# TrackFlow: A Shipment Tracking System

## Minor Project-II (ENSI252)

*Submitted in partial fulfilment of the requirement of the degree of*

**BACHELOR OF TECHNOLOGY in Computer Science and Engineering with Specialization (AI-ML)**

*to*

## K.R Mangalam University

*by*

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Department of Computer Science and Engineering

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April 2025

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# Project Use Case & Deployment Confirmation Certificate

This is to formally acknowledge that the following student(s) from K.R. Mangalam University have successfully undertaken and completed an industry-based project under our mentorship, in alignment with the stated objectives and requirements of our organization.

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**Project Details:**

- **Project Title:** Shipment Tracking
- **Domain/Technology Used:** Node.js, Express.js, MySQL, FileZilla
- **Industry Use Case / Business Problem Addressed:**

The need for a reliable, real-time shipment tracking system for an airline company.

- **Expected Outcome/Utility of the Project in Our Organization:**

It enables customers and internal teams to monitor the shipment status accurately and efficiently.

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**Mentor Declaration & Disclaimer:**

I, the undersigned, hereby declare that:

1. The above-mentioned project has been developed by the student(s) under my guidance and supervision.
2. The project addresses a real-world use case relevant to our organization.
3. The student(s) have demonstrated the ability to **successfully deploy the solution** in a functional or pilot-ready form.
4. The developed project has the potential to be adopted/implemented for the intended purpose within our organization.
5. All intellectual property rights, confidentiality, or proprietary rights, if applicable, are governed by our internal policies and this document does not transfer any such rights.

**Industry Mentor Details:**

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# ABSTRACT

In the rapidly evolving logistics industry, real-time shipment tracking is critical for operational efficiency and customer satisfaction. QuickBox India, a logistics provider, faced challenges due to the absence of a real-time tracking system on its website, resulting in reduced transparency and increased customer queries. The **TrackFlow** project addresses these issues by developing a custom shipment tracking system tailored for airplane logistics. The system integrates a responsive frontend built with HTML, CSS, and JavaScript, a scalable backend powered by Node.js, and a MySQL database for efficient data management. Deployed using FileZilla and tested locally with XAMPP, TrackFlow provides seamless real-time tracking, enhancing transparency and reducing customer support overhead. Future enhancements include SMS/email notifications, flight tracking API integration, and an admin dashboard. This project demonstrates the application of full-stack development to solve real-world logistics challenges, improving both operational efficiency and customer experience.

***Keywords:*** *Shipment Tracking, Airplane Logistics, Real-Time Tracking, Node.js, MySQL, Full-Stack Development*

# Chapter 1: INTRODUCTION

## 1.1 Background of the Project

Logistics is a cornerstone of global trade, enabling the seamless movement of goods across borders. Air cargo logistics, in particular, demands precision and real-time visibility due to its high-speed nature. However, traditional shipment tracking systems often rely on periodic updates, leading to delays, inefficiencies, and a lack of transparency. QuickBox India, a logistics company specializing in air cargo, faced significant challenges due to the absence of a real-time tracking feature on its website. This resulted in reduced customer trust, increased support queries, and lower website engagement.

The **TrackFlow** project was developed to address these challenges by creating a real-time shipment tracking system tailored for QuickBox India. The system provides customers with instant access to shipment status, origin, destination, and other critical details through an intuitive web interface. By leveraging modern web technologies, TrackFlow enhances transparency, reduces customer queries, and improves operational efficiency.

## 1.2 Scope of the Project

The project focuses on developing a full-stack web application for real-time shipment tracking, with the following features:

- A user-friendly frontend for customers to input tracking IDs and view shipment details.
- A robust backend to process tracking requests and retrieve data from a MySQL database.
- Scalable database design to support future enhancements.
- Deployment on QuickBox India's live website using FileZilla.

The system is designed to integrate with flight tracking APIs in the future, enabling precise tracking of air cargo shipments.

# Chapter 2: MOTIVATION

The logistics industry faces numerous challenges, including shipment delays, lack of real-time visibility, and inefficient tracking processes. For QuickBox India, the absence of a tracking system led to:

- **Customer Uncertainty**: Customers could not monitor shipment status independently, leading to distrust.
- **Increased Support Load**: The support team was overwhelmed with tracking-related queries.
- **Low Website Engagement**: Without tracking functionality, customers had little reason to interact with the website.

These challenges motivated the development of **TrackFlow**, a system designed to:

- Provide real-time tracking for on-time delivery assurance.
- Replace manual tracking processes with automated solutions.
- Enhance customer satisfaction by improving transparency.
- Streamline logistics operations through a centralized tracking platform.

The project aligns with the growing demand for automated, self-sustained tracking systems in the logistics sector, driven by the rise in global trade and e-commerce.

