SYNOPSIS

ON

“Tracking the Indoor Vicinity”

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Synopsis

1. Introduction

Tracking the Indoor Vicinity is a mobile application which is basically an indoor navigation system which enables the user to navigate to a destined location using Augmented Reality. Our project deals with navigation within buildings. It can be used for train stations, airports, shopping centers etc. It can include many other services.

For example: -

Customers in the shopping mall face difficulties in locating the correct shops for finding the suitable product due to the size of the mall and the navigation challenges.

This also affects the shops which are not able to reach to right customers, the business also getting affected as customers are not easily find it.

As a solution for this problem considering Win -Win situation for customers as well as businessmen, A mobile application for indoor navigation to reach each corner of mall can be designed.

2. Literature Review

Indoor positioning has gained popularity recently due to its potential to be used in the increasing complexity of indoor environment. Unfortunately, GPS signals are restricted to outdoor purposes. The main objective of this work is to design a new method to develop indoor positioning navigation system without using wireless technology.

Augmented reality is being used to superimpose the directional signage on the real view of the indoor environment in 3D form. Along with the 3D guides, voice guidance will be output from the system to assist users in identifying their locations easily.

Introduction

Experiments have revealed that Global Positioning System (GPS) is not suitable for enclosed areas due to the satellite signals being attenuated higher than 1dB per meter of structure.

Now also most of the common navigation guidance in indoor environment still rely on the non-interactive signage and floor plan or map around the building. Augmented Reality (AR) is used to superimpose computer-generated graphics on the real view of the user to create the effect of mixture of virtual and reality.

The motivation force behind the technology is the enhancement of the visual effect that could assist users in presuming certain object more easily. Therefore, the interactive 3D image being superimposed on the real scene may improve the efficiency in training-based application such as assisting doctors in surgery demonstration, robotic design and others. The basic working of the ARtoolkit (open source augmented reality software) is to display a virtual object (VRML model) on the detected marker. AR toolkit has been used in this work to display directional information in 3D format to deepen user's perception in recognizing the route for the navigation.

Technology Used:

A. ARtoolkit-

It is an open source software library for developer to develop AR applications. The great part of ARtoolkit is that it is able to precisely real-time track the view point of the user by using

computer vision techniques to calculate the camera position and orientation relative to the marker orientation so that the virtual object that rendered on top of the marker appears always aligned with the marker. The rendering from ARtoolkit provides smooth animation of 3D object.

B. Analysis of AR toolkit's Accuracy -

The performance of ARtoolkit plays an important role in determining the performance of the entire indoor positioning system as the 3D arrows and all navigation guides are dependent on the detection input from ARtoolkit. The subsequence modules in the program are more stable than the detection module of ARtoolkit. The performance of ARtoolkit can be evaluated from its ability of detecting a marker and the tracking accuracy upon the detection of marker. Confidence value that represents the matching percentage of the detected marker with the pretrained marker will be calculated by ARtoolkit once it detects a marker. The accuracy of ARtoolkit to detect a marker is highly dependent on the lighting condition from where it detects the marker.

C. Vuforia-

Vuforia provides these main features:

-rendering of the camera video feed (akas "video background").

- detection and tracking of known image targets or frame markers

- exposing the Pose (position and orientation) of any tracked target/marker, so to allow your app to render 3D augmentations that are virtually "anchored" to your targets.

D. Map-Box-

The most versatile geographic and cartographic management tool in the market."

Pros: What I like most about this tool is that it is in the cloud. You do not have to go through difficult installation processes like with similar products. It is easy to work, even if you are not from the GIS area or have another career not related to geography. I like the possibility of interaction that has the data on a map. It is perfect for presentations to multidisciplinary groups of people who do not know how to analyse a map, since the final products possess qualities that traditional digital maps do not possess. Mapbox has known how to evolve in the field of

GIS, combining the ease and practicality of similar services such as google maps, with the precision and efficiency in editing and processing proprietary software data such as Argis. The best part is that it is open source.

