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Real Time Practical Navigator Using Augmented Reality

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Abstract

The use of mobile phones has become ubiquitous in today's world. Integrating the Navigation System with the smartphone technology is no more a new concept. The Global Positioning System (GPS) acts as a key factor to merge them together. It is a satellite-based radio-navigation system that provides geo-location and time information. The advancements in technology have enabled us to use the Augmented Reality concept in the field of navigation and thus make it more reliable and user friendly. Merging the real world information with the virtual objects to show directions to the user helps in creating a real time effect for the user while navigating. In this project the GPS of the device or mobile and also some API's provided by Google is used to develop a Real Time Practical Navigator using Augmented Reality.

Keywords: *Navigation, Global Positioning System, Geo-location, Augmented Reality*

INTRODUCTION

Augmented Reality (AR) is a technology that places virtual objects in the physical world using the device's camera. It is a field of research that focuses on enhancing the real world by overlaying computer graphics on top of it.

Augmented Reality provides a parallel link between the physical world and virtual information about that world. It provides simple interaction with the virtual world to the user.

As part of Virtual reality field, AR is a technology which combines the real world and the virtual world [3] Augmented Reality is categorized as Marker Oriented Augmented Reality and Markerless Augmented Reality. The Marker Oriented

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Augmented Reality augments an object by using a special marker. The special marker is used for obtaining the position where virtual objects are supposed to be placed. Marker oriented AR can be implemented using various libraries such as AR Tag or AR Tookit which provide a fast and accurate way to calculate co-ordinates in the making of a real-time AR system. The Markerless Augmented Reality does not use a special marker. Instead it uses the information of the objects in the real world to augment the object. This method also detects the 3D object's corners and then uses the original form of the object as the object's augmented position.

An AR navigation system uses augmented reality technology in navigation. Essentially, this system combines navigation information in the virtual form with the real world objects. Such systems can be applied to a variety of scenarios such as vehicular navigation, pedestrian navigation, indoor navigation, social navigation etc. In all of above scenarios, the objective is to aid the user to reach the desired destination more efficiently by augmenting the real world with navigation information. Examples of such systems include vehicular navigation or navigation systems through smartphones. The vehicular navigation system can make use of the camera attached to the front of a car. The smartphone's camera can also act as a device which can help to augment virtual objects by capturing the real world data.

LITERATURE SURVEY

Currently, [2] the navigation systems that are widely used are either Smartphone applications or standalone systems that make use of satellites for mapping the location information. In the traditional navigation system a map is displayed on which a navigation path is shown along with the current position of the user. These systems are reactive and prompt the user by giving instruction, either visually or via audio, to follow the intended path. Although current navigation systems solve the problem of navigation efficiently, they lack in providing a good user experience. Conventional navigation systems show navigation information in a simple form by showing arrows pointing towards the intended direction or by providing a "bird's eye view" of the map and the calculated path.

Suyoto[4] has utilized the location based augmented reality for searching the tourist attractions and culinary places in a particular city. The application provides a location and route feature for user for heading from start point (current position)

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to the end point (destination). It uses Location Based Service (LBS) that is information service that is accessible with mobile devices through mobile network and having the ability to make utilization of the location of the mobile device.

Nicola Capece's definition of [6] Points of Interest (POI) states that a POI represents a specific point, geo localized in the world, corresponding to locations such as a shop, a restaurant, a hotel, a road or a specific address. POI can also be a location that is of particular interest to a specialized user, such as companies carrying out relief work, maintenance, etc. In this case the POI may be a critical area, or it may identify an at-risk area (e.g. from flooding). In his system, POIs were displayed on a mobile device using billboards that were overlaid onto a scene that is captured by the device's camera. The billboard is an icon that takes different shapes and colors based on the POI. Each billboard is associated with a label that displays information such as the distance between the device and the POI, etc.

EXISTING SYSTEM

According to [1]Piarsa et al, Augmented Reality Based Technology enables the provision of variety of information such as pictures and location of buildings in the navigation field. The existing Augmented Reality based navigation systems are made to simplify many users' need for navigation to desired places. It is able to show many Augmented Reality objects which can help users determining routes that they need in order to get to the destination.

In the existing system the path is visualized using objects that are shaped like dots along the road that they need to follow, along with many road signs that will help users in navigating their way. This kind of Augmented Reality uses location data (latitude and longitude) to show the objects. The technology used in the system makes it possible to provide optimal route dynamically according to user's location in real life. This enables to create a more interactive system.

Drawbacks of Existing System

There are certain drawbacks of these systems:

1. ***Plethora of AR objects***: Currently implemented prototypes have saturation of the AR objects. This saturation of AR objects on the mobile screen limits the real-world view of the

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user, which in turn risks the safety of the driver.

