Virtual Fencing for Mobile Silencing

[1]Sunitha P, [2] Margaret R E, [3] Suvin Brahma, [4] Vallish Bharadwaj A, [5] Shashank S J

[1] [2] [3] [4] [5] Department of Computer Science and Engineering, Malnad College of Engineering, Karnataka, India.
Corresponding Author Email: [1] ps@mcehassan.ac.in, [2] rem@mcehassan.ac.in, [3] suvinbrahma@gmail.com,
[4] vallisha94483@gmail.com, [5] shashanksj6247@gmail.com

Abstract— Mobile devices are becoming really important now a days as they are usually the main tool for communications. Mobile devices like smartphones and tablets has been used widely inrecent past years. However, the main function of mobile phone which is the ringing sound has created nuisance in certain circumstances such as in important meetings or inside places like library, cinema and prayer area. The above issue occurs because most of the users forget to switch their mobile device into silent mode. To address the problem, the paper presents a novel approach of automatically switching mobile devices into silent mode. Virtual fence is created around a specific area based on geofencing technique. Whenever a mobile device crosses the virtual fence into the area, the device will be automatically switched into silent or vibrate mode. The device will be switched back to normal mode once it crosses the virtual fence to exit the area. The current location of the user is accessed based on the Global Positioning System (GPS) data provided to the device. The advantage of this application over other geofencing applications is that the geofence locations will be preloaded in the application, allowing applications to reuse the data locations.

Index Terms— Geofence, Virtual, Network.

I. INTRODUCTION

Mobiles are the devices that three quarters of the world's inhabitants have access to, according to the World Bank. With the arrival of the Smartphones, the functions increased, and so did the sounds. Now a days, people are inseparable from their phones and have lost the human side of socializing in some ways. Whenever people are in the public places like Courts, Colleges, Hospitals, Libraries etc., their mobile phones should be made silent, to maintain discipline and to give respect to the places (such as Courts). All smartphones can be turned into silent mode by setting it manually by pressing the volume button. If they forget to mute their mobile phones, it leads to unnecessary problems like Courts may punish, mobiles may be seized in colleges, cause problems to patients in hospitals.

Obviously in libraries mobiles have to be in silent mode because silence is the most basic rule in libraries. And especially on trains. Why? Because ringtones can be very annoying. And closed spaces reflect sound from all walls, the ceiling and the floor, trapping the sound inside the room and making it even more obnoxious.

The main objective of the project is to avoid all these consequences occurred by not muting the mobile phones .Hence, an app is developed which automatically mutes the mobile phones based on user specified location. User has to specify at which place his/her mobile should be silent. The developed.

Phone Silencer App is an Android Application which mutes the smart phones when user enters a specified premises and unmutes when the user leaves that specified premises.

The project is mainly based on the location of the smartphone. The app fetches the user's location in regular intervals of time and then performs the desired operations like Mute/Unmute the Smartphone based upon the location.

II. LITERATURE SURVEY

Nowadays, a lot of smartphone has been produced in the mobile market. Mobile phone manufacturers such as Samsung, Apple, HTC, Sony and many more are competing each other to produce their best smartphone with a lot of functions. One of the functions of the smartphone is the ringer volume. In general, all smartphones can be turned into the silent mode by setting it manually by pressing volume button. However, there are the software application that turn the volume into silent mode automatically based on predefined setting. Every mobile manufacturer just focus on the technology for the future but forget that the ringer function can be their future technology [2].

Authors [5,6,7] have made survey on the effect of smart phone notifications on health of the human beings and have reported that it is leading to hypertension and inattention in the daily lives of the people. They have triangulated correlational and experimental methods and have analyzed that phone interruptions might cause symptoms of ADHD in the general population. Consequently, it becomes critical to identify a means to switch mobile phones into silent mode automatically during acute situations.

