

A Geolocation Tracking Solution for Community-Dwelling Older Adults: Enhancing Safety Through Open-Source Technology

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Background and Objectives

Population ageing presents significant safety challenges, particularly for older adults with mobility limitations or chronic conditions. Unattended accidents such as falls may lead to serious consequences if timely assistance is unavailable. Real-time location tracking enables family members and caregivers to monitor older adults remotely. While Apple's FindMy application offers robust tracking capabilities, its restriction to Apple devices limits accessibility and affordability. This study aimed to develop a cross-platform, cost-effective location tracking system for elderly safety monitoring by leveraging the FindMy network through open-source technology.

Methods

An open-source Python module was utilised to interface with Apple's FindMy network without requiring Apple hardware for monitoring. Low-cost ESP32 microcontroller chips were programmed as Bluetooth Low Energy tracking devices simulating Apple-compatible beacons. A web application was built using the Python Flask framework, featuring user authentication via Apple accounts, device registration using private encryption keys, and real-time location display on embedded interactive maps. The system was designed to operate across Windows, Linux, and other platforms.

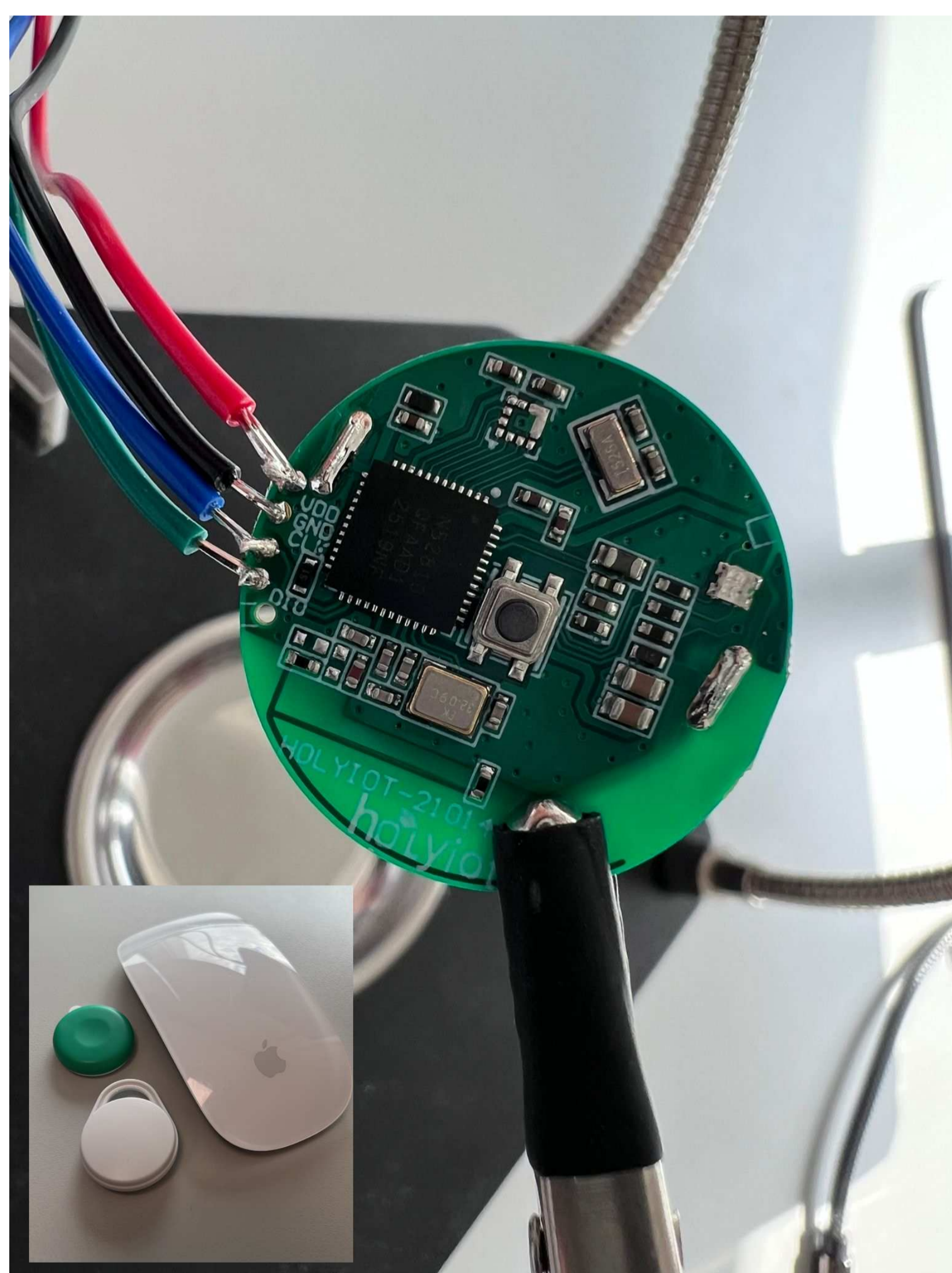


Figure 1: An ESP32-based tracking device.

