

# GPS TRACKING SYSTEM BASED ON SETTING WAYPOINT USING GEO-FENCING

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**Abstract—** In this paper we propose an Android-based application to help working parents keep a track of their children's whereabouts in their daily lives. To effectively track a user's movements and where they are, we first propose an efficient and effective method to define a geo-fence for predefined points on a map. This method gets activated when the user enters a certain fence area and sends a trigger. The location updates are output to parents in the form of SMS or an app notification. Performance of the proposed waypoint algorithm is quantitatively evaluated. This is beneficial for working parents who cannot be around their children all the time and thus helping them in knowing their child is safe through real-time monitoring or via SMS

**Keywords—** Geo-fence, tracking, Global Positioning System (GPS), Short messaging service (SMS), waypoint

## I. 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.[7] Even in a developed country like the U.S. roughly 800,000 children are reported missing each year.[6] This number is increasing rapidly as the baby boomer generation ages. Recent developments in GPS tracking, smart phones, and continuous internet connection make it feasible to assist these individuals by developing GPS products that combine tracking technology with other existing technologies. The system proposed in this paper 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.

Existing commercial products include smart phones. Owning a smart phone is essential in today's digital age. People of all ages, including children possess a smart phone due to the easy availability and relatively affordable costs. In today's digital age, internet connectivity and availability is 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 smart phone 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.

Today, there are already a few systems that have some promise for safety; however they only notify people if a person has reached their destination. For example, many applications can be set to call trusted contacts if a person does not reach their destination, or monitor their family member's movements for whatever reasons. They do not take into consideration of the possibility of what happens on the route between the start and the end destination. A big limitation in this endeavour is the fact that in developing countries like India, there is no continuous internet connection and this poses a huge problem for most people due to the cost factor which would be incurred if they use SMS.

## II. TECHNOLOGY REVIEW

### A. Tracking Systems

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 system. 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. Recent developments in mobile computing, GPS tracking, and internet availability make it feasible to assist these individuals by developing GPS-based applications that combine machine learning technology with other existing tracking technologies. Connectivity is essential in today's society. Location tracking has become an essential part of how many companies offer their services and provide an improved user experience. And while this can help the users and those who rely on location based suggestions, there are few applications that can provide navigation based on waypoints which can be used to predict if a user has encountered any delay at some point.

The ability of people who have busy schedules or have significant commitments to be able to keep an eye on the whereabouts of their family will enhance independent living and foster economic and social self-sufficiency. Today, there are already a few systems that have some promise for this use, but they only consider a trip at start and the end. For

example, most tracking applications will save a user's travel routes which the user enters, however it does not take into consideration alternative paths which a user may take to reach their destination faster.

### B. Maps and geo-location based technologies

Some systems for maps and geo-location such as Google Maps might be employed in these and similar situations. Such systems integrate multiple features offered by Google to offer the function of providing a graphical map as output to display functionalities like showing current location, navigation, location search. However, these systems are generally designed for people who are travelling to new locations and for navigating their way while driving or through other means of transport.

Moreover, most applications available rely heavily on the assumption that the user has internet access for sending location data to trusted contacts. However, our system aims to also work in cases where the device is offline by sending data via SMS or other available channels. Furthermore, these systems require a manually set each route they travel by.

### C. Way point based Technique

Our proposed system should effectively handle multiple paths, and provide effective routes and compute the estimated time required for the user to reach. As of now, there are very few systems which offer such functionalities.

We approach the problem in stages. To make sure the device can be tracked at all times, we need to make sure that the GPS is enabled at all times. This may often result in reduced battery life for the mobile device. To extract the data such as location co-ordinates, the application required the predefined user permissions. Then, we store the locations the user visits frequently. It is a challenging problem to automatically set waypoints and the number of waypoints for routes chosen by the user. The waypoints have a geo-fence with a fixed radius around each point on the map.

## III. LITERATURE REVIEW

Various literatures [1, 2, 4] are available on GPS Tracking focuses on navigation purposes, but not so much on using waypoints. These literatures focus on an optimal procedure for setting waypoints between the paths so it can send a trigger when a child enters a specific boundary of the geo-fence. These also focus on using the waypoint system which will be incorporated in this system for guiding UAVs to reach their destination. This is an area of growing interest as automated drones are the latest trend for the current year. UAVs are picking up popularity, especially ones where there is no need for a human controller. The waypoint technology used in these systems can be simplified and adapted to our application for firing triggers when the device enters the boundary area.

## IV. PROPOSED METHOD

This system is developed to make the life of working parents easy. This is a location based system to track a child and send alert the parent if they do not reach their predefined destination. This is very beneficial in case of people who have busy work schedules thus helping them in not having to

worry or stress out about their child's safety when they are unavailable. In order to use this system, all the user needs to do is install the application and give permission to access device hardware which then monitors device movement which means it can be used to tell you where your family members are. The application implements a waypoint concept where a trigger can be set when the child enters the set radius of the waypoint. Thus this application really benefits parents and thus making their work easy as they don't have to worry about their child's whereabouts. This is very easy to use and affordable as it requires a running internet connection and an Android smart phone to obtain the location of the device and send it to the concerned parent. This is now easy to implement as most of the mobile phones today have the required GPS and computation technology in order to give a rich user experience and track movement and calculate the waypoints. This system can be implemented on a vast majority of existing smart phones.

### A. Application installation and permission setting

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. Figure 1 shows the workflow of proposed system.

