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Offline Navigation Map for Remote Areas

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ABSTRACT :

An Android application called the Offline Navigation System enables users to view maps and follow journeys without the need for an internet connection. The system displays offline maps and GPS coordinates using OpenStreetMap data that has been incorporated using the OSMdroid library. It facilitates user navigation in isolated locations with poor network access, including hilly or rural areas. The program retrieves the GPS location of the device, shows it on the map, and lets users annotate locations. The system offers a similar experience to online navigation apps by supporting basic map features including zoom, pan, and marker placement. The goal of this project is to provide a dependable and portable offline substitute for conventional navigation systems that can be accessed from anywhere at any time.

INTRODUCTION

The use of navigation apps such as Google Maps is restricted in areas with inadequate or nonexistent network coverage due to their heavy reliance on internet connectivity. In order to get around this problem, users can use pre-downloaded map data for real-time GPS tracking with the Offline Navigation and Route Tracking App. Using Java in Android Studio, this application incorporates OpenStreetMap (OSM) via the OSMdroid library, enabling offline.osm.map rendering.

Without utilising the internet, the software offers crucial functions including navigation markers, map visualisation, current location display, and manual location entry. Trekkers, tourists, and transit personnel working in low-network areas will especially benefit from the technology.

Objective:

1. Enable Offline Navigation: Make it possible for users to browse maps and track their location in real time without requiring an active internet connection. This guarantees continuous use in isolated locations, while travelling, or in areas with poor network coverage. To cut down on data usage, maps and route information are pre-downloaded and saved locally. By reducing continuous mobile data usage, this feature also helps save battery life.

2. Show Actual GPS Location: Using the device's integrated GPS sensors, show the user's precise location even in the absence of a network. This makes accurate tracking possible whether hiking, driving, or walking. The user's movements cause the GPS coordinates to update dynamically, enabling precise progress tracking. By keeping users always aware of their current location, the tool improves safety.

3. Assistance Guide – Destination Input: Give consumers the option to enter their destination and see the best possible path displayed on the map. Using map data that has been stored, the system can recommend the safest or shortest route. Before embarking on a journey, customers can make confident direction choices with the aid of route previews. This enables offline travellers to make travel plans on their own without outside assistance.

4. Improve Accessibility: Provide a straightforward, uncluttered, and user-friendly interface that facilitates route tracking and offline trip management. Users of all ages should be able to easily understand buttons, menus, and icons. For novice users, easy navigation is ensured via visual signals and sparse text. Users who struggle with vision or reading can benefit from accessibility features like voice notifications and large fonts.

LITERATURE SURVEY

An active internet connection is the primary requirement for early navigation systems like Google Maps and Waze to carry out functions like route calculation, traffic updates, and map rendering. Usability in places with poor network service, like rural areas, forests, or international travel, is restricted by this dependency. Alternative solutions that save map data locally on the user's device have been investigated by developers in response to the growing demand for dependable offline navigation. OpenStreetMap (OSM), a community-driven, editable, and open-source mapping technology, has been used by researchers to get around these restrictions.

The usefulness of offline navigation is demonstrated by technologies such as Osm and MAPS.ME, which store vector tiles that may be drawn without internet access. In order to enable offline map visualisation, interactivity, and GPS tracking, developers can additionally utilise supporting libraries like Leaflet for web-based systems and OSMdroid for Android applications. OSM is perfect for academic research and prototype creation because it is open-source, which promotes experimentation and customisation more than proprietary tools do. Previous research shows that even in the absence of network connectivity, precise real-time tracking may be achieved by integrating GPS modules with OSM data. Like online commercial navigation programs, offline systems can also be expanded with more sophisticated features like voice help, turn-by-turn advice, and route planning. Offline navigation systems are positioned by these characteristics as affordable, portable, and promising options for upcoming travel, emergency response, and remote-area exploration applications.

METHODOLOGY

Data Preparation: Geofabrik provides offline.osm.map files for the desired region (India-South_oam.osm.map, for example).

Development Setup: Java is the primary programming language used in the development of the application, which is done in Android Studio.

Library Integration: To render OpenStreetMap data offline, the OSMdroid library is integrated.

