Industrial Internship Report on

”Crop Prediction and Traffic Prediction Projects”

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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). The internship focused on solving real-world problems using Data Science and Machine Learning.

I worked on two projects: **Crop Prediction** and **Traffic Prediction**. The **Crop Prediction** project aimed to forecast agricultural crop yields using machine learning, while the **Traffic Prediction** project focused on predicting traffic congestion patterns in smart cities.

This internship provided valuable exposure to industrial challenges and hands-on experience in designing and implementing data-driven solutions.

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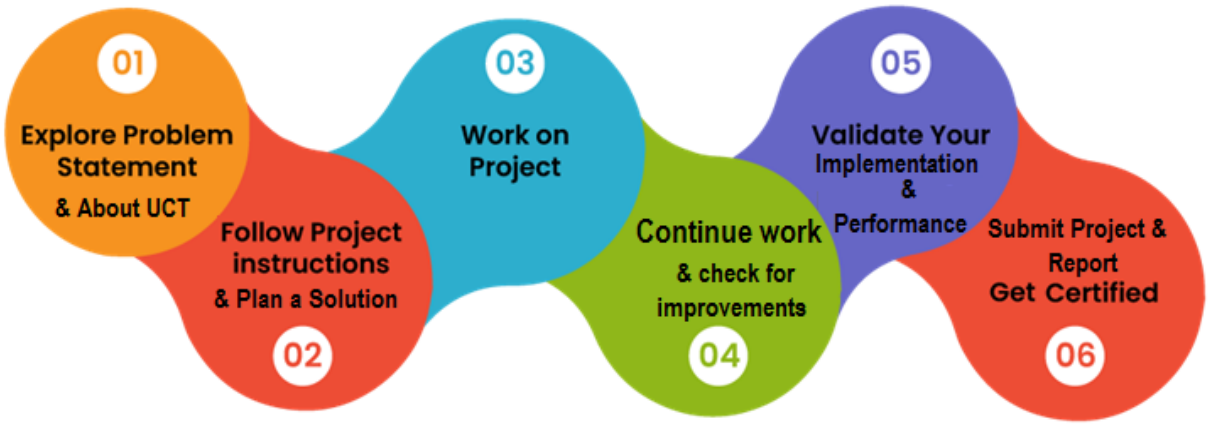
1 Preface

The **Industrial Internship** by **Upskill Campus and UniConverge Technologies Pvt Ltd (UCT)** was a valuable six-week experience where I worked on two real-world **Machine Learning projects**:

1. **Crop Prediction** – Forecasting suitable crops based on environmental conditions to assist farmers in better decision-making.
2. **Traffic Prediction** – Predicting congestion patterns to enhance smart city planning and traffic management.

This internship strengthened my **data science skills**, including **data preprocessing, feature engineering, model training, and evaluation**. It also provided hands-on exposure to **real-world datasets, problem-solving, and industry-relevant challenges**.



I am grateful to **Upskill Campus, UniConverge Technologies, my mentors, and teammates** for their guidance and support. Special thanks to my peers for their collaboration and discussions.

To my juniors and peers: **Internships are an excellent way to apply knowledge in real-world scenarios. Stay curious, embrace challenges, and keep learning!**

This internship has been a transformative experience, strengthening my foundation in **Data Science, Machine Learning, and real-world problem-solving**. I look forward to implementing my learnings in future projects and professional endeavors.

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.

