

**Head StARt**

by

Nic Bandy, Brian Dougher

Submitted to  
the Faculty of the School of Information Technology  
in Partial Fulfillment of the Requirements for  
the Degree of Bachelor of Science  
in Information Technology

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*Nic Bandy*

Nic Bandy

*4/13*

Date

*Brian Dougher*

Brian Dougher

*4/13*

Date

*Abdou Fall*

Abdou Fall, Faculty Advisor

*4/13*

Date

University of Cincinnati  
College of  
Education, Criminal Justice, and Human Services

April 2020



Prepared by  
Nic Bandy & Brian Dougher

Students of  
University of Cincinnati  
College of Education, Criminal Justice, and Human Services  
School of Information Technology

April 13, 2020

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## **ACRONYMS AND ABBREVIATIONS**

AR	Augmented Reality
SDK	Software Development Kit
IDE	Integrated Development Environment
CAD	Computer-aided Design
SQL	Structured Query Language
3D	Three Dimensional

## **ABSTRACT**

Head StARt is an interactive Augmented Reality (AR) application designed to aid incoming freshmen going through college orientation. The current college orientation process is very heavy on information in the form of stacks of paper. This can lead to students feeling overwhelmed and missing key information. Paired with a brochure or document of choice, Head StARt allows you to use your phone to scan the document and bring up interactive AR experiences, helping students better understand and retain key information. Our application will also have an easy to read map, with pictures and models of the buildings provided when you scan the map. Head StARt can take any brochure or pamphlet to the next level by engaging the audience in an exciting way and helping new students better retain important information.

## **PROBLEM STATEMENT**

### **Introduction**

Universities have long been challenged with the task of conveying vital information to their incoming students. The standard approach of getting all incoming students together for a big information session has since become the standard. With advances in modern technology, we wondered how we could use the smart devices many students have with them every day to enhance the experience. Adding an augmented reality experience to a standard school orientation can help engage and connect with the modern college student. The remainder of this final report outlines in detail how the project was completed. The report includes the following sections: project management aspects, technical elements, design goals, and a conclusion as of Spring 2020.

### **Problem**

In the survey, “The American Freshman: National Norms Fall 2014,” involving more than 150,000 incoming full-time students at four-year colleges it was found that 34.6 percent of incoming college freshmen felt overwhelmed due to the number of things going on in this stressful time period.

One aspect that adds to this feeling of being overwhelmed is information overload. When attending college for the first time, new students are bombarded with information and it can be difficult for students to retain it all. Currently, universities will often give students folders with stacks of paper filled with important information. This leads to most students not taking the time to seriously go through and thoroughly read all the documents. Conveying important information to new students is a problem that colleges have been facing for many years.

## **Solution**

The Head StARt application serves the needs of both incoming freshmen and the University by allowing the University to highlight important information using augmented reality. Augmented reality has been proven to increase content understanding, student motivation, and long term memory retention (Radu, Iulian. (2014). Augmented reality in education: A meta-review and cross-media analysis. *Personal and Ubiquitous Computing*. 18. 1533-1543. 10.1007/s00779-013-0747-y.).

The application will be used as a companion to a traditional paper document. The document will be marked for use with the AR companion application. Once the student has the application, they can use augmented reality in conjunction with the information already in front of them to participate in an interactive learning experience. This will help the Universities engage students with exciting AR technology while increasing learning and information retention in new students.

## **Project Description**

The Head StARt application is an interactive augmented reality application used by incoming freshmen at college orientation. Creating interactive AR experiences using multimedia objects like images, videos, and 3D models that work hand in hand with a physical pamphlet or document in front of the student. The addition of these augmented reality experiences will cause students to pay more attention to the document and help them retain valuable information going into their freshman year of college.

The remainder of this final report will cover the specifics of how this project was completed. The following sections will cover all relevant information: project concept, user profile, use case diagram, timeline, and technical details.

## **DISCUSSION**

### **Project Concept**

Taking inspiration from the ever-changing world of IT, it has become clear that augmented reality will serve a vital role in the world of tomorrow. While AR is largely an enterprise tool at the moment, with many manufacturers like Boeing and Porsche utilizing the new technology for training and assembly. Companies like Amazon, IKEA, and Sherwin Williams have already deployed augmented reality applications to consumers which allows the user to use their smartphone to see products in their home.

