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SECURE LOCATION TRACKING OF FAMILY AND FRIENDS USING GPS ONLINE AND OFFLINE

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Abstract: ***In today's life most of the people uses Android hand-held devices, which provides users with great opportunity to innovate and get things done in a mobile device. Now a days android stared as phone operating system as every system started using android operating system, the need of portability risen. So applications related to every single need are available in market. GPS is another very important feature in the system. So, GPS is used to track location every possible object. To save time as well as money, we need more advance location tracking services. GPS is a system that is present from long time to track exact co-ordinate position of objects, it is an open network, anyone can access easily without any restriction.***

The goal of the project is to present the design and implementation of a tracking system using on Android phones GPS location on maps, able to find persons in case of emergency and give a set of necessary information for rescue. After using GPS the information collected from GPD, we needed a cellular device to calculate the information gain. So to track location android device is best choice. In this application, the provides the security for family safety issues, tracking android devices and android users for finding the location of users by using GPS, Internet and Mobile sensors.

Keywords: ***Android, Communication System, Networking, GPS.***

1. INTRODUCTION

Accounting for more than half of the presently used hand-held devices, Android, as an operating system, has provided users with great opportunity to innovate and get things done in a mobile device. Starting as a phone OS, the array of devices compatible with Android is even driving the market in the direction of PC experience with rumors that Intel and some of the partners are working on laptop prototypes with Atom processors. And so, the need for portability has risen by leaps and bounds. People have started developing apps for every other need.

With recent technological advancement of modern science people are now expecting the information about the location of any object for

tracking purposes. Presently, we want more location based services for being advanced and to save time and money also. GPS is a system which is already implemented and everyone can access it without any restriction. Having the facility of GPS to develop this system we need a cellular GPS device to calculate the location from the information taken from GPS. Hence, we have chosen Android device to perform this calculations because Android mobile phone is cost effective and offers multidimensional purposes having some special built-in features like GPS service. Thus, this system is developed for location tracking of a group of people with a notification, massage alert system using various latest demanding tools and technology like Java, android, JSP, java script, html, CSS, Google places APIs, Google's material design, firebase notification.

The first part of the project involves Android Application Development of a GPS based Location Tracker in which with the help of any mobile device (app installed); any other GPS enabled handset (app installed) could be located. Though target user may be located anywhere in the world, he must have network connectivity and/or be GPS enabled.

There are many situations which request a tracking and localization system. Some examples are cpersons tracking and localization in case of accidents or disasters. Due to the hardware and software characteristics of the smartphones, these devices are suitable to work as terminals for such a system. The goal of the project is to present the design and implementation of a tracking and localization system using on Android phones GPS location, able to find persons in case of accident or any other emergency and give a set of necessary information for rescue. The system sends the GPS coordinates of the person, display the coordinates on a map and computes the shortest route to the accident site.

In this application, the system provides the security for family safety issues, tracking android devices and android users for finding the location of user by using GPS.

2. GROWING IMPORTANCE OF ANDROID PHONE

Android is software for the mobile devices that includes an operating system, middleware and key applications. The Android SDK provides the tools and APIs necessary for developing applications on the Android platform using the Java programming language. The Android is a Linux-based operating system for mobile devices such as Smartphone's and tablet computers. It is developed by the Open Handset alliance led by Google.

It is the largest community of developers writing applications that extend the functionality of the device. Developers write primarily in a

customized version of Java. The Android applications can be downloaded from the third-party sites or through online store such as Google Play which is maintained by Google.

3. FEATURES

3.1 SOS Feature:

SOS is a feature that can alert your family and emergency respondents to a potential situation. If any person feels insecure (serious trouble), then he/she can just press a dedicated SOS key or Panic button of the phone. Thereafter, this feature will automatically send an alert to a set of emergency contacts or nearest police station and help him/her get rescued. Many experts found that there should be one feature in smartphones that can provide immediate and real security to a person who is in real trouble. So they have come with this interesting feature. Using this feature, if a person found himself in a big trouble, then he can press SOS key to send an alert to nearest police station. In short: this feature will act as an emergency alarm and send SMS to pre-set numbers.

The SOS feature will take pictures from your front and rear camera, and record a clip of the ambient audio. It will then attach these files to a message containing your exact location with the words “I need help,” and this will be sent to all of your emergency contacts.

3.2 Group Management:

In group management feature of this proposed application provides feature of creating family and friends groups. To use SOS feature the family group is considered for sending emergency messages with location. So that emergency message will sent to only users family members. The user can create any number of family and friends group. Family group type is always private and friends group may be private or public as per users’ choice. User can see the current location of all group members on map. Only the user who created the group will be admin at very first and only and admin can delete group.

3.3 Location Tracking:

In this proposed the Location Tracking is main feature and by providing location of user to family members and friends application is going to provide the best security to user. To track location of user GPS and Internet is used. The tracking is performed in case of offline that means without internet by using only GPS. Location of user is updated after some time slots on server continuously. And get fetched after every request for the location by user.

In online Location Tracking internet is used with GPS. By fetching location using GPS user come to know about current location of user. Latitude and

longitude is get updated to server in online case. In offline case Latitude and Longitude will store in mobile memory itself to avoid interrupt while using application for location tracking. By using Osmdroid android library osmdroid map is used to show map even in offline case (Without Internet). Osmdroid Android library that provides Tools/Views to interact with Open Street Map-Data. The Open Street Map View is a (almost) full/free replacement for Android's MapView class.

