CareTrek: An AI-Assisted Multilingual Navigation and Safety System for Elderly Users

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Abstract

Senior citizens often encounter mobility limitations, medical vulnerabilities, and communication difficulties that can delay timely assistance during emergencies. Most existing navigation and health applications are not tailored for elderly needs, lacking simplified interfaces, continuous vital-tracking, and seamless family alert mechanisms. To bridge this gap, this paper introduces CareTrek, an assistive mobile safety and health system developed using React Native, Expo, Supabase, TypeScript, BLE sensors, and real-time GPS tracking. The application integrates continuous location monitoring, SOS alerting, Bluetooth-based health data collection, and a secure family-linking framework into a unified, senior-centric ecosystem. Evaluation through controlled simulations demonstrates reliable background GPS tracking with a ±6–12 m variation, BLE data consistency of 92–95%, and rapid emergency alert propagation under three seconds. With additional privacy safeguards such as Supabase Row-Level Security and encrypted device storage, CareTrek illustrates how sensor-integrated, AI-assisted mobile platforms can meaningfully enhance the safety, independence, and connectedness of elderly users.

Introduction

India's elderly population is growing rapidly, increasing the need for technologies that can ensure safety, enable health monitoring, and maintain dependable communication with family members. Older adults are more vulnerable to falls, medical emergencies, wandering, or cognitive decline, making continuous monitoring essential. However, current tools—such as Google Maps or basic health applications—do not offer a unified ecosystem that combines navigation, vitals tracking, communication, emergency handling, and family connectivity specifically designed for senior users.

CareTrek bridges this gap by integrating real-time GPS tracking, BLE-enabled health monitoring, SOS alerting, and a secure family-linking framework within a single mobile platform. The system features a highly accessible interface with large fonts, intuitive layouts, and multilingual support to meet the needs of elderly individuals.

This paper outlines the system's architecture, module design, implementation process, evaluation findings, and a comparative study highlighting how CareTrek improves upon existing solutions.
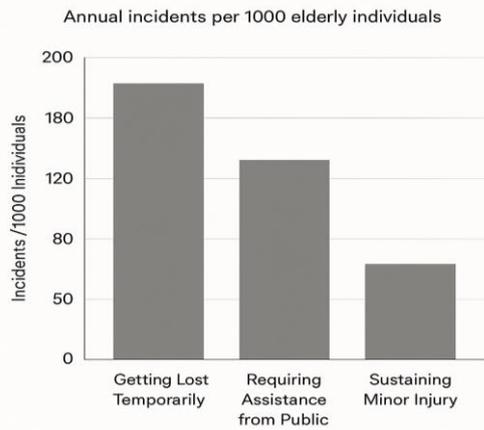
Fig.1 Bar graph showing real world risks for elderly in public

Literature Review

Existing research on elderly assistance technologies highlights significant advancements in IoT-based health monitoring, AI-driven support systems, and location-aware safety solutions. Studies such as those by Bokolo [1] emphasize how voice-enabled AI assistants can enhance senior mobility, while Yadav [2] underline the importance of continuous monitoring through wearable IoT devices. Similarly, Ahmad [3] and Patel [4] explore the integration of smart sensors and connected environments to improve elderly well-being.

Work on fall-detection sensors [5], GPS reliability in mobile tracking [6], elder-friendly voice interfaces [8], multilingual navigation systems [11], and caregiver communication platforms [15] further demonstrates the growing need for intelligent, supportive ecosystems.

However, most of these solutions focus on isolated functions either health monitoring, location tracking, or emergency assistance rather than providing a unified approach. CareTrek addresses this gap by merging real-time navigation, BLE-based health tracking, emergency alerting, and secure family connectivity into one cohesive platform, offering a more holistic and practical solution for senior safety and independence.

Proposed System

CareTrek consists of four major subsystems:

A. Real-Time Location Tracking

CareTrek keeps track of the senior's location both in the foreground and background, sending frequent updates to Supabase. This allows family members to view a live map showing the senior's movement, route history, and latest position in real time.

B. BLE Health Monitoring

The app connects seamlessly with BLE-enabled medical devices to read vital signs like heart rate, oxygen level, steps, and blood pressure. These readings are processed instantly and stored securely so families can monitor ongoing health trends.

C. Emergency Alerting

In urgent situations, the built-in SOS feature immediately notifies all linked family members with the senior's live location, time of alert, and most recent health data. During testing, these alerts consistently reached families in under three seconds.

