

Software Requirement Specification

for

FastTrack

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Contents

1	Introduction	4
1.1	Purpose	4
1.2	Document Conventions	4
1.3	Intended Audience and Reading Suggestions	4
1.4	Project Scope	4
1.5	References	5
2	Overall Description	5
2.1	Product Perspective	5
2.2	Product Features	5
2.3	User Classes and Characteristics	5
2.4	Operating Environment	6
2.5	Design and Implementation Constraints	6
2.6	User Documentation	6
2.7	Assumptions and Dependencies	7
3	System Features	7
3.1	Route Optimization	7
3.1.1	Description and Priority	7
3.1.2	Stimulus/Response Sequences	7
3.1.3	Functional Requirements	7
3.2	Dynamic Route Adjustment	8
3.2.1	Description and Priority	8
3.2.2	Stimulus/Response Sequences	8
3.2.3	Functional Requirements	8
3.3	Proof of Delivery and Documentation	8
3.3.1	Description and Priority	8
3.3.2	Stimulus/Response Sequences	8
3.3.3	Functional Requirements	8
3.4	Dynamic Data-Driven Delivery Insights	9
3.4.1	Description and Priority	9
3.4.2	Stimulus/Response Sequences	9
3.4.3	Functional Requirement	9
3.5	Route Export and Data Integration	9
3.5.1	Description and Priority	9
3.5.2	Stimulus/Response Sequences	9
3.5.3	Functional Requirements	9
4	External Interface Requirements	10
4.1	User Interfaces	10
4.2	Hardware Interfaces	10
4.3	Software Interfaces	10
4.4	Communications Interfaces	10
5	Other Nonfunctional Requirements	11
5.1	Performance Requirements	11
5.2	Safety Requirements	11
5.3	Security Requirements	11
5.4	Software Quality Attributes	11
6	Other Requirements	12
6.1	Database Requirements	12
6.2	Internationalization Requirements	12
6.3	Legal Requirements	12
6.4	Backup and Recovery	12

7	Appendix A: Glossary	12
8	Appendix B: Analysis Models	13
9	Appendix C: Issues List	13

1 Introduction

1.1 Purpose

This Software Requirements Specification document outlines the requirements for the FastTrack application, a platform designed to calculate and optimize delivery routes for delivery personnel efficiently. It specifies the functionalities, features, and requirements of the product. It covers aspects like location input, default location integration, route optimization algorithms, time estimation, and route visualization through an interactive map interface. The primary scope is to enhance the efficiency and reliability of delivery operations while minimizing travel time and fuel consumption. The application aims to provide an intuitive interface, seamless navigation, and support for real-time updates to improve delivery service quality and customer satisfaction.

1.2 Document Conventions

- *This document follows a standardized format, including numbered sections, bullet points, diagrams, and tables for clarity and readability.*
- *Acronyms, abbreviations, and technical terms are defined upon first usage and compiled in the glossary (Appendix A) for quick reference.*
- *All requirements are assigned unique identifiers and listed systematically to ensure easy tracking and cross-referencing throughout the document.*

1.3 Intended Audience and Reading Suggestions

This document is intended for the following readers:

- *Developers: To understand the technical requirements and system functionality.*
- *Project Managers: To track progress and ensure the requirements are implemented.*
- *Testers: To create test cases based on requirements.*
- *End Users (Delivery Personnel and Administrators): To comprehend the application's functionality and benefits.*

Reading Suggestions include

- *Overview Sections: Recommended for all readers to gain a general understanding of the application.*
- *Functional and Non-functional Requirements: Crucial for developers, testers, and project managers to ensure proper implementation and verification of the system.*
- *User Interface and Workflow Sections: Important for end users to familiarize themselves with the application's features and usage.*

1.4 Project Scope

The FastTrack application is designed to streamline delivery operations by optimizing routes for delivery personnel. Its key objectives include:

- *Efficient Route Optimization: Calculating the most efficient delivery route for multiple destinations using advanced algorithms, reducing travel time and fuel consumption.*
- *Default Location Integration: Incorporating a fixed starting point for consistent and reliable route planning.*
- *Interactive Map Visualization: Providing clear and user-friendly route displays, along with real-time navigation support.*
- *Time and Distance Estimation: Offering accurate estimates for delivery time and travel distance to enhance scheduling and customer satisfaction.*

- *Dynamic Updates: Allowing for real-time adjustments to routes in response to changes, such as additional stops or delays.*

The application aims to improve delivery efficiency, reduce operational costs, and ensure timely deliveries while enhancing the overall user experience for delivery personnel and service providers.

