City Paths - Documentation

1. Introduction

City Paths is a mobile application designed to help users safely navigate urban environments. It offers route suggestions based on real-time and historical safety data, including lighting conditions, business presence, crime rates, and community hazard reports.

2. System Overview

The application adopts a client-server architecture and integrates several modules to assess and optimize walking routes for safety.

2.1 Mobile App (Flutter)

- User registration and login
- Route selection and real-time navigation
- Visual map overlays (lighting, crime, hazards, businesses)
- Reporting interface
- User feedback and route ratings

2.2 Backend Server (Node.js)

- REST API for communication
- Safety Score Engine (Python + ML)
- Real-time data updates and alerts
- Integration with external APIs (government crime data, Google Places, etc.)
- PostgreSQL database

2.3 Machine Learning Module

- Random Forest model for safety prediction
- Factors: streetlight coverage, business activity, crime reports, user ratings
- Dynamic adjustment based on live input

3. Functional Components

3.1 Route Calculation

- Input: origin, destination (with optional waypoints)
- Output: multiple route options with safety scores
- Real-time updates: hazards, closed roads, changes in lighting/business status

3.2 User Reports

- Categories: lighting issues, suspicious activity, violence, harassment
- Optional photo upload and urgency rating

- Location & time tagging
- Community validation of reports

3.3 Notifications

- Smart alerts for route deviations
- Risk area entry warnings
- Business closures on the selected path

3.4 Community & Profile Features

- Route ratings and reviews
- Emergency sharing options
- Saved routes and preferences

4. Technology Stack

Component	Technology
Mobile App	Flutter (Dart)
Backend	Node.js + Express
Database	PostgreSQL
ML & Analytics	Python + Pandas
Maps & Navigation	Google Maps API / OpenStreetMap

5. Data Layers

- Lighting Layer: municipal sources, daily updates
- Crime Layer: official statistics, historical data
- Business Layer: Google Places API, hourly updates
- User Reports Layer: community reports, verified and filtered
- Navigation Layer: Map routing and rerouting in real-time