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Visual Positioning System In 3D Space

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ABSTRACT—
With the application and development of technologies based on user location information, location-based services are now growing at a rapid pace. In this paper we present VPN application which is used to navigate in large complex areas such as urban region where VPN application is used to navigate, it provides pop up in real time on application screen with the information of nearest cluster of data. It is android based application which does not requires any external hardware other than mobile phones. This application is used for better navigational guidance in urban areas.
KEYWORDS: *GYROSCOPE; ACCELEROMETER; BEARING ANGLE; EMULATOR; COMPASS.*

I. Introduction

Due to the increasing popularity of location-based services, the need for reliable and cost-effective indoor positioning methods is rising. As an alternative to radio-based localization methods, in 2011, we introduced MoVIPS (Mobile Visual Indoor Positioning System), which is based on the idea to extract visual feature points from a query image and compare them to those of previously collected geo-referenced images. The general feasibility of positioning by SURF points on a conventional smartphone was already shown in our previous work. However, the system still faced several shortcomings concerning real-world usage such as request times being too high and distance estimation being unreliable because of the employed estimation method not being rotation invariant. In this paper, three extensions are presented that improve the practical applicability of MoVIPS. To speed up request times, both a deadreckoning approach (based on step counting using the accelerometer) and an orientation estimation (based on the smartphones compass) are introduced to filter relevant images from the database and thus to reduce the number of images to compare the query image to. Furthermore, the vectors of the SURF points are quantized. For this purpose, clusters are calculated from all SURF points from the database. As a result, each image can be represented by a histogram of cluster frequencies, which can be compared with each other a lot more efficiently. The third extension is an improvement of the distance estimation method, which uses the matched feature points of an image to perform a perspective transformation and to determine the actual position with the aid of the transformation matrix.

WORKING
Phase 1:Identifying All Sensors Values

1) Accelerometer:
The motion sensors in accelerometer is used to identify the orientation of device using axis-based motion sensing which can even be used to detect earthquakes, and many by used in medical devices such as bionic limbs and other artificial body parts.

2) Compass Direction:
A compass is an instrument used for navigation and orientation that shows direction relative to the geographical cardinal directions.

3) Longitude:
Vertical mapping lines on earth of longitude, known as "meridians". One simple way to visualize this might be to think about having hula hoops cut in half, vertically positioned with one end at the North Pole and the other at the South Pole.

4) Latitude:
Horizontal mapping lines on Earth are lines of latitude. They are known as "parallels" of latitude, because they run parallel to the equator.

5) Bearing Angle:
Your bearing is the direction you'd take to move towards that destination. In the case of the tree you'd bear east to reach it. Your bearing is calculated to the nearest degree and is typically the most direct route from Point A to Point B.

Phase 2: <u>Proposed Method</u>

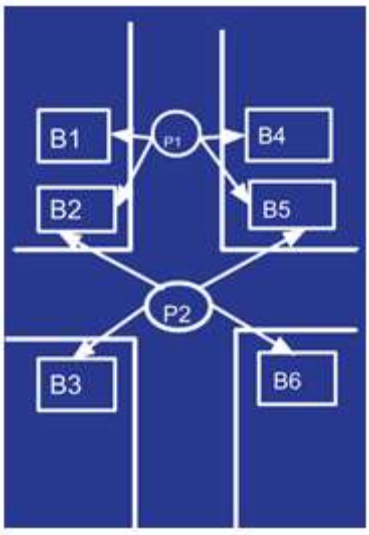
- Design and Developing VPS (Visual Positioning System) where a mobile app guide user with the help of dynamic pop-up information about view user is seeing using mobile camera currently.
- User just need to hold a mobile camera toward the object it may be building, street, shop, mall, office, just a board, or any other object in street view.
- With the help of different sensor and some complex mathematical algorithms system can calculate the user position information in 3D space and send a query to database and fetch relative information.
- It's not about image processing or the Augmented reality

1) Image Layering:
Layers are used in digital image editing to separate different elements of an image. A layer can be compared to a transparency on which imaging effects or images are applied and over or under an image. Today they are an integral feature of image editors.

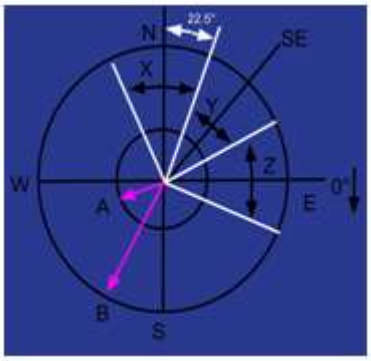
2) Image Rendering:
Rendering or image synthesis is the automatic process of generating a photorealistic or non- photorealistic image from a 2D or 3D model by means of computer program

Phase 3:<u>Mathematical Calculations</u>

1) Street viewing position concepts:



1) At position P1 direction of building are as followed:
B1->W B2->WS
B4->E B5->ES
2) At position P2 direction of building are as followed:
B2->NW B3->WS
B5->NE B6->ES
3) It means same building can be viewed at
different angle from different position.
4) While changing the position of user the angle of viewing building change.