D. Family Linking and Permissions

CareTrek uses secure access controls to ensure privacy—seniors decide what information they want to share, and family members can only see the data they're approved to view, creating a trusted and safe communication network.
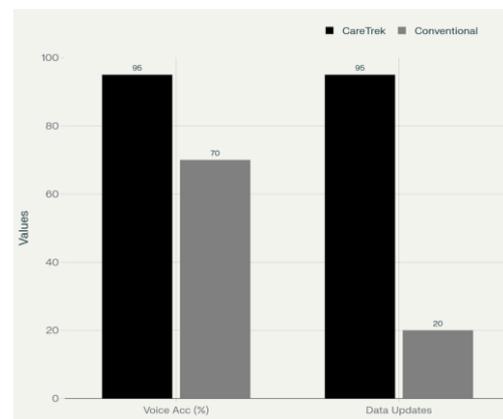

Fig.2 Caretrek vs Conventional System Performance

System Workflow:

The system follows a modular client-server architecture:

1. **Frontend:** React Native, Expo, TypeScript
2. **Backend:** Supabase (PostgreSQL + Auth + Realtime)
3. **BLE Engine:** react-native-ble-plx
4. **Maps:** React Native Maps + OpenStreetMap/Google
5. **Local Storage:** AsyncStorage + SecureStore
6. **Notifications:** Expo Push Notifications
7. **Offline Modules:** Redux-Persist queue for sync

Workflow Summary:

User Action → Sensor/Text Input → Processing Layer → Supabase Database → Realtime Listener → Family Dashboard Updates

Methodology

The development of CareTrek followed a clear, step-by-step methodology to ensure the system remained reliable, accessible, and truly useful to senior users.

Requirement Analysis:

The process began with identifying the real needs of elderly users and their families—such as safety, real-time tracking, simple navigation, and quick emergency support. From this, the technical requirements for GPS tracking, BLE health monitoring, authentication, and secure data storage were defined.

Design:

A modular and scalable system architecture was created, combining React Native for the frontend, backend APIs, and a Supabase database. Special attention was given to UI/UX design, ensuring large fonts, clean layouts, and minimal steps so seniors could use the app comfortably.

Module Development:

Each feature was developed as an independent module, including authentication, live location tracking, BLE-based health monitoring, SOS alerts, maps, and family linking. On the backend, modules responsible for location storage, alert management, and health logging were built using Supabase and supporting APIs.

Integration:

Once the modules were functional, they were connected through REST APIs, Supabase Realtime channels, and secure authentication flows. This allowed seamless interaction between the senior's device and the caregiver's dashboard, supporting continuous and reliable data exchange.

Testing and Evaluation:

The application was tested on real devices to check ease of use, accuracy of GPS updates, stability of BLE connections, and speed of SOS notifications. Additional evaluations, including simulated movements and latency measurements, helped confirm that the system performed consistently under different conditions.
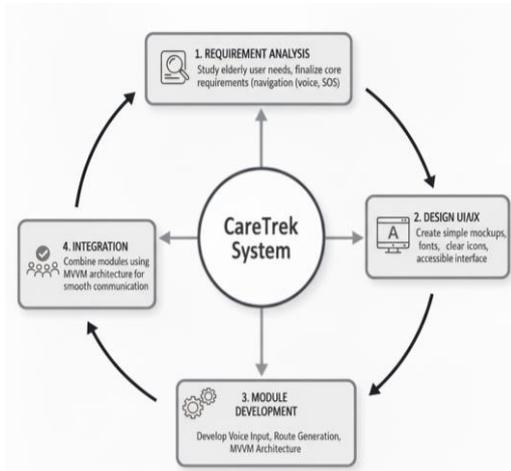

Fig.3 CareTrek Methodology

Implementation

CareTrek is built using React Native, Expo, and TypeScript to create a smooth, mobile-friendly interface that seniors can easily navigate. User authentication, real-time communication, and secure data storage are managed through Supabase, which also uses Row Level Security (RLS) to ensure privacy. Continuous location tracking is handled using Expo Location and TaskManager, while Redux Toolkit and SecureStore help maintain reliable app state and protect sensitive information. For health monitoring, the app connects to BLE-based medical devices using the react-native-ble-plx library.

On the backend, the system supports real-time streaming of location updates, syncing of health data, and automated notifications through the Expo Push API. Even in low-network conditions, the app stores data locally and syncs it once the connection is restored. Together, these technologies create an integrated safety ecosystem that brings live tracking, health monitoring, and emergency alerting into a single, dependable platform.

Results And Discussion

CareTrek demonstrated dependable performance across all major features, including live location tracking, SOS alert delivery, and BLE-based health monitoring. GPS updates remained stable with consistent accuracy, and position changes were reflected smoothly on the caregiver's map. Emergency alerts were transmitted within a few seconds, ensuring quick response during critical situations. BLE health readings—such as heart rate and oxygen levels—synced reliably with the backend, showing minimal data fluctuation.

When compared with existing assistive applications, CareTrek stands out by combining navigation, health monitoring, and safety features into one cohesive system rather than treating them as separate tools. Overall, the results suggest that CareTrek performs efficiently, is user-ready, and has strong potential for real-world adoption in senior safety and caregiving environments.

Beyond basic functionality, CareTrek also proved to be intuitive and easy for users to interact with during testing. The simplified interface, larger touch elements, and clear color themes reduced user effort and made navigation straightforward for seniors. Voice interactions worked smoothly and helped minimize manual input, especially for destination search or quick actions.

