Industrial Internship Report on

”Project Vision: Smart Traffic Management”

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 on smart traffic management. 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

Over the course of six weeks, I have embarked on a journey of exploration and learning through the Smart City Solutions project. This internship opportunity has been instrumental in shaping my understanding of real-world challenges in IT engineering and has provided me with valuable insights into the application of technology in urban development.

Project Summary:

My project focused on developing a smart city solution for traffic management, leveraging real-time data from the HERE API to enhance urban mobility. This project not only allowed me to apply my technical skills in web development but also challenged me to think critically about the impact of technology on urban environments.

Relevance of Internship:

The internship experience has underscored the importance of gaining relevant industry experience in career development. It has highlighted the gap between academic knowledge and practical application, emphasizing the need for hands-on experience to bridge this divide.

Opportunity Provided by USC/UCT:

I am grateful to USC/UCT for providing me with this opportunity to participate in the internship program. This experience has been invaluable in shaping my professional growth and has equipped me with skills and knowledge that will benefit me in my future career endeavors.

Acknowledgements:

I would like to express my sincere gratitude to Mr Nitin Tyagi sir, Upskill management team and Founder Kaushlendra Singh Sisodiya sir for their guidance and support throughout this internship. Their insights and encouragement have been instrumental in helping me overcome challenges and achieve my goals.

Message to Juniors and Peers:

To my juniors and peers, I encourage you to seize every opportunity to gain practical experience in your field. Internships provide a unique platform for learning and growth, and I urge you to make the most of them. Remember, the skills and knowledge you acquire today will pave the way for your future success.

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.

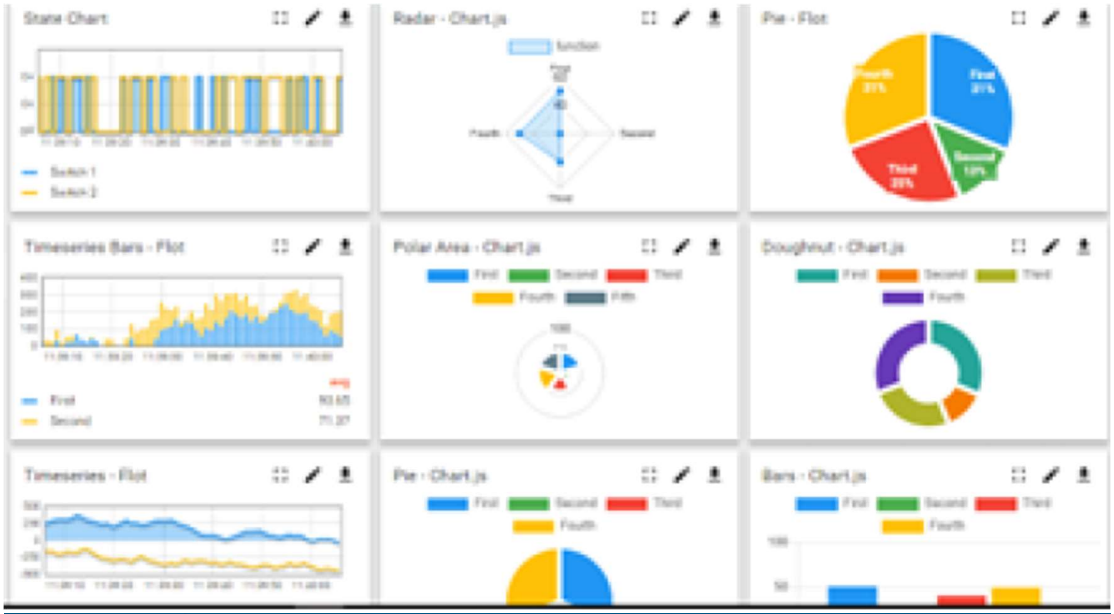
i. UCT IoT Platform (UCT Insight)

