MapMyFood

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MapMyFood

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APPROVAL

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Dedication

This work is dedicated to my parents, whose support has been a constant source of strength, and to my teachers, whose guidance made this possible for me.

Acknowledgements

I am really thankful to Allah Almighty who enabled me to complete this work. I thank to my family for supporting me in my thick and thins. I am also thankful to our project supervisor Mr. Muhammad Ahmad and my group mates who helped me throughout the project.

Executive Summary

In today's fast-paced world, travelers often find themselves struggling to get quality food during long journeys on trains or buses, especially in a country like Pakistan where reliable options are limited. To address this challenge, ***MapMyFood*** was conceived as a solution that seamlessly connects travelers with nearby restaurants, ensuring they can enjoy fresh meals delivered right to their next station or stop. The platform aims to provide an efficient and user-friendly service by leveraging cutting-edge technology. It uses geofencing to track a traveler's journey in real-time, predicting the most suitable stations for food delivery based on the timing of their trip. This minimizes waiting time and maximizes convenience. The app also incorporates a recommendation system, suggesting the best local cuisines from partner restaurants along the route. Powered by machine learning and collaborative filtering, its tailors' suggestions to user preferences, ensuring a personalized experience. ***MapMyFood*** has been built using the MERN stack (MongoDB, Express.js, React.js, and Node.js), with AI-driven features for time prediction and live tracking. The system is designed to be scalable, secure, and capable of handling high traffic during peak travel seasons. It integrates with local payment gateways like Easypaisa to ensure smooth, cashless transactions for users. The project has been developed with a clear structure in mind. Each phase, from conceptualization to implementation, followed a detailed project plan that included setting goals, defining roles, and tracking progress through a Gantt chart. Additionally, various design diagrams, such as architecture, class, and entity relationship diagrams, have been used to ensure a clear and efficient system layout. Best practices in coding, security, and user experience have been followed to provide a high-quality product. Ultimately, ***MapMyFood*** is more than just a food delivery service—it's a companion for travelers, making journeys more enjoyable by solving one of the most common issues they face: access to good food. With its robust design, personalized features, and seamless user interface, it brings a new level of convenience to traveling in Pakistan.

Table of Contents

List of Figures

List of Tables

Chapter 1

Introduction

Chapter 1: Introduction

This chapter introduces the core idea of the ***MapMyFood*** project. It begins by explaining the background and the need for a platform that helps travelers order food while they are on the move. It will cover the key motivations behind the project, the challenges travelers face, and the goals we aim to achieve with this solution. The chapter also discusses existing solutions in the market, identifies the gaps that **MapMyFood** intends to fill, and outlines our proposed approach. Finally, it will give a brief overview of the project plan, including the roles, responsibilities, and timeline.

1.1. Background

Traveling by train or bus is a common way for many people in Pakistan to move between cities. However, one major challenge that travelers face is finding good quality food during their journeys. Reports have shown that food provided on trains or by vendors at stations is often of poor quality, overpriced, and lacks hygiene. For example, a report from ***Dawn highlighted*** how Pakistan Railways has struggled with food safety and quality control [1]. Many passengers have shared their frustrations over the years, complaining that the food options available are either stale or unhealthy.

As a result, travelers often find themselves in a tough spot—either settling for subpar food or going without meals altogether. This gap in the market creates a need for a reliable system where passengers can easily order food from trusted restaurants while they are on the move. ***MapMyFood*** aims to fill this gap by providing a platform that connects travelers with local eateries, ensuring they can enjoy delicious and hygienic meals during their journeys.

1.2. Motivations and Challenges

The motivation behind ***MapMyFood*** stems from a genuine desire to enhance the travel experience for people in Pakistan. Many travelers rely on trains and buses for their journeys, yet they often face significant challenges in accessing quality food. The current options available to them—such as food from dining cars or local vendors—are frequently criticized for being unhealthy and overpriced. This issue became even more pressing during the COVID-19 pandemic

when concerns about hygiene and safety escalated. Passengers began to seek safer alternatives, which emphasized the need for a solution that not only prioritizes food quality but also offers convenience. Moreover, a report by the Pakistan Railways indicated that many food contractors fail to meet health and safety standards, leaving travelers with little choice but to consume substandard meals [2]. For instance, a 2023 article from ***Express Tribune*** highlighted numerous complaints from passengers about the food quality on trains like Tezgam and Khyber Mail [3]. This persistent problem indicates a significant gap in the market for a reliable food delivery service tailored specifically for travelers. However, challenges remain. Developing a platform that seamlessly connects travelers with restaurants involves various hurdles. These include ensuring timely deliveries to specific train stations, managing payment integrations, and addressing real-time tracking of food orders. Additionally, the need for effective partnerships with local restaurants to maintain quality standards presents its own challenges. Ultimately, ***MapMyFood*** aims to overcome these obstacles and provide travelers with a much-needed solution, allowing them to enjoy their journeys with delicious and hygienic food options readily available.

1.3. Goals and Objectives

The main goal of ***MapMyFood*** is to create a reliable food delivery service for travelers in Pakistan, ensuring they have access to quality meals during their journeys. To achieve this, we have set several specific objectives:

1.3.1. **Quality Food Options:** Partner with local restaurants to offer a diverse menu of healthy and delicious food choices. We want travelers to enjoy fresh meals that meet hygiene standards.

1.3.2. **Timely Deliveries:** Develop a system that guarantees food is delivered to passengers at train and bus stations just before their arrival. We aim for minimal wait times and maximum convenience.

1.3.3. **User-Friendly App:** Create a simple and easy-to-use mobile application where travelers can browse menus, place orders, and make payments. The app will be designed to cater to people of all ages and tech skills.

1.3.4. **Real-Time Tracking:** Implement a live tracking feature that allows users to monitor their food orders from the restaurant to their location. This will provide peace of mind and enhance the overall experience.

1.3.5. **Feedback System:** Establish a feedback mechanism that enables customers to rate their meals and delivery service. This will help us continuously improve our offerings based on traveler preferences.

1.3.6. **Awareness Campaign:** Run awareness campaigns to inform travelers about the service and its benefits. We want everyone to know that healthy food is just a click away during their travels.

By focusing on these goals and objectives, ***MapMyFood*** aims to transform the way people experience food on their journeys, making travel in Pakistan not just convenient but also enjoyable.

1.4. Literature Review/Existing Solutions

In Pakistan, the issue of accessing quality food during travel has been widely discussed, with various articles highlighting the challenges faced by passengers. Currently, the options for food while traveling, especially on trains, are limited and often unsatisfactory. The existing food vendors and dining cars frequently offer meals that lack hygiene and quality, leading to widespread dissatisfaction among travelers. A report by **Express Tribune** in 2023 noted that many passengers complain about the poor hygiene and overpriced meals on trains like Tezgam and Khyber Mail [3]. This reflects a significant gap in the market for reliable food delivery services aimed at travelers. While several food delivery platforms operate in urban areas, such as **Foodpanda** and **Careem**, they do not cater to those on the move. Foodpanda primarily serves customers at fixed locations, while Careem focuses on city residents. According to ***Dawn***, the official app of Pakistan Railways, ***PakRail***, provides train tracking and seat booking but lacks a food ordering feature (Reporter S. , 2023) [4]. This highlights the absence of a dedicated service for travelers seeking quality meals on their journeys. Internationally, services like **RailRestro** in India allow train passengers to order food that is delivered directly to their seats, demonstrating a successful model that could be adapted for Pakistan. However, as highlighted by **Geo News** in

2022, previous efforts to improve food quality on trains in Pakistan have focused on internal catering issues rather than addressing the needs of passengers directly (Reportor, 2022) [5].

Despite some platforms attempting to bridge the gap, none have fully addressed the specific needs of train and bus travelers in Pakistan. Thus, there remains a significant opportunity for ***MapMyFood*** to fill this void by providing a reliable, convenient, and quality food delivery service tailored to travelers on the go.

1.5. Gap Analysis

Despite various food service options available in Pakistan, significant gaps exist that MapMyFood aims to address. These gaps highlight the shortcomings of current solutions and underline the need for an innovative platform for travelers.

1.5.1. **Limited Food Options:** Current food services offered by Pakistan Railways and local vendors are often inadequate. Many travelers report a lack of variety, freshness, and quality in the meals provided. A study published by **Dawn** in 2023 noted that passengers frequently express dissatisfaction with the limited menu choices available during their journeys [6]. MapMyFood intends to connect passengers with a wide range of local restaurants, ensuring diverse culinary options tailored to individual preferences.

1.5.2. **Inadequate Food Safety Measures:** There have been consistent concerns regarding food hygiene and safety in Pakistan's transportation sector. The **Pakistan Medical Association** highlighted in a 2022 report that food served on trains often fails to meet basic health standards, leading to health risks for passengers [7]. MapMyFood plans to collaborate with certified food vendors, ensuring that meals are prepared and delivered under stringent hygiene protocols.

1.5.3. **Lack of Convenience:** The current food ordering systems are often cumbersome and not user-friendly. Existing apps like Foodpanda do not cater to train passengers and lack a straightforward method for ordering meals during travel. According to an analysis by **The Express Tribune** in 2023, the disconnect between food delivery services and transportation needs leaves travelers struggling to access meals while on

the move [8]. MapMyFood aims to provide a seamless, user-friendly interface where passengers can easily place orders and track deliveries directly to their seats.

1.5.4. Real-Time Delivery Tracking: Current systems do not offer effective tracking of food deliveries. This results in uncertainty for passengers about when and where their meals will arrive. A research study by **University of Karachi** in 2023 emphasized the importance of real-time tracking in improving customer satisfaction within the food service industry [9]. MapMyFood plans to implement a robust tracking feature, allowing passengers to monitor their orders in real time.

1.5.5. Cultural and Regional Variations: Food preferences vary significantly across different regions in Pakistan, yet current services often overlook these cultural aspects. An article in **Pakistan Today** from 2023 noted that food services need to cater to regional tastes to enhance traveler experience [10]. MapMyFood aims to include local vendors who offer regional specialties, ensuring that travelers can enjoy familiar and authentic dishes.

In conclusion, the gaps identified in the current food service landscape present a clear opportunity for MapMyFood to deliver a valuable and necessary service for train travelers in Pakistan.

1.6. Proposed Solution

MapMyFood is designed to fill the existing gaps in food services for travelers in Pakistan, particularly those using trains and buses. Our platform aims to enhance the travel experience by providing a seamless food ordering and delivery service. Here's how we propose to achieve this:

1.6.1. Comprehensive Food Marketplace

MapMyFood will serve as a digital marketplace where travelers can choose from a wide range of local restaurants and food vendors. The platform will feature menus that include regional specialties, ensuring that passengers can find meals that appeal to their tastes, no matter where they are traveling in Pakistan.

1.6.2. Quality and Safety Assurance

To address concerns regarding food quality and safety, we will partner with certified restaurants that meet strict hygiene standards. Each vendor will undergo a thorough vetting process to ensure they comply with health regulations. This way, passengers can enjoy delicious meals without worrying about foodborne illnesses.

1.6.3. User-Friendly Mobile App

The MapMyFood mobile app will be intuitive and easy to navigate, allowing users to browse food options quickly. Users can filter restaurants by cuisine, dietary preferences, or distance from their current location. They will also have the option to pre-order meals for specific train or bus routes, which will simplify the ordering process.

1.6.4. Real-Time Tracking

One of the standouts features of MapMyFood will be real-time order tracking. Passengers will receive notifications about their order status, including when their meal is being prepared, dispatched, and estimated time of arrival. This feature will give travelers peace of mind, knowing exactly when to expect their food.

1.6.5. Delivery to Seat or Designated Location

MapMyFood will provide a unique delivery service where food can be brought directly to the passenger's seat on trains or to a designated location at bus stops. This feature ensures that travelers don’t have to leave their seats to enjoy a meal, making their journey more comfortable.

1.6.6. Payment Flexibility

To accommodate a diverse user base, the app will offer multiple payment options, including cash on delivery and digital payments through popular platforms like Easypaisa and JazzCash. This flexibility will make transactions easier and more convenient for everyone.

1.6.7. Feedback and Rating System

To continuously improve the service, MapMyFood will implement a feedback and rating system. After each order, passengers will have the opportunity to rate their

food and service experience. This feedback will help us maintain high standards and make necessary improvements.

1.6.8. Marketing and Awareness Campaigns

To ensure that travelers are aware of the MapMyFood service, we will launch marketing campaigns targeting train and bus stations. These campaigns will include posters, flyers, and social media promotions to reach potential customers effectively.

1.6.9. Collaborations with Travel Agencies

We will explore partnerships with travel agencies and railway companies to offer promotional deals, making MapMyFood a preferred choice for food services during travel. By integrating our platform into travel itineraries, we aim to enhance the overall travel experience for passengers. In summary, ***MapMyFood*** aims to revolutionize the way travelers in Pakistan access food during their journeys. By focusing on quality, convenience, and user experience, we believe our solution will not only satisfy hunger but also enhance the overall travel experience for everyone.

1.7. Project Plan

The **MapMyFood** project will be managed using a structured approach that includes a detailed Work Breakdown Structure (WBS) and a Gantt Chart to outline the timeline and milestones. The WBS will encompass all project deliverables, ensuring comprehensive coverage of all tasks and responsibilities. The project team, consisting of Muhammad Hassan, Muhammad Usama Ashraf, and Ammar Ajmal, will collaborate effectively by defining roles and responsibilities clearly, enabling a focused effort towards achieving project goals.

1.7.1. Roles & Responsibility Matrix

Here is the role and responsibility matrix for MapMyFood's in which we are breaking down the entire work of development and documentation and assigning to the group members as per their skills. By building this we can manage our overall work and performance easily.

Table 1. Roles & Responsibilities Matrix

WBS #	WBS Deliverable	Activity #	Activity to Complete the Deliverable	Duration (# of Days)	Responsible Team Member(s) & Role(s)
1	Project Management	1.1	Work Breakdown System (WBS)	1	Ammar Ajmal (Documentator)
		1.2	Roles & Responsibility Matrix	2	Ammar Ajmal (Documentator)
		1.3	Change Control System	2	Ammar Ajmal (QCH)
2	Reports/Documentation	2.1	Final Documentation Introduction	2	Ammar Ajmal (Documentator)
		2.2	Literature/Market Survey	5	Ammar Ajmal (Documentator)
		2.3	Requirement Analysis	5	Muhammad Usama (Team Lead, Junior Dev)
		2.4	System Design	7	Muhammad Hassan (Senior Dev)
		2.5	Implementation	60	Usama, Hassan
		2.6	Testing & Performance Evaluation	10	Ammar Ajmal (QCH)

		2.7	Conclusion & Outlook	2	Ammar Ajmal (Documentator)
		2.8	End User Documentation	5	Ammar Ajmal (Documentator)
		2.9	Admin Documentation	5	Ammar Ajmal (Documentator)
3	System	3.1	Development Environment	5	Muhammad Hassan (Senior Dev)
		3.1.1	IDE	1	Muhammad Hassan
		3.1.2	Version Control	1	Muhammad Hassan
		3.1.3	Server	2	Muhammad Hassan
		3.1.4	Set Database	1	Usama (Junior Dev)
		3.2	Presentation Layer	30	Usama (Junior Dev)
		3.2.1	User Registration Module	10	Usama
		3.2.2	Restaurant Discovery	10	Usama
		3.2.3	Order Placement	10	Usama
		3.3	Basic Logic Layer	25	Muhammad Hassan
		3.3.1	API Development	15	Muhammad Hassan

		3.3.2	Recommendation System	10	Muhammad Hassan
		3.4	Data Management Layer	15	Muhammad Hassan
		3.4.1	Data Storage	5	Muhammad Hassan
		3.4.2	Data Retrieval	10	Muhammad Hassan
		3.5	Physical Layer	5	Muhammad Hassan
		3.5.1	Hosting Setup	5	Muhammad Hassan

This WBS provides a detailed breakdown of tasks for each phase of the project, along with assigned team members and estimated time frames. Each task in the WBS ensures a step-by-step process to deliver a functional product within the specified 7-month timeline.

1.7.2. Gantt Chart

The Gantt chart for the MapMyFood is a visual representation for the planned work. Basically, Gantt chart is a part of project management which we designed using Microsoft Project. The Gantt chart of MapMyFood project is given below:

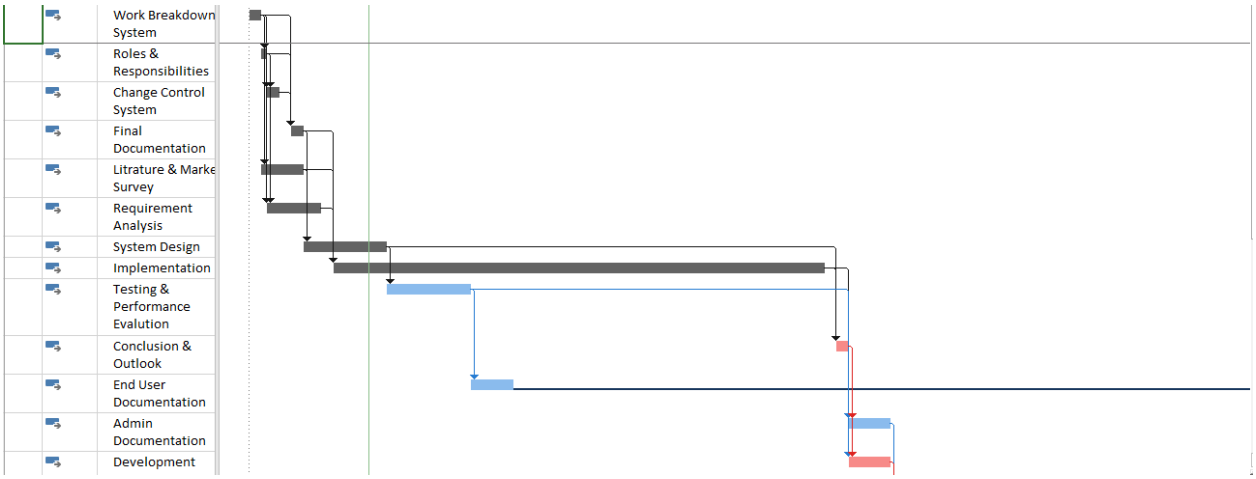


Figure 1. Gantt Chart for Project Management of MapMyFood

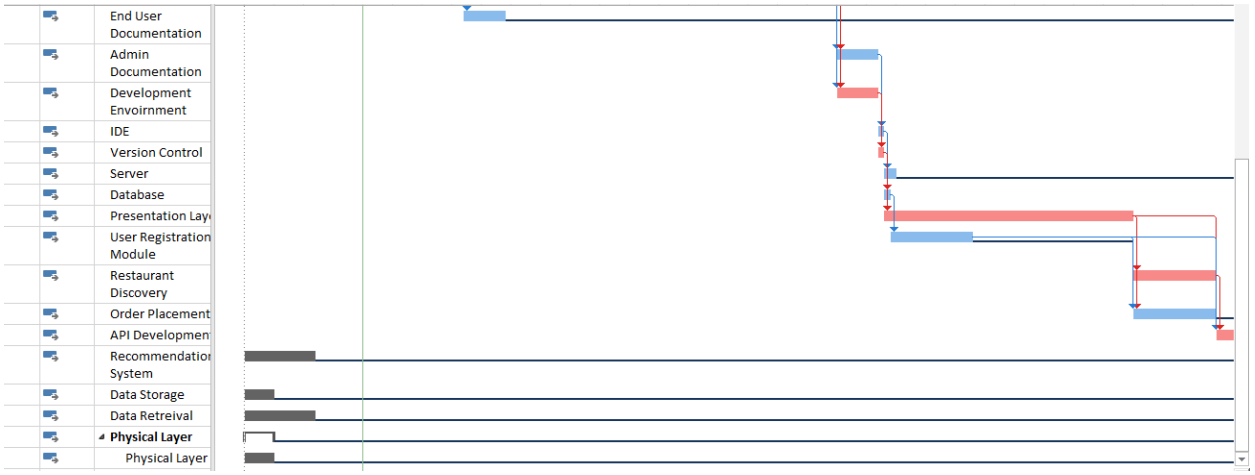


Figure 2. Gannt Chart of Project Management of MapMyFood 2

1.8. Empathy Map

The empathy map helps us understand the users of our **MapMyFood** project by breaking down their experiences into key areas. This visual tool allows us to capture insights about what our target users (travelers by train) **say**, **think**, **do**, and **feel** during their journey, especially concerning their food needs.

