



Mini Project Report On

Multi-Modal Transport App

*Submitted in partial fulfillment of the requirements for the
award of the degree of*

Bachelor of Technology

in

Computer Science & Engineering

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CERTIFICATE

*This is to certify that the mini project report entitled "**Multi-Modal Transport App**" is a bonafide record of the work done by **Fabin Chandi (U2103088)**, **Elviin Thomas Eldho (U2103085)**, **Gayathri Bijoy (U2103093)**, **Kuruvilla Jacob (U2103127)**, submitted to the APJ Abdul Kalam Technological University in partial fulfillment of the requirements for the award of the degree of Bachelor of Technology (B.Tech.) in Computer Science and Engineering during the academic year 2023-2024.*

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Abstract

The introduction of metro and water metro stations has revolutionized public transportation, offering a blend of efficiency and comfort. However, despite the presence of these modern transit systems, many commuters struggle to navigate the intricate web of routes spanning metros, water metros, and buses. This lack of awareness often leads to sub-optimal travel experiences and unnecessary delays. To address this challenge, we present a multi-modal transport app tailored specifically for Kochi's unique landscape. Our app seamlessly integrates data from various transportation modes, with a primary focus on maximizing the utilization of Kochi Metro and Water Metro services. We leverage comprehensive mapping data to prioritize routes that not only optimize travel time but also offer users a quicker, eco-friendly, and more scenic alternative to traditional land-based routes. By meticulously analyzing the occupancy data and ticket utilization at each station, our app ensures a real-time understanding of the demand and supply dynamics, allowing us to optimize the route suggestions for maximum convenience. Our app goes beyond mere route suggestions. It provides detailed itineraries encompassing multiple modes of transport, including buses, metros, and water metros. Users can effortlessly visualize different travel paths, along with estimated travel times and associated fare costs. Additionally, to streamline the travel experience further, we offer an integrated ticket booking feature. Whether it's purchasing metro tickets, water metro passes, or bus fares, users can conveniently book all necessary tickets within the app. Understanding that real-time data is key to a seamless commuting experience, our app relies on crowdsourcing as the primary means to track passengers across different modes of transport. By harnessing the collective intelligence of users, we provide dynamic information about arrival times and current occupancy, ensuring users are always well-informed for a smooth and comfortable journey.

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List of Abbreviations

Acronym - Expansion

Chapter 1

Introduction

1.1 Background

In an increasingly interconnected world where urban mobility is a critical aspect of daily life, there arises a need for innovative solutions to streamline and enhance transportation options for individuals navigating bustling cityscapes. This project aims to revolutionize the way people plan and execute their journeys within urban environments by offering a comprehensive platform that seamlessly integrates various modes of transportation, including buses, metros, waterways, and other forms of transport.

The motivation behind this project stems from the challenges faced by commuters in navigating complex transportation networks, often resulting in inefficiencies, delays, and frustration. By providing a user-friendly and intuitive application, we seek to empower commuters with the tools and information needed to make informed decisions about their travel routes, optimize their journeys for efficiency and convenience, and ultimately enhance their overall transportation experience.

1.2 Problem Definition

The Multi-Modal Transport Application aims to revolutionize urban mobility by providing a user-friendly platform that seamlessly integrates various modes of transportation. By offering real-time route options, live location sharing, points of interest information, and in-app translation services, the project aims to empower commuters with the tools and information needed to optimize their travel experiences, enhance efficiency, and contribute to sustainable urban mobility solutions.

1.3 Scope and Motivation

The Multimodal Transport app caters to the needs of commuters, students, and tourists in Kochi, Kerala, providing a user-friendly platform for journey planning and execution across various transportation modes including metro, bus, and ferries. Through optimized travel routes, improved efficiency, and real-time information, the app greatly enhances the commuting experience for daily travelers, offers convenient travel solutions for students, and expands exploration opportunities for tourists. By facilitating seamless transportation options, the app contributes to the development of a robust transportation network in Kochi, fostering connectivity and accessibility for all users.

The absence of a comprehensive multimodal transport application in Kerala, particularly in Kochi, presents significant challenges for commuters and tourists navigating the city's diverse transportation options. This gap in centralized information and coordination impedes the accessibility and efficiency of public transport systems for residents and visitors. Students, especially those unfamiliar with the local language, encounter additional obstacles in understanding and utilizing forms of transportation such as buses and ferries. Developing a user-friendly Multimodal Transport app aims to address these challenges by providing intuitive navigation tools and in-app translation services, empowering individuals of all backgrounds to navigate Kochi's transportation network confidently. Implementing such a solution has the potential to revolutionize urban mobility in Kerala, offering a vital resource that benefits residents, tourists, and students alike.

1.4 Objectives

- Provide a user-friendly platform for planning and executing journeys across various transportation modes (metro, bus, ferries).
- Optimize travel routes to minimize travel time and enhance efficiency. journeys across various transportation modes (metro, bus, ferries).
- Offer real-time information on travel options, including arrival times
- Support personalized user profiles to tailor the app experience to individual preferences

ences.

- Enable users to view detailed itineraries for selected routes, including estimated travel times and associated fare costs.
- Allow users to receive notifications/alerts regarding changes or disruptions in their selected route.
- Enable users to discover nearby attractions at each stop, enhancing the overall travel experience.
- Support continuous evolution and improvement based on user feedback and changing needs.

1.5 Challenges

Developing a Multimodal Transport app entails challenges like integrating diverse transportation modes and ensuring real-time data accuracy. Addressing user interface design complexities, language barriers, and data privacy concerns are also key considerations. Overcoming these hurdles requires collaborative efforts, ongoing adaptation to user needs, and stringent adherence to best practices in technology development and data management.

1.6 Assumptions

The project depends on the consistent availability and reliability of third-party components and APIs, such as GPS and transportation databases, for seamless integration. Any issues with these components could potentially hinder the functionality and performance of the app. Additionally, the success of the project hinges on user adoption and acceptance, necessitating careful consideration of assumptions regarding user preferences, behaviors, and willingness to embrace new technology, which may inform the app's design and marketing strategies.

1.7 Societal / Industrial Relevance

Societal Impact:

- **Enhancing Urban Mobility:** By providing a comprehensive and user-friendly platform for multimodal transportation, the project contributes to improving urban mobility, making it easier for residents to navigate cities and access essential services, employment, and recreational activities.
- **Inclusivity and Accessibility:** The app's features, such as in-app translation services and accessibility options, cater to diverse user needs, including those with language barriers or disabilities, promoting inclusivity and equal access to transportation services.
- **Environmental Sustainability:** By promoting the use of public transportation and ride-sharing services, the project supports efforts to reduce carbon emissions and alleviate traffic congestion, contributing to environmental sustainability and healthier urban environments.

Industrial Applications:

- **Tourism and Hospitality Sector:** The app can serve as a valuable tool for tourists and travelers, providing them with convenient access to transportation options, points of interest, and local attractions, thereby enhancing their overall travel experience and supporting the tourism industry.
- **Transportation and Logistics Industry:** For transportation companies and logistics providers, the project offers opportunities for collaboration and integration, enabling them to optimize route planning, enhance operational efficiency, and deliver better services to customers.
- **Technology and Innovation:** The development of the app fosters innovation in the technology sector, driving advancements in mobile applications, data analytics, and location-based services, while also creating new business opportunities and revenue streams for app developers and technology firms.

1.8 Organization of the Report

The report on the Multi-Modal Transport App is organized to comprehensively address all aspects of its development and implementation. The introduction sets the stage by elucidating the background, problem definition, and scope, while also outlining objectives, challenges, and assumptions. This section concludes with a discussion of the societal and industrial relevance of the app, followed by a succinct overview of the report's organization.

Moving forward, the Software Requirements Specification delves into the technical requirements of the app, detailing its overall description, interface requirements, system features, and nonfunctional necessities. This section serves as a blueprint for the app's development, ensuring alignment with user needs and technical specifications.

Subsequently, the System Architecture and Design section provides a deep dive into the app's structural framework. It covers system overview, architectural design, identified datasets, proposed methodologies/algorithms, user interface design, database design, implementation strategies, module division, and a work schedule depicted through a Gantt chart. This comprehensive breakdown ensures clarity in understanding the app's architecture, design rationale, and implementation roadmap, facilitating effective development and deployment.

Chapter 2

Software Requirements Specification

2.1 Introduction

2.1.1 Purpose

This Software Requirements Specification (SRS) document pertains to The “Multimodal Transport App for Optimal Travel in Kochi.” It outlines the requirements for the development of the app, including its features, functionality, and constraints. The scope of this SRS encompasses the entire product, detailing its specifications and components comprehensively.

2.1.2 Product Scope

The Multimodal Transport app is tailored to serve commuters, students, and tourists in Kochi, Kerala, offering a user-friendly platform for planning and executing journeys across transportation modes like metro, bus, and ferries. By optimizing travel routes, enhancing efficiency, and providing real-time information, the app significantly improves the commuting experience for daily commuters, facilitates convenient travel for students, and enhances exploration opportunities for tourists, ultimately contributing to a seamless transportation network in Kochi.

2.2 Overall Description

2.2.1 Product Functions

- Provide a user-friendly platform for planning and executing journeys across various transportation modes (metro, bus, ferries).
- Optimize travel routes to minimize travel time and enhance efficiency.

- Offer real-time information on travel options, including arrival times.
- Support personalized user profiles to tailor the app experience to individual preferences.
- Enable users to view detailed itineraries for selected routes, including estimated travel times and associated fare costs.
- Allow users to receive notifications/alerts regarding changes or disruptions in their selected route.
- Enable users to discover nearby attractions at each stop, enhancing the overall travel experience.
- Support continuous evolution and improvement based on user feedback and changing needs.

