

# **Database Management System**

**Semester-III (Batch-2024)**

## **Courier Delivery Tracking System**



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## 1. Introduction

In today's digital era, the courier and logistics industry play a vital role in enabling e-commerce, trade, and day-to-day deliveries. With the rapid growth of online shopping and global supply chains, customers expect **speed, accuracy, and transparency** in the delivery process. Traditional paper-based methods of booking and tracking parcels are no longer efficient, as they often lead to delays, errors, and lack of real-time information.

The **Courier Delivery Tracking System** is a database-driven application designed to overcome these challenges by providing a **centralized, automated, and user-friendly platform** for managing courier operations. This system simplifies the workflow for all stakeholders:

- **Customers** can book shipments, track their parcels in real time, and receive timely updates.
- **Employees** can manage assignments, update delivery statuses, and optimize their workload.
- **Administrators** can monitor performance, analyze data, and ensure smooth logistics operations.

By integrating modern database management principles with courier services, the system ensures **efficient data storage, quick retrieval, secure transactions, and scalable design** that can adapt to growing demands.

The primary goal of this project is to build a **reliable and transparent courier management solution** that not only reduces manual effort but also improves operational efficiency, enhances customer satisfaction, and supports future expansion of courier businesses.

## 2. Problem Overview

Courier and shipment companies without a computerized system face several issues:

- **Manual inefficiency** – Recording bookings and deliveries on paper is slow and error-prone.
- **Lack of real-time tracking** – Customers cannot know the exact location or status of their parcels.
- **Data redundancy & inconsistency** – The same details often get recorded multiple times, leading to mismatched records.
- **Poor resource allocation** – Assigning shipments to delivery staff is difficult without a centralized system.
- **Limited scalability** – Managing hundreds of consignments daily becomes unmanageable with manual methods.
- **Security concerns** – Physical registers are prone to loss, theft, or unauthorized access of sensitive data.
- **Low customer satisfaction** – Delays, mismanagement, and lack of transparency reduce trust in the service.

The **Courier Delivery Tracking System** is proposed to overcome these problems by introducing automation, centralized data management, and real-time parcel tracking.

### 3. Scope of the Project

The proposed **Courier Delivery Tracking System** will:

- Maintain detailed records of **customers, consignments, employees, and payments** in a centralized database.
- Allow **customers** to book parcels, track real-time delivery status, and receive timely notifications.
- Enable **employees** to manage courier assignments, update shipment statuses, and optimize delivery routes.
- Provide **administrators** with tools to monitor performance, generate reports, and ensure smooth operations.
- Implement **role-based access control** to protect sensitive data and restrict unauthorized usage.
- Support **scalability** to handle an increasing number of customers, parcels, and employees as the business grows.
- Ensure **data accuracy and consistency** using relational database principles such as primary keys and foreign keys.
- Improve **efficiency, transparency, and customer satisfaction** through automation of booking, tracking, and reporting

## 4. Objectives

The main objectives of the **Courier Delivery Tracking System** are:

- **Centralized Data Management** – Maintain all courier, customer, employee, and payment records in a single database.
- **Efficient Data Retrieval** – Provide optimized queries to quickly fetch shipment status, customer details, and payment history.
- **Real-Time Tracking** – Allow customers to track their parcels and receive live updates about delivery progress.
- **Role-Based Access Control** – Ensure secure access by defining different privileges for administrators, employees, and customers.
- **Error Reduction** – Minimize human errors and inconsistencies by automating booking and reporting processes.
- **Improved Transparency** – Provide clear visibility of courier operations for customers and management.
- **Scalability** – Support future business growth with the ability to handle more consignments, employees, and services.
- **Customer Satisfaction** – Enhance user experience through faster service, reliable tracking, and timely deliveries.

## 5. Significance of the Project

The **Courier Delivery Tracking System** is significant because it:

- **Streamlines operations** – Automates booking, tracking, and delivery updates, reducing delays and confusion.
- **Increases accuracy** – Eliminates errors caused by manual data entry and record keeping.
- **Enhances transparency** – Provides clear visibility of courier status, employee activity, and customer interactions.
- **Saves time and effort** – Enables quick data retrieval and faster processing of courier-related tasks.
- **Improves customer trust** – Real-time tracking and timely updates increase customer satisfaction and reliability.
- **Strengthens security** – Protects sensitive customer and payment details using role-based access and secure databases.
- **Supports scalability** – Easily adapts to business expansion and increased courier volumes.
- **Promotes efficiency** – Optimizes resource allocation and delivery management for better performance