Knowing what we know about the affect augmented reality has on a person's ability to learn new information it is hard to think of a more worthwhile place to implement this technology than a college orientation. Currently, there is no product specifically designed for this use case. There are development platforms like Vuforia Studio which aim to create codeless AR authoring tools for custom built AR applications but Head StARt will go beyond this by using the latest AR development tools to create an interactive AR experience for a specific document(s) as the most exciting part of any college orientation.

### **Initial Goals Abandoned**

Since beginning to create Head StARt in the fall, like most software we have had some development goals that were abandoned. One major goal that we shifted away from was the goal of cross platform development for IOS and Android. The immense extra workload was quickly realized due to some of the difficulties in developing for IOS in Apple's locked down ecosystem. Instead Android has been are target operating system.

Another abandoned goal was the move away from heavy 3D model usage. 3D models remain a part of Head StARt but the original idea of using 3D models primarily in the map portion of the application was changed as development went. Simple 2D images seemed to give the user a clearer visual of the buildings and therefore fit our design goals of making campus easier to navigate. For certain buildings or AR experiences 3D models remain superior but learning to pivot development ideas like this was a vital part of creating Head StARt.

### **User Profile**

We have determined that the End User is the only type of user that will be interacting with our application. The potential users for the Head StARt application are incoming college freshmen. These users will interact with the application by having a brochure in front of them which will work in companion with the application. The user will hold their phone over the brochure and bring up an augmented reality experience related to the content on the brochure.

Figure 1: User Profile, illustrates the user profile for the Head StARt application. It denotes potential users of the application, related experience and similar applications that the user may have encountered, the tasks the user is expected complete when using the application.

<b>User Profile Form</b>
<p><b>PROJECT:</b> Head StARt- Augmented reality orientation application.</p>
<p><b>POTENTIAL USERS:</b></p> <ul style="list-style-type: none"> <li>- Freshmen going into college orientation.</li> <li>- Students looking for a more interactive experience with learning materials.</li> <li>- Less interested students, who still need to receive vital orientation information</li> </ul>
<p><b>SOFTWARE, INTERFACE, AND RELATED EXPERIENCE:</b></p> <p>This project will be utilized by incoming college freshmen. Universities will use Head StARt in combination with an orientation brochure document to create an informative Augmented Reality experience.</p> <p>Any student with a phone can scan the brochure with their camera and pull up interactive Augmented Reality experiences. AR has been proven to increase content understanding, student motivation, and long term memory retention.</p> <p>Head StARt will allow students looking to go deeper into their orientation materials to do so. While also helping less interested students retain vital information that they might usually skip over.</p>
<p><b>EXPERIENCE WITH SIMILAR APPLICATIONS:</b></p> <ul style="list-style-type: none"> <li>- Amazon AR View</li> <li>- 3D CAD models</li> </ul>
<p><b>TASK EXPERIENCE:</b></p> <ul style="list-style-type: none"> <li>- Using mainstream AR apps like Amazon AR View to see objects in real space.</li> <li>- Going to college orientations and experiencing information overload.</li> </ul>

**Figure 1. User Profile**

## Use Case Diagram

The following diagram, Figure 2: Use Case Diagram, displays the use case for Head StARt. The Diagram depicts all users of Head StARt along with the corresponding tasks each user will have access to when interacting with the application. Arrows coming from the university are representative of building the features while the college freshman will use the features.

