



In – Nav: an AR Based Navigation System

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In – nav: An AR based navigation system

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Abstract—Through this paper, the idea to use augmented reality for the purpose of indoor navigation is proposed. With the growing number of complex buildings and facilities around the world, the problem of navigating around them with ease also arises. Using the conventional methods such as directional hoardings and signs is not always convenient and is a pretty old concept as well. The conventional system is not much helpful as it takes time to find a particular area using sign boards and this task can prove tedious to the newcomers, children, old people, people who can't understand the local language, people with disabilities etc. Using an indoor navigation system can prove pretty useful in dealing with most of the aforementioned problems. There have been lots of developments in the indoor navigation field and they all propose different kinds of approaches but we find the usage of augmented reality a better method as it has proven to be convenient and does not require much technical complexity. We aim to make in- nav an AR based application which can be deployed on the user's smartphone and guide him to his desired location by using real time pointers while providing him the shortest possible path.

Keywords—augmented reality, convenient, navigation.

I. INTRODUCTION

AR (Augmented Reality) as a technology has been around for a while and has found its application in quite too many fields from medical to technical to gaming and navigation. Augmented reality is used to project virtual entities in real world via smart devices such as virtual reality gear or smartphones. We can use this feature in navigation as well. In navigation, AR has proved to be better than GPS (global positioning system) which revolutionized outdoor navigation completely. It is so because GPS has some restrictions when it is used for navigation in confined complexes as things like tall buildings, dirt and water may cause the deviation in the GPS signal causing it to stray and reduce precision. Smartphones these days come well equipped with quite strong computational capabilities and are also equipped with sensors like – accelerometer, gyroscope and proximity sensor and also have really good cameras. All this has made deploying AR based applications on smartphones very easy.

Augmented reality is thus, a better way to deal with that issue as it can provide real time pointers in the physical world whilst being independent of the perks related to the other technologies.

II. LITERATURE REVIEW

Rudiger Pryssa [1] has explained about the usage of an engine called AREA (Augmented Reality Engine Application) which is a kernel that helps in the development of smartphone based augmented reality applications. He

specifies that in the projects that were made using this kernel, a track making feature was created which would help people interested in adventure sports like mountaineering and trekking. The experiments conducted on this kernel fetched quite better results than some of the peer commercial technologies such as AR GPS navigator. This kernel performed better than most of its competitors with the exception being that of static scene by Android.

Ashly Martin [2] developed an augmented reality navigation application using Unity engine and Vuforia SDK. In that system, pointers were generated to denote path direction from source to destination. Every destination was represented as a node in a graph data structure. At the starting point, the user scans a QR code and then selects a destination, post selection, the shortest path finding algorithm of the application is triggered to generate the shortest path from the starting to ending point. The users can navigate their way by using smartphone devices and following the generated pointers to guide themselves to their chosen destination.

In an indoor navigation system developed by Gaetano C. La Delfa [3], marker based and non- marker-based approaches of computer vision were used. Three markers were chosen for doing a qualitative analysis on in order to determine which one of them gave the best performance. The three markers selected were – AprilTag, Vuforia and ArUco. All the markers were tested to check performance in different criteria such as draw speed, distance from the phone's camera and the dimensions of the markers. The analysis concluded that Vuforia performed the best among the three when the marker size has a dimension of 5 x 5 cm sq. ArUco performed well in all sizes, all lighting conditions and all floor patterns in the real time environment. AprilTag also showed similar performance under these conditions.

In an indoor navigation system developed by Buti Al Delail [4], a system which combined both augmented reality and inertial tracking was evaluated. In this system, the user was notified about its location provided good precision in finding the destinations. A system based on machine learning for the purpose of image identification was used such that it could be identified from a given database post running it in the system. After recognizing the place from the image, markers were projected in the environment in real time using augmented reality. This allowed the user to navigate to that destination. This system showed that using inertial navigation was a good approach when the user's location is to be tracked while in an indoor facility. This system can also be deployed on the

modern smartphones as they consist of the necessary system requirements.