## 6. E-R Diagram

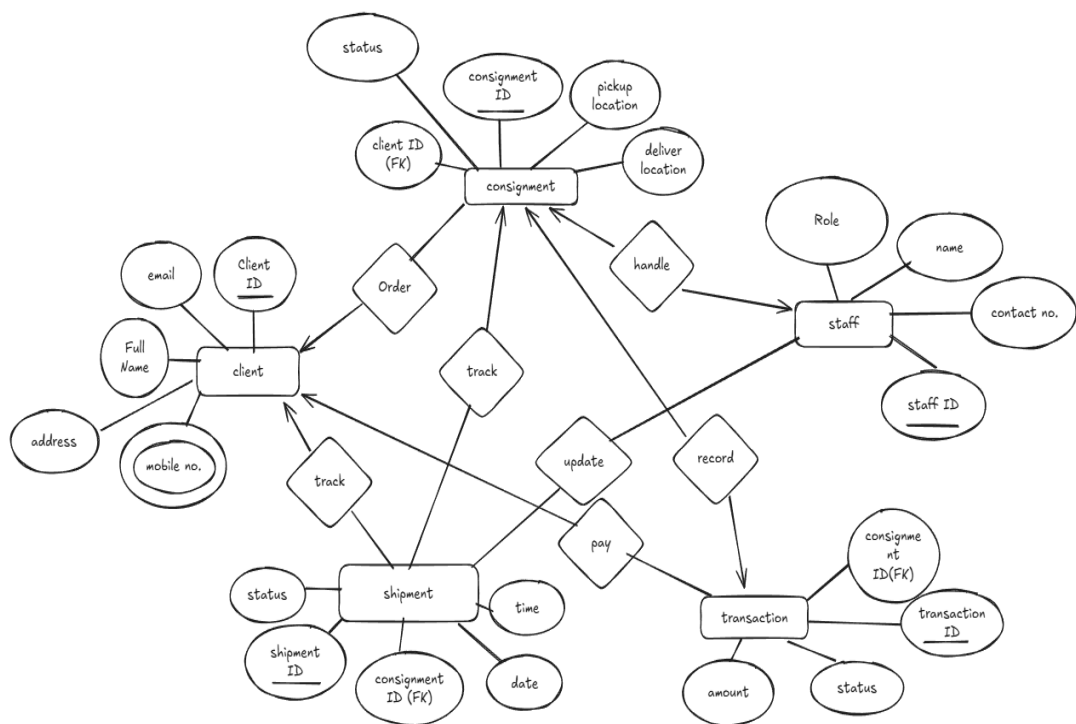
The **Entity–Relationship (E-R) Diagram** is used to model the logical structure of the Courier Delivery Tracking System. It highlights the main entities and their relationships, ensuring that data is well-organized and easily accessible.