### HeadStARt Use Case Diagram

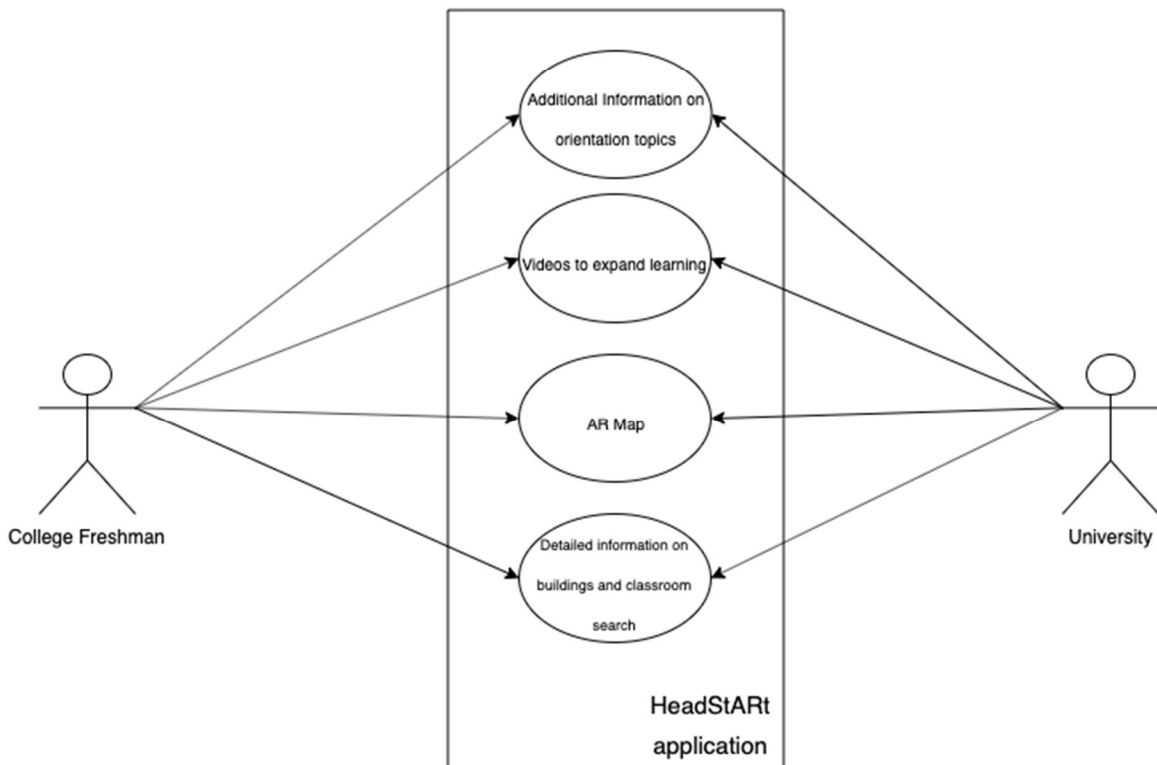


Figure 2. Use Case Diagram

# PROJECT MANAGEMENT

## Project Schedule

Planning is a vital part of any successful project. Below you can find the Gantt Chart and the Work Breakdown Structure followed during development of Head StArt. The goal being to separate the project into smaller pieces to be completed at set times.

