Waypoint Based GPS Tracking System

Shawn Lobo, Stefano Alvares

Abstract— This paper proposes an Android based system to monitor a user's movements and send his/her location to the assigned contact to let them know they are safe. This is very beneficial in cases where the parent is not able to be around their children all the time and thus helping them in knowing where their child is through real-time monitoring or via SMS. Thus, this application really benefits working parents and thus making their everyday busy schedule a little less demanding. This is very easy to use and affordable as it requires an internet connection and an Android based smartphone to track movement and send updates. This technology also proposes a way to use the application offline either as a fallback or for devices without an active internet connection. This project can be implemented on multiple mobile platforms.

Index Terms— Android, Child Tracking, Cross Platform, Geo-fence, Global Positioning System (GPS), Offline, Short messaging service (SMS).

1 Introduction

In India, a child goes missing every eight minutes, according to data from the National Crime Records Bureau in 2012. This statistic has increased by about 84% between 2013-2015 for people of ages below 15-30 years. Even in a developed country like the U.S. roughly 800,000 children are reported missing each year.

The system proposed in this project is aimed at individuals 13 years and above. Individuals below the age of 13 generally do not possess mobile phones and also, having a mobile phone increases the chances of them being targeted by people with bad intentions. Owning a smartphone is essential in today's digital age. People of all ages, including children possess a smartphone due to the easy availability and relatively affordable costs. In today's digital age, internet connectivity and availability are very common and also affordable. Due to continuous internet connection, it has become possible to connect with people and even monitor their movements and make sure they are safe. As a result, it is very easy to use smartphone to keep track of a person's whereabouts. Given a person's busy work schedule or other commitments, it is not possible for that person to keep track of their loved one's whereabouts, especially children.

A number of systems have been designed specifically for parents to keep track of their children's whereabouts. Android being the most commonly used mobile Operating System will be used for this project. Unlike other platforms like iOS or less used ones like Windows or Blackberry OS, Android provides easy access to device hardware without compromising on security and easy implementation as well as a vast number of devices to service the application on.

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2 Background

2.1 Safety

Safety is a concern today with an increasingly high number of people going missing. This affects a large number of people especially working parents who are unable to keep a constant tab on the whereabouts of their children. In densely populated regions like cities or metropolitan areas missing children are very hard to track down.

2.2 Existing Systems

The recent developments in mobile software and technology, it has become possible to leverage mobile devices for safety purposes among the various other existing services.

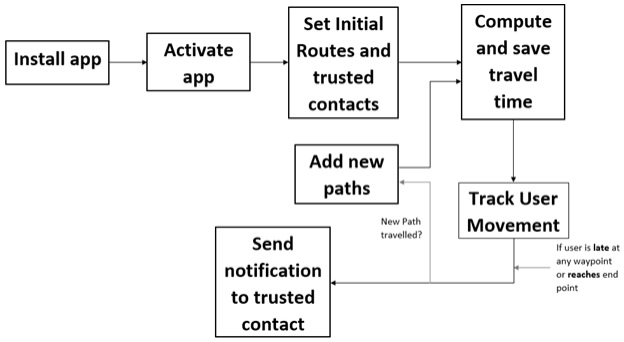
Rapid adoption of the Internet and constant connectivity has made it easier for people to be connected with each other. This has also reduced the cost of communication exponentially which makes it cheaper and faster for people to talk to each other even if they are separated by large geographic distances.

Global Positioning System (GPS) has become a common system which is used by a large number of applications and services. Location-based service (LBS) is the latest service which has been incorporated by a large number of service providers.

Constant location tracking has made it possible to know where an individual is at any given point of time with a good level of precision. This can be used for sending parents periodic updates about the whereabouts of their children without having to call them up to ask the same.

Using the above-mentioned technologies, we can create a system which can enable constant tracking of an individual and send periodic updates of their whereabouts to their trusted contacts.

3 PROPOSED SYSTEM



The proposed system is an Android based application. The user installs the application on their Android powered device and uses it for sending location updates to their family members.