2.3 Operating Environment

The Multimodal Transport app is designed to operate on smartphones and mobile devices running iOS (version 11 or later) and Android (version 7.0 or later) operating systems, ensuring compatibility across a broad range of devices. It utilizes GPS services for real-time location data and navigation assistance and interfaces with transportation authorities' databases for route information. Internet connectivity is required for accessing real-time updates and nearby attractions information, with offline capabilities available for areas with limited network coverage. The app prioritizes user accessibility, adhering to relevant standards and guidelines for an inclusive experience. Overall, the app functions seamlessly within its operating environment, providing users with an efficient platform for planning and executing journeys across various transportation modes.

2.4 Design and Implementation Constraints

- **Regulatory Compliance:** Adherence to data privacy, security, and accessibility regulations is mandatory.
- **Interfaces to Other Applications:** Integration with GPS services and nearby attractions databases may affect design decisions.

- **Communication Protocols:** Support for various communication protocols is needed for seamless data exchange and acceptance by public transport authorities.
- **Maintenance Responsibility:** Regular updates and improvements are essential for keeping the app functional and addressing user feedback. This ongoing maintenance ensures sustained public acceptance and usability by continually enhancing the app's features and addressing any issues that arise.

2.5 Assumptions and Dependencies

- **Third-party Components:** The project assumes the availability and reliability of third-party components or APIs for integrating services like GPS, and transportation databases. Any issues with these components could impact the functionality and performance of the app.
- **External Dependencies:** The project may have dependencies on external factors such as software components, libraries, or frameworks that are intended for reuse. Any changes or updates to these dependencies could impact the project's development and functionality.
- **Industry Partnership:** The project depends on effective communication and collaboration with stakeholders, including public transport authorities and facilities, for acceptance and adoption of the app. Any misunderstandings or lack of cooperation could hinder the project's success.
- **User Adoption:** The project's success relies on user adoption and acceptance of the app. Assumptions about user preferences, behavior, and willingness to adopt new technology may influence the app's design and marketing strategies.

2.6 External Interface Requirements

2.6.1 User Interfaces

The software product interfaces with users through various features. Users start with a login/signup screen and navigate to the main dashboard offering options like 'Plan Journey' and 'Settings'. The 'Plan Journey' feature lets users input their location and destination, showing route options with travel time and costs. Real-time GPS tracking displays journey progress on a map. Emergency contact sharing and nearby attractions enhance user experience. A translation aid between English and Malayalam is available, and users can customize settings. Help/support is accessible throughout the app.

2.6.2 Hardware Interfaces

The multimodal transport app for Kochi works with various devices like smartphones and tablets, running on iOS and Android. It uses hardware like GPS for location tracking and relies on internet connectivity to access mapping and transportation data. It communicates using standard protocols like GPS and HTTP/HTTPS. The app may also utilize device sensors for enhanced features and optimize data processing to save power. It ensures smooth operation and provides a seamless travel experience for users in Kochi.

2.6.3 Software Interfaces

The app connects with mapping and transportation databases like Google Maps or OpenStreetMap to get route information and real-time updates. It operates on user devices using operating systems like iOS and Android and may use tools like Google Play Services Location API or Core Location Framework for GPS tracking. The app communicates securely with external services and databases through HTTP/HTTPS protocols and may integrate with messaging services to share selected routes with emergency contacts. It shares data like user location, selected routes, and occupancy information across software components and follows API protocols documented in technical specifications.

2.6.4 Communications Interfaces

The transport app for Kochi requires communication functions for accessing mapping databases and transportation updates, typically using HTTP/HTTPS protocols for secure data exchange. It may integrate with messaging services for sharing routes with

emergency contacts and utilize standard email protocols for notifications. Message formatting adheres to standard protocols compatible with web browsers and mobile devices. Communication security is ensured through encryption mechanisms, and data transfer rates are optimized for efficient real-time updates. Synchronization mechanisms maintain consistency across devices and platforms, facilitating a seamless user experience.

2.7 System Features

2.7.1 Route Planning and Optimization

Description and Priority

This feature allows users to plan their journeys using various public transport options in Kochi, including metro, water metro, and buses. It prioritizes routes that optimize travel time while offering eco-friendly and scenic alternatives (**High priority**).

- **Benefit:** High (Reduces travel time, improves user experience)
- **Penalty:** Medium (Increased development complexity)
- **Cost:** Medium (Requires integration with multiple data sources)
- **Risk:** Low (Functionality can be demonstrably tested)

Stimulus/Response Sequences

A user enters origin and destination addresses:

- The system auto-completes addresses using location services (optional)
- The system validates entered addresses (e.g., checks for missing information).

User selects preferred travel mode:

- Users can choose "All" for multimodal options or select specific modes (metro, water, metro, bus).
- The system filters route options based on the chosen mode(s).

User selects route optimization preference:

- Users can choose "Fastest" (default), "Eco-friendly," or "Scenic."
- The system prioritizes routes based on the chosen preference.

The system retrieves route options and displays results:

- The system displays a list of route options on a map.
- Each option highlights the different transport modes used in the journey.
- The system displays the estimated travel time for each route.

Functional Requirements

- **REQ-1:** The system shall allow users to enter origin and destination addresses (**High priority**).
- **REQ-2:** The system shall integrate with location services to offer address auto-completion (**Medium priority**).
- **REQ-3:** The system shall validate entered addresses and provide informative error messages for missing or invalid data (**High priority**).
- **REQ-4:** The system shall allow users to select their preferred travel mode(s) (**Medium priority**).
- **REQ-5:** The system shall filter route options based on the chosen travel mode(s) (**Medium priority**).
- **REQ-6:** The system shall allow users to select their route optimization preference (Fastest, Eco-friendly, Scenic) (**High priority**).
- **REQ-7:** The system shall prioritize route options based on the chosen optimization preference (**High priority**).
- **REQ-8:** The system shall display route options on a map with clear differentiation between transport modes (**High priority**).
- **REQ-9:** The system shall calculate and display estimated travel time for each route option (**High priority**).

- **REQ-10:** The system shall handle situations where no route is available due to service disruptions or invalid origin/destination combinations (**High priority**). In such cases, the system should provide informative error messages and suggest alternative actions (e.g., suggesting alternative routes or informing the user about planned service disruptions).

2.7.2 Real-Time Information

Description and Priority

This feature provides users with real-time information about their progress during their journey, including the upcoming stops and the estimated arrival times for their chosen route (**High priority**).

- **Benefit:** High (Improves user experience, reduces anxiety)
- **Penalty:** Medium (Requires continuous data feed from public transport authorities)
- **Cost:** Medium (Requires integration with real-time data APIs)
- **Risk:** Medium (Data accuracy depends on external sources)

Stimulus/Response Sequences

User selects a route and initiates navigation:

- The system initiates real-time journey tracking based on the chosen route.

The system continuously updates the user location:

- The system utilizes GPS or other location services to track the user's progress.

The system retrieves real-time information on public transport schedules:

- The system integrates with real-time data feeds from public transport authorities to obtain information on upcoming stops and estimated arrival times.

The system displays real-time progress information:

- The system displays the user's current location on a map relative to the chosen route.
- The system highlights the upcoming stop on the route.
- The system displays the estimated arrival time for the upcoming stop.

Functional Requirements

- **REQ-1:** The system shall continuously track the user's location during their journey (**High priority**).
- **REQ-2:** The system shall integrate with real-time public transport data feeds to obtain information on upcoming stops (**High priority**).
- **REQ-3:** The system shall display the user's current location on a map relative to the chosen route (**High priority**).
- **REQ-4:** The system shall highlight the upcoming stop on the route (**High priority**).
- **REQ-5:** The system shall display the estimated arrival time for the upcoming stop, based on real-time data (**High priority**).
- **REQ-6:** The system shall handle situations where real-time data is unavailable (**Medium priority**). In such cases, the system should display the most recent available information and notify the user about potential delays.

2.7.3 User Itinerary and Tracking

Description and Priority

This feature provides users with a detailed itinerary for their chosen route, including information on each transport leg, transfers, estimated travel times, and fares (**High priority**). It also allows users to track their progress during the journey.

- **Benefit:** High (Improves user experience, transparency, and planning)

- **Penalty:** Low (Minimal impact on core functionalities)
- **Cost:** Low (Leverages existing functionalities)
- **Risk:** Low (Straightforward implementation)

Stimulus/Response Sequences

User selects a route:

- The system retrieves and displays a detailed itinerary for the chosen route.

Functional Requirements

- **REQ-1:** The system shall generate a comprehensive itinerary for the chosen route, including information on (**High priority**):
 - Each leg of the journey with the corresponding transport mode (e.g., metro line, bus route number, water metro route).
 - Transfer information between different transport modes.
 - Estimated travel time for each leg of the journey.
- **REQ-2:** The system shall calculate and display the total fare cost for the entire journey, considering potential transfer fees (**High priority**).
- **REQ-3:** The system shall allow users to access and review their itinerary at any point during their journey (**Medium priority**).

2.7.4 User Safety and Convenience

Description and Priority

This feature provides functionalities to enhance user safety and convenience during their journeys, including in-app translation support for Malayalam (**Medium priority**).

- **Benefit:** High (Improves user experience for Malayalam users, reduces stress)
- **Penalty:** Low (Optional feature, minimal impact on core functionalities)

- **Cost:** Medium (Requires integration with translation API)
- **Risk:** Low (Straightforward implementation)

Stimulus/Response Sequences

Sharing Live Location and Route

- User selects the "Share Live Location" option.
- User chooses emergency contacts to share location with.
- System prompts users to confirm sharing permissions.
- System securely transmits the user's location and route information to designated contacts.

Points of Interest (POIs) Information

- User's location progresses along the route (automatic).
- System detects nearby POIs based on user location and route data.
- System displays information on relevant POIs along the route (e.g., name, category, distance).

In-app Malayalam Translation

- User encounters a bus plaque card or station board in Malayalam (automatic).
- User selects the on-screen translation option (if available).
- System utilizes the translation API to convert the Malayalam text to English and display it within the app.