Figure 3: Gantt Chart

Table 2: Work Breakdown Structure

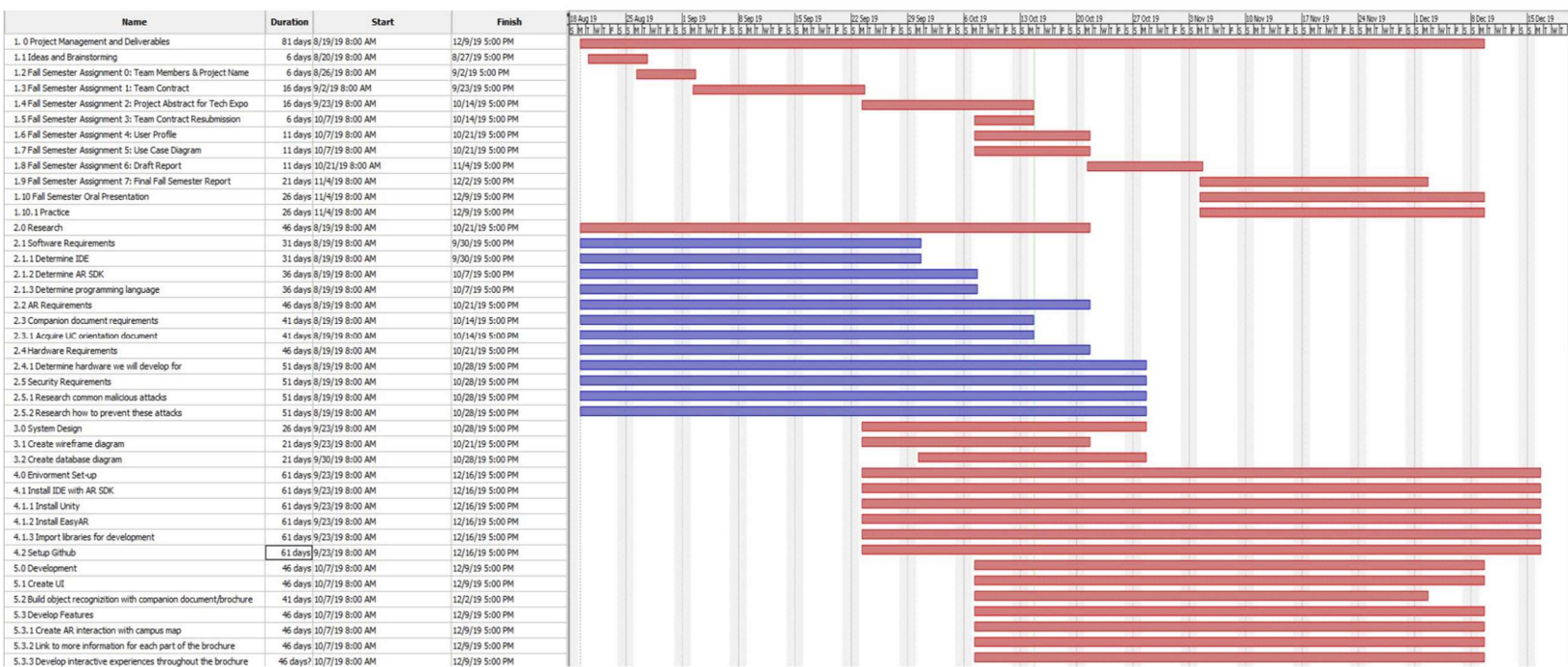


Figure 3. Gantt Chart

Name	Duration	Start	Finish
1. 0 Project Management and Deliverables	81 days	8/19/19 8:00 AM	12/9/19 5:00 PM
1.1 Ideas and Brainstorming	6 days	8/20/19 8:00 AM	8/27/19 5:00 PM
1.2 Fall Semester Assignment 0: Team Members & Project Name	6 days	8/26/19 8:00 AM	9/2/19 5:00 PM
1.3 Fall Semester Assignment 1: Team Contract	16 days	9/2/19 8:00 AM	9/23/19 5:00 PM
1.4 Fall Semester Assignment 2: Project Abstract for Tech Expo	16 days	9/23/19 8:00 AM	10/14/19 5:00 PM
1.5 Fall Semester Assignment 3: Team Contract Resubmission	6 days	10/7/19 8:00 AM	10/14/19 5:00 PM
1.6 Fall Semester Assignment 4: User Profile	11 days	10/7/19 8:00 AM	10/21/19 5:00 PM
1.7 Fall Semester Assignment 5: Use Case Diagram	11 days	10/7/19 8:00 AM	10/21/19 5:00 PM
1.8 Fall Semester Assignment 6: Draft Report	11 days	10/21/19 8:00 AM	11/4/19 5:00 PM
1.9 Fall Semester Assignment 7: Final Fall Semester Report	21 days	11/4/19 8:00 AM	12/2/19 5:00 PM
1.10 Fall Semester Oral Presentation	26 days	11/4/19 8:00 AM	12/9/19 5:00 PM
1.10.1 Practice	26 days	11/4/19 8:00 AM	12/9/19 5:00 PM
2.0 Research	46 days	8/19/19 8:00 AM	10/21/19 5:00 PM
2.1 Software Requirements	31 days	8/19/19 8:00 AM	9/30/19 5:00 PM
2.1.1 Determine IDE	31 days	8/19/19 8:00 AM	9/30/19 5:00 PM
2.1.2 Determine AR SDK	36 days	8/19/19 8:00 AM	10/7/19 5:00 PM
2.1.3 Determine programming language	36 days	8/19/19 8:00 AM	10/7/19 5:00 PM
2.2 AR Requirements	46 days	8/19/19 8:00 AM	10/21/19 5:00 PM
2.3 Companion document requirements	41 days	8/19/19 8:00 AM	10/14/19 5:00 PM
2.3.1 Acquire UC orientation document	41 days	8/19/19 8:00 AM	10/14/19 5:00 PM
2.4 Hardware Requirements	46 days	8/19/19 8:00 AM	10/21/19 5:00 PM
2.4.1 Determine hardware we will develop for	51 days	8/19/19 8:00 AM	10/28/19 5:00 PM
2.5 Security Requirements	51 days	8/19/19 8:00 AM	10/28/19 5:00 PM
2.5.1 Research common malicious attacks	51 days	8/19/19 8:00 AM	10/28/19 5:00 PM
2.5.2 Research how to prevent these attacks	51 days	8/19/19 8:00 AM	10/28/19 5:00 PM
3.0 System Design	26 days	9/23/19 8:00 AM	10/28/19 5:00 PM
3.1 Create wireframe diagram	21 days	9/23/19 8:00 AM	10/21/19 5:00 PM
3.2 Create database diagram	21 days	9/30/19 8:00 AM	10/28/19 5:00 PM
4.0 Environment Set-up	61 days	9/23/19 8:00 AM	12/16/19 5:00 PM
4.1 Install IDE with AR SDK	61 days	9/23/19 8:00 AM	12/16/19 5:00 PM
4.1.1 Install Unity	61 days	9/23/19 8:00 AM	12/16/19 5:00 PM
4.1.2 Install EasyAR	61 days	9/23/19 8:00 AM	12/16/19 5:00 PM
4.1.3 Import libraries for development	61 days	9/23/19 8:00 AM	12/16/19 5:00 PM
4.2 Setup Github	61 days	9/23/19 8:00 AM	12/16/19 5:00 PM
5.0 Development	46 days	10/7/19 8:00 AM	12/9/19 5:00 PM
5.1 Create UI	46 days	10/7/19 8:00 AM	12/9/19 5:00 PM
5.2 Build object recognition with companion document/brochure	41 days	10/7/19 8:00 AM	12/2/19 5:00 PM
5.3 Develop Features	46 days	10/7/19 8:00 AM	12/9/19 5:00 PM
5.3.1 Create AR interaction with campus map	46 days	10/7/19 8:00 AM	12/9/19 5:00 PM
5.3.2 Link to more information for each part of the brochure	46 days	10/7/19 8:00 AM	12/9/19 5:00 PM
5.3.3 Develop interactive experiences throughout the brochure	46 days?	10/7/19 8:00 AM	12/9/19 5:00 PM

