

**CS 685 Spring 2017**

**Internet Of Things – Car's Ecosystem**

**Milestone 1**

**Car Fleet Management System**

**Team 2**

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# 1. Introduction

Fleet management is the management of a commercial transportation fleet. Fleet management includes a vast array of functionality, such as real-time vehicle telematics monitoring, fuel monitoring, active speed governing, asset tracking, driver monitoring, vehicle usage analytics, communications, vehicle maintenance coordination, navigation, vehicle leasing solution assistance, driver roster management, and safety and security of both the vehicles and drivers.

A comprehensive fleet management system is built for use by multiple stakeholders with different needs in mind, such as the passengers, drivers, managers and the enterprise owners whose use of the application is different from one another. The different segments that cover the overall application are functional fleet monitoring and management, scheduling and navigation system, vehicular dispatch system, asset tracking system, and safety and security management.

## 2. Application Functionality

Fleet management is the strategic coordination of a group of commercial vehicles' routes in order to optimize the efficiency of the routes with respect to time and operating costs. The most important part of fleet management is the ability to monitor any given vehicle's instantaneous location via a GPS tracker inserted into each vehicle's on-board diagnostic port, or OBD port. This provides the tracker with a power source, allowing for the real-time tracking of a vehicle's location throughout the course of the route. By using this information, a manager can design newer, more efficient routes to reduce wear on the vehicles and manage fuel better.

The OBD port does not simply provide power to the tracker, but also direct access to the microprocessor in charge of running the vehicle. By coupling the GPS tracker with a device that can read information from the OBD port, fleet management software allows for real-time diagnostics for a vehicle in addition to simply providing a location. In doing so, a much broader range of services are available to utilize, such as analyzing a driver's driving behavior and analyzing the usage of each vehicle individually.

## 3. Use Cases

The Fleet Management System has four end users, or 'actors', each having access to different services. The different users are as follows:

1. Passenger
2. Driver
3. Manager
4. Enterprise Owner

### 3.1 Passenger

A Passenger is an end user whom uses the fleet management system for a door-to-door service with as much comfort and security as possible. A passenger will be required to have the application installed on his/her mobile device so they can create an account and add their credit card details. The passenger must provide the pickup point and destination point in order to calculate both the route and fare required to reach the

destination. Once the passenger books the cab, the application will have a method to optimize the route, calculate the distance to the destination, alert them about the vehicle picking them up, provide their driver's information, and show the amount debited from their account. Once the passenger enters the cab, he/she will be able to keep track of the route taken by the driver on their mobile device. Once the passenger reaches their destination, they will be able to provide a review, enter a rating about their experience, and leave a tip. Although the review is optional, it will allow the passenger to express their opinion about the experience, in the event the passenger did not enjoy the ride altogether or the behavior the driver exhibited while operating the vehicle. Passenger will be given the option to cancel the ride any time before entering the car. If there are any available coupons or discounts, the application will notify the passenger and, with the passenger's consent, apply the coupons and discounts to their ride.

The following are the list of primary uses cases identified for the End User – Passenger.

1. Create Account
2. Login
3. Check Availability
4. Route
5. Cost
6. Estimated Time of Arrival to Pick up point
7. Estimated Time to Destination
8. Driver and Vehicle Information
9. Distance to Destination
10. Real-Time Tracking
11. Cancellation
12. Alert
13. Coupons and Discount

## **3.2 Driver**

A driver either can use their own vehicle or can lease one within the fleet or from a leasing company. The driver must have a valid and proper driver's license, the appropriate insurance, a well-maintained vehicle, and must be registered within the fleet. The driver must create an account and be logged in in order to use the app. Whenever the passenger books a cab, a driver will be given the option to either accept or decline the request based on whether he is already on call, out of range of the passenger, or another undisclosed reason. If multiple drivers accept the request at same time, path optimization will allocate the ride to the driver closest to the requesting passenger. The driver that the fare is allocated to is immediately given the proper navigation directions in order to reach the passenger requesting a ride, as well as the distance to the pickup point, the estimated time remaining until arrival at the pickup location, and the necessary passenger information to identify them once they reach the pickup point. Once the driver reaches the pickup point, the passenger enters the vehicle and the driver drops them at the destination point using another set of navigation directions provided by the app, allowing the driver to view and track the route to the destination and the estimated time of arrival to the destination. A driver should complete a daily quota of rides allocated to them. The driver's salary is a percentage of the ride fare plus any tips left by the passengers. They should collect all the fuel receipts for reimbursement from the company. The driver must obey all traffic rules, but should the driver so much as drive over the speed limit for a brief moment, the dongle connected to the driver's OBD port will send an alert

