



Global Positioning System (GPS) Based Location Finder on Android

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Abstract

This thesis presents the development of an android application which has the capability of using the concepts of augmented reality to submerge the virtual information of user's surroundings by detecting and tracking user's location in real time.

Eclipse is an open source software, used in professional development of software solutions and programming applications. It provides extensive availability of free libraries. It has been employed for the development of software used in this thesis.

As the android GPS is notified, the application is fully location aware which keeps the track of user's location. When the user points the camera in a specific direction, the application tracks the camera orientation and displays the records of a specific place. Then the application keeps on updating the information as the direction changes.

The additional information is displayed with the help of "Google" databases. The information when gathered is then displayed to the live feed of camera which helps the users to interact in a more reliable way. Option for viewing the places in map view with the help of Google Maps is also available.

Keywords: Java, Android, Database management system,

Desktop applications, Google databases, Maps

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Chapter 1

Introduction

"Global Positioning System Based Location Finder on Android" is a smart phone application that uses location based information and concepts of augmented reality to enhance user's experience. Using android GPS, the application is location aware. It keeps track of the user location in real time. Whenever user points the phone in any direction, application updates its camera view by displaying the label tags with additional information of the buildings and places in that respective direction. The application keeps on updating the view as the user changes location or direction. Information for different places is extracted from the "Google" database. All the information of the user's location is augmented on to the user's reality in this case the live camera feed.

1.1 Problem Statement

The following problem statement briefly defines the boundaries and environment of this project:

"The Development of an android application which has the capability of using the concepts of augmented reality to submerge the virtual information of user's surroundings by detecting and tracking user's location in real time."

As the android GPS is notified, the application is fully location aware which keeps the track of user's location. When the user points the camera in a specific direction, the application tracks the camera orientation and displays the records of a specific place. Then the application keeps on updating the information as the direction changes. The additional information is displayed with the help of "Google" databases. The information when gathered is then displayed to the live feed of camera which helps the users to interact in a more reliable way. Option for viewing the places in map view with the help of Google Maps is also available.

1.2 Objectives of the project

The main features include

- Option for selecting a place from a list of categories which are
 - Hotels
 - Hospitals
 - Shopping Centers

- Schools, Colleges & Universities
- Airports
- Railway Stations
- Police Stations
- Petrol Pumps
- Entertainment areas

- Option for viewing in
 - Augmented Reality Mode
 - Map Mode

1.3 Interface Requirement

Following is the list of software, development kits and libraries which are required to develop and test the proposed application.

- **Operating System**
The platform used for development of this project was Windows 7 Operating system.
- **Programming Language**
Java was used as development language.
- **Environment**
Eclipse (HELIOS)
- **GUI**
The GUI was designed in eclipse using XML
- **Other Tools**
Java JDK (Java Development Kit)
Android SDK (Software Development Kit)
- **APIs**
Google Maps API has also been used in the development of this application.
- **Android Version**
Minimum requirement for android version of our application is v. 2.3.4.

1.4 Features and functionality of the proposed system

The proposed application requires the use of an android Smartphone having version 2.3.4 or above. Whenever user points the phone in any direction, application updates its camera view by displaying the label tags with additional information of the buildings and places in that respective direction. The basic functionality of this application is to fetch location from GPS and send current location to some database. Then it receives the information of surrounding places from database, and use device compass and accelerometer to set the device orientation. This information is then fed into an algorithm that maps these coordinates on the screen.

1.5 Technology to be used

- ▶ ADT Bundle (Android Development Toolkit)
- ▶ Android SDK
- ▶ Smartphone
- ▶ Wi-Fi

Chapter 2

Background

2.1 Android

There is a lot of advancement in the OS (Operating Systems) since the last few decades. When we look at the early stages of the cell phones, the black and white phones were came into focus but with the passage of time, cell phones were pushed onto the next level and now smart phones are particularly in focus. Mobile OS has come into horizon. The operating systems for smart phones & tablets, there was a need of change, so after the year 2000 the OS like Android and Blackberry were urbanized. With the passage of time, among all the greatest and widely used mobile operating systems there was android. Android Inc. was founded in Palo Alto of California, U.S. by Andy Rubin, Rich miner, and Chris White in early 2000. Then later on in 2005 Android was picked up by Google. With the advancement in Android OS, numerous versions were introduced. After that there have been a number of updates in the original version of Android [1]. Android Operating System gives the flexibility for both (users & developers).

2.2 Why we chose Android

The Key reasons that forced us to choose Android were:

- Open Platform/ Manufacturer independent

Android is not constraint to any maker, so it allows us to develop and change the existence of original and makes us more innovative in the development process.

- Rapid improvement

As the developer of Android, we have the opportunity to take the advancement to the next level. Advancement can be in any form like the OLED display in the Android cell phones.

- Development Language options

Many mobile applications can be developed in any language like JAVA, Perl etc.

- License Free

The license expenses does matter a lot, which is not noticeable in the Android development because of its free sourcing advantage.

■ Ease in Application Development

The emulator plays an important role in the testing process of any application made for android with the help of Android SDK (Software Development Kit).

■ Popularity

With more advancement in android, it has become the most popular OS of all times as compared to others.

2.3 Challenges for Android

► Hard to Integrate for Vendors

When talking about the iOS, the developers have to deal with fewer complications in the developing process because of the fewer versions. The same is not the case with Android applications. There are different brands in the market offering different screen sizes and using various kinds of processors. So this makes a great deal of opportunity for the android developers to innovate something new which can be nearly compared to as a difficult task.

► Performance Consideration

Every device has its own way of handling itself. Different brands, offering different devices with various screen sizes and using various kinds of processors results in performance issues.

► Too Much Google Dependent

When talking about android, we automatically came to know that it is a lot in the handled by Google. Google makes Android a bit more terms independent which makes it much better.

2.4 Android in Future:

The future years are going to introduce Android to a greater level. The developed applications in Android are well known by the Android users. In imminent, developers will be in a big problem in deciding their launch of first applications. The growing Android base is absolutely a positive factor. In other words, the Android Application Developers cannot fail to notice the positive response that they can earn with Android based Smartphone [2].