**Table 1. Work Breakdown Structure**

## **Project Testing**

The goal of testing is to determine which aspects of the application are running as intended and which parts are not working correctly. During testing, each part of the application is tested multiple times to ensure that everything is worked as intended.

### **Testing Procedures**

Application Launch Test – Results of this test will show that Head StARt is able to launch on an Android phone.

User Interface Test – Results of this test will determine if all aspects of the UI are working as intended for the user.

Functionality Test- Every part of the application use case will be tested

Application Launch Test - The application launch test will be conducted using the Redmi Note 7 android phone. This test's purpose is to determine that the application can start up with no issues or delays. The application will be opened 50 times in order to ensure the accuracy of this test. The two things the tester will be looking for over the course of the test is:

1. Did any errors occur over the course of the test?
2. Was there any extended delay while waiting for the application to open?

### **User Interface Test**

The user interface test determines if the application is running as intended from the users prospective. This test includes the map of 3D models, and the functionality of the UI. Each menu option will be tested 25 times to ensure that it is working consistently with no errors. The questions asked by the tester for this scenario are as follows:

1. Is each menu item working as intended?

2. Are you able to interact with any AR generated by the application?
3. Are there any performance issues when using AR capabilities?

### **Functionality Test**

The functionality test will focus on all of Head StARt's features. These features include AR capabilities, navigating to videos, and a map of campus. The questions answered in this testing scenario are:

1. Is the camera working?
2. Does the camera have any trouble recognizing any specified images in the companion brochure?
3. When the user tapped on the AR video, did it pull up the video externally on YouTube?

Pass/Fail Conditions:

All tests must be passed in order to label Head StARt as bug free. Any test failure will be recorded.

### **Test Results**

We were able to complete all testing without any errors or bugs found. We are confident in the code and functionality of our application. We realize Head StARt is simple when it comes to testing, and there is not a lot that can go wrong. However, we expect with more features being added to our application, that testing procedures and time will vary. On the following page in table 2, the details of the test results are shown.