to the manager about the driving infraction instantaneously. The OBD port dongle also alerts the manager about the idle time taken by the driver and wastage of the fuel.

The following are the list of primary uses cases identified for the End user – Driver.

1. Fleet Registration
2. Creates Account
3. Login
4. Accept Request
5. Decline Request
6. Fuel Consumption
7. Salary
8. Time to pick up point
9. Time to Destination
10. User Information
11. Insurance cost
12. Maintenance cost
13. Passenger Rating
14. Cancel Ride
15. Safety and Security

### **3.3 Manager**

A manager is a fleet owner of a particular division or area who handles all the cars within his area. The prime role of a manager is to manage the fleet's activities and monitor both the drivers and their vehicles. A manager is responsible for the safety and security of the fleet. A manager should make sure that the drivers are adhering to all the traffic rules. The OBD port dongle will give out the data about speed, idle time taken by the driver. The manager will have access to an extensive database and can pull up any reports they need. They will also be given a system to take care of the payroll, manage fuel consumption, set quota targets to be achieved by the drivers, view the total fleet size, track driver distance, and perform vehicle diagnostics.

The following are the list of primary uses cases identified for the End user – Manager.

1. Creates Account
2. Driver Monitor
3. Fuel Consumption and Management
4. Safety and Security
5. Database control
6. Report Generation
7. Speed Monitor
8. Idle Time Monitor
9. Target Monitor
10. Payroll System
11. Event Management
12. Dashboard
13. Distance Tracker

14. Vehicle Diagnostics
15. Fleet Size

### **3.4 Enterprise Owner.**

An enterprise owner is the overall owner of the corporation utilizing the software, such as a Managing Director or the Chief Executive Officer. This person has access to the overall report including the finance, cost-benefit analysis, marketing, damage control, and other application features inaccessible to other user groups, along with access to all the services and functionalities that are available to the manager.

Apart from the primary use cases mentioned for the managers, the following list of use cases are identifiable for the Enterprise owner:

