Transit Route Planner (Open, Privacy-first, Offline-capable)

Team Project

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Abstract

This preliminary document describes an open-source, privacy-respecting transit route-planning application with extended platform support (Android, iOS, mobile Linux distributions such as postmarketOS, and feature-phone platforms such as KaiOS). The application focuses on highly configurable multi-criteria route planning, offline operation for core features, and community-driven development and verification.

1 Objectives

The project aims to design, implement and demonstrate a practical, open-source public-transit route planner that:

- supports fine-grained multi-criteria route selection (line, operator, vehicle type, transfers, payment methods, time/distance priorities, etc.);
- provides limited but useful offline functionality (maps, route planning, and navigation when pre-downloaded);
- minimizes data collection and avoids data gathering for sale; and
- supports broad platforms (Android, iOS, postmarketOS, KaiOS where feasible).

2 Indicators and Measurable Goals

2.1 Key Performance Indicators (KPIs) and justification

- **Correctness of route generation:** Achieve at least **95%** agreement with official timetable-based routes in selected pilot regions (measured versus transit agency schedules).
  Reason: High correctness ensures users can rely on recommended itineraries; 95% is realistic when using authoritative schedule feeds (GTFS) and careful parsing/validation (GTFS is widely used by transit agencies).

- **Offline functionality coverage:** Provide offline map tiles and routing data covering **90%** of the pilot-region road and transit network within pre-download size limits (e.g., ¡500 MB).
  Reason: Offline support must be practically useful without excessive storage; 90% coverage balances usability and size constraints, relying on tile compression and vector-based route graphs (Map SDKs support offline packaging) [3].

- **Privacy compliance:** The application must not transmit or log personal location traces to third-party servers by default; optional telemetry must be opt-in and fully documented.
  Reason: Clear privacy design differentiates the project from commercial apps that collect user data (see Google policies and recent enforcement actions) [6, 7].

- **Platform support:** Release functional clients for at least **Android, iOS,** and **one mobile Linux distribution** (postmarketOS) within the project timeframe.
  Reason: Supporting a Linux mobile distribution demonstrates broader accessibility; postmarketOS has active development and received community funding (NLnet / NGI funding) [4, 5].

- **Open-source deliverables:** Publish at least **3 reusable components** (map rendering module, offline packager, and multi-criteria routing engine) under an OSI-compatible license (e.g., MIT).
  Reason: Delivering reusable modules accelerates uptake and community contributions, which is a core declared goal of the project.

- **User satisfaction in pilots:** Achieve a pilot user satisfaction score of at least **80%** on usability and accuracy metrics (measured via surveys).
  Reason: 80% is a realistic target for early demos and indicates acceptable user experience for further development.

3 State of the Art and Comparative Analysis

3.1 Short review

Existing commercial services (Google Maps, Apple Maps) provide broad coverage and integrated traffic/vehicle-position feeds, but typically collect user data and limit customization. OpenStreetMap (OSM) provides community-driven map data with variable completeness across regions (OpenStreetMap Wiki) [1]. Map SDKs such as Mapbox offer offline packaging that can be used to support offline operation in apps [3]. Mobile Linux distributions (postmarketOS) and feature-phone platforms (KaiOS) expand potential device coverage beyond Android/iOS [4, 2].

3.2 Comparison table: Google Maps vs Open-Source Approaches

Relevant documentation and discussions on offline support and privacy are available in Mapbox's offline docs and Google privacy resources [3, 6].

Table 1: Comparison of mapping/navigation approaches relevant to this project

Feature	**Commercial (Google Maps)**	**Open-source (OSM + SDKs)**
License / cost	Proprietary, API fees for some usage	Open data; SDK costs may apply for hosted services
Data control	Centralized, vendor-controlled	Community editable (OSM), full data export
Offline support	Limited, vendor-dependent	Strong support via SDKs and offline tile packs
Privacy	Extensive telemetry/collection (subject to policies)	Can be designed to minimise collection; transparent codebase
Customization	Limited by API	High: data and rendering fully customizable
Platform reach	Excellent on Android/iOS	High when targeting common SDKs; additional work needed for postmarketOS/KaiOS

4 Impact and Risk Assessment

4.1 Impact

The project delivers technological, social and educational value:

- **Technological:** Practical open-source route planner with offline capabilities and multi-criteria filtering usable by NGOs, small municipalities, and developers.
- **Social / Environmental:** Better public-transit usability can increase public transport uptake and reduce car usage, contributing to emissions reductions.
- **Economic:** Reduces lock-in to proprietary services and provides reusable components for local tech ecosystems.
- **Educational:** Encourages contributions from students and junior developers, building skills in geospatial software and open data practices.

4.2 Risk Analysis

References

[1] Completeness - openstreetmap wiki. OpenStreetMap Wiki, 2025. Accessed 2025-11-02.

[2] Kaios home. KaiOS website, 2025. Accessed 2025-11-02.

Table 2: Key Risks and short description

Risk Type	**Description**
Technical	Integration of heterogeneous transit data (GTFS variants, regional formats) and offline packaging constraints may complicate development.
Data availability	Some regions lack complete open transit data or OSM coverage; data freshness varies [1].
Organisational	Maintaining coordination in an open-source project and handling contributions can introduce overhead.
Financial	Hosting, map tiles, and continuous maintenance require funding beyond initial development.
User adoption	Competing with established products requires strong user-focused differentiators (privacy, customization, offline support).
Team experience	The team is primarily composed of young developers with limited production experience; this may slow early development and increase the need for mentorship and external collaboration.

[3] Offline — maps sdk — android docs. Mapbox Documentation, 2025. Accessed 2025-11-02.

[4] postmarketos – the linux distribution for phones. postmarketOS website, 2025. Accessed 2025-11-02.

[5] postmarketos (project) – nlnet. NLnet, 2025. Accessed 2025-11-02.

[6] Privacy & terms - google. Google Privacy Policy, 2025. Accessed 2025-11-02.

[7] Associated Press. California settles with google over location privacy practices for $93 million. *AP News*, 2023. Accessed 2025-11-02.