EARL: Earlham's Augmented ReaLity Mobile Application For Better Campus Tour Experience

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1. INTRODUCTION

Imagine yourself being on a university campus that you have never been before. Without the assistance of a student or a person who has been there for a while, knowing your location and destination would be difficult. You will need to have a traditional map and ask random strangers to know where a certain building or what the purpose of that building is. Thanks to the advances of a technology call "Augmented Reality", the struggle of familiarizing ourselves to an unfamiliar place can be less of a nightmare and more of a fun adventure. Augmented Reality is one of the technologies that will be able to provide a ubiquitous learning environment in the near future. Although Augmented Reality as concept has existed since the 1960s, it is only in recent decades that the technological advances make it a possible research field[2]. Yovcheva and et al. pointed out that the strength of mobile based Augmented Reality application is that they can be used to access personalized and updated information at any time and place and, by using them, the users will be able to view information about an object of interest in their surroundings[4].

Augmented Reality has been already utilized by a variety of fields and continues to be tested in many new areas. These areas include education, medicine, entertainment and commerce. Inspired by the technology, I decided to tackle the frustration of navigating around an unfamiliar place, getting used to it and learning more about the space. By using AR technology, we can create an application that can provide both navigation and information of our surroundings in real time. Augmented Reality supplement our real world surroundings with virtual objects that appear to coexist in the real space. These objects will help provide additional information about the real objects and their environment. Packed with the level of usefulness and the amount of interactivity and fun Augmented Reality can bring, this mobile application will help visitors and new students of Earlham College explore the campus without the thought of getting lost and enjoy their stay with information available just within a touch on the mobile devices.

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1.1 Aim Of The Project

The main aim of the project is to create an full fledged Augmented Reality mobile application designed for better campus tour experience at the end of the semester. The full fledged application will has navigation system, virtual informational overlays for all buildings on campus, a working tutorial, mini-games and fun facts. To satisfy the main objective, I will have to write a software and install it on a mobile hardware. Then I have to experiment it on the campus of Earlham. Although I am ambitious about the aim of the project, I will focus on Navigation, virtual information and tutorial before I move onto other minor goals because of the time and skill constraint. As a personal goal, I want to learn more about Augmented Reality and improve my skills in software developing.

2. RELATED WORK

Over last few years, there have been several attempts in creating navigation application that uses Augmented Reality [1]. However, most of these applications are navigation systems for drivers. A few of them are applications that show points of interest in the surrounding area of the user. They do not have information more than what a place is (for example: a restaurant). There was an application called "TigerEye" that is designed for navigating on the campus of Clemson University[3]. However, navigation is the only function the application can deliver.

The application for this project, EARL, will be different and unique from the AR applications on the market because it is designed solely for better campus tour experiences. By combining the elements of navigation and virtual information overlays, the application will bring a new level of campus tour experience to the users.

3. DESIGNING A MOBILE AUGMENTED REALITY APPLICATION FOR TOURS

There are two principle components in creating the application: the hardware and the software. In this project, I will make EARL an android application with specific software development kits and libraries for Augmented Reality features.

3.1 Hardware

To develop Augmented Reality mobile applicaiton, we need specific hardware. There are certain core requirements that the chosen device for implementing augmented reality must meet. First of all, the device must be an android device. It

has to support a fairly recent version of Android OS (Android 4.0+ is recommended for AR development). The device must also possess GPS for tracking the user's current position within the world. The device requires a rear-facing camera so that the user can point at markers or text and that the device will know the location of the object on which it should augment virtual overlays. The chosen device should also have an accelerometer to detect movements. The ability to be able to connect to the internet will be very useful in the process of further development and improvement. For most mobile devices, battery life and CPU power is limited. To render and augment 3D objects smoothly, the device must have a capable CPU (armv7a and NEON support). Rendering 3D models also requires a lot of power for the graphics and drains battery rapidly in the process. Having a good battery would be necessary to run the application while exploring the campus.

3.2 Software

In my opinion, the aim to develop a full-fledged mobile AR application by the end of the semester is a bit ambitious. Therefore, I will give priority to navigation and virtual 3D content augmentation followed with a fully functioning tutorial in this project. These are the most important and fundamental parts of EARL. I will elaborate each component in subsections. Figure 2 illustrates inputs, processes and outputs of the software.

3.2.1 User Interface Design

The user interface design of the application is function-based. EARL will be simplified so that the focus will be more on the implementation of the software. However the application will be designed with user-friendliness in mind. In Figure[1], a sample version of main menu is shown. Each button will lead to a different page specialized for the designated function of that button. Each page will be minimal but still aesthetically pleasing and user-friendly.

3.2.2 Navigation

To implement navigation component of the application, Google map will be embedded in the system. Google Map Android API key will be necessary in doing so. Google play services SDK will be installed to get the necessary key. GPS will track the user's current location and feed it to the device as shown in Figure[2]. The device will then use Google map to generate a walking path from the current location to the desired destination. The path will be imposed on the screen of the device.

3.2.3 Virtual Information Overlays

The process of augmenting virtual informational overlays will take its cue from text recognition API and marker recognition API as shown in Figure[2]. I am planning to implement the application to be able to recognize typed text from the real world and augment its respective overlay accordingly. To implement this, an OCR API has to be used and I am looking at an API called Anyline. Moreover, the device will also recognize fiducial markers too. This will be handled by image recognition algorithm of the framework/SDK chosen(Wikitude or Vuforia). Both of the SDKs are available in free development versions with restricted features but they are still suitable for this project.