1. Damage Control
2. Data Analytics
3. Cost-Benefit Analysis
4. Overall Report

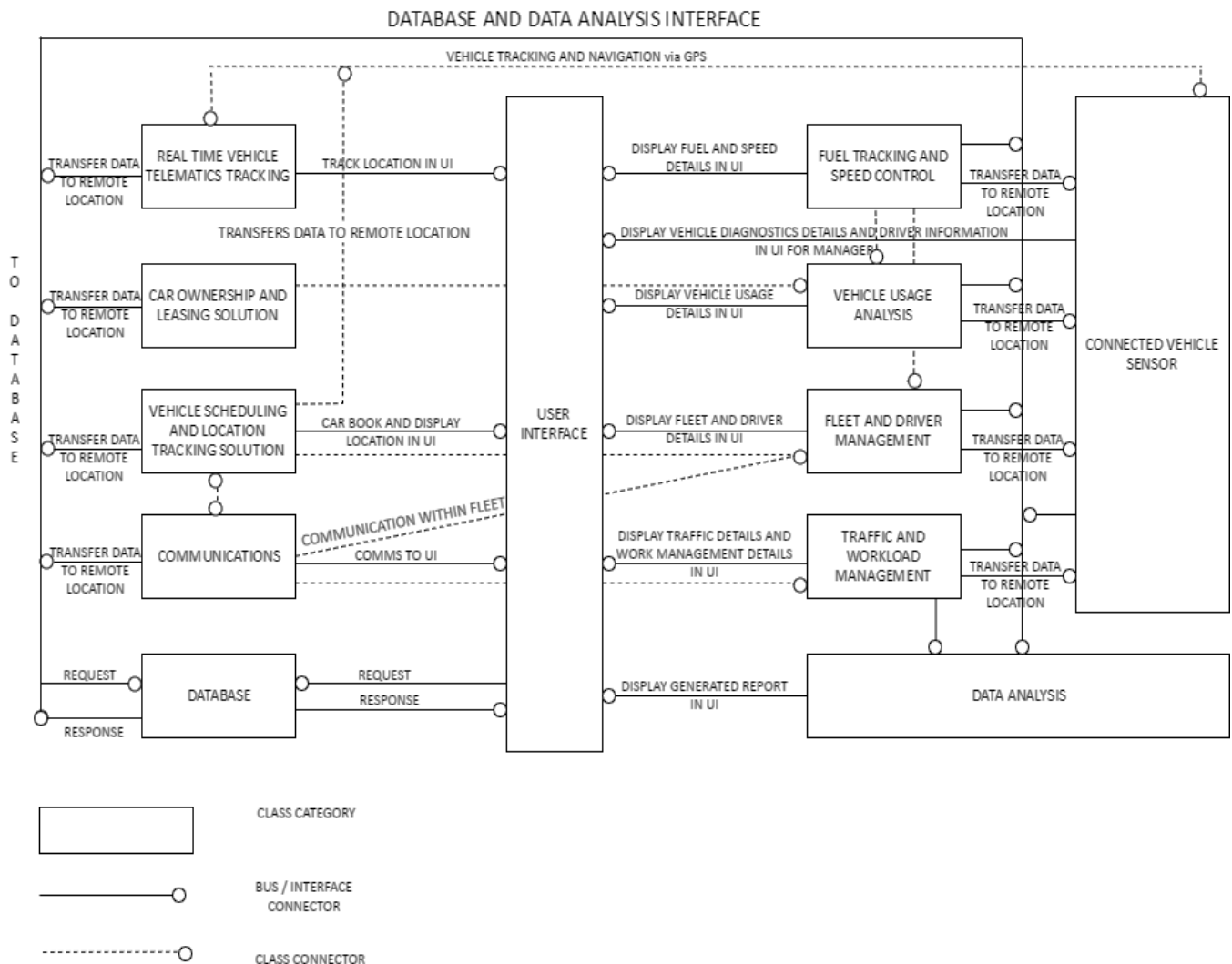
## **4. Architecturally Significant Requirements**

The following lists the Architecturally Significant Requirements derived from the requirements and use cases for all potential users:

1. Connected Vehicle Sensor(OBD port dongle)
2. Real-Time Vehicle Telematics Tracking
3. Vehicle Scheduling and Location Tracking Solution
4. Fuel Tracking and Speed Control
5. Vehicle Usage Analysis
6. Car Ownership and Leasing Solutions
7. Fleet and Driver Management
8. Traffic and Workload Management
9. Data Analytics
10. Communications
11. User Interface
12. Database

The above functionalities are architecturally significant requirements due to their high amount of perceptible effect on the software's architecture. These requirements are of significant importance that influences the stakeholders. These architecturally significant requirements are of high business value; hence, they are also correlational to business risk.

## 5. Logical View Diagram



### 1. Connected Vehicle Sensor(OBD port dongle)

The OBD port, first implemented in 1968, directs access to the microprocessor in charge of running the vehicle. By coupling the GPS tracker with a device that can read information from the OBD port, fleet management software allows for real-time diagnostics for a vehicle in addition to simply providing a location. In doing so, a much broader range of services are available to utilize, such as analyzing a driver's driving behavior and analyzing the usage of each vehicle individually.

### 2. Real-Time Vehicle Telematics Tracking

Telematics is the real-time integrated use of communications and information which can send, receive and store information remotely. Vehicle telematics is a way of monitoring the location, movement, status and behavior of a car within a fleet, achieved through a combination of a GPS receiver and an

electronic GSM device installed in each vehicle, which then communicates with the user and application. This increases productivity, reduces labor costs, controls fuel costs, improves customer service, increases overall fleet safety and security, and reduces unauthorized vehicle use.