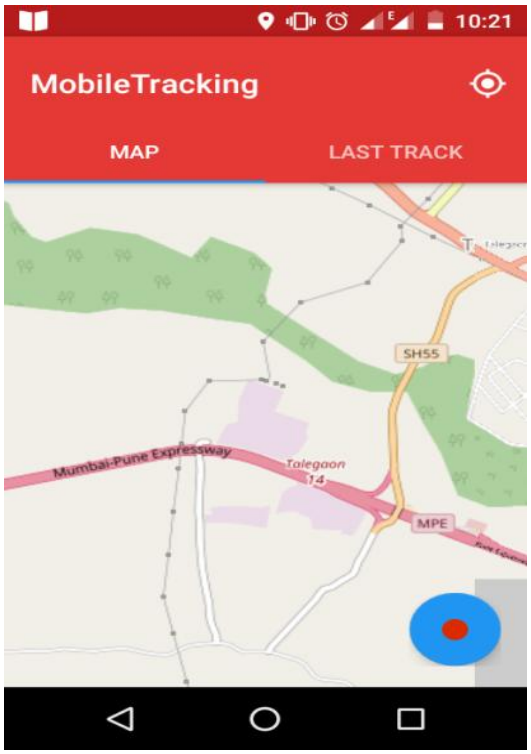


Fig 1: Offline Map

3.4 MySql:

MySQL is open source relational database management system (RDBMS) which is freely available and makes use of Structured Query Language. It was widely used open source client server RDBMS. It is one of the best RDBMS being used for developing web-based software applications. MySQL is developed, marketed, and supported by MySQL AB, which is Swedish company. It makes use of a standard form of the well-known SQL data language. It has become popular because of its features. MySQL is released under an open-source license. So you need not require paying. It is capable of handling a large subset of functionality of the most expensive as well as powerful database packages. It is scalable and it has the ability to handle almost any amount of data. It is a secure database. It includes solid data security layers which protect sensitive data from intruders. It supports the several development interfaces like JDBD, ODBC ad scripting (PHP and Perl). It can be executed under a number of operating system.

4. MATHEMATICAL MODEL

1. Let S be a system that described online cloud compiler

S = {....}

2. Identify input as I

S = {I,..}

Let I = {i1, i2}

i1: OTP, Username, Password.

i2: latitude, longitude, altitude, bearing.

3. Identify output O

S = {I, O}

O = {get tracking information of other user via web service response, or via push message or via Message}

4. Identify the processes as P

S = {I, O, P,....}

Let P = {p1, p2, p3, p4, p5, p6}

P1: Authentication

p2: get current location and sync it with server

p3: track other user

p4: receive response or receive push message or receive Message

p5: get location details (address) from Google places API

p6: Display the output using list

5. Identify failure cases as F.

S = {I, O, P, F,....}

F = {Failure occurs if user is not valid and server fails or no GPS found}

6. Identify success cases as s.

S = {I, O, P, F, s....}

s = {Success occurs when receive other user location tracking details successfully by using we-service response or push message or sms}

7. Identify Initial condition as Ic.

S = {I, O, P, F, s, Ic}

Ic = {User should get registered by providing all details}

5. PROPOSED MODEL

This Proposed System contains following modules:

5.1. Emergency Alert:

In this module, one emergency button is provided so that by clicking this particular button that particular user can inform to his emergency contacts (members) which are set previously in emergency contact list by user.

This module provides safety to the user.

5.2. Self-Tracking:

In this module, user can track location of himself in both cases with and without internet. In case of absence of the internet, using osmdroid library of android is used to show map without internet.

When user want to track himself that this module will be very beneficial.

5.3. Friend and Family Member Tracking:

There is facility of groups provided in this proposed system in which public and private groups for family and friends are maintained. User can track the location of any particular members of any groups by clicking on that member.

It is helpful to get the location of the particular member to track that member and to know where that user is located. If case of emergency and mobile phone theft, this feature of system will be very beneficial to the user.

5.4. Finding Nearby Friends:

In this module, It provides the facility to set the radius to specify nearby area of user, In which the users who are in this area will be shown on map. Location of that members will be also shown using markers with date and time.

When user want to see people who are in nearby places, This module will be useful.

5.5. Three Call Attempts:

After three full call attempts if user does not receive call in specified time. To ensure that where that user is located. So that After knowing location user calling user will come to know at least location of user. This for security purpose.

5.6. Low Battery Alert Feature:

When user is in danger area and user is feeling unsafe in that area. In that case, If mobile phone is going to switch of due to low battery, that time this module will automatically send the location to the emergency contacts to inform people about location and battery status. This helps user to be more secure.

5.7. Three Calls Feature:

In this special feature of system when the user calls at least three times to any other user in five minutes. If full call attempts are done and user who is already registered in this proposed system and log in does not respond to three full calls in five minute that time the location of the user who did not give response will get fetched and send to the calling user for security purpose.

6. SYSTEM ARCHITECTURE:

Following diagram shows system architecture of proposed system:

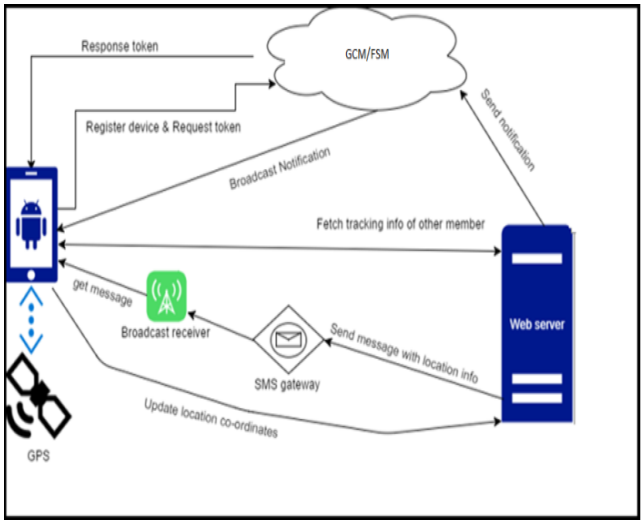


Fig 2: Architecture Diagram

The purpose of system design is to create a technical solution that serves the user. The system should be designed in such a way that is very flexible to use for the user. The preparation of the environment needed to build the system, the testing

of the system and the migration and the preparation of the data that will ultimately be used by the system are equally important. In addition to designing the technical solution, system design is the time to initiate focused planning efforts for both the testing and data preparation activates. This application is a real life problem solving application. The user sections are designed in such a way that all users/family members enjoy the facilities of the application.