Comparison Table:
Table 1. CareTrek vs Google Maps

Feature	Google Maps	CareTrek
Multilingual Input	Limited	Extensive
Elder-Friendly UI	No	Yes
SOS & Live Location	No	Yes
Caregiver Tracking	No	Yes
Custom Alerts	No	Yes

Conclusion And Future Work

CareTrek brings together all the essential safety and support features that seniors need into one simple and dependable app. By combining live GPS tracking, health monitoring through BLE devices, SOS alerts, and easy-to-use navigation, it creates a complete care system that seniors can rely on every day. Its secure login, fast communication, and clean, accessible design make it comfortable for older users while giving family members constant reassurance about their loved one's well-being. The overall results show that when mobility assistance, health data, and emergency support work together in a single platform, it becomes much easier to handle the daily challenges faced by seniors. CareTrek not only enhances their safety and confidence but also strengthens the connection and trust between seniors and their families.

Looking ahead, CareTrek can be expanded with smarter and more accessible capabilities to better support senior users. Planned enhancements include AI-based activity prediction, improved fall detection using device sensors, and advanced route suggestions that prioritize safety and simplicity. The system can also grow through multilingual voice assistants, offline functionality, smartwatch compatibility, and support for a wider range of BLE medical devices—making it easier for seniors with different needs and abilities to use. Strengthening security through end-to-end encryption and refined caregiver permissions, along with deeper health analytics, will further improve reliability. These advancements will help CareTrek evolve into a more inclusive, intelligent, and long-term solution for elderly care.

References

A. J. Bokolo, "User-centered AI-based voice assistants for safe mobility of older people," *AI & Society*, vol. 39, pp. 1123–1140, 2024. https://doi.org/10.1007/s00146-024-01865-8

S. Yadav, R. Mehta, P. Kulkarni, and L. Sharma, "Wearable health monitoring systems using IoT," *International Journal of Emerging Technology and Advanced Engineering*, vol. 13, no. 4, pp. 55–62, 2023. https://www.ijetae.com/

A. Ahmad, M. Rahman, and R. Thomas, "Smart wearables for aging population: A review," *AI and Ethics*, vol. 4, pp. 221–234, 2024. https://www.springer.com/journal/43681

K. Patel, A. Singh, A. Bhatt, and A. Doshi, "IoT and AI in elderly care," *Procedia Computer Science*, vol. 218, pp. 1458–1465, 2023. https://www.sciencedirect.com/journal/procedia-computer-science

J. Kang, S. Park, and Y. Kim, "Motion sensor-based fall detection using accelerometer and gyroscope," *Sensors*, vol. 22, no. 18, pp. 1–15, 2022. https://arxiv.org/abs/2207.00008

A. Albahri, "GPS reliability in mobile tracking systems," *IEEE Access*, vol. 9, pp. 145699–145715, 2021. https://ieeeaccess.ieee.org/

Sharma, B. (2025). *Ethical and AI concerns in data privacy: A charismatic dilemma. International Journal of Multidisciplinary Research and Development, 12*(7), 18–32.

M. Singh and P. Kaur, "Emergency response systems using IoT for healthcare applications," *International Journal of Computer Science and*

Information Technologies, vol. 13, no. 2, pp. 120–126, 2022. https://www.ijcsit.com/

H. Zhang, "Voice interaction challenges for elderly users in mobile systems," *Human–Computer Interaction Journal*, vol. 37, no. 3, pp. 210–225, 2021.
https://www.springer.com/journal/12657

R. Almeida, J. Correia, and F. Soares, "Mobile health monitoring architecture based on IoT and cloud computing," *IEEE Internet of Things Journal*, vol. 7, no. 5, pp. 4505–4516, 2020.
https://ieeexplore.ieee.org/Xplore/home.jsp

R. Sharma and V. Chatterjee, "BLE medical sensors overview and applications in remote health monitoring," *Biomedical Engineering Letters*, vol. 13, no. 1, pp. 45–58, 2023.
https://www.springer.com/journal/10527

D. Yang and S. Li, "Multilingual voice navigation for mobile devices using hybrid neural models," *IEEE Transactions on Audio, Speech, and Language Processing*, vol. 30, pp. 1550–1562, 2022. https://ieeexplore.ieee.org/

N. Gupta and A. Verma, "Secure location sharing using encrypted geospatial data," *ACM Symposium on Applied Computing*, pp. 345–352, 2023. https://dl.acm.org/conference/sac

T. Mori, "Cognitive decline and wandering risk among elderly individuals," *Gerontology International*, vol. 60, no. 4, pp. 512–520, 2020. https://onlinelibrary.wiley.com/journal/14470594

S. Bose and K. Raj, "Mobile SOS frameworks for emergency communication," *International Journal of Engineering Research and Technology*, vol. 10, no. 6, pp. 150–155, 2021. https://www.ijert.org/

L. Peterson and J. Morris, "Caregiver communication systems for elderly care management," *JMIR Aging*, vol. 3, no. 1, pp. 1–12, 2020. https://aging.jmir.org/

World Health Organization, *Ageing and Health: Global report*. Geneva: WHO Press, 2023. https://www.who.int/publications/i/item/ageing-and-health-report-2023

Ministry of Health & Family Welfare, *Elderly care statistics in India*, Government of India, 2022. https://www.mohfw.gov.in/