Chapter 3

Augmented Reality

3.1 Definition of Augmented Reality

AR (Augmented Reality) is one of the most interesting topics of the virtual reality area. There is a big difference between the real and the virtual reality and when these two realities merge together at a point, it makes a mixed reality. The information which is around us plans us to have a great deal for the users. The Augmented reality is like a grouping of the real scene viewed by the user and a virtual scene created by the computer that augments the scene with extra information. Extra information may include any tags, pictures, historical events etc.

Augmented Reality enhances the perception of the user, by making a better presentation of the nearby objects. The main objective that Augmented Reality has to accomplish is that not to make any difference between the real and virtual environment [3]. It should be in such a way that users feel like it is actually a real scene/environment. With this, the virtual images are merged with the real view to create the augmented display.

Not the proper implementation puts the user in a dark scene for not getting the required information. The system generated virtual objects in form of graphics must be correctly registered with the real world in all dimensions. These objects are meant to be maintained while the user moves or changes the direction from place to place.

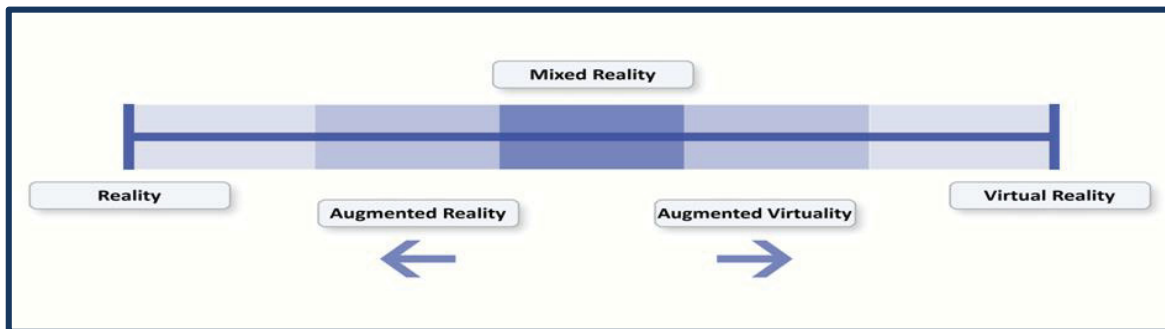


Figure1- Difference between virtual reality and augmented reality

Now, the real and the virtual environment are the two way different ends. When these two points are meant to mix with each other at a point, it normally makes a mixed Reality. Augmented Reality stays with the Reality end just to ensure that the reality end of the line with the preponderate insight being the real world augmented by computer generated data.

3.2 Background

Augmented reality was originated and has progressed with virtual reality since the commencement of 1950, but it got advancements in the last decade of 19th century [4].

The CAD software of Aircraft assembly design, simulation, navigation, military has used this technology for many years. Installation and maintenance kind of complex tasks can be simplified help in product prototypes and training can be held without being manufactured.

While augmented reality technology in itself has proved very useful in daily basis. Especially their use in marketing than ads placed in traditional 2 -D, not only is appealing as extensive material, resulting in an interactive, cool, savvy, and given the initial novelty - high viral potential. Consumers love, clever marketing and respond positively to products that will be remembered.

AR application depends on the ability of the audience. Audience through smart phones and to limit the number of assembly, and to people interested in downloading the software.

What is certain is that the population is growing Smartphone, and it is also on the level of processing power. More and more customers, phones, and more receptive to match future regulation can display augmented reality, and once the software is downloaded and scan them is their first principles - driven by curiosity.

The resulting expansion even more attractive and creative content , users actually a new and fun twist on the usual marketing and service as go through augmented reality .

3.3 How is it used?

The hidden content augmented reality often behind the image of markers that are included in the print media and film can be hidden until the symbol for a suitable period appears to define in a stable position for the application and analysis. Depending on the contents, the mark may still be visible.

In recent times it is used by advertisers, where it is popular to create a 3D representation of a product like a car or a soccer shoe, and solve these be used as an overlay to a marker. This allows the consumer to see a 360-degree image (more or less, sometimes the basis of the article may be difficult to see) of the product. Depending on the quality of reinforcement, it may go so far as to indicate the approximate size of the element, and that consumers "carry" the article, seen through their mobile phones.

Furthermore, it can also be used to print a label and optional settings to keep them in front of a webcam connected to a computer. To view the image of the brand and the bottom of the webcam on the screen, so that consumers to place the cursor in places like the forehead (a mask), or move the cursor one character in a game with control.

3.4 How does it work?

With a mobile app, the identification of a cell phone camera, and interprets a label, usually a barcode image in black and white. The software analyzes the cursor in a virtual image overlay to create on the phone screen in the camera position. This means that the application works with the camera angle and distance phone has to be interpreted by the cursor away.

It must render the image because of the large number of calculations by phone to make an image or model of the cursor, smartphones are often only able to support augmented reality successfully. Phones need a camera, and data in RA are not in the app, saved good 3G internet [5].

3.5 Types of Augmented Reality

When talking about AR, it has following types:

► Projection

This is a type of AR, which is most commonly used in the line scrimmage or the total yardage needed to be shown like a virtual view of the field in a real environment. It is a type of augmented reality, which uses virtual imagery to augment what you see live.

► Marker Based

In this type of AR, it recognizes the shapes, faces or other objects in the real environment to provide users with greater deal of information. Some smart phones has the ability to recognize and read the bar codes of a product and with that bar code, additional information like the reviews and the price of the product can also be shown.

► Location Based

This variety uses the GPS for location information. This service provides the facility of gathering the in close proximity and return additional information to the users. An example can be like a user can use a smart phone with GPS to determine their respective location, and then they can have some onscreen indication s augmented over a live image and guide them towards their correct destination.

► Outline

Outline is a type of AR that combines the outline of one's body or a part of body with virtual objects, this allows the users to mix the virtual objects to the real environment allowing them to pick up any object or manipulate objects that do not exist in reality.

3.6 Applications of Augmented Reality

Applications for augmented reality are wide ranging. They are included in different areas such as:

■ Direction

Direction finding applications or also known as navigation are mostly the natural fit of augmented reality. Enhanced system like GPS is being used to make it easier for the user to get from one point to another.

■ Sightseeing

There are a various applications for augmented reality in the sightseeing and for tourism industries. The sightseeing application has been made more enthralling with the use of augmented reality. A smart phone equipped with a camera, vacationers can walk through any historic events and see the facts or figures overlaid on their live camera screen.