7. IMLIMENTATION

This system is implemented according to following sequences of milestones. Frist this system is divided in small parts mentioned as follows then implemented one by one using different techniques:

7.1 User Management:

- Permission Handling
- User Registration
- User Login
- Forgot Password
- OTP for Mobile verification
- User Profile

7.2 Near By Friends:

- Fetch all nearby friends by applying area of radius in KM and / or applying any specific group.
- In this use of the following mentioned algorithm is used to find out distance form one user to another.

7.3 Self Tracking:

- Finding out best location from providers after each 10 Sec update user location onto the map by displaying dotted markers.

7.4 Group Management:

- Public and Private groups feature is implemented
- Creation of groups
- Group management
- Add members in group
- Remove members from group
- Leave user
- Delete group
- Edit group name

7.5 SOS Feature:

- Add or Update emergency contact number
- Send SOS message to emergency contact

7.6 Offline Tracking:

- Prepare deep linking URL which indicates request command send this deep link message to end user, after receiving at end user parse deep linking URL calculate latest

location and send response deep linking response message to requested user.

7.7 Three Calls Attempt Feature:

- Finding three successive outgoing calls attempts in five minute for same number. Count that number of calls and condition of five minutes.
- Check that number is exist in system and belongs to calling users group.
- Show location of that end user.

7.8 Low Battery Alert Feature:

- If battery status is less than 4% it will send message to emergency number which is already set by user.

8. ALGORITHM USED

Algorithm : Input : List of all locations(latitudes-longitudes)

Output : List of nearby locations(latitudes-longitudes)

STEPS –

1. Get all locations from the list with relevant latitudes-longitudes.

2. Find the bounding co-ordinates for given radius and distance, where distance is the distance from the point represented by this Geo-Location instance. Must be measured in the same unit as the radius argument. Radius is - the radius of the sphere, e.g. the average radius for a spherical approximation of the figure of the Earth is approximately 6371.01 kilometers.

2.1 Computes the bounding coordinates of all points on the surface of a sphere that have a great circle distance to the point represented by this Geo-Location instance that is less or equal to the distance argument.

2.2. Find out distance in radians by- radDist = distance / radius;

2.3. Calculate minLat, minLng and maxLat, maxLong by. - double minLat = radLat - radDist; double maxLat = radLat + radDist; double minLon, maxLon; if (minLat > MIN_LAT && maxLat < MAX_LAT)
{ double deltaLon = Math.asin(Math.sin(radDist) / Math.cos(radLat)); minLon = radLon - deltaLon; if (minLon < MIN_LON) minLon += 2d * Math.PI; maxLon = radLon + deltaLon; if (maxLon > MAX_LON) maxLon -= 2d * Math.PI; }
else { // a pole is within the distance minLat = Math.max(minLat, MIN_LAT); maxLat = Math.min(maxLat, MAX_LAT); minLon = MIN_LON; maxLon = MAX_LON; }

2.4 Calculate radians (in terms of degree) for minLat, minLng and radians(in terms of degree) for maxLat, maxLng.

And initialize array of Geo-Location class where - here The latitude of any point within the specified distance is greater or equal to the latitude of the first array element and smaller or equal to the latitude of the second array element.

If the longitude of the first array element is smaller or equal to the longitude of the second element, then the longitude of any point within the specified distance is greater or equal to the longitude of the first array element and smaller or equal to the longitude of the second array element.

If the longitude of the first array element is greater than the longitude of the second element (this is the case if the 180th meridian is within the distance), then the longitude of any point within the specified distance is greater or equal to the longitude of the first array element smaller or equal to the longitude of the second array element.

These are nothing but bounding latitudes-longitudes co-ordinates.

3. Check whether meridian 180 Within distance (boolean) by checking bounding Coordinates [0].get Longitude In Radians () greater than bounding Coordinates[1]. Get Longitude In Radians ()

4. Now find nearby locations by checking every location (each location: lat, lng for each user)

4.1. latitude of each location is greater than or equal to bounding Coordinates[0]. getLatitudeInRadians() and less than or equal to bounding Coordinates[1].get LatitudeInRadians()

4.2

4.2.1 longitude of each location is greater than or equal to Bounding Coordinates[0]. get LongitudeInRadians()

4.2.2 longitude of reach location is less than or equal to bounding Coordinates[1].getLongitudeInRadians()

4.2.3 if median calculated in step 3 is true then calculate ORing of step 4.2.1 and 4.2.2 else calculate ANDing of step 4.2.1 and 4.2.2.

4.3 Calculate acos(sin(location.getLatitudeInRadians()) * sin(Lat) + cos(location.getLatitudeInRadians()) * cos(Lat) * cos(Lon - location.getLongitudeInRadians())) and check whether the calculation is greater than or equal to (distance / radius)

4.4 Calculate whether ANDing of step 4.2.1 result, step 4.2.2 and step 4.2.3 becomes true or false.

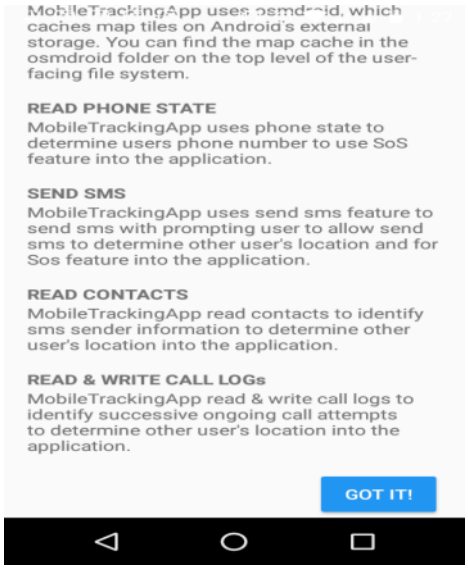
If condition is true that means location(record from list of lat, lng s) of the is within radius range.

