V.E.S.I.T. Indoor Navigation using Augmented Reality Concepts

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Abstract— Outdoor navigation has advanced drastically due to the advent of Google maps. However, the problem of Indoor navigation, that is, navigation within the walls of an infrastructure has not yet adequately researched and solved. Even though there have been many applications available in Smartphone devices, both on Android and IOS platforms, there is no proper technology for the people which can be applied to every different infrastructure. We suppose that this paper shall address an alternative to the technologies that already exist and thus we demonstrate an effort to provide indoor navigation facility using augmented reality technology inside any particular infrastructure. For the sake of consideration, we have developed the application for the indoors of our institute V.E.S.I.T.

Key words: Indoor Navigation, Augmented Reality, Image Recognition

I. INTRODUCTION

VESIT Indoor Navigator is an android based augmented reality application designed by us to help the user navigate the locality of any institute or organization. For purpose of demonstration, we have used our college campus as the indoor environment.

II. EXISTING SYSTEMS

The following are some systems that are currently being used for the purpose of indoor navigation:

A. Inside App:

Fig. 1: Inside (Indoor Navigation App)

Developed by Israeli start-up Shopcloud, Inside starts by accessing the internet upon entering a building, and accessing a floor plan – this means that buildings offering the system would first have to supply that plan to Shopcloud, plus a team would have to come through to gather spatial data. Once the information has been downloaded by the user, continued internet access isn't necessary. The phone uses its camera to spot unique visual landmarks, processing the images using computer vision algorithms to keep track of the user's approximate location. The accelerometer, gyroscope and magnetometer also kick in to track the user's more precise movement through space, and actually "learn" the one-of-a-kind movement signature of that person – apparently, if the phone is handed to someone else, the app will know that it's not the same person. The app currently works on iPhone models 4S and up, and Android phones with minimum specs similar to those of the Samsung Galaxy S3. A Windows version is also in the works.

1) Advantages:

- Very good accuracy
- If the phone is handed to someone else, the app will know that it's not the same person

B. Indoor Navigator by Infsoft Apps:

In this indoor navigator app developed by Infsoft apps, all the information is combined, resulting the position of the person and even its associated floor. Furthermore, the app automatically connects to GPS when leaving the enclosed environment, being a perfect solution for indoors and outdoors. When calculates the fastest way to the destination, the app also takes account of floor changes, like stairs or elevators. Another nice feature is the possibility of creating a 2D or 3D visualization of a multi-level building. In order to create a more pleasant experience and to demark better the areas from the building, users can choose different colors for rooms and locations. Also, based on the information from the integrated compass, the map moves in real-time with the user's orientation. The most interesting capability of infsoft's app is the augmented reality, which overlays virtual information over the image that is received from the mobile device's camera.

1) Advantages:

- User can create his own indoor maps

2) Disadvantages:

- The app is able to locate a person that is inside a building with an accuracy of only a few meters.

Fig. 2: Infsofts's Indoor navigation app

III. PROPOSED SYSTEM

The application primarily consists of 3 modes:

- GPS (Global Positioning System) mode

– IR (Image Recognition) mode
– QR (Quick Response code) mode

Addition to these modes, notifications are provided by the application according to the necessities of the campus.

Fig. 3: Vesit Indoor Navigator

At the start-up, the application allows user to choose any one of the three modes. The modes function as follows:

A. GPS Mode:

In this mode, the current position of the user is calculated using the GPS co-ordinates (latitude and longitude) and displayed on the screen. Also, directions to the nearby areas of the campus are provided as a walkthrough for the users.

1) Requirements:

The latitudes and longitudes of the organisation have to be pre-mapped by the developers while the application for that institution is being developed. For the GPS mode to function, internet connection to the device, WI-FI or Mobile data (preferably 3G) is required. For latitudes and longitudes to be calculated, the device must be held under clear skies for the satellites to detect it as we have used the GPS_PROVDER class for fetching the co-ordinates.

2) Pictorial Demonstration:

The screenshot below shows the user being notified about its location (in this case, the entrance of the VESIT campus).

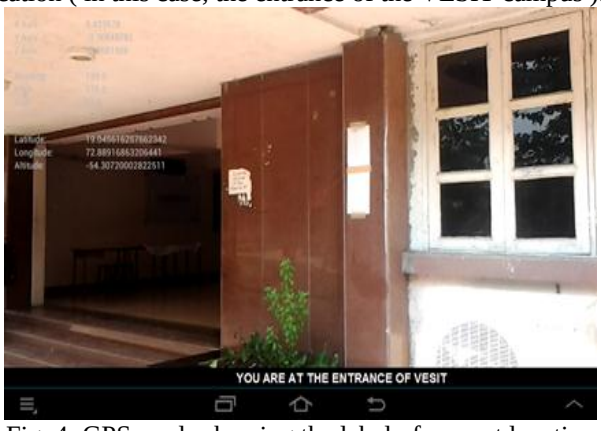

Fig. 4: GPS mode showing the label of current location using GPS co-ordinates

B. IR Mode:

In Image Recognition mode, the primary camera of the android device opens and the live feed captured by the camera is fetched by the application and compared with the previously stored images of the internal locations of the institute. After the scene gets matched, the corresponding information of the scene is displayed to the user and any available directions to the nearby areas, if present, are provided. For the recognition of current location, the real-time video feed with the images stored on the servers of moodstocks.com and their API is used for the comparison.

