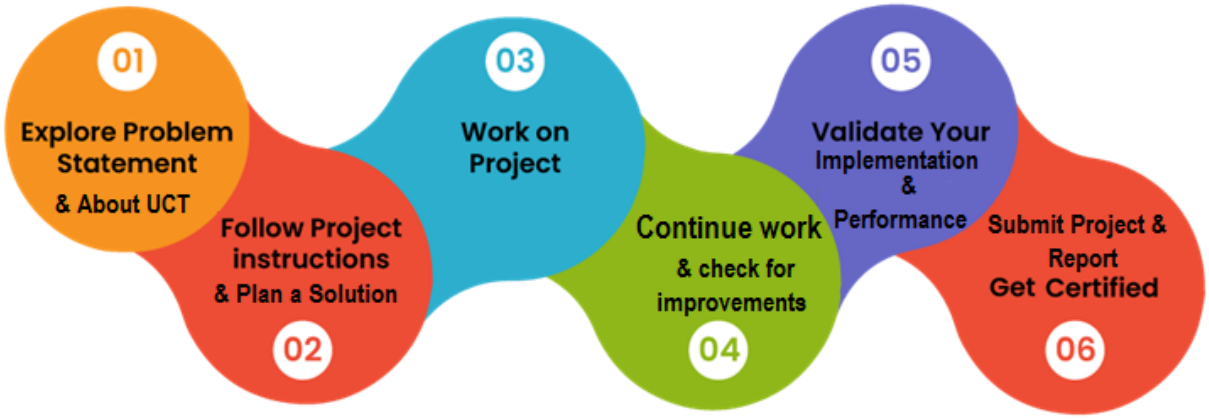
Summary of the whole 6 weeks' work.

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.

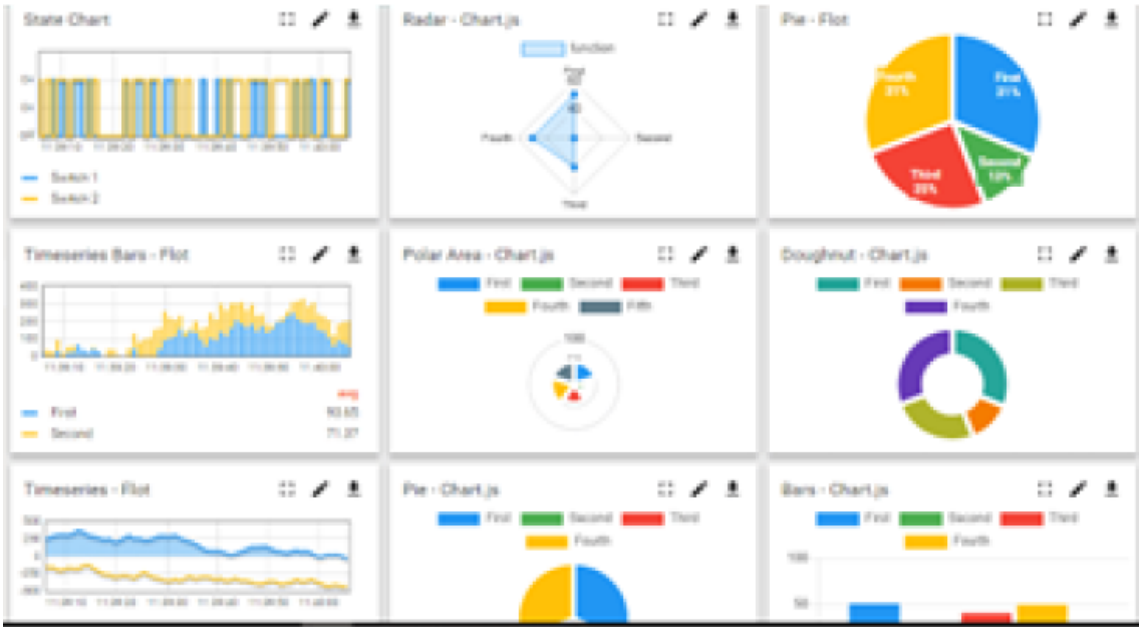
i. UCT IoT Platform (UCT Insight)