The text or marker recognized by text recognition or marker

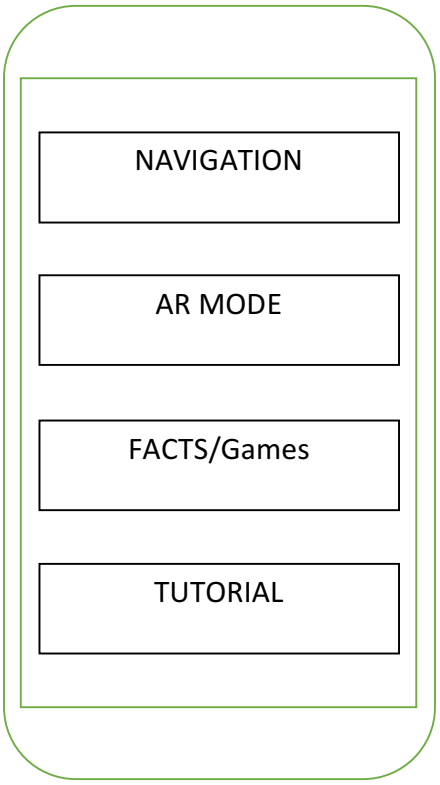

Figure 1: Main Screen Layout

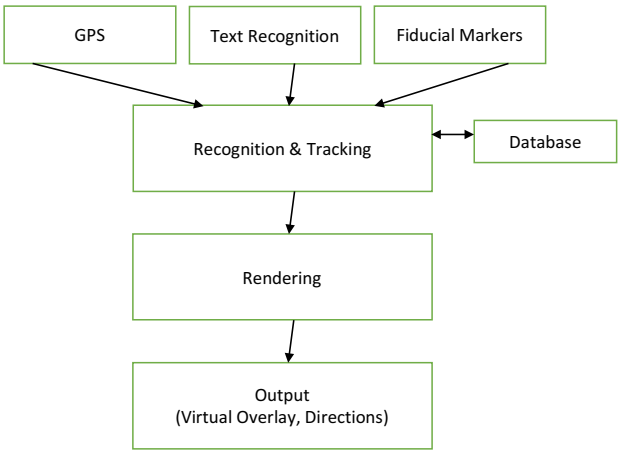

Figure 2: Flowchart of The Application

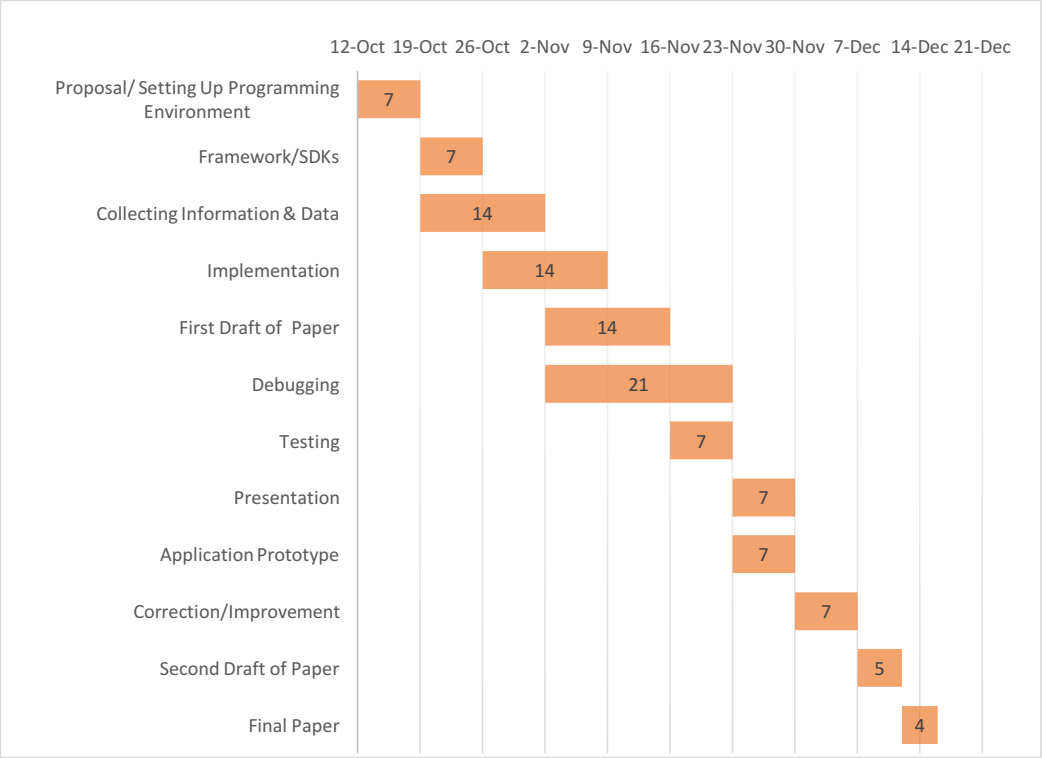

Figure 3: Estimated Project Timeline

recognition will be fed to the recognition and tracking process of the application as demonstrated in Figure[2]. Then the device will look up the respective informational overlay in the database and render it on the screen so that the user will see it superposed on the real world. Augmented Reality SDKs and libraries will be used for this recognizing and rendering part.

4. TIMELINE

In order to streamline the project, I have created a Gantt Chart to visualize how the rest of the semester would be like. Figure [3] illustrates the timeline of the project.

4.1 Budget

To have a minimum budget for this project, only free trial versions of SDKs and softwares will be used. However, an Android Phone for development,field testing and prototyping would be essential and it would cost around $100-$150. There might be some hidden costs that are not obvious and predictable yet.

5. REFERENCES

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