Cons: It is a tool for online use, so when there are faults in the internet connection, obviously the quality of the mapbox service is limited. In addition, the tool has some free geoprocessing and upload functions to the cloud, but those of us working with GIS know that a map completed with its associated data base can weigh hundreds of MB, and that cloud storage space It is definitely not free and nothing affordable.

E. Sceneform-

Sceneform SDK is a high-level 3D framework that makes it easy for users to build AR apps in Java. It offers a new library for Android that enables the rapid creation and integration of AR experiences, and combines ARCore with a powerful physically-based 3D renderer. It includes a runtime API for working with graphics and rendering, and a plugin to help you import, preview, and tweak the look and feel of your assets directly in Android Studio.

Sceneform is highly optimized for mobile. Java developers can now build immersive, 3D apps without having to learn complicated APIs like OpenGL. They can use it to build AR apps from scratch as well as add AR features to existing ones.

What follows is a walkthrough of how to use Sceneform. It's more technically advanced than most of the other content in this course--it's very helpful to have a little background in Java to fully appreciate how you might use it yourself--but we've included it so that aspiring creators can start to learn how to use Sceneform to make their own AR content.

F. Unity-

Unity is a cross-platform game engine and development environment for both 3D and 2D interactive applications. It has a variety of tools, from the simple to the professionally complex, to allow for the streamlined creation of 3D objects and environments.

Poly toolkit for Unity is a plugin that allows you to import assets from Poly into Unity at edit time and at runtime.

Edit-time means manually downloading assets from Poly and importing them into your app's project while you are creating your app or experience.

Runtime means downloading assets from Poly when your app is running. This allows your app to leverage Poly's ever-expanding library of assets.

Industry Landscape:

An extensive landscape study of the indoor navigation domain sheds light on the existing products that dominate the market. We studied and compared some of the prominent indoor navigation systems such as Qualcomm's IZAT, Google Indoor Maps, Place Lab Intel Research, NAVVIS and InfSoft.

A. Qualcomm Indoor Location Technology –

Qualcomm's indoor location technology (IZat) is a chip-based platform that facilitates delivery of location-aware networks. Qualcomm Atheros' 802.11ac and 802.11n access point solutions include advanced Wi-Fi based calculations to localize devices indoors with an accuracy of 5 meters. These access points, in conjunction with a server component they interact with, form a cohesive indoor positioning system.

B. Google Indoor Maps -

Google Indoor Maps have been activated for over 10,000 floor plans throughout the world. These indoor spaces include airports, malls, museums etc. Its indoor navigation algorithm is based on Wi-Fi access points and mobile towers to determine user's location.

C. Place Lab- Intel Research -

The Place Lab architecture, developed for research purposes, consists of three key elements as shown in Figure 4: Radio beacons installed at various places indoors, Databases containing the beacon location information and clients that estimate their location from this data. Place Lab provides location based on known positions of the access points which are provided by a database cached on the detecting device. Place Lab is entirely dependent on the availability of beacon locations, without which it cannot estimate anything about the current location.

D. The active badge location system -

A novel system for the location of people in an office environment is described. Members of staff wear badges that transmit signals providing information about their location to a

centralized location service, through a network of sensors. The paper also examines alternative location techniques, system design issues and applications, particularly relating to telephone call routing. Location systems raise concerns about the privacy of an individual and these issues are also addressed.

Research Paper:

1. The Research of Indoor Navigation using Pseudolites:

   Abstract: Pseudolites are ground-based transmitters that send global navigation satellite system like signals. As an independent system for indoor positioning, pseudolites technique can be explored for a wide range of positioning and navigation application where the signal of satellite GNSS can't be received. However, with indoor environment, the positioning method of pseudolite navigation system is not entirely same as GNSS, and there are some challenging issues in research and system design. In this paper, two major problems, near-far problem and time synchronization are studied. Firstly, near-far problem in indoor pseudolite positioning system is analyzed, and the near far ratio is presented. Then, based on different structure of pseudolite positioning system, the methods of time synchronization were researched. Finally, a synchronization method with navigation message is studied and the conditions of the method are proposed.