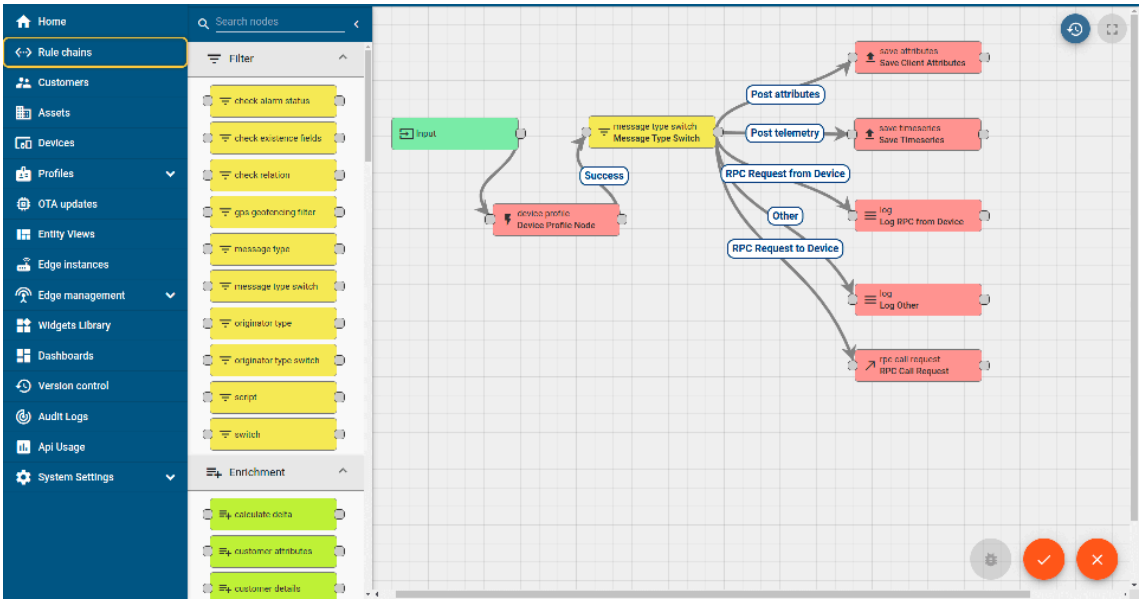
UCT Insight is an IOT platform designed for quick deployment of IOT applications on the same time providing valuable “insight” for your process/business. It has been built in Java for backend and ReactJS for Front end. It has support for MySQL and various NoSql Databases.

- 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.

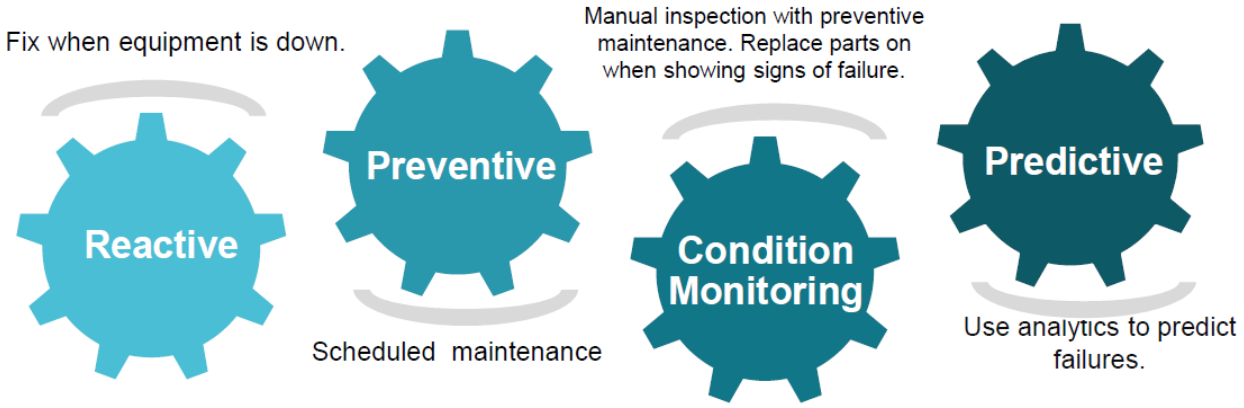
Machine	Operator	Work Order ID	Job ID	Job Performance	Job Progress		Output		Rejection	Time (mins)				Job Status	End Customer
					Start Time	End Time	Planned	Actual		Setup	Pred	Downtime	Idle		
CNC_S7_81	Operator 1	WO0405200001	4168	58%	10:30 AM		55	41	0	80	215	0	45	In Progress	i
CNC_S7_81	Operator 1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