■ Military

The HUD (Heads-Up Display) is the prototype of augmented reality when it comes to military applications. Data like elevation, airspeed and the prospect line and any other critical data can be shown in the form of a transparent display which is directly positioning the fighter pilots view. The term "heads-up" came from the fact that the pilot doesn't have to look down at the aircraft's instrumentation to get the data they need.

■ Medical

There have been truly remarkable progresses in medical sciences application of augmented reality. Visualizations explain obscure medical conditions to patients. AR can minimize the risk of an operation by giving the general practitioner an enhanced sensory acuity. AR can also be combined with the technology like MRI or X-ray systems which can bring everything into a single view for the general practitioner.

■ Gaming

With the advanced progresses in computing systems and related technology, gaming applications in augmented reality are on a peak. Many new games use the features of Augmented Reality which makes the environment more mesmerizing and agreeable.

■ Entertainment

With the reviews on Augmented Reality, the marker based augmented reality is a great source of entertainment now days. This augmented reality category allows

the users to interact with certain objects on your computer screen in 3D. Other applications may include Maintenance and Repair, Advertising and Promotion etc.

3.7 Key Components of Augmented Reality

The key concepts related to augmented reality are as follows:

► Camera Data

Displaying the live feed from the Android camera is the reality in augmented reality. The camera data is available by using the APIs available within the android hardware Camera package.

If your application doesn't need to analyze frame data, then starting a preview in the normal way by using a SurfaceHolder object with the `setPreviewDisplay()` method is appropriate. With this method, you'll be able to display what the camera is recording on the screen for use. However, if your application does need the frame data, it's available by calling the `setPreviewCallback()` method with a valid `Camera.PreviewCallback` object.

► Location Data

Just having the camera feed for most augmented reality applications isn't enough. You'll also need to determine the location of the device (and therefore its user). To do this, you'll need to access fine or coarse location information, commonly accessed through the APIs available within the `android.location` package, with its `LocationManager` class. This way, your application can listen to location events and use those to determine where "live" items of interest are located in relation to the device.

► Sensor Data

Sensor data is often important to AR implementations. For example, knowing the orientation of the phone is usually very useful when trying to keep data synchronized with the camera feed.

To determine the orientation of an Android device, you'll need to leverage the APIs available in the `android.hardware.SensorManager` package. Some sensors you're likely to tap include:

- `Sensor.TYPE_MAGNETIC_FIELD`
- `Sensor.TYPE_ACCELEROMETER`
- `Sensor.TYPE_ROTATION_VECTOR`

The use of sensors to allow the user to move the device around and see changes on the screen in relation to it really pulls the user into applications in an immersive fashion. When the camera feed is showing, this is critical, but in other applications,

such as those exploring prerecorded image data (such as with Google Sky Map or Street View), this technique is still very useful and intuitive for users.

► **Bringing It Together: The Graphics Overlay**

Of course, the whole point of augmented reality is to draw something over the camera feed that, well, augments what the user is seeing live. Conceptually, this is as simple as simply drawing something over the camera feed. How you achieve this, though, is up to you. You could read in each frame from of the camera feed, add an overlay to it, and draw the frame on the screen (perhaps as a Bitmap or maybe as a texture on a 3D surface). For instance, you could leverage the android.hardware.Camera.Preview.Callback class, which allows your application to get frame-by-frame images.

Alternately, you could use a standard Surface Holder with the android.hardware.Camera object and simply draw over the top of the Surface, as needed.

Finally, what and how you draw depends upon your individual application requirements—there are either 2D or 3D graphics APIs available on Android, most notably the APIs within the android.graphics and android.opengl packages.

► **Storing and Accessing Augmentation Data**

So where does the augmentation data come from? Generally speaking, you'll either be getting this data from your own database, which might be stored locally or from a database online somewhere through a web or cloud service. If you have preloaded augmentation data on the device, you'll likely want to use a SQLite database for quick and easy lookups; you'll find the SQLite APIs in the android.database, SQLite package. For web-based data, you'll want to connect up to a web service using the normal methods: HTTP and (usually) XML parsing.

For this, you can simply use java.net.URL class with one of the XML parsing classes, such as the XmlPullParser class, to parse the results.

3.8 Limitations and the Future of Augmented Reality

Augmented reality still has some challenges to overcome. For example, GPS is only accurate to within 30 feet (9 meters) and doesn't work as well indoors, although improved image recognition technology may be able to help. People may not want to rely on their cell phones, which have small screens on which to superimpose information. For that reason, wearable devices like Sixth Sense or augmented reality capable contact lenses and glasses will provide users with more convenient, expansive views of the world around them. Screen real estate will no longer be an issue. In the near future, you may be able to play a real-time strategy game on your computer, or you can invite a friend over, put on your AR glasses, and play on the tabletop in front of you. There is such a thing as too much information. Just as the "CrackBerry" phenomenon and Internet addiction are concerns, an overreliance on augmented

reality could mean that people are missing out on what's right in front of them. Some people may prefer to use their AR iPhone applications rather than an experienced tour guide, even though a tour guide may be able to offer a level of interaction, an experience and a personal touch unavailable in a computer program. And there are times when a real plaque on a building is preferable to a virtual one, which would be accessible only by people with certain technologies [6].

Chapter 4

Features and Design

4.1 Features and Design Description

The project takes GPS plotting to the next level by enhancing the 3D interface for users. This allows the user to view the labeled coordinated from the GPS in a more friendly way.

The interior performance of the application is something way too easy to explain. This application not only shows the interest point in 2D map but also label these 2D points to a 3D environment. The 3D plotting is achieved through the camera view which makes it easier for the user to check the relevant point in the real time environment. To achieve this goal in the real time, the label updates the camera view, fetches data from the GPS, compass and accelerometer data is fed into an algorithm which then helps us to convert the 2D plotting to 3D. This process makes the direction finding more unproblematic.

The main features of LFA are:

Option for selecting a place from a list of categories, which are:

1. Hotels
2. Hospitals
3. Educational Areas
4. Shopping Centers
5. Airports
6. Railway Station
7. Police Station
8. Petrol Pumps
9. Entertainment areas

■ Option for viewing in:

- Map Mode
- Augmented Reality Mode



Figure 4.1: User Interface to select a Place

4.2 Map mode

This option loads the Google map with annotations that display title of respective locations and points the locations on map.