Functional Requirements

In-app Malayalam Translation

- **REQ-1:** The system shall integrate with a reliable Malayalam-English translation API (**Medium priority**).

- **REQ-2:** The system shall offer an on-screen option for users to initiate the translation of Malayalam text (**High priority**).
- **REQ-3:** The system shall display the translated English text within the app interface (**High priority**).

Sharing Live Location and Route

- **REQ-4:** The system shall allow users to share their live location and route with designated emergency contacts (**Medium priority**).
- **REQ-5:** The system shall implement secure protocols (e.g., encryption) for sharing user location data (**High priority**).
- **REQ-6:** The system shall obtain user consent before sharing location information (**High priority**).

Points of Interest (POIs) Information

- **REQ-7:** The system shall integrate with POI databases to retrieve information on relevant points of interest (**Medium priority**).
- **REQ-8:** The system shall identify POIs located near the user's current location and along their chosen route (**Medium priority**).
- **REQ-9:** The system shall display user-friendly information on nearby POIs, such as name, category, and distance (**Medium priority**).

2.8 Other Nonfunctional Requirements

Performance Requirements

- **Response Time:**
 - The app should respond to user inputs (such as selecting source and destination, applying filters, etc.) within milliseconds to provide a smooth and responsive experience.

- Notifications regarding the current distance of the mode of transport from a particular stop should be delivered within seconds of the update.

- **Route Optimization Time:**

- The time taken to calculate and present the optimized route should be minimal, even when considering various filters like time, distance, and fare. This ensures that users can quickly make informed decisions about their travel plans.

- **Data Processing Time:**

- The time taken to process and display large amounts of data related to routes, schedules, fares, and real-time updates should be optimized to ensure smooth performance, especially during peak usage times.

- **Scalability:**

- The system should be able to handle a large number of concurrent users without compromising performance. This includes both the app's backend infrastructure and any third-party services or APIs used for route calculation or real-time tracking.

Safety Requirements

- **Real-Time Tracking Accuracy:**

- Ensure that the real-time tracking system accurately reflects the position and status of transport modes to prevent users from missing stops or experiencing delays. Implement regular checks and maintenance of tracking hardware and software to maintain accuracy. Prevent inaccuracies in tracking data by employing robust quality assurance measures during development and deployment.

- **Emergency Response and Notification:**

- Enable timely notifications to users in case of service disruptions, emergencies, or critical updates. Implement an emergency notification system capable of

quickly disseminating relevant information to users. Prevent delays or failures in delivering emergency notifications by optimizing notification delivery systems and ensuring redundancy where possible.

- **Route Optimization Reliability:**

- Ensure the reliability of route optimization algorithms to prevent users from being directed through unsafe or inefficient routes. Conduct thorough testing and validation of route optimization algorithms to ensure accuracy and reliability. Prevent routing errors by continuously updating and refining algorithms based on user feedback and real-world data.

Security Requirements

- **Data Security:**

- Ensure that all user data, including personal information and travel history, is securely stored and transmitted. Implement encryption protocols to protect data both at rest and in transit, and regularly audit security measures to identify and address vulnerabilities. Adhere to relevant data protection regulations such as GDPR, CCPA, or industry-specific standards governing the handling of sensitive information.

- **User Identity Authentication:**

- Implement robust user identity authentication mechanisms to prevent unauthorized access to user accounts and sensitive data. Utilize multi-factor authentication methods, strong password policies, and session management controls to verify user identities securely. Comply with industry standards for user authentication, such as those outlined in the OpenID Connect or OAuth 2.0 protocols.

- **Privacy Protection:**

- Respect user privacy by minimizing the collection and retention of personally identifiable information (PII) to only what is necessary for the app's functionality. Provide clear and transparent privacy policies to users, obtain explicit

consent for data collection and processing, and offer options for users to manage their privacy settings. Ensure compliance with privacy regulations such as GDPR, which mandates user consent for data processing and provides rights to access, rectify, or erase personal data.

Software Quality Attributes

- **Reliability**

- **Requirement:** The app should deliver consistent operation with minimal errors or failures.
- **Quantifiable Measure:** Mean Time Between Failures (MTBF) will be tracked to monitor uptime.
- **Verification Strategy:** Regular automated and manual testing will be conducted to achieve a target uptime of at least 99

- **Maintainability**

- **Requirement:** The app's codebase should be easy to understand, modify, and update.
- **Quantifiable Measure:** Maintainability will be evaluated using a maintainability index score, aiming for a score of at least 70 out of 100. This score can be derived from metrics like code complexity and modularity.
- **Verification Strategy:** We will implement well-defined coding standards and a modular design approach to achieve the target maintainability score.

- **Usability**

- **Requirement:** The app should prioritize an intuitive and user-friendly experience for all demographics.
- **Quantifiable Measure:** User experience will be assessed through task completion times and user satisfaction surveys. We will aim for a System Usability Scale (SUS) score of at least 70 out of 100.

- **Verification Strategy:** Usability testing will be conducted with representative users throughout the development process to identify and address any usability issues.

- **Portability**

- **Requirement:** The app should be adaptable for deployment across various platforms (e.g., iOS, Android, web).
- **Quantifiable Measure:** The effort required to port the app to different platforms will be tracked.
- **Verification Strategy:** The app will be designed with platform-agnostic code wherever possible, and compatibility testing will be conducted on target platforms (e.g., iOS, Android, web) to ensure seamless functionality.

- **Interoperability**

- **Requirement:** The app should seamlessly integrate with other relevant transportation systems and data sources.
- **Quantifiable Measure:** The ability to exchange data through standard interfaces will be evaluated.
- **Verification Strategy:** Interoperability testing will be conducted to ensure successful data exchange with at least three external systems crucial for app functionality (e.g., public transport authority APIs, real-time data feeds).

Chapter 3

System Architecture and Design

3.1 System Overview

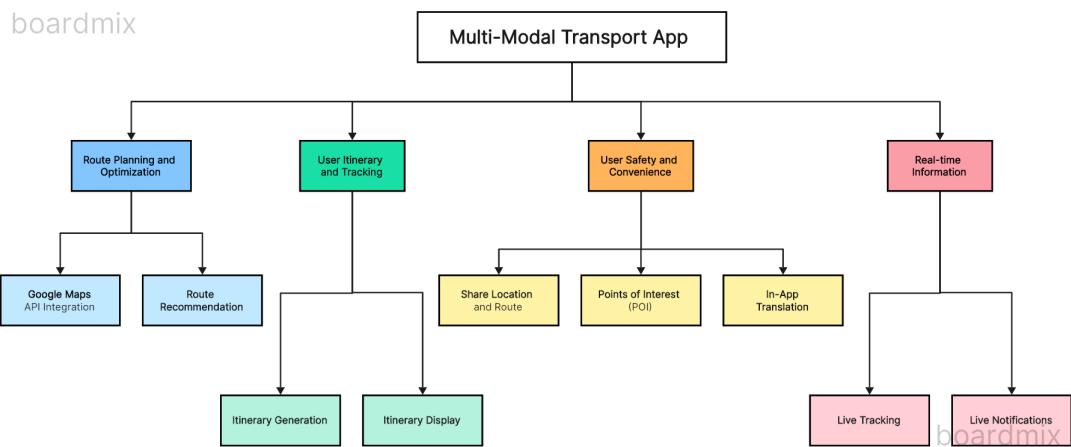


Figure 3.1: Architecture Diagram

- **User Input and Validation:**

- Users enter origin and destination addresses, with optional auto-completion using location services.
- System validates entered addresses, ensuring accuracy and completeness.

- **Preferred Travel Mode Selection:**

- Users can choose "All" or specific modes like metro, water transport, or buses.
- System filters route options based on the selected mode(s).

- **Route Optimization Preferences:**

- Users select route optimization preferences: "Fastest," "Eco-friendly," or "Scenic."

- System prioritizes routes based on chosen preference.

- **Route Retrieval and Display:**

- System retrieves route options and displays them on a map.
- Each option highlights different transport modes used in the journey.

- **Initiation of Navigation:**

- Users select a route and initiate real-time journey tracking.
- System continuously updates user location using GPS or other services.

- **Real-Time Progress Information:**

- System integrates with real-time data feeds for upcoming stops and arrival times.
- Users view current location, upcoming stops, and estimated arrival times on a map.

- **Sharing Live Location and Route:**

- Users share live location and route with designated emergency contacts.
- System securely transmits this information to selected contacts.

- **Points of Interest (POIs) Information:**

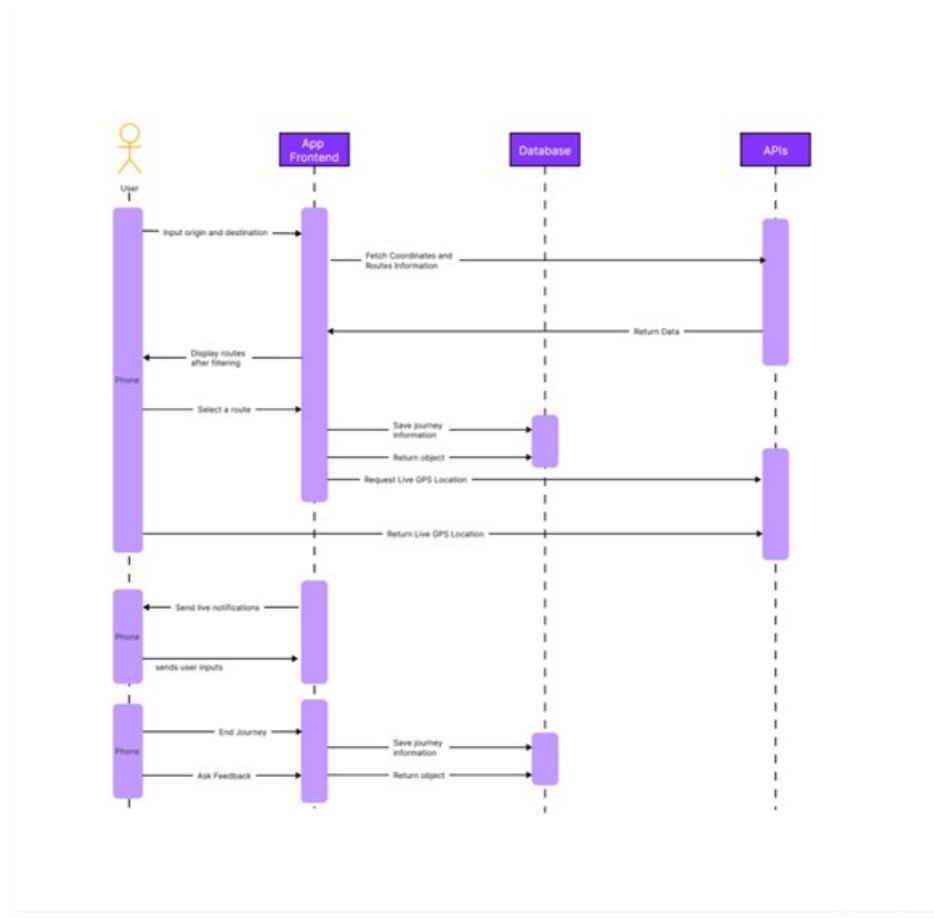
- System detects nearby POIs based on user location and route data.
- Relevant information on POIs, like name and distance, is displayed.