Where the initial angle is 22.5° Which is subdivided into 16 parts.

A=Radius of user location.
B=Radius of viewing area that is visible area.

X=It is a threshold for viewing angle for direction S.
Y=threshold for SE.
Z=Threshold for E.
1)Where angles X, Y, Z=45°.
2)Where X range is 247.5°-292.5°
3)Where Y range is 292.5°-337.5°
4)Where Z range is 337.5°-22.5°

2)Process:
It basically works on three main information.
1) Location information:
It is main type of information to locate the user location.
2) Direction information: After the location is set the user need to see around us to find the directions.
3) Angle information: It is a final step to identify the floors after the location and direction is fix.

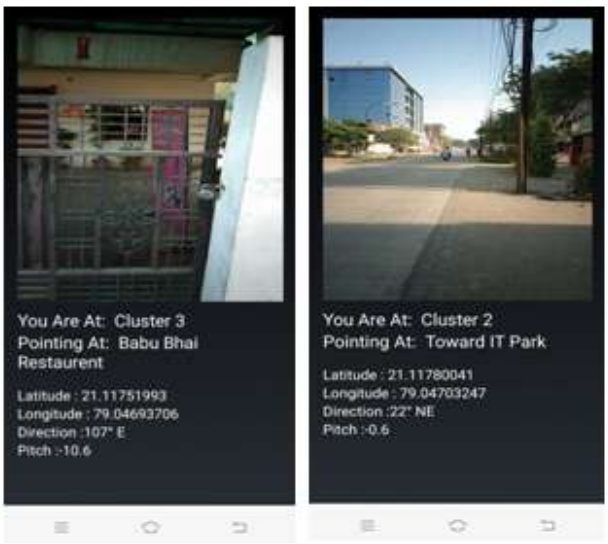
Phase 4: <u>Database Connectivity and Data Fetching.</u>

1. Knowledge base building.

ID	Lat.	Lon.	Min Angle	Max Angle	Object Angle	Max Angle	Text
1	21.54 624	74.54 684	NE	10	25	25	Mall
2	21.15 462	74.65 879	SW	10	25	25	Petrol pump
3	21.69 735	74.15 698	NW	10	25	25	Hospital

2. Extracting data from knowledge base.

Application Samples:



II. Related Works

Google Map:

Google map is a web mapping service developed by Google. It offers satellite imagery, street maps, 360 degrees panoramic views of streets, real time traffic conditions and route planning for travelling by foot, car, bicycle or public transportation.

Google map began as a C++ desktop program at where two technologies. In October 2004, the company was acquired by Google, which converted it into web application. After additional acquisition of geospatial data visualization company and a real time analyzer, Google Maps was launched in February 2005.The service's front end utilizes JavaScript, XML, and Ajax.

GLOBAL POSITIONING SYSTEM

The Global Positioning System (GPS), originally Navistar GPS, is a satellite-based radio-navigation system owned by the United States Government and operated by the United States Air Force. It is a global navigation satellite system that provides geolocation and time information to a GPS receiver anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites. Obstacles such as mountains and buildings block the relatively weak GPS signals.

SYSTEM OVERVIEW

The objective of our project is set on the Visual Positioning System (VPS) which connects to the camera and accesses the video stream in order to perform object detection as well as position determination of detected objects with all aspects of the object including cluster as well as latitude and longitude. All this informationis sent to a central software component, the Detection Module (DM) which performs local tracking of the user, aggregates the position information and transmits it to the Tracking/Identification Module (TM/IM). The TM/IM performs global tracking and identification of the externally observed positions and forwards the appropriate data to the correct registered endpoints, i.e. mobile positioning clients.

The support of hardware is the main reason for the excellent performance of the VPS. Now the hardware we have used in our system are inbuilt GPS, magnetic compass, inbuilt accelerometer, and the camera which are supportable with the Android mobile phone.

As we are to target our VPS for global use, our requirement was to go online for the mapping of the location so we decided to use the MS-SQL server with Java and we have used the android studio as well as an emulator for designing and testing of our app.

III. Conclusion

With the help of visual positioning system user can know the better details about the environment around by just moving the mobile camera view to the specific direction or pointing the mobile at particular location or building. Project could give following advantage and benefits of the system

- Ease of navigation, guidance in historical places
- Helps in navigation in small campus where Google map won't help
- Google street view has limitation of showing location only not the legends, proposed system will help in the same.

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