List view

It returns the places surrounding the user in the form of a list

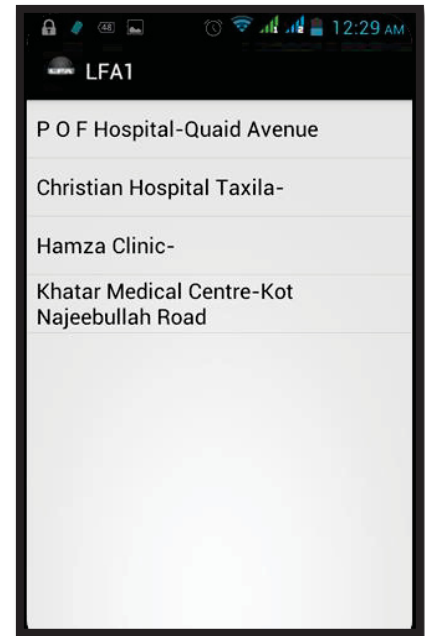


Figure 4.2: List View

Map view

It returns the places surrounding the user in the form of map view.

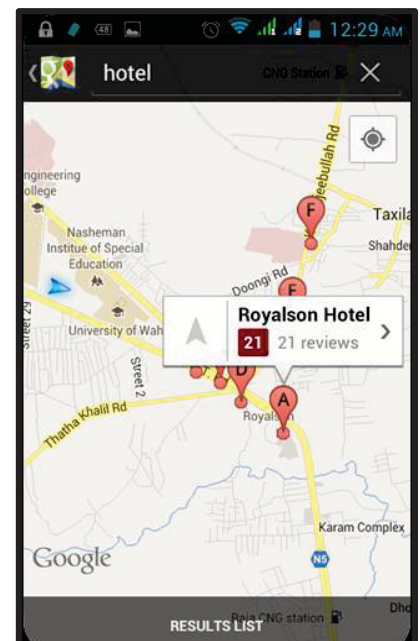


Figure 4.3: Map View

4.3 Augmented Reality mode

This option is to have a visual form a camera that displays the information using the concepts of Augmented Reality.

Camera View

- Places are displayed in the form of red colored AR tags.
- Radar at the top left corner gives information in the form of small points about the places which are currently being displayed on the screen

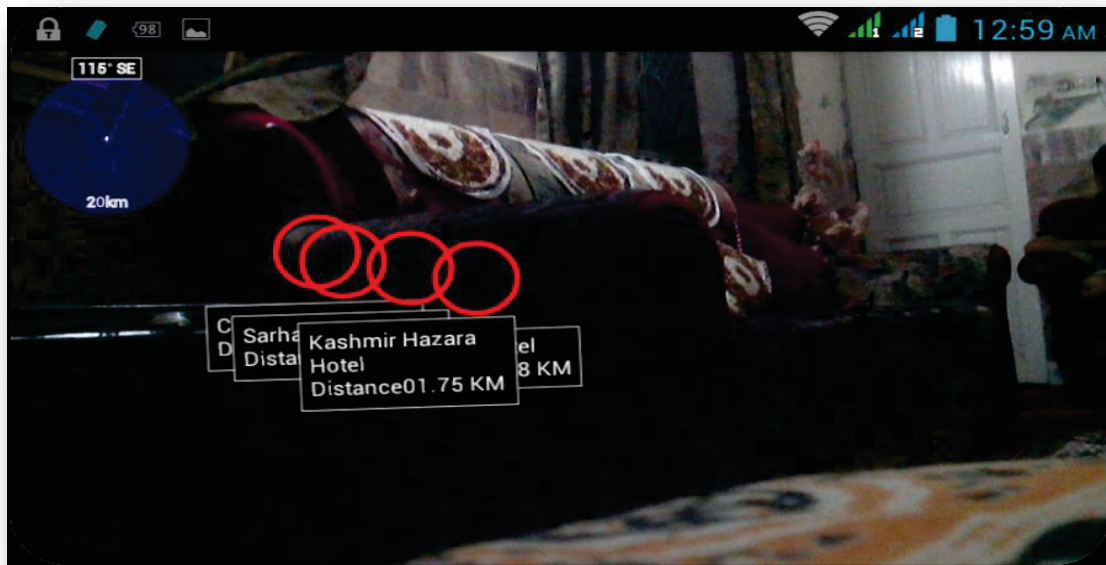


Figure 4.4: Tags in Augmented Reality Mode

Chapter 5

Components and Architecture

5.1 Basic Architecture for a Location Based Application

- The basic architecture of a location-based application involves
- A simple camera view
- The user's current location
- The cell phone's orientation
- List of locations for items that we want to show on the display