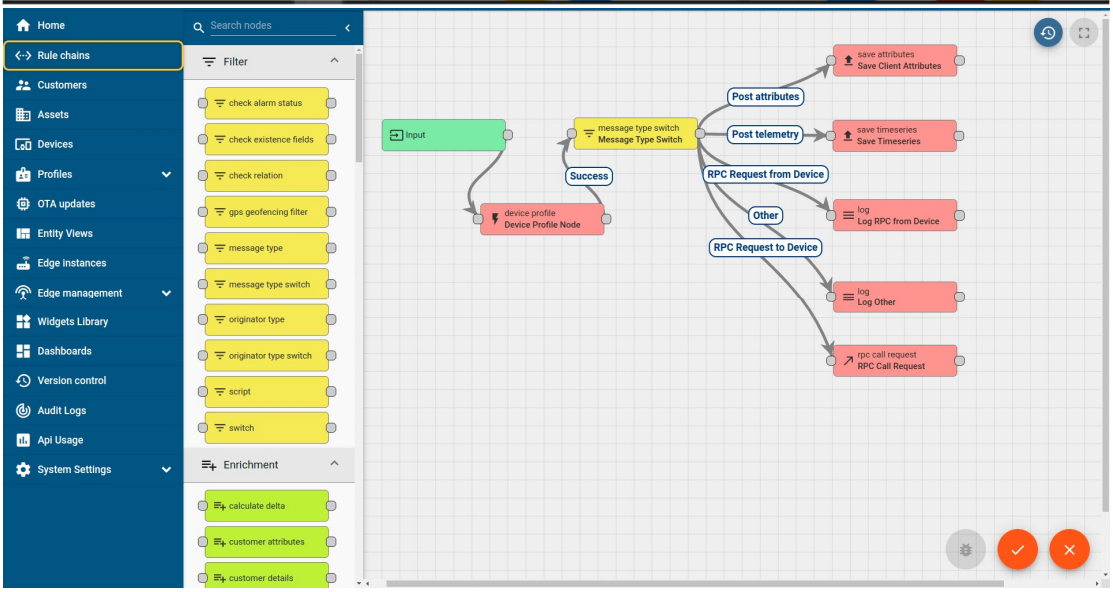
UCT Insight is an IOT platform designed for quick deployment of IOT applications on the same time providing valuable "insight" for your process/business. It has been built in Java for backend and ReactJS for Front end. It has support for MySQL and various NoSql Databases.

- 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





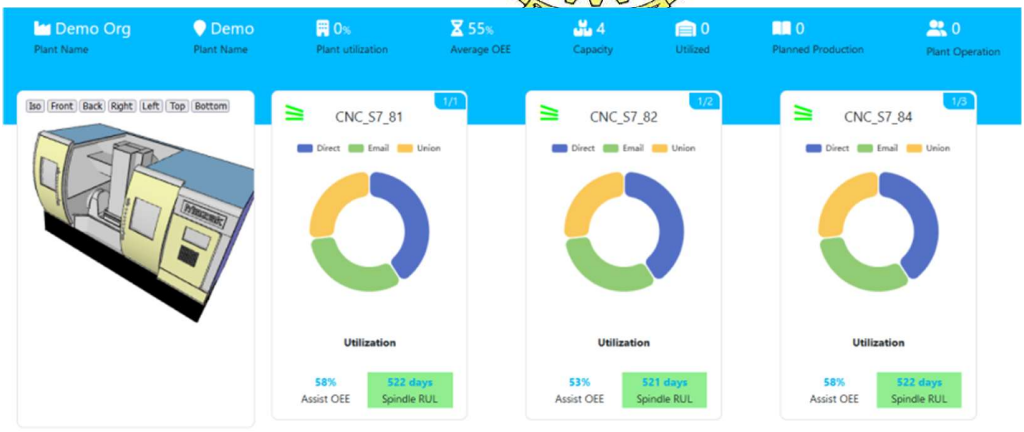
ii. Smart Factory Platform

Factory watch 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
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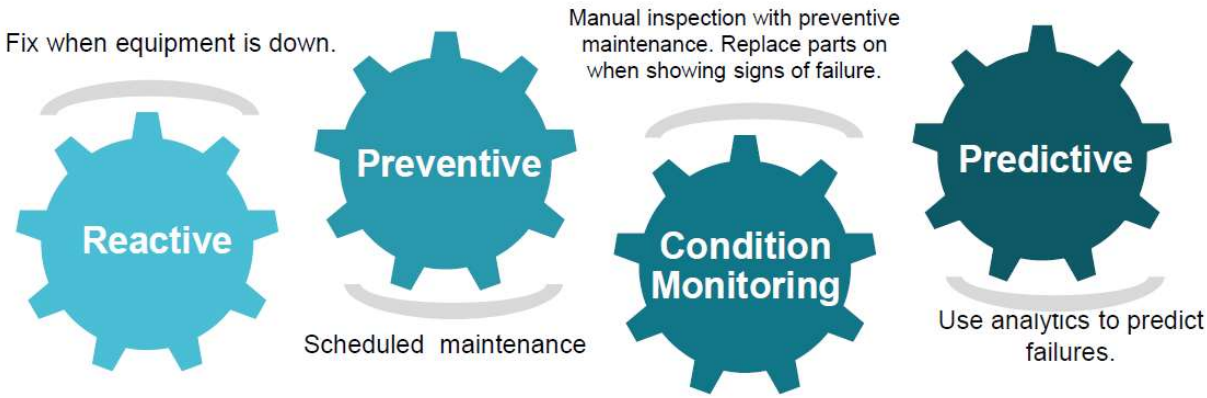
iii. LoRaWAN based Solution