Test Performed	Results
Application Launch Test	<p>Test performed 50 times: <b>Pass</b></p> <p>Notes- Application needs to be fully closed out for the splash screen to appear on launch. Unity splash screen appears for roughly 3 seconds (no option to remove with free Unity license).</p>
UI Test- Menu items	<p>Test performed 25 times: <b>Pass</b></p> <p>Notes- Internal menu items tested repeatedly. “i” icon ability to hide and display AR content is working as intended.</p>
UI Test- AR interaction	<p>Test performed 25 times: <b>Pass</b></p> <p>Notes- Interaction with AR content like videos, images, and 3D models all tested. Front page video plays as expected, 3D models and images appear as expected.</p>
UI Test- General Performance	<p>Test performed 50 times: <b>Pass</b></p> <p>Notes- General UI performance has performed as expected. Buttons work quickly and properly. Application feels smooth to navigate.</p>
Functionality- Camera	<p>Test performed 50 times: <b>Pass</b></p> <p>Notes- Camera launches after user taps to bypass the splash screen. Camera launches quickly and reliably.</p>
Functionality- Image Recognition	<p>Test performed 50 times: <b>Pass</b></p> <p>Notes- Image recognition to display the AR elements worked as expected. Quality of the source image, the lighting during use, and device camera all affect how well image recognition works. Using the Redmi Note 7 under decent lighting yielded good results.</p>
Functionality- External Links	<p>Test performed 50 times: <b>Pass</b></p> <p>Notes- Link icons function as expected and led to external sites. Tapping on images functioned properly as well.</p>

**Table 2. Test Results**

## Budget

Below in table 3 you can see the actual budget of our application along with the projected budget if this application was to be adopted by a university and put into use

Item	Our Project	Enterprise
Labor	\$0	\$12500
Hardware	\$100	\$3000
Pamphlet	\$0	\$1000
Licenses	\$0	\$400/month

**Table 3. Budget**

As for the cost estimates it is estimated it would take roughly 250 hours of development and planning for an enterprise team to build a finalized version of our application. After taking an average hourly wage of \$50 between AR developers, business analysts, and project managers. Therefore, it is projected to be \$12,500 in labor costs. The hardware costs of \$3000 includes the cost of test devices and computers for developers. Our team spent 100\$ on one test Android device but at an enterprise level more testing across more devices would have to be done. As for the pamphlet costs it is projected it would cost a university about \$1000 dollars to do a brief redesign of the pamphlet to include information about the Head StARt app. Finally, at a University level software licenses would have to be procured. Some of these costs could be lowered if the University already pays for certain licenses. If not, Visual Studio will cost \$250/month and Unity \$150/month.

## **Design Goals**

Head StARt has followed the core design goal of being easy to use to ensure the highest number of students possible will utilize it. The application is intuitive for any user to pick up and experience. For this reason, a simple user interface is being pursued. Head StARt will fail in its goal to help transfer knowledge to new students if the user must spend tremendous amounts of timing just learning how to use the application. The companion document in front of the user is an integral part of the experience and the app is designed around this document. There is a seamless connection between the application and the document in front of the user. Once the application is installed and launched any person who has used a smart phone will be able to point their camera at the pamphlet and experience Head Start.

## **TECHNICAL ELEMENTS**

### **Network**

Head StARt has only minimal networking built into the application. Most assets like 3D models, videos, images are loaded directly into the application. Of course, if file size becomes too large the issue will be addressed with the possibility of external network usage to load assets in. Simple networking like linking to external websites is integrated within the application.