Applications like Shush! and Phone Silencer: Schedule mute, is available for free on the Play Store. It allows to control the duration of smart phone in Do Not Disturb mode. It allows to set exact duration to fit user needs, and not just from hour to hour. Polite app also switches the mobile into silent mode (or vibrate mode) automatically at the right times. Supports few features like:

- Can mention specific times in weekly schedule to automatically enter into silent mode.
- Phone can enter into silent mode during calendar

events in the calendar app.

- Keywords such as "meeting" can be set and Polite be used to keep phone into silence.

Android Timer Based Phone Silencer App is a project which allows the user to set the phone to silencer mode by predefining the date and time so that the phone does not ring while attending a meeting or in an important situation. In this project, the front-end involves XML, Android-Java and the back-end involves SQLite.

The Global Positioning System (GPS) is a space-based navigation system that provides location and time information in all weather conditions, anywhere on or near the Earth, where there is an unobstructed line of sight to four or more GPS satellites. GPS was originally designed in the early 1970s for the United States (US) military by the US Department of Defense (DoD). Current GPS system offers critical capabilities to military, public and commercial users around the world. The system is maintained by the United States government and is freely accessible to anyone with a GPS receiver. GPS consist of approximately 30 satellites orbiting in Medium Earth Orbit around the Earth. 24 satellites provide global coverage through the precise radio signals that the satellites are transmitting which consist of the satellite's position and the time they transmitted the signals. The signals can be easily received by GPS receivers, allowing the calculation and determination of the accurate location, speed and time information. Using this information, GPS receivers triangulate data and pinpoint user location [3].

Geofence is a tool or software program that uses the GPS to create a virtual perimeter or barrier around a real-world geographical area. The procedure of using a geofence is called geofencing which uses the same concept as location-based service (LBS). LBS is a common class of computer program-level services that use location data to control features. A geofence can be used to trigger an activity in any geoenabled mobile devices. Geofencing can be used to trigger automatic notifications when a device enters or exits the boundaries defined by the application. Many geofencing applications incorporate map services such as Google Maps and Apple Maps, allowing the applications to create boundaries on top of a satellite view of a specific geographical area.

Geofencing main feature is to define the Boundaries using longitude and latitude. In addition, it supports a lot of potential usage. For instance, parents can receive an email or text message that is automatically generated when their child leave from school and arrive at home. The geofence would be a virtual geographic barrier placed around the school and house. When the child's smartphone or GPS tracker exits or enters the geofence, a notification will be automatically sent to the parent by the geofence application on the device. There are many advantages on using geofence because it can be very useful in many situations. With the ability to send an alert to the user, it can act as a reminder, advertising and many more [3].

Kole [4] has made a survey that in Australia, government has taken initiative to make mobile phone in silent mode in public transit. Similarly in France, bullet trains have exclusive compartments as "zen zones" where travelers can opt for these compartments during reservations. "Cellphone free zones" are created in Sweden for travelling in subways, buses and commuter trains so that people can have a peaceful travel.

The apps developed to automatically switch the cell phones to silent mode are to be installed and are not cost effective. To overcome the above limitation, the project aims to design a cost effective app using geofencing technique.

III. APPROACH

Hearing ringtone blasting during an important meeting or wedding ceremony is enough to make anybody cringe. But having ringer turned off and missing an important call can be a big problem. It becomes critical to put the Android phone onto silent when needed and then turn the ringer back on manually. There are several ways to automatically turn silent mode on and off on your Android phone. Few of them are listed below.

- Toggle Silent Mode Using Do Not Disturb.
- Control Your Android Ringer With IFTTT : A popular tool that lets you link all sorts of services together, including functions on your Android device.

The novel approach of geofencing-based auto-silent mode application for Android is developed using Android Studio Software Development Kit (SDK). Android Studio SDK is used to design the user interface (UI) and to code the main activity java codes. It also acts as an emulator to test the running project or application without installing the application on an actual device. Android Studio SDK is the official Integrated Geofencing- based Auto-Silent Mode Application Development Environment (IDE) launched by Google, for Android application development, is based on IntelliJ IDEA's powerful code editor and developers' tools.