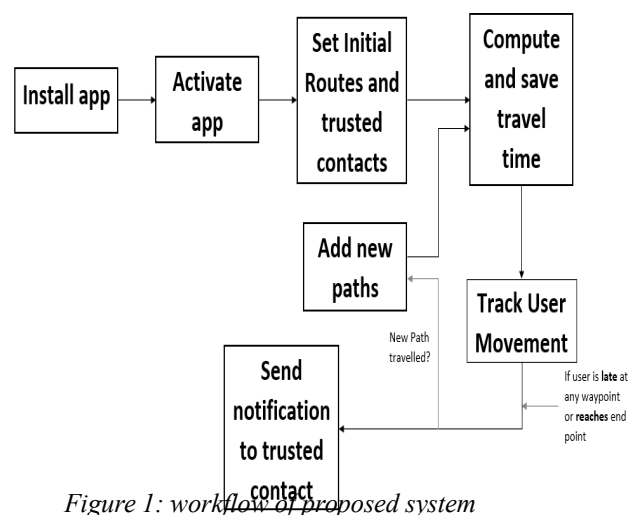


Figure 1: workflow of proposed system

The system requests for user permission for internet and GPS access on initialization. The client needs to set their trusted contacts which are ordinarily relatives or close friends. The client at that point sets their movement courses and the application stores that data. The application monitors client development and even saves an approximate time taken for each travel route. The application then sets waypoints with a geo-fence around each point on the course.

The waypoints can be utilized to set triggers when a client enters or exits the geo-fence. If a client surpasses the time taken to reach a specific waypoint, the application sends a message to saved contacts. On the off chance that the client goes on another course, at that point the application includes it as an alternative course which can be utilized for future purposes. If there should arise an occurrence of no internet availability, a SMS is sent to saved contacts

### B. Algorithm for finding path

Readings Digital maps had several advantages over the print equivalent – different zoom levels, ability to add your own points of interest, etc. but perhaps the most attractive feature was the ability to use the computer (or smartphone) to calculate the shortest distance from point A to B without needing to figure it out yourself or asking someone who has lived in the place long enough to know it by experience

This point is where Dijkstra's shortest path algorithm is used. This could be used to compute the shortest path between two points which is helpful for navigation purposes.[10] While Dijkstra's Shortest Path Algorithm was the original algorithm used for navigation purposes, many developers are moving to newer algorithms such as A\* Search Algorithms and similar algorithms which are extensions of the Dijkstra's algorithm. This algorithm has not been directly implemented in this system but forms the basis of the system.

### C. Software Requirements

#### a. Real-time Database

A real-time database is utilized because of its fast execution and adaptability. Aside from this, the database will process huge amounts of information and perform calculations and synchronize the different clients (Android application and Web Console) of the application. The database will perform key operations such as client authorization and validation, session handling as well as data storage.

#### b. SMS Gateway

The SMS portal comes into picture when the user does not have a working internet connection. The SMS portal will exchange user location details to and from the server.

#### c. Web Browser

A web browser is used to access the interface to the web console of the application. The trusted contacts can view the user's current location through the web console

#### d. LAMP STACK

LAMP stack is a popular open source web platform commonly used to run dynamic web sites and servers. It includes Linux, Apache, MySQL, and PHP/Python/Perl and is considered by many the platform of choice for development and deployment of high performance web applications which require a solid and reliable

foundation. Since its creation, the LAMP model has been adapted to other componentry, though typically consisting of free and open-source software. The modularity of a LAMP stack may vary, but this particular software combination has become popular because it is entirely free and open-source software.[9]

## V. RESULTS AND CONCLUSION

### A. 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 which 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. Figure 2 and 3 show the snapshots of Android App.



Figure 2: Splash Screen

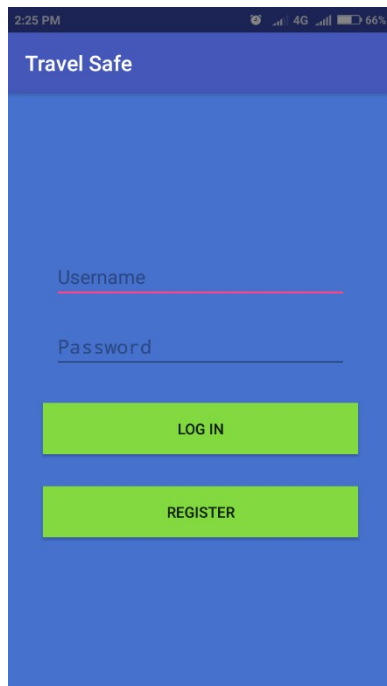


Figure 3 Login Screen

### B. 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. Figure 4 shows the snapshot of current location.

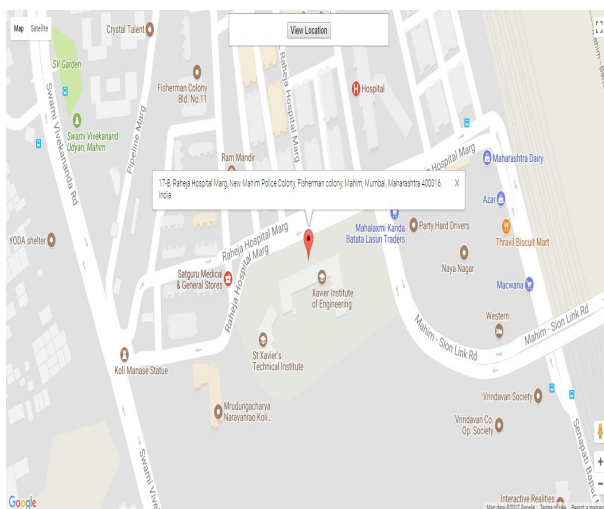


Figure 4: Current Location

## VI. CONCLUSION

Proposed system 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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