2. ***Indoor Navigation:*** The existing system does not support indoor areas for navigation. Indoor navigation using AR might lead to discover various applications. These may include navigation set up in a huge workplace, shopping malls or even on an airport.

3. ***No Real Time POIs:*** Existing systems do not provide loading of POIs in real time. That means the screen should be refreshed every time the position of the user changes. This leads to performance deterioration and also degrades user experience.

PROPOSED SYSTEM

The android mobile device with installed AR application requires having an internet connection for receiving the information of data. The mobile devices are equipped with GPS receiver feature and internet service. GPS receiver connects to satellite directly to receive the location coordinate data of mobile device.

The system requests for GPS data to the satellite via GPS sensor embedded in the handheld device. The current location is stored and then passed to the Google Server along with the radius of the area to be searched. The Google Application Programming Interface (API) responds with the list of all the POIs within the radius provided. The Google Places API does this task efficiently. For every POI the geo coordinates are obtained and same are passed to the Mobile Device. Along with the geo coordinates, the name of the place and type of the place is also obtained. The distance is calculated with the help of current location Geo-coordinates and the POI Geo-coordinate. The Geo-coordinates of each POIs are passed to the Beyond AR Engine and those are translated into Real World Co-ordinates. Then after obtaining the Real-world co-ordinates the 2d objects are placed into Real world which can be seen via the mobile's Camera. According to the type of the place the specific icon is attached to the 2d object placed. Also the distance calculated is shown with the POI AR object.

IMPLEMENTATION

The proposed system is a Mobile application that will calculate the route from one location to another as per the user's input. The camera lenses will feed the real world information along with the users' current location to the application. The application will further generate

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virtual information based on the inputs. This generated information will be merged with the real world data and will be displayed to the user.