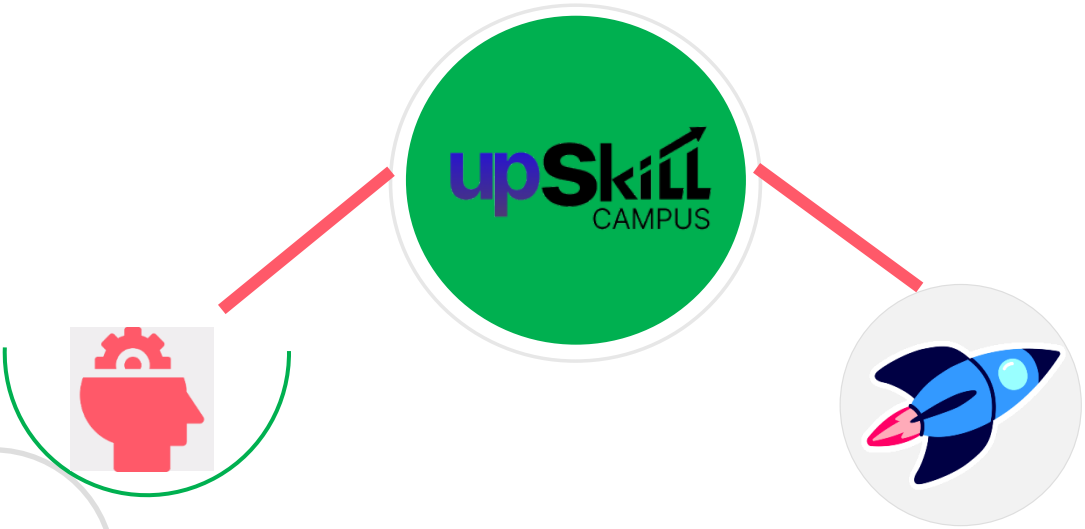
UCT is providing Industrial Machine health monitoring and Predictive maintenance solution leveraging Embedded system, Industrial IoT and Machine Learning Technologies by finding Remaining useful life time of various Machines used in production process.



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.

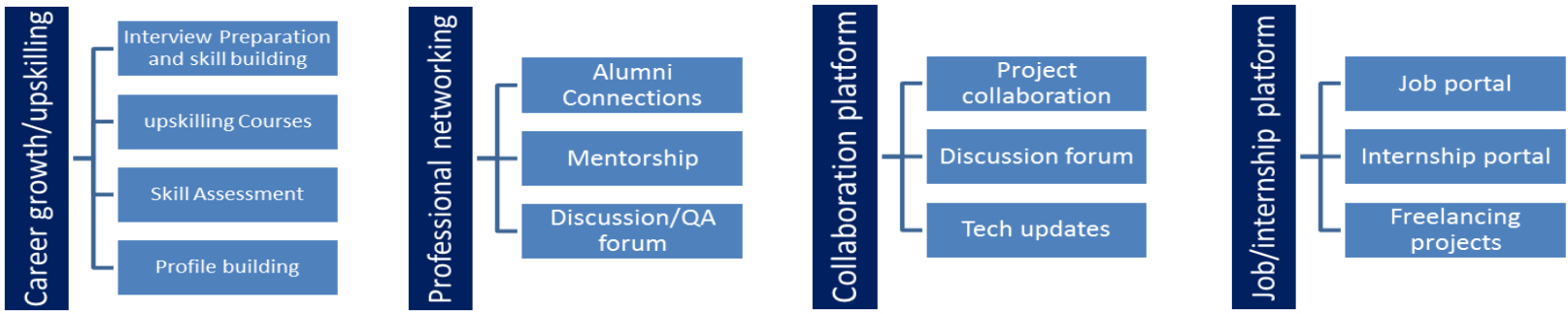
USC is a career development platform that delivers **personalized executive coaching** in a more affordable, scalable and measurable way.