### Key Entities and Relationships

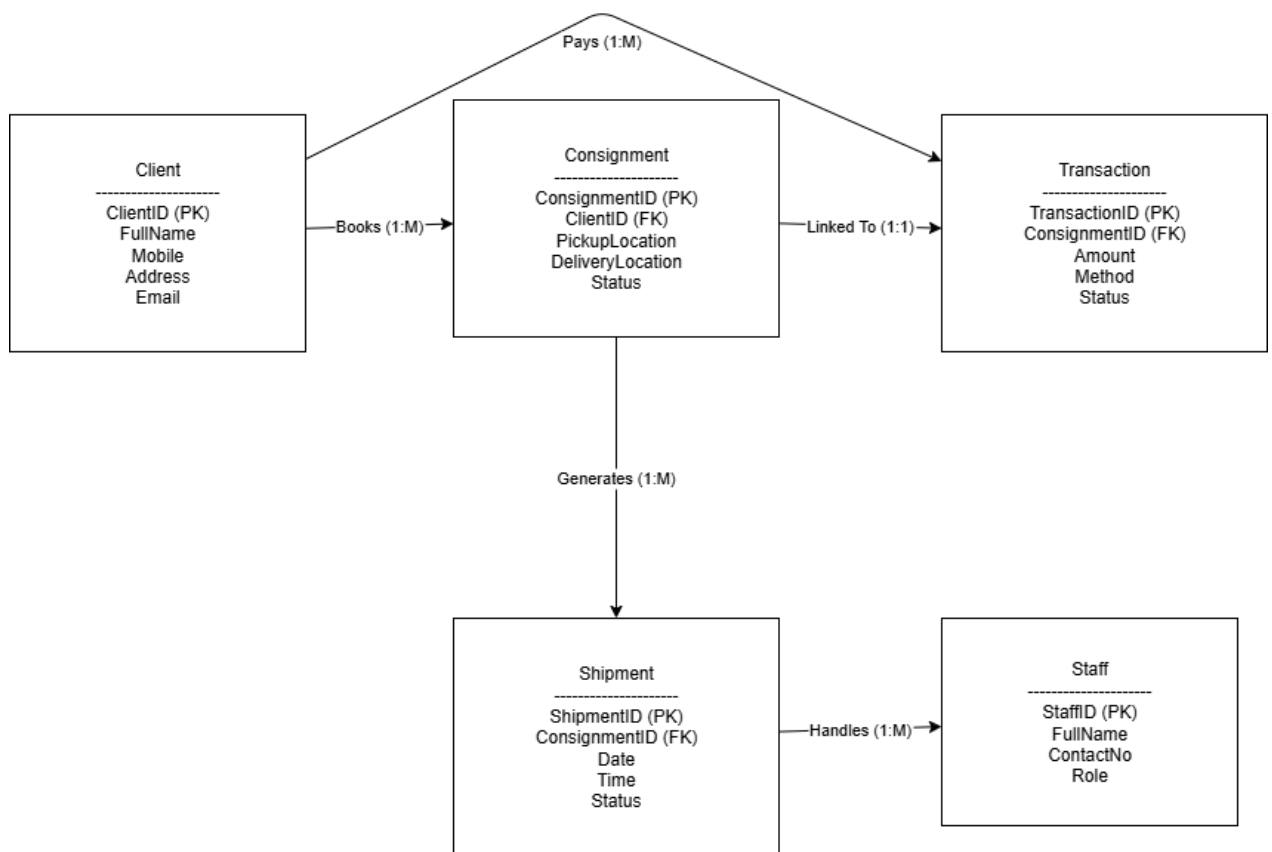
- **Client ↔ Consignment:** A client can book many consignments (1:M).
- **Client ↔ Transaction:** Each client makes one payment per consignment (1:1).
- **Consignment ↔ Shipment:** One consignment may have multiple shipment records (1:M).
- **Staff ↔ Shipment:** A staff member can handle multiple shipments (1:M).
- **Consignment ↔ Transaction:** Each consignment corresponds to a single transaction (1:1).



[Figure 1: E-R Diagram Placeholder]



[Figure 2: E-R Model Placeholder]



## 7. Database Schema

A database schema defines how data will be stored in the system. It includes tables, attributes, data types, and relationships.

**Table 1: Client**

Field	Type	Description
ClientID (PK)	INT	Unique ID for each client
Full Name	VARCHAR (50)	Name of Client
Mobile	VARCHAR (15)	Contact Number
Address	VARCHAR (100)	Client's Address
Email	VARCHAR (100)	Client's Email ID

**Table 2: Consignment**

Field	Type	Description
Consignment ID (PK)	INT	Unique ID of Consignment
Client ID(FK)	INT	Linked to client
PickupLocation	VARCHAR (50)	Pickup Address
DeliveryLocation	VARCHAR (50)	Destination Address

Status	VARCHAR (20)	Pending/Out for Delivery/Delivered
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**Table 3: Shipment**

Field	Type	Description
Shipment ID (PK)	INT	Unique ID of Shipment
Consignment ID (FK)	INT	Linked to Consignment
Date	DATE	Shipment date
Time	TIME	Shipment time
Status	VARCHAR (20)	InProgress/Delivered/Failed

**Table 4: Staff**

Field	Type	Description
Staff ID	INT	Unique ID to Staff
Full Name	VARCHAR (50)	Staff Member Name

Contact NO	VARCHAR (15)	Staff Contact Number
Role	VARCHAR (20)	Delivery/Manager

**Table 5: Transaction**

Field	Type	Description
Transaction ID (PK)	INT	Unique ID of transaction
Consignment ID (FK)	INT	Linked to consignment
Amount	DECIMAL (10,2)	Payment Amount
Status	VARCHAR (20)	Completed/Failed

