SIMULATED AUGMENTED REALITY SYSTEM FOR NAVIGATION

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Abstract - *The purpose of this study was to prove the enhancement of the conventional maps' navigation using Augmented Reality technology. A general survey was conducted to know whether people are interested in trying out an alternative method of navigation. This survey exhibited that a significant group of people are attracted in trying a new approach due to the problems faced by them in the regular maps' navigation. To prove this hypothesis, an android application was developed by the Agile design methodology. This application was fashioned in Android Studio framework by incorporating Google APIs. This application allowed the users to navigate to a specific location guided by camera's AR view where AR objects highlight the path. Considering the feedback from the users, it is all right to state that the hypothesis was successfully proven.*

Key Words: Augmented Reality, Agile Design Methodology, Android Application

1. INTRODUCTION

In this rapidly changing era, technology has brought human world closer to the digital world. Everyone is familiar with the conventional form of navigation ever since google launched google maps in 2005. Augmented reality is one such technology which has directly impacted the interface between the human world and the digital world. This research implies the use of Augmented reality technology to study the prospects of enhanced navigation.

1.1 What is Augmented Reality?

Unlike virtual reality (VR), augmented reality (AR) does not create a virtual environment in which the users can themselves. AR creates an environment where virtual computer-generated objects are superimposed on the physical objects. The physical objects in the people's environment become the background and target things for virtually produced objects as mentioned in the paper [7] which was published by Nanyang Technological University, Singapore. The primary objective of this paper was to provide a roadmap for future researchers in augmented reality to conduct studies of their own in this comparatively unexplored field in the early 21st century.

1.2 How Augmented Reality can be used to enhance the navigation experience?

This paper explores the idea that car can be considered as an AR apparatus which can shift the paradigm of the navigation systems which can enhance user interaction. Considering this principle, a camera recognizes the driver's eye position and subsequently empowers the framework to suitably show the growth in respect to the driver's stature and area on the seat. The new worldview takes out the equivocalness that may emerge, e.g., when regular navigation frameworks require the driver to turn left with two intersections consecutive. Intersections that are avoided the driver (e.g., because different vehicles or ascends in the scene confine the driver's view) can be made noticeable by means of AR. The 3D portrayal of the road in AR navigation frameworks is determined utilizing the information originating from a customary navigation framework—the present GPS position and introduction, the maps, the geology data, and the determined course.

1.3 Creating the AR Experience

As mentioned in the article [7] to create an AR experience, following steps should be followed. Illustrations rendering equipment and programming that can make the virtual content for overlaying this present reality. Use of effective tracking techniques to track the position of the user which can be reflected in the graphics. Aligning of the real & virtual world by using appropriate tracker calibration tools. Display equipment for blending virtual pictures with the perspectives on this present reality. Input & output devices for running the AR simulation. Use of interaction techniques, so that the user can manipulate the AR content. Other such factors to create an AR experience are as follows: usability evaluation, wearable systems, visualization techniques, multimodal AR input, novel rendering methods and software architecture.

2. LITRETURE REVIEW

2.1 Tracking techniques

Tracking in AR is fundamental registration and mapping of surroundings of the user in a specific location to display the digital content which perfectly synchronizes with the real world. As perfectly stated in the paper [4] spatial consistency between real and virtual objects can be achieved by tracking the position and orientation of real objects. It is one of the fundamental techniques for enabling the AR experience.

The group of researchers mentioned in the paper [2] which was published at 2nd IEEE and ACM International Workshop on Augmented Reality of 1999 described a conferencing system for interfacing the real and virtual content. As computers are used to enhance the collaboration between humans, the commonly known practice of Human-Computer interface is evolving into a new field known as Human-Human interface mediated by a computer. This is the fundamental principle in development of augmented reality applications.

2.1.1 Vision Based Tracking

Image processing methods are used in vision-based tracking to calculate the relative position of the real-world objects with respect to the camera. Feature-based methods where the feature-based methods are to discover a correspondence between 2D picture highlights, and their 3D world casing arranges. The camera posture would then be able to be found from anticipating the 3D directions of the element into the watched 2D picture organizes and limiting the separation to their comparing 2D highlights. Model-based methods where model-based trackers often develop their models dependent on lines or edges in the model. Edges are the most much of the time utilized highlights as they are computationally effective to discover and powerful to changes in lighting. [7]

2.1.2 Position Based Tracking

The Global Positioning System gives overall inclusion and measures the user's 3-D position commonly inside 30 meters for ordinary GPS and around 3 meters for differential. GPS tracking requires 3 out of 24 satellites for position tracking.
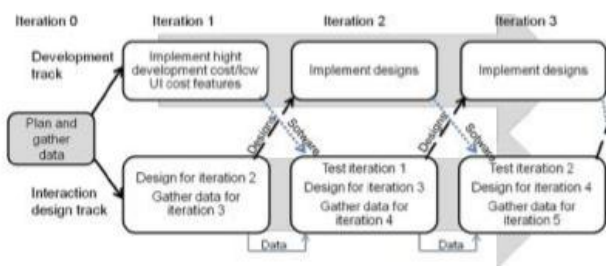
3. METHODOLOGY