In a survey conducted on indoor positioning system and navigation by Rhuta Joshi [5], multiple existing methods were reviewed in order to create an indoor navigation application meant to be used on smartphones. Reviewing existing technologies helps in enhancing the application which is to be built and improvements can be implemented. This system consisted two phases: one being the owner who provides the maps and data of the indoor locations and the second being the visitor who will use the system. Each destination is marked as a node in a graph. The visitor can start the application to chose his current location by using the location detecting algorithms and then proceed to choose the destination from the list. Post selection, the shortest path algorithm is run in order to determine the shortest path from the user to the destination node. The user can follow this path to reach the selected destination.

Jaewoo Chung [6] describes the problems that occurs when pedestrians fixate their attention to their smartphones instead of the way while walking. This often leads to accidents and thus a navigation system which can solve this issue and improves the way we experience a navigation app was proposed. This system intended to provide the user with directions in real time environment while he follows them. This allowed the user to be aware of the environment and reduced confusion and errors and provided a normal walking experience along with a reduced travel time.

III. EXISTING SYSTEM

The existing systems are designed for different environments and have different hardware requirements. The typical Global positioning system (GPS) cannot be used for indoor navigation as it is error prone. Using low energy Bluetooth navigation technology is also error prone as often times wrong devices receive the signal packets and there is a chance of data breach. However, this technology can be helpful in cases where tracking indoor movement of objects such as cargo is required. Google's Visual positioning system (VPS) is a system which tries to imitate the human eye to identify a location by using a phone's camera and comparing that data with the databases of google street view then providing the user on screen directions. This technology is also limited due to the lack of advanced Application Programming Interfaces (API) which may be available later.

IV. PROPOSED SYSTEM

A. System Requirements

- An android smartphone with android version 8.0 and beyond.
- The smartphone should have a functioning camera.
- The device should support Google AR core.

- The device should have proximity sensor, light sensor and gyroscope.

B. What is Augmented Reality

Augmented reality (AR) is a modified version of the real world. This modification is attained by projecting virtual entity in a real time environment via the use of devices such as smartphones and smart glasses. These virtual entities can be interacted with in real time. It's a blend of the real and virtual world. This technology has its application in various fields as of now. It is being used in games, it has its application in medical field, architects are using it to project their designs in real world, it is being used for navigation purposes and much more.

C. Google ARCore

- ARCore is a platform developed by google which is meant for building and developing augmented reality experiences.
- It uses different Application Programming Interfaces (APIs) to make your phone able to sense the environment it is present in, understand it and be able to interact with it.
- There are three necessary pre requisites for ARCore which are used for the purpose of integration of virtual entities to the real world – motion tracking, environmental understanding and estimation of light.
- Using motion tracking, the position of the smartphone in relation to its environment can be determined.
- ARCore combines the abilities of understanding its surrounding and tracking its position relative to that surrounding when motion is happening to identify some specific 'points' and evaluate their behaviour with the change in position of the device.
- In addition to that, ARCore is able to detect the geometry of the surfaces such as a table or the floor and can determine the information of the light availability of that surrounding as well. All this is done using the on device inertial sensors.
- Due to this understanding of the environment, ARCore allows you to place interactable virtual entity in that environment in a pretty seamless manner.
- Many popular development environments use ARCore Software Development Kits (SDKs) to develop augmented reality - based applications.

D. Methodology

In our proposed system, we have decided to use ARCore for the development purpose. This system uses arrow markers to display the directions from the source to destination. In this method of indoor navigation, a map of the indoor complex is to be made initially. To do that, the administrator will store all the sources and destinations in the application in a list format. Post doing this, he is required to visit to a certain source, open the application and then leave pointer notes in the way to a chosen destination. This is achieved using placenote software development kit. The map data is stored in the cloud. Once the storage of paths is finished, they are integrated into a search

like interface so that the user can make a selection to choose which destination is to be reached.