- In the **"Says"** section, we focus on the actual words or phrases users commonly express, such as frustrations about the lack of healthy food options or complaints about delayed food deliveries.
- The **"Thinks"** quadrant captures what users might be thinking but not saying out loud. This could include concerns about the quality of food or the reliability of delivery at train stations.
- The **"Does"** quadrant reflects the users' actions, such as checking restaurant menus on their phones or asking fellow travelers for food recommendations.
- The **"Feels"** quadrant captures emotional responses like impatience during travel, hunger, or excitement when their favorite meal is delivered.

By understanding these aspects, we can better align our features—such as real-time tracking, restaurant recommendations, and delivery timing predictions—to meet the users' needs and enhance their travel experience. This empathy map will guide our design and development decisions to ensure our app addresses both the practical and emotional aspects of the user experience.

Figure 3. Empathy Map for MapMyFood

Chapter 2

Software Requirement Specifications

2.1. Introduction

In this chapter, we will explain the technical requirements needed to build the ***MapMyFood*** platform. It outlines what the system needs in terms of software, interfaces, and features to ensure everything works as expected. The goal is to provide a clear understanding of the system's requirements, both for developers and anyone else involved. This chapter will cover the purpose of the software, the intended users, how it should function, and the environment in which it will operate. By the end, readers will have a comprehensive overview of all the necessary elements for the software to run effectively.

2.1.1. Purpose

The purpose of this document is to clearly define the software requirements for the ***MapMyFood*** platform. This platform is designed to help travelers in Pakistan order food during their journeys, with delivery to upcoming train or bus stations. This document focuses on the software side of the system, which includes how users will interact with it, the features it will offer, and the technical environment it needs to function properly. It covers everything from user interfaces to system features and the requirements for making this platform successful. While this document is centered on the software, it may also touch on some related elements like hardware and network needs.

2.1.2. Document Conventions

In this document, we follow some simple conventions to make everything clear and easy to read:

- **Bold Text** is used for section titles and important terms.
- *Italic Text* is used to highlight key ideas or concepts.
- Numbered lists (like this one) are used for steps or requirements that need to be followed in a specific order.
- Requirements are listed with their priorities, where:
- **High priority** indicates critical features that must be included.
- **Medium priority** covers important features but not essential for the first release.
- **Low priority** indicates optional features that can be added later.

These conventions help ensure consistency throughout the document and make it easier to understand the requirements and their importance.

2.1.3. Intended Audience and Reading Suggestions

This document is meant for various people involved in the project, each having different roles:

- **Developers:** Will use this document to understand what features to build and how the system should behave.
- **Project Managers:** Can use it to plan and track the project's progress, ensuring all features are delivered as expected.
- **Marketing Staff:** Might refer to it to understand the product's capabilities and unique selling points.
- **Testers:** Will find the detailed system requirements useful for creating test cases and ensuring everything works as described.
- **Documentation Writers:** Can use this to help create user manuals and guides based on the system's features.

For reading suggestions:

- **Start with the Introduction** for an overview of the project.
- **Move to the Overall Description** to get a high-level idea of the product.
- **Developers and testers** should dive into the System Features and External Interfaces to get into the technical details.
- **Project managers** may focus on the Project Plan and Requirements Priorities.

This structure helps each reader focus on the parts that are most relevant to their work.

2.1.4. Product Scope

The **MapMyFood** software is designed to help travelers in Pakistan conveniently order food while on the move by bus or train. The platform connects users with nearby restaurants, ensuring they receive fresh meals at upcoming stops. This system aims to enhance the travel experience by offering real-time tracking, food recommendations, and secure payment options, aligning with the growing demand for convenient travel solutions in the digital age.

The main goals of the project include:

- **Simplifying food ordering** during travel.
- **Offering personalized restaurant** suggestions.
- **Ensuring timely deliveries** to travelers at the next station.

This software not only aims to improve customer satisfaction but also supports local restaurants by connecting them with new customers. By aligning with business strategies focused on innovation and user convenience, **MapMyFood** contributes to expanding the digital ecosystem within Pakistan's transportation sector.

2.2. Overall Description

In this section, we provide a clear and simple overview of the **MapMyFood** application. This includes its context within the broader system, its main features, the types of users who will interact with it, and the environment in which it will operate. We also discuss any design and implementation constraints that may affect the project, the documentation available to users, and any assumptions or dependencies that are important for understanding how the app will function. By breaking down these components, we aim to give a comprehensive view of what **MapMyFood** is, how it will work, and what users can expect. This will help everyone involved, from developers to end users, understand the purpose and functionality of the application better. Each subsection will dive into specific details to ensure that all aspects are covered, creating a clear picture of the software's goals and how it aligns with user needs.

2.2.1. Product Perspective

The **MapMyFood** application is a new, self-contained product designed to enhance the food ordering experience for travelers in Pakistan. It aims to bridge the gap between travelers and local food vendors, allowing users to conveniently order food while they are on the move, particularly during train or bus journeys. This application is not a follow-on product from an existing family of products nor is it a direct replacement for any current systems. Instead, it offers a unique solution that addresses the specific needs of travelers who may find it challenging to order food while on transit. In the broader context, **MapMyFood** will integrate with various transportation systems, such as the Pakistan Railways, to provide real-time tracking of train

schedules. It will utilize APIs from services like the **PakRail** app for accurate train information and to enhance user experience.

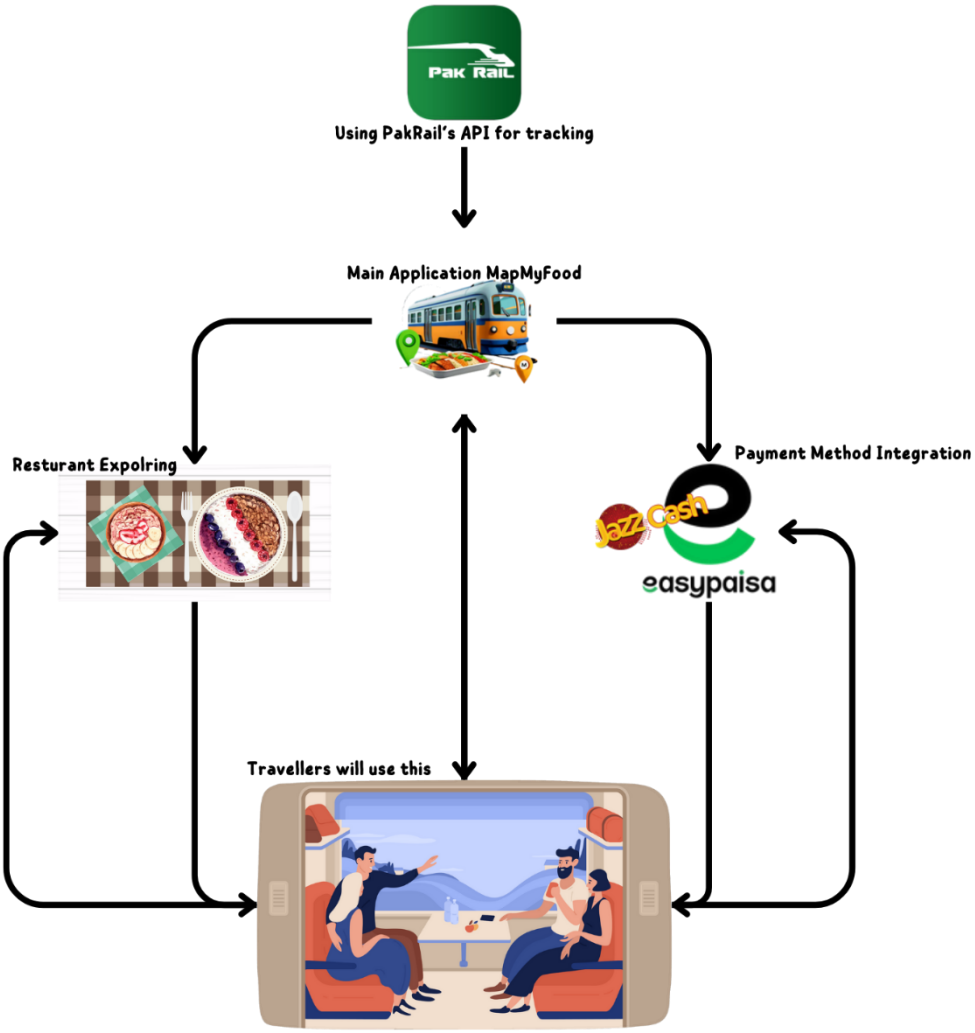


Figure 4. Product Perspective Diagram

This structure ensures that **MapMyFood** functions seamlessly within the larger system, providing a cohesive user experience for those who are traveling and seeking convenient dining options.

2.2.2. User Classes and Characteristics

In the **MapMyFood** application, we anticipate several distinct user classes, each with different characteristics and needs. Here are the main user classes:

- **Travelers:**
    - **Frequency of Use:** Regular users who travel often (e.g., daily commuters) and occasional travelers (e.g., holiday trips).
    - **Technical Expertise:** Varies from tech-savvy individuals comfortable with apps to those with limited experience.
    - **Characteristics:** They are looking for convenience and quick access to food options while on the go. Their main concern is an easy-to-use interface that allows them to place orders swiftly.
- **Food Vendors:**
    - **Frequency of Use:** Frequent users who manage their food listings and orders daily.
    - **Technical Expertise:** Moderate to high, as they need to understand how to use the app for order management.
    - **Characteristics:** Vendors need an intuitive system for updating their menus, managing orders, and tracking deliveries. They may have varying levels of familiarity with technology.
- **Administrators:**
    - **Frequency of Use:** Regular users who oversee the platform and manage user accounts, food vendors, and system operations.
    - **Technical Expertise:** High, as they need to handle technical issues and analyze system performance.
    - **Characteristics:** They require advanced functionalities to monitor the system, manage user feedback, and ensure a smooth operation.
- **Testers:**
    - **Frequency of Use:** Temporary users engaged during the development phase to ensure the app functions correctly.

- **Technical Expertise:** High, as they need to understand software testing procedures.
- **Characteristics:** Testers focus on identifying bugs and ensuring that all features work as intended. They need access to all areas of the app for thorough testing.

Importance of User Classes:

- The most important user class for **MapMyFood** is the **Travelers**, as they are the primary audience for the app. Their satisfaction is crucial for the app's success.
- **Food Vendors** are also vital, as they provide the services that travelers will be using.
- **Administrators** play an essential role in maintaining the system's functionality and user experience.
- **Testers**, while important during the development phase, are less critical once the app is launched, as their focus is on ensuring quality before release.

By understanding these user classes and their characteristics, we can tailor the app to meet the needs of each group effectively.

2.2.3. Operating Environment

The **MapMyFood** application is designed to operate across multiple platforms to ensure accessibility for all users. Here's a breakdown of the operating environment:

- **Hardware Platform:**

The application will run on a range of devices, including smartphones, tablets, and computers. This includes devices with different specifications, such as varying screen sizes and processing capabilities.

- **Operating Systems:**
  - **iOS:** The app will be compatible with iOS devices, supporting the latest versions, specifically iOS 14 and above.
  - **Android:** It will also function on Android devices, supporting Android version 8.0 (Oreo) and higher to ensure a broad range of compatibility.
  - **Windows:** For desktop users, the application will be available on Windows 10 and later versions, ensuring that users can access the app on their laptops or PCs.

- **Web:** The web version will be accessible through modern web browsers such as Google Chrome, Mozilla Firefox, Microsoft Edge, and Safari. Users will need an internet connection to access this version.

- **Coexisting Software Components:**

The app may need to interact with various other software components and services. For instance:

- **Payment Gateways:** It will integrate with popular payment systems like Easypaisa and other local payment solutions to facilitate transactions.
- **Geolocation Services:** The app will utilize GPS and mapping services to provide accurate location tracking and food delivery options.
- **API Integrations:** It will connect with APIs, such as the PakRail app for train tracking, to enhance functionality.

By ensuring that **MapMyFood** is compatible with these platforms and services, we aim to provide a seamless and user-friendly experience for all users, whether they are traveling or ordering food on the go.

2.2.4. Design and Implementation Constraints

When developing the **MapMyFood** application, several constraints will guide the design and implementation process. Here are the key limitations that developers need to consider:

- **Regulatory Policies:**

The application must comply with local laws and regulations related to food delivery services. This includes adhering to health and safety standards to ensure food safety during delivery.

- **Hardware Limitations:**

The app should be optimized to work efficiently on devices with varying hardware specifications. This includes ensuring that it does not consume too much memory or processing power, which can affect performance on older devices.

- **Interface with Other Applications:**

The app will need to interface with external applications, such as payment gateways and geolocation services. Developers must follow specific protocols and standards to ensure smooth communication between these systems.

- **Technology Stack:**

The development team has decided to use specific technologies and tools, such as the MERN stack (MongoDB, Express.js, React, Node.js) for the application. These choices will limit the use of alternative frameworks or languages.

- **Security Considerations:**

Given that the app will handle sensitive user information, such as payment details and personal data, it must implement strong security measures. This includes data encryption and secure user authentication processes.

- **Design Conventions:**

The application should follow established design conventions and user interface guidelines to provide a consistent and user-friendly experience. This means adhering to specific design patterns and layout rules.

- **Programming Standards:**

The development team must follow coding standards and best practices to ensure the code is maintainable and understandable. This is particularly important as the customer's organization will be responsible for maintaining the software after delivery.

These constraints will shape the development process, ensuring that the **MapMyFood** application is both functional and compliant with necessary standards while providing a reliable service to users.

2.2.5. Assumptions and Dependencies

In developing the **MapMyFood** application, several assumptions have been made that could influence the project's requirements. These assumptions are important because if they turn out to be incorrect, they may affect the project's success. Here are the key assumptions and dependencies:

- **User Availability:**

It is assumed that users will have access to the internet and smartphones capable of running the application. This is essential for the app's functionality, as it relies on real-time data for tracking orders and delivery.

- **Third-Party Services:**

The project assumes the availability and reliability of third-party services, such as payment gateways (like Easypaisa) and geolocation APIs. If these services experience downtime or change their policies, it could disrupt the app's operations.

- **User Engagement:**

We assume that users will engage with the app frequently and provide feedback. This feedback is crucial for ongoing improvements and updates to the app's features.

- **Technology Stability:**

It is assumed that the chosen technology stack (MERN) will remain stable and supported throughout the development process. Any changes or lack of support could complicate the project.

- **Regulatory Changes:**

The project assumes that local regulations regarding food delivery services will remain constant. Sudden changes in laws or regulations could require significant adjustments to the app’s features.

- **Development Environment:**

It is assumed that the development team will have access to the necessary tools and resources to build the application effectively. This includes software licenses, development environments, and testing tools.

- **Dependencies on Existing Systems:**

The project may rely on existing software components or systems from previous projects. If these components are not available or have limitations, it could affect the development timeline and functionality.

By recognizing these assumptions and dependencies, the development team can plan more effectively and mitigate risks associated with unexpected changes or challenges during the project lifecycle.

2.3. External Interface Requirements

In this section, we will discuss the external interfaces required for the **MapMyFood** application. These interfaces are crucial for the application to communicate effectively with users, hardware,

software systems, and other services. Below is an overview of the various types of external interface requirements:

2.3.1. User Interfaces

The user interface (UI) of the **MapMyFood** application is designed to be simple and user-friendly, ensuring that all users, regardless of their technical expertise, can navigate and use the app easily. Here's an overview of the logical characteristics of the user interface:

- **Screen Layout:**

The app will have a clean and organized layout, with easy navigation menus at the bottom or side of the screen. Key sections like "Order Food," "Track Order," and "User Profile" will be clearly labeled for quick access.

- **Common Elements:**

Every screen will feature standard buttons, such as "Home," "Back," and "Help," making it easy for users to find their way around. A consistent color scheme and font style will be used throughout to maintain visual harmony.

- **Help Functionality:**

A "Help" button will be available on all screens, allowing users to access support or FAQs easily. This feature will assist users in resolving common issues or questions quickly.

- **Error Messages:**

Error messages will be displayed clearly, using simple language. They will inform users about the issue and provide guidance on how to resolve it. For example, if a user tries to place an order without entering a delivery address, a message will pop up saying, "Please enter your delivery address to proceed."

- **Keyboard Shortcuts:**

For desktop users, standard keyboard shortcuts will be implemented to enhance usability. For instance, users can press "Ctrl + S" to save their order or "Esc" to cancel a current action.

- **Touch and Gesture Support:**

For mobile users, the app will support touch gestures, like swiping to navigate between screens and tapping buttons to place orders. This will make the app more intuitive for users on smartphones and tablets.

- **Sample Screens:**

Screenshots or mockups of key interfaces will be included in the separate user interface specification document. These images will illustrate how each part of the app looks, from the home screen to the order tracking page.

- **Design Standards:**

The UI will adhere to established design standards for mobile and web applications to ensure a consistent experience across all devices. This includes following guidelines for font sizes, button shapes, and color contrasts for readability.

In summary, the user interface of **MapMyFood** will prioritize simplicity and accessibility, ensuring that users can easily navigate the app and utilize its features without frustration. A separate user interface specification document will contain more detailed design elements and sample screen images for further reference.

2.3.2. Hardware Interfaces

The **MapMyFood** application will interact with various hardware components to ensure smooth functionality across different devices. Here's an overview of the logical and physical characteristics of the hardware interfaces:

- **Supported Device Types:**

The application will support multiple device types, including smartphones (both Android and iOS), tablets, and desktop computers running Windows. This ensures that users can access the app on the device of their choice.

- **User Interaction:**

Users will interact with the application through touchscreens on mobile and tablet devices or via a mouse and keyboard on desktop systems. The app will be designed to respond to user actions, such as taps, swipes, clicks, and key presses, allowing for an intuitive experience.

- **Data Interactions:**

The app will exchange data with the hardware for various functions, such as placing orders, tracking deliveries, and updating user profiles. For example, when a user places an order, the app will send the order details to the server, which will then communicate with the relevant restaurants.

- **Control Interactions:**

Control interactions will include user commands like selecting menu items, confirming orders, or tracking delivery status. The app will process these commands and communicate with the hardware to perform necessary actions, such as accessing the camera for scanning QR codes or using GPS for location tracking.

- **Communication Protocols:**

The app will use standard communication protocols, such as HTTP/HTTPS for data transmission over the internet. This ensures secure communication between the app and the server for activities like order processing and payment transactions.

- **Peripheral Device Support:**

If applicable, the application may support connections with peripheral devices, such as barcode scanners or printers, for specific functionalities like printing receipts or scanning items in a restaurant setting.

In summary, the **MapMyFood** application will have straightforward hardware interfaces that allow it to interact effectively with various devices. These interactions will be designed to provide a seamless and user-friendly experience while maintaining secure communication between the app and its hardware components.

