RescueLink: A Mobile Application for Victim Localization in Emergency Situations

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June 1, 2024

Abstract

In emergency situations, rapid and accurate localization of potential victims is crucial for effective rescue operations. This project presents an innovative Android application using Bluetooth Low Energy (BLE) technology, trilateration, and GPS to enhance victim localization. The system ustilizes an ah-hoc BLE network to share information between devices and computes the victim's position using trilateration when GPS is not available.

1 Introduction

During emergency situations such as natural disasters, fires, and large-scale accidents, the timely and accurate localization of potential victims is foundational to effective rescue operations. Current methods usually rely on visual searches and may be ineffective in low-visibility scenarios. Due to the influence of modern technology, the majority of people carry smartphones and other BLE-enabled devices with them. This project aims to leverage these devices to localize victims in emergency situations. A version of the application can also be installed on the victim's device to further enhance the localization process.

2 Background

2.1 Bluetooth Low Energy

Bluetooth Low Energy (BLE) is a wireless communication technology designed for short-range data transmission with minimal power consumption. Experimental tests have shown that BLE can cover up to 200 meters in an open field[1]. Introduced as part of the Bluetooth 4.0 specification, BLE is optimized for applications requiring intermittent data transfers, this makes it ideal for use in mobile devices.

2.2 GPS

Global Positioning System (GPS) is a satellite-based localization system that provides accurate position information to GPS-enabled devices. GPS uses the travel time of signals to estimate the distance between the device and the satellites, then trilateration is used to

determine the device's position.

2.3 Trilateration

Trilateration is a geometric technique used to determine the position of a point by measuring the distances from that point to three or more known locations. The implementation of trilateration in this project solves an optimization problem to find the victim's position with the lowest error. To estimate the distance between the victim and the BLE devices, the Received Signal Strength (RSS) is used.

2.4 RSS

The Received Signal Strength (RSS) is a measure of the power level of a received signal. Combined with the path loss model, and knowing the transmit power, the RSS can be used to estimate the distance between the transmitter and the receiver. RSSI is the Received Signal Strength Indicator, a value that represents the power level of the received signal in dBm. The formula used to estimate the distance is:

$$D = 10^{\frac{txPower - RSSI}{10*n}} \quad (1)$$

We used $n = 2$ as the path loss exponent because we expect a typical outdoor environment.

3 System Design

3.1 Application Interface

3.2 Data Sharing

4 Results

5 Conclusion

References

[1] M. Lodeiro-Santiago, I. Santos-González, P. Caballero-Gil, and C. Caballero-Gil, "Secure system based on uav and ble for improving sar missions," *Journal of Ambient Intelligence and Humanized Computing*, vol. 11, no. 8, p. 3109–3120, Oct. 2017. [Online]. Available: http://dx.doi.org/10.1007/s12652-017-0603-4