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Industrial Internship Report on

”Object Counter System”

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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. I had to finish the project including the report in 6 weeks’ time. My project was (Object Counter System Project) 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

During this six-week internship, I was tasked with developing a Real-Time Object Counter System. The project provided an opportunity to apply machine learning and computer vision skills in a practical industrial context, addressing real-world challenges. I am grateful to UniConverge Technologies Pvt Ltd and upskill Campus for the opportunity to work on this project, which significantly contributed to my understanding of industrial applications of technology.

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.

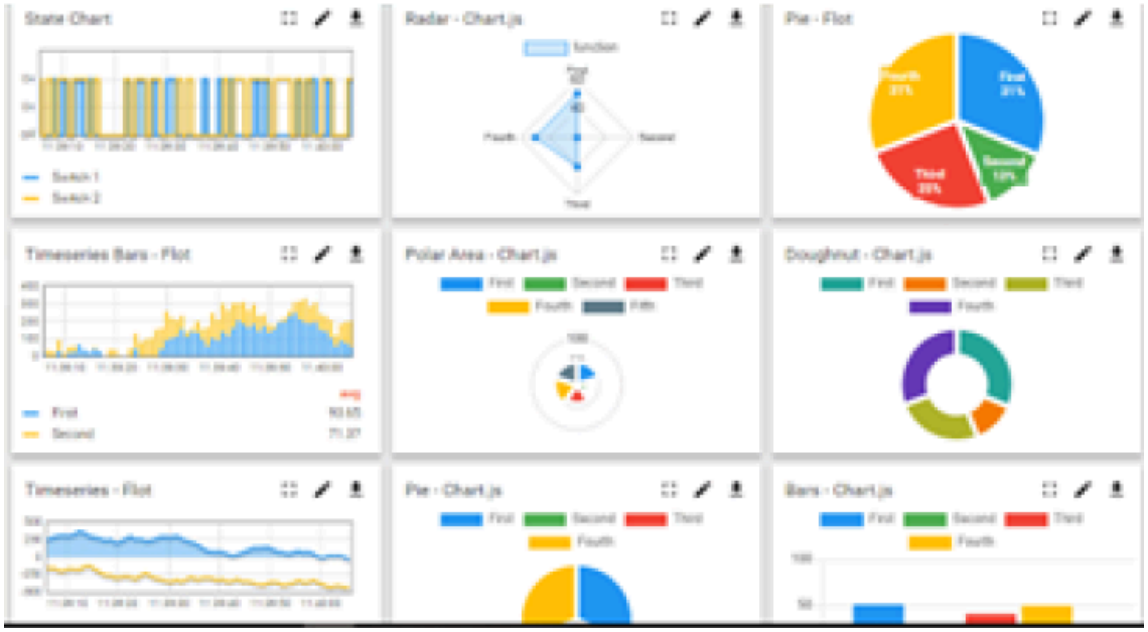
i. UCT IoT Platform (Insight)

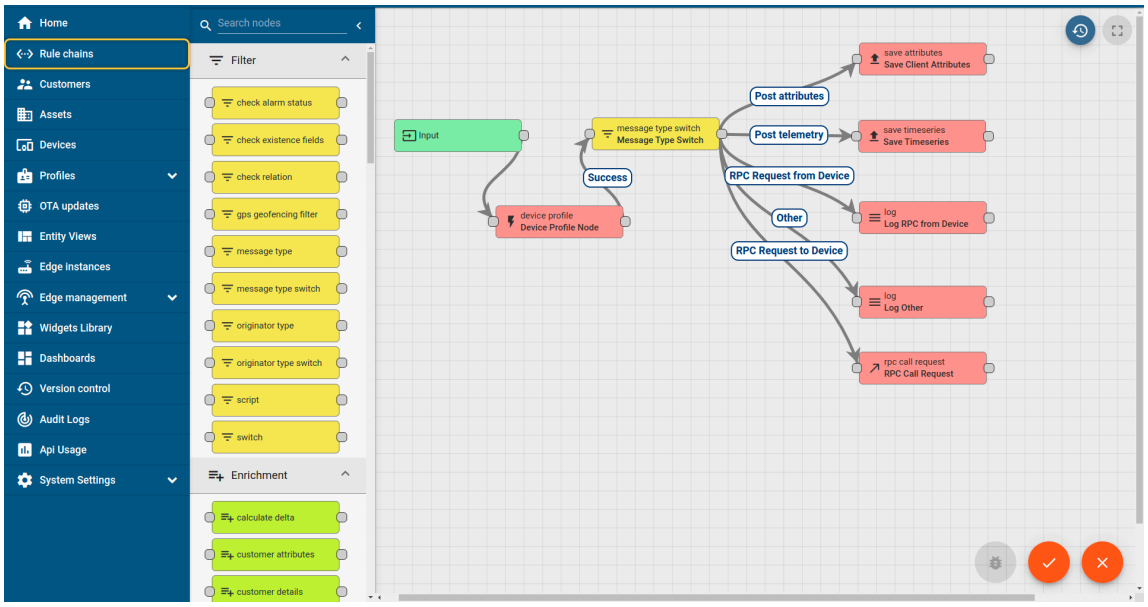
UCT Insight is an IOT platform designed for quick deployment of IOT applications on the same time providing valuable “insight” for your process/business. It has been built in Java for backend and ReactJS for Front end. It has support for MySQL and various NoSql Databases.

- 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.