3.1 Artefact Design

Figure 1 : Agile-UX Block Diagram

The approach used for this research is known as Agile design approach. As explained in the paper [5] the mixture of values and practices from Agile software engineering methods and User centered design methods which is a trend of last decade is known as the Agile-User Experience Design or Agile-UX. This method is bound to provide quick software that upholds the quality according to the user's needs. The

agile methodology works on a manifesto that interactions between people over processes, software over tedious documentation, customer collaboration and responding to change immediately. Agile development was a solution to the problem of delayed projects, stressful jobs, and budget overruns. With this method, a software which can fulfil customer's requirements can be developed in a short time. The user interface depends on the interactions and collaboration between the developers and customers.

3.2 Apparatus

The application was developed in android studio with the help of Google Maps and ARCore. It is an android based application which works on Android 8(OREO) and above versions.

3.3.1 Android Studio

Android as an open source and a certain level of community driven development makes it a pleasant environment for the developers to work in. This centralization is finally available for the developers due to the IDE Android Studio. [6]. It is a Java integrated development environment that includes its developer tools and code editing. Android studio uses a gradle based build system, code templates, emulator, and GitHub integration. It also includes Android app modules, Library modules and Google App Engine. There exists a code editor for writing, refactoring, and analysis of the code. The applications are then extracted in an APK format. [1]

3.3.2 Google Maps

Google maps is a web mapping service developed by google. Google has built various APIs for developers to build applications. The APIs used in this application are Maps API, Places API, Directions API, Geocoding API and Geolocation API.

3.3.3 ARCore

The book [3] was published considering the interest of people who have no prior experience in game or graphic programming. This book provides a roadmap to people who wish for a career in Augmented Reality field. As stated in the book, Google developed ARCore so that the developers can incorporate the visual enhancements or virtual enhancements into the applications based on Augmented Reality. It is a software development kit to develop android applications. It addresses three specific areas: Motion tracking, Environmental understanding, and Light estimation.

4. RESULTS

The purpose of this research was to prove the hypotheses that Augmented Reality can be used to enhance the navigation experience. Overall, the result of this research was a success. Although there is still need for improvement

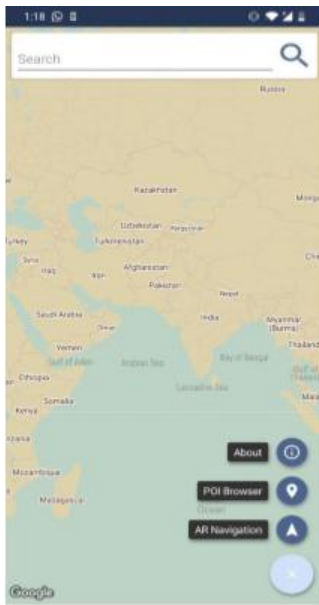in various aspects, but it proves the hypothesis of this research at some extent.

Figure 2 : Applications' home screen

As shown in the figure 2, the home screen of this application has a world map on the screen with a search bar on the top. User can search for places by filing the field with a desired address. On the bottom right corner there are three buttons: the first one is to show the information about the application, the second button takes the user to the 'POI' browser feature, and the third button will take the user to the conventional maps navigation feature.

The conventional maps navigation feature of this application is dependent on the following APIs: Maps SDK, Places API, and Directions API. Listed below is a use case scenario of this feature. The source and destination fields successfully take the values of addresses from the user.
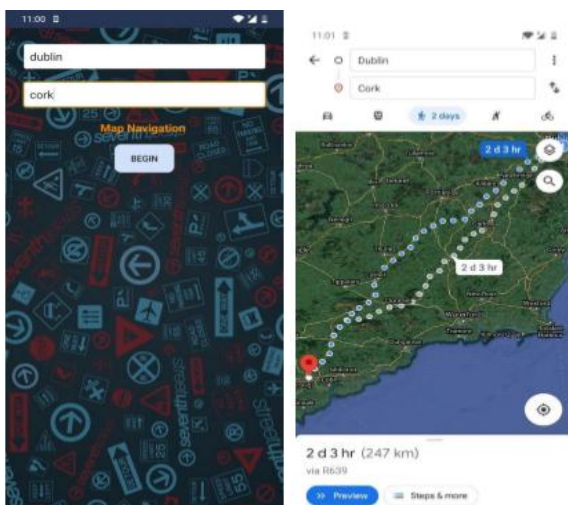
Figure 3 & 4 : Convetional Navigation Feature

After entering the addresses in the source and destination fields, the application successfully considers the addresses as shown in the figure 3. Figure 4 shows the direction between the two locations on the map.

