Location Based Augmented Reality

Prof. P. B. Alappanavar, Bhushan Kurvey, Monali Karad , Sunil Bhagwatkar
IT department, Sinhgad Academy of Engineering, University of Pune Pune.
pankaja.ba@gmail.com
bhushankurvey11@gmail.com
monalikrd@gmail.com
bhagwatkar.sunil27@gmail.com

Abstract

The computational ability of mobile devices have been rapidly increasing day by day. Augmented reality has become feasible on cell phones. We are giving an approach for pose estimation to support augmented reality view on Global Positioning System(GPS) which is commonly available feature on a mobile phone platforms like Android. Using the embedded camera of the phone, the application uses the device in a common environment and determines its orientation. The dimensions , longitude and altitude are determined from GPS ,matching the co-ordinates of the current position ,3D virtual objects from a database can be projected into the image and displayed on mobile screen. The application enables the user both to visualize virtual objects in the camera image and to localize the user in a familiar environment. We describe in detail the process of building the database and the pose estimation algorithm used on the mobile phone .In addition, Auto-profiling is new feature which is introduced. Getting longitude and altitude, the application selects and sets mobile profile as previously defined by user.

Keyword:*GPS,Location,3D virtual View, Augmented view, Pose computation.*

1. Introduction

There are many approaches for visual augmentation of the objects . They are mainly categorized in two methods: Pose Computation and Object Recognition. In many of the AR related application object recognition is commonly used to recognize the objects. But this works only when we are looking for a particular known object. This method does not support if there is no special object in the picture. However Pose Computation is more flexible approach which determines the Six-degree of Freedom **see figure:-1** of the image and project the augmented image on the user's screen at any location and project the 3D view.

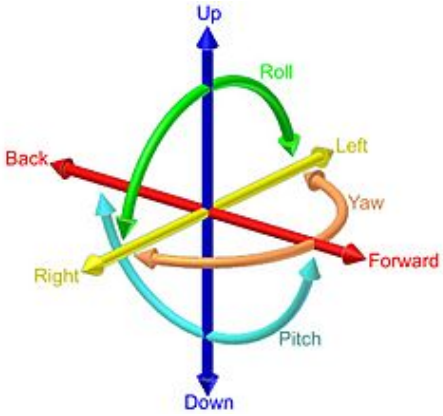

Figure:-1 ***Six-degree of Freedom.***

Although any object cab be inserted in the database , rectangles make it easier for visualization and error measuring. We built a database of images and picked rectangles in the 3D models. After the user points the cell phone in the direction of these objects , the pose between the cell phone camera and the database image is computed. The visible objects are then projected into the cell phone according to the pose estimation. The bigger the images, the more features will be extracted, so the precision will be better but the algorithm will be slower.

Our work uses an approach of this type, computing the sensor pose on GPS of mobile phone and augmenting the scene by projecting 3D information into the image. A database can be created of the different locations containing augmented views of the real objects of environment. This database is a local database to mobile phones and created offline. The algorithm selects the database image which is the most similar to the live cell phone image. The next step is to match the two images to find point correspondences, based on features extracted in both images. Then the pose between the two images can be computed so that the position and the orientation of the cell phone can be known. 3D virtual objects from the database are then projected in the image according to co-ordinates matched on GPS map. Using mobile phones for augmented reality has both advantages and drawbacks. AR applications can benefit from cell phone sensors such as accelerometers and magnetometers, which improve the quality of augmented reality and facilitate user tracking.

2. Database

As the database is created locally , we have to create the database offline. This involves actual visits to the places for which we have to create an augmented view. The mobile phone camera can be used for the imaging . The images then pre-processed to find out the co-ordinates of it and augmented projection can be formed. For each image we store the pose of the camera, its absolute rotation ,position and its intrinsic parameters. Thus we form a 3D image and can store it to the local database of mobile phones.

3. Database Limitations

As we are storing images for every object , the database contains large number of files. Finding out the correct matching points of the image for the given coordinates is relatively difficult amongst large number of files . For the created database if the images are relatively different to each other i.e. if the objects stored in the database are with the different coordinates then it is much easier to find out the match.

There is a way to overcome these problems and make easier process to get the right image on screen. We have used two criteria to select only the relevant image.

First, for a database image to be considered, its center has to be seen by the cell phone camera. We can determine this since we stored the 3D point of the center of all the database images. In case the 3D point of the center is not inside the camera's field of view, the overlap region (if there is some) between the two images is not large enough for the pose estimation to be precise enough. Because there is an uncertainty on the phone orientation estimated by the sensors, we have to extend somewhat the field of view of the cell phone camera in which we search for the 3D point. In the same way, we assume that the user location is close to the estimated location.(With the help of GPS which compute the previous location).

The second criterion prevents bad image matching configurations. The matching step is done using features that are rotation-invariant to some extent. The matching process will fail if there is too much rotation between the two images. Thus we do not search for images that have an orientation that is too different from the camera. This criterion also helps to remove many irrelevant images.

4. Retrieving Image and Processing On Screen

When we are done with creating a database after processing the images, we need to scan the actual object and compare it to database images . This is done more effectively with the help of accelerometer , magnetometer , GPS and the rotation sensors . These features are commonly valuable now a days in Android phones.

When user goes to a certain location, the GPS gives a longitude and altitude . Magnetometer and Rotation sensor gives position and direction of the phone. The phone camera gets us the co-ordinates it scans through its lens. All together can process an image and give matching image on screen.

A simple example is shown in **Figure :-2 ,** the GPS , Accelerometer, Magnetometer and rotation sensor gives a location ,position and direction. As database is previously created it gives command to scan front image . when the camera scans an image it finds out the coordinates of the front image.

As shown in figure , the front image has a complex. The application scans its boundary coordinates and then gives a pre-processed augmented image which is stored in database.

Figure:- 2 ***Co-ordinates scanned by application.***

5. Auto-Profiling

we have given one more exclusive feature to the application which is Auto-profiling. As we have seen many times user forget to silent his phone's ring tone when he visits places like college , hospitals ,school premises ,government offices. Even to the places like Petrol pumps , Gas agencies , companies where it is dangerous by mobile radiations for explosives. This auto profiling feature will make user's phone to select Profile automatically. User has to set profile for a particular place . when the user visits that place , the Auto profiling is done. i.e. if user has set silent mode for College premises then whenever user visits college premises then mobile phone goes on silent automatically.

This feature gives a facility which is very beneficial to user. we have designed and included this feature experiencing general problems of the mobile phone user.

6. Conclusion

We have showed in this paper that the augmented reality concept can be implemented on mobile phones. The GPS services can be more effective using Augmentation concept. Searches on GPS for places , streets , maps etc can be visualized virtually. Auto profiling is a major feature which can be

added to the application which gives flexibility to the mobile phones and user convenience. 3D virtual images can give user an idea of the actual object he/she is looking for.

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