Map Loading: At runtime, the offline map file is loaded into the application from its location in the project's assets folder.

GPS Location Access: The application marks the device's location on the map after retrieving its GPS location (or a fictitious place for demonstration).

Manual Input: Using coordinates or map touch inputs, users can manually set their present or destination location.

Testing and Debugging: To ensure seamless offline operation, the system is tested on both a real Android smartphone and an emulator.

Existing system:

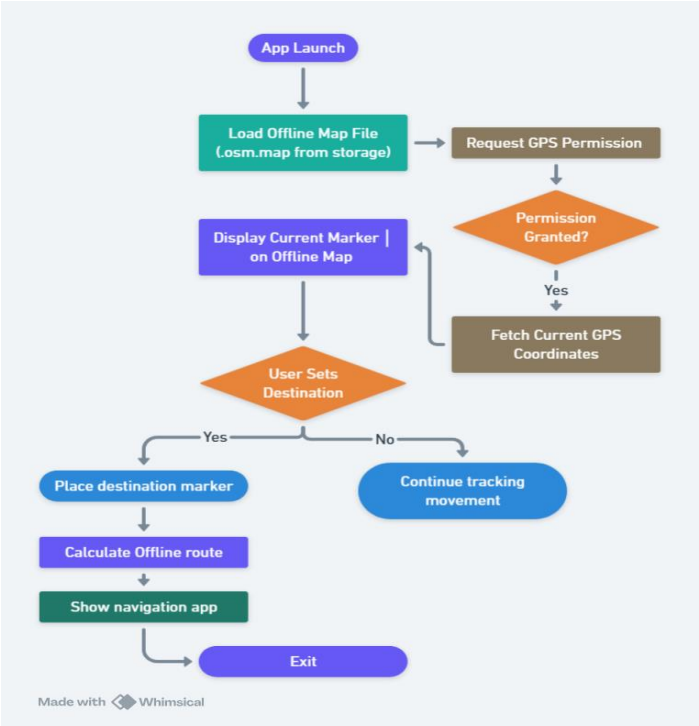
In order to download map tiles, retrieve route data, and offer real-time assistance, traditional navigation apps mainly depend on constant internet connectivity. Consequently, users in isolated or underdeveloped regions frequently encounter restricted access to essential map information, resulting in sluggish or imprecise navigational answers. Weak network strength also substantially impairs performance by preventing routes and sites of interest from loading properly. Additionally, without an active data connection, these apps usually cannot provide full GPS-based navigation, which might be inconvenient when travelling. Conventional navigation systems are expensive and ineffective for frequent use due to the high mobile data consumption caused by continuous map resource downloads.

Disadvantages:

- Traditional navigation apps require a constant internet connection, making them unusable in offline environments.
- They consume high amounts of mobile data due to continuous downloading of map tiles and routing information.
- Their usability becomes severely restricted in remote or rural areas where network coverage is poor or unavailable.
- They rely heavily on Google Play Services for GPS accuracy, creating dependency issues on specific platforms.

Proposed system:

The suggested Offline guidance App uses pre-downloaded OpenStreetMap (OSM) files to remove reliance on the internet, addressing the drawbacks of conventional guidance systems. In order to effectively show geographical data without network connection, it incorporates the OSMdroid library to create offline map tiles. To ensure precise positioning, the program uses the device's sensor to acquire the user's current GPS location. The ability to manually enter destination coordinates or places allows users to navigate freely in any setting. This technology provides accessibility in areas with erratic internet connectivity, especially in rural or isolated areas. Future iterations can also be improved with voice help, turn-by-turn directions, and routing algorithms, which will make navigation more engaging and easy to use. The suggested system provides a useful, affordable, and dependable offline navigation solution that is appropriate for travel.



SYSTEM REQUIREMENTS

Hardware Requirements:

- Android Device or Emulator
- Minimum 2 GB RAM.
- Quad-core processor or above
- At least 200 MB storage for map data

Software Requirements:

- Android Studio IDE
- Java Development Kit (JDK 17)
- Gradle Build System.
- OSMdroid Library (for map rendering).
- Offline OSM Map File (e.g., India-South_oam.osm.map)

Module Description

1. **Map Display Module:**

   Loads offline OpenStreetMap data and renders it on the screen using the OSMdroid library.