- **In-App Malayalam Translation:**

- Users encounter Malayalam text, translated to English using an in-app translation service.
- System utilizes a translation API for seamless communication and understanding.

3.2 Architectural Design

boardmix



boardmix

Figure 3.2: Sequence Diagram

3.3 Dataset identified

Our project does not involve Language learning models (LLM) or machine learning techniques, rendering a dataset unnecessary. Instead, we prioritize developing a practical Multimodal Transport Application aimed at enhancing urban mobility efficiently.”

3.4 Proposed Methodology/Algorithms

Algorithm: Multimodal Transport App Process

1. Route Optimization Algorithm:

- (a) Utilize proprietary algorithm to determine the most efficient path between specified start and end points.

2. User Input and Location Selection:

- (a) User inputs start and end locations within the app.

3. Bus Transit Option Generation:

- (a) Utilize Google Maps API to generate a selection of bus transit options for the journey.
- (b) Options can be filtered based on parameters such as overall distance, time duration, and fare considerations.

4. Metro Transit Option Generation:

- (a) If the user opts for metro transit:
 - i. Utilize Geocode API to ascertain the user's current location.
 - ii. Identify the nearest metro station relative to both origin and destination points.
 - iii. Present user with various transportation modes available from current location to nearest metro station, similar to bus routes.
 - iv. Utilize Uber API to retrieve fare estimates for the selected mode of transportation from the current location to the nearest metro station.
- (b) Repeat the process for the journey from the nearest metro station to the specified destination.

5. Presentation of Options:

- (a) Display generated transit options to the user, including bus and metro.

- (b) Provide details such as distance, time duration, and fare estimates for each option.

6. Selection and Confirmation:

- (a) User selects preferred transit mode based on presented options.

7. Initiation of Navigation:

- (a) Upon user selection, initiate real-time journey tracking based on the chosen route.

8. Continuous User Location Updates:

- (a) Utilize GPS or other location services to continuously track the user's progress throughout the journey.

9. Real-time Information Retrieval:

- (a) Integrate with real-time data feeds from public transport authorities to obtain information on upcoming stops and estimated arrival times.

10. Display of Real-time Progress Information:

- (a) Display the user's current location on a map relative to the chosen route.
- (b) Highlight upcoming stops on the route.
- (c) Display estimated arrival time for the upcoming stop to provide real-time progress information to the user.

11. Sharing Live Location and Route:

- (a) Users share live location and route with designated emergency contacts.
- (b) System securely transmits this information to selected contacts.

12. Points of Interest (POIs) Information:

- (a) System detects nearby POIs based on user location and route data.
- (b) Display relevant information on POIs, such as name and distance, to the user.

13. In-App Malayalam Translation:

- (a) Users encounter Malayalam text, translated to English using an in-app translation service.
- (b) System utilizes a translation API for seamless communication and understanding.

3.5 User Interface Design

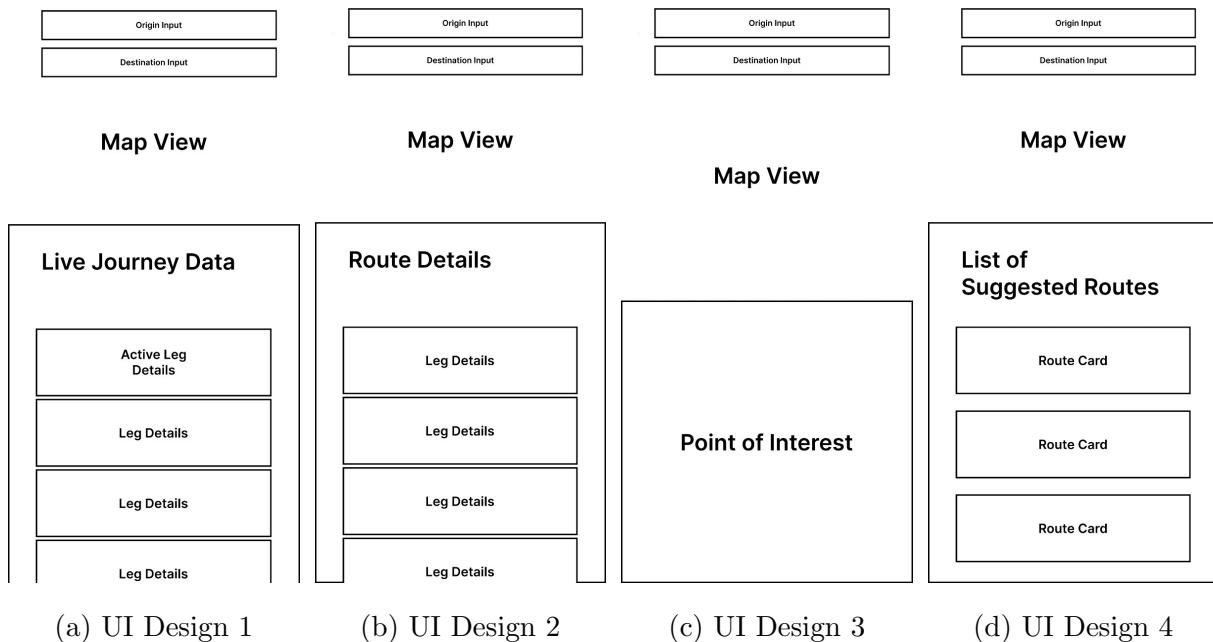


Figure 3.3: User Interface Designs

3.6 Database Design

MongoDB's document-oriented architecture aligns well with the dynamic and varied data structures inherent in a multi-modal transport system, offering flexibility and scalability crucial for handling diverse data types such as user profiles, transport schedules, and route information. Its support for geo-spatial queries also enhances location-based functionalities, facilitating efficient route planning and tracking. Additionally, MongoDB's robust performance and horizontal scalability cater to the app's anticipated growth, en-

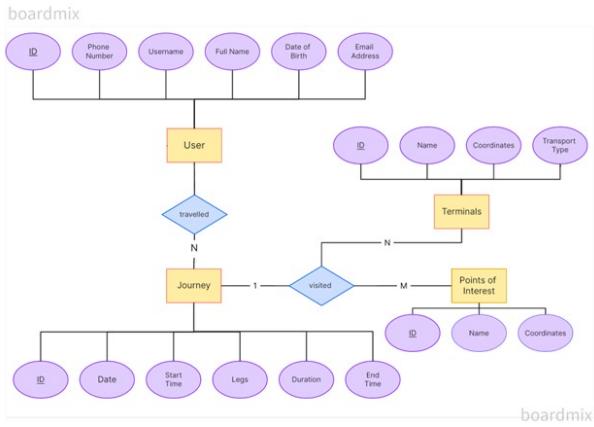


Figure 3.4: ER Diagram

suring seamless operations even as the user base expands. Therefore, MongoDB emerges as the optimal choice for our application, providing the necessary features to support its functionality and scalability requirements effectively.

3.7 Description of Implementation Strategies

In this implementation, we utilize React Native to develop a mobile application for route planning and navigation. We leverage various libraries and APIs to achieve functionality such as geocoding, fetching route details, and displaying them to the user. For geocoding, we utilize the Google Maps Geocoding API to convert user-inputted addresses into latitude and longitude coordinates. This is achieved using Axios for making HTTP requests to the API endpoints. Subsequently, we utilize the Google Maps Directions API to fetch route details between the origin and destination coordinates, including distance, duration, and step-by-step directions. The obtained route details are then displayed to the user interface, allowing for easy visualization of the suggested routes.

Google Maps Geocoding API:

This API is used to convert user-inputted addresses into latitude and longitude coordinates, which are essential for obtaining route details.

Google Maps Directions API:

This API is used to fetch route details between the origin and destination coordinates, including distance, duration, and step-by-step directions.

3.8 Module Division

Route Optimization and Preferences

Upon selecting a route, the system tracks the journey in real-time using GPS, continuously updating the user's location for accurate navigation. By integrating with public transport authorities' real-time data, the system provides up-to-date information on upcoming stops and estimated arrival times along the route. This information is displayed on a map interface, highlighting the user's current location and presenting the next scheduled stop and estimated arrival times, enhancing the overall journey experience with seamless navigation and informed travel. To be executed by Fabin Chandi.