### **3. Vehicle Scheduling and Location Tracking Solution**

Vehicle Scheduling and Location Tracking System allows a way for the passenger to book a cab using the application and effectively coordinates the passengers, drivers and dispatchers to streamline operations. This provides an improvised customer service that Facilitates GPS based fleet wide visibility with real-time status updates for the customers to track a vehicle.

### **4. Fuel Tracking and Speed Control**

Using the on-board diagnostic port integrated with a telematics system, managers can keep track of the fleet vehicles' fuel consumption and control the speed by setting a threshold that alerts the manager if the driver exceeds said threshold.

### **5. Vehicle Usage Analysis**

This service enables the manager to assign work properly and avoid excess spending. It provides sensible real-time information like the vehicle's fleet number and license plate number, distance travelled, hours completed, trips made, average and total operating cost, and percentage of utilization.

### **6. Car Ownership and Leasing Solutions**

This keeps track of drivers who register with the fleet. A driver either can use their own vehicle or can lease a vehicle from the fleet. If the driver leases a vehicle, it keeps track of the payments due by the lessee each month and records the payment history.

### **7. Fleet and Driver Management**

This gives an overall view of the fleet in a dashboard, such as the total number of registered vehicles, amount of part-time and full-time employees, total number of rides completed, total distance covered, driver monitoring, a payroll system, vehicle diagnostics, and vehicle maintenance. This allows the manager to easily monitor the fleet and take necessary action accordingly.

### **8. Traffic and Workload Management**

This enables the manager to create an ideal routine for the drivers, balancing their personal and professional life so they are not overworked, and managing all the assets, giving importance to densely populated areas where the projected revenue is maximum and emphasizing the safety and security of one self and of the fleet.

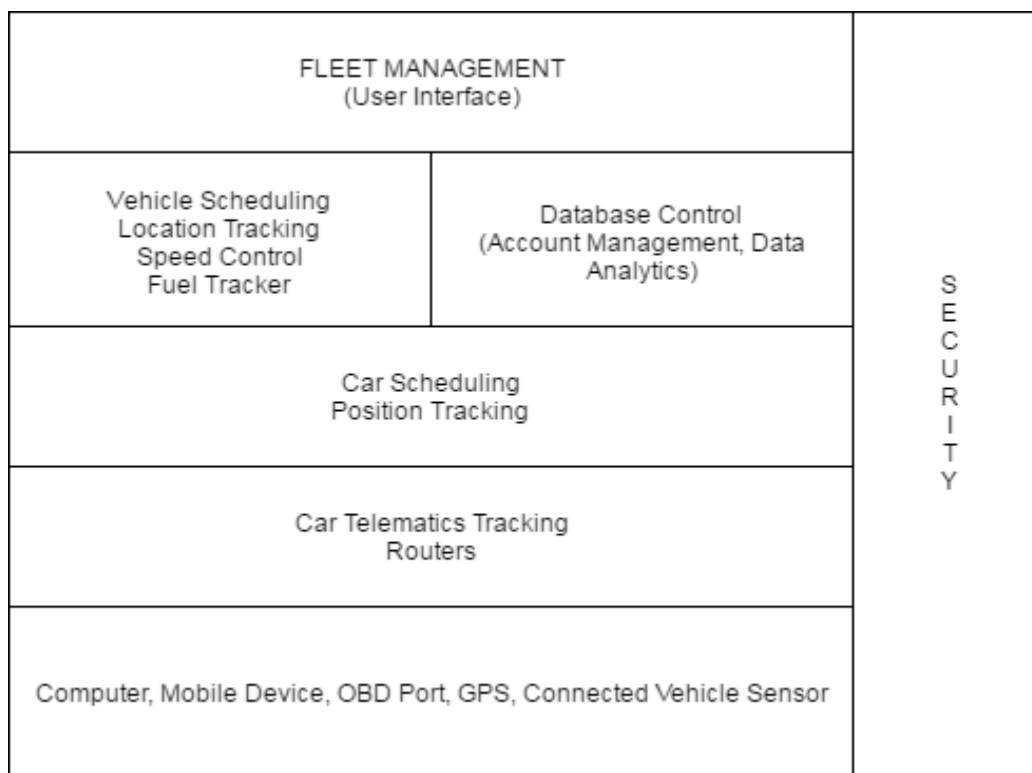
## 9. Data Analytics

Data analytics is a technique used to enhance the productivity of the business. All the data is collected, Identified, and categorized based on their features to analyze the behavior of the customer in order to develop a business strategy for maximizing revenue.