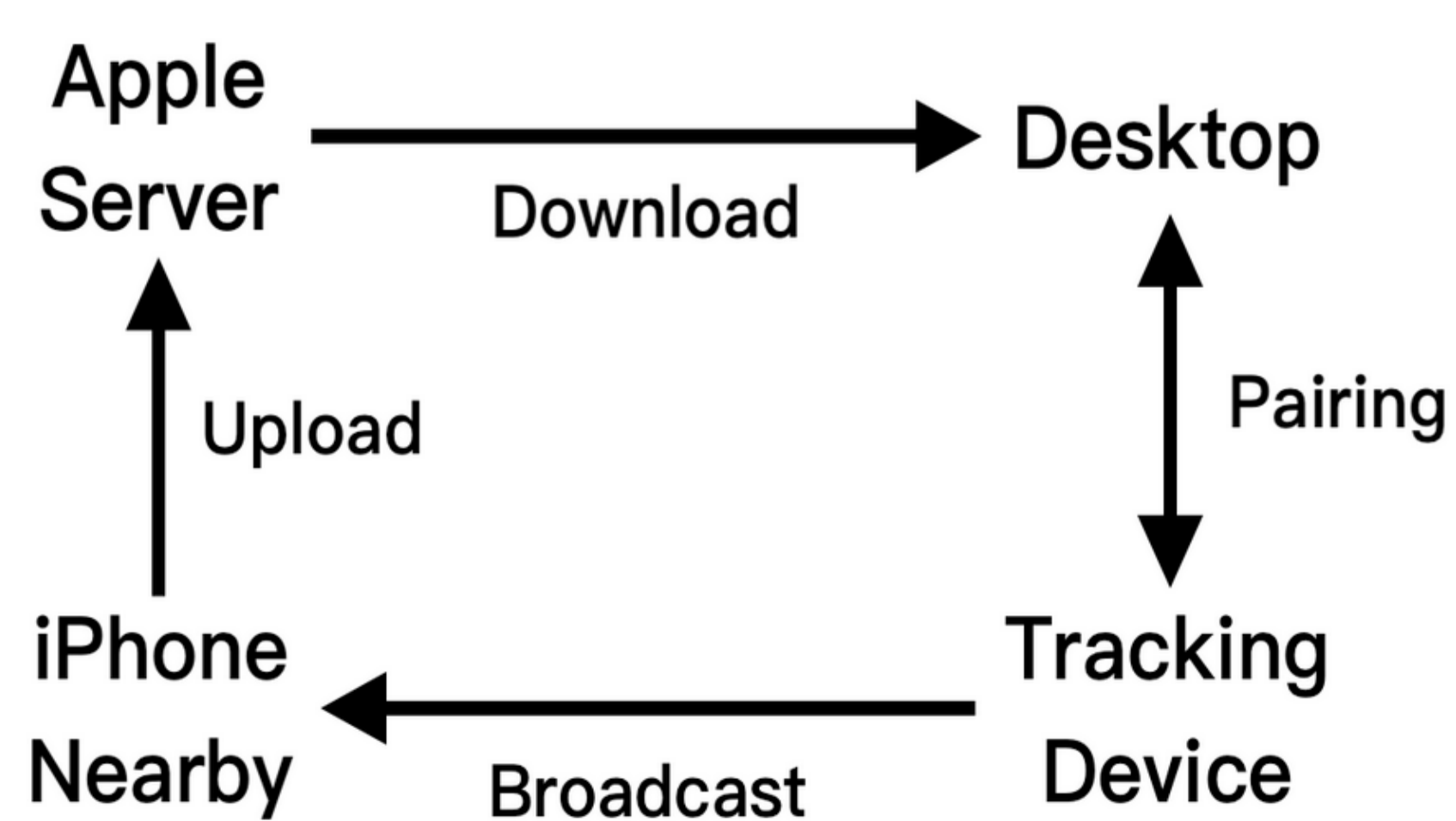


Figure 2: Message flow of Apple's FindMy network.