Real Time Tracking

The system provides real-time information to users as they navigate their chosen route. This begins with the initiation of real-time journey tracking upon route selection, utilizing GPS or other location services to continuously update the user's progress. By integrating with public transport authorities' real-time data feeds, the system retrieves information on upcoming stops and estimated arrival times for public transport services. This information is then displayed to the user through a map interface, showing their current location relative to the route, highlighting the upcoming stop, and presenting the estimated arrival time. Through these features, the system ensures users are informed and their journey is facilitated with up-to-date information. To be executed by Elviin Eldho.

User Safety and Convenience

User safety and convenience are prioritized in our system. When users choose to share their live location, they can select emergency contacts, and the system securely transmits their location and route information. The system also automatically updates the user's

location along the route and detects nearby Points of Interest (POIs), providing relevant details. Additionally, it translates Malayalam text to English, enhancing accessibility for users. Through these features, our system ensures a safe and convenient travel experience. To be executed by. To be executed by Kuruvilla Jacob.

User Itinerary and Tracking

The system provides users with a comprehensive itinerary for their selected route, detailing each leg of the journey, including transfer information and estimated travel times. It calculates the total fare cost, factoring in potential transfer fees, and allows users to access and review their itinerary at any stage of their journey, ensuring convenience and control. To be executed by Gayathri Bijoy.

3.9 Work Schedule - Gantt Chart



Figure 3.5: Gantt Chart

Chapter 4

Results and Discussions

4.1 Overview

The Multi-Modal Transport Application has successfully transformed urban mobility by introducing a user-friendly platform that effortlessly integrates diverse transportation modes. Through real-time route suggestions, live location sharing, access to points of interest, and in-app translation services, the project has empowered commuters with the resources necessary to enhance their travel experiences, boost efficiency, and actively support sustainable urban mobility solutions.

4.2 Testing

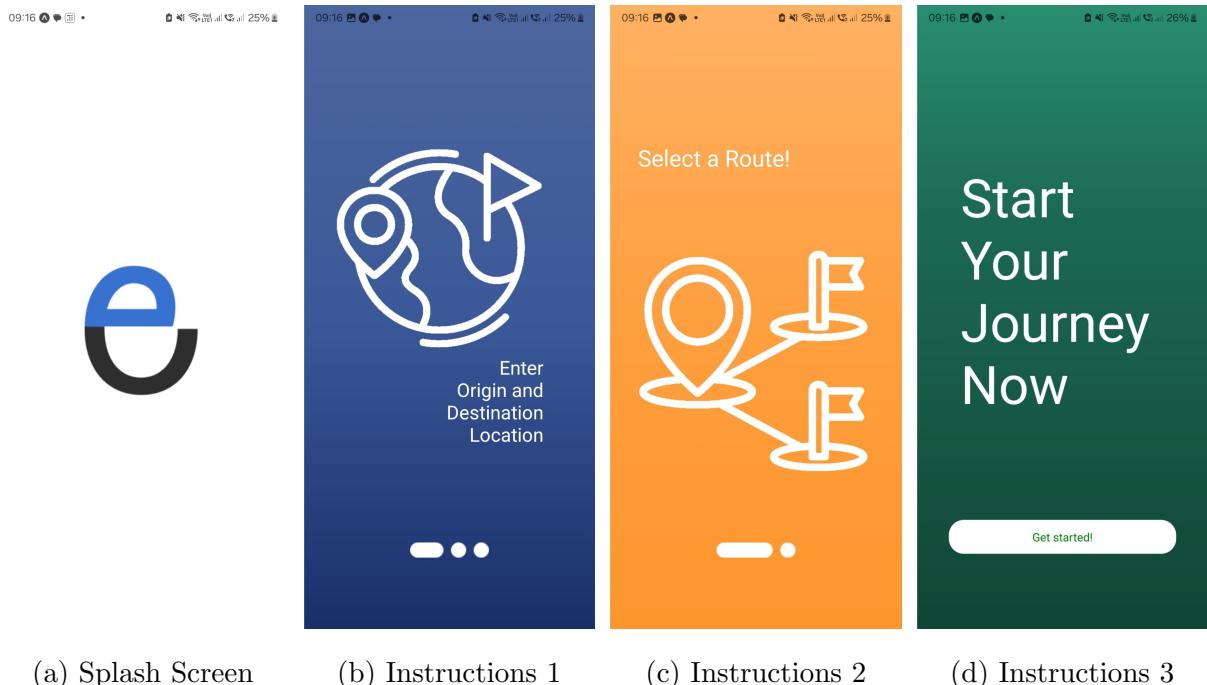
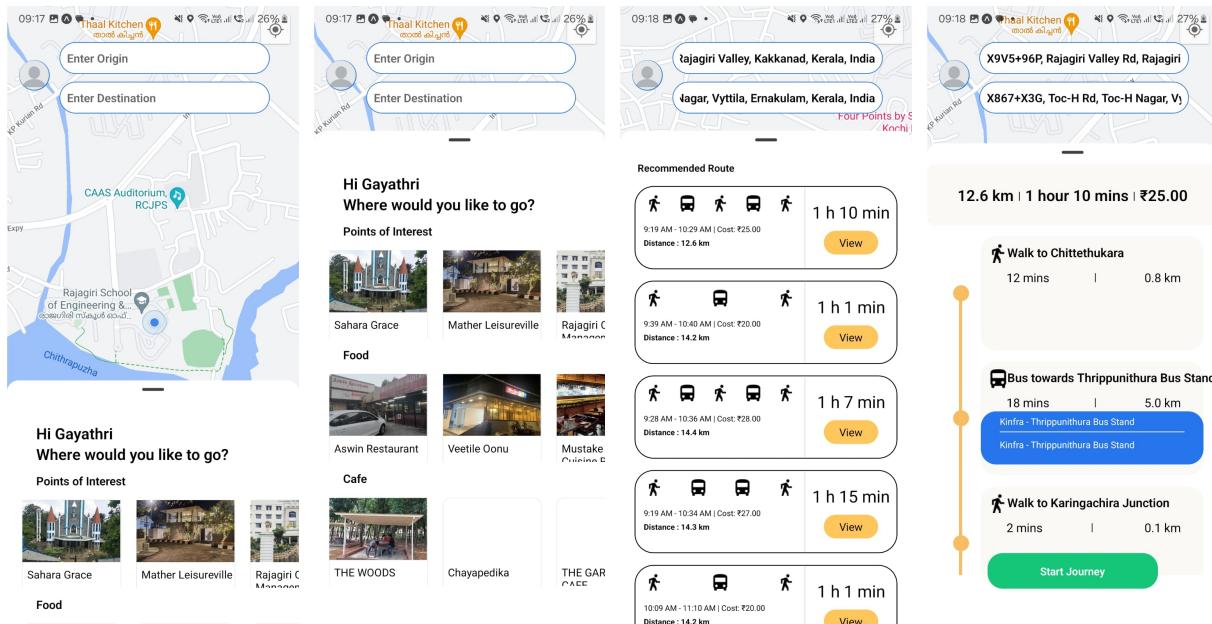


Figure 4.1: User Interface Designs

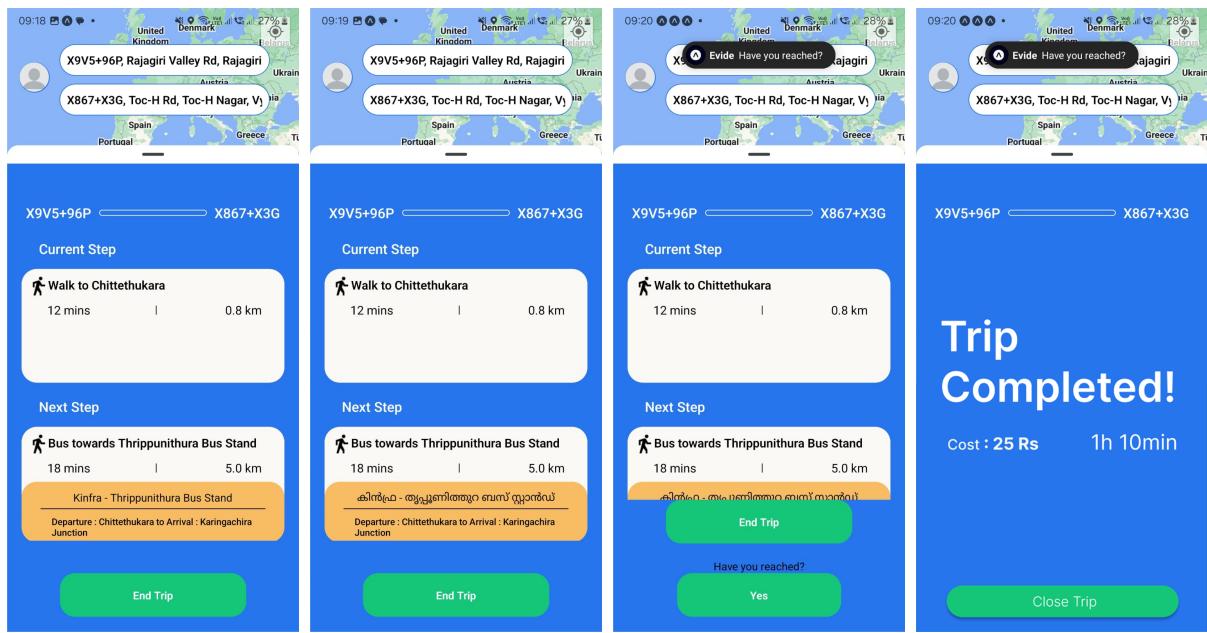


(a) Landing Page

(b) Explore Modal

(c) Route Suggestions

(d) Route Details



(a) Live Tracking 1

(b) Live Tracking 2

(c) Live Tracking 3

(d) Live Tracking 4

4.3 Graphical Analysis

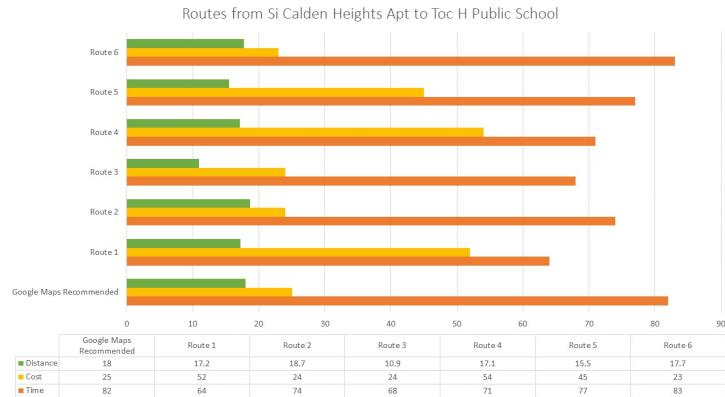


Figure 4.4: Performance graph illustrating quantitative results.