## 10. Communications

Communication plays a vital role throughout the fleet; a passenger can clarify details about his/her location with the driver and vice versa. A manager can contact the driver in case of an emergency.

# 6. Reference Architecture



## 6.1 Assumptions

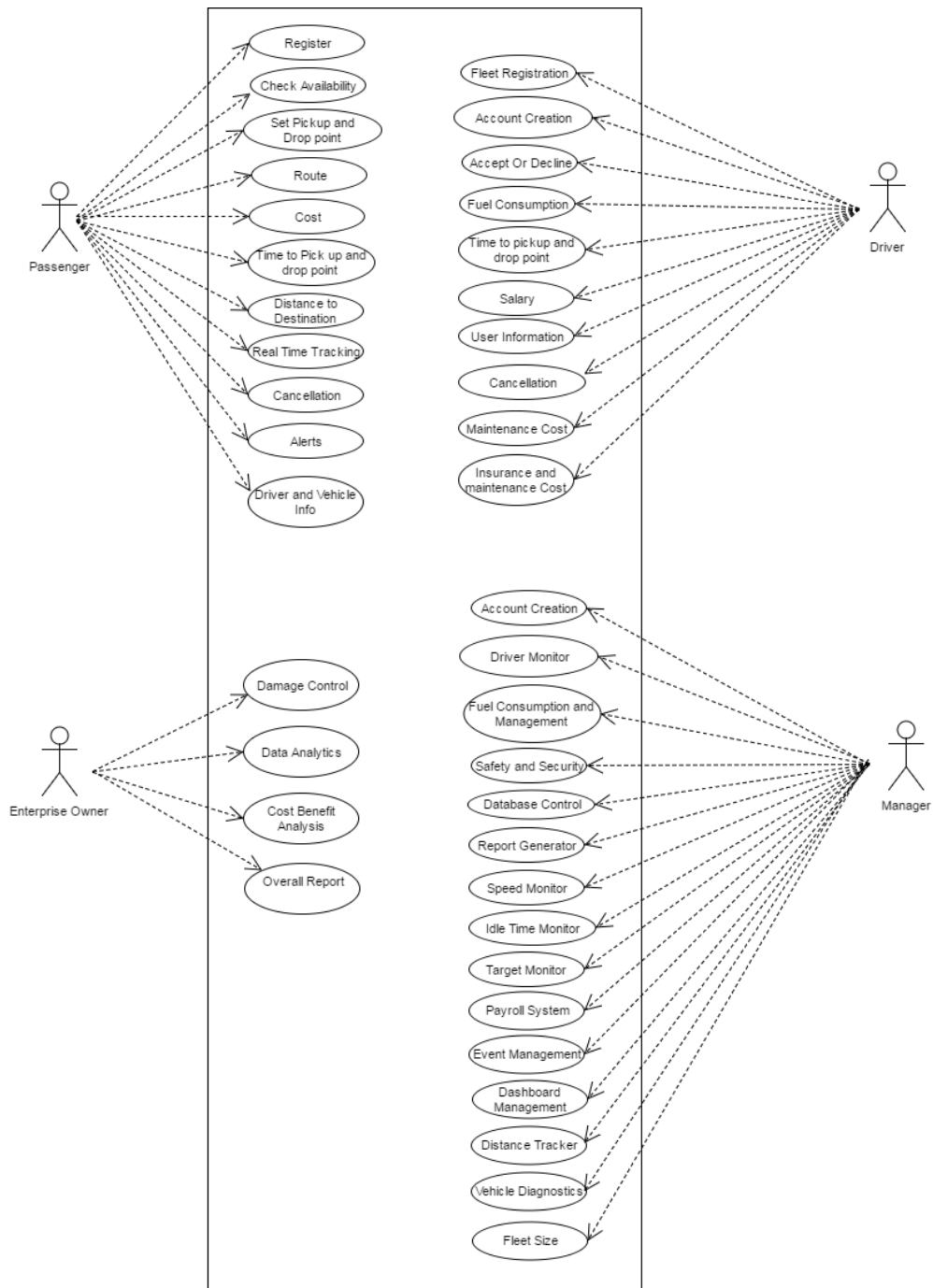
Application	-	Fleet Management
Events	-	Vehicle Scheduling, Location Tracking, Speed Control, Fuel Tracker
Database	-	Account Management, Data Analytics
Routing	-	Car Scheduling and Position Tracking
Network/Transport	-	Car Telematics Tracking
Devices	-	Computer, Mobile Device, GPS, OBD port dongle, Connected Vehicle Sensor
Security	-	Protection to all Layers (Non-Functional Requirement).