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.

3 Problem Statement

In the assigned problem statement

Manual queue systems often lead to crowding, confusion, and inefficient service, especially in high-footfall areas like hospitals or government offices. There is a lack of automation, transparency, and real-time monitoring in existing queue systems, resulting in poor user experience and delays.

4 Existing and Proposed solution

Existing Solution: Traditional systems use manual ticketing or basic token displays. These systems do not authenticate users or provide real-time updates and cloud integration.

Proposed Solution: A smart, automated queue management system using Raspberry Pi with face recognition, token dispensing, cloud data logging, and real-time analytics to improve efficiency, reduce wait times, and enhance the overall experience.

4.1 Code submission (Github link)

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

5 Proposed Design/ Model

A modular smart queue system that integrates sensors, a Raspberry Pi, camera module, token dispenser, cloud storage, and a display system for real-time updates.

5.1 High Level Diagram

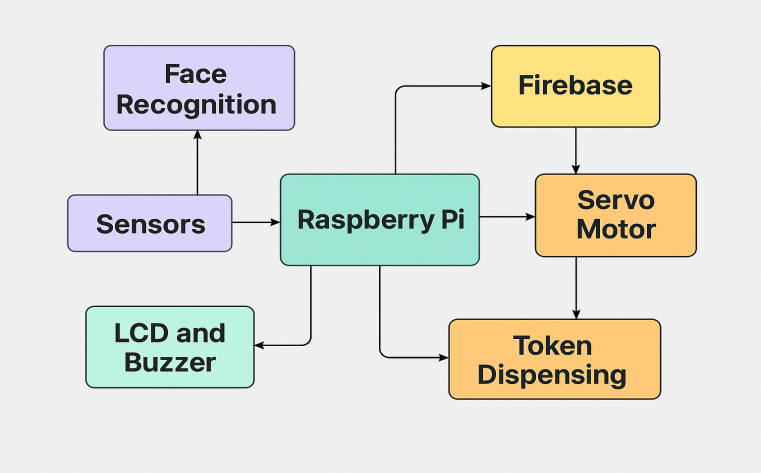
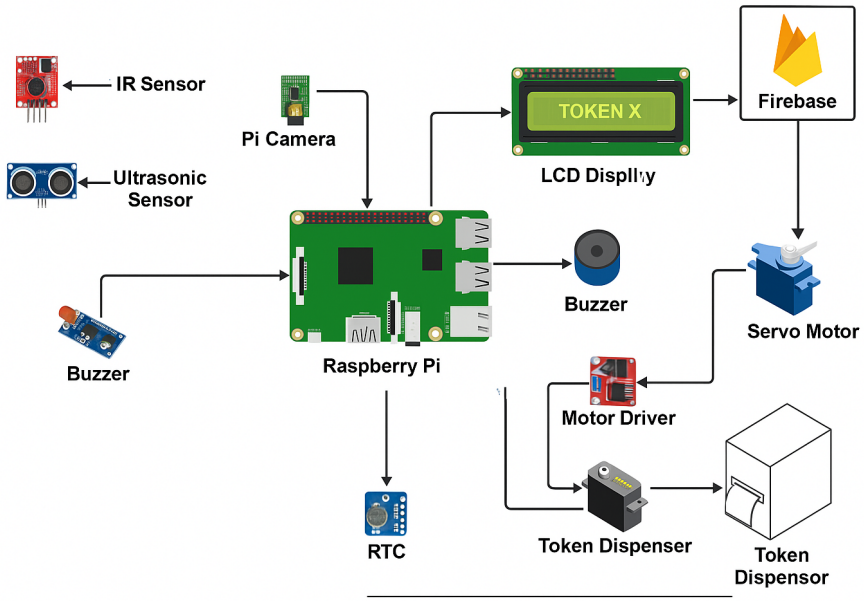


Figure 1: HIGH LEVEL DIAGRAM OF THE SYSTEM

5.2 Low Level Diagram



5.3 Interfaces

The system interacts with multiple hardware and software components to manage and control the smart queue effectively. The interfaces are:

User Interface (Face Recognition Camera + LCD Display):

The Pi camera acts as the user identification interface by capturing the user's face and verifying identity using OpenCV-based facial recognition. The 16x2 LCD display provides real-time feedback to the user, such as current queue status, assigned token number, and instructions.