4.4 Discussion

In summary, the Multi-Modal Transport Application has yielded significant results in revolutionizing urban mobility. Through its user-friendly platform, seamless integration of various transportation modes, real-time route options, live location sharing, points of interest information, and in-app translation services, the project has successfully empowered commuters to optimize their travel experiences. The application has notably enhanced efficiency and contributed to sustainable urban mobility solutions by providing users with the tools and information needed to make informed travel choices. The positive reception and adoption rates signify the project's effectiveness in meeting the needs of modern commuters and addressing challenges in urban transportation. The deviation of results, if any, could be attributed to external factors such as infrastructure limitations or user behavior variations across different regions. However, continual updates and improvements based on user feedback ensure the application remains responsive to evolving needs and challenges in urban mobility.

Chapter 5

Conclusion

5.1 Conclusion

In conclusion, the Multi-Modal Transport Application marks a significant milestone in the realm of urban mobility. Throughout its development and implementation, the project has demonstrated its capacity to transform the way commuters navigate and engage with transportation options within cities. By providing a comprehensive suite of features including real-time route planning, live location sharing, points of interest information, and in-app translation services, the application has effectively empowered users to make informed decisions, optimize their travel experiences, and contribute to sustainable urban mobility solutions. As the project concludes, it leaves a lasting legacy of innovation and accessibility in urban transportation, paving the way for further advancements in enhancing the efficiency, convenience, and environmental sustainability of city travel. Moving forward, the lessons learned and successes achieved through this endeavor will continue to inform future initiatives aimed at addressing the evolving needs and challenges of urban mobility on a global scale.

5.2 Future Scope

Looking ahead, the Multi-Modal Transport Application holds immense potential for future enhancements and extensions. One avenue for expansion could involve integrating emerging technologies such as artificial intelligence and machine learning to further personalize and optimize route recommendations based on user preferences and real-time data. Additionally, partnerships with local authorities and transportation providers could facilitate the incorporation of additional modes of transportation, such as micro-mobility options like e-scooters and bike-sharing services, into the application's ecosystem. Moreover, leveraging geospatial data analytics could enable the development of predictive mod-

els to anticipate traffic patterns and optimize route planning even further. Furthermore, continuous refinement of the user interface and accessibility features could ensure the application remains inclusive and user-friendly for all commuters, including those with diverse mobility needs.

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Appendix A: Presentation



Multi Modal Transport App

FINAL PRESENTATION

Dr Sminu Izudheen

Elviin Thomas Eldho
Kuruvilla Jacob
Fabin Chandi
Gayathri Bijoy

14/05/24

Multi Modal Transport App

1



Contents

- Introduction
- Problem Definition
- Objectives
- Scope and Relevance
- System Design
- Work Division - Gantt Chart
- Software/Hardware Requirements
- Results
- Conclusion
- Future Enhancements
- References

14/05/24

Multi Modal Transport App

2



Introduction

- Lack of seamless travel due to fragmented transportation
- Cumbersome trip planning in Kochi
- Absence of a unified transport app
- Tourists struggle to explore Kochi's public transport options

14/05/24

Multi Modal Transport App

3



Problem Definition

- The project entails creating the Multimodal Transport App for Optimal Travel in Kochi, revolutionizing commuting by seamlessly integrating various modes of transportation for efficient journey planning and execution.

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Multi Modal Transport App

4



Objectives

1. Seamless Trip Planning

- Make entering destinations, selecting travel modes, and finding optimal routes a smooth and intuitive experience

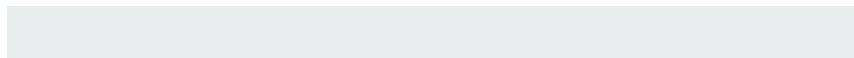
2. Real-Time Journey Navigation

- Guide users through their journey with real-time location tracking, upcoming stop information, and estimated arrival times.

14/05/24

Multi Modal Transport App

5



Objectives

3. Optimized Route Selection

- Prioritize routes based on user preferences (fastest, eco-friendly, scenic) and provide clear visual representations with travel time estimates

4. User-Friendly Interface with Multilingual Support

- Deliver a clear and user-friendly interface with comprehensive itinerary details, fare cost calculations, and Malayalam-English translation options for enhanced accessibility

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Scope and Relevance

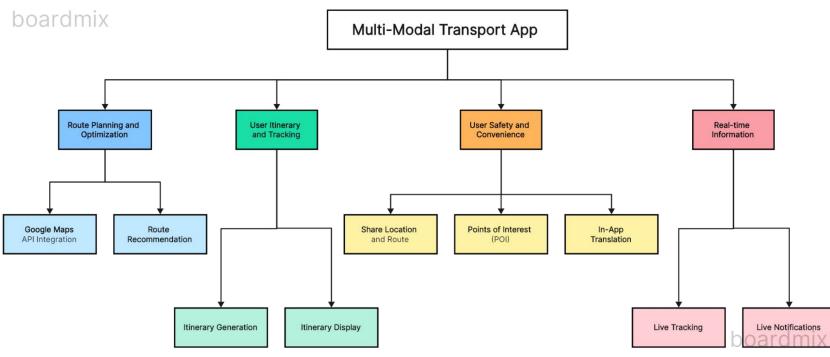
1. **Tailored Transportation Solutions:** The Multimodal Transport app is customized to meet the needs of commuters, students, and tourists in Kochi, Kerala, providing a user-friendly interface for planning and executing journeys across multiple transportation modes such as metro, bus, and ferries.
2. **Enhanced Commuting Experience:** Through route optimization, efficiency enhancements, and real-time information updates, the app greatly enhances the commuting experience for daily travelers, making their journeys smoother and more efficient.
3. **Convenience for Students and Tourists:** Students benefit from convenient travel options facilitated by the app, while tourists find enhanced exploration opportunities in Kochi, leading to a seamless and enjoyable transportation experience for all users.

7

System Design

8

Architectural Design



9

Modules

1. Route planning and optimization

- The user inputs **origin** and **destination addresses**, optionally aided by location services for autocomplete and validation.
- Users select their preferred **travel mode**, either multimodal or specific modes like metro, water, or bus.
- The system filters route options based on the selected mode(s) and **optimization preference**.
- Retrieved routes are visually presented on a map, highlighting transport modes and providing **estimated travel times**.

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Modules

2. Real-Time Information

- The system utilizes GPS or similar location services to **continuously track** the user's location along the chosen route.
- The system retrieves **real-time information** on upcoming stops and estimated arrival times.
- **User's current location** is displayed on a map, along with the chosen route.
- The next scheduled stop is highlighted, and **estimated arrival times** are provided for user convenience.

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Modules

3. User Safety and Convenience

- User selects "**Share Live Location**" and chooses emergency contacts. System prompts confirmation and securely **shares user's location** and route info to selected contacts.
- User's location progresses automatically along the route. System detects nearby **POIs** and displays relevant information (name, category, distance).
- System utilizes translation API to convert **Malayalam text to English** and displays it within the app.

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Modules

4. User Itinerary and Tracking

- The system generates a **thorough itinerary** for the chosen route, covering details like each leg of the journey with corresponding transport modes, transfer information between different modes, and estimated travel time for each leg.
- It calculates and shows the **total fare cost** for the entire journey, factoring in potential transfer fees.
- Users have the capability to access and **review their itinerary** at any stage during their journey.

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Algorithm

1. User Input and Location Selection:

- 1.1. User inputs start and end locations within the app.

2. Bus Transit Option Generation:

- 2.1. Utilize Google Maps API to generate a selection of bus transit options for the journey.

2.2. Options can be filtered based on parameters such as overall distance, time duration, and fare considerations.

3. Metro Transit Option Generation:

- 3.1. If user opts for metro transit:

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Algorithm

- 3.1.1. Utilize Geocode API to ascertain user's current location.
 - 3.1.2. Identify nearest metro station relative to both origin and destination points.
 - 3.1.3. Present user with various transportation modes available from current location to nearest metro station, similar to bus routes.
 - 3.1.4. Utilize Uber API to retrieve fare estimate for selected mode of transportation from current location to nearest metro station.
 - 3.1.5. Repeat process for journey from nearest metro station to specified destination.
4. Presentation of Options:
- 4.1. Display generated transit options to the user, including bus and metro.
 - 4.2. Provide details such as distance, time duration, and fare estimates for each option.
5. User Selection and Confirmation:

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Algorithm

- 5.1. User selects preferred transit mode based on presented options.
6. Initiation of Navigation:
- 6.1. Upon user selection, initiate real-time journey tracking based on the chosen route.
7. Continuous User Location Updates:
- 7.1. Utilize GPS or other location services to continuously track user's progress throughout the journey.
8. Real-time Information Retrieval:
- 8.1. Integrate with real-time data feeds from public transport authorities to obtain information on upcoming stops and estimated arrival times.
9. Display of Real-time Progress Information:
- 9.1. Display user's current location on a map relative to the chosen route.
 - 9.2. Highlight upcoming stop on the route.