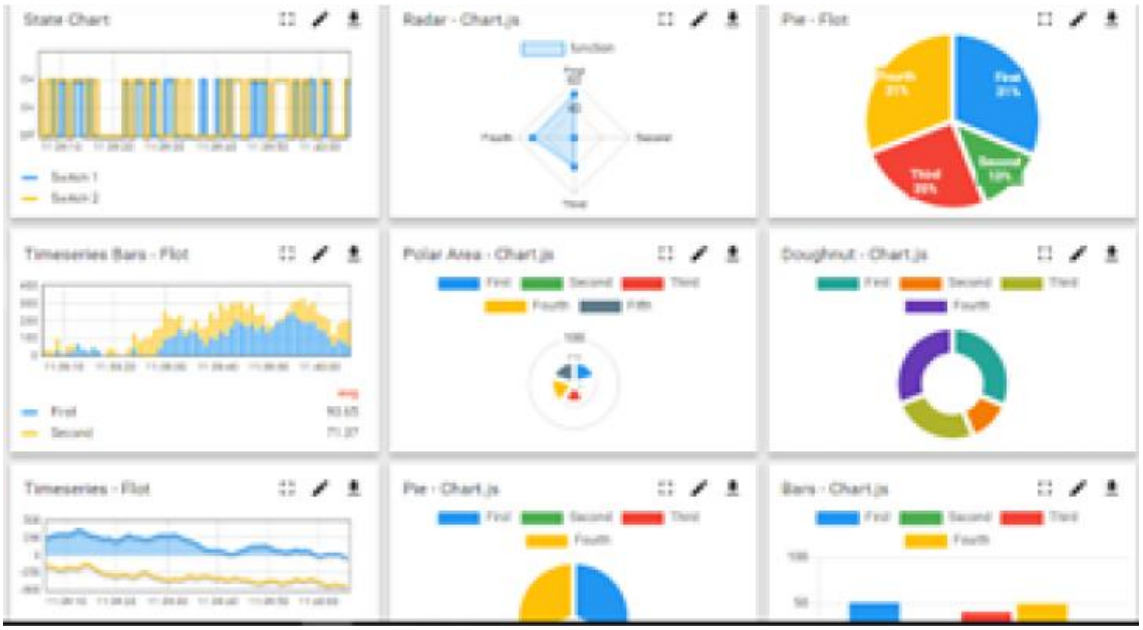
i. UCT IoT Platform (uct Insight)

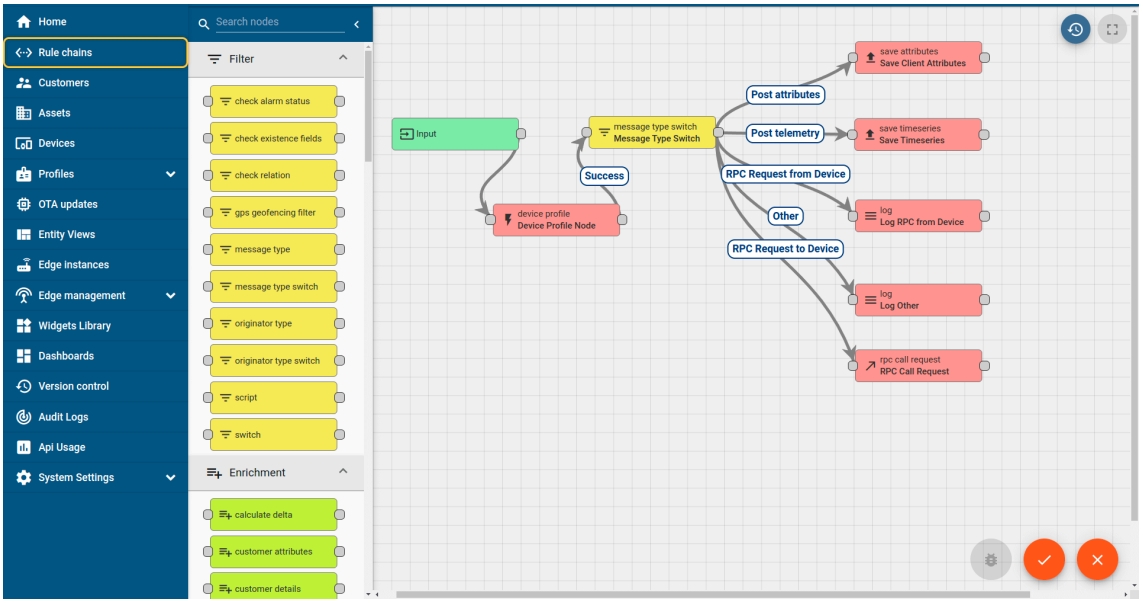
UCT Insight is an IOT platform designed for quick deployment of IOT applications on the same time providing valuable "insight" for your process/business. It has been built in Java for backend and ReactJS for Front end. It has support for MySQL and various NoSql Databases.