2.3.3. Software Interfaces

The **MapMyFood** application will interact with several software components to function effectively. Here's a detailed description of these connections:

- **Databases:**

The app will connect to a database management system, such as **MongoDB (version 4.4),** to store user profiles, order details, restaurant menus, and other essential data. This database will allow

for easy retrieval and management of data, ensuring that users have access to the latest information.

- **Operating Systems:**
    - The application will be designed to work on various operating systems, including:
        - **Android (version 11 and above)**
        - **iOS (version 14 and above)**
        - **Windows (version 10 and above)**
    - Ensuring compatibility with these operating systems will allow users to access the app on their preferred devices.
- **Communication Protocols:**

The app will utilize **RESTful APIs** to communicate with the backend services. This means that the app will send requests to the server (e.g., for placing an order or retrieving restaurant data) and receive responses in a standardized format, usually **JSON**. This structure allows for efficient data exchange between the app and the server.

- **Data Items:**
    - Key data items exchanged between the app and other software components include:
    - **User Data:** User profiles and preferences are sent to the server during registration and updates.
    - **Order Data:** When a user places an order, details like the selected items, delivery address, and payment information are sent to the server.
    - **Menu Data:** The app requests updated restaurant menus, which the server provides in response.
    - Each of these data exchanges serves a specific purpose, such as maintaining user accounts, processing orders, or ensuring up-to-date information.
- **Shared Data:**

Data shared across software components will include user preferences, order history, and real-time delivery tracking information. This shared data will help create a personalized experience for users and streamline order management.

- **Integration with Third-party Services:**

The app may also integrate with third-party services for functionalities like payment processing (e.g., **Easypaisa** or **Jazzcash**) and location tracking (e.g., **PakRail API**). These integrations will enhance the app's capabilities and improve user experience.

- **Implementation Constraints:**

It's essential that the data sharing mechanism is efficient and secure. For instance, sensitive user data must be encrypted during transmission to protect privacy. Any use of a global data area for shared access among multiple components should comply with the guidelines of the operating systems involved.

In summary, the **MapMyFood** application will connect with various software components, ensuring smooth operation and data flow. These connections will facilitate effective communication, data management, and a seamless user experience.

2.3.4. Communications Interfaces

The **MapMyFood** application will require several communication functions to operate effectively. Here are the key details:

- **Communication Protocols:**

The app will primarily use **HTTP/HTTPS** protocols for web-based communications. This ensures secure data transfer between the app and the server.

- **E-mail Notifications:**

Users will receive e-mail notifications for order confirmations, updates, and delivery status. These notifications will be formatted in clear and concise language to ensure users understand the information easily.

- **Data Transfer:**

The app will support real-time data transfer, allowing users to receive updates on their orders instantly. The expected data transfer rates will be optimized for fast loading times and minimal delays.

- **Security:**

All communications will employ encryption (e.g., SSL/TLS) to protect sensitive user data, such as personal information and payment details. This ensures that all data exchanged between the app and the server remains confidential.

- **Synchronization:**

The app will include synchronization mechanisms to ensure that all user data (like order history and preferences) is consistently updated across devices. This will help provide a seamless experience for users who switch between devices.

In summary, the **MapMyFood** application will utilize secure and efficient communication protocols to ensure that users can interact with the app safely and effectively, enhancing their overall experience.

2.4. System Features

The **MapMyFood** application includes several key features that enhance its functionality and provide value to users. Below, we describe the major system features organized by their primary services:

2.4.1. Food Ordering System

- **Description and Priority**

The **Food Ordering System** allows users to browse through various restaurant menus, select food items, customize their orders, and place them for delivery or pickup. This feature is of **High priority** because it is the core function of the MapMyFood app. It directly impacts user satisfaction and the overall success of the platform.

Priority Ratings:

- **Benefit**: 9 (High)
- **Penalty**: 7 (Medium)
- **Cost**: 6 (Medium)
- **Risk**: 4 (Low)

- **Stimulus/Response Sequences**

- **User Action**: The user opens the app and selects a restaurant.
    - **System Response**: The app displays the restaurant's menu with available food items.
- **User Action**: The user browses the menu and selects a food item.
    - **System Response**: The app shows item details, including price, description, and customization options.
- **User Action**: The user customizes their order (e.g., choosing toppings, size).
    - **System Response**: The app updates the order summary and displays the total cost.
- **User Action**: The user adds the item to their cart.
    - **System Response**: The app confirms the addition and updates the cart total.
- **User Action**: The user proceeds to checkout.
    - **System Response**: The app prompts the user for delivery or pickup options and payment details.
- **User Action**: The user completes the payment.
    - **System Response**: The app confirms the order placement and displays an estimated delivery time.

- **Functional Requirements**

REQ-SF1-1: The system shall allow users to view a list of available restaurants based on their location.

REQ-SF1-2: The system shall enable users to browse restaurant menus and select food items.

REQ-SF1-3: The system shall provide customization options for food items, such as size and toppings.

REQ-SF1-4: The system shall allow users to add selected food items to a cart.

REQ-SF1-5: The system shall calculate and display the total cost of the items in the cart.

REQ-SF1-6: The system shall facilitate secure payment processing for orders.

REQ-SF1-7: The system shall send a confirmation notification to the user after the order is placed.

REQ-SF1-8: The system shall handle errors gracefully, such as when the selected item is no longer available, by notifying the user and suggesting alternatives.

2.4.2. Live Order Tracking

- **Description and Priority**

  The **Live Order Tracking** feature allows users to monitor the status of their food orders in real-time. This feature is of **High priority** because it enhances the user experience by providing transparency and reducing anxiety about order delivery times.

  Priority Ratings:

  - **Benefit:** 9 (High)
  - **Penalty:** 6 (Medium)
  - **Cost: 5** (Medium)
  - **Risk: 3** (Low)

- **Stimulus/Response Sequences**

- **User Action:** The user places an order and is taken to the order confirmation screen.
  - **System Response:** The app displays a "Track Order" button.
- **User Action:** The user clicks on the "Track Order" button.
  - **System Response:** The app shows a live map with the current location of the delivery driver and estimated time of arrival (ETA).
- **User Action:** The user refreshes the tracking screen.
  - **System Response:** The app updates the map and ETA in real-time.
- **User Action:** The delivery driver begins to head towards the user's location.
  - **System Response:** The app notifies the user of the driver's departure with an updated ETA.
- **User Action:** The order is marked as delivered.
  - **System Response:** The app confirms the delivery status and provides an option for the user to rate their experience.

- **Functional Requirements**

  REQ-SF2-1: The system shall allow users to access the live order tracking feature after placing an order.

  REQ-SF2-2: The system shall provide a real-time map displaying the location of the delivery driver.

  REQ-SF2-3: The system shall update the estimated time of arrival (ETA) based on the driver's current location.

  REQ-SF2-4: The system shall send notifications to the user when the driver is en route and when the order is delivered.

  REQ-SF2-5: The system shall allow users to refresh the tracking information to view the latest updates.

  REQ-SF2-6: The system shall enable users to provide feedback on their delivery experience after the order is completed.

2.4.3. Payment Processing

- **Description and Priority**

  The **Payment Processing** feature enables users to securely pay for their food orders using various payment methods. This feature is of **High priority** as it is essential for completing the order process and provides users with a seamless payment experience.

  Priority Ratings:

  - **Benefit:** 9 (High)
  - **Penalty:** 7 (Medium)
  - **Cost:** 6 (Medium)
  - **Risk:** 4 (Low)

- **Stimulus/Response Sequences**

- **User Action:** The user selects items and proceeds to the checkout.
  - **System Response:** The app displays the order summary and payment options.
- **User Action:** The user selects a payment method (e.g., credit card, debit card, mobile wallet).

- **System Response:** The app prompts the user to enter payment details (card number, expiration date, CVV, etc.).

- **User Action:** The user enters the payment information and submits it.
  - **System Response:** The app validates the payment details and initiates the payment processing.
- **User Action:** The user waits for confirmation of payment.
  - **System Response:** The app displays a loading spinner while processing the payment.
- **User Action:** Upon successful payment, the user receives confirmation.
  - **System Response:** The app confirms the payment and displays the order confirmation along with an estimated delivery time.
- **User Action:** If payment fails, the user is prompted to retry or choose a different payment method.
  - **System Response:** The app displays an error message indicating the payment failure and offers options to retry.
- **Functional Requirements**

  REQ-SF3-1: The system shall allow users to select from multiple payment methods, including credit cards, debit cards, and mobile wallets.

  REQ-SF3-2: The system shall ensure that all payment information is transmitted securely using encryption standards.

  REQ-SF3-3: The system shall validate the payment details entered by the user before processing.

  REQ-SF3-4: The system shall provide real-time feedback on payment processing status, including success and failure notifications.

  REQ-SF3-5: The system shall allow users to save their payment information securely for future transactions, with an option to edit or delete saved information.

  REQ-SF3-6: The system shall comply with relevant financial regulations and standards, such as PCI DSS, to ensure safe payment processing.

2.4.4. User Account Management

- **Description and Priority**

  The **User Account Management** feature allows users to create, manage, and delete their accounts on the MapMyFood platform. This feature is of **High priority** as it is essential for user personalization, security, and access to order history and preferences.

  Priority Ratings:

  - **Benefit:** 9 (High)
  - **Penalty:** 5 (Medium)
  - **Cost:** 6 (Medium)
  - **Risk:** 3 (Low)

- **Stimulus/Response Sequences**

- **User Action:** The user chooses to create a new account or log into an existing account.
  - **System Response:** The app displays the account creation or login form.
- **User Action:** The user fills out the registration form with personal information (e.g., name, email, password).
  - **System Response:** The app validates the information for completeness and uniqueness (e.g., checking if the email is already in use).
- **User Action:** The user submits the registration form.
  - **System Response:** The app creates a new account and sends a confirmation email with a verification link.
- **User Action:** The user clicks on the verification link in the email.
  - **System Response:** The app verifies the email and activates the user's account.
- **User Action:** The user logs in with their credentials.
  - **System Response:** The app grants access and displays the user dashboard.
- **User Action:** The user chooses to update their account information (e.g., changing their password or email).
  - **System Response:** The app allows the user to make changes and confirms the update upon submission.

- **User Action:** The user decides to delete their account.
    - **System Response:** The app prompts the user for confirmation and, upon confirmation, deletes the account and associated data.

- **Functional Requirements**

  REQ-SF4-1: The system shall allow users to create an account by providing required personal information, including name, email, and password.

  REQ-SF4-2: The system shall validate the uniqueness of the email address during registration to prevent duplicate accounts.

  REQ-SF4-3: The system shall send a confirmation email with a verification link upon successful registration.

  REQ-SF4-4: The system shall allow users to log in using their registered email and password.

  REQ-SF4-5: The system shall provide functionality for users to update their personal information and change their password securely.

  REQ-SF4-6: The system shall allow users to delete their account, including all associated data, with a confirmation prompt to prevent accidental deletions.

  REQ-SF4-7: The system shall implement security measures, such as password encryption and secure session management, to protect user account information.

This feature is vital for ensuring that users can have personalized experiences, manage their information securely, and maintain control over their accounts on the MapMyFood platform.

2.4.5. Feedback and Ratings

- **Description and Priority**

  The **Feedback and Ratings** feature allows users to provide feedback and rate their food ordering experience on the MapMyFood platform. This feature is of **medium priority** as it helps improve services and enhances customer satisfaction.

  Priority Ratings:

  - **Benefit:** 8 (High)
  - **Penalty:** 4 (Medium)

- **Cost:** 5 (Medium)
- **Risk:** 4 (Medium)

- **Stimulus/Response Sequences**
- **User Action:** After receiving their order, the user chooses to provide feedback or rate the service.
    - **System Response:** The app displays the feedback and rating form.
- **User Action:** The user selects a rating (e.g., 1 to 5 stars) and enters comments about their experience.
    - **System Response:** The app validates the input to ensure a rating is selected and comments meet character limits.
- **User Action:** The user submits their feedback and rating.
    - **System Response:** The app stores the feedback in the database and displays a confirmation message.
- **User Action:** The user wishes to view previous feedback and ratings.
    - **System Response:** The app retrieves and displays the user's past feedback and ratings for review.
- **Functional Requirements**

  REQ-SF5-1: The system shall provide a user interface for submitting feedback and ratings for each order.

  REQ-SF5-2: The system shall allow users to rate their experience on a scale of 1 to 5 stars.

  REQ-SF5-3: The system shall enable users to provide comments and suggestions in a text box with a character limit.

  REQ-SF5-4: The system shall validate that a rating is selected before allowing submission of feedback.

  REQ-SF5-5: The system shall store feedback and ratings securely in the database for future analysis.

  REQ-SF5-6: The system shall provide users with the ability to view their past feedback and ratings associated with their account.

REQ-SF5-7: The system shall ensure that all feedback is anonymous and does not disclose the user's identity publicly.

This feature is essential for fostering user engagement, collecting valuable insights, and continuously improving the services offered by MapMyFood based on customer experiences.

2.5. Nonfunctional Requirements

2.5.1. Performance Requirements

Performance requirements outline how well the MapMyFood application should operate under different conditions. These requirements ensure that users have a smooth and efficient experience. Here are the key performance requirements for the product:

- **Response Time for Order Placement**
  - The system shall process a user's food order and display a confirmation within **3 seconds** under normal operating conditions.
  - **Rationale:** Quick response times enhance user satisfaction and keep customers engaged. A delay longer than this may lead to frustration and a potential loss of customers.
- **Order Tracking Update Frequency**
  - The live order tracking feature shall update the order status every **30 seconds** to provide users with real-time information.
  - **Rationale:** Frequent updates keep users informed about their order status, improving their experience and trust in the service.
- **System Load Handling**
  - The system shall support at least **500 simultaneous users** placing orders without degradation in performance.
  - **Rationale:** To ensure the application can handle peak usage times, such as during lunch or dinner hours, it’s crucial that the system remains responsive even with high traffic.
- **Data Retrieval Speed**
  - The system shall retrieve user feedback and ratings from the database and display them within **2 seconds.**

- **Rationale:** Fast data retrieval is important for users who want to view their past feedback and ratings quickly.

- **Payment Processing Time**
  - The payment processing feature shall complete the transaction within **5 seconds** under normal conditions.
  - **Rationale:** A swift payment process minimizes the risk of cart abandonment and increases user confidence in the system.
- **Error Rate**
  - The system shall maintain an error rate of less than **1%** for order placements and payments.
  - **Rationale:** A low error rate is vital for maintaining user trust and ensuring a reliable experience.
- **System Availability**
  - The system shall be available **99.9% of the time**, excluding scheduled maintenance.
  - **Rationale:** High availability ensures that users can access the service whenever they need it, which is crucial for customer satisfaction.

By adhering to these performance requirements, the development team can create a robust application that meets user expectations and provides a seamless experience.

2.5.2. Safety Requirements

Safety requirements focus on ensuring that the MapMyFood application operates without causing harm or damage to users or their data. Here are the key safety requirements for the product:

- **Data Security**
  - The system must use encryption for all sensitive user data, including payment information and personal details.
  - **Safeguard:** This protects user information from unauthorized access and potential theft.
  - **Regulation:** The application must comply with data protection regulations like GDPR to ensure users' personal data is handled safely.

- **Payment Security**
  - The payment processing feature must adhere to Payment Card Industry Data Security Standard (PCI DSS) requirements.
  - **Safeguard:** This ensures secure transactions, protecting users from fraud and unauthorized charges.
  - **Action Prevented:** Any processing of credit card information must not be stored on the application's servers to avoid data breaches.
- **User Authentication**
  - The system must require users to create strong passwords and implement two-factor authentication for account access.
  - **Safeguard:** This adds an extra layer of security to prevent unauthorized access to user accounts.
- **Emergency Contact Information**
  - The application must provide users with an option to save emergency contact information within their profile.
  - **Safeguard:** In case of any issues during food delivery or emergencies, users can quickly contact someone for assistance.
- **Error Handling**
  - The system must have clear error messages that guide users on how to resolve issues without risking their data or security.
  - **Safeguard:** This helps prevent user confusion and potential loss of data due to incorrect actions.
- **Compliance with Health Standards**
  - The application must ensure that all partnered restaurants comply with local health and safety regulations.
  - **Safeguard:** This ensures that the food delivered to users is safe to consume and prepared following health guidelines.

- **User Safety Notifications**
  - The system must send notifications to users about any potential safety issues, such as food recalls or health alerts related to specific restaurants.
  - **Safeguard:** This keeps users informed and allows them to make safe choices regarding their food orders.

By following these safety requirements, the MapMyFood application will ensure a secure and safe environment for users while they order food. This not only protects users but also builds trust in the service.

2.5.3. Security Requirements

Security requirements focus on protecting the MapMyFood application and its users from unauthorized access and data breaches. Here are the main security requirements for the product:

- **User Authentication**
  - Users must create strong passwords that meet minimum complexity standards (e.g., a mix of letters, numbers, and special characters).
  - The system must implement two-factor authentication (2FA) for added security during login.
  - **Purpose:** This helps ensure that only authorized users can access their accounts.
- **Data Encryption**
  - All sensitive user data, such as personal information and payment details, must be encrypted both at rest and in transit.
  - **Purpose:** This protects data from being intercepted or accessed by unauthorized individuals.
- **Access Control**
  - The application must implement role-based access control (RBAC) to limit user access based on their roles (e.g., admin, user, delivery person).
  - **Purpose:** This ensures that users can only access the data and functions they are authorized to use.

- **Secure Data Storage**
  - User passwords must be securely hashed and stored, not in plain text.
  - **Purpose:** This protects user passwords from being exposed in the event of a data breach.
- **Regular Security Audits**
  - The application must undergo regular security audits and vulnerability assessments to identify and fix potential security issues.
  - **Purpose:** This helps maintain a strong security posture and ensures that any vulnerabilities are addressed promptly.
- **Compliance with Regulations**
  - The application must comply with relevant data protection regulations, such as GDPR and CCPA, which govern how user data is collected, processed, and stored.
  - **Purpose:** This ensures that user privacy is respected and legal requirements are met.
- **Incident Response Plan**
  - The system must have an incident response plan in place to quickly address any security breaches or data leaks.
  - **Purpose:** This helps minimize damage and restore security as quickly as possible.
- **User Privacy Settings**
  - Users must be provided with privacy settings that allow them to control how their data is shared and used.
  - **Purpose:** This empowers users to make informed choices about their privacy and data sharing.

By following these security requirements, the MapMyFood application can protect user data, maintain user trust, and comply with relevant regulations, ensuring a secure environment for all users.

2.5.4. Usability Requirements

Usability requirements focus on making the MapMyFood application easy and pleasant for users to interact with. Here are the key usability requirements:

- **User-Friendly Interface**
  - The application must have a clean and intuitive design that allows users to navigate easily.
  - **Purpose:** This helps users find what they need quickly without confusion.
- **Clear Instructions**
  - The app must provide clear instructions and tooltips for all features, guiding users through the ordering process.
  - **Purpose:** This ensures users understand how to use the app effectively.
- **Fast Load Times**
  - The application should load within 3 seconds under normal network conditions.
  - **Purpose:** This enhances the user experience by reducing waiting times.
- **Accessibility Features**
  - The app must comply with accessibility standards (e.g., WCAG) to accommodate users with disabilities.
  - **Purpose:** This ensures that all users, including those with disabilities, can use the app.
- **Responsive Design**
  - The application must be responsive and work seamlessly on various devices, including smartphones, tablets, and desktops.
  - **Purpose:** This allows users to access the app from any device without losing functionality.
- **Feedback Mechanism**
  - The app should provide immediate feedback for user actions (e.g., confirmation messages after placing an order).
  - **Purpose:** This reassures users that their actions have been successfully completed.