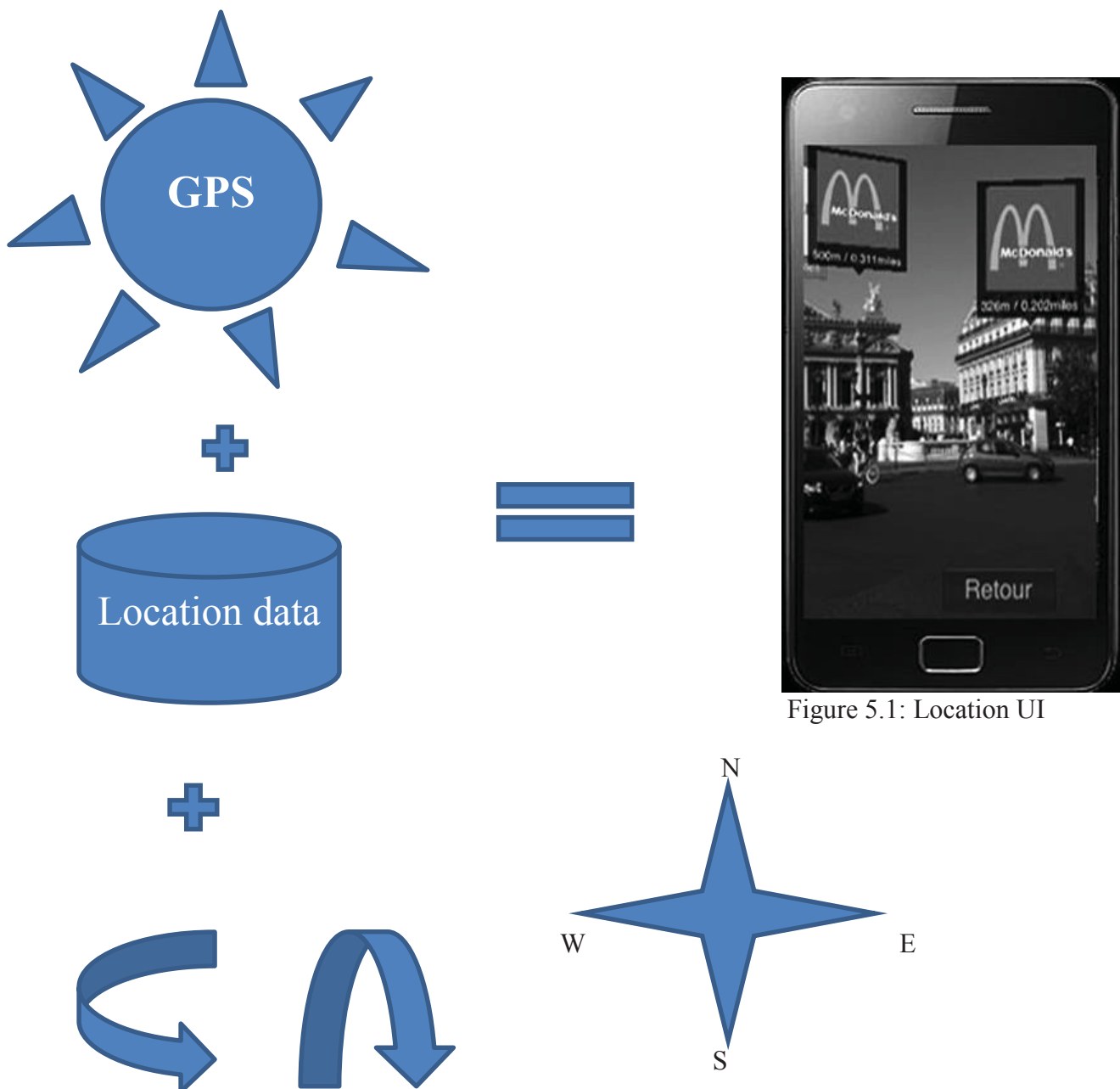


Figure 5.1: Location UI

5.2 Hardware & Other Components

The following stature shows the hardware & other components that we used in

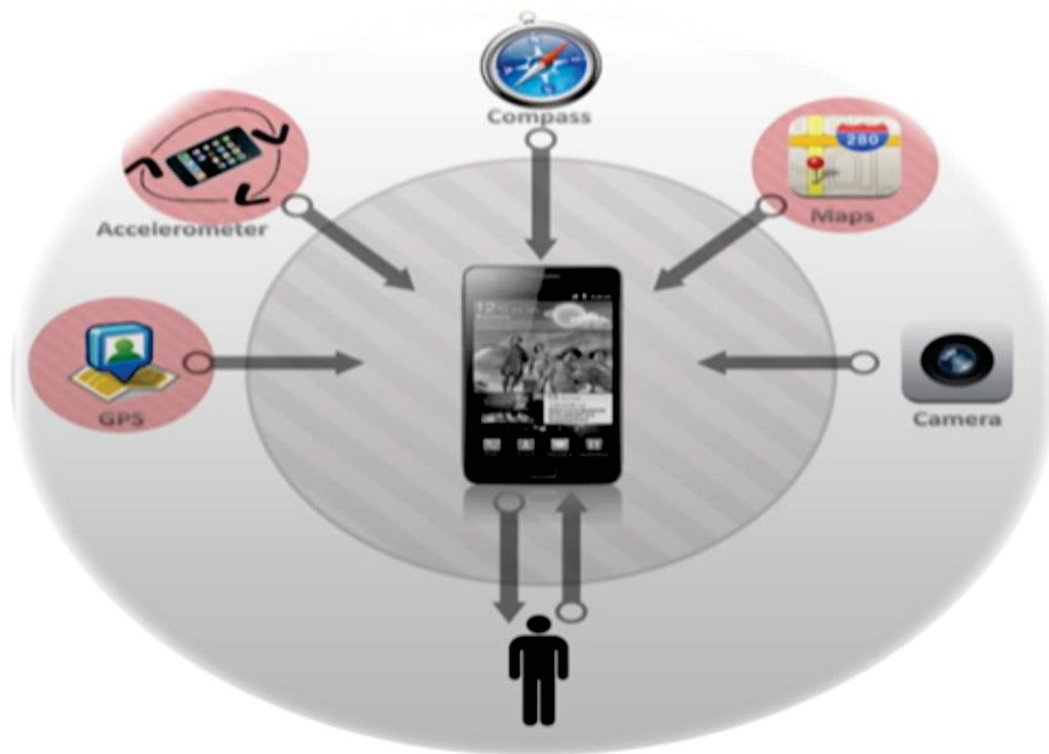


Figure 5.2: Hardware & Other Components

- The GPS is getting the current location of a user. The surrounding information is well known to the user when the current location is identified correctly.
- The Accelerometer is checking the orientation of the cell phone.
- Compass is getting the NEWS information.
- The camera is used by the augmented.
- Reality mode to display the information on the screen.

5.3 Operating System

Windows 7 has been used as an Operating System for the making of the project.

5.4 Programming Language

Java was used as development language for this application.

5.5 Environment

Eclipse (HELIOS)

5.6 Interface

XML files were created for a GUI interface.

5.7 Other Tools

Java JDK (Java Development Kit)

Android SDK (Software Development Kit)

5.8 APIs

Google Maps API has been used for the development which plays an important role in the application.

5.9 Android Version

Minimum requirement for android version of our application is v. 2.3.4.

Chapter 6

Methodology

The figure shows the basic initiative and gives a synopsis of how LFA application works.