1.5 References

- *Route Optimization Apps to Minimize Delivery Delays with Dynamic Routes, nandbox, 2024. Retrieved from nandbox.com*
- *Route4Me API and SDK Developer Documentation, Route4Me, 2024. Retrieved from support.route4me.com*
- *How to Use Python for Route Optimization in Logistics, Data Head Hunters Academy, 2024. Retrieved from dataheadhunters.com*
- *Delivery Route Optimization in Python, AskPython, 2024. Retrieved from askpython.com*

2 Overall Description

2.1 Product Perspective

The FastTrack application is a new, self-contained product designed to address the challenges of delivery route optimization. Unlike existing manual or semi-automated systems, FastTrack leverages advanced algorithms and geolocation technology to create an intuitive, user-friendly platform for delivery personnel. This application operates independently, without requiring integration with any legacy systems, but can seamlessly integrate with popular GPS and mapping tools. It is designed to serve small and medium-sized businesses seeking efficient delivery solutions, enhancing operational efficiency and reducing delivery time. The concept stems from the need to simplify delivery operations, reduce costs, and improve the overall reliability of delivery services, particularly in dynamic environments with multiple destination points.

2.2 Product Features

The primary feature of FastTrack include:

1. *Route Optimization: Users can efficiently plan routes with up to 300 stops, utilizing real-time traffic data and delivery-specific parameters for optimized navigation.*
2. *Dynamic Route Adjustment: Users can adapt to changing conditions through real-time route adjustments, minimizing delays caused by traffic, road closures, or weather disruptions.*
3. *Proof of Delivery and Documentation: Users can securely document proof of delivery through photos, notes, and signatures, ensuring seamless record-keeping and dispute resolution.*
4. *Dynamic Data-Driven Delivery Insights: Users can access detailed delivery performance insights, including metrics like distance, time, and fuel savings, with exportable reports for analysis and improvement.*
5. *Route Export and Data Integration: The system enables seamless export of route data in CSV or Excel formats, ensuring integration with logistics and operations management systems.*

2.3 User Classes and Characteristics

- *Admin: Responsible for overseeing operations, managing user accounts, monitoring system performance, and resolving issues. Requires a moderate to high level of technical expertise and familiarity with system functionalities.*
- *Delivery Personnel: Primarily uses the product for route optimization, proof of delivery, and real-time updates. Requires basic technical expertise and familiarity with smartphone applications.*

- *Technical Expertise:* Includes developers and system administrators responsible for maintaining the application, integrating APIs, and ensuring system reliability. Requires advanced technical knowledge and troubleshooting skills.
- *Company:* Refers to stakeholders or management personnel who utilize delivery insights, performance reports, and other analytics for decision-making. Requires a high-level understanding of operational metrics but minimal technical expertise.

2.4 Operating Environment

- *Hardware Platform:*
 - Mobile devices with at least 2 GB of RAM and 16 GB of internal storage.
 - GPS enabled smartphone.
- *Operating System:*
 - Android (Version 8.0 and above).
 - iOS (Version 13.0 and above).

2.5 Design and Implementation Constraints

- *Hardware Limitations:* Requires smartphones with GPS functionality, a minimum of 2 GB RAM and stable internet connectivity.
- *Security Considerations:* Data exchanged between the app and server will be encrypted using HTTPS for secure communication.
- *Programming Standards:* The application will be developed using modern frameworks like Flutter for cross-platform compatibility.
- *Database Technology:* A cloud-based database, such as Firebase will store route details, delivery data, and user information.
- *Third-party APIs:* Integration with GPS services for route optimization and location tracking.
- *Design Standards:* Adherence to mobile app design conventions for usability and accessibility.

2.6 User Documentation

The following user documentation components will be delivered with the FastTrack application to ensure ease of use and proper understanding of its features:

- *User Manual:* A comprehensive guide in PDF format that covers installation, setup, usage, troubleshooting, and frequently asked questions.
- *Online Help:* Context-sensitive help integrated within the application, offering quick access to tooltips and feature explanations.
- *Tutorials:* Video tutorials hosted on the app, demonstrating key functionalities like route planning and navigation.
- *Quick Start Guide:* A concise, easy-to-follow document that provides a fast overview of the application's primary features and setup instructions.
- *Release Notes:* A detailed document that outlines new features, updates, and bug fixes for each version, available in PDF format.