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Algorithm

9.3. Display estimated arrival time for the upcoming stop to provide real-time progress information to the user.

10. Sharing Live Location and Route:

10.1. Users share live location and route with designated emergency contacts.

10.2. System securely transmits this information to selected contacts.

11. Points of Interest (POIs) Information:

11.1. System detects nearby POIs based on user location and route data.

11.2. Display relevant information on POIs, such as name and distance, to the user.

12. In-App Malayalam Translation:

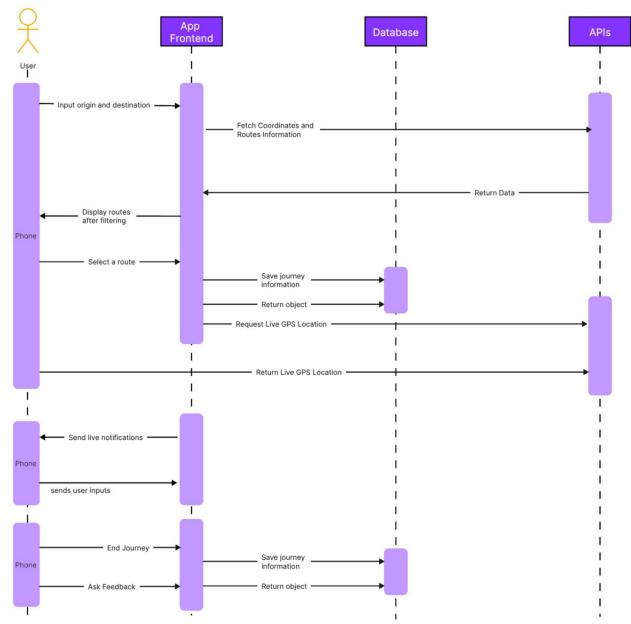
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12.2. System utilizes a translation API for seamless communication and understanding.

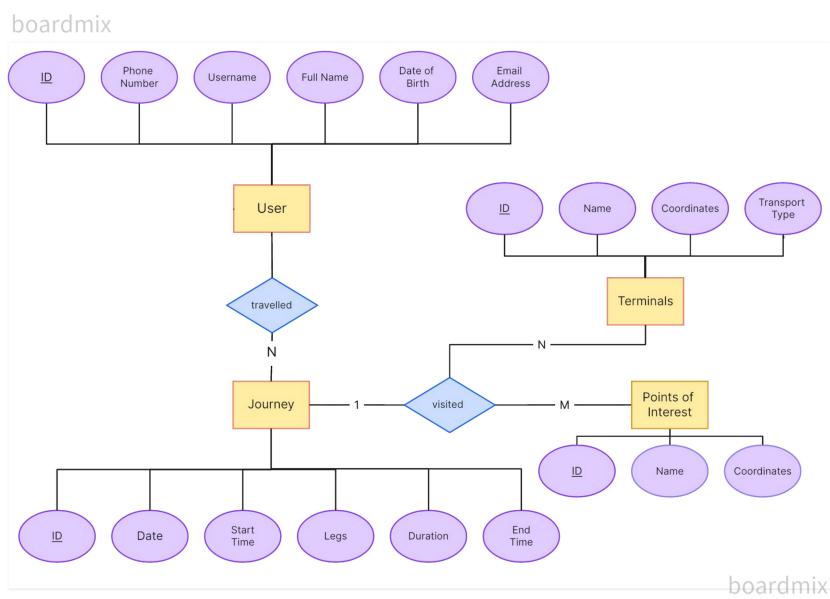
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Design Models

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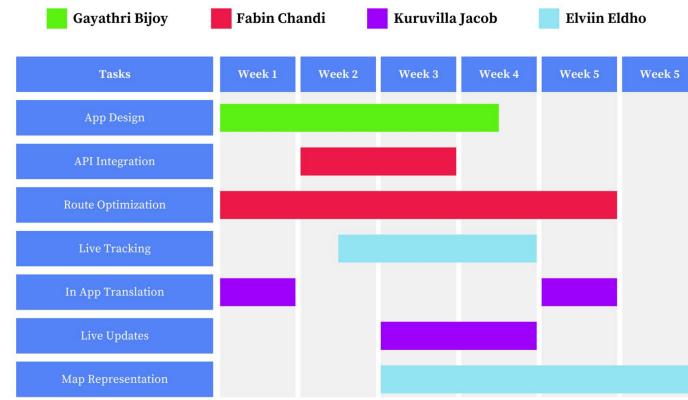


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Multi Modal Transport App

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Work Division



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Multi Modal Transport App

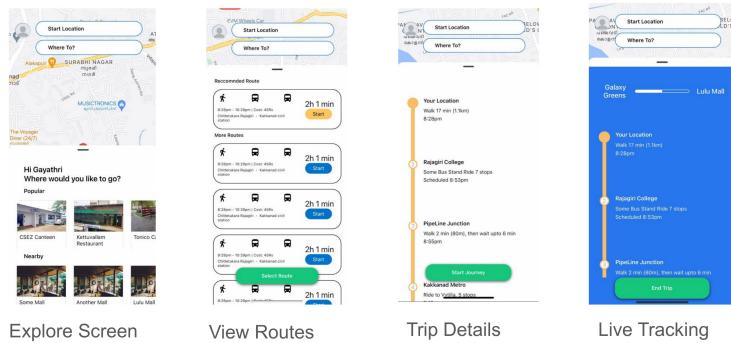
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Software / Hardware Requirements

- Software
 - Javascript
 - React Native (Android & iOS Development)
 - Google Maps API, Uber API
 - In-app translation API (Google Translate API)
 - NodeJS, Express
 - MongoDB Database
- Hardware
 - Android Smartphones / iPhones

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Results



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Conclusion

The product is the Multimodal Transport App for Optimal Travel in Kochi, revolutionizing commuting by seamlessly integrating various modes of transportation.

- User-friendly platform for planning & navigating trips (metro, bus, ferry).
- Optimizes routes, improves efficiency, and provides real-time information.
- Enhances commutes for residents, facilitates travel for students, and empowers tourist exploration.

Future enhancements

- **Diverse Transit Options:** Adding autos and ferries to our app's transportation modes alongside buses, metro, and water metro, offering users more travel choices and flexibility.
- **Nationwide Accessibility:** Expanding our app's reach beyond regions with centralized transport systems like Kerala, ensuring convenient travel for users across the country, even in areas with fragmented transportation networks.
- **Data-Driven Predictions:** Utilizing user-generated data to develop predictive models for arrival times, travel durations, estimated fares, and other travel details within our app, ensuring accurate and reliable information for users without dependency on external sources like Google Maps.

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Appendix B: Vision, Mission, Programme Outcomes and Course Outcomes

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
RAJAGIRI SCHOOL OF ENGINEERING & TECHNOLOGY (AUTONOMOUS)
RAJAGIRI VALLEY, KAKKANAD, KOCHI, 682039
(Affiliated to APJ Abdul Kalam Technological University)



RSET
RAJAGIRI SCHOOL OF
ENGINEERING & TECHNOLOGY
(AUTONOMOUS)

Vision, Mission, Programme Outcomes and Course Outcomes

Institute Vision

To evolve into a premier technological institution, molding eminent professionals with creative minds, innovative ideas, and sound practical skills, and to shape a future where technology works for the enrichment of mankind.

Institute Mission

To impart state-of-the-art knowledge to individuals in various technological disciplines and to inculcate in them a high degree of social consciousness and human values, thereby enabling them to face the challenges of life with courage and conviction.

Department Vision

To become a center of excellence in Computer Science and Engineering, molding professionals catering to the research and professional needs of national and international organizations.

Department Mission

To inspire and nurture students, with up-to-date knowledge in Computer Science and Engineering, ethics, team spirit, leadership abilities, innovation, and creativity to come out with solutions meeting societal needs.

Programme Outcomes (PO)

Engineering Graduates will be able to:

- 1. Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- 2. Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using the first principles of mathematics, natural sciences, and engineering sciences.
- 3. Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.
- 4. Conduct investigations of complex problems:** Use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- 5. Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- 6. The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- 7. Environment and sustainability:** Understand the impact of professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- 8. Ethics:** Apply ethical principles and commit to professional ethics and responsi-

bilities and norms of the engineering practice.

9. Individual and Team work: Function effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings.

10. Communication: Communicate effectively with the engineering community and with society at large. Be able to comprehend and write effective reports and documentation. Make effective presentations, and give and receive clear instructions.

11. Project management and finance: Demonstrate knowledge and understanding of engineering and management principles and apply these to one's work, as a member and leader in a team. Manage projects in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

Programme Specific Outcomes (PSO)

A graduate of the Computer Science and Engineering Program will demonstrate:

PSO1: Computer Science Specific Skills

The ability to identify, analyze, and design solutions for complex engineering problems in multidisciplinary areas by understanding the core principles and concepts of computer science and thereby engage in national grand challenges.

PSO2: Programming and Software Development Skills

The ability to acquire programming efficiency by designing algorithms and applying standard practices in software project development to deliver quality software products meeting the demands of the industry.

PSO3: Professional Skills

The ability to apply the fundamentals of computer science in competitive research and to develop innovative products to meet societal needs thereby evolving as an eminent researcher and entrepreneur.