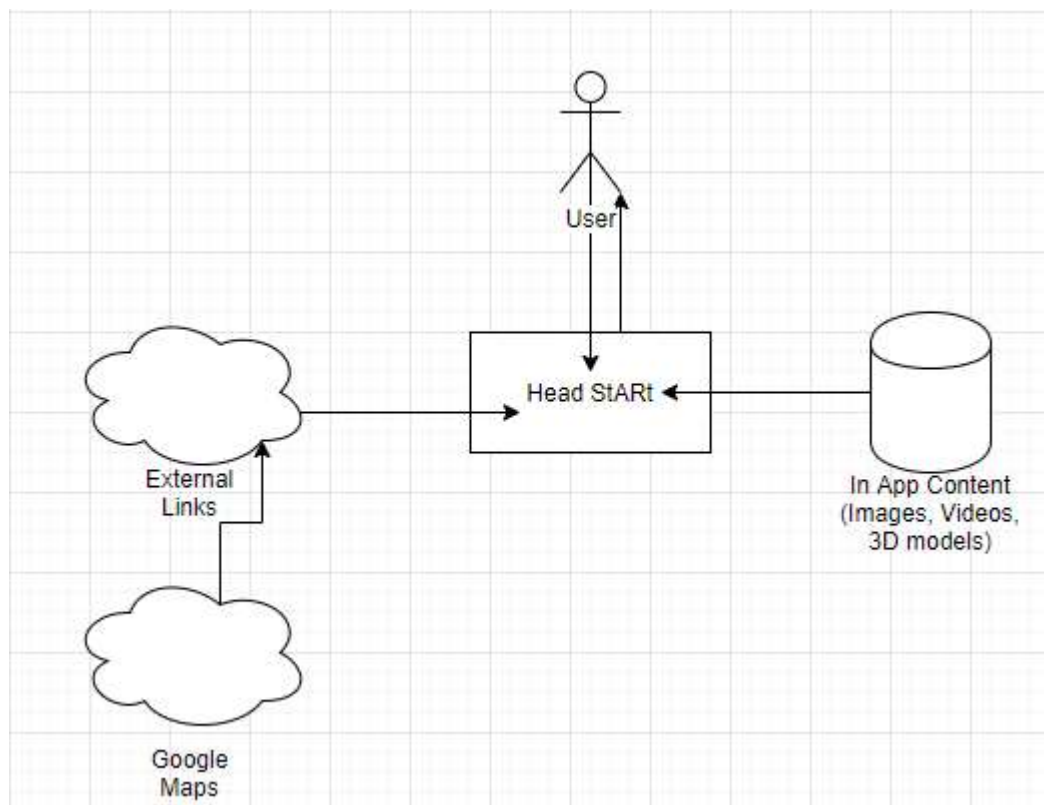
### **Hardware**

Augmented reality on smartphones inherently has some technical requirements. A modern phone deemed augmented reality ready by Apple (IOS) or Google (Android) is required. We have procured a Redmi Note 7 as our Android development device and will

use an iPhone X for IOS. These devices will simply need to have the application installed for basic use. A Wi-Fi connection would also be required to access external links, or any objects not loaded within the application files.

## Application

When building and augmented reality application like Head StARt, the use of existing AR software development kits (SDKs) was essential to building a complete application. There are multiple options which will be explored more in depth in the following section. In order to properly leverage these tools, a robust IDE like Unity must be used. Below in figure 4 is the technical architecture diagram, explaining the basic flow of the application's technical layout.



**Figure 4. Technical Architecture Diagram**

## **SDK Selection**

Since augmented reality going mainstream in recent years, the number of available SDKs has increased substantially. Tools like Vuforia or EasyAR have been the standard for the past few years. Recently, both Apple and Android have released their own SDKs allowing developers to have more low level control of the augmented reality development. After analyzing the available SDKs, we eventually decided to use EasyAR because of it offers a no cost option vs Vuforia, while also allowing cross platform development, giving it a leg up over ARKit (Apple's AR SDK) and ARCore (Google's AR SDK). EasyAR works seamlessly with Unity providing the necessary technical features to build Head StARt. Features like planar image tracking/recognition, surface tracking, video playback, and the ability to create interactive augmented reality experiences.