2. Development of a Zoo Walk Navigation System using the Positional Measurement Technology and the Wireless Communication Technology:

   Abstract: In this article, we propose and evaluate a Zoo Walk Navigation System consisting of the Animal Contents Registering and Editing Web Management System and the Animal Contents Browsing and Acquiring Smartphone Application. The Animal Contents Registering and Editing Web Management System for zoo staff enables to register/edit various animal contents. Thereby, this web management system provides real-time and flesh zoo information to the Animal Contents Browsing and Acquiring Smartphone Application. On the other hand, the Animal Contents Browsing and Acquiring Smartphone Application for zoo visitors enables to browse various animal contents which zoo staff registered through the Animal Contents Registering and Editing Web Management System. The Animal Contents Browsing and Acquiring Smartphone

Application has the animal guide browsing function, the animal quiz function, the beacon notification browsing function, the zoo map navigating function, and the AR camera function. Zoo visitors can enjoy a zoo park using this smartphone application. This system is the new type navigation system which zoo staff can renew contents to avoid contents obsolescence. And, this system always provides new information to zoo visitors in real time by the beacon notification function.

3. Project Objective

To display and showcase the shop's offers/discount to reach each customer. Customers can find the appropriate shop of their choice; App can help them Navigate to the shops whatever he likes. GPS reception is normally non-existent inside buildings, So marker based positioning approaches will be used.

4. Feasibility Study:

Indoor navigation is always called for when people want to navigate through complex buildings. However, there are also some interesting visitor services available along with the navigation function.

- **Economic feasibility:**

  It is Economically Feasible because In respect of Hardware, we will use Marker (like QR code Scanner) which is actually a poster, worth a penny.

  And in respect of software, it is basic freely available android app for user and vendors will pay a small amount as a charge of Database server.

- **Technical feasibility**

  In this era of digitalization every person's carrying smartphone, and our project is a mobile application-based software which can easily installed in smartphone above Android 8 with API level 28.

- **Operational feasibility**

  It is a platform where vendors and seller can get a window to window communication and vendors can present his discount chart within the app and user can find the best intended required item.

- **Legal feasibility**

  Our Application is fully Legalized as it doesn't violate any Illegal, Unauthorized or Irrelevant Activity. It doesn't violate any copyright and doesn't intend to harm any authorities, person or government.

5. Methodology/ Planning of work

For this project we are taking the use case for Shopping Malls. At the initial phase, we will build and E-Commerce platform the shop owners and customers, where shop owners can make vendor account and can list the items available in their shop. The user account will allow the user to search for the items available in the shopping center. We will be using Google Firebase, real-time database feature, for the database of vendor and customer. As the item from a shop gets selected by the user, then an activity will be launched helping the user to navigate to the shop from where item was selected.

The Map box SDK is used to design the custom map of the area to track the vicinity. We will use the marker based Augmented Reality; these markers will help to find the position of the person in that area. Then our application will help him navigate to the intended shop.

We will make this project using Evolutionary Prototype Model, the phase of prototype model are given below:

Phase 1: Requirements gathering and analysis

First, we will gather the information of the area to make a map using mapbox, for which we required the account for the mapbox sdk. Then we have to get a device that support Google Play Services for AR. We also use the Online real-time Database to store the information for the items available in the different shops of the mall. As a hardware requirement we also need a Beacons/Bluetooth module to track the indoor position of the person.

Phase 2: Quick design

In this phase firstly we will design the UI for Ecommerce Platform using Android Studio. In the Ecommerce Service we will add the searching, sorting, and filter functionality.
Then, we will design the internal map of the mall using mapbox or Google Indoor Maps

Phase 3: Build a Prototype

In this Phase we will be having our ecommerce service as well as its backend along with database will be ready. For the Navigation part the app will be able to receive the signal from the Bluetooth module. Through which the person will be able to position itself inside the mall. And we already know the position of the destined shop. Now app can easily navigate from source to destination using Augmented Reality.