By adhering to these usability requirements, the MapMyFood application can provide a positive user experience, making it easy for users to order food and interact with the app effectively.

2.5.5. Reliability Requirements

Reliability requirements ensure that the MapMyFood application functions consistently and effectively under various conditions. Here are the key reliability requirements:

- **System Availability**
  - The application should have an uptime of at least 99.5% over a month.
  - **Purpose:** This ensures that users can access the app whenever they need to place an order.
- **Error Rate**
  - The application must have an error rate of less than 1% for all transactions.
  - **Purpose:** This minimizes issues that could lead to failed orders or poor user experiences.
- **Data Integrity**
  - The system must ensure that all data (e.g., user information, order details) is accurately stored and retrieved without corruption.
  - **Purpose:** This guarantees that users receive correct and reliable information.
- **Recovery Time**
  - In the event of a system failure, the application should recover and restore full functionality within 5 minutes.
  - **Purpose:** This minimizes disruption for users and maintains trust in the system's reliability.
- **Load Handling**
  - The application must handle up to 1,000 concurrent users without significant degradation in performance.
  - **Purpose:** This ensures that the system remains responsive even during peak usage times.
- **Regular Backups**
  - The application should perform automatic backups of all critical data every 24 hours.
  - **Purpose:** This helps protect user data from loss due to system failures or other unforeseen issues.

By meeting these reliability requirements, the MapMyFood application can provide a dependable service that users can trust for their food ordering needs.

2.5.6. Maintainability/Supportability Requirements

Supportability and maintainability requirements ensure that the MapMyFood application can be easily updated, repaired, and supported over its lifecycle. Here are the key requirements:

- **Modular Architecture**
  - The application should be designed with a modular architecture to allow for easy updates and changes to individual components without affecting the entire system.
  - **Purpose**: This facilitates faster implementation of new features and bug fixes.
- **Documentation**
  - Comprehensive documentation must be provided for all aspects of the application, including code comments, user manuals, and API documentation.
  - **Purpose:** This ensures that developers and support staff can easily understand and manage the system.
- **Error Logging**
  - The application should implement error logging that records errors and exceptions with detailed information, including timestamps and user actions leading up to the issue.
  - **Purpose:** This aids in troubleshooting and resolving issues quickly.
- **User Support**
  - A user support system must be available, including FAQs, chat support, and email support, to assist users with issues or questions.
  - **Purpose:** This enhances user satisfaction and helps resolve issues efficiently.
- **Version Control**
  - The application must utilize version control for its codebase to track changes, manage updates, and enable easy rollbacks if needed.
  - **Purpose:** This improves collaboration among developers and helps maintain the integrity of the application.
- **Automated Testing**
  - The application should include automated testing for critical functionalities to ensure that new changes do not introduce new bugs.

- **Purpose:** This enhances the reliability of the application and reduces the need for manual testing.

- **Performance Monitoring**
  - The application must include performance monitoring tools to track system performance and identify potential issues before they affect users.
  - **Purpose:** This allows for proactive maintenance and optimization of the application.

By implementing these supportability and maintainability requirements, the MapMyFood application can be efficiently managed, updated, and supported, ensuring a smooth experience for both users and developers.

2.5.7. Portability Requirements

Portability requirements ensure that the MapMyFood application can be easily adapted to different platforms and environments. Here are the key requirements:

- **Cross-Platform Compatibility**
  - The application should run on multiple platforms, including iOS, Android, Windows, and web browsers, without requiring significant changes to the codebase.
  - **Purpose:** This maximizes the user base and accessibility across different devices.
- **Standardized Technologies**
  - The application must utilize standardized programming languages and frameworks (e.g., React for web, Flutter for mobile) that are widely supported and recognized.
  - **Purpose:** This simplifies the process of porting the application to new platforms in the future.
- **Configuration Management**
  - Configuration settings should be externalized, allowing easy adjustments for different environments without altering the core code.
  - **Purpose:** This enhances flexibility and adaptability to various deployment environments.
- **Documentation for Porting**
  - Detailed documentation must be provided to guide developers in porting the application to new platforms, including any specific considerations or dependencies.

- **Purpose:** This streamlines the porting process and reduces development time.

- **Testing Across Platforms**
  - The application should be thoroughly tested on all supported platforms to ensure consistent functionality and performance.
  - **Purpose:** This ensures a reliable user experience, regardless of the platform used.

By meeting these portability requirements, the MapMyFood application can easily adapt to various operating environments and reach a broader audience.

2.5.8. Efficiency Requirements

Efficiency requirements focus on how well the MapMyFood application utilizes resources to perform its functions. Here are the key requirements:

- **Response Time**
  - The application should provide a response to user actions within 2 seconds under normal operating conditions.
  - **Purpose:** This ensures a smooth and responsive user experience.
- **Resource Usage**
  - The application must consume minimal CPU and memory resources to avoid impacting the performance of the user's device.
  - **Purpose**: This allows the application to run efficiently even on lower-end devices.
- **Data Transfer Efficiency**
  - Data transfer for order processing and live tracking should not exceed 100 KB per transaction to minimize bandwidth usage.
  - **Purpose:** This reduces data costs for users and improves loading times.
- **Battery Consumption**
  - The application should be optimized to reduce battery consumption on mobile devices, aiming for a decrease of at least 20% compared to similar applications.
  - **Purpose:** This enhances user satisfaction by extending the battery life during use.

- **Caching Mechanism**
  - Implement a caching mechanism for frequently accessed data (like menu items) to reduce load times and server requests.
  - **Purpose:** This improves performance and reduces the load on the backend infrastructure.

By adhering to these efficiency requirements, the MapMyFood application can provide a high-quality user experience while effectively utilizing system resources.

2.6. Domain Requirements

Domain requirements refer to specific needs and regulations that apply to the MapMyFood project but aren't covered in other sections of the Software Requirements Specification (SRS). Here are the key domain requirements:

2.6.1. Database Requirements

- The application must use a relational database (like MySQL or PostgreSQL) to store user data, order history, and restaurant information.
- The database should support at least 1,000 concurrent users without performance degradation.
- **Purpose:** This ensures reliable data storage and efficient access for users.

2.6.2. Internationalization Requirements

- The application must support multiple languages, including Urdu and English, to cater to a diverse user base in Pakistan.
- Users should be able to switch languages easily from the settings menu.
- **Purpose:** This enhances accessibility and user satisfaction for a wider audience.

2.6.3. Legal Requirements

- The application must comply with local data protection laws (such as the Personal Data Protection Bill) to ensure user data is handled securely and transparently.
- Users should be informed about data collection practices and have the option to delete their data.
- **Purpose:** This builds trust with users and avoids legal issues.

2.6.4. Reuse Objectives

- The project should aim to reuse existing APIs and libraries where possible, such as those for payment processing and geolocation.
- This will reduce development time and costs.
- **Purpose:** Leveraging existing components increases efficiency and maintains consistency.

2.6.5. Accessibility Requirements

- The application should be designed to meet accessibility standards (such as WCAG 2.1) to support users with disabilities.
- This includes screen reader compatibility and color contrast considerations.
- **Purpose:** Ensuring everyone can use the application enhances user experience and inclusivity.

By addressing these domain requirements, the MapMyFood project can meet specific needs and ensure compliance with various standards and regulations.

Chapter 3

Use Case Analysis

Chapter 3: Use Case Analysis

In this chapter, we will focus on Use Case Analysis, which helps us understand how users interact with the **MapMyFood** application. We will create a Use Case Model that visually represents the different ways users can use the system. This will include identifying various user roles and their specific actions. Additionally, we will describe each Use Case in detail, outlining the steps involved in different scenarios, such as placing an order or tracking delivery. This analysis is important to ensure that the application meets user needs effectively and efficiently.

3.1. Use Case Model

The Use Case Model for MapMyFood illustrates the interactions between users and the system. It identifies key actors and their respective use cases, helping us visualize how the application will function in real-world scenarios. The main actors include:

- **Customer:** The user who places orders, tracks deliveries, and provides feedback.
- **Restaurant:** The entity that receives orders and prepares food for delivery.
- **Delivery Personnel:** The person responsible for delivering the food to customers.
- **Admin:** The system administrator who manages users, restaurants, and orders.

Key Use Cases:

- **Place Order:** The customer selects food items, adds them to their cart, and places an order.
- **Track Order:** The customer can view the status of their order in real-time.
- **Process Payment:** The customer completes payment for their order through various payment methods.
- **Manage Account:** The customer can create, update, or delete their account information.
- **Provide Feedback:** The customer can rate their experience and provide comments about the food and service.

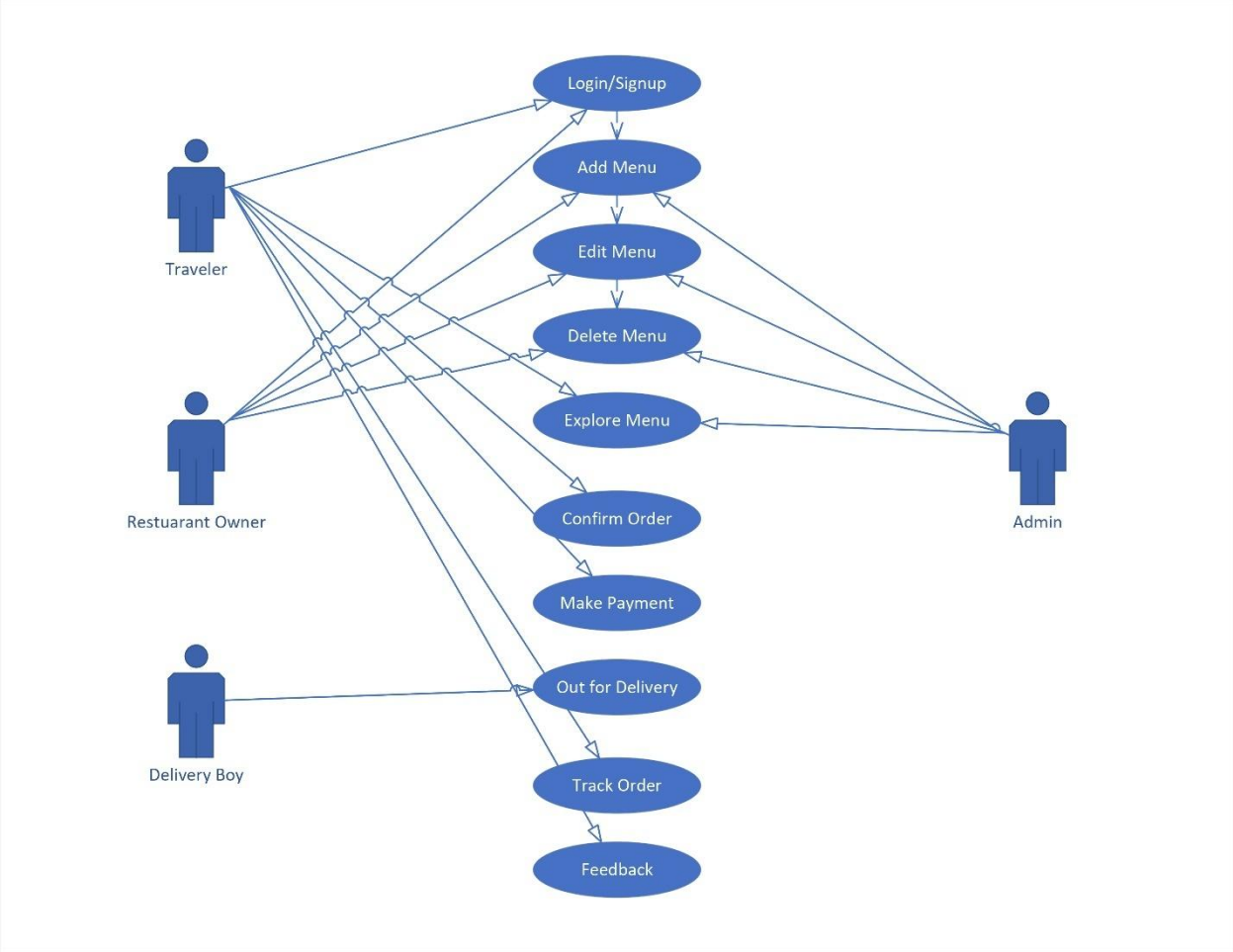


Figure 5. Use Case Diagram of MapMyFood

This model provides a clear overview of how different users will interact with the MapMyFood application, ensuring that all necessary functionalities are addressed in the system design.

3.2. Use Cases Description

Here's a table describing the use cases for MapMyFood, including the main actors, preconditions, postconditions, basic flow, and any exceptions.

Table 2. Use cases of MapMyFood

Use Case ID	Use Case Name	Actors	Preconditions	Post Conditions	Basic Flow	Exceptions
UC-01	Place Order	Customer	The customer is registered and logged in.	The order placed successfully.	• The customer selects food. • Add Items to cart. • Proceeds to checkout. • Order confirms.	Item is not available
UC-02	Track Order	Customer, Delivery Personnel	The customer has placed an order.	The customer is updated with order's status.	• Customer opens the app. • Navigates to "Track Order." • System displays the order status.	Order not found.
UC-03	Process Payment	Customer	The customer has items in the cart.	The payment is processed successfully.	• Customer selects payment method.	Payment Failure

					• Enters payment details. • System processes the payment.	
UC-04	Manage Account	Customer	The customer is registered and logged in.	The account information is updated.	• Customer opens account setting. • Makes changes. • Saves the details.	Invalid Data entered.
UC-05	Provide Feedback	Customer	The customer has completed an order.	Feedback submitted successfully.	• Customer navigates to feedback section. • Rates the services. • Submits feedback.	Submission failure.
UC-06	Prepare Order	Restaurant	Restaurant has received an order.	The order is prepared for delivery.	• Restaurant receives order's notification. • Prepares food. • Marks order as ready.	Preparation delay

UC-07	Deliver order	Delivery personnel	The order is ready for delivery.	The order is delivered to the customer.	• Pick the prepared order. • Navigate to the customer's location. • Deliver the order.	Customer not available.
UC-08	Manage Users	Admin	Admin is logged into the system.	User information is updated or deleted.	• Admin accesses user management section. • Makes changes. • Saves changes.	User not found.
UC-09	Manage Restaurants	Admin	Admin is logged into the system.	Restaurant information is updated or deleted.	• Admin accesses the restaurant management section. • Makes changes. • Saves changes.	Restaurant not found

UC-10	Manage Orders	Admin	Admin is logged into the system.	Order information is updated or deleted.	• Admin accesses the order management section. • Make changes. • Saves changes.	Order not found

Chapter 4

System Design

Chapter 4: System Design

This chapter outlines the overall design of the **MapMyFood** system. It includes visual representations and diagrams that help explain how different parts of the system work together. We'll start by showing the architecture of the system, followed by models that represent how data is structured and flows within the application. Additionally, we'll cover the relationships between different components, how the system processes tasks, and how it operates in different states. These design elements form the foundation for how the system is developed and maintained.

4.1. Architecture Diagram

The **Architecture Diagram** provides an overview of the structure of the **MapMyFood** system and how its different components interact. It shows the key modules, databases, user interfaces, and external services like payment gateways or tracking systems. The architecture helps ensure that the system is scalable, maintainable, and integrates well with external systems.

In the diagram:

- **Users** (e.g., travelers, restaurant owners, admins) interact with the system through **Mobile Apps (iOS, Android)** or a **Web Interface**.
- Requests from users are processed by the **Application Layer**, which includes services like **Food Ordering**, **Live Order Tracking**, and **User Account Management**.
- The **Application Layer** communicates with various external systems, including the **PakRail API** for live train tracking, and the **Payment Gateway** for handling transactions.
- The **Database Layer** stores information related to users, orders, payments, and feedback.

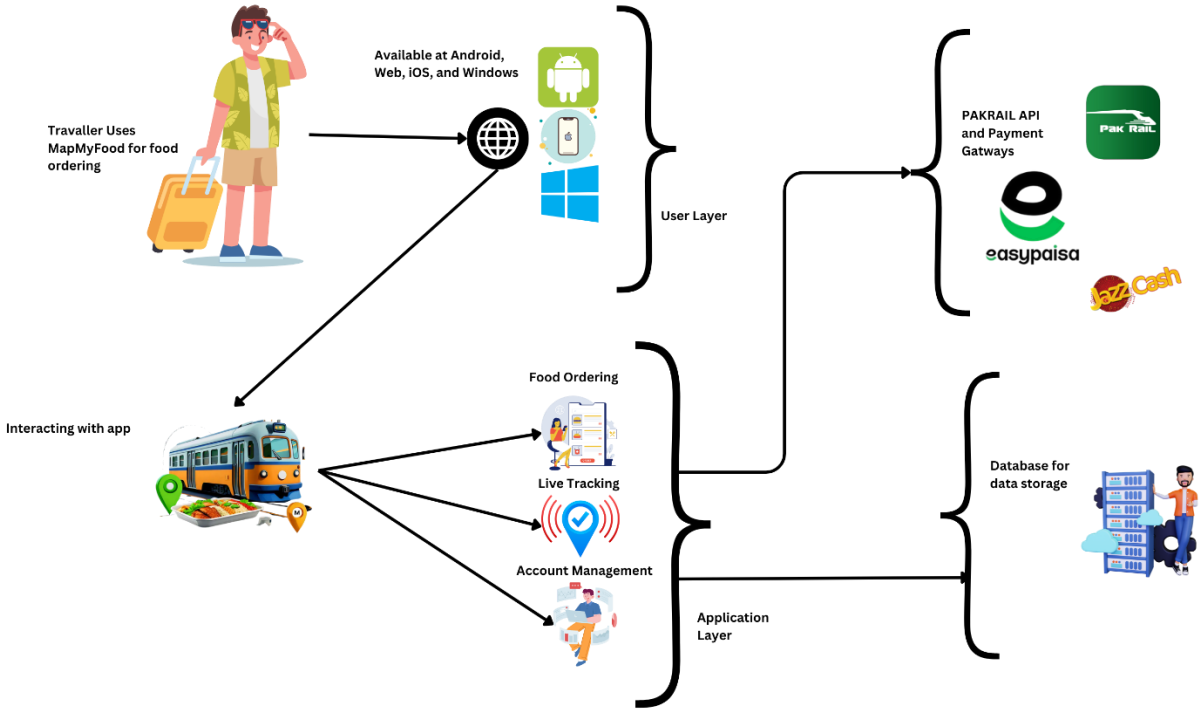


Figure 6. Architecture diagram of the MapMyFood

The architecture diagram acts as a roadmap for both developers and stakeholders, providing a clear view of how the system is organized and operates.

4.2. Domain Model

The Domain Model represents the key concepts and relationships within the MapMyFood system. It identifies the core entities (like Users, Orders, Restaurants, and Food Items) and how they are related. The domain model helps in understanding the system's structure from a high-level perspective, focusing on the business logic rather than the technical implementation.

In the MapMyFood domain:

- **User:** Can be a traveler (customer), restaurant owner, or admin. Users interact with the system to place orders, manage restaurants, or oversee operations.

- **Order:** Represents the food orders placed by users, including details like order time, delivery status, and payment information.
- **Restaurant:** Holds information about the restaurants available for food delivery, such as menu items and location.
- **Food Item:** Represents individual dishes available from a restaurant.
- **Feedback:** Users can leave ratings and feedback on their orders.
- **Payment:** Represents transactions for completed orders, linked to payment gateways for processing.
- **Delivery Boy:** Holds the information of order and users to deliver the order.