- 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.

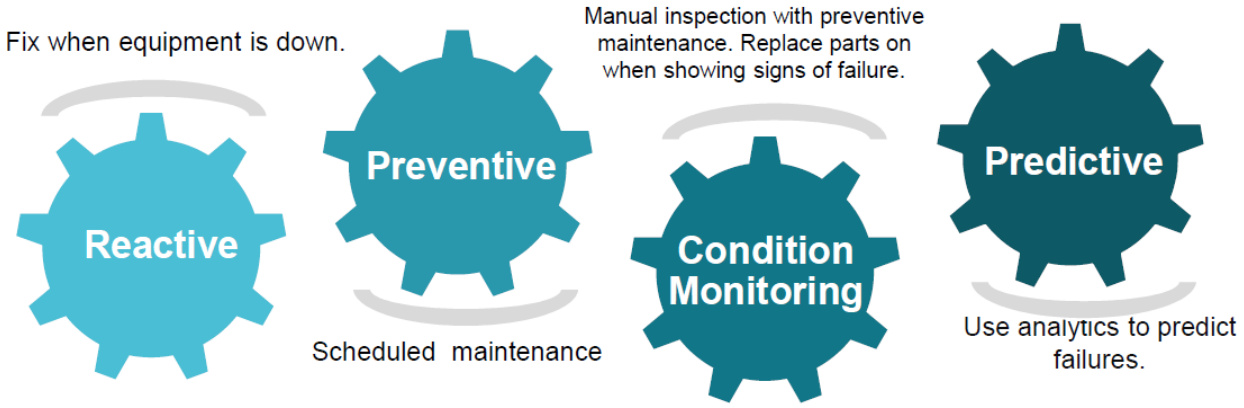
Machine	Operator	Work Order ID	Job ID	Job Performance	Job Progress		Output		Rejection	Time (mins)				Job Status	End Customer
					Start Time	End Time	Planned	Actual		Setup	Pred	Downtime	Idle		
CNC_S7_81	Operator 1	WO0405200001	4168	58%	10:30 AM		55	41	0	80	215	0	45	In Progress	i
CNC_S7_81	Operator 1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

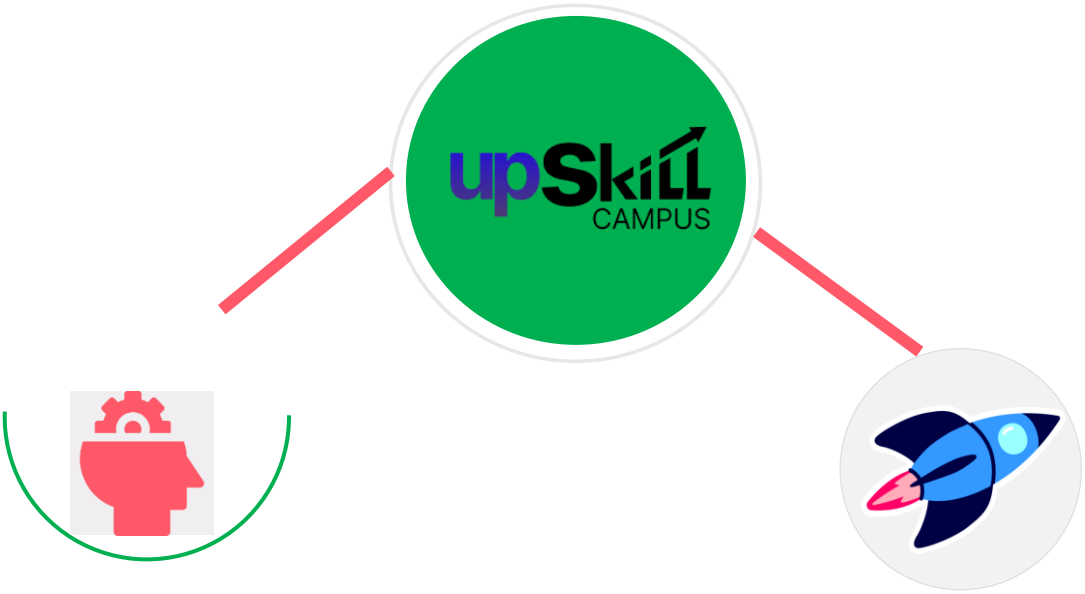
UCT is providing Industrial Machine health monitoring and Predictive maintenance solution leveraging Embedded system, Industrial IoT and Machine Learning Technologies by finding Remaining useful life time of various Machines used in production process.