6. Facilities required for proposed work

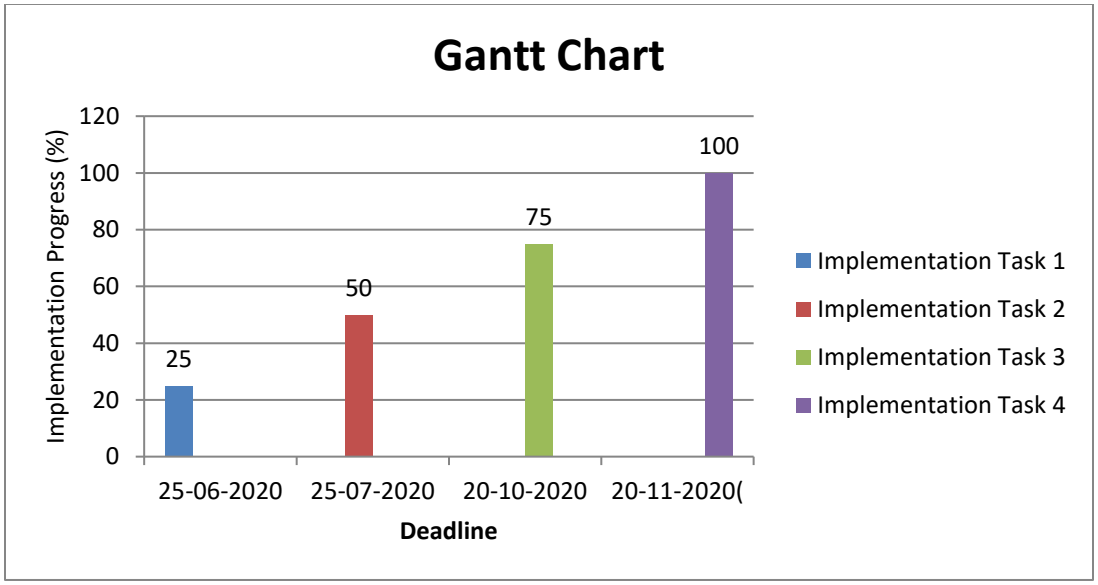
6.1 Hardware Requirements

- Device compatible of running Android Operating System
- Device enabled with Gyroscopic sensor.
- Device accessible to camera. The front-facing (selfie) camera is not supported.

6.2 Software Requirements

- Device supporting at least OpenGL ES 3.0
- AR required apps must declare minSdkVersion >=24
- Google Play Services for AR (built in ARcore SDK)

7. Schedule of activities (Gantt chart):



Implementation Task 1: UI for E-Commerce Platform

Implementation Task 2: Backend/Database for E-Commerce using Real-time Database

Implementation Task 3: Creating Virtual Map of the Mall.

Implementation Task 4: Augmented Reality

8. Chapterization

The project has been organized into seven chapters.

1. The First Chapter Introduces the concept of Indoor Navigation System project, basic idea of the its versatile behavior and implementation of Indoor Navigation System.

2. The Second Chapter presents the appropriate Review of literature.
3. The Third Chapter describes the Objective and real-life application of Indoor Navigation System in Mall.
4. The Fourth Chapter explains various feasibility test, and it contains requirement, needs and significance of the Project.
5. The Fifth Chapter presents Methodology and Planning of Work, it will include the steps to be followed to achieve the objective of the project during the project development.
6. The Sixth Chapter discusses the facilities required for this project, it contains both Hardware and Software requirement for this Project.
7. The Seventh Chapter presents the Schedule of Activities (with Gantt Chart). In this we divide overall implementation work into four major tasks.

9. References

Here specifies the description of the study material referred for the development of the project. (List all research papers mentioned in literature review & other resources).

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https://developers.google.com/ar/reference/java/arcore/reference/com/google/ar/core/package-summary

2.Map-Box documentation:
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