Appendix C: CO-PO-PSO Mapping

COURSE OUTCOMES:

After completion of the course the student will be able to

SL. NO	DESCRIPTION	Blooms' Taxonomy Level
CO1	Identify technically and economically feasible problems (Cognitive Knowledge Level: Apply)	Level 3: Apply
CO2	Identify and survey the relevant literature for getting exposed to related solutions and get familiarized with software development processes (Cognitive Knowledge Level: Apply)	Level 3: Apply
CO3	Perform requirement analysis, identify design methodologies and develop adaptable & reusable solutions of minimal complexity by using modern tools & advanced programming techniques (Cognitive Knowledge Level: Apply)	Level 3: Apply
CO4	Prepare technical report and deliver presentation (Cognitive Knowledge Level: Apply)	Level 3: Apply
CO5	Apply engineering and management principles to achieve the goal of the project (Cognitive Knowledge Level: Apply)	Level 3: Apply

CO-PO AND CO-PSO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS O3
C O1	3	3	3	3		2	2	3	2	2	2	3	2	2	2
C O2	3	3	3	3	3	2		3	2	3	2	3	2	2	2
C O3	3	3	3	3	3	2	2	3	2	2	2	3			2
C O4	2	3	2	2	2			3	3	3	2	3	2	2	2
C O5	3	3	3	2	2	2	2	3	2		2	3	2	2	2

3/2/1: high/medium/low

JUSTIFICATIONS FOR CO-PO MAPPING

MAPPING	LOW/ MEDIUM/ HIGH	JUSTIFICATION
101003/CS6 22T.1-PO1	HIGH	Identify technically and economically feasible problems by applying the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
101003/CS6 22T.1-PO2	HIGH	Identify technically and economically feasible problems by analysing complex engineering problems reaching substantiated conclusions using first principles of mathematics.
101003/CS6 22T.1-PO3	HIGH	Design solutions for complex engineering problems by identifying technically and economically feasible problems.
101003/CS6 22T.1-PO4	HIGH	Identify technically and economically feasible problems by analysis and interpretation of data.
101003/CS6 22T.1-PO6	MEDIUM	Responsibilities relevant to the professional engineering practice by identifying the problem.
101003/CS6 22T.1-PO7	MEDIUM	Identify technically and economically feasible problems by understanding the impact of the professional engineering solutions.
101003/CS6 22T.1-PO8	HIGH	Apply ethical principles and commit to professional ethics to identify technically and economically feasible problems.
101003/CS6 22T.1-PO9	MEDIUM	Identify technically and economically feasible problems by working as a team.
101003/CS6 22T.1-PO10	MEDIUM	Communicate effectively with the engineering community by identifying technically and economically feasible problems.
101003/CS6 22T.1-P011	MEDIUM	Demonstrate knowledge and understanding of engineering and management principles by selecting the technically and economically feasible problems.
101003/CS6 22T.1-PO12	HIGH	Identify technically and economically feasible problems for long term learning.
101003/CS6 22T.1-PSO1	MEDIUM	Ability to identify, analyze and design solutions to identify technically and economically feasible problems.
101003/CS6 22T.1-PSO2	MEDIUM	By designing algorithms and applying standard practices in software project development and Identifying technically and economically feasible problems.
101003/CS6 22T.1-PSO3	MEDIUM	Fundamentals of computer science in competitive research can be applied to Identify technically and economically feasible problems.
101003/CS6 22T.2-PO1	HIGH	Identify and survey the relevant by applying the knowledge of mathematics, science, engineering fundamentals.

101003/CS6 22T.2-PO2	HIGH	Identify, formulate, review research literature, and analyze complex engineering problems get familiarized with software development processes.
101003/CS6 22T.2-PO3	HIGH	Design solutions for complex engineering problems and design based on the relevant literature.
101003/CS6 22T.2-PO4	HIGH	Use research-based knowledge including design of experiments based on relevant literature.
101003/CS6 22T.2-PO5	HIGH	Identify and survey the relevant literature for getting exposed to related solutions and get familiarized with software development processes by using modern tools.
101003/CS6 22T.2-PO6	MEDIUM	Create, select, and apply appropriate techniques, resources, by identifying and surveying the relevant literature.
101003/CS6 22T.2-PO8	HIGH	Apply ethical principles and commit to professional ethics based on the relevant literature.
101003/CS6 22T.2-PO9	MEDIUM	Identify and survey the relevant literature as a team.
101003/CS6 22T.2-PO10	HIGH	Identify and survey the relevant literature for a good communication to the engineering fraternity.
101003/CS6 22T.2-PO11	MEDIUM	Identify and survey the relevant literature to demonstrate knowledge and understanding of engineering and management principles.
101003/CS6 22T.2-PO12	HIGH	Identify and survey the relevant literature for independent and lifelong learning.
101003/CS6 22T.2-PSO1	MEDIUM	Design solutions for complex engineering problems by Identifying and survey the relevant literature.
101003/CS6 22T.2-PSO2	MEDIUM	Identify and survey the relevant literature for acquiring programming efficiency by designing algorithms and applying standard practices.
101003/CS6 22T.2-PSO3	MEDIUM	Identify and survey the relevant literature to apply the fundamentals of computer science in competitive research.
101003/CS6 22T.3-PO1	HIGH	Perform requirement analysis, identify design methodologies by using modern tools & advanced programming techniques and by applying the knowledge of mathematics, science, engineering fundamentals.
101003/CS6 22T.3-PO2	HIGH	Identify, formulate, review research literature for requirement analysis, identify design methodologies and develop adaptable & reusable solutions.

101003/CS6 22T.3-PO3	HIGH	Design solutions for complex engineering problems and perform requirement analysis, identify design methodologies.
101003/CS6 22T.3-PO4	HIGH	Use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
101003/CS6 22T.3-PO5	HIGH	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools.
101003/CS6 22T.3-PO6	MEDIUM	Perform requirement analysis, identify design methodologies and assess societal, health, safety, legal, and cultural issues.
101003/CS6 22T.3-PO7	MEDIUM	Understand the impact of the professional engineering solutions in societal and environmental contexts and Perform requirement analysis, identify design methodologies and develop adaptable & reusable solutions.
101003/CS6 22T.3-PO8	HIGH	Perform requirement analysis, identify design methodologies and develop adaptable & reusable solutions by applying ethical principles and commit to professional ethics.
101003/CS6 22T.3-PO9	MEDIUM	Function effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings.
101003/CS6 22T.3-PO10	MEDIUM	Communicate effectively with the engineering community and with society at large to perform requirement analysis, identify design methodologies.
101003/CS6 22T.3-PO11	MEDIUM	Demonstrate knowledge and understanding of engineering requirement analysis by identifying design methodologies.
101003/CS6 22T.3-PO12	HIGH	Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change by analysis, identify design methodologies and develop adaptable & reusable solutions.
101003/CS6 22T.3-PSO3	MEDIUM	The ability to apply the fundamentals of computer science in competitive research and prior to that perform requirement analysis, identify design methodologies.
101003/CS6 22T.4-PO1	MEDIUM	Prepare technical report and deliver presentation by applying the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
101003/CS6 22T.4-PO2	HIGH	Identify, formulate, review research literature, and analyze complex engineering problems by preparing technical report and deliver presentation.

101003/CS6 22T.4-PO3	MEDIUM	Prepare Design solutions for complex engineering problems and create technical report and deliver presentation.
101003/CS6 22T.4-PO4	MEDIUM	Use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions and prepare technical report and deliver presentation.
101003/CS6 22T.4-PO5	MEDIUM	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools and Prepare technical report and deliver presentation.
101003/CS6 22T.4-PO8	HIGH	Prepare technical report and deliver presentation by applying ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
101003/CS6 22T.4-PO9	HIGH	Prepare technical report and deliver presentation effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings.
101003/CS6 22T.4-PO10	HIGH	Communicate effectively with the engineering community and with society at large by prepare technical report and deliver presentation.
101003/CS6 22T.4-PO11	MEDIUM	Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work by prepare technical report and deliver presentation.
101003/CS6 22T.4-PO12	HIGH	Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change by prepare technical report and deliver presentation.
101003/CS6 22T.4-PSO1	MEDIUM	Prepare a technical report and deliver presentation to identify, analyze and design solutions for complex engineering problems in multidisciplinary areas.
101003/CS6 22T.4-PSO2	MEDIUM	To acquire programming efficiency by designing algorithms and applying standard practices in software project development and to prepare technical report and deliver presentation.
101003/CS6 22T.4-PSO3	MEDIUM	To apply the fundamentals of computer science in competitive research and to develop innovative products to meet the societal needs by preparing technical report and deliver presentation.
101003/CS6 22T.5-PO1	HIGH	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
101003/CS6 22T.5-PO2	HIGH	Identify, formulate, review research literature, and analyze complex engineering problems by applying engineering and management principles to achieve the goal of the project.

101003/CS6 22T.5-PO3	HIGH	Apply engineering and management principles to achieve the goal of the project and to design solutions for complex engineering problems and design system components or processes that meet the specified needs.
101003/CS6 22T.5-PO4	MEDIUM	Apply engineering and management principles to achieve the goal of the project and use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
101003/CS6 22T.5-PO5	MEDIUM	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools and to apply engineering and management principles to achieve the goal of the project.
101003/CS6 22T.5-PO6	MEDIUM	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities by applying engineering and management principles to achieve the goal of the project.
101003/CS6 22T.5-PO7	MEDIUM	Understand the impact of the professional engineering solutions in societal and environmental contexts, and apply engineering and management principles to achieve the goal of the project.
101003/CS6 22T.5-PO8	HIGH	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice and to use the engineering and management principles to achieve the goal of the project.
101003/CS6 22T.5-PO9	MEDIUM	Function effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings and to apply engineering and management principles to achieve the goal of the project.
101003/CS6 22T.5-PO11	MEDIUM	Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member and leader in a team. Manage projects in multidisciplinary environments and to apply engineering and management principles to achieve the goal of the project.
101003/CS6 22T.5-PO12	HIGH	Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change and to apply engineering and management principles to achieve the goal of the project.
101003/CS6 22T.5-PSO1	MEDIUM	The ability to identify, analyze and design solutions for complex engineering problems in multidisciplinary areas. Apply engineering and management principles to achieve the goal of the project.

101003/CS6 22T.5-PSO2	MEDIUM	The ability to acquire programming efficiency by designing algorithms and applying standard practices in software project development to deliver quality software products meeting the demands of the industry and to apply engineering and management principles to achieve the goal of the project.
101003/CS6 22T.5-PSO3	MEDIUM	The ability to apply the fundamentals of computer science in competitive research and to develop innovative products to meet the societal needs thereby evolving as an eminent researcher and entrepreneur and apply engineering and management principles to achieve the goal of the project.