## 8. Relational Algebra Queries -20-25

Table 6: Dummy data table for queries

Courier ID	CustomerID	Source	Destination	Weight	Status
101	1	Delhi	Mumbai	5.2	Booked
102	2	Chennai	Bangalore	2.5	In transit
103	3	Delhi	Pune	7.8	Delivered
104	4	Mumbai	Kolkata	1.2	Booked
105	3	Delhi	Mumbai	9.0	In transit
106	6	Hyderabad	Delhi	0.9	Delivered
108	8	Delhi	Goa	6.0	In transit
109	1	Pune	Delhi	4.1	Delivered
110	9	Kolkata	Delhi	8.3	Booked

### Queries

1. List all clients:

$\pi$  ClientID, FullName, Email (Client)

2. Find clients living in "Delhi":  
 $\sigma \text{ Address}=\text{"Delhi"} \text{ (Client)}$
3. Get clients with mobile numbers starting with "98":  
 $\sigma \text{ Mobile LIKE "98\%"} \text{ (Client)}$
4. Find clients who ordered consignments:  
 $\pi \text{ ClientID, FullName (Client } \bowtie \text{ Consignment)}$
5. Find clients who did not order any consignments:  
 $\pi \text{ ClientID, FullName (Client)} - \pi \text{ ClientID, FullName (Client } \bowtie \text{ Consignment)}$
6. List all consignments with pickup & delivery:  
 $\pi \text{ ConsignmentID, PickupLocation, DeliveryLocation (Consignment)}$
7. Find consignments with status "Pending":  
 $\sigma \text{ Status}=\text{"Pending"} \text{ (Consignment)}$
8. Get consignments where pickup="Mumbai" and delivery="Delhi":  
 $\sigma \text{ PickupLocation}=\text{"Mumbai"} \wedge \text{DeliveryLocation}=\text{"Delhi"} \text{ (Consignment)}$
9. Find consignments of a specific client (ClientID=5):  
 $\sigma \text{ ClientID}=5 \text{ (Consignment)}$
10. Count number of consignments per client:  
 $\gamma \text{ ClientID, COUNT(ConsignmentID) (Consignment)}$
11. List all shipments and their status:  
 $\pi \text{ ShipmentID, Status (Shipment)}$
12. Find shipments completed on "2025-01-01":  
 $\sigma \text{ Date}=\text{"2025-01-01"} \wedge \text{Status}=\text{"Completed"} \text{ (Shipment)}$
13. Show shipments linked to consignments:  
 $\pi \text{ ShipmentID, ConsignmentID (Shipment } \bowtie \text{ Consignment)}$

14. Get shipments still "In Transit":  
 $\sigma \text{ Status} = \text{"In Transit"} (\text{Shipment})$
15. Find clients whose consignments are still in transit:  
 $\pi \text{ FullName} (\text{Client} \bowtie \text{Consignment} \bowtie \text{Shipment} \sigma \text{ Status} = \text{"In Transit"})$
16. List all staff names and roles:  
 $\pi \text{ FullName, Role} (\text{Staff})$
17. Find staff with role "Delivery Boy":  
 $\sigma \text{ Role} = \text{"Delivery Boy"} (\text{Staff})$
18. Get staff who handled at least one shipment:  
 $\pi \text{ StaffID, FullName} (\text{Staff} \bowtie \text{Shipment})$
19. Find staff who never handled a shipment:  
 $\pi \text{ StaffID, FullName} (\text{Staff}) - \pi \text{ StaffID, FullName} (\text{Staff} \bowtie \text{Shipment})$
20. List staff and consignments they handled:  
 $\pi \text{ FullName, ConsignmentID} (\text{Staff} \bowtie \text{Shipment} \bowtie \text{Consignment})$
21. List all transactions with amount:  
 $\pi \text{ TransactionID, Amount} (\text{Transaction})$
22. Find transactions greater than ₹5000:  
 $\sigma \text{ Amount} > 5000 (\text{Transaction})$
23. Get transactions made via "UPI":  
 $\sigma \text{ Method} = \text{"UPI"} (\text{Transaction})$
24. Find successful transactions:  
 $\sigma \text{ Status} = \text{"Successful"} (\text{Transaction})$
25. Show client names with their payment details:  
 $\pi \text{ FullName, Amount, Method} (\text{Client} \bowtie \text{Consignment} \bowtie \text{Transaction})$



## 9. References

-<https://www.w3schools.com/sql/>

- <https://www.geeksforgeeks.org/dbms/>

-Database System Concepts by Abraham Silberschatz, Henry F. Korth, S. Sudarshan