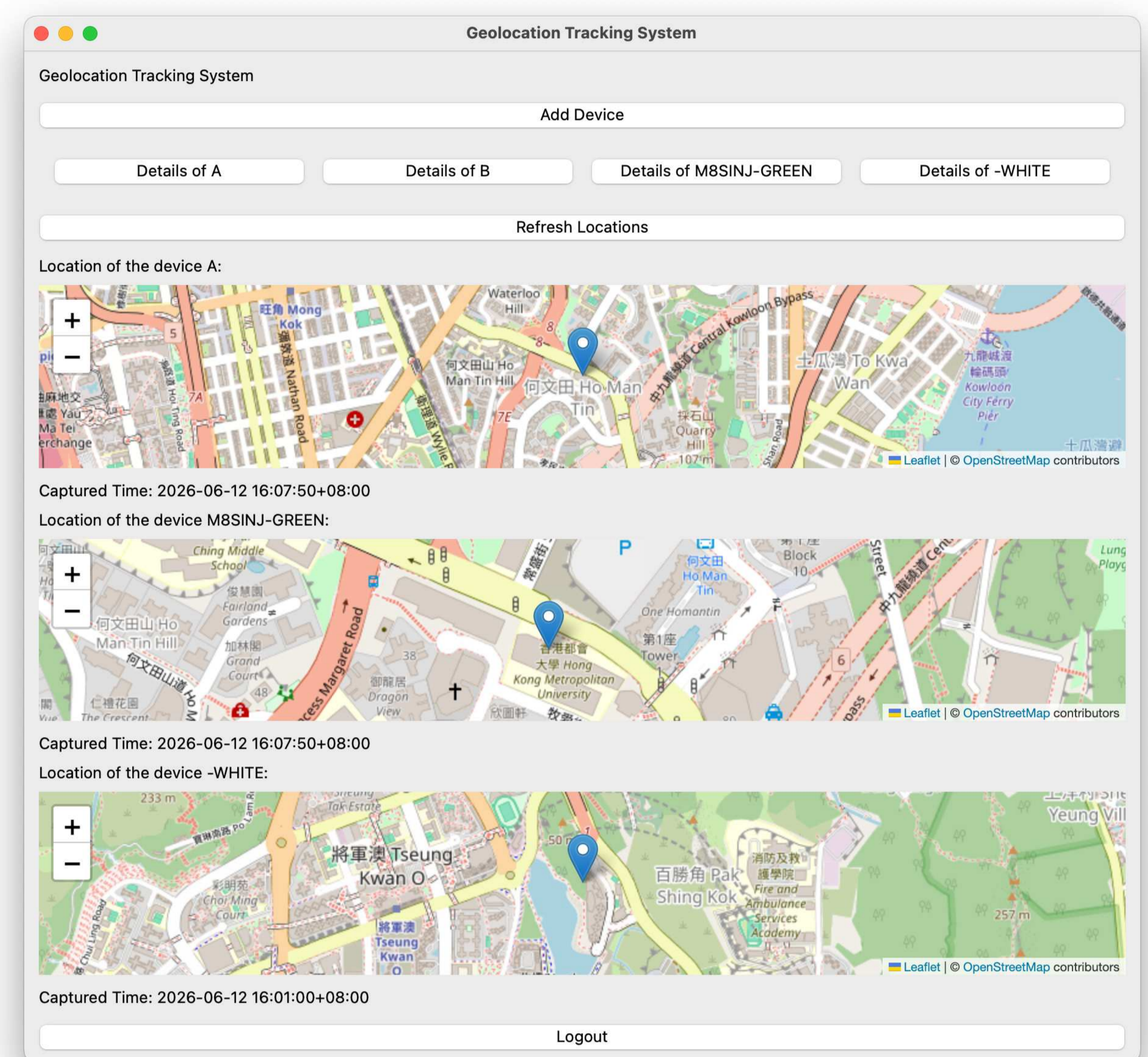


Figure 3: GUI interface of the geolocation tracking system.

Results

The system was successfully implemented and tested. Users could log in, register ESP32-based tracking devices, and view real-time locations on the web interface. The application operated reliably on non-Apple platforms, effectively removing the original hardware dependency. The ESP32 devices communicated successfully with the FindMy network, demonstrating that affordable open-source hardware can leverage existing commercial location infrastructure for elderly safety monitoring.