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

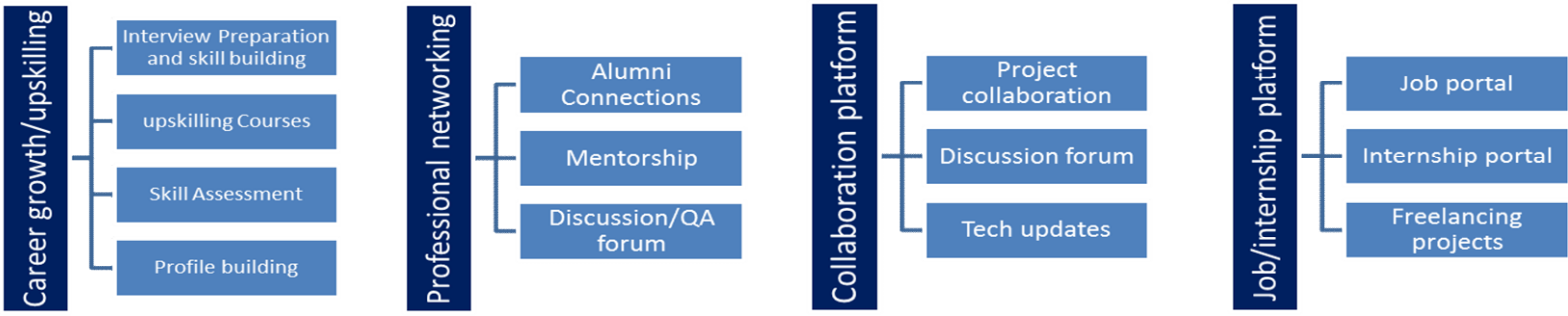
UCT is providing Industrial Machine health monitoring and Predictive maintenance solution leveraging Embedded system, Industrial IoT and Machine Learning Technologies by finding Remaining useful life time of various Machines used in production process.



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.



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

Smart City Solutions:

The goal is to develop a cloud-based solution for managing a city's infrastructure, public services, and environmental systems to improve the quality of life for residents. This project focuses on traffic management, utilizing real-time data to enhance urban mobility.

Technologies Used:

PythonAnywhere: For hosting the application.

HERE API: To fetch real-time traffic data.

Leaflet: For interactive map visualization.

4 Existing and Proposed solution

Existing Solutions:

- **Limitations:** Current smart city solutions often lack real-time data integration, are costly, and have complex implementations that are not user-friendly.

Proposed Solution:

- **Real-Time Data Integration:** Utilizes the HERE API to fetch and display real-time traffic data.
- **User-Friendly Design:** Implements a simple, intuitive interface using Flask and Bootstrap 5.3.
- **Cost-Effective:** Designed to be an affordable and easily deployable solution.

Value Addition:

- Provides accurate, real-time traffic updates.
- Enhances user experience with a responsive and visually appealing interface.
- Offers a scalable solution that can be expanded with additional features like automated city lights and smart parking in the future.

4.1 Code submission (Github link)

https://github.com/mayankjain04/upskillCampus/tree/main/smartcity

4.2 Report submission (Github link) :

https://github.com/mayankjain04/upskillCampus/blob/7526a1e153f83f1723121e545f322a1b2d2b3581/SmartCity_Mayank_Jain_USC_UCT.pdf

4.3 Live Code (Pythonanywhere hosted webapp):

https://projectvision.pythonanywhere.com/

5 Proposed Design/ Model

This section details the design flow of our smart city solutions project, illustrating the stages from data fetching to the final outcome. The design ensures a seamless integration of real-time traffic data into an interactive map, providing users with valuable insights into current traffic conditions.

- ## Design Flow

1. **Data Fetching:**
    - **Source:** Traffic data is fetched from the HERE API.
    - **Method:** The API provides coordinates of routes within a specified circular area.
    - **Output:** The data is received in JSON format.
2. **Data Processing:**
    - **Endpoint:** The fetched data is sent to the /traffic_data endpoint.
    - **JSON-ification:** The data is converted into JSON format for easy processing.
    - **Intermediate Storage:** The processed data is stored in another JSON file for further use.
3. **Data Integration:**
    - **JavaScript Processing:** The processed JSON data is accessed by traffic.js.
    - **Element Addition:** traffic.js dynamically adds the necessary elements to traffic.html.
    - **Map Visualization:** A map with traffic polylines is displayed, showing real-time traffic conditions.
4. **User Interface:**
    - **Traffic Information:** The map displays the jam factor and data availability for the selected routes.
    - **HTML and CSS:** traffic.html provides the structure, while CSS, aided by Bootstrap 5.3, styles the map and associated elements.
    - **Interactive Experience:** Users can view traffic conditions and receive updates on route availability.