2.7 Assumptions and Dependencies

Assumptions include:

- *Users have access to GPS-enabled smartphones with stable internet connectivity.*
- *The application will primarily operate within areas where GPS accuracy and internet speed are reliable.*
- *Delivery routes provided by third-party services are accurate and up-to-date.*

Dependencies include:

- *Stable and continuous GPS and internet services for route optimization and real-time updates.*
- *Functional smartphones meeting the specified hardware requirements.*
- *Continued availability and performance of third-party APIs for GPS and location services.*
- *Reliable cloud-based database for storing user data, route details, and delivery updates.*

3 System Features

3.1 Route Optimization

3.1.1 Description and Priority

- *Description: Curates the best route from an extensive list of destinations (up to 200 per route) and tailored vehicle types.*
- *Priority: High*
- *Benefit: 9*
- *Penalty: 1*
- *Cost: 8*
- *Risk: 3*

3.1.2 Stimulus/Response Sequences

- *Stimulus: User inputs a list of destinations.*
- *Response: The system generates the most optimized route based on distance and time, considering current traffic conditions.*

3.1.3 Functional Requirements

- *The system should be capable of handling up to 300 stops per route without additional cost.*
- *The route should be optimized using real-time traffic data, considering factors such as time, distance, and mode of delivery.*
- *The system should offer quick optimization for routes with up to 100 stops in 5 seconds.*
- *The user should be able to save and duplicate routes, adding new destinations from previous routes easily.*

3.2 Dynamic Route Adjustment

3.2.1 Description and Priority

- *Description: Allows dynamic adjustments to routes in real-time based on changing conditions (e.g., traffic, weather, etc.).*
- *Priority: High*
- *Benefit: 9*
- *Penalty: 1*
- *Cost: 7*
- *Risk: 3*

3.2.2 Stimulus/Response Sequences

- *Stimulus: Real-time data indicates a traffic jam or road closure.*
- *Response: The system automatically adjusts the route to avoid delays, presenting the updated route to the driver.*

3.2.3 Functional Requirements

- *The system must be capable of adjusting routes in real-time based on live traffic, road closures, and weather conditions.*
- *The system should ensure minimum disruption when adding or removing stops in dynamic routes.*

3.3 Proof of Delivery and Documentation

3.3.1 Description and Priority

- *Description: Captures proof of delivery via photos, notes, and signatures.*
- *Priority: Medium*
- *Benefit: 7*
- *Penalty: 2*
- *Cost: 5*
- *Risk: 3*

3.3.2 Stimulus/Response Sequences

- *Stimulus: User completes a delivery.*
- *Response: The system captures proof (photos, notes, or signatures) for documentation purposes.*

3.3.3 Functional Requirements

- *The system should allow users to capture and save photos, notes, and signatures for each stop as proof of delivery.*
- *It must provide the ability to export this proof for further documentation or dispute resolution.*
- *The system should automatically associate proof of delivery with the corresponding stop for easy access.*

3.4 Dynamic Data-Driven Delivery Insights

3.4.1 Description and Priority

- *Description: Provides detailed statistics on delivery performance, including distance, time, and fuel costs saved.*
- *Priority: Medium*
- *Benefit: 7*
- *Penalty: 4*
- *Cost: 7*
- *Risk: 2*

3.4.2 Stimulus/Response Sequences

- *Stimulus: User requests a report or insight into delivery performance.*
- *Response: The system generates detailed reports on delivery efficiency, including statistics on time, distance, and fuel costs.*

3.4.3 Functional Requirement

- *The system should provide detailed performance reports on each delivery, including metrics like distance, time, fuel savings, and ETA accuracy.*
- *It must allow users to access and analyze historical route data for performance improvement*

3.5 Route Export and Data Integration

3.5.1 Description and Priority

- *Description: Facilitates exporting routes in CSV or Excel formats, ensuring compatibility with other systems.*
- *Priority: Medium*
- *Benefit: 7*
- *Penalty: 3*
- *Cost: 6*
- *Risk: 2*