The system begins with asking user for permissions for accessing the device GPS and internet access. The user has to set their trusted contacts which are normally family members. The user then sets their travel routes and the application saves it. The application keeps track of user movement and even saves an approximate travel time for each route.

The application sets waypoints with a geo-fence around each point on the route. The waypoints can be used to set triggers when a user enters in the geo-fence. Based on the user's movement, if a user exceeds the approximate time, the application sends a notification to trusted contacts. If the user travels on a new route, then the application adds it as a new route which can be used for future travels. In case of no internet connection, a SMS is sent to trusted contacts.

4 SOFTWARE REQUIREMENTS

4.1 REALTIME DATABASE

A real-time database is used due to its performance and scalability. Apart from this, the database will process massive amount of data and perform calculations and synchronize the various clients (Android application and Web Console) of the application. The database will perform key functions such as user authentication, session handling and data storage.

4.2 REALTIME SERVER PROGRAMMING LANGUAGE

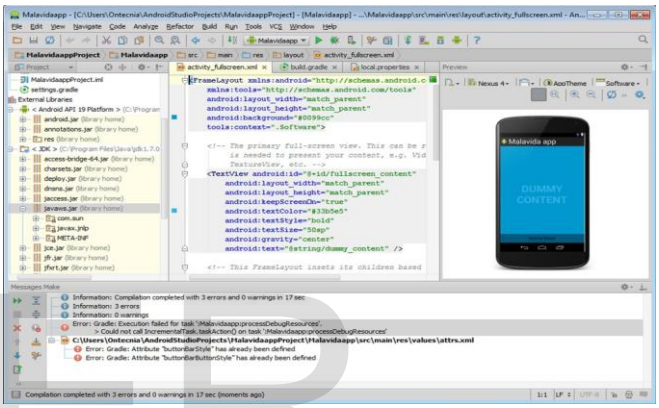
While most of the computation is performed on the device itself, the server is used to synchronize data across the user's devices. A real-time programming language is used to provide asynchronous request and response architecture to improve the performance and scalability of the system.

4.3 SMS GATEWAY

The SMS gateway comes into picture when either the mobile client is offline (not connected to the internet). The SMS gateway will transfer encrypted packets of data to and from the server.

4.4 APPLICATION DEVELOPMENT IDE

Android is an operating system for mobile devices based on the Linux kernel. The Android SDK is supported by a number of integrated development environments, however we selected Android Studio which is the best IDE integrated with the SDK as it is developed and maintained by Google LLC which is also the developer of the Android Operating System



5 PARTS OF THE TECHNOLOGY

5.1 ANDROID APPLICATION

The android application provides most of the functionality required for operation. The user must download and install the application in order to register for the service. After installation of the application, the user must create an account and login. The app allows the user to set trusted contacts to whom alerts will be sent. After setting the contacts, the user must set waypoints on the path. Every waypoint has a geo-fence attached to it with which the tracking is achieved. Apart from this, the application can be used to monitor another account that has listed it as a trusted contacted.

5.2 WEB CONSOLE

The web console is an extension to the mobile application. A guardian need not necessarily have the application to monitor progress. This can be done with the help of the Web console. The web console provides similar functions for

monitoring like the application. The guardian needs to be listed contact in order to use the web console. Apart from this, the web console also allows modifying parameters of the application from the web. Parameters like contacts, waypoints, priority and other functions can be updated.

6 LIMITATIONS

The proposed system offers a solution for a person's safety, but every technology has some limitations. Some of the limitations in our proposed system are listed below:

(1) Cannot be used by children of lower age groups as possession of a mobile device may amount to an increased threat to a child's safety.
(2) It is essential that the user is capable to operate an android smartphone which makes the application unusable for a particular age group, especially children.
(3) Application does not work when the mobile device is switched off.
(4) Can raise false alarms due to uncertainty.

7 CONCLUSION

This project represents a solution for tracking between a journey intended for use by people who have to look after their loved ones and children. A key feature of the algorithm is the ability to detect when a device enters a certain geo-fence at some distance, allowing the application to know where the child is and send updates to the parent. Experimental results with a simulation demonstrate the feasibility of the system. In the future we plan to port our system to other mobile platforms, and to extend our system to encompass various other domains.

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