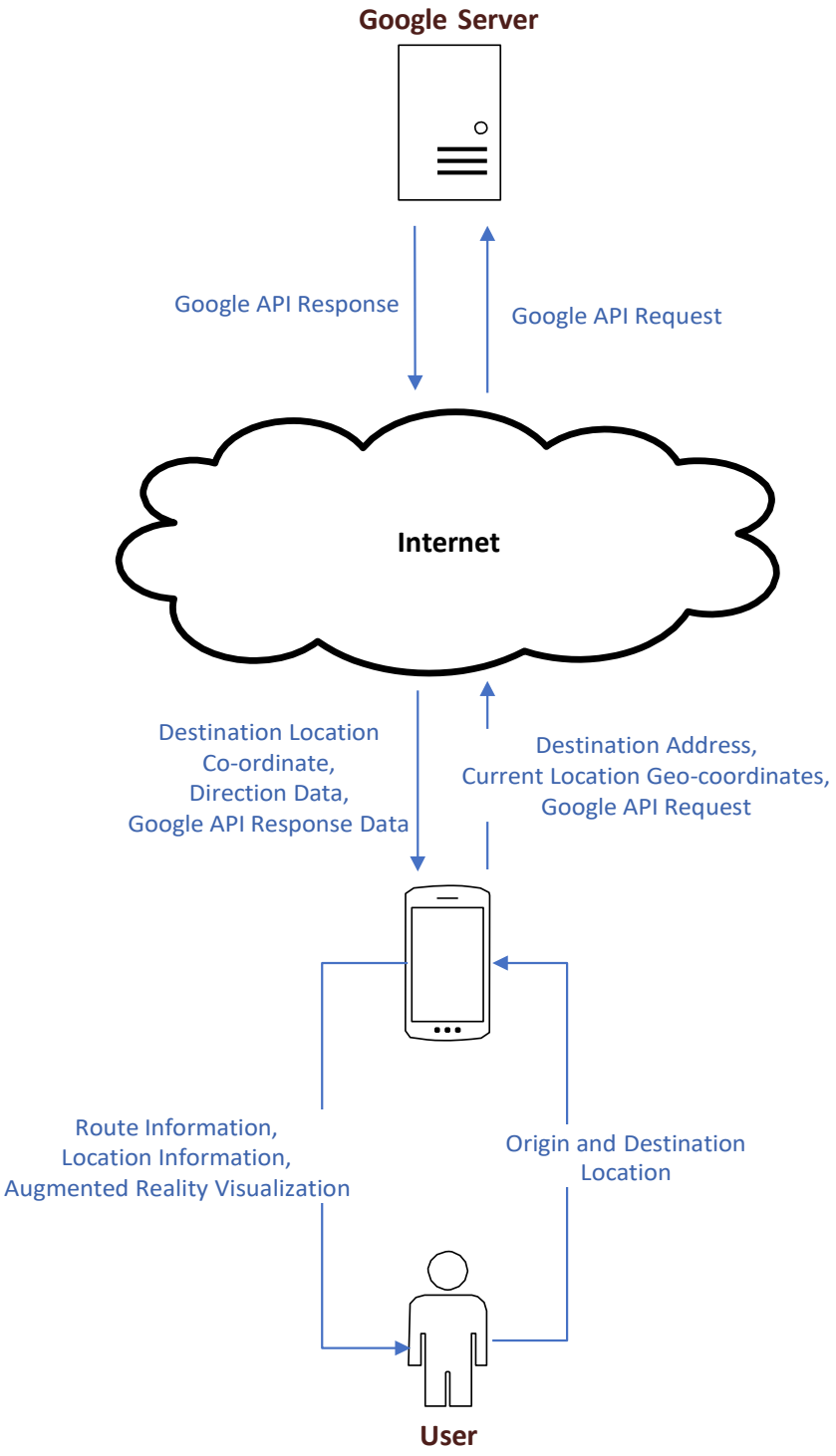


Fig 1: Block Diagram of Proposed Work

Module 1: Points of Interest

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The POI module of this project consists of the Point of Interest module. Here the GPS of the device captures the current location of the user and requests the system for the nearby POIs. The location of the user viz. the latitude and longitude is then sent to the system which in turn forwards the request to the Google Places API. The Places API returns the list of the available POIs to the system. The user also sends the Google Places API, a radius within which POIs are to be obtained.

The user requests the Google Places API using current position's Geo-coordinates, radius and the API key. API Key can be generated on Google Cloud Platform. The API key is always passed with each request to the Google API.

After the POI request is sent to the Google server, the system obtains the JSON format of the same. The system uses Retrofit Library to convert the JSON format into Java objects using GSON library. The Java Object in turn contains a list of all the attributes. The attributes include place id, place name, type, place-ordinates, etc.

The system then classifies each POI based upon its type. The type may include ATMs, Hospitals, Restaurants, Movie Theatre, Café, Shopping malls, Bus Stations, Parks, and Pharmacy etc. After the list is obtained, each object in the list is traversed and the location for each object is retrieved. By using the method Spherical Util. compute Distance Between (), the distance is calculated between the user's location and POI location. This distance is viewed with each POI 2D object. The object is passed to the add Beyondar Object () method which instantiates the objects in the real world.

Module 2: Navigation Using AR

In this part, the application takes source and destination co-ordinates from the user. Then it fetches the starting point and the destination point from the activity to the AR Activity. In this activity it plots the start and destination places with a spcific marker. The source and destination coordinates are sent to the Google server for path calculation. The Directions service returns all the routes, legs of each route and the steps of each leg.

Each element in the legs array specifies a single leg of the journey from the origin to the destination in the calculated route. For routes that contain no waypoints, the route will consist of a single "leg," but for routes that define one or more waypoints, the route will consist of one or more legs,

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corresponding to the specific legs of the journey.

Each element in the steps array defines a single step of the calculated directions. A step is the most atomic unit of a direction's route, containing a single step describing a specific, single instruction on the journey.

The instructions parameter obtained from the Directions Response is used to display the arrow marks. If the instruction in a step contains a string right/left, then the geo coordinates of the place are obtained. Accrodingly the arrows are placed using BeyondAR Engine.

Alongwith the AR Camera view, the application also implements the Google Maps Fragment, which views the route on a 2d map. This helps the user to easily watch out for different POIs along the route. This hybrid view allows the user to navigate through the straight roads without any AR obstacles. This fragment continuously tracks the location of the user and updates accordingly.

CONCLUSION

The navigation systems currently used needs the user to look at mobile phones while driving which risks the safety of driver. The navigation system may also cause wrong turns due to inaccurate tracking of the original roads and roads on 2d map. The Augmented Reality technology which allows to instantiate objects in the real world can be utilized for overcoming these problems.

In this paper, an Android application model is proposed to enhance the navigation experience by increasing accuracy and safety while driving. Augmented Reality Engine named Beyond AR has been used to implement this prototype. This prototype enhances user experience by generating symbols at turns in the camera view. A hybrid approach of the same is achieved by implementing a 2d fragment map which reduces AR objects on the road. This allows the user to look at the 2d map on the straight road, if necessary, which is less harmful and look at AR Camera view at turns.

FURTURE SCOPE

With the help of good hardware in low end cars, this system can be developed for Android Auto systems. This prototype can be reshaped and used by the government to promote tourism. This prototype can be re developed for the AR glasses coming in the future.

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