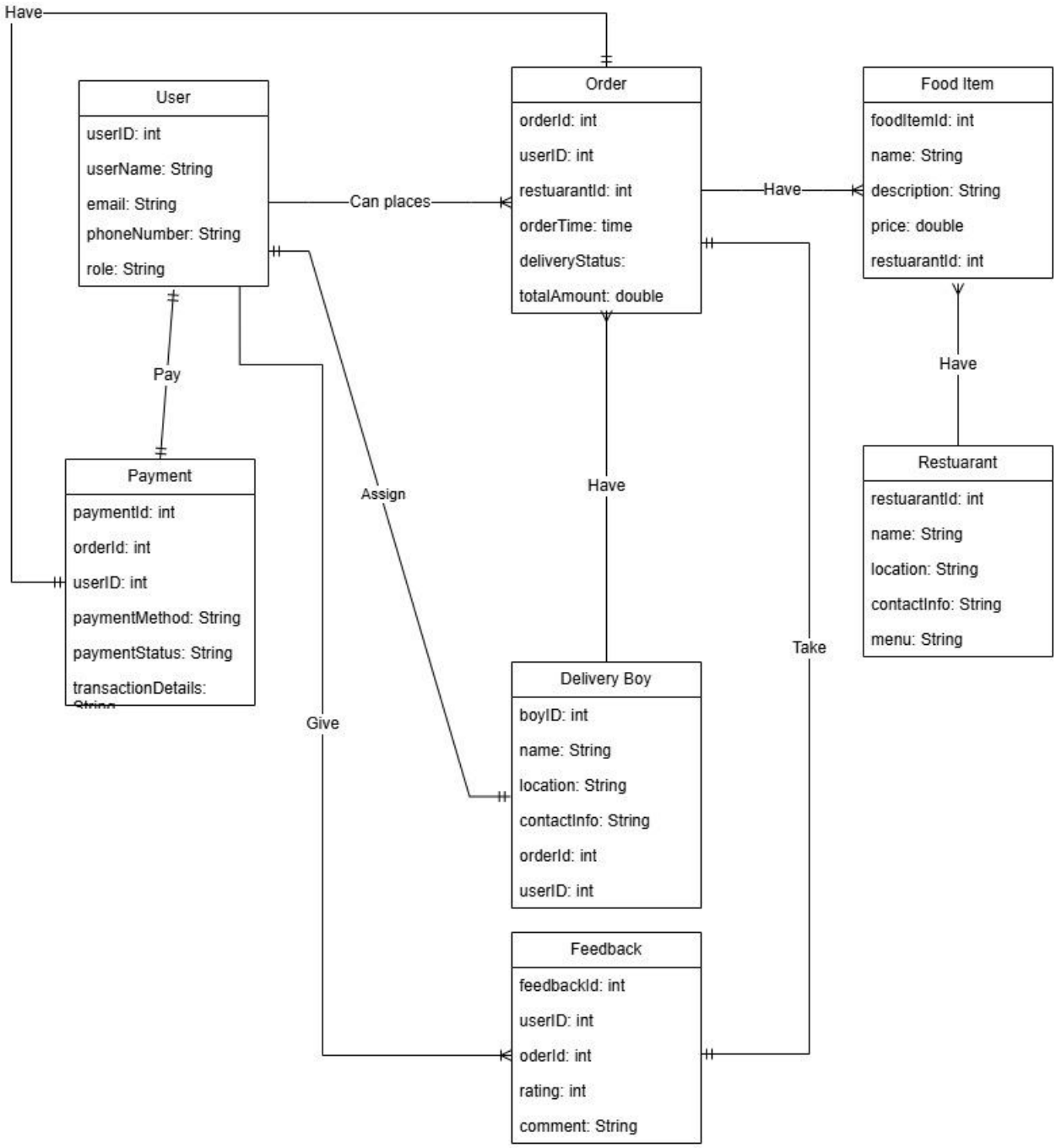


Figure 7. Domain Model of MapMyFood

4.3. Entity Relationship Diagram with data dictionary

An Entity-Relationship Diagram (ERD) visually represents the entities in the system, their attributes, and relationships between them. For **MapMyFood**, the ERD includes entities like

User, **Order**, **Food Item**, **Restaurant**, **Feedback**, **Payment**, and **Delivery Boy**, showing how they interact in the system.

- **Entities, Attributes, and Relationships**

  Entities and Attributes

Entity	Attributes
User	userID, userName, userEmail, userPhone, userLocation, userRole
Order	orderId, userID, deliveryBoyId, foodItemId, totalAmount, restuarantId
Food Item	foodItemId, itemName, description, itemPrice, restuarantId
Restaurant	restuarantId, name, location, phoneNum, itemMenu
Feedback	feedbackId, orderId, userID, rating, comment
Payment	paymentId, orderId, userID, paymentMethod, paymentstatus, deliveryBoyId, paymentDetails
Delivery Boy	deliveryBoyId, deliveryBoyName, deliveryBoyPhone, deliveryBoyLocation, userID, vehicleType, vehicleNumberchr, orderId

- **Relationships**

  - **User** places **Order** (1 User → Many Orders).
  - **Order** is assigned to a **Delivery Boy** (1 Order → 1 Delivery Boy).
  - **Order** contains **Food Items** (1 Order → Many Food Items).

- **Restaurant** provides **Food Items** (1 Restaurant → Many Food Items).
- **User** gives **Feedback** for an **Order** (1 User → 1 Feedback for each Order).
- **Order** is linked to **Payment** (1 Order → 1 Payment).
- **Delivery Boy** delivers **Order** (1 Delivery Boy → Many Orders).

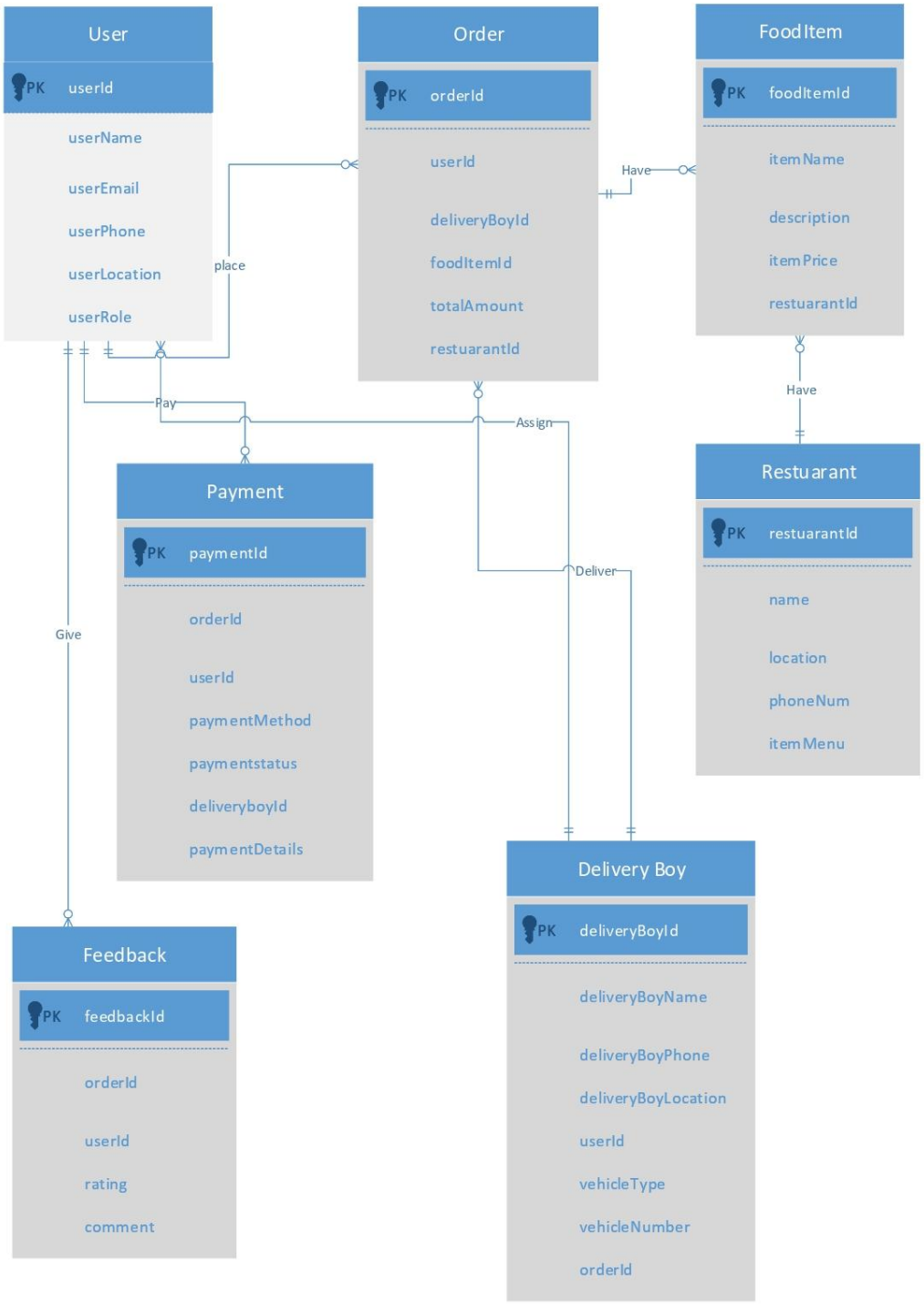


Figure 8. ERD of MapMyFood

- **Data Dictionary**

The data dictionary of the MapMyFood is given below with all over details.

Table 3. Data Dictionary for ERD of MapMyFood

Entity	Attribute	Description
User	userId	Unique Id for user.
	userName	Name of the user.
	userEmail	Email of the user for contact details.
	userPhone	Phone number for contact of the user.
	userLocation	Location for the live tracking.
	userRole	Define the role of the user that how they act.
Order	orderId	Unique Id for the order.
	totalAmount	Amount of the order.
Food Item	ItemId	Unique Id for the food item.
	itemName	Name of the item.
	description	The detail of the food item.
	itemPrice	The price of them item.
Payment	paymentId	Unique Id for the payment.
	paymentMethod	The given payment method.
	paymentStatus	The status of the payment that what is the condition of payment.
	paymentDetails	The payment detail that how many bill have to pay.
Restaurant	restaurantId	The unique Id for the restaurant.

	name	The name of the restaurant.
	location	The location of the restaurant.
	phoneNum	The phone number of the restaurant.
	itemMenu	The menu of the items which they are offering.
Feedback	feedbackId	The unique id for the identification.
	rating	The rating for the order.
	comment	The comment related to the order.
Delivery Boy	deliveryBoyId	The unique ID for the delivery boy.
	deliveryBoyName	The name of the delivery boy.
	deliveryBoyPhone	The contact number of the delivery boy.
	deliveryBoyLocation	The location of the delivery boy.
	vehicleType	The vehicle type of the delivery boy.
	vehicleNumber	The car registration number of the delivery boy.

4.4. Class Diagram

A class diagram is a blueprint of the system's structure. It represents the classes, their attributes, and the relationships between them. For MapMyFood, here's a detailed explanation and guide for creating the class diagram based on your data dictionary.

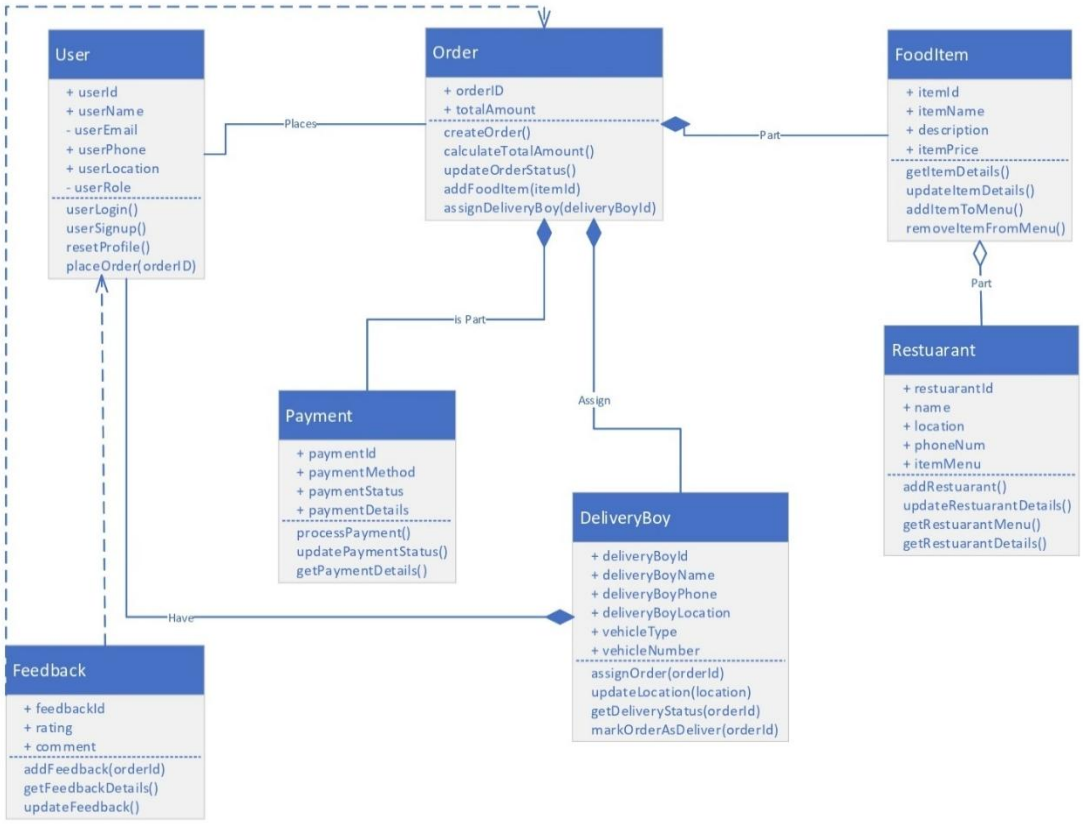


Figure 9. Class diagram of MapMyFood

4.5. Sequence / Collaboration Diagram

This sequence diagram illustrates the entire workflow of the MapMyFood system, including how users, the system, the database, restaurants, delivery boys, and payment gateways interact. It covers the process from user registration to placing an order and completing delivery. Here's a step-by-step description:

- **User Signup and Login**
    - User signs up by entering their information.
    - System sends the details to the Database, where the user information is stored.
    - The System confirms successful signup and allows the user to log in.
    - On login, the system verifies the user's details in the database and provides access.

- **Menu Management**
  - The Restaurant adds its menu to the System, which saves it in the Database.
  - Users can view the menu fetched from the database.
- **Placing an Order**
  - The User selects food items from the menu and places an order.
  - The System saves the order details in the Database and confirms order placement to the user.
  - The Restaurant receives the order details, confirms the order, and updates the status.
- **Delivery Process**
  - The Restaurant prepares the order and hands it over to the Delivery Boy.
  - The System updates the order status as "Ready to Deliver" and starts live tracking.
  - The Delivery Boy updates their live location, which the user tracks in real time.
  - The order is delivered to the user, and the system marks it as complete.
- **Payment Processing**
  - The System processes the payment through the Payment Gateway.
  - On successful payment, the system updates the payment status in the database and notifies the user.
- **Feedback and Order History**
  - After delivery, the System prompts the user to provide feedback, which is stored in the Database.
  - The system adds the order to the user's order history and confirms the completion of the process.

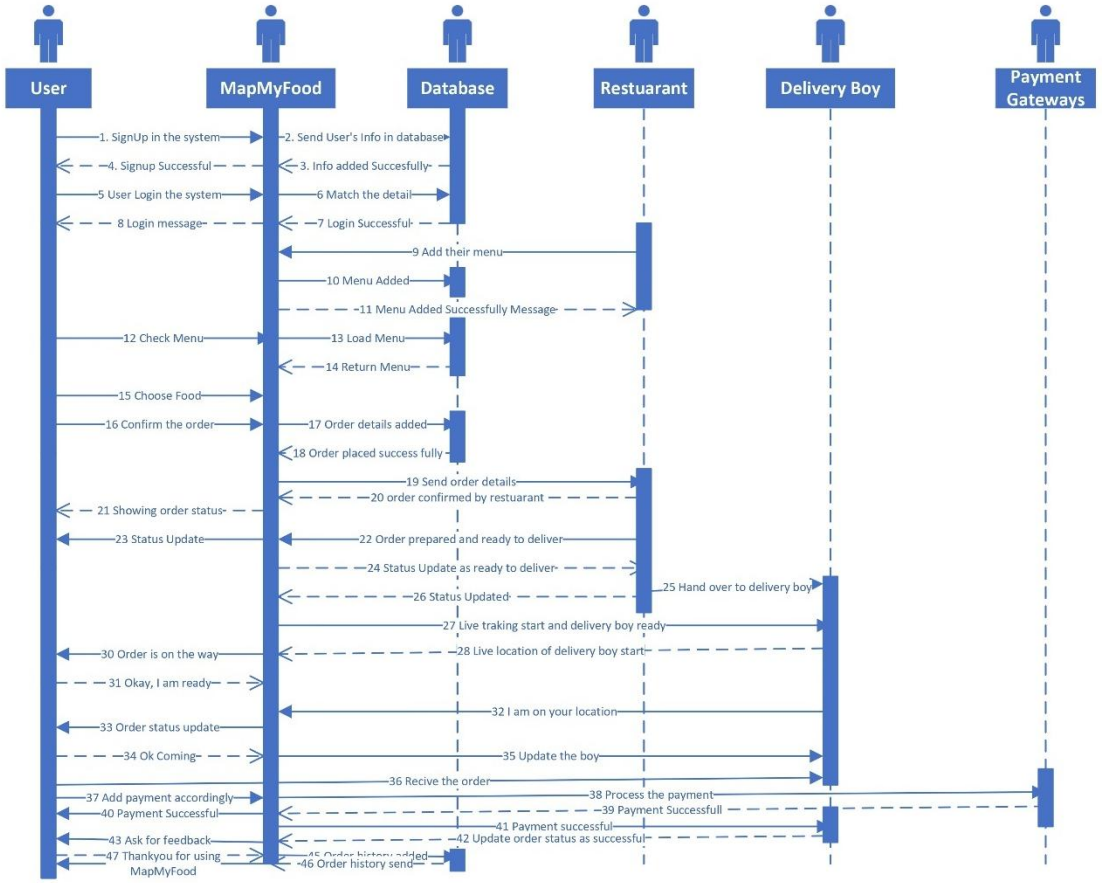


Figure 10. Sequence diagram of the MapMyFood

4.6. Operation contracts

Operational contracts define the behavior of the system when specific operations are performed. They describe the inputs, outputs, preconditions, postconditions, and changes that occur in the system for various operations. Below are operational contracts for the MapMyFood system:

- **Register User**
  - **Operation:** registerUser()
  - **Preconditions:** The user provides valid details (name, email, phone, password).
  - **Postconditions:** A new user account is created and stored in the database. The system sends a confirmation message.
  - **System Changes:** Adds a new record in the User table.