Token Interface (Dispenser + Button):

Once the user is recognized, a motorized token dispenser issues a physical token. A push-button can be used to manually start or reset the token generation process.

Sensor Interface (IR Sensor + Ultrasonic Sensor):

The IR sensor detects the presence of a user in front of the system, while the ultrasonic sensor counts the number of people in the queue and measures distance for precise crowd detection.

Access Control Interface (Servo Motor + LEDs + Buzzer):

The servo motor operates a physical gate or barrier, allowing or denying access based on token validation. The LEDs (green, red, yellow) provide visual status indicators, and the buzzer alerts the user when it's their turn.

Cloud Interface (Firebase/Thingspeak):

The Raspberry Pi communicates with a cloud database like Firebase to store token data, time of issue, and user logs. This allows administrators to monitor the system remotely and retrieve historical data.

Wi-Fi Network Interface:

Used to connect the Raspberry Pi to the internet for cloud synchronization and real-time data updates.

6 Performance Test

To ensure the reliability and efficiency of the Smart Queue Management System, a series of performance tests were conducted. These tests focused on verifying the functionality of each module, evaluating system response times, and confirming data synchronization with the cloud. The testing was aimed at simulating real-world conditions to ensure the system performs accurately in practical scenarios, including environments like hospitals or government offices. The performance evaluation covered the complete workflow — starting from user detection and face recognition to token generation, gate control, and data logging in Firebase.

6.1 Test Plan/ Test Cases

The system was tested for different real-life use cases and operating conditions. This included verifying whether the IR sensor detects a person standing in front of the system, whether the ultrasonic sensor correctly measures queue length, and whether the face recognition module authenticates users accurately. Once a person is authenticated, the token dispensing module was tested to see if it issues a physical token and updates the LCD screen with the correct token number. The system was then observed to confirm that this data is pushed to Firebase along with the timestamp. The gate mechanism was also tested to ensure it allows entry only for valid tokens and the correct token number. Notifications via buzzer and LEDs were also tested under different scenarios such as early arrival, no token, or valid token. Overall, system response time and consistency were observed throughout all test cases.

6.2 Test Procedure

The system was first powered on and checked for proper startup. A person stood in front of the IR sensor to start the process. The camera performed face recognition, and if the person was verified, a token was given through the dispenser. The token number was shown on the LCD screen, and the same data was sent to the cloud. After some time, when that token number was called, the person came back. The system checked the token and, if valid, opened the gate using a servo motor. The LEDs and buzzer gave the signal to move forward. Each step was observed to ensure it worked correctly and without delay.

6.3 Performance Outcome

The system worked well during testing. It accurately detected people, recognized faces, gave tokens, and allowed entry based on the token number. All token data was stored in the cloud correctly. The LCD, buzzer, and LEDs responded on time, and the gate opened smoothly. The overall system performance was fast and reliable in normal conditions.

7 My learnings

- Integrated hardware components like sensors, camera, and servos.
- Gained hands-on experience with Raspberry Pi GPIO programming.
- Learned face recognition using Python & OpenCV.
- Implemented real-time cloud sync with Firebase.
- Understood system testing, debugging, and real-world deployment challenges.

8 Future work scope

- Add Aadhaar/QR code-based identity verification.
- Implement a multilingual voice assistant.
- Add AI-based priority system for elderly or emergency cases.
- Develop a mobile app for queue tracking and token alerts.
- Use machine learning to predict wait times and user flow.
- Integrate a thermal scanner for health monitoring during entry.