1) Requirements:

The application needs internet connection for first time use as the image set is stored on cloud servers. For the successive uses, the signature of the images are stored in cache memory of the device and hence, the application can function even without internet connection. For the demo implementation of our application we restricted to 10 images throughout our college building. The resolution of the images stored in image set should be moderate, around 1600 X 900 pixels.

2) Pictorial Demonstration:

The screenshot below shows the user being notified about its location within the building (in this case, the reception of the VESIT main building).

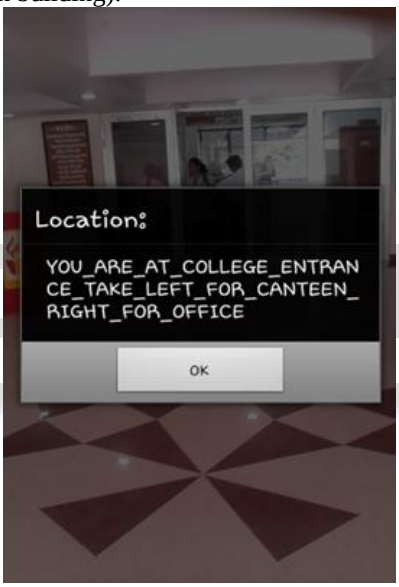

Fig. 5: Image Recognition mode showing the current location and directions to other locations by recognizing live video feed

C. QR Mode:

In QR mode, the application opens a QR code decoder that would scan the QR codes and fetch the information encoded in it to the user. It then asks for the user to enter a valid password (earlier determined by the application developers) thus ensuring only authorized personals to have access to the decoded information. This mode was included to help the institutions provide detailed information about their sections (in case of our college, the labs, the classrooms, etc.) to the users. This would bring an ease of information flow within the organization.

1) Requirements:

QR code for every required section has to be put up by the institution for users to scan them.

2) Pictorial Demonstration:

The screenshots below shows the sample QR code for one of the labs of VESIT and the information decoded from it after entering valid password.

Fig. 6: sample QR code

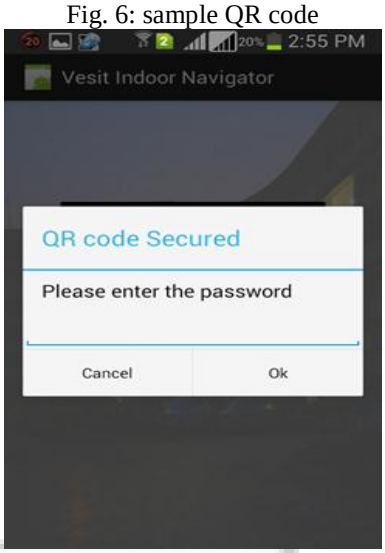

Fig. 7: Dialog box demanding password

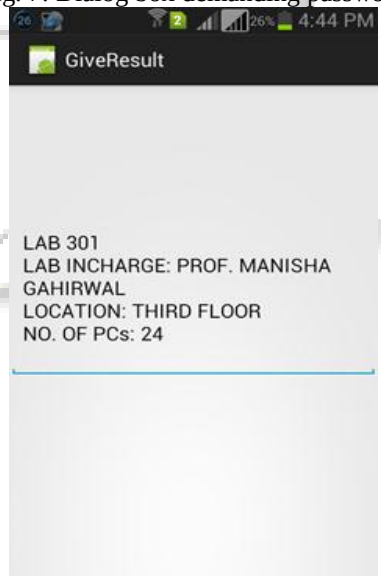

Fig. 8: Decoded information from the QR code

3) Advantages:

1) Our indoor navigation app not only provides the directions and navigation but also provides information about the different entities such as labs, offices, cabins, etc.
2) The app can work without internet connection.

4) Disadvantage:

1) For every different infrastructure, the developers have to create a separate application consisting of its GPS co-ordinates and information encrypted in QR codes.

IV. Conclusion

In this project, we have tried to implement the rapidly developing concepts of Augmented Reality and have tried to put our own inputs and contributions in the blooming field of Indoor Navigation. We have also implemented the concepts of Image Recognition, GPS tracking and QR code encoding/decoding that would increase the utility of the application.

V. Future Scope

Further work on our application would comprise of extending the database of our application and improving the existing features like IR mode to display the approximate distance of the locations from the current device position. Also, adding additional features like providing storage facility for the decoded information of the QR codes would be included in the further work of our project. We would also like to include features such as providing users the opportunity to dynamically add tags and labels to their desired GPS co-ordinates and give suitable directions to the other locations within the infrastructure.

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