The project develops application that uses ACCESS FINE LOCATION permission to acquire the user's device address level location, allowing the application to acquire precise location information of the device. It also uses INTERNET and ACCESS NETWORK STATE permission for Assisted GPS (A-GPS) ability. A-GPS significantly improves startup performance and time-to-first-fix (TTFF), of a GPS, thus allowing faster and more accurate location determination. TTFF is a measure of the time required for a GPS navigation device to acquire satellite signals and navigation data, and calculate the fix position solution .The Google Maps application provides program interface (API) key for the application to access and uses the Google Maps service. The API key is provided by Google to allow communication with Google Services and their integration to other services.

Figure 1 illustrates the flow of control of the app. Initially, the GPS of the system is enable. The app fetches the location

using GPS. The app checks whether the user is within the Geofence Area and triggers the Silent mode of the smart phone. If not, the mobile phone switches back into normal mode.
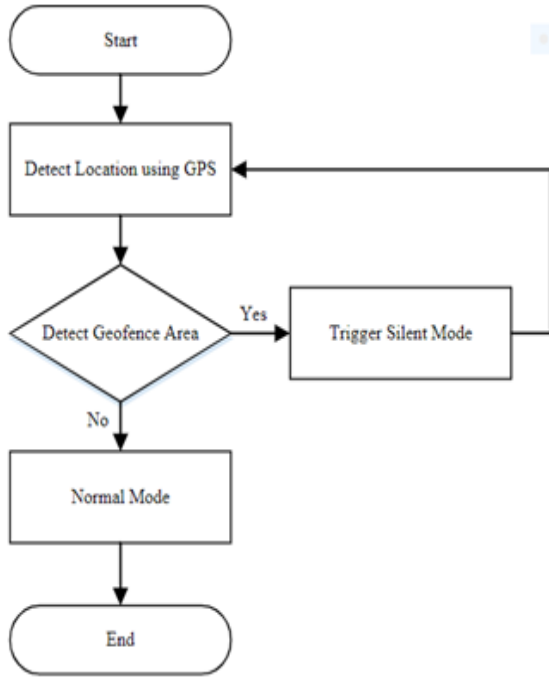
Figure 1: Architecture of the model

There are 3 types of geofence transitions which are:
- GeoFence Transition Enter
- GeoFence Transition Exit
- GeoFence Transition Dwell

Each transitions has its own function. Initially, GEOFENCE TRANSITION ENTER will turn the smartphone into silent/vibrate mode when user enters the geofence and sends a notification to alert the user.

The next transition, GEOFENCE TRANSITION DWELL, will keep the smartphone in silent/vibrate mode. This transition will prevent the smartphone from switching back to normal mode as long as the device remains in the geofence area.

The last transition, GEOFENCE TRANSITION EXIT, will switch back from silent/vibrate mode to normal mode when the device is exiting the geofence area and sends a notification to alert the user.

IV. RESULTS

Once the application is developed completely, it needs to be tested on real circumstances. The application is side loaded to an Android device by using Android Studio. The application is then evaluated on an actual device to test the stability of the application and the geofence transitions. The virtual device emulator in Android Studio cannot evaluate the geofence transition as it does not have a GPS transceiver.