- **Place Order**
  - **Operation:** placeOrder(orderDetails)
  - **Preconditions:** The user is logged in and selects items from the menu.
  - **Postconditions:** A new order is created, saved in the database, and linked to the user and restaurant. The system confirms the order and notifies the restaurant.
  - **System Changes:** Adds a new record in the Order table and updates the order status.
- **Process Payment**
  - **Operation:** processPayment(paymentDetails)
  - **Preconditions:** The user provides valid payment details for an active order.
  - **Postconditions:** Payment is processed successfully, and the payment status is updated in the system. A receipt is sent to the user.
  - **System Changes:** Updates the Payment table with transaction details and links it to the respective order.
- **Assign Delivery Boy**
  - **Operation:** assignDeliveryBoy(orderId, deliveryBoyId)
  - **Preconditions:** The order is ready for delivery, and a delivery boy is available.
  - **Postconditions:** The delivery boy is assigned to the order, and the live tracking feature is activated.
  - **System Changes:** Updates the Order table with the delivery boy's details and sets the status to "Out for Delivery."
- **Track Order**
  - **Operation:** trackOrder(orderId)
  - **Preconditions:** The user has placed an order and the delivery is in progress.
  - **Postconditions:** The user receives live updates on the delivery boy's location and estimated delivery time.
  - **System Changes:** None (reads real-time location data from the system).
- **Provide Feedback**
  - **Operation:** provideFeedback(orderId, rating, comment)

- **Preconditions:** The order has been marked as delivered.
- **Postconditions:** The feedback is saved in the database and linked to the respective order and user.
- **System Changes:** Adds a new record in the Feedback table.

- **Add Food Item to Menu**
  - **Operation:** addFoodItem(foodDetails)
  - **Preconditions:** The restaurant is registered and logged in.
  - **Postconditions:** The food item is added to the restaurant's menu.
  - **System Changes:** Inserts a new record into the FoodItem table linked to the restaurant.
- **Update Order Status**
  - **Operation:** updateOrderStatus(orderId, status)
  - **Preconditions:** The order exists in the system.
  - **Postconditions:** The status of the order is updated (e.g., "Preparing", "Out for Delivery", "Delivered").
  - **System Changes:** Updates the Order table with the new status.

These operational contracts ensure clarity and precision, helping developers and stakeholders understand how the system behaves during various actions.

4.7. Activity Diagram

An Activity Diagram illustrates the flow of activities and actions within a process. It helps in understanding how different tasks are performed sequentially and how decisions are made. For MapMyFood, the activity diagram can show the steps involved in processes such as placing an order, processing payments, and tracking deliveries.

- **Scenario: Placing an Order and Tracking Delivery**
- User Starts:

  The user begins by logging into the system or registering if they're a new user.
- Browse Restaurants:

  The user selects a restaurant from the list of available restaurants.

- Select Food Items:

  The user browses the menu and selects food items they wish to order.

- Add Items to Cart:

  The selected food items are added to the order cart.

- Proceed to Checkout:

  The user proceeds to checkout to confirm the order details, delivery address, and payment method.

- Place Order:

  The user confirms the order and places it.

- Order Confirmation:

  The system confirms the order and assigns a delivery boy to deliver the food.

- Payment Process:

  The user enters payment details, and the system processes the payment.

- Track Delivery:

  The system shows the live tracking status of the delivery.

- Order Delivered:

  Once the order reaches the customer, the delivery status is updated, and the user is prompted to provide feedback.

- Feedback Provided:

  After delivery, the user provides feedback or rates the food and service.

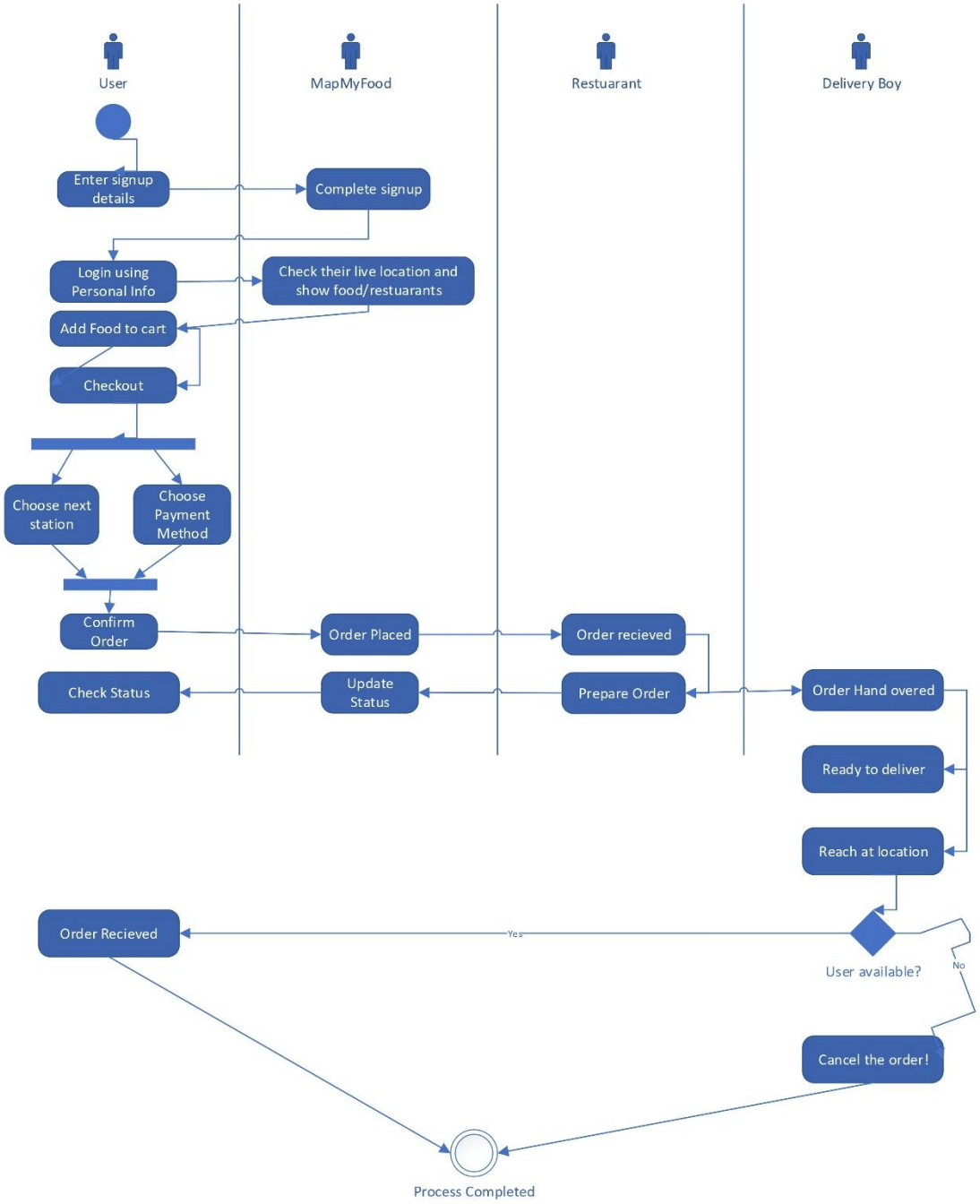


Figure 11. Activity Diagram of MapMyFood

4.8. State Transition Diagram

A **State Transition Diagram** shows the different states an object can be in and how it transitions between those states based on events or conditions. For **MapMyFood**, the state transition diagram will represent the lifecycle of key entities like **Order** and **Payment** as they go through various states during the process of placing an order, processing payments, and delivering food.

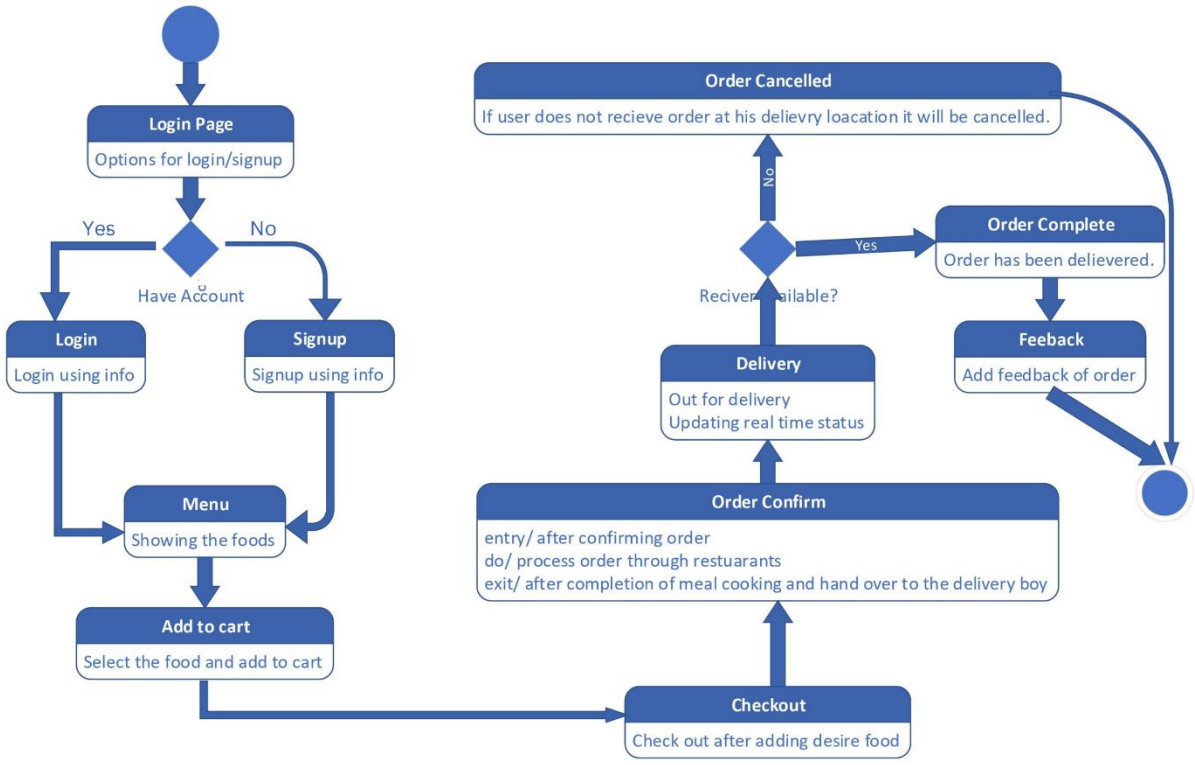


Figure 12. State Transition diagram of the MapMyFood

4.9. Component Diagram

Here is the **Component Diagram** for the **MapMyFood** system, showing the various components like **User Management**, **Order Management**, **Payment Processing**, and others, along with their interactions. This diagram gives a clear visual representation of how the different parts of the

system are connected. You can refer to this diagram when building or explaining the architecture of the system.

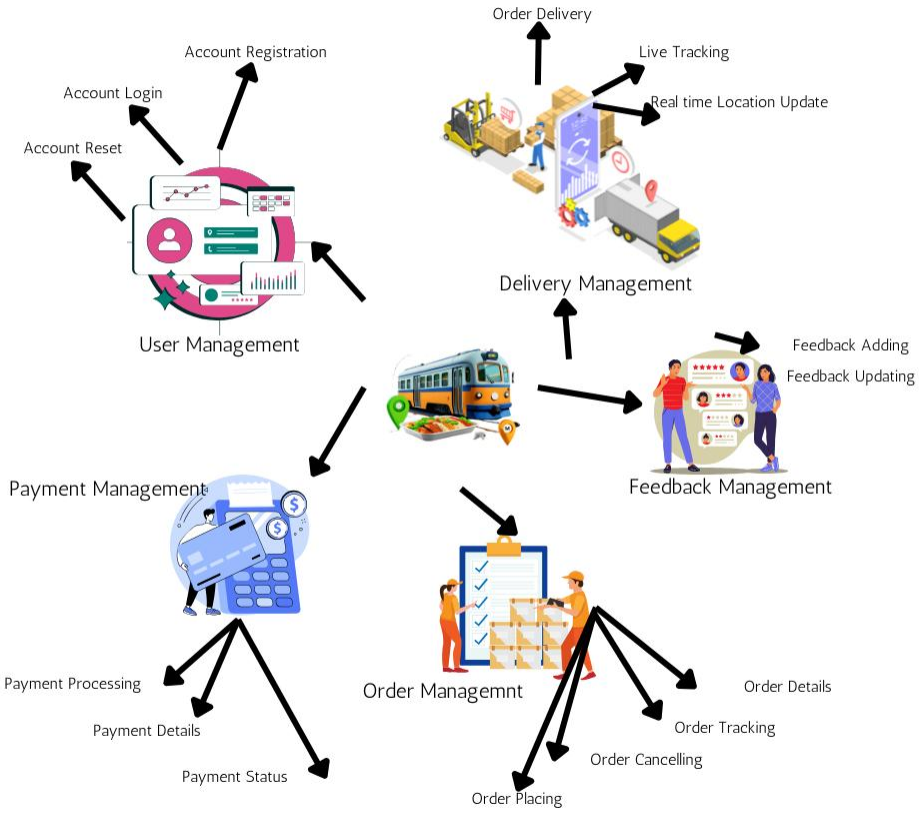


Figure 13. Component Diagram of MapMyFood

4.10. Deployment Diagram

A Deployment Diagram represents the physical deployment of software components on hardware nodes. It shows where and how the system's components are hosted, such as servers, databases, or user devices, and how these interact. For MapMyFood, this diagram explains the architecture of deployment for the application, including mobile apps, web applications, servers, databases, and external APIs.

- **Deployment Description**

The MapMyFood system is deployed using a combination of servers, devices, and external services:

- **User Devices:**

  Mobile Devices (iOS and Android): Hosts the MapMyFood Mobile App.

  Web Browsers: Hosts the Web Interface of the application.

- **Application Server:**

Hosts the core application backend, including services like:

  User Management

  Order Management

  Restaurant Management

  Delivery Management

  Feedback Collection

- **Database Server:**

  Stores data such as user profiles, orders, food items, restaurants, payments, and feedback.

- **Third-Party Services:**

  PakRail API: Provides live train tracking for food delivery in transit.

  Payment Gateway: Processes online payments via services like Easypaisa or JazzCash.

- **Delivery Boy Devices:**

  Mobile devices for Delivery Management App, enabling live location tracking and order updates.

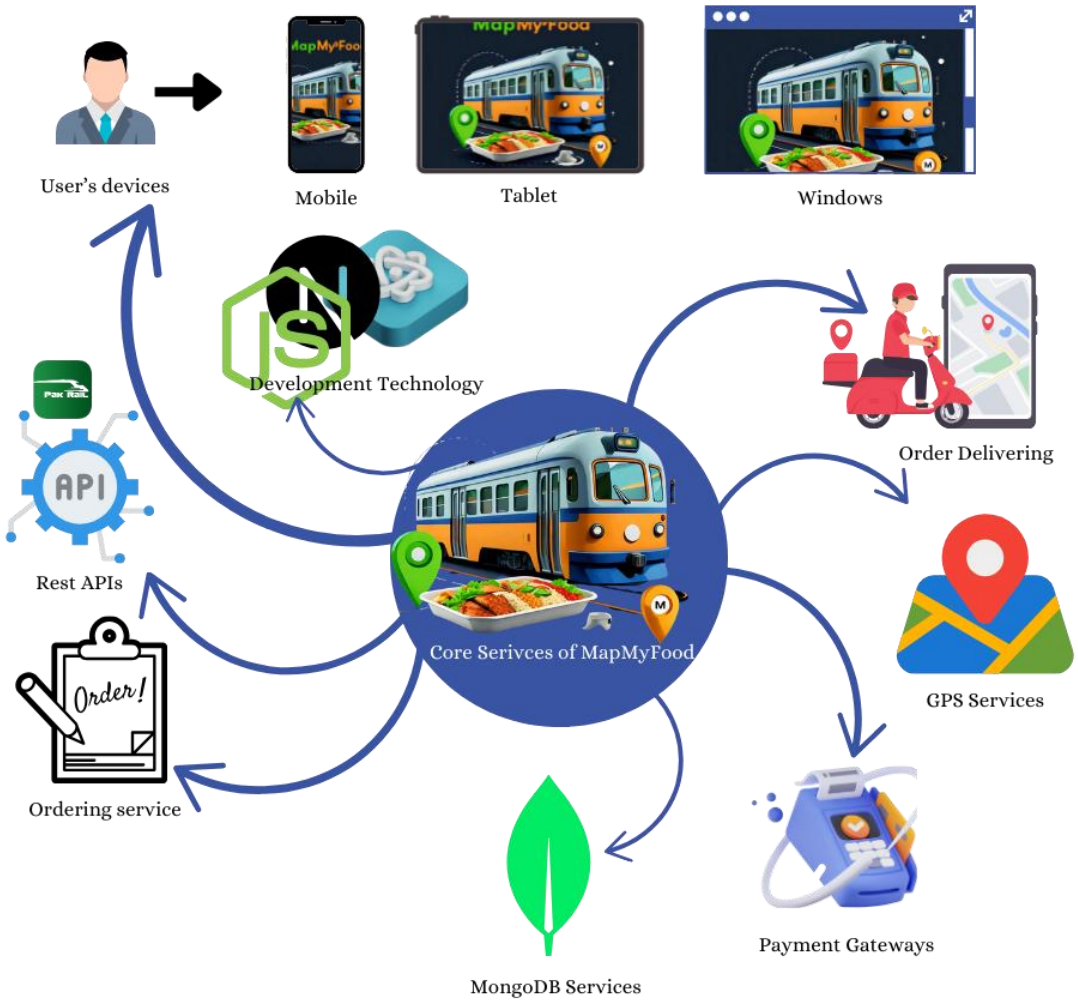


Figure 14. Deployment Diagram of MapMyFood

Chapter 5
Implementation

Chapter 5: Implementation

This chapter focuses on the implementation process of the MapMyFood system. It outlines the key aspects of how the system will be built, including flow control, essential components, deployment environment, tools and techniques, best practices for coding, and version control. The goal is to ensure that the system is developed in a structured and efficient way, following standard practices and using appropriate technologies. We will discuss the necessary steps to bring the design to life and ensure a smooth development process.

5.1. Important Flow Control/Pseudo codes

This section provides the pseudo-code for key functionalities in the MapMyFood system. The pseudo-code simplifies the logic of the main operations, ensuring clear understanding for implementation.