E. Workflow Diagram

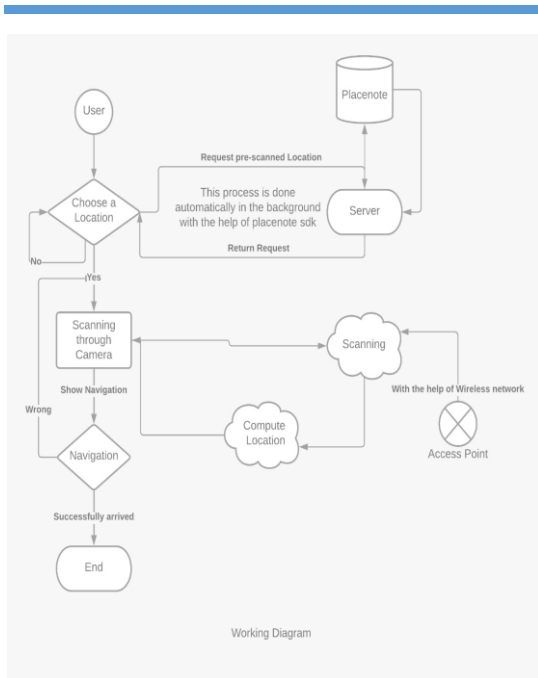


Fig. 1. Workflow diagram.

This workflow diagram is a depiction of the approaches which are going to be taken by the user to use the application. The user begins by selecting a location he has to visit. After that, the user’s current location is automatically determined in the background with the help of placenote sdk. The details are then sent to the server which then issues a return request about the location of the user. If the user has selected a valid-destination then the camera scanning begins to scan the plane and then shows the navigation path.

F. System Sequence Diagram

This system sequence diagram in Fig. 2. Represents the order of the interaction between the objects in the proposed system. In the initial step, the user interacts with the smartphone device in order to start the application. The application then makes requests for location to the server. Post receiving that info, then interaction happens with database to gather info related to that location. The info is then reverted back to the server, then the requested data is forwarded to the application so that the user can choose or create a location. After this, scanning takes place and wireless identifications are sent back from the access point after which the processes needed in order to provide the directions takes place and the user can then navigate to the selected destination.

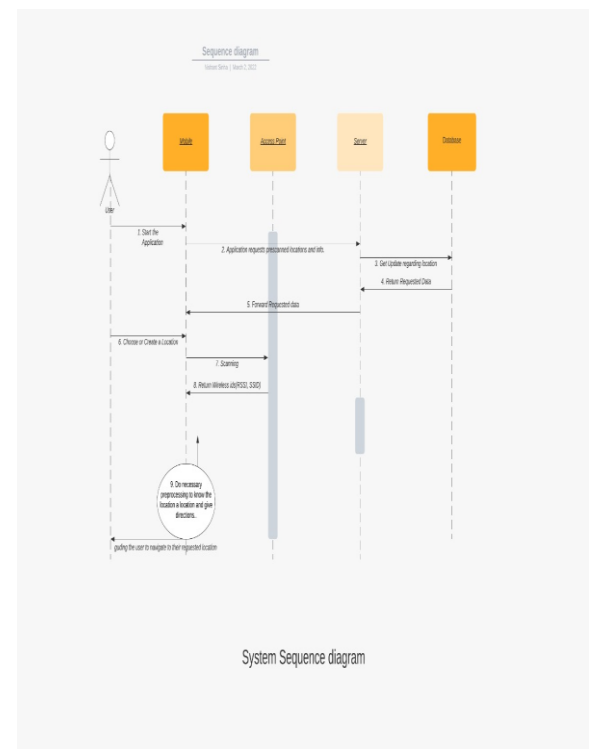


Fig. 2. System Sequence diagram

CONCLUSION

we developed a modern indoor navigation application which allows the user to navigate through indoors of a complex/ facility. The User interface of the application is quite simple and easy to interact with. The performance of the initial version is also quite good. The proposed application can be implemented in places like hospitals, hotels and universities where people require assistance in order to navigate to certain places inside those places. In future, audio assistance can also be integrated in order to help users with visual disabilities.

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