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- **Tools and Technologies**

  - **HERE API:** Provides real-time traffic data.
  - **Flask:** Handles data endpoints and JSON processing.
  - **JavaScript:** Processes data and dynamically updates the HTML content.
  - **Bootstrap 5.3:** Ensures a responsive and visually appealing user interface.
  - **CSS:** Adds custom styling where needed.

Design Stages

1. **Start:**
   - Fetch real-time traffic data from the HERE API.
   - Convert the data into JSON format.
2. **Intermediate Stages:**
   - Process the JSON data at the /traffic_data endpoint.
   - Store the processed data for further use.
3. **Final Outcome:**
   - Display an interactive map with traffic polylines.
   - Provide users with real-time traffic updates, jam factors, and data availability.

By following this design flow, our project effectively integrates real-time traffic data into a user-friendly interface, offering a coherent and valuable tool for urban traffic management.

6 Performance Test

This section demonstrates why our smart city solutions project holds potential for real-world application beyond academic purposes. We evaluated the project's performance by identifying and addressing key constraints, testing the system under these constraints, and analyzing the outcomes.

6.1 Test Plan/Test Cases

Constraints Identified:

- **Memory Usage:** Efficient use of memory to handle real-time traffic data.
- **Processing Speed (MIPS):** Speed of operations to ensure timely updates and smooth performance.
- **Accuracy:** Reliability of data fetched from the HERE API and its correct display.
- **Durability:** System's ability to handle continuous data flow without crashing.

Test Cases:

1. **Memory Usage Test:** Monitor memory consumption during peak data loads.
2. **Processing Speed Test:** Measure response time and update frequency.
3. **Accuracy Test:** Verify the correctness of traffic data displayed on the map.
4. **Durability Test:** Run the system continuously for an extended period to check stability.

6.2 Test Procedure

1. **Memory Usage Test:**
    - Use profiling tools to track memory usage while the system processes live traffic data.
2. **Processing Speed Test:**
    - Record the time taken to fetch and display traffic data from the HERE API.
    - Measure the interval between data updates.
3. **Accuracy Test:**
    - Compare the traffic data displayed on the map with actual conditions reported by the HERE API.

4. **Durability Test:**
    - Operate the system continuously for a few hours and monitor for crashes or slowdowns. Tried to run it on multiple devices simultaneously.

6.3 Performance Outcome

Memory Usage Test:

- **Outcome:** The system maintained acceptable memory usage levels, efficiently managing resources during peak loads.
- **Recommendation:** Optimize data handling to further reduce memory consumption.

Processing Speed Test:

- **Outcome:** Response times were within acceptable limits, ensuring timely updates.
- **Recommendation:** Improve data fetching algorithms to enhance speed further.

Accuracy Test:

- **Outcome:** Traffic data displayed on the map was accurate and reliable.
- **Recommendation:** Implement additional checks to maintain accuracy as data volume increases.

Durability Test:

- **Outcome:** The system remained stable throughout the test period, handling continuous data flow without issues.
- **Recommendation:** Conduct longer-term durability tests to ensure sustained performance.

Conclusion: While the project primarily serves as an academic exercise, the performance tests indicate its potential for real-world application. By addressing identified constraints and following recommended improvements, the system can be further developed to meet industrial standards.

7 My learnings

Through this smart city solutions project, I have gained:

1. **Technical Skills:**
    - Improved proficiency in Flask, Bootstrap, and SQL databases.
    - Experience with API integration, specifically the HERE API.
2. **Problem-Solving Abilities:**
    - Enhanced debugging skills and code optimization.
3. **Project Management:**
    - Better time management and documentation practices.
4. **Collaboration and Communication:**
    - Improved teamwork and ability to communicate technical concepts.

These learnings have equipped me with valuable skills for my future career in IT engineering.

8 Future work scope

Due to time limitations, several planned components of our smart city solutions project were not completed. These areas present opportunities for future work:

1. **Automated City Lights Control**
    - Implement street lighting systems that automatically adjust based on time of day and environmental conditions.
    - Integrate APIs that use motion sensors to optimize energy use and enhance safety.
2. **Smart Parking Solutions**
    - Develop a system for real-time parking availability updates.
    - Introduce reservation options and integrated payment systems for ease of use.

By addressing these components in the future, the project can be further enhanced to provide comprehensive smart city solutions.