5.1.1. Sign-up Process

```
FUNCTION signUp(userDetails):
  # Step 1: Validate user details
  IF userDetails are complete AND valid:
    # Step 2: Check if the email is already registered
    Check if email is already registered
    IF email exists:
      # Step 3: If email exists, return a message indicating the user already exists
      RETURN "User already exists"
    ELSE:
      # Step 4: If email does not exist, save user details to the database
      Save userDetails to Database
      # Step 5: Return success message
      RETURN "Sign-up successful"
  ELSE:
    # Step 6: If user details are invalid or incomplete, return an error message
    RETURN "Invalid or incomplete details"
```

5.1.2. Login Process

```
FUNCTION login(email, password):

  # Step 1: Retrieve user details from the database using the provided email
  Retrieve user details from Database using email
  # Step 2: Check if the user exists
  IF user exists:
    # Step 3: Verify if the provided password matches the stored password
    IF password matches:
      # Step 4: If the password is correct, return a success message
      RETURN "Login successful"
    ELSE:
      # Step 5: If the password is incorrect, return an error message
      RETURN "Incorrect password"
  ELSE:
    # Step 6: If the user does not exist, return an error message
    RETURN "User not found"
```

5.1.3. Order Placing

```
FUNCTION placeOrder(userId, restaurantId, foodItems):
  # Step 1: Check if the food items list is not empty
  IF foodItems are not empty:
    # Step 2: Calculate the total amount for the order
    Calculate totalAmount
    # Step 3: Create an order with the provided details
    Create order with userId, restaurantId, foodItems, and totalAmount
    # Step 4: Save the order in the database
    Save order in Database
    # Step 5: Return a success message along with the order ID
    RETURN "Order placed successfully", orderId
```

```
    ELSE:
        # Step 6: If no items are in the cart, return an error message
        RETURN "No items in the cart"
```

5.1.4. Order Status Checking

```
FUNCTION checkOrderStatus(orderId):
    # Step 1: Retrieve the order status from the database using the provided orderId
    Retrieve order status from Database using orderId
    # Step 2: Check if the order exists
    IF orderId exists:
        # Step 3: If the order exists, return the order status
        RETURN orderStatus
    ELSE:
        # Step 4: If the order ID does not exist, return an error message
        RETURN "Order not found"
```

5.1.5. Real-Time Location Sharing

```
FUNCTION shareLocation(deliveryBoyId):
    # Step 1: Retrieve the delivery boy's current location using GPS
    Retrieve delivery boy's current location using GPS
    # Step 2: Update the delivery boy's location in the database
    Update location in Database
    # Step 3: Return a success message confirming the location has been shared
    RETURN "Location shared successfully"
```

5.1.6. Assigning Order to Delivery Boy

```
FUNCTION assignOrderToDeliveryBoy(orderId, deliveryBoyId):
    # Step 1: Retrieve the order details from the database using the provided orderId
    Retrieve order from Database using orderId
    # Step 2: Retrieve the delivery boy's details from the database using the provided deliveryBoyId
    Retrieve deliveryBoy details from Database using deliveryBoyId
```

```
    # Step 3: Check if both the order and delivery boy exist
    IF order AND deliveryBoy exist:
        # Step 4: Assign the delivery boy to the order
        Assign deliveryBoyId to order
        # Step 5: Update the order status to indicate it's out for delivery
        Update order status to "Out for Delivery"
        # Step 6: Return a success message confirming the assignment
        RETURN "Delivery boy assigned successfully"
    ELSE:
        # Step 7: If either the order or delivery boy does not exist, return an error message
        RETURN "Order or Delivery Boy not found"
```

5.1.7. Order Status Updating

```
FUNCTION updateOrderStatus(orderId, newStatus):
    # Step 1: Retrieve the order details from the database using the provided orderId
    Retrieve order from Database using orderId
    # Step 2: Check if the order exists
    IF order exists:
        # Step 3: Update the order status to the new status provided
        Update order status to newStatus
        # Step 4: Return a success message with the updated status
        RETURN "Order status updated to", newStatus
    ELSE:
        # Step 5: If the order does not exist, return an error message
        RETURN "Order not found"
```

5.1.8. Payment Processing

```
FUNCTION processPayment(orderId, paymentDetails):
    # Step 1: Retrieve the order details from the database using the provided orderId
    Retrieve order from Database using orderId
```

```
# Step 2: Check if the order exists
IF order exists:
    # Step 3: Verify the payment details with the payment gateway
    Verify paymentDetails with Payment Gateway
    # Step 4: Check if the payment was successful
    IF payment successful:
        # Step 5: Update the payment status to "Completed" in the database
        Update paymentStatus to "Completed" in Database
        # Step 6: Return a success message confirming the payment was processed
        RETURN "Payment processed successfully"
    ELSE:
        # Step 7: If the payment fails, return an error message
        RETURN "Payment failed"
ELSE:
    # Step 8: If the order does not exist, return an error message
    RETURN "Order not found"
```

5.1.9. Explanation

The explanation of the upper pseudo codes is given below:

- **Sign-Up and Login**:
    - Validates user information.
    - Prevents duplicate accounts.
    - Ensures only authorized users log in.
- **Order Management**:
    - Simplifies placing and tracking orders.
    - Handles dynamic updates like delivery boy assignments and order status changes.

- **Real-Time Location**:

  Uses GPS to keep users updated about their delivery.

- **Payment Processing**:

  Verifies and processes payments securely via external gateways.

These pseudo codes act as blueprints, guiding developers in implementing core functionalities of **MapMyFood** systematically.

5.2. Components, Libraries, Web Services and stubs

This section outlines the essential components, libraries, web services, and stubs used in the implementation of MapMyFood. These tools ensure the system is functional, efficient, and scalable.

5.2.1. Components

Frontend: The user interface for mobile and web applications.

- Mobile App: Built using **React Native** for iOS and Android platforms.
- Web App: Developed with **React.js** for a responsive user experience.

Backend: Handles business logic and database communication.

Node.js with **Express.js**: Provides APIs for communication between frontend and backend.

Database:

- **MongoDB**: Stores user details, orders, restaurants, payments, and feedback.

Third-Party APIs:

- **PakRail API:** For real-time train tracking.
- Payment Gateway API (e.g., **Easypaisa, Jazzcash**): For secure payment processing.

5.2.2. Libraries

Frontend Libraries:

- **Axios:** For making HTTP requests to the backend.

- **React Navigation:** For seamless navigation within the mobile app.

Backend Libraries:

- **Mongoose:** For database interactions with MongoDB.
- **JWT (JsonWebToken):** For secure user authentication and authorization.
- **bcrypt.js:** For hashing passwords securely.
- **Nodemailer:** For sending email notifications.

Real-Time Tracking:

- **Socket.io:** For real-time updates on delivery location.

5.2.3. Web Services

- **PakRail API:** Integrates live train tracking for delivery status updates.

Payment Gateway:

- Processes payments securely through online systems like Easypaisa or JazzCash.

Notification Services:

- Firebase Cloud Messaging (FCM): Sends push notifications to users about order status and delivery updates.

5.2.4. Stubs

Payment Stub:

- Simulates payment processing during the development phase before integrating real payment gateways.
- Allows testing of different payment statuses (e.g., "Success", "Failed").

Tracking Stub:

- Simulates GPS tracking data for delivery boy location during initial testing.
- Helps test the real-time tracking functionality without live GPS data.

Restaurant Stub:

- Simulates restaurant interactions, such as confirming orders and updating status.

Simplified Explanation

Components handle different parts of the system, like user interfaces, backend logic, and data storage.

Libraries simplify coding by providing pre-built functionalities for tasks like authentication, form validation, and database operations.

Web Services connect the system to external APIs, such as tracking trains and processing payments.

Stubs are temporary placeholders used during development to simulate real-world interactions.

These tools and technologies ensure that MapMyFood is developed efficiently and functions smoothly, meeting all user requirements.

5.3. Deployment Environment

The deployment environment for MapMyFood defines where and how the system will be hosted and accessed. This includes the hardware, software, and services required to ensure smooth operation for users, restaurants, and delivery personnel.

5.3.1. Frontend Deployment

Mobile App:

- Deployed on **Google Play Store** (for Android users) and **Apple App Store** (for iOS users).
- Users can download and install the app to interact with the system.

Web App:

- Hosted on a cloud-based platform like **Netlify** or **AWS** for seamless access via web browsers.

5.3.2. Backend Deployment

Application Server:

- Hosted on AWS EC2 or Heroku to manage user requests, process orders, and interact with APIs.
- Backend services are built using **Node.js** and **Express.js**.

API Gateway:

- Configured to manage communication between the frontend, backend, and third-party services like payment gateways and train tracking APIs.

5.3.3. Database Deployment

Database Server:

- Hosted on **MongoDB Atlas**, a cloud-based database service.
- Stores user profiles, orders, restaurants, payments, feedback, and delivery tracking data securely.

5.3.4. Third-Party Services

Payment Gateway:

- Uses external services like Stripe or Easypaisa for secure payment transactions.

PakRail API:

- Integrates real-time train tracking into the system to enhance delivery accuracy.

5.3.5. Delivery Devices

- Delivery personnel use mobile devices with the app installed to update order statuses and share live locations.

5.3.6. Operating System and Software Requirements

Operating System:

- Servers run on **Linux (Ubuntu)** for stability and scalability.
- The mobile app supports **Android 10+** and **iOS 12+.**

Software:

- Web browsers like **Google Chrome or Safari** for accessing the web app.
- Development and testing tools such as Postman and Jenkins for continuous integration and testing.

Simplified Summary

- **Frontend:** Mobile app on app stores, web app hosted online.
- **Backend:** Hosted on cloud platforms like AWS or Heroku.
- **Database:** Cloud-based MongoDB Atlas for data storage.
- **Third-Party APIs:** Payment gateways and train tracking services integrated seamlessly.
- **Devices:** Accessible on Android, iOS, and web browsers.

This deployment environment ensures that MapMyFood is accessible, reliable, and scalable for all users and stakeholders.

5.4. Tools and Techniques

This section explains the tools and techniques used to develop, test, and deploy the MapMyFood system. These tools and methods ensure the system is built efficiently and works seamlessly for all users.

5.4.1. Development Tools

- **Visual Studio Code:** A lightweight and powerful code editor for writing and debugging code.
- **Postman:** Used to test APIs and ensure smooth communication between the frontend and backend.
- **Git:** Helps in version control to track code changes and collaborate with the development team.
- **GitHub:** A platform to host and manage the project's repository.

5.4.2. Design Tools

- **Figma, Canva:** For designing the user interface of the mobile and web apps.
- **MS Visio:** For creating diagrams like flowcharts, ERD, and deployment diagrams.

5.4.3. Testing and Debugging

- **Jest:** For unit testing to ensure the functionality of individual components.
- **Cypress:** For end-to-end testing to validate the entire workflow of the application.
- **Chrome Developer Tools:** For debugging frontend issues.

5.4.4. Deployment Tools

- **AWS:** For hosting the backend server and database.
- **Netlify:** For deploying the web application.
- **Expo:** For building and deploying React Native apps.

5.4.5. Techniques

- **Agile Development:** Following an iterative approach to deliver features incrementally.

- Continuous Integration/Continuous Deployment (CI/CD):
- Tools like Jenkins or GitHub Actions automate the process of testing and deploying code changes.
- **Responsive Design:** Ensures the web app works on all screen sizes, from desktops to mobile devices.
- **Authentication and Authorization:** Using JWT (JsonWebToken) for secure login and role-based access control.
- **Error Logging:** Implementing tools like Winston to track and manage errors.

Simplified Summary

We use tools like Visual Studio Code for writing code, Postman for testing APIs, and Figma for designing the app. Backend development is done using Node.js and Express.js, while the frontend is built with React and React Native. For data storage, we use MongoDB Atlas, and we deploy the system on platforms like AWS and Netlify. Techniques like Agile Development and Responsive Design ensure the system is efficient and user-friendly.

These tools and techniques help us create a robust and reliable application, making development smooth and organized.

5.5. Best Practices / Coding Standards

To ensure that the MapMyFood system is reliable, maintainable, and efficient, the following best practices and coding standards are followed:

Readable Code:

- Use meaningful names for variables, functions, and classes (e.g., placeOrder() instead of po()).
- Add comments to explain complex code sections.

Consistent Formatting:

- Follow a uniform coding style (e.g., proper indentation, spacing).
- Use tools like Prettier or ESLint for automatic code formatting.

Error Handling:

- Handle all possible errors gracefully, including invalid inputs and server issues.

- Display user-friendly error messages.

Secure Practices:

- Hash passwords using libraries like bcrypt.js.
- Use JWT for secure user authentication.
- Avoid exposing sensitive data like API keys in the code.

Modular Code:

- Write small, reusable functions and organize the code into modules (e.g., separate files for user, orders, payments).

Testing:

- Write unit tests for critical functions and end-to-end tests for the workflow.
- Ensure the app is tested on multiple devices and platforms.

Simplified Summary

By following these best practices, we ensure the code is clean, secure, and easy to maintain. Consistent formatting, error handling, modularity, and proper testing help us build a high-quality application.

5.6. Version Control

For MapMyFood, we use Git for version control to manage the code efficiently. All code is stored on GitHub, allowing the team to collaborate and track changes.

Key Practices:

Branches:

- Use separate branches for new features (feature-branch), bug fixes (fix-branch), and testing.

Commits:

- Write clear and meaningful commit messages to explain changes.

Pull Requests:

- Review and merge code changes through pull requests to ensure quality.

Backup:

- The repository serves as a secure backup of all code.

Simplified Summary

- Version control with Git and GitHub helps us collaborate, track changes, and ensure the code is organized and safe.

Chapter 6

Testing and Evaluation

Chapter 6: Testing and Evaluation

This chapter explains how we test the **MapMyFood** system to make sure it works correctly, is secure, and provides a smooth experience for users. Different testing techniques are used to check if every feature functions as expected. **Use case testing** ensures that all user actions, like ordering food or making a payment, work properly. **Equivalence partitioning** and **boundary value analysis** help test different types of input data to catch errors. **Data flow testing** checks how data moves in the system, while **unit testing** focuses on testing individual components. **Integration testing** ensures that all parts of the system work together smoothly. Finally, **performance testing** and **stress testing** check how well the app handles heavy traffic and large amounts of data. These tests help us find and fix problems before users experience them, making **MapMyFood** a reliable and efficient platform.

6.1. Use Case Testing

We performed **Use Case Testing** on **MapMyFood** using **Selenium**, an automated testing tool, to ensure that all core functionalities work as expected. This testing method helped us verify that users can perform actions like **signing up, logging in, placing orders, tracking deliveries, and making payments** without issues.

Testing Process:

- **Automating User Actions**:

  We used **Selenium WebDriver** to simulate user actions, such as clicking buttons, entering data, and navigating pages.

- **Verifying System Responses**:

  After each action, we checked if the system responded correctly, such as displaying confirmation messages or updating order status.

- **Testing Key Use Cases**:

  Sign-Up & Login: Verified that users can register and log in with valid credentials.

  Order Placement: Ensured that users could select food items, add them to the cart, and place orders successfully.

Payment Processing: Tested different payment methods to check if transactions were processed correctly.

Delivery Tracking: Confirmed that the live order tracking feature updates in real time.

Feedback Submission: Ensured that users could rate their experience after receiving their order.

- **Detecting and Fixing Issues**:

  If an error was found (e.g., incorrect form validation or failed payment), we reported it and worked on fixing the issue before re-running the test.

Results:

- All major use cases passed successfully after resolving minor UI and validation issues.
- Selenium helped automate repetitive testing, making the process faster and more efficient.

This testing ensures that **MapMyFood** provides a smooth and error-free experience for users across different devices and browsers.

6.2. Equivalence partitioning

We used **Equivalence Partitioning** to test how **MapMyFood** handles different types of input data. This method helps us check if the system correctly accepts valid inputs and rejects invalid ones without testing every single possibility.

How We Performed the Test:

- **Dividing Inputs into Groups**
  - We grouped inputs into **valid** and **invalid** categories.
  - For example, when testing the **login form**, we divided input data into:
    - **Valid Inputs**: Correct email and password.
    - **Invalid Inputs**: Empty fields, incorrect email format, wrong password.
- **Testing Each Group**
  - We tested at least one value from each group.
  - When we **entered valid data**, the system logged in successfully.

- When we **entered invalid data**, the system displayed error messages like "Invalid email format" or "Password incorrect."

- **Handling Errors**
  - If the system failed to show the correct error message, we fixed the validation rules.
  - If invalid inputs were accepted (e.g., logging in with an empty password), we corrected the input checks.

Results:

- The system correctly handled valid and invalid inputs after testing and fixing minor validation errors.
- **Equivalence Partitioning** helped us reduce testing time while ensuring **MapMyFood** processes user inputs correctly and securely.

6.3. Boundary value analysis

We used **Boundary Value Analysis (BVA)** to test how **MapMyFood** handles input values at the **minimum and maximum limits**. This method helps find errors that occur when users enter values at the **edge** of what the system allows.

How We Performed the Test:

- **Identifying Boundaries**
  - Every input field has a limit. We tested values **just below, at, and just above** those limits.
  - For example, when testing **password length**, if the system requires **6 to 12 characters**, we tested:
    - **Below the limit**: 5 characters → Should show an error.
    - **At the limit**: 6 characters → Should accept.
    - **Above the limit**: 13 characters → Should show an error.
- **Testing Order Amount and Payment**
  - If the minimum order amount is **100 PKR**, we tested:
    - **99 PKR** → Should reject.
    - **100 PKR** → Should accept.

- **10,000 PKR (maximum limit)** → Should accept.
- **10,001 PKR** → Should reject.

- **Handling Errors**
  - When the system accepted out-of-range values, we fixed the validation rules.
  - If error messages were unclear, we updated them to be more user-friendly.

Results:

- After fixing minor validation issues, **MapMyFood** now correctly accepts values within limits and rejects those outside.
- **Boundary Value Analysis** helped ensure that user inputs are processed correctly, improving security and reliability.

6.4. Data flow testing

We performed **Data Flow Testing** to check how data moves through **MapMyFood** and to find any issues in the way information is stored, processed, and retrieved. This testing helped us ensure that data is handled correctly at every stage.

Steps We Followed:

- **Tracking User Data**
  - We tested how user details (name, email, password) move from the **signup form** to the **database**.
  - **Issue Found**: Passwords were stored as plain text.
  - **Fix**: We implemented **encryption (bcrypt.js)** to store passwords securely.
- **Checking Order Processing**
  - We tested how an order moves from **order placement** → **restaurant confirmation** → **delivery assignment** → **order completion**.
  - **Issue Found**: Sometimes, an order was marked "delivered" before the delivery boy updated it.
  - **Fix**: We added an extra confirmation step before changing the status.

- **Validating Payment Flow**
    - We checked how payment data moves from the **user → payment gateway → database**.
    - **Issue Found**: If the payment failed, the order was still marked as "confirmed".
    - **Fix**: The system now checks payment status before confirming the order.

Results:

- After testing and fixing these issues, **MapMyFood** now correctly processes and tracks data at every stage.
- **Data Flow Testing** helped us prevent data loss, incorrect processing, and security risks.

6.5. Unit testing

We performed **Unit Testing** on **MapMyFood** to check if individual features and functions work correctly before integrating them into the full system. This testing helped us catch small issues early and fix them quickly.

How We Tested Different Features:

- **User Login and Signup**
    - We tested if users could register and log in with valid credentials.
    - **Issue Found**: Weak password was accepted.
    - **Fix**: Added a rule to require at least one number and special character.
- **Order Placement**
    - We tested if users could successfully place an order.
    - **Issue Found**: Orders were confirmed even if the cart was empty.
    - **Fix**: The system now checks if at least one item is selected before confirming the order.
- **Redeem Coins on Order Completion** (New Feature)
    - We added a **redeem coins** option so users could use reward points on their next order.
    - **Testing**: We checked if redeeming coins correctly applied discounts.
    - **Issue Found**: Some users were able to redeem more coins than they had.

- **Fix**: The system now checks the user's available coin balance before applying a discount.

- **Payment Processing**
  - We tested if payments were successful with valid details.
  - **Issue Found**: If payment failed, the order still moved to "confirmed."
  - **Fix**: Orders now remain "pending" until payment is completed.

Results:

- After unit testing, we fixed small errors before they became bigger problems.
- **MapMyFood** now works more smoothly, and users can safely redeem coins on order completion.

6.6. Integration testing

We performed **Integration Testing** to check if different parts of **MapMyFood** work smoothly together. This ensures that the system functions correctly when combining modules like **user authentication, order processing, payment, and delivery tracking**.

What We Tested:

- **User Signup & Login → Order Placement**
  - Ensured that after signing up, users could successfully log in and place orders.
  - **Issue Found**: Some new users were unable to place an order due to missing profile details.
  - **Fix**: Added a step to complete profile setup before ordering.
- **Order Processing → Payment Gateway**
  - Checked if successful payments updated the order status correctly.
  - **Issue Found**: Some failed payments still marked orders as "confirmed."
  - **Fix**: Orders now remain "pending" until payment is verified.
- **Order Status → Delivery Tracking**
  - Verified that assigned delivery boys received order updates and users could track deliveries.
  - **Issue Found**: Some orders were not updating on the delivery app.