3.5.2 Stimulus/Response Sequences

- *Stimulus: User requests an export of the current route data.*
- *Response: The system generates the export in CSV or Excel format for integration with other systems.*

3.5.3 Functional Requirements

- *The system should support exporting route data in CSV and Excel formats.*
- *It must ensure compatibility with other logistics and operations management systems.*
- *The export should include all relevant stop data such as addresses, times, phone numbers, and other custom fields.*

4 External Interface Requirements

4.1 User Interfaces

The FastTrack application provides multiple user interfaces to facilitate interactions with the system. The application will feature for mobile interface. Below are the logical characteristics for the interfaces between the software and the users.

- *Login Screen: The login screen will require users to enter credentials (username/email and password) for authentication. A Forgot Password link will also be provided.*
- *Home Screen: The home screen will display a dashboard with an overview of deliveries, available routes, and important notifications. A navigation bar will allow access to different sections such as Route Optimization, Settings, and User Profile.*
- *Route Optimization Screen: This screen will allow users to input delivery destinations and view the optimized route. It will feature a map interface with a Start Navigation button.*
- *Delivery Details Screen: Once a delivery is selected, users will see detailed information about the delivery, such as destination, estimated time of arrival (ETA), and route breakdown.*

4.2 Hardware Interfaces

Device Compatibility: The application will support GPS-enabled smartphones and tablets meeting the following minimum requirements:

- *RAM: 2 GB or more to ensure smooth operation of the application.*
- *Storage: 16 GB free space to accommodate the app and required data, including maps and route optimization data.*
- *Operating Systems: The application will support Android 8.0 (Oreo) or higher, and iOS 12.0 or higher to ensure compatibility with the latest device features and updates.*

The mobile devices will connect to the internet via Wi-Fi or cellular networks (3G, 4G, or 5G) to communicate with the backend server for route optimization, delivery updates, and real-time notifications.

4.3 Software Interfaces

- *Operating Systems: Android (version 8.0 or higher) and iOS (version 12.0 or higher).*
- *Cloud-based database: MySQL and Firebase for storing user data and product details.*
- *Third-party APIs: Google Maps API (Android) and Core Location API (iOS) for real-time location tracking and route optimization.*
- *Data exchanged between the app and server will use JSON format over HTTPS for secure transmission.*

4.4 Communications Interfaces

- *Communication Protocols: HTTP/HTTPS for secure client-server communication.*
- *Standards and Security: End-to-end encryption for sensitive data.*
- *Error Handling: Notifications for communication failures.*
- *Synchronization and Transfer Rates: Real-time synchronization for auction updates, product availability, and location tracking and Optimized for low-latency data transfer.*

5 Other Nonfunctional Requirements

5.1 Performance Requirements

- *Response Time:* The system must calculate the optimal route within 2 seconds for graphs with up to 500 nodes and within 5 seconds for larger graphs (up to 2,000 nodes).
- *Scalability:* The system should handle up to 1,000 simultaneous delivery route calculations without significant performance degradation.
- *Scalability:* The system should handle up to 1,000 simultaneous delivery route calculations without significant performance degradation.
- *Data Update:* Real-time traffic updates, if integrated, must be processed within 10 seconds to adjust route calculations dynamically.
- *Algorithm Efficiency:* The implemented algorithm must operate with a time complexity in the range of $O(n^2)$ to $O(n^3)$ for graphs where n is the number of locations (destinations).

5.2 Safety Requirements

- *Data Integrity:* Ensure no loss or corruption of delivery location data during input or output processing.
- *Error Handling:* Provide clear error messages for invalid inputs.
- *Backup and Recovery:* Include backup mechanisms to save progress during route calculations, ensuring the system can recover in case of crashes.
- *Regulatory Compliance:* Adhere to any data protection regulations if user or customer data is involved in the system.

5.3 Security Requirements

- *Authentication:* Require secure login credentials for users accessing the system, especially for systems deployed in enterprise settings.
- *Privacy:* Ensure sensitive data, such as customer addresses or delivery points, is encrypted during transmission and storage.
- *Access Control:* Restrict administrative functionalities to authorized personnel only.
- *Fraud Prevention:* Detect and prevent malicious route manipulations, such as tampering with delivery point data.