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.

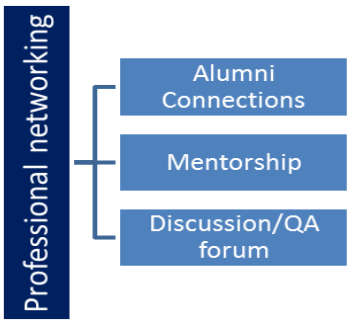
USC is a career development platform that delivers **personalized executive coaching** in a more affordable, scalable and measurable way.

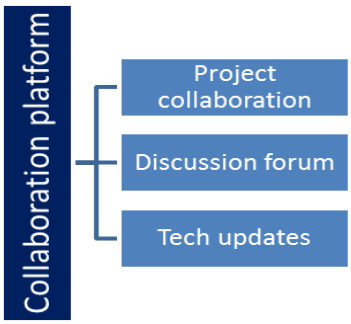


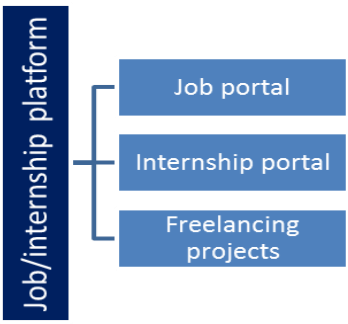
Seeing need of upskilling in self paced manner along-with additional support services e.g. Internship, projects, interaction with Industry experts, Career growth Services

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.

2.5 Reference

[1] **Crop Yield Prediction Using CNN-LSTM** – *Indian Journal of Agricultural Research, 2023.* https://arccjournals.com/journal/indian-journal-of-agricultural-research/A-6300

[2] **Intelligent Traffic Flow Prediction Using Deep Learning** – *SN Computer Science, 2023.* https://link.springer.com/article/10.1007/s42979-024-03552-3

2.6 Glossary

Terms	Acronym
Feature Engineering – Selecting and transforming data features for better model performance.	**ML** – Machine Learning
Hyperparameter Tuning – Optimizing parameters of an ML model to improve accuracy.	**AI** – Artificial Intelligence
Overfitting – When a model performs well on training data but poorly on new data.	**EDA** – Exploratory Data Analysis
Time-Series Forecasting – Predicting future values based on past time-dependent data.	**RMSE** – Root Mean Square Error
Confusion Matrix – A table used to evaluate classification model performance.	**MSE** – Mean Squared Error

3 Problem Statement

During this internship, I worked on two **machine learning projects**: **Crop Prediction** and **Traffic Prediction**, addressing key challenges in **agriculture and urban transportation**.