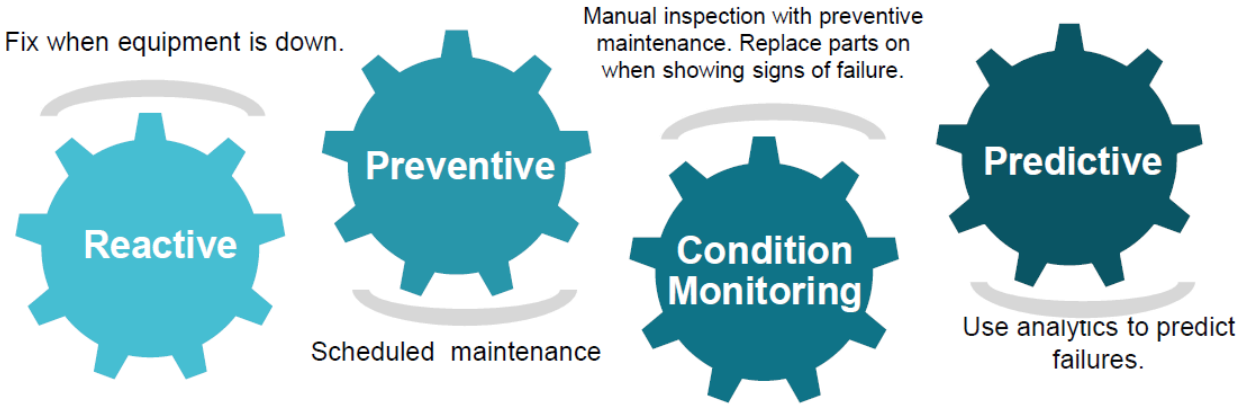
Machine	Operator	Work Order ID	Job ID	Job Performance	Job Progress		Output		Rejection	Time (mins)				Job Status	End Customer
					Start Time	End Time	Planned	Actual		Setup	Pred	Downtime	Idle		
CNC_S7_81	Operator 1	WO0405200001	4168	58%	10:30 AM		55	41	0	80	215	0	45	In Progress	i
CNC_S7_81	Operator 1	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 m additional support services e.g. Internship, projec ndustry experts, Career growth Services

h lcampus.com/

upSkill Campus aiming to upskill 1 million ext 5 year

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

•Gain practical industrial experience.

•Develop a solution to a real-world problem using machine learning and computer vision.

•Enhance understanding of object detection and counting technologies.

•Contribute to the potential industrial applications of the developed system.

2.5 Reference

[1] Redmon, J., & Farhadi, A. (2018). YOLOv3: An Incremental Improvement.

[2] Zhang, Z., & Tao, X. (2020). Real-time Object Counting with Computer Vision and Deep Learning.

[3] Pereira, L., & Gonçalves, P. (2021). Integrating Machine Learning Models into Industrial IoT Systems.

2.6 Glossary

Terms	Acronym
YOLO (You Only Look Once)	A state-of-the-art, real-time object detection system that identifies and localizes objects within an image in a single pass through the network, known for its speed and accuracy.
Object Detection	The process of identifying and locating objects within an image or video feed.
Computer Vision	A field of artificial intelligence that enables computers to interpret and make decisions based on visual data from the world, such as images and videos.
Deep Learning	A subset of machine learning that uses neural networks with many layers (deep networks) to model complex patterns in data.
Frame Differencing	A basic computer vision technique that detects moving objects by comparing differences between consecutive video frames.

3 Problem Statement

In the assigned problem statement

The goal of the project was to design and implement a Real-Time Object Counter System that can accurately detect and count objects in a video feed. This system is intended to be used in environments such as factories, warehouses, and public spaces where automated monitoring and counting are crucial.

4 Existing and Proposed solution

Existing Solutions:

Current solutions for object counting often rely on simpler techniques like frame differencing or blob detection, which can be inaccurate in dynamic environments. Moreover, many existing systems lack real-time capabilities or are unable to handle a large variety of object types.

Proposed Solution:

The proposed solution utilizes the YOLO object detection model, which is known for its accuracy and speed. The model can detect multiple object classes in real-time, making it suitable for diverse applications. This solution aims to improve accuracy, speed, and versatility compared to existing methods.

Value Addition:

The project enhances the accuracy of object detection and counting by leveraging advanced deep learning techniques. The system's ability to function in real-time with high accuracy makes it suitable for industrial applications.

4.1 Code submission (Github link)

https://github.com/crjaiyaduvanshi/upskillcampus/blob/main/BlobDetection.java

4.2 Report submission (Github link)

https://github.com/crjaiyaduvanshi/upskillcampus/blob/main/Final%20Report_Jai%20Yadav.pdf

4.3

5 Proposed Design/ Model

5.1 High Level Diagram

Diagram illustrating the overall architecture, showing the flow from video input to object detection and counting logic.

5.1 Low Level Diagram

Detailed diagram showing the interaction between different components, such as the camera, YOLO model, and counting logic.

5.2 Interfaces

Description of the interfaces used, including data flow, protocols, and any relevant flowcharts or state machines.

6 Performance Test

6.1. Test Plan/ Test Cases

Test cases were designed to evaluate the system's accuracy, speed, and ability to handle multiple objects in various conditions (e.g., different lighting, object sizes).

6.1 Test Procedure

The system was tested using a set of videos with varying complexities, ensuring that it meets the performance criteria for industrial applications.

6.2 Performance Outcome

The system demonstrated a high level of accuracy in counting objects in real-time, with a performance benchmark that aligns with industrial requirements. Constraints such as memory usage and processing speed were also evaluated and optimized.

7 My learnings

This internship provided invaluable experience in developing a real-time system with significant industrial applications. I gained a deeper understanding of object detection technologies and learned how to integrate machine learning models into practical solutions. This experience has greatly enhanced my technical skills and prepared me for future challenges in my career.

8 Future work scope

Future enhancements could include:

Implementing object tracking to improve counting accuracy in crowded scenes. Extending the system to classify and count objects based on custom datasets.

Optimizing the system for deployment on edge devices for more scalable industrial applications.