- I. Fetch location from GPS
- II. Send current location to some database
- III. Receive the information of surrounding places from database
- IV. Use device compass and accelerometer to set the device orientation
- V. This information is then fed into an algorithm that maps these coordinates on the screen



Figure 6.1:- Working Methodology

Chapter 7

Implementation

7.1 Setting up the camera

The first step, which has to be kept in mind is the comfortable view of the camera while developing an Augmented Reality application. For this purpose we have to do the following steps:

- Defining the Application Screen draft
- Defining a Surface view to still the Camera Content
- Implementing the Surface Holder Callbacks

In these methods, we will call the camera parameters defined in the android library.

7.2 Using the On- Device GPS

For this location-based AR application, it's crucial that we know where exactly the device located is. And, for accuracy, we want the best location provider which is available on the device Applications which use any sort of location data from the device need certain location permissions. For this purpose, there are two options available. One is to use a coarse location that returns a location which is based on cellular towers or known as Wi-Fi access points. This level of result works great for determining what city we are in and maybe the locality. However, it probably won't be able to determine which street or block you're on correctly. The other option is to use the fine location, which uses the GPS on the device to get an accurate position. It may take a little longer, but uses GPS satellites and cellular towers to increase the location accuracy [7]. Fine location data can be helpful for determining what side of the street we are on. It's basically the level of accuracy and exactness that is generally used for AR apps.

So the next step here will be

- ▶ Adding location permissions in the manifest file.
- ▶ Listening to Location by using the Location Listener interface. It will include methods will deal with the location data when a location is changed, setting the accuracy criteria, requesting location updates, getting the best provider etc.

7.3 Sending and receiving the location data

The process for sending and receiving of data would be as follows;

- The location data (latitude/longitude) received in the previous step is then sent to some online database, in our case, Google data base.
- From there we then receive the information of all the places that are in the surroundings of the user in a certain format. In our case the format is known as JSON.
- The JSON format is then read by a JSON handler class that deals with this process.
- The surrounding location data is then stored in the form of arrays after being received.
- The data received may have information like the title, address, vicinity, phone number.

7.4 Calculating Direction and Distance between Two Points

We are interested in is the direction to the object relative to the device. In navigation, this is called the bearing. A path between two points on a spherical object, such as the planet Earth, is shortest by following what's called the great-circle distance. In using AR techniques, to find a location or display where some fixed object might be in relation to our location, this would be reasonable distance mechanism to use. As we get closer, the bearing might change, but we would still be following the shortest route to that location.

An alternate solution might be to calculate a straight line, in 3D space, between two points on the sphere. This method assumes that a path through the sphere, as opposed to around its surface, but this method is not in the least useful.

We have used the great circle distance to calculate the distance. It can be found out by using Haversine formula. The said formula is used to calculate the distance between two points on a sphere from their latitudes and longitudes.

$$\Delta \text{Lat} = \text{Lat}_2 - \text{Lat}_1$$

Lat=Latitude

$$\Delta \text{Long} = \text{Long}_2 - \text{Long}_1$$

Long= Longitude

$$a = \sin^2\left(\frac{\Delta \text{Lat}}{2}\right) + \cos(\text{Lat}_1) \cos(\text{Lat}_2) \sin^2\left(\frac{\Delta \text{Long}}{2}\right)$$

$$c = 2 \arctan2 [\sqrt{a}, \sqrt{a(1-a)}]$$

$$d = Rc$$

Where R is earth's radius (mean radius = 6,371km)

We need to get distance and bearing because ultimately we want the locations to be determined from a database or feed. We can then filter relevant objects to display on the view by distance.

7.5 Determining the Handset Bearing

Now that we can determine the bearing to a target, we need to know which direction the phone is pointed. For this purpose we will use the phone's compass. So we need to convert the data into a format that tells us which way the phone is pointing.

This requires taking into account the orientation of the device, which uses a combination of the accelerometer and compass. The end result will be a vector with rotation angles around each of the 3 axes. This precisely orients the device with respect to the planet which is exactly what we want.

The first method we can use is located in the SensorManager class: `getOrientation()`.

This method takes a rotation matrix and returns a vector with azimuth, pitch, and roll values. The azimuth value is rotation around the Z-axis and the Z-axis is that which points straight down to the center of the planet. The roll value is the rotation around the Y-axis, where the Y-axis is tangential to the planetary sphere and points towards geomagnetic North. The pitch value is the rotation around the X-axis, which is the vector product of the Z-axis and Y-axis –it points to what could be called magnetic West.

Rotation matrix can be called by method i.e. `getRotationMatrix()`. It takes in the accelerometer vector and compass vector.

Remap the rotation matrix so that the camera is pointed along the positive direction of the Y axis, before calculating the orientation vector.

7.6 - Marking the Target Location in the Overlay View

Now we have all of the information needed to place the target on the screen: the direction the camera is facing and the location of the target relative to our location. We currently have two vectors: the camera orientation and the bearing to the target. What we need to do is map the screen to a range of rotation values, and then plot the target point on the View when its location is within the field of view of the camera image as displayed on the screen.

- The orientation vector starts out with the azimuth, or the rotation around the Z-axis, which point straight down.
- With the Y-axis pointing to Geomagnetic North, the azimuth will be compared to our bearing and this will determine how far left or right the target is on the screen.
- Similarly, the pitch is used to determine how far up or down the target should be drawn on the screen.
- Finally, the roll would change the virtual horizon that might show on the screen; that is, this would be the total screen rotation.

The Camera Parameters class can provide the field of view of the device camera, as configured by the manufacturer. Now we can apply the appropriate rotation and translation to place the target point correctly, relative to the screen and field of view of the camera. Basically, what we do is rotate by the roll value; translate up and down by the pitch value, and then draw a horizon line. Then the azimuth is used for left or right translation of the field of view and the location is drawn where expected.

Chapter 8

Results and Conclusions

8.1 Results

Augmented Reality:

The snapshot shows the "Hotels/Restaurants" search in Augmented Reality Mode.