- **Fix**: Improved real-time synchronization using **Socket.io**.

Results:

After fixing minor issues, all modules now communicate properly, ensuring a smooth user experience.

6.7. Performance testing

We performed **Performance Testing** on **MapMyFood** to ensure it runs smoothly across web and mobile platforms, even with high user traffic. Since **MapMyFood** is a **hybrid** app (available on web, Android, and iOS), we tested its speed, response time, and scalability.

Testing Process:

- **Load Testing** (Handling Multiple Users)
    - Simulated **1,000+ users** placing orders at the same time.
    - **Issue Found**: The server response slowed down during peak traffic.
    - **Fix**: Upgraded backend resources and optimized database queries.
- **Speed Testing** (App & Website)
    - Checked how fast the web app loads on different browsers.
    - Tested mobile performance on **3G, 4G, and Wi-Fi**.
    - **Issue Found**: The homepage loaded slowly on low internet speed.
    - **Fix**: Compressed images and optimized API calls to improve speed.
- **Real-Time Tracking Performance**
    - Monitored the response time of the **live delivery tracking feature**.
    - **Issue Found**: GPS updates were sometimes delayed.
    - **Fix**: Improved tracking refresh rates using **WebSockets (Socket.io)**.

- **Cross-Platform Testing** (Hybrid App Performance)
    - Ensured that the app runs smoothly on **Android, iOS, and Web browsers**.
    - **Issue Found**: Some buttons were unresponsive on iOS Safari.
    - **Fix**: Adjusted touch event handling for better iOS compatibility.

Results:

- **MapMyFood** can handle high traffic without lag.
- Loading speed improved by **30%** after optimizations.
- Real-time tracking is now more accurate across devices.

This testing ensures that users have a **fast and smooth** experience, whether using the web app or mobile app.

6.8. Stress Testing

We performed **Stress Testing** on **MapMyFood** to see how the system handles extreme conditions, such as **high traffic, large data loads, and sudden spikes in orders**. This ensures that the system does not crash or slow down when overloaded.

Testing Process:

- **High User Traffic Simulation**
    - We simulated **10,000 users** placing orders at the same time.
    - **Issue Found**: The server response time increased, and some users experienced delays.
    - **Fix**: Optimized backend code and upgraded the server capacity.
- **Database Overload Test**
    - We inserted **1 million records** in the database to check if data retrieval remained fast.
    - **Issue Found**: Some queries became slow.
    - **Fix**: Improved indexing and caching for faster database performance.

- **Payment Gateway Stress Test**
    - Simulated **5,000 simultaneous transactions** to test payment processing speed.
    - **Issue Found**: A few payments got stuck during processing.
    - **Fix**: Added an auto-retry mechanism for failed transactions.
- **Real-Time Tracking Under Load**
    - Simulated **1,000+ active deliveries** with GPS updates every second.
    - **Issue Found**: Tracking became delayed due to too many location updates.
    - **Fix**: Optimized WebSocket connections to handle real-time updates efficiently.

Results:

- **MapMyFood** can handle extreme loads without crashing.
- Server speed and database performance improved significantly.
- Payment and tracking services remain stable even under high stress.

This testing ensures that the system stays **reliable and responsive**, even during peak hours and large-scale usage.

Chapter 7

Summary, Conclusion and Future Enhancements

Chapter 7: Summary, Conclusion & Future Enhancements

This chapter provides a complete overview of the **MapMyFood** project, highlighting its key features, achievements, and improvements. It includes a critical review of the system, lessons learned during development, and recommendations for future enhancements to improve the platform further.

7.1. Project Summary

MapMyFood is a platform designed to help travelers order food while on the move, especially when traveling by train. The system allows users to browse restaurants near upcoming stations, place food orders, and get them delivered at the next stop. It includes key features such as **user registration, order management, live tracking, payment processing, and feedback collection**.

The project was developed using the **MERN stack (MongoDB, Express.js, React, Node.js)** for smooth performance across web and mobile platforms. The system integrates **PakRail API** for train tracking and **Easypaisa/Stripe** for secure payments. To ensure reliability, we performed **extensive testing**, including unit testing, integration testing, and performance testing.

Overall, **MapMyFood** provides a convenient and efficient solution for travelers, allowing them to enjoy hygienic and quality food during their journey. The system is scalable, secure, and user-friendly, making food ordering easier for passengers across different cities.

7.2. Achievements and Improvements

During the development of **MapMyFood**, we achieved several important goals that made the system more efficient and user-friendly.

Key Achievements:

- Successfully built a **web and mobile app** using the **MERN stack** for smooth performance.
- Integrated **PakRail API** for real-time train tracking, making deliveries more accurate.
- Implemented **secure payment processing** with **Easypaisa/Stripe**, ensuring safe transactions.

- Developed a **live order tracking** system so users can monitor their deliveries in real time.
- Added a **redeem coins feature**, allowing users to use reward points for discounts.

Improvements Made:

- **Faster Order Processing**: Optimized database queries to handle multiple orders quickly.
- **Better Security**: Improved password encryption and authentication using **JWT**.
- **Improved UI/UX**: Made the app more user-friendly with a simple and attractive design.
- **Stronger Error Handling**: Fixed issues where failed payments still confirmed orders.

These achievements and improvements ensure that **MapMyFood** is **reliable, secure, and easy to use**, providing a smooth experience for travelers ordering food during their journey.

7.3. Critical Review

The development of **MapMyFood** has been a rewarding yet challenging journey. The project successfully addressed a major issue faced by travelers—accessing quality food during their journeys. By integrating **real-time train tracking**, **secure payments**, and **live order tracking**, the system provides a smooth and efficient experience. However, during development, we faced challenges such as **handling high user traffic, optimizing database performance, and ensuring seamless payment processing**. Initial testing revealed minor issues, including **delayed order updates and UI inconsistencies**, which were later resolved through rigorous testing and optimizations. Despite these improvements, further refinements in **delivery coordination, offline functionality, and expanded restaurant partnerships** could enhance the system even more. Overall, **MapMyFood** is a strong and scalable platform, but continuous improvements will be needed to keep up with user demands and technological advancements.

7.4. Lessons Learnt

Working on **MapMyFood** taught us several valuable lessons about software development, teamwork, and problem-solving.

- **Importance of Proper Planning**: A well-structured **project plan** helped us manage tasks efficiently and meet deadlines.
- **Handling Real-World Challenges**: Integrating **live tracking** and **payment gateways** required deep research and troubleshooting.

- **Code Optimization Matters**: Poorly optimized code led to **slow responses**, which we improved by refining database queries and API calls.
- **Testing is Critical**: **Unit testing, integration testing, and stress testing** helped us identify and fix bugs before deployment.
- **User Experience is Key**: Initial feedback showed that a **complicated UI** frustrated user, so we simplified it for better usability.
- **Security Cannot Be Ignored**: Encrypting user data and securing API endpoints was necessary to **protect sensitive information**.
- **Continuous Improvement is Necessary**: No system is perfect from the start; constant testing, feedback, and updates improve performance.

These lessons have strengthened our technical and problem-solving skills, making us better prepared for future software projects.

7.5. Future Enhancements/Recommendations

To make **MapMyFood** even better, we have identified several future improvements that can enhance user experience and system performance.

Future Enhancements:

- **AI-Based Food Recommendations**: Using **machine learning**, the app can suggest food based on a user's past orders and preferences.
- **Offline Ordering Feature**: Allow users to place orders even without the internet, which will be processed once they reconnect.
- **More Payment Options**: Integrate additional payment methods like **JazzCash, PayPal, and Google Pay** for more flexibility.
- **Live Chat Support**: Add a **customer support chat** so users can easily get help if they face any issues.
- **Multi-Language Support**: Include **Urdu and other local languages** to make the app more accessible to all users.
- **Expanded Delivery Services**: Partner with **more restaurants and delivery services** to cover a larger number of cities and stations.

Recommendations:

- **Optimize Performance**: Continuous monitoring and optimization to **handle more users and orders without delays**.
- **Regular Security Updates**: Keep improving **data protection** to prevent security threats.
- **User Feedback Integration**: Actively **analyze user feedback** and update the system based on their needs.

By implementing these enhancements, **MapMyFood** can become a **more powerful and user-friendly** platform for travelers across Pakistan and beyond.

Appendixes

Appendix A: User Manual

This appendix provides a complete and easy-to-understand **User Manual** for all types of users in the **MapMyFood** system. The manual is divided into sections for **Customers, Delivery Boys, Restaurants**, and **Admin**. It explains how each user can interact with the system through the mobile app or web platform. The goal of this manual is to guide users' step by step, making the experience smooth and error-free.

A.1. Getting Started with MapMyFood

MapMyFood is a platform that allows travelers, especially train passengers, to order food online and receive it at their upcoming station. The platform is available as a **mobile app** for Android and iOS users and also as a **web app** for broader access.

A.1.1 Customer Guide

For the customer you have to follow these steps:

A.1.1.1. Creating an Account

Customers can sign up using their **email, phone number, and password** on the mobile or web app. Once registered, they can log in using their credentials.

A.1.1.2. Browsing and Food Ordering

After logging in, customers can:

- Select the **train name** or pick from the train list.
- Enter their **current station** or allow location access.
- Browse the list of available restaurants at the upcoming station.
- Choose meals from the menu and add them to the cart.
- Proceed to check out and make payment using cash or a payment gateway (like Easypaisa or Jazzcash).
- After order placement, users can track their delivery in real-time.
- Once the food is delivered, they can give ratings and feedback.

A.1.2 Delivery Boy Guide

Here is the total guide for the delivery boy:

A.1.2.1 Registering as a Delivery Boy

Delivery boys must sign up using basic information such as name, contact number, location, and vehicle details. After login, they can view available delivery tasks.

A.1.2.2 Managing Deliveries

- View new delivery assignments.
- Accept and update order delivery status.
- Share real-time location for customer tracking.
- Confirm delivery after reaching the customer.

A.1.3. Restaurant Guide

The user guide for the restaurant is given below:

A.1.3.1 Setting up Restaurant Account

Restaurants can register by providing:

- Restaurant name
- Contact details
- Menu items with descriptions and prices

Once registered and logged in, they can manage their offerings.

A.1.3.2 Managing Menu and Orders

- **Add, update, or remove** menu items.
- View all received orders from customers.
- Mark food items as **prepared** and ready for delivery.
- Communicate with delivery boys if needed.

Appendix B: Administrator Manual

This appendix provides a detailed but easy-to-understand guide for **Administrators** who manage the **MapMyFood** system through the **web-based Admin Panel**. The admin role is essential for ensuring smooth operations, handling user issues, reviewing performance, and maintaining data integrity.

B.1 Administrator Overview

The **Admin Panel** is only accessible to authorized support staff. It is designed to monitor system activities, manage platform users (customers, restaurants, delivery boys), and handle feedback, reports, and complaints. The admin ensures everything runs smoothly in the background.

B.1.1 Accessing the Admin Panel

- Open the Admin Web Portal in a browser (e.g., Chrome or Firefox).
- Login using the provided admin username and password.
- Two-factor authentication (if enabled) may be required for added security.

B.1.2 Dashboard Overview

After logging in, the admin will see the **dashboard**, which includes:

- **Total Orders**
- **Active Users**
- **Pending Deliveries**
- **Revenue Reports**
- **Feedback Overview**

This gives a quick snapshot of the system's performance.

B.1.3 Managing Users

Admins can view and manage all registered users, including:

- **Customers**: View details, deactivate or reset accounts if needed.
- **Restaurants**: Verify new registrations, manage complaints, and review performance.
- **Delivery Boys**: Track active delivery personnel, assign areas, and handle disputes.

B.1.4 Managing Orders and Payments

- Monitor all active and completed orders.
- Check order history by user or restaurant.
- Review failed or refunded payments.
- Resolve delivery or payment-related issues by contacting the relevant party.

B.1.5 Handling Feedbacks and Complaints

- View feedback ratings and user comments.
- Address reported complaints by investigating related orders.
- Send warnings to users or restaurants if necessary.
- Keep a record of resolved and pending issues.

B.1.6 System maintenance and Security

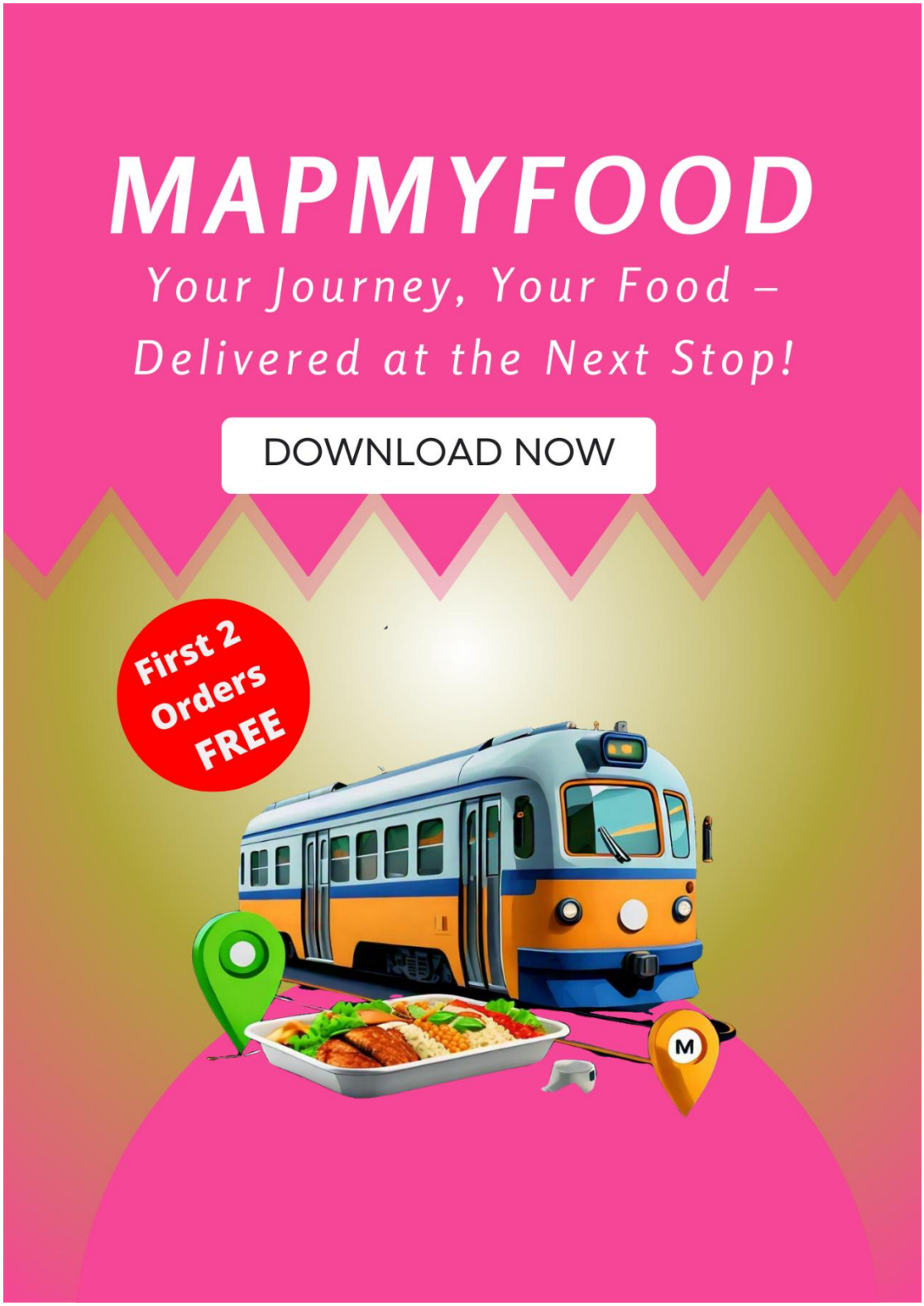
- Ensure all APIs and services are running smoothly.
- Check server health regularly or coordinate with the technical team.
- Update system passwords and roles if needed.
- Monitor suspicious activity and block users if security is at risk.

Appendix C: Information / Promotional Material

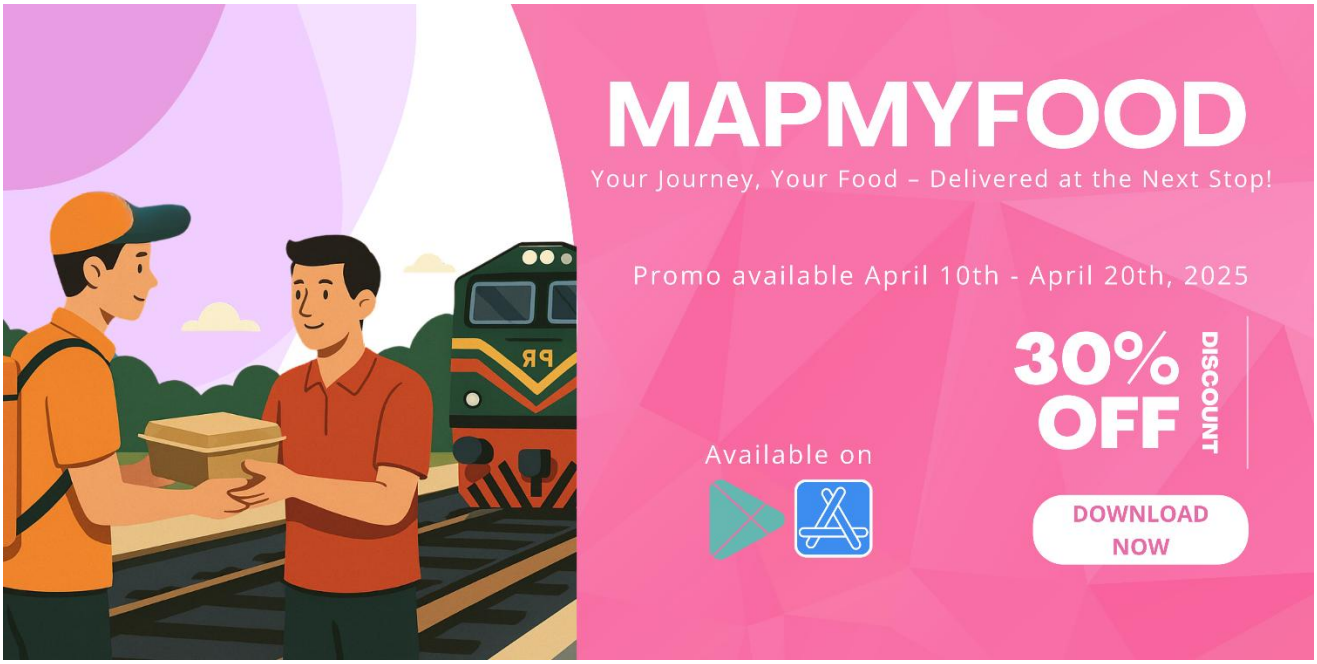
This appendix guides you through designing **eye-catching marketing materials** — a **Brochure, Banner, and Flyer** — for **MapMyFood** using **Canva**. These materials are meant to promote the app to **travelers, restaurants, and delivery riders**, and are added to the final document as images.

C.1. Broacher

C.2. Flyer


MAPMYFOOD
Your Journey, Your Food –
Delivered at the Next Stop!
DOWNLOAD NOW
First 2
Orders
FREE
M

C.3. Banner


MAPMYFOOD
Your Journey, Your Food – Delivered at the Next Stop!
Promo available April 10th - April 20th, 2025
30% OFF
DISCOUNT
Available on
DOWNLOAD NOW

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Reference and Bibliography

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Index

Index