# Chapter 3: LITERATURE REVIEW

## 3.1 Review of Existing Literature

Shipment tracking systems have evolved significantly, but many still face limitations in real-time tracking and automation. Below is a review of relevant studies and technologies:

1. **Traditional Tracking Systems**
   Traditional logistics tracking systems rely on manual updates at predefined checkpoints. According to a study by Sankaranarayanan et al. (2019), these systems lack real-time visibility, leading to information gaps and reduced customer trust. They are also prone to human errors during data entry.

2. **Flight Tracking Technologies**
   APIs like OpenSky Network and FlightAware provide real-time aircraft movement data, which can enhance shipment tracking accuracy. A paper by Zhou & Huang (2017) highlights that integrating such APIs into logistics systems remains limited, creating opportunities for innovation.

3. **Automation and Predictive Analytics**
   Modern logistics platforms are beginning to adopt automation and predictive analytics. Gupta et al. (2020) discuss the use of automated notifications and AI-driven analytics to improve tracking efficiency. However, many systems still rely on manual data entry, leading to inefficiencies.

4. **Web-Based Tracking Systems**
   Web-based tracking systems, as discussed by Kim & Kim (2019), offer scalable solutions for real-time monitoring. These systems use technologies like Node.js and MySQL to handle large datasets and provide seamless user experiences.

## 3.2 Comparative Work (Table 1)

| Project/System | Objectives | Technologies Used | Outcomes |
|---|---|---|---|
| FedEx Tracking System | Real-time parcel tracking | APIs, Web Interfaces, Databases | Improved customer satisfaction, scalability |
| DHL Track & Trace | Multi-carrier shipment visibility | Cloud, APIs, Mobile Apps | Enhanced transparency, reduced queries |
| Custom Logistics Platform | Automated tracking for local logistics | PHP, MySQL, JavaScript | Limited scalability, no real-time API support |

**TrackFlow** builds on these systems by focusing on air cargo logistics, with plans to integrate flight tracking APIs for enhanced accuracy.

# Chapter 4: GAP ANALYSIS

Despite advancements in shipment tracking, several gaps remain:

- **Manual Data Entry**: Many systems require manual updates, leading to errors and delays.
- **Limited Real-Time Visibility**: Few systems integrate flight tracking APIs for precise air cargo monitoring.
- **Lack of Automation**: Automated notifications and alerts are not widely implemented, reducing efficiency.
- **Scalability Issues**: Some systems struggle to handle large datasets or integrate with multiple carriers.

**TrackFlow** addresses these gaps by:

- Using a MySQL database to eliminate manual data entry errors.
- Designing a scalable backend with Node.js for future API integrations.
- Providing a user-friendly interface for real-time tracking.
- Planning for automated SMS/email notifications to enhance customer communication.

# Chapter 5: PROBLEM STATEMENT

QuickBox India's website lacks a real-time shipment tracking system, leading to:

- **Reduced Transparency**: Customers cannot monitor shipment status independently.
- **Increased Customer Queries**: Support teams are overwhelmed with tracking requests.
- **Low Website Engagement**: The absence of tracking reduces customer interaction with the website.

**TrackFlow** aims to develop a custom shipment tracking system that:

- Enables real-time monitoring of air cargo shipments.
- Provides a seamless, user-friendly interface for customers.
- Reduces support queries through automated status updates.
- Lays the foundation for future enhancements like flight tracking API integration and automated notifications.

# Chapter 6: OBJECTIVES

The primary objectives of the **TrackFlow** project are:

1. Develop a real-time shipment tracking system for QuickBox India's air cargo logistics.
2. Design a responsive frontend using HTML, CSS, and JavaScript for seamless user interaction.
3. Implement a scalable backend with Node.js to process tracking requests.
4. Create a MySQL database to store and manage shipment data efficiently.
5. Deploy the system on QuickBox India's live website using FileZilla.
6. Ensure scalability for future features like flight tracking APIs, SMS/email notifications, and an admin dashboard.

# Chapter 7: TOOLS/PLATFORM USED

The following tools and technologies were used to develop **TrackFlow (Table2)**:

| Tool/Technology | Purpose |
|---|---|
| **HTML, CSS, JavaScript** | Frontend development for responsive UI |
| **Node.js** | Backend development for API and server logic |
| **MySQL** | Database management for shipment data |
| **FileZilla** | FTP deployment to QuickBox India's website |
| **XAMPP** | Local testing environment |
| **VSCode** | Code editing and debugging |
| **Excel** | Initial data import for database |

These tools were selected for their industry relevance, scalability, and ease of integration.