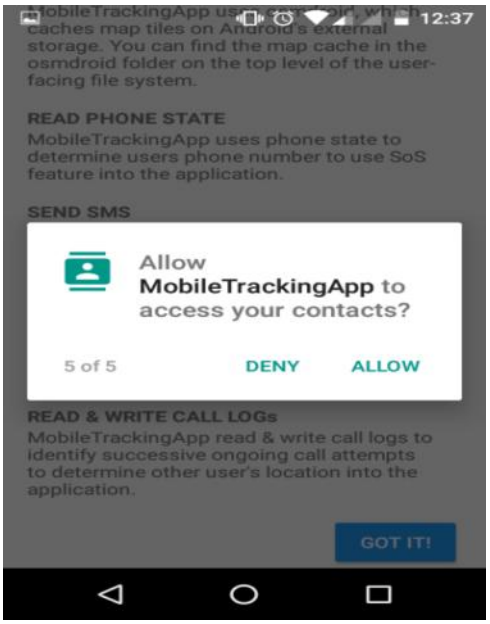
5.Repeat the steps 4.1 to 4.4 for each users location to find whether their location(lat,lng) within range or not.

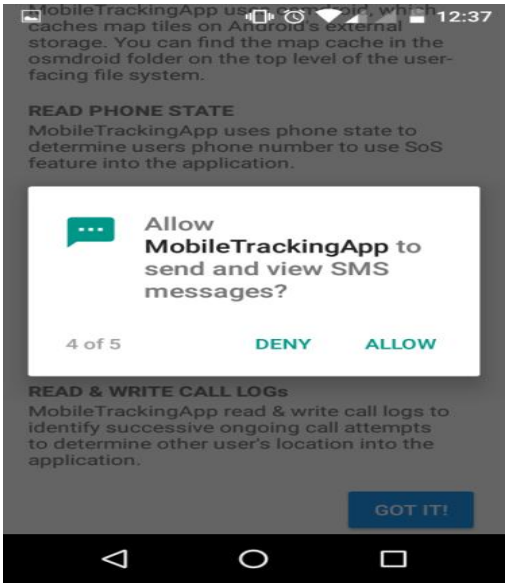
6. Prepare result of locations (list) identified in step 5 those who are within range.

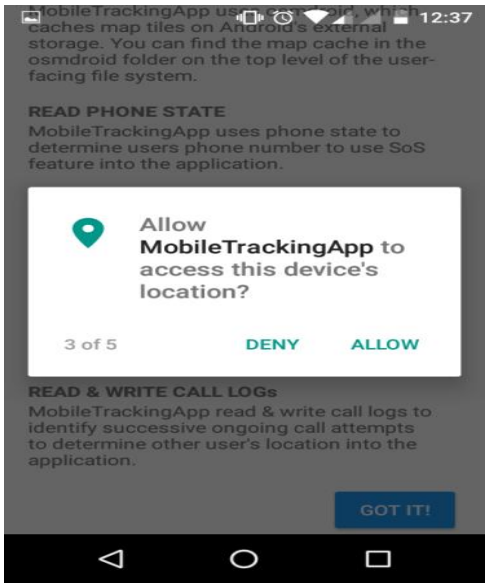
9. RESULT

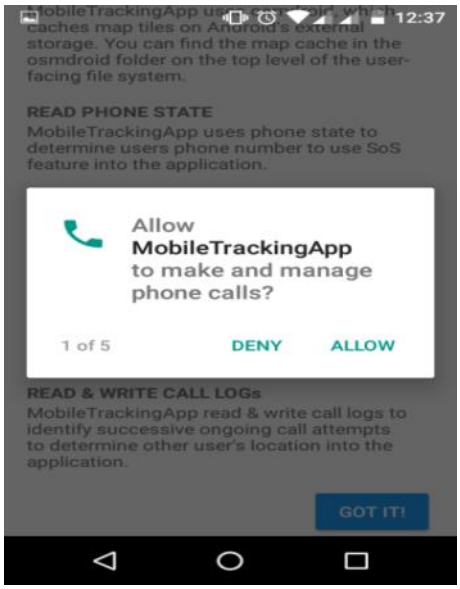
9.1 Information Screen:

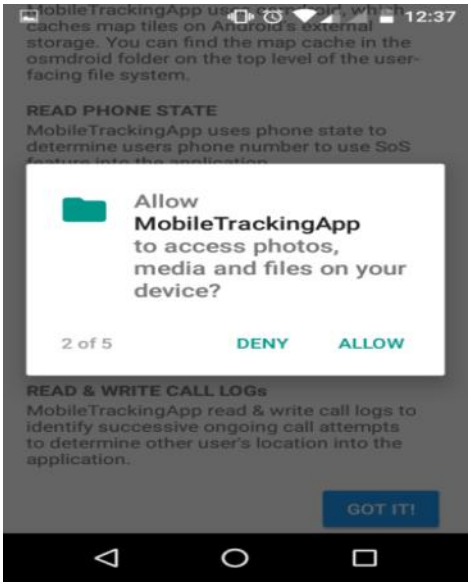


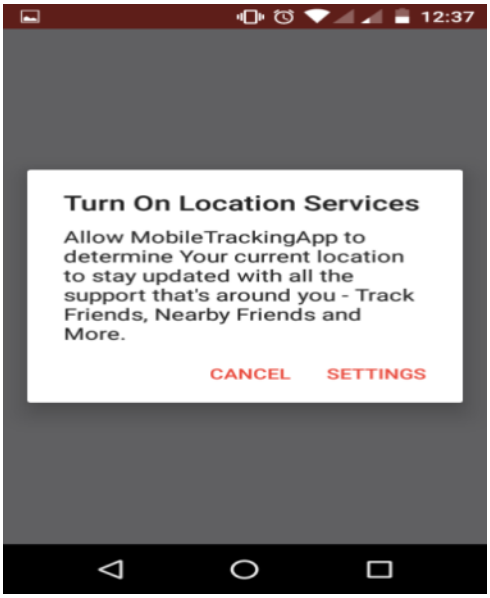


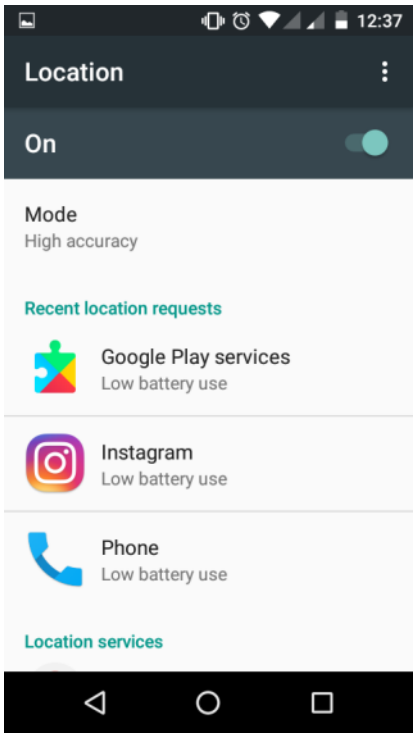



12:37
caches map tiles on Android's external storage. You can find the map cache in the osmdroid folder on the top level of the user-facing file system.
READ PHONE STATE
MobileTrackingApp uses phone state to determine users phone number to use SoS feature into the application.
Allow MobileTrackingApp to access this device's location?
3 of 5
DENY
ALLOW
READ & WRITE CALL LOGs
MobileTrackingApp read & write call logs to identify successive ongoing call attempts to determine other user's location into the application.
GOT IT!

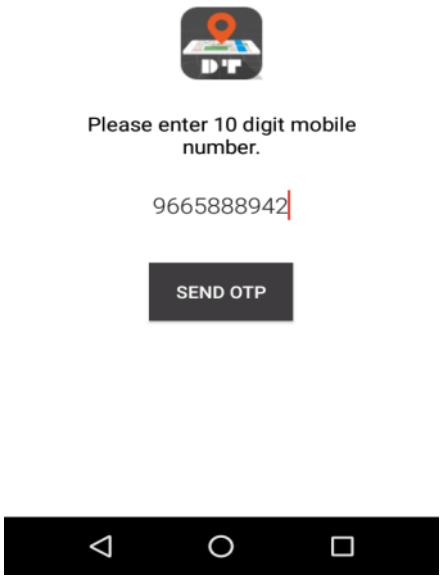

12:37
caches map tiles on Android's external storage. You can find the map cache in the osmdroid folder on the top level of the user-facing file system.
READ PHONE STATE
MobileTrackingApp uses phone state to determine users phone number to use SoS feature into the application.
Allow MobileTrackingApp to make and manage phone calls?
1 of 5
DENY
ALLOW
READ & WRITE CALL LOGs
MobileTrackingApp read & write call logs to identify successive ongoing call attempts to determine other user's location into the application.
GOT IT!


12:37
caches map tiles on Android's external storage. You can find the map cache in the osmdroid folder on the top level of the user-facing file system.
READ PHONE STATE
MobileTrackingApp uses phone state to determine users phone number to use SoS
Allow MobileTrackingApp to access photos, media and files on your device?
2 of 5
DENY
ALLOW
READ & WRITE CALL LOGs
MobileTrackingApp read & write call logs to identify successive ongoing call attempts to determine other user's location into the application.
GOT IT!

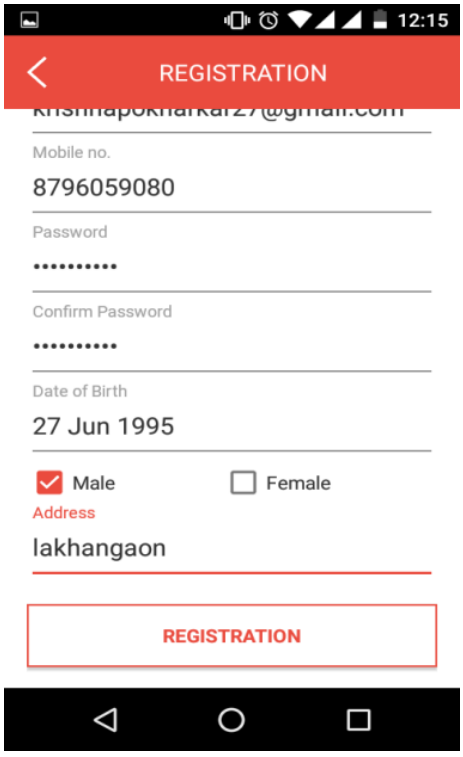

12:37
Turn On Location Services
Allow MobileTrackingApp to determine Your current location to stay updated with all the support that's around you - Track Friends, Nearby Friends and More.
CANCEL
SETTINGS