2. **Current Location Module:**

   Fetches and displays the device's GPS coordinates (or mock location) on the map.

3. **Manual Location Module:**

   Allows the user to manually enter or select a destination location.

4. **Marker Module:**

   Places visual markers on the map to show current and destination points.

5. **User Interface Module:**

   Simple and clean layout for map view, buttons, and navigation options.

6. **Future Routing Module (Planned):**

   Will calculate routes between two points using offline routing graphs (like GraphHopper or BRouter).

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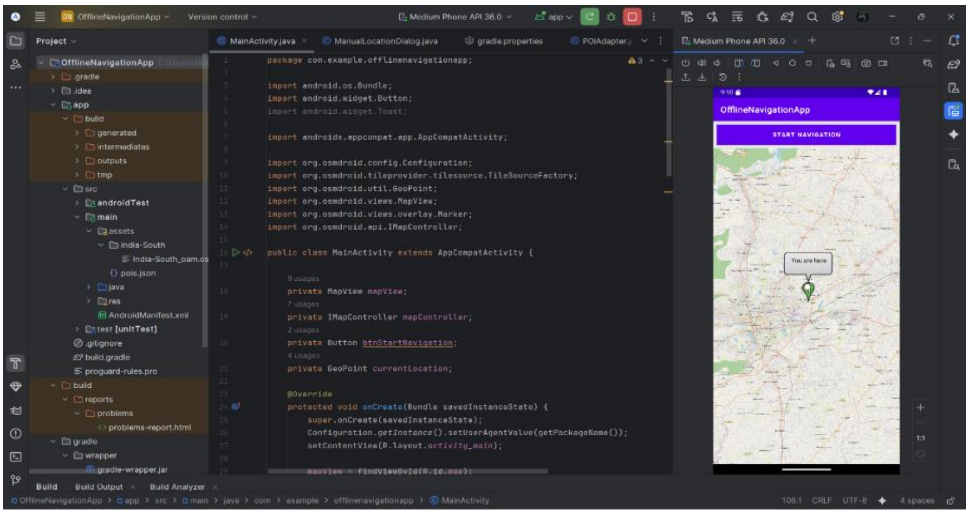

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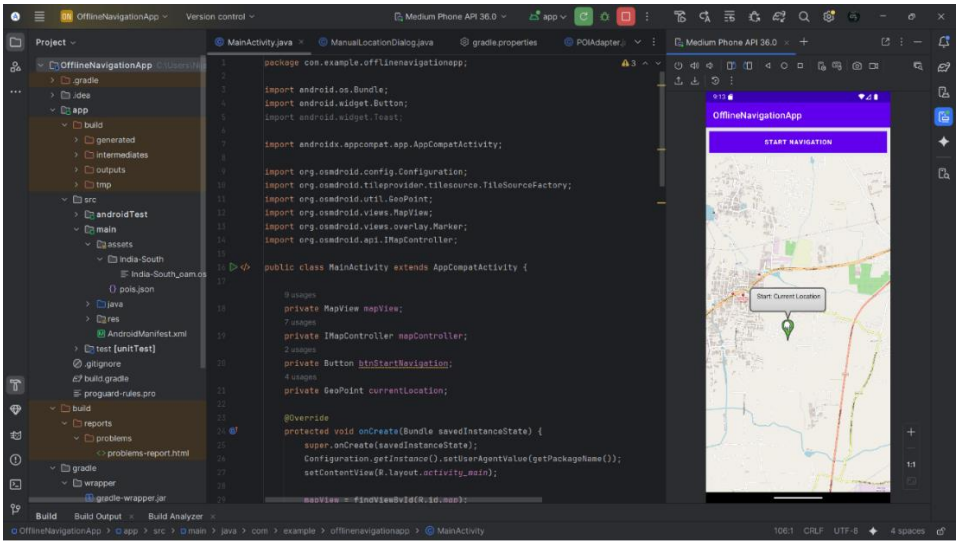

