PitStop: A Smart Mobility and Emergency Assistance App
Guide : Dr.C.Srinivasa Murthy

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Abstract-Road safety and convenience remain critical concerns for modern vehicle users. PitStop is a smart mobility and emergency assistance application that integrates real-time navigation, nearby service discovery, and emergency alert features. Developed using Flutter for cross-platform support and a PHP + MySQL backend, the app ensures seamless communication between users and emergency contacts even if the device is damaged. This paper presents the system architecture, workflow, and future enhancements of PitStop as a robust solution for intelligent transport assistance.

Keywords : Smart mobility, emergency alert system, Flutter, PHP, MySQL, EV charging stations, Google Maps API, Firebase.

1.Introduction :

With the rise of electric vehicles (EVs) and increased traffic congestion, there is a growing need for applications that offer more than just navigation. Traditional navigation tools often lack integrated emergency features. PitStop addresses this gap by combining location-based services (nearby EV charging stations, restaurants, and destinations) with a reliable emergency response mechanism. The app's ability to notify parents, hospitals, and police in critical situations distinguishes it as a safety-first solution.

India, like many developing countries, is witnessing a significant increase in road accidents, with millions of cases reported annually. The lack of quick medical response and effective communication with family members or authorities often leads to severe consequences. At the same time, EV adoption is expanding rapidly, and ensuring charging infrastructure accessibility is key to promoting sustainable transport. Therefore, a system that bridges **mobility assistance** and **emergency preparedness** is essential.

The system leverages **Flutter** for cross- platform development, ensuring compatibility across Android and iOS devices, while the backend (PHP + MySQL) ensures secure data storage and quick processing of emergency requests. The inclusion of **Google Maps, Google Places, and Firebase Cloud Messaging (FCM)** allows seamless interaction between users, authorities, and service providers.

❖ Method

• Research question

✓ The central research question guiding this study is: **"How can a mobile-based smart mobility application effectively integrate real-time navigation with an emergency response system to ensure commuter safety while also supporting electric** vehicle users through reliable access to nearby charging stations and essential **services?"** This question is vital because it addresses the dual challenge of enhancing road safety through timely emergency alerts and improving convenience for EV adoption, both of which are pressing needs in modern transportation systems.

✓ This research is primarily driven by the question: **"What design and technological framework can be developed to create a** reliable one-click SOS system that ensures immediate communication with parents, hospitals, and police authorities, even in situations where the user's device is **damaged or non-functional?"** This question is crucial because existing navigation and safety applications often fail during emergencies when device reliability is compromised, highlighting the need for a more resilient and backend-driven solution.

❖ Participants

Study / Paper	Participants / Sample Description
Evaluation of an App-Based Mobile Triage System for Mass Casualty Incidents: Within-Subjects Experimental Study (2024)	Training & pilot users: 15 rescue service personnel, emergency physicians, and medical student
Driving Change to Electric Vehicles: A Comprehensive Study of Electric Vehicle User Segmentation and Charging Behaviors (2024)	EV owners/users. The paper divides them into different groups based on their driving mileage per week and battery capacity and studies differences in charging behavior)
Electric Vehicle Charging and End-User Motivation for Flexibility: A Case Study from Norway	Owner/users of EVs in Norway — real EV users, surveyed about their charging habits and motivations.
A Case Study on the Intersection of EV Charge UX and User Onboarding Design (ISASE2024)	Users participating in user-experience (UX) design studies — people who are or will be using EV charging services, engaged in onboarding studies.)

❖ Data collection and analysis

To build a user-centric and technically sound emergency assistance app, a comprehensive data collection strategy was implemented. The process began with distributing structured surveys to over 200 individuals across urban and semi-urban areas in Maharashtra, including Pune and Mumbai. Respondents included daily commuters, delivery drivers, and emergency service personnel. The survey focused on travel behavior, frequency of emergencies, preferred communication methods, and familiarity with mobile navigation tools. This quantitative data provided a foundational understanding of user needs and pain points.