The screen shot of the designed app is given in fig. 2 and fig 3.
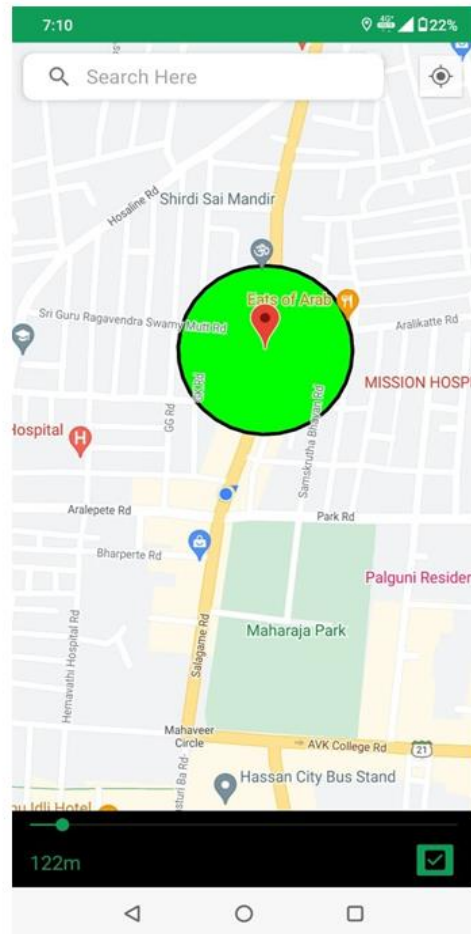
Figure 2: Radius of a Location
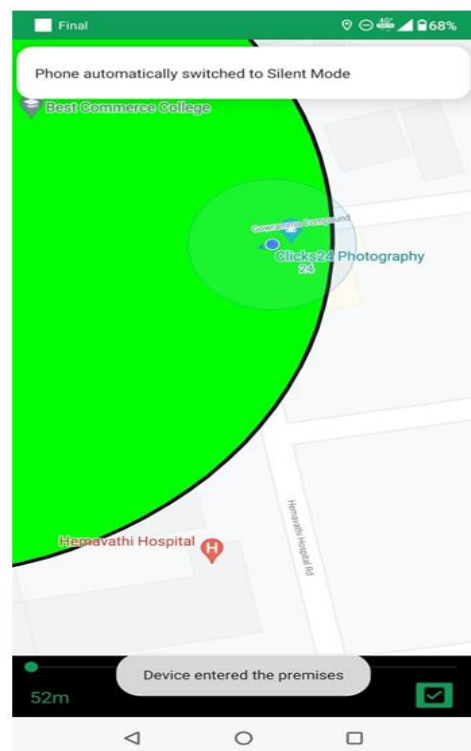
Figure 3: Device entering the premises

After specifying the circular region in which the mobile should be silent, a click of a button at bottom right, app starts the present location and whenever user enters the circular region mobile is muted as shown in the below screenshot. A message "Device Entered the premises" is displayed which is at the bottom and at the top a notification is displayed "Phone automatically switched to Silent mode". Later a pop-up window is displayed to store that particular location which consists of Name, Address (position at which mobile should be silent. It is basically the Centre of the dotted circle which is shown in Fig. 3) and the Radius of the location (Fig. 2). When "Save" button is pressed the data will be saved on to the database, and can be retrieved to the other tab present in the app i.e., "Mute Points".

V. FUTURE WORK AND CONCLUSION

In this project, the development of geofencing-based auto-silent mode application has been presented. The application is developed for Android mobile platform using Android Studio SDK, but the concept can be easily applied to other mobile platform such as iOS, Windows Phone or Blackberry. This application is developed based on the geofencing technique where virtual fences will be created around specific areas. Whenever the mobile device crosses the virtual fence into the area, the application automatically mutes or switches the device into silent/vibrate mode. In addition, a notification is sent to the device's notification bar to inform the user. When the device leaves the area and crosses the geofence, the application switched back to normal mode.

The accuracy of the location information can be improved by using Assisted GPS (A-GPS) or other positioning techniques. The main advantage of this application over other geofencing applications is that the geofence locations can be preloaded in the application. This concept allows applications with specific purpose to be developed. For instance, an application with the location of all the mosque/temples in the world can be developed, and whenever users enter any mosque, their devices will be automatically turned into silent/vibrate mode. This will solve the problem of ringing phone disturbing the concentration of congregation performing prayer in the mosque. Separate application for other places that require silence such as cinema, library and lecture halls can also be easily developed.

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