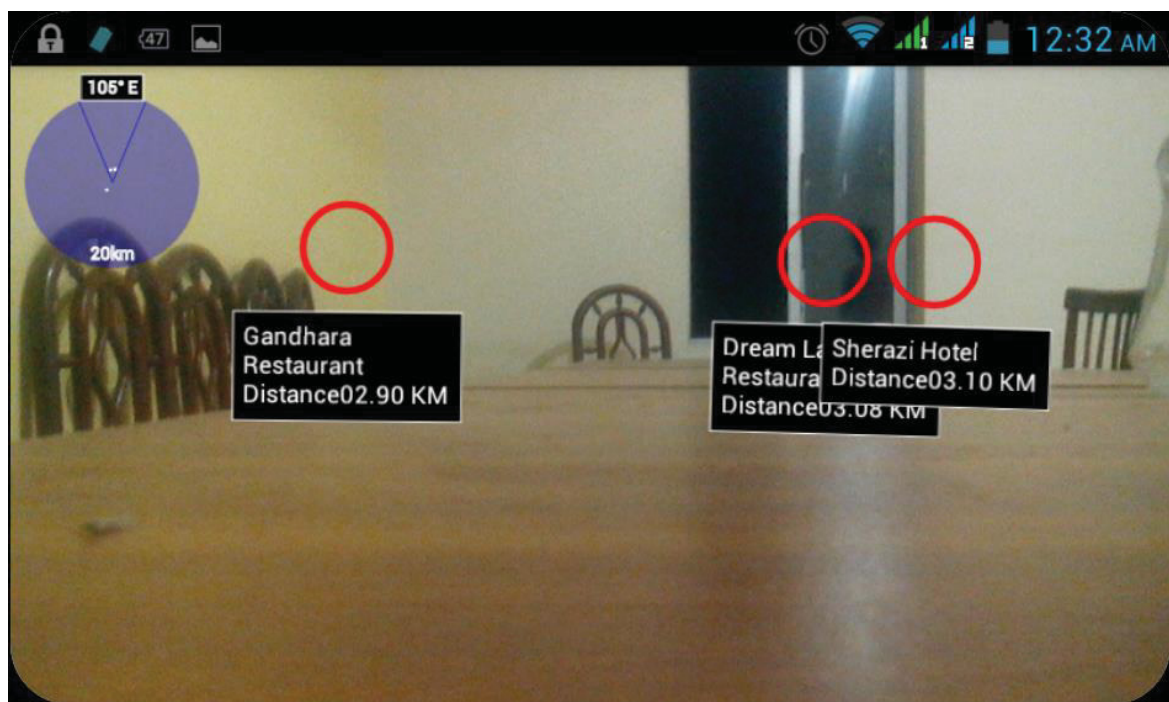


Figure 8.1:- An example of hotels search

The snapshot shows the "Hospital" search in Augmented Reality Mode.

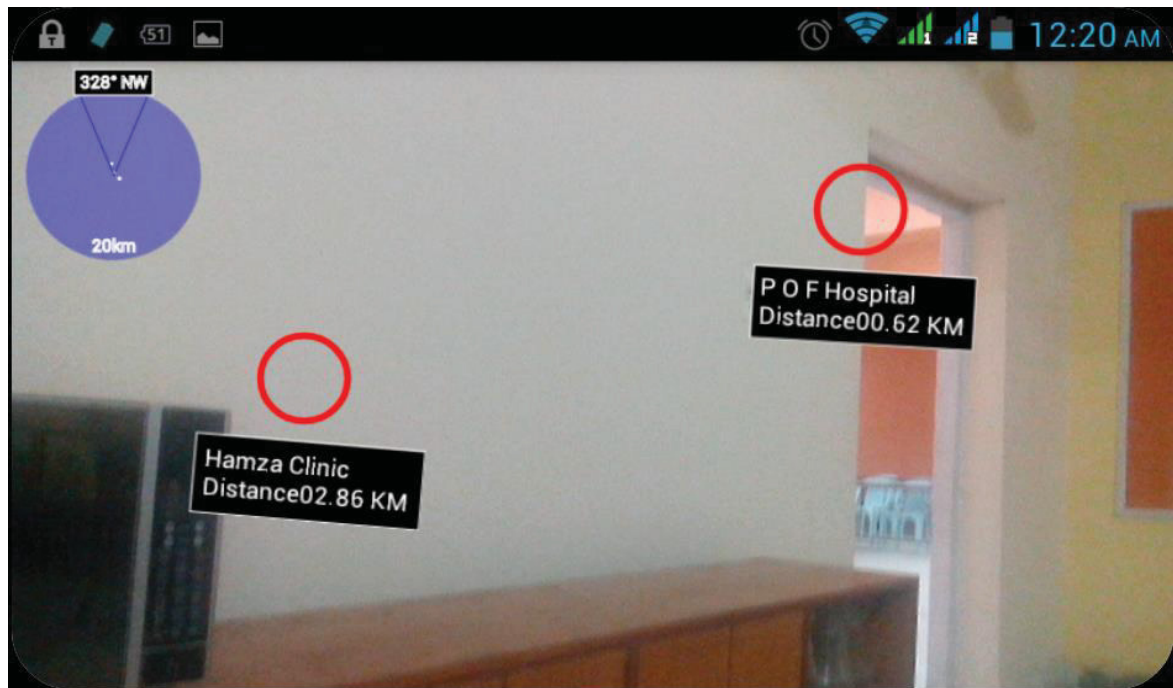


Figure 8.2:- An example of hospitals search

The snapshot shows the "Petrol Pumps" search in Augmented Reality Mode.