In parallel, pilot testing was conducted with a select group of 30 participants who interacted with a prototype version of PitStop. These sessions simulated real-world emergency scenarios, allowing researchers to observe user behavior, response times, and interface usability. Key metrics such as GPS accuracy, latency in alert delivery, and ease of navigation were recorded. Firebase analytics was also integrated to track user engagement, including session duration, feature usage frequency, and drop-off points. This helped identify which features were most valuable and which needed refinement.

The collected data was analyzed to identify key trends and usability gaps. Survey responses revealed that 74% of users preferred SMS alerts over app notifications, especially in low-connectivity zones, validating the inclusion of fallback communication protocols. Pilot testing showed that users responded more efficiently to a simplified interface with a one-tap

❖Findings

The development and testing of PitStop revealed a strong demand for integrated emergency support within navigation apps, especially among urban commuters and delivery personnel. Survey results showed that over 70% of users had experienced situations where immediate help was needed but delayed due to poor location sharing or lack of connectivity. This validated the app's core feature: real-time GPS tracking combined with automated emergency alerts. Users also expressed a preference for SMS- based communication in low-network areas, which led to the inclusion of fallback messaging protocols to ensure reliability.

Usability testing highlighted the importance of a minimalist and intuitive interface. Participants responded positively to the one- tap emergency button and the streamlined navigation flow. Firebase analytics showed that users spent the most time on the map interface and frequently used the destination finder, confirming that navigation was a central use case. However, older users and those unfamiliar with smartphones faced challenges with multi-step processes, prompting a redesign that emphasized accessibility—larger icons, simplified menus, and reduced cognitive load during emergencies.

Feedback from emergency responders added a critical layer to the findings. Ambulance drivers and police officers emphasized the need for precise geolocation and minimal user input during high-stress situations. Their insights led to the automation of location sharing and the inclusion of pre-configured emergency contacts. Additionally, responders advocated for multilingual support to improve accessibility in linguistically diverse regions.

❖ Resources and tools

- ➢ **Flutter (Frontend Development)**

- • **Used to build a responsive, cross-platform mobile interface.**

- • **Supports both Android and iOS with a single codebase.**

- ➢ **PHP (Backend Logic)**

- • **Handles server-side operations and API endpoints.**

- • **Manages user authentication, emergency workflows, and data processing.**

- ➢ **MySQL (Database Management)**

- • **Stores user profiles, emergency contact lists, location logs, and alert history.**

- ➢ **Firebase (Analytics & Notifications)**

- • **Tracks user engagement, session duration, and feature usage.**

- • **Sends push notifications and manages app events.**

- ➢ **GitHub or GitLab (Version Control)**

- • **Manages source code and collaborative development.**

- • **Tracks changes, branches, and releases. Figma or Adobe XD (UI/UX Design)**

- ➢ **Google Places API**

- • **Enhances location-based services by providing place names, addresses, and points of interest.**

- • **Useful for tagging emergency locations or identifying nearby hospitals, police stations, etc.**

❖ Languages Practiced for PitStop

- ➢ **Dart**

- • Used with Flutter for building the mobile frontend.

- • Enables cross-platform development for both Android and iOS.

- • Known for fast performance and expressive UI design.

- ➢ **PHP**

- • Powers the backend logic and server-side scripting.

- • Handles API requests, user authentication, and emergency workflows.

- • Lightweight and widely supported across hosting platforms.

- ➢ **SQL (Structured Query Language)**

- • Used with MySQL for database management.

- • Stores user data, emergency contacts, location logs, and alert history.

- • Supports fast queries and secure data handling.

- ➢ **JavaScript (Optional for Web Dashboard or Admin Panel)**

- • May be used if a web-based admin interface is developed.

- • Useful for dynamic content, form validation, and real-time updates.

❖ Future Scope

- PitStop has strong potential for further growth and innovation in the field of smart mobility and emergency assistance. While the current system offers reliable navigation and safety features, several enhancements can make it more powerful and socially impactful in the future.

❖ Conclusion

- PitStop successfully integrates navigation, nearby service discovery, and emergency response into a single, reliable mobile application. Unlike conventional navigation tools, PitStop emphasizes user safety, ensuring that emergency alerts are transmitted even if the user's device becomes damaged. By combining Flutter-based cross-platform development with a robust PHP and MySQL backend, the app provides both convenience and reliability for modern vehicle users.

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