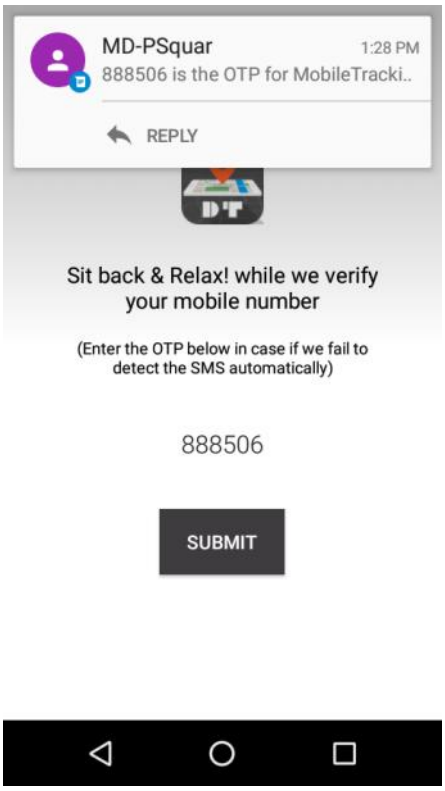


9.3 OTP Screen:

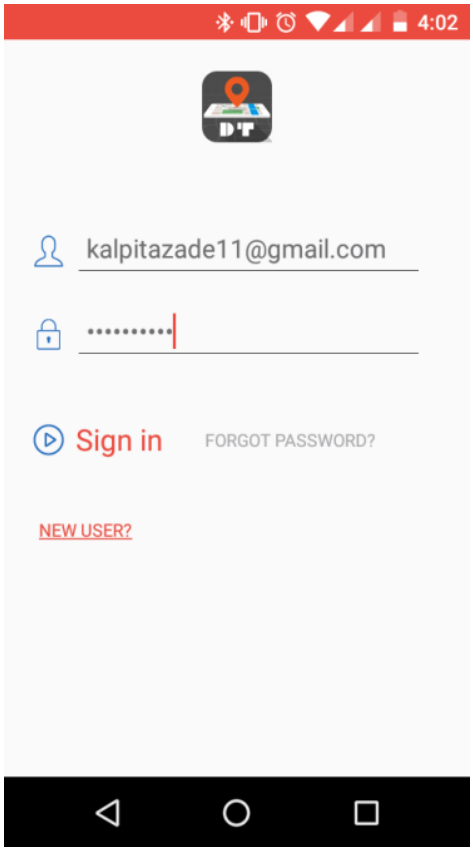


9.2 User Registration Form:

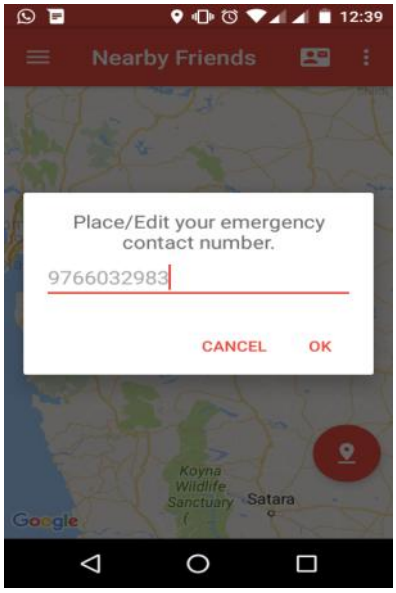




9.4 User Login Form:

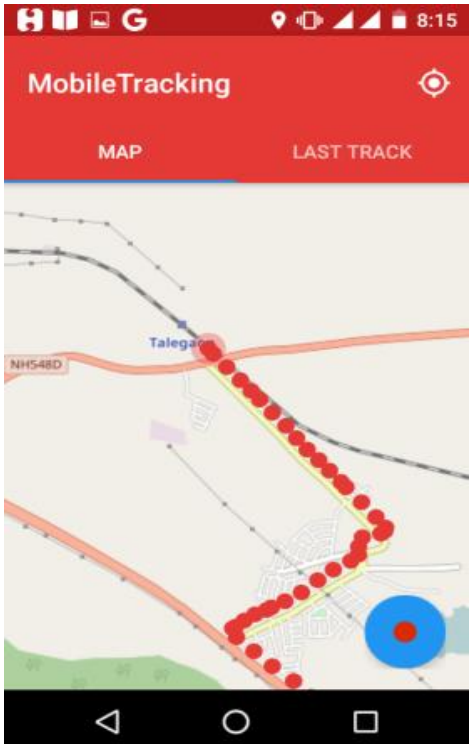


9.5 Setting Emergency Contact:

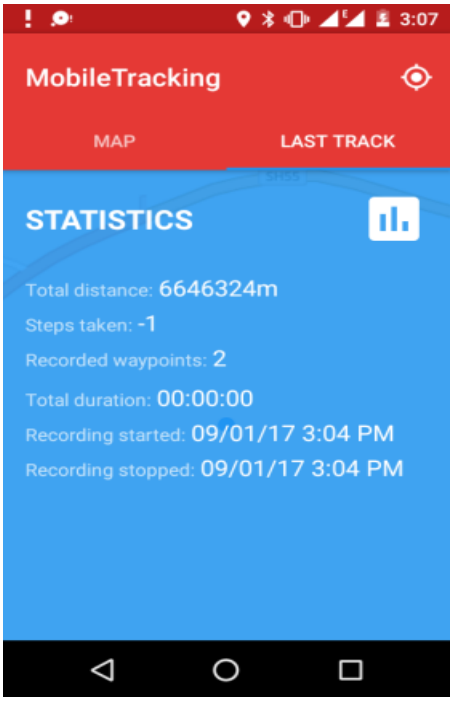


9.6 Self Location Tracking:

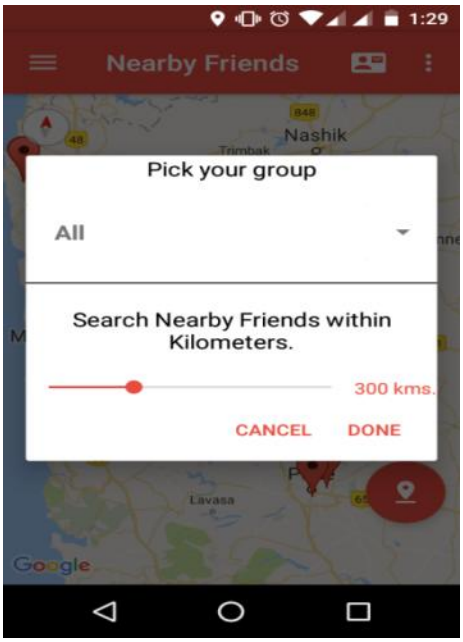
9.6.1 Offline Self Tracking:



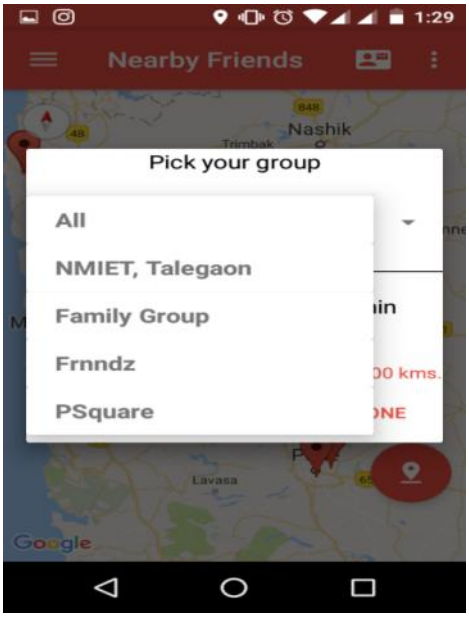
9.6.2 Statistics Information of Self Tracking:



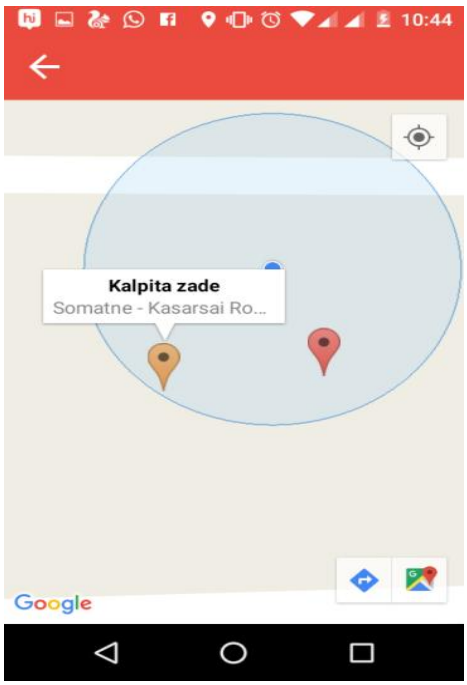
9.6.3 Online Self Tracking:



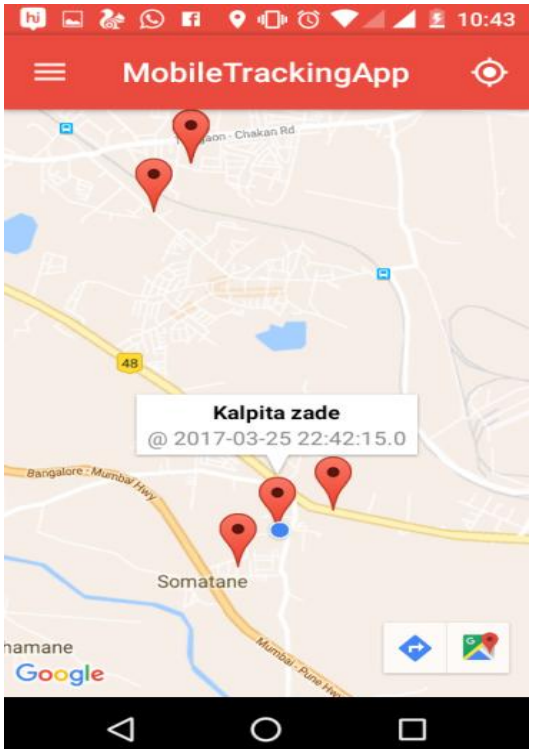
9.7 Selecting Group and Setting Radius for Nearby Friends Feature:



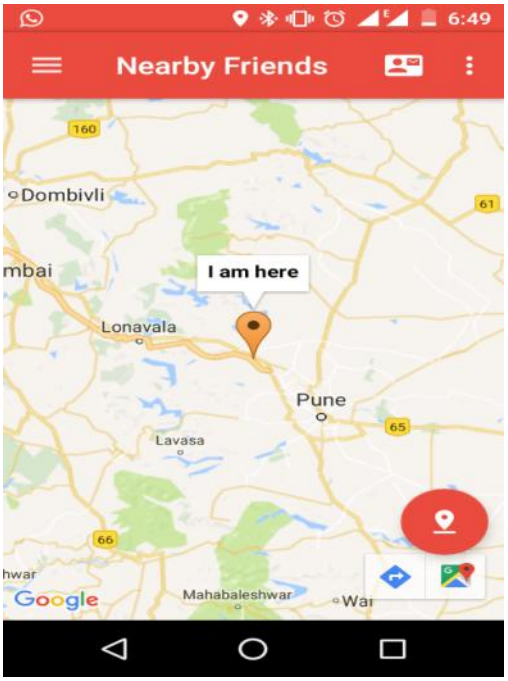
9.8 Finding Nearby Friends Within Range:



9.9 After Clicking on Particular Member:

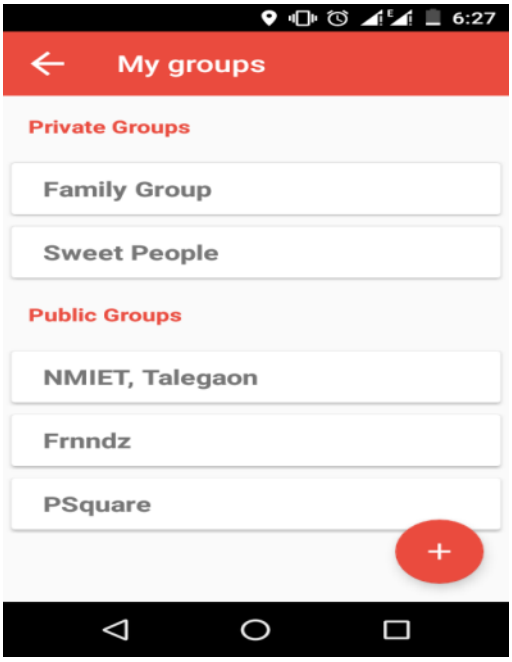


9.10 Home Screen:



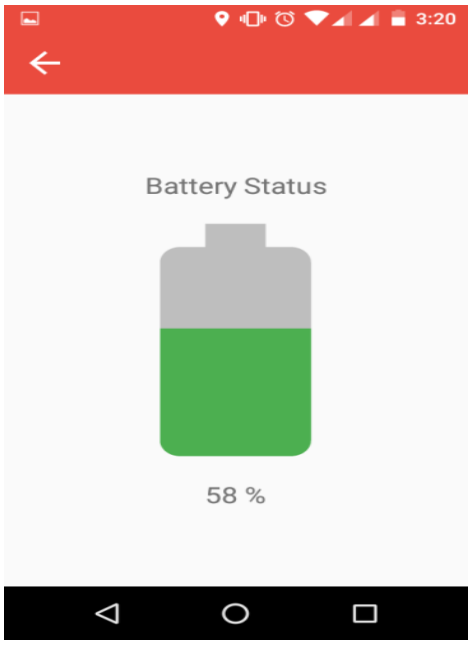
9.11 Selected Member Tracking (Friend Tracking):

9.12 Group Management:

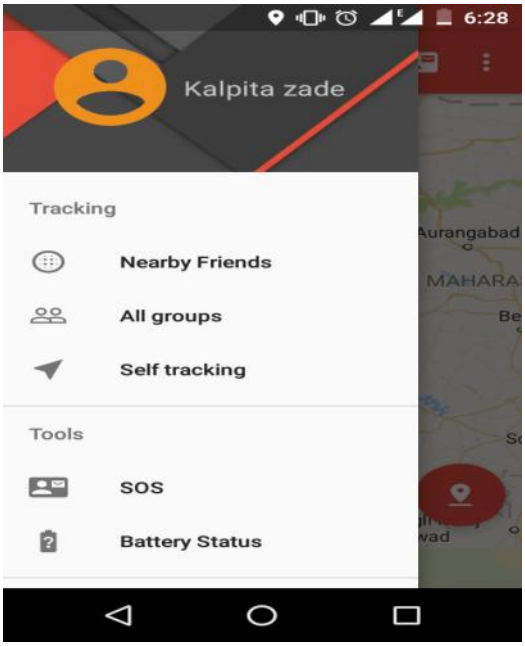


8.13 SOS Feature for Emergency

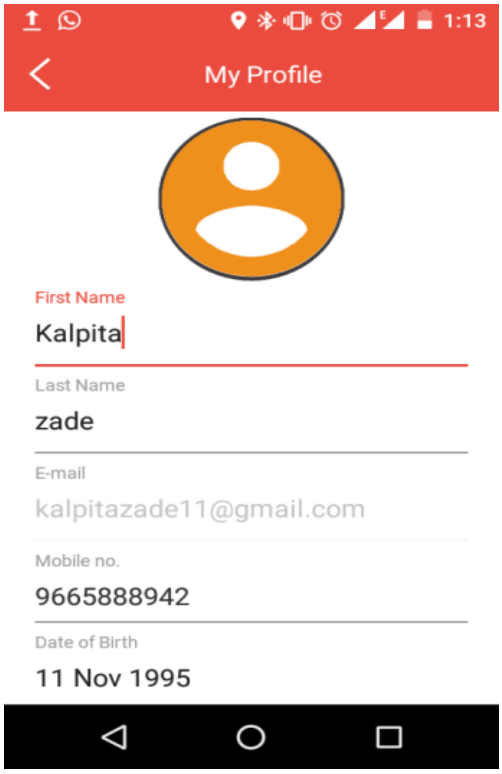
9.14 Low Battery Status:



8.15 Menus:



8.12ser Profile:



10. SUMMARY

As the dedicated GPS devices are costly we have chosen an-droid mobile phone as GPS device. Because of all the android mobile phones having this built-in feature, GPS device will find out the current location from satellite. Depending on certain condition we will find the location again. After certain distance of location change application will count the location again. At the same time application will connect with an external restful web server to send this information Location tracking studies are grown wisely through web-services. For online scenario location would be fetch from internet and sync with the server by using web-services. To update other end user Google cloud messaging (GCM) notifications are most reliable and efficient for the notification of broadcasting message. While fetching location from the internet will reduce battery consumption which is gaining by GPS.

While in offline case this can be achieved by sending current location updates via broadcasting SMS fetch from GPS. In overall cases, this application would work in online as well as in offline mode to achieve the best tracking use cases.

11. FUTURE WORK

1. Can increase the capacity of the number of group members by increasing capacity of the server.
2. Can add small games in app as extra feature based on location
3. In future this system can be enhanced by user of gestures and voice and images also, in case on emergency.
4. Can give instructions to be safe according to weather by checking weather conditions.

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