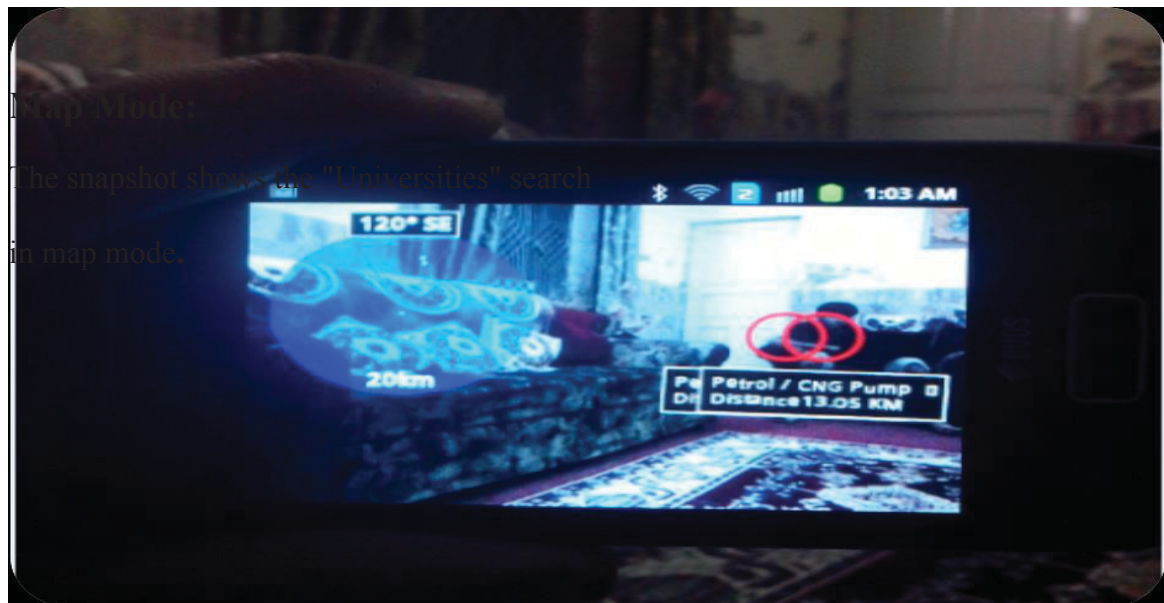


Figure 8.3:- An example of Fueling stations search

The snapshot shows the "Colleges" search in Map Mode.

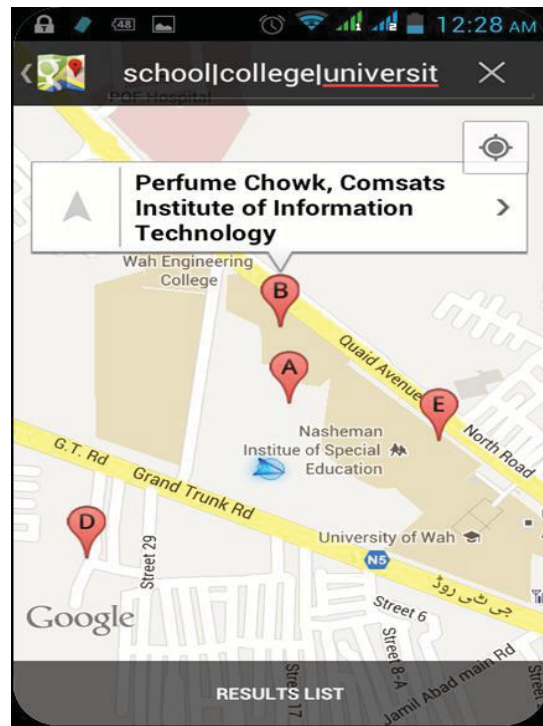


Figure 8.4:- An example of Colleges search

The snapshot shows the "Hospitals" search in Map Mode.

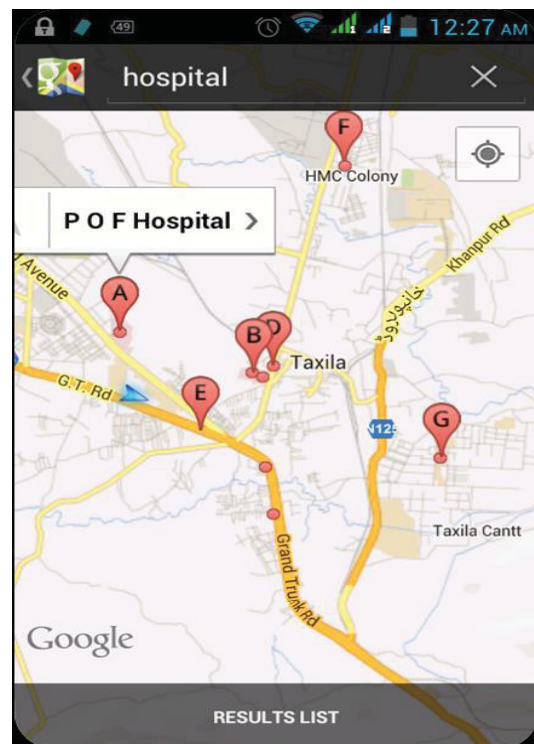


Figure 8.5:- An example of hospitals search

List View:

The snapshot shows the "Hospitals" search in List View. List view can be seen by the Option Button in android smart phone.

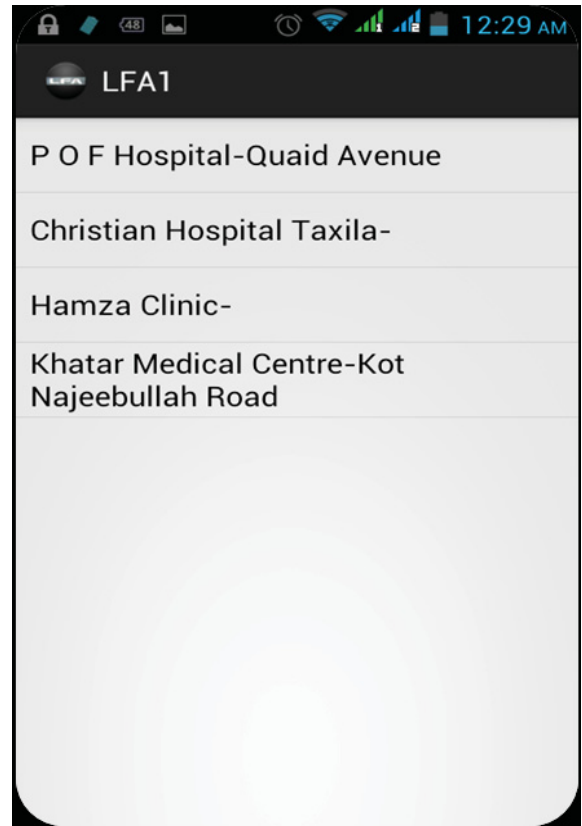


Figure 8.6:- An example of hospitals search

8.2 Conclusion

This application being a consumer based product, aimed at enhancing the user experience. The designed application uses the concepts of augmented reality and Android phone's sensor data to achieve 3-D registration in real time. All information is engrossed on live camera feed. Augmented Reality is more supportive for getting some additional information. This information is then displayed on Smartphone's screen to get the required response depending on the type of query given. The 3-D representation is more likely appreciated which helps the user to get to a specific place. In Augmented Reality mode, the places are assigned with a tag [8]. Those tags are then shown when a user directs a camera in a specific direction.

Chapter 9

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