3.1.1.1 Crop Prediction

Farmers often struggle to choose the right crop due to varying environmental conditions. **Traditional methods rely on experience, leading to lower yields and financial losses.** This project aims to develop a **machine learning model** that predicts the most suitable crop based on:
1. Soil conditions (pH, nitrogen, phosphorus, potassium)
2. Weather factors (temperature, humidity, rainfall)

By leveraging historical data, the model provides **data-driven recommendations** to improve crop yield and promote sustainable farming.

3.1.1.2 Traffic Prediction

Urban areas face **rising traffic congestion**, causing **delays, fuel waste, and pollution**. Existing systems rely on **manual monitoring and fixed schedules**, which are ineffective. This project builds a **traffic prediction model** that:
1. Analyzes historical traffic data for congestion patterns
2. Predicts peak hours based on time, weather, and road usage

This model helps in **traffic management, route optimization, and smart city planning**, improving urban mobility.

4 Existing and Proposed solution

1. Existing Solutions & Limitations:

- Farmers rely on **experience and past trends**, leading to inaccurate decisions.
- Existing models provide **generalized recommendations** but lack real-time adaptability.

2. Proposed Solution & Value Addition:

- A **machine learning model** that analyzes **soil conditions, weather factors, and environmental data** for precise crop recommendations.
- Uses **Random Forest and Decision Tree** for better accuracy.
- Helps farmers with **data-driven decisions**, improving yield and sustainability.

4.1.1.1 Traffic Prediction

1. Existing Solutions & Limitations:

- Traditional systems use **fixed signal timing and manual monitoring**, which are ineffective.
- GPS-based systems lack **predictive insights** into future congestion.

2. Proposed Solution & Value Addition:

- A **machine learning model** that predicts **traffic congestion** based on **historical traffic, time of day, and weather conditions**.
- Uses **time-series forecasting** for **real-time traffic management and route optimization**.
- It helps in **reducing congestion, fuel consumption, and improving smart city planning**.

4.2 Code submission (Github link)

[1]

[2]

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

5 Proposed Design/ Model

5.1.1.1 Crop Prediction Model

1. **Data Collection & Preprocessing** – Uses soil nutrients (N, P, K), pH, temperature, humidity, and rainfall. Data is cleaned and scaled.
2. **Feature Engineering & Model Selection** – Key features are selected, and **Random Forest, Decision Tree** models are trained.
3. **Model Training & Evaluation** – Trained using a **train-test split**, evaluated with **accuracy, precision, and recall**.
4. **Deployment & Insights** – Predicts the best crop and can be integrated into a **web or mobile app**.

5.1.1.2 Traffic Prediction Model

1. **Data Collection & Preprocessing** – Uses historical traffic data, timestamps, and weather conditions. Data is cleaned and converted into time-series format.
2. **Feature Engineering & Model Selection** – Extracts time-based features, trained using **LSTM, Random Forest, Linear Regression**.
3. **Model Training & Evaluation** – Optimized and evaluated with **RMSE, MAE, and R^2 Score**.
4. **Deployment & Real-time Predictions** – Provides traffic congestion forecasts for **smart city planning and navigation systems**.