## 6.2 Use Case Diagram

As explained earlier in Section 3.0, the Fleet Management System has four end users, or 'actors', each having access to different services. The different users are as follows:

1. Passenger
2. Driver
3. Manager
4. Enterprise Owner



## 7. Platform Requirements

SERVICES	INPUT	OUTPUT	FUNCTIONALITY	ASSOCIATED ASR
Onboard Sensor Management	Gathers the information about coordinates using GPS, driver's behavior and vehicle usage from the car	Transmit and storing of these data in remote location	Onboard Sensor Management employs the device OBD port, which directly accesses the microprocessor. By coupling the GPS tracker with the device, it can analyze a driver's driving behavior and analyzing the usage of each vehicle individually.	Connected Vehicle Sensor
Device Management	All of the fleets device asset	Store and manage the fleets device		
Network	N/W Device, provides GPS Coordinates at regular interval	Calculates the location of the Car at regular interval, thus calculating speed and estimates a time	Vehicle telematics is a way of monitoring the location, movement, status and behavior of a car within a fleet	Real-Time Vehicle Telematics Tracking
Car Events	1. Passenger should have an updated mobile app 2. Location service should be turned 'ON' in the mobile device	1. Passenger purchases a cab ride using mobile app. 2. Location of the Passenger is disclosed to the driver and vice versa	By generating revenue, it allows a way for the passenger to book a cab using the application and effectively coordinates the passengers, drivers and dispatchers to streamline operations.	Vehicle Scheduling and Location Tracking Solution
Event Management	1.Odometer Speed 2.Fuel Level and Distance Travelled	1. Speed Monitor and Control 2. Fuel Usage tracker	Managers can keep track of the fleet vehicles' fuel consumption and control speed by setting a threshold that alerts the manager if the driver exceeds said threshold.	Fuel Tracking and Speed Control
Reporting	Speed and Fuel Level	Alerts Manager/Superior about over speeding		
Car Monitoring	Gather performance data about the car and	Store and Analyze the data for future use.	It provides information about the total vehicle's in	Vehicle Usage Analysis

	its usage		the fleet, license plate number, distance compiled, hours completed, trips made, average and total operating cost, and percentage of utilization.	
Car Registration	Driver's License, Insurance and other legal documents	Fleet Registration with self-car or car is leased	It keeps track of drivers who register with the fleet. If the driver does not own a car, he can lease a vehicle. This service keeps track of the payments due by the lessee each month and records the payment history.	Car Ownership and Leasing Solutions
Fleet and Driver Monitor	Driver Behavior, salary, Fleet details like fleet size, devices, logistics managers and employees	Store and Analyze the behavior of the driver and constantly monitor the driver. Also monitoring of the fleet	This gives an overall view of the fleet, which displays - total number of registered vehicles, amount of part-time and full-time employees, driver monitoring, vehicle diagnostics, and car maintenance	Fleet and Driver Management
Security Management	1.Gathering traffic patterns 2.Employee work performance	1. Safety and security of the fleet. 2. Safety and security of the workers	By Creating a balanced routine and giving importance to safety and security of the fleet	Traffic and Workload Management
Analytics	Data from all the services	Store and Analyze the data for improvements	All the data is collected and categorized based on their features to analyze the behavior of the customer in order to develop a business strategy for maximizing revenue.	Data Analytics
Communication System	Mobile device, radio device.	Communication within fleet and passengers and drivers.	Communication in case of emergency, a driver can call a passenger to clarify about the location and vice versa	Communications