The last feature 'POI' browser is the one which has the Augmented Reality navigation feature in it. It is also dependent on the Places API for functioning. This can be explained with a use case scenario. As the user clicks on the 'POI' browser button, the AR camera of the phone is accessed. The screen displays the nearby prominent locations with the images categorized accordingly.
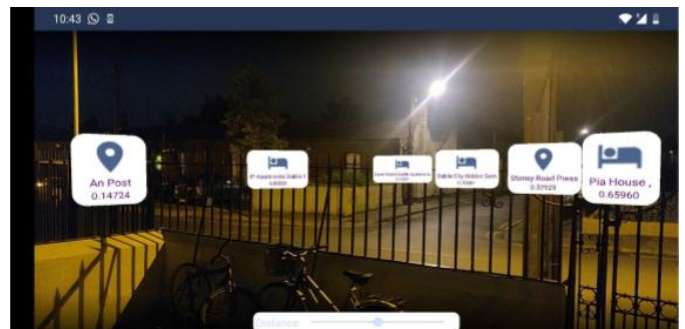

Figure 5 : POI Browser view

If the user clicks on the 'An Post' icon, the application will show the address of that place as shown in the figure 5 and will ask AR directions to that location.
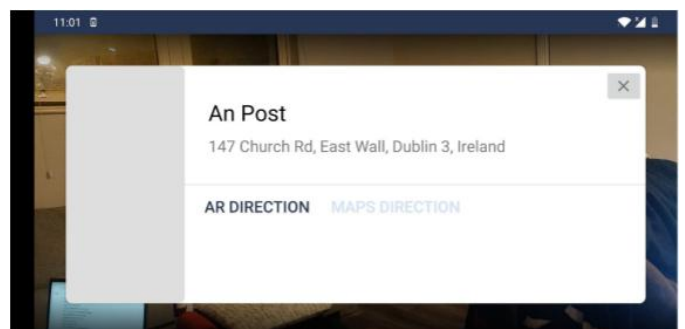

Figure 6 : Place Details

After clicking the 'AR directions' button the application will draw the AR directions to location in the form of 'AR objects' which highlight the road in the direction of the place as shown in the figure 7.
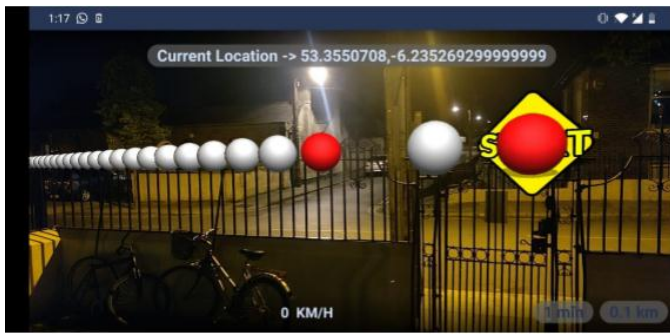
Figure 7 : AR view in the application

5. DISCUSSION

Two surveys were conducted in this study: First one was an opiniated survey and second was the user feedback survey. The first survey was conducted at the start of this study. Another survey was created which was a user feedback survey. Feedback of 15 people were noted.
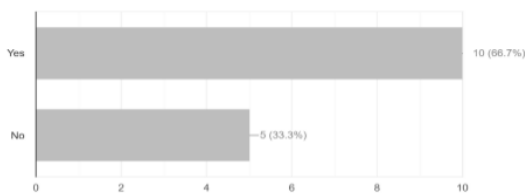

Figure 8 : 1st Survey

Among these people 66.7% of people knew about the Augmented reality technology and had used applications related to Augmented Reality beforehand. Considering this, almost all of them thought the application was easy to use as seen in the figure 8.
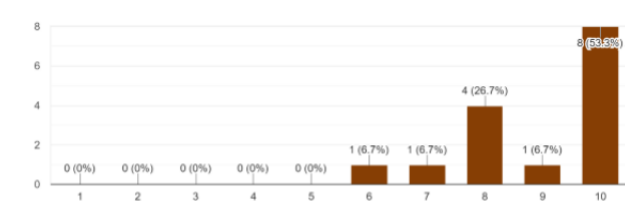
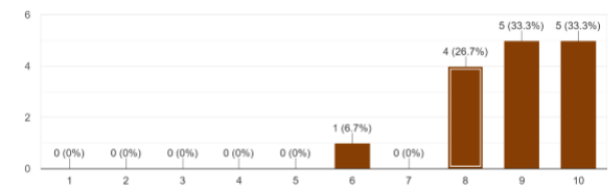**Figure 9 :** Snippet on survey's UI feedback question.

Figure 10 : Snippet of survey's application rating question.

Overall, on a scale of one to ten everyone rated the application as a good option instead of the conventional maps navigation. Surely these results help in proving the hypotheses that Augmented reality can be used to enhance the current navigation experience.

6. CONCLUSIONS

The research aimed at the hypothesis that Augmented reality can improve the navigation experience for the user. However, this research has shown that people would like an innovative way of navigation. This study has successfully shown that an advanced way of navigation is possible over the conventional way of navigation.

ACKNOWLEDGEMENT

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