5.4 Software Quality Attributes

- *Usability:* Provide a simple interface for inputting delivery points and configuring preferences.
- *Modularity:* Implement modular code to simplify debugging and future updates, especially for algorithm enhancements.
- *Localization:* Allow the use of local measurement units and integrate localized traffic data sources if real-time updates are used.
- *Availability:* Implement failover mechanisms to maintain functionality in case of minor hardware or software failures.
- *Adaptability:* Provide support for future updates, including the integration of new mapping services, delivery algorithms, or hardware components, with minimal disruption to existing functionality.

6 Other Requirements

6.1 Database Requirements

- *The system must utilize a relational database management system (RDBMS) to store user data, delivery routes, location information, and performance metrics.*
- *The database schema must be scalable to handle an increasing number of deliveries, users, and data points as the system grows.*

6.2 Internationalization Requirements

- *Currency and distance units should be configurable according to the user's region.*
- *Date and time formats should be adjustable based on the user's locale to accommodate international users.*

6.3 Legal Requirements

- *The application should include clear terms and conditions and privacy policies to inform users about data usage and security measures.*
- *The application must comply with data protection regulations such as the General Data Protection Regulation (GDPR) for users within the EU and Data Protection Laws in India (IT Act, 2000) for users within India.*

6.4 Backup and Recovery

- *The system must include automated daily backups of all critical data, ensuring recovery in the event of data loss or corruption.*
- *A disaster recovery plan should be in place to restore full functionality within 24 hours of a major system failure.*

7 Appendix A: Glossary

- *API (Application Programming Interface): A set of protocols and tools that allow different software applications to communicate with each other.*
- *GPS (Global Positioning System): A satellite-based navigation system that provides location and time information anywhere on Earth.*
- *RDBMS (Relational Database Management System): A database management system that stores data in a structured format using rows and columns.*
- *Route Optimization: The process of determining the most efficient path or route for delivery based on various factors like distance, time, and traffic.*
- *UI (User Interface): The means by which a user interacts with the system or application, typically through visual elements like buttons, menus, and forms.*
- *API Key: A unique identifier used to authenticate requests to an API service.*
- *ETA (Estimated Time of Arrival): The predicted time a delivery will arrive at a given destination.*
- *GDPR (General Data Protection Regulation): A regulation in the EU law on data protection and privacy in the European Union and the European Economic Area.*
- *Firebase: A platform developed by Google that provides cloud-based backend services like real-time databases, authentication, and hosting for mobile and web applications.*
- *Cloud-based Database: A type of database that is hosted on the cloud, allowing for remote storage and access over the internet.*

8 Appendix B: Analysis Models

- *Data Flow Diagram (DFD): A diagram showing how data flows through the system. The DFD will include external entities (users, APIs), processes (route optimization, delivery tracking), data stores (delivery data, user profiles), and data flows.*
- *Use Case Diagram: A visual representation of the system's functional requirements, detailing how users (delivery drivers, administrators) will interact with the system (e.g., input destinations, request optimized routes).*
- *Entity-Relationship Diagram (ERD): A diagram that shows the relationships between the different data entities (e.g., Users, Routes, Deliveries, Locations) within the system.*
- *Class Diagram: A diagram that models the object-oriented structure of the system, showing the classes (e.g., User, Route, Delivery) and their relationships.*

9 Appendix C: Issues List

- *TBD: Integration of third-party APIs: The exact details of integrating the Google Maps API and Core Location API still need to be finalized, including the authentication process and API limits.*
- *Data Synchronization: There is an ongoing discussion about how the real-time delivery updates will synchronize across multiple devices and servers.*
- *Traffic Data Accuracy: Ensuring the accuracy and timeliness of real-time traffic data is a challenge, especially in regions with poor coverage or inconsistent data feeds.*
- *User Interface Design: The exact layout and user flow for the route optimization and delivery tracking screens need further refinement to ensure a seamless user experience.*
- *Security for User Data: The security measures for sensitive user data, especially delivery addresses and contact details, are being reviewed to ensure full compliance with GDPR and other data protection laws.*
- *Device Compatibility Issues: Further testing is required to confirm that the app will function properly across all supported devices, especially for different screen sizes and operating systems.*
- *Route Optimization Algorithm Performance: More tests are needed to ensure the optimization algorithm can efficiently handle large datasets and produce accurate routes in real-time.*