5.2 High Level Diagram (if applicable)

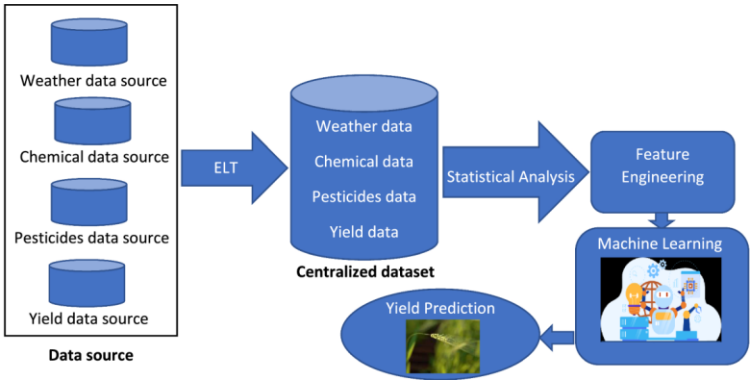


Figure 1: HIGH LEVEL DIAGRAM OF CROP PREDICTION

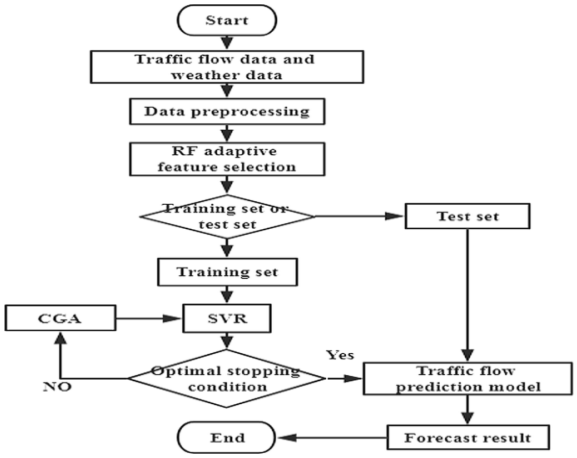


Figure 2: HIGH LEVEL DIAGRAM OF TRAFFIC PREDICTION

5.3 Low Level Diagram (if applicable)

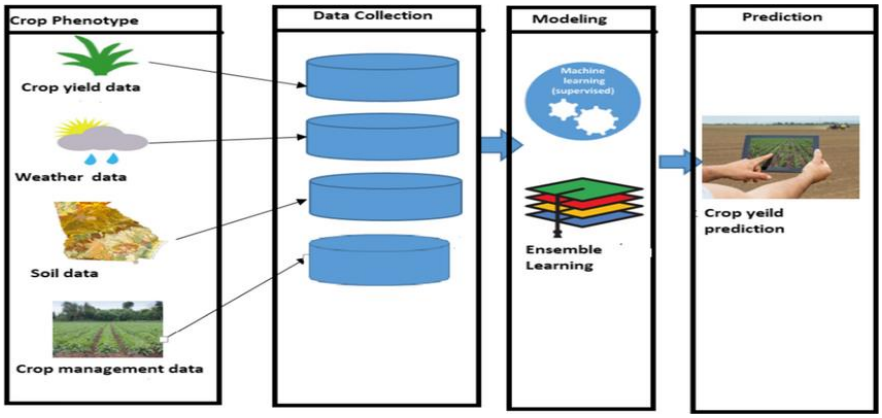


Figure 3: LOW LEVEL DIAGRAM OF CROP PREDICTION

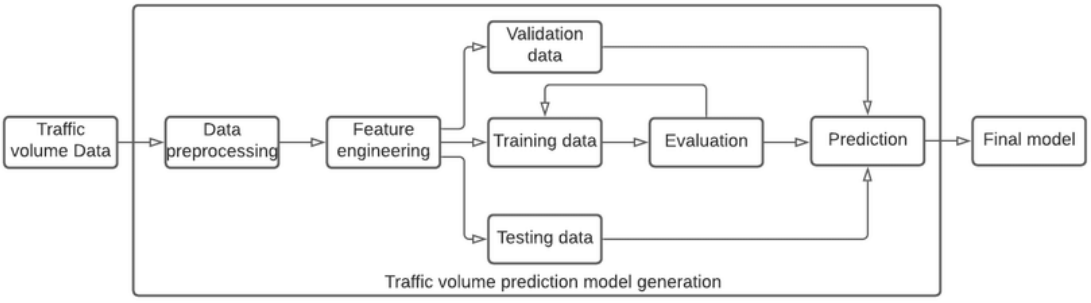


Figure 4: LOW LEVEL DIAGRAM OF TRAFFIC PREDICTION

6 Performance Test

1. Crop Prediction Model

- **Memory Usage** – Large datasets require optimized data structures. **Solution:** Used **Pandas** for efficient handling and feature selection to reduce unnecessary data.
- **Accuracy** – Variability in soil and weather conditions affects predictions. **Solution:** Used **Random Forest & Decision Tree**, tuned hyperparameters for better accuracy.