Conclusions

This project demonstrates the feasibility of a cross-platform, low-cost location tracking system for elderly safety using open-source technology. By removing platform restrictions, this solution enhances the accessibility of location-based safety monitoring for older adults. Future development includes integration of fall detection sensors, real-time alert mechanisms, and geofencing capabilities to build a comprehensive elderly safety system.

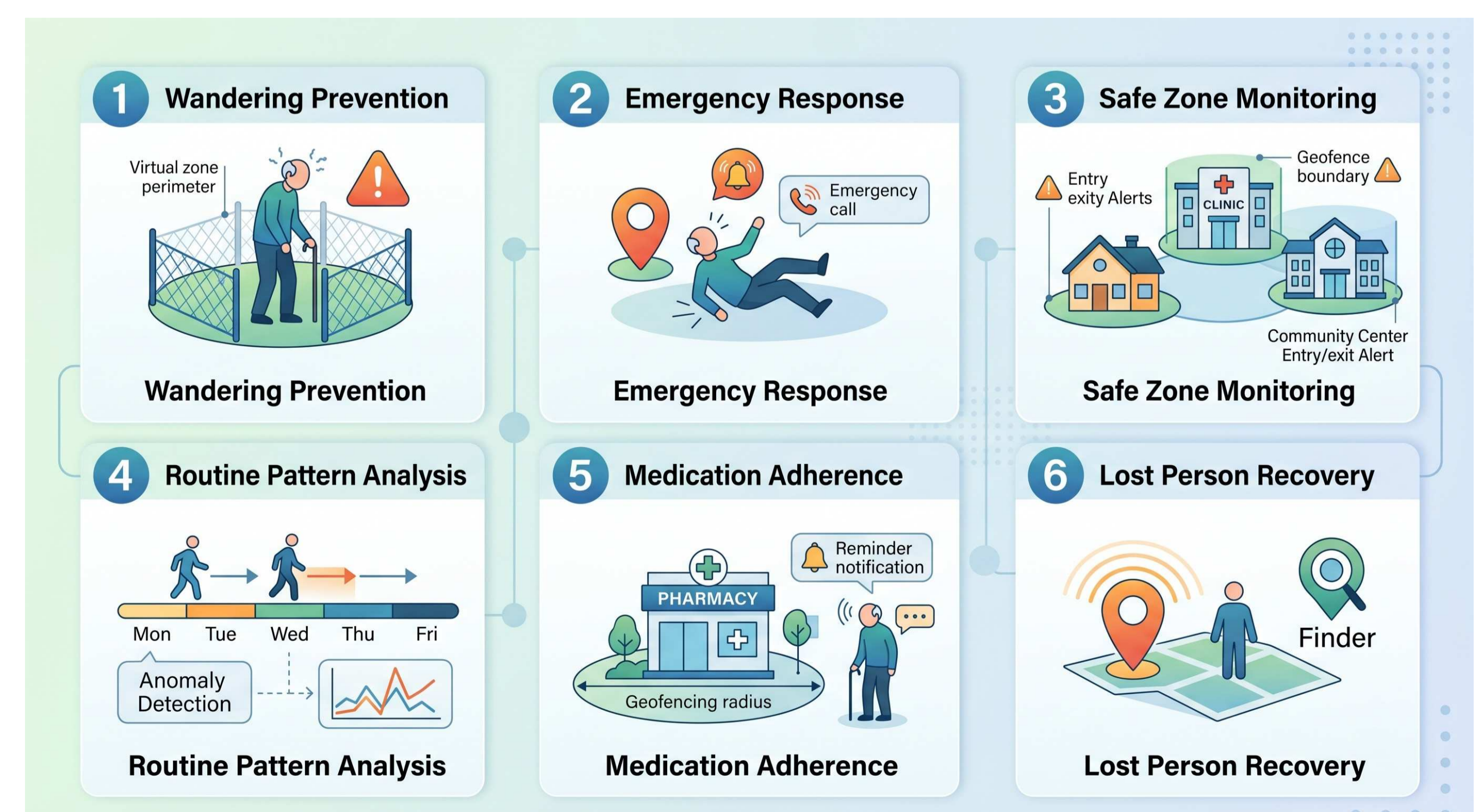


Figure 4: Potential application scenarios of using the geolocation tracking system.