# Chapter 8: METHODOLOGY

## 8.1 Overall Architecture

The **TrackFlow** system follows a client-server architecture, as depicted below:

TrackFlow Architecture Diagram

**Figure 1**: TrackFlow System Architecture
*Description*: The user interacts with the frontend (HTML, CSS, JavaScript) via a web browser. The frontend sends tracking requests to the Node.js backend, which queries the MySQL database and returns shipment details. The system is deployed to QuickBox India's server using FileZilla.

## 8.2 Development Phases

1. **Requirement Analysis**
   - Identified QuickBox India's need for a real-time tracking system.
   - Defined functional requirements: tracking form, instant results, and database integration.
2. **Database Design**
   - Created a MySQL table shipments with fields:
     - tracking_id (Primary Key)
     - sender
     - receiver
     - origin
     - destination
     - status
     - timestamp
   - Imported initial data from Excel for testing.
3. **Backend Development**
   - Built REST APIs using Node.js to handle tracking requests.
   - Implemented endpoints for querying the database based on tracking IDs.
4. **Frontend Development**
   - Designed a responsive tracking form using HTML, CSS, and JavaScript.
   - Integrated JavaScript for instant result display without page reloads.
5. **Testing**
   - Conducted local testing using XAMPP to simulate the server environment.
   - Tested frontend-backend integration and database queries.

## 6. Deployment

- Deployed the system to QuickBox India's live website using FileZilla.
- Ensured compatibility with the existing website design.

# Chapter 9: EXPERIMENTAL SETUP

## 9.1 Hardware Requirements

- **Development**: Standard PCs/laptops with at least 8GB RAM and 2GHz processors.
- **Deployment**: QuickBox India's web server with Node.js and MySQL support.

## 9.2 Software Requirements

- **Operating System**: Windows/Linux/MacOS.
- **Development Tools**: VSCode, XAMPP, FileZilla.
- **Runtime Environment**: Node.js v16+, MySQL v8+.
- **Browsers**: Chrome, Firefox, Edge for frontend testing.

## 9.3 Testing Environment

- **Local Testing**: XAMPP was used to host the Node.js server and MySQL database locally.
- **Live Testing**: Deployed to QuickBox India's server and tested on multiple devices (desktop, mobile).

# Chapter 10: EVALUATION METRICS

The **TrackFlow** system was evaluated based on the following metrics:

1. **Response Time**: Time taken to retrieve and display shipment details (< 2 seconds).
2. **Accuracy**: Correctness of shipment data retrieved from the database (100% for test data).
3. **Usability**: Ease of use for customers (tested via user feedback).
4. **Scalability**: Ability to handle multiple simultaneous requests (tested with 50 concurrent users).
5. **Deployment Success**: Seamless integration with QuickBox India's website (verified post-deployment).

# Chapter 11: RESULTS AND DISCUSSION

## 11.1 Results

- **Frontend**: The tracking form is responsive, intuitive, and matches QuickBox India's website design. Users can input tracking IDs and view results instantly.
- **Backend**: Node.js APIs successfully process requests and retrieve data from the MySQL database with minimal latency.
- **Database**: The shipments table efficiently stores and retrieves data, supporting scalability for future enhancements.
- **Deployment**: The system was successfully deployed to QuickBox India's live website, with no compatibility issues.
- **User Feedback**: Customers reported improved transparency and reduced need to contact support.

## 11.2 Discussion

The **TrackFlow** system effectively addresses QuickBox India's challenges by providing real-time tracking, enhancing transparency, and reducing support queries. The use of Node.js and MySQL ensures scalability, while the frontend's seamless integration improves user engagement. Challenges during development included:

- **Database Optimization**: Initial queries were slow for large datasets, resolved by indexing the tracking_id field.
- **Deployment Issues**: FileZilla connectivity issues were resolved by updating FTP credentials.

The system lays a strong foundation for future enhancements like flight tracking APIs and automated notifications.

# Chapter 12: CONCLUSION & FUTURE WORK

## 12.1 Conclusion

The **TrackFlow** project successfully delivers a real-time shipment tracking system for QuickBox India, addressing key challenges in transparency, customer queries, and website engagement. By leveraging full-stack development with HTML, CSS, JavaScript, Node.js, and MySQL, the system provides a scalable and user-friendly solution for air cargo logistics. The project demonstrates the practical application of web technologies to solve real-world industry problems, enhancing both operational efficiency and customer satisfaction.

## 12.2 Future Work

Future enhancements for **TrackFlow** include:

- Integration with flight tracking APIs (e.g., OpenSky, FlightAware) for precise air cargo monitoring.
- Automated SMS/email notifications using services like Twilio and SendGrid.
- Development of an admin dashboard for logistics managers to manage shipments.
- QR-based tracking for faster shipment identification.
- AI-driven analytics for predictive tracking and exception detection.

# Chapter 13: REFERENCES


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