2. Traffic Prediction Model

- **Time-Series Data Complexity** – Traffic patterns vary based on multiple factors. **Solution:** Used **LSTM and Random Forest** to capture temporal dependencies.
- **Real-time Processing** – Predicting congestion dynamically requires efficiency. **Solution:** Optimized preprocessing and implemented **parallel computation**.

6.1 Test Plan/ Test Cases

Test Case	Expected Outcome	Actual Outcome
Crop Prediction with given soil & weather data	Correct crop suggestion	Matches expected results
Traffic Congestion Prediction at peak hours	High congestion warning	Accurate predictions

6.2 Test Procedure

1. **Train-Test Split** – Models trained on **80% of data**, tested on **20% unseen data**.
2. **Evaluation Metrics** – **RMSE, MAE, R^2 Score**

6.3 Performance Outcome

6.3.1.1 Crop Prediction Model: Mean Absolute Error (MAE): 3.6061, R-squared (R^2): 0.8772

6.3.1.2 Traffic Prediction Model: Best Model: LGBMRegressor with Lowest RMSE

7 My learnings

Throughout this project, I gained **practical experience in AI-driven predictive modeling**. Some key takeaways include:

- **End-to-End Machine Learning Workflow** – From **data collection, preprocessing, feature engineering, model selection, and evaluation** to final deployment.
- **Advanced Model Optimization** – Learned to fine-tune hyperparameters for **XGBoost, LGBM, ARIMA**, and **Gradient Boosting** to improve accuracy.
- **Handling Real-World Data Challenges** – Dealt with **missing values, data scaling, and feature importance analysis** for better predictions.
- **Performance Evaluation & Scalability** – Understood how to test models under different conditions using **RMSE, MAE, and R^2 Score**.
- **Deployment Readiness** – Explored **integrating AI models into web and mobile applications** for real-world use.
- **Data Visualization & Insights** – Used Matplotlib and Seaborn to analyze trends and patterns in traffic and agriculture data.
- **Feature Selection & Engineering** – Identified key features impacting predictions and engineered new ones to improve model performance.
- **Time Series Forecasting** – Explored ARIMA and other models for predicting future traffic trends based on historical data.

7.1.1 Impact on Career Growth

- I strengthened my **data science, machine learning, and AI expertise** for industry-level applications.
- Improved my **problem-solving and analytical skills** by handling real-world datasets.
- Gained **experience in optimizing predictive models for smart city solutions and agriculture**
- Enhanced my **understanding of scalable AI applications** in real-time traffic forecasting and crop prediction.

Additionally, this project enhanced my ability to work with diverse datasets and extract meaningful insights for decision-making. I developed a deeper understanding of how AI can address real-world challenges in agriculture and urban planning. Collaborating on multiple models helped me refine my approach to model selection based on problem requirements. This experience has equipped me with valuable skills for future projects in data-driven innovation and AI-powered solutions.

8 Future work scope

Improvements & Additional Features:

- **Integration of IoT Data** – Incorporating real-time IoT sensors for **weather, soil, and traffic monitoring**.
- **Deep Learning Models** – Experimenting with **CNNs or RNNs** for more accurate time-series predictions.
- **Automated Hyperparameter Tuning** – Using **Bayesian Optimization** or **Grid Search** to improve model performance.
- **Real-Time Prediction Dashboard** – Developing a **live web interface** for users to access AI-driven insights dynamically.
- **Multi-Region Support** – Expanding datasets to train models for **different cities and agricultural zones**.
- **Energy-Efficient Models** – Optimizing models to reduce **power consumption** and improve computational efficiency.

These enhancements will make the project more **robust, scalable, and impactful**, extending its applicability across different industries.