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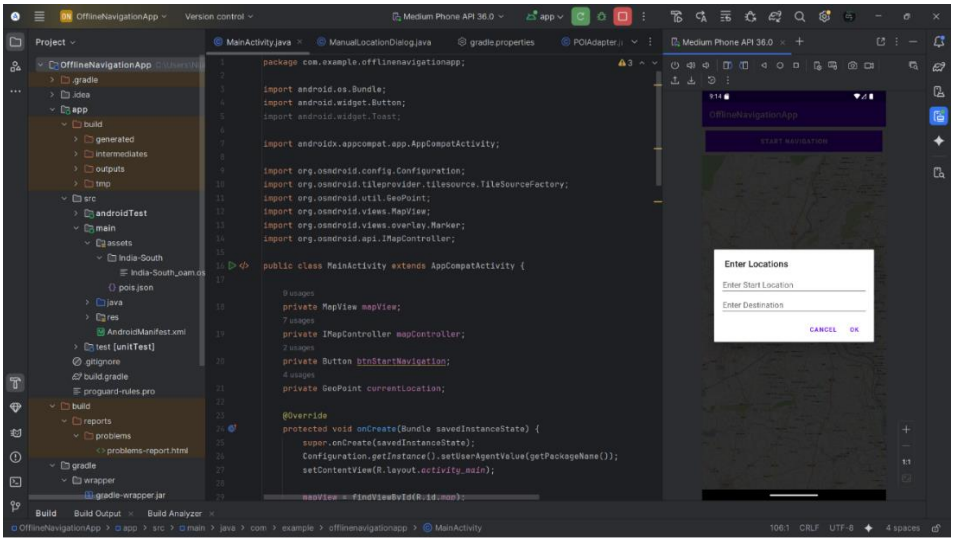

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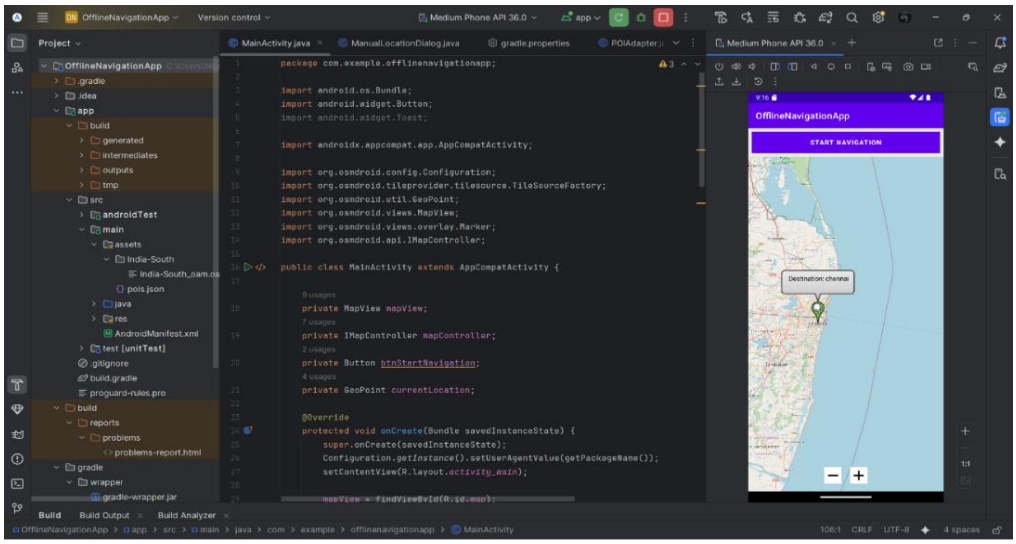

CONCLUSION

The Offline Navigation and Route Tracking System effectively illustrates that dependable navigation is achievable even in the absence of an internet connection. The application offers crucial mapping and GPS functions in offline mode by utilising OpenStreetMap data and the OSMdroid library. It enables safe navigation for users in isolated or rural locations without relying on network signals or mobile data. The project's objective of offering a user-friendly, portable, and effective offline navigation tool is fulfilled. In the future, this system could be improved with offline routing algorithms, turn-by-turn voice guidance, and route optimisation, which would make it a comprehensive substitute for conventional online map services like Google Maps.

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