## **IDE Selection**

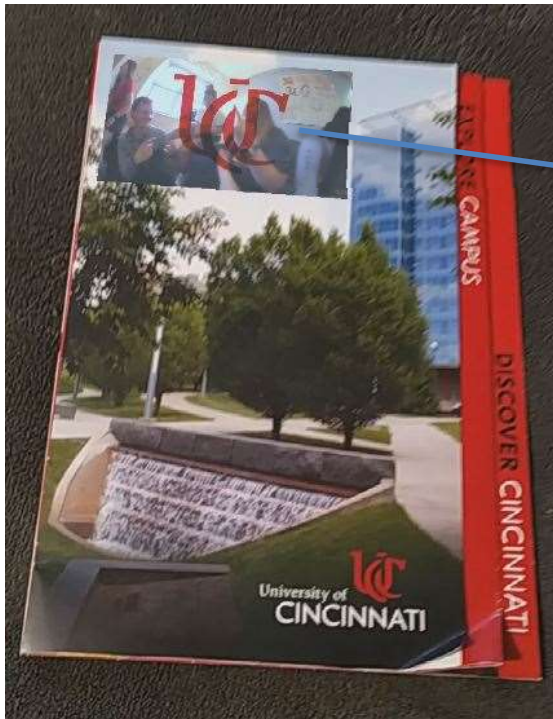
The next most important decision to make after choosing an SDK is choosing an Integrated development environment (IDE) optimized for 3D objects and augmented reality. Unity is one of the most popular and powerful game engines in use today. It has been co-opted as the standard environment for development of augmented reality applications due to its inherent ability to handle 3D objects and build highly customizable applications. Because of this, we have chosen Unity as our preferred IDE. Alongside Unity we need another IDE to handle external scripting, we choose to use Visual Studio for any C# code we needed to write the logic of the application.

### **3D Modeling Software**

We needed the ability to edit/convert existing 3D objects and even build design our own. This requires computer aided design (CAD) software. After analyzing the available products in this category, we opted to use Blender due to its ability to import a wide variety of formats like .fbx .stl and .obj. It is free to use and relatively easy to learn as well. A powerful piece of CAD software like Blender is instrumental in creating an AR application like Head StARt.

### **Primary Application features**

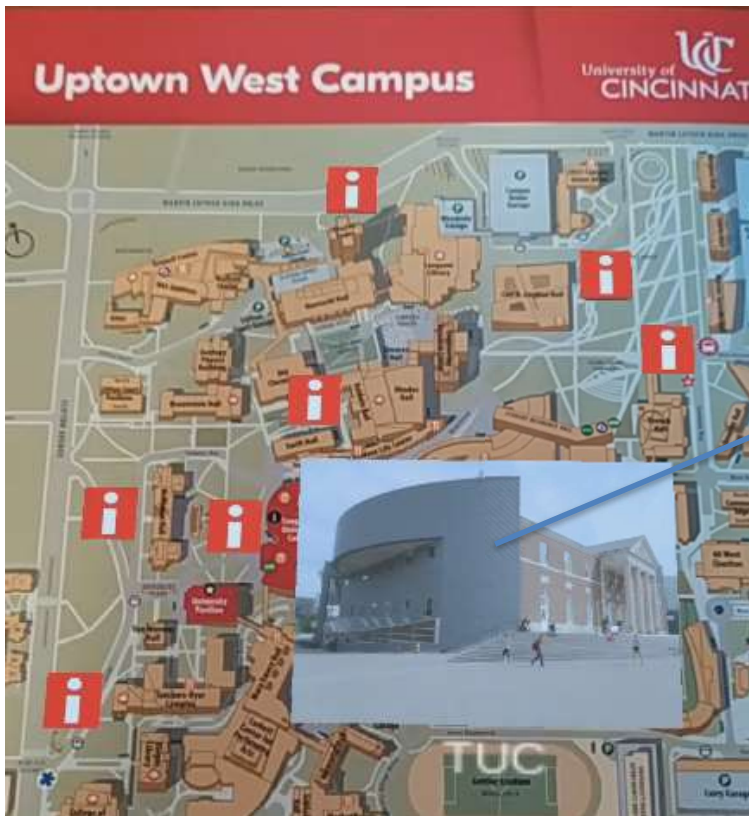
As previously discussed, Head StARt will create an interactive augmented reality experience for students using a companion document in front of the student. The primary feature in building these experiences is the ability to display multimedia to the user in augmented reality. On the following page, you can see what these primary features look like. Figure 5 shows a video being projected over the pamphlet and Figure 6 shows the AR map feature. The ability to provide extra content on top of the pamphlet in the AR layer is the main goal of our application. The “i” icon can also be replaced with a link icon meant to link users directly to webpages.



Once the application is launched, the user can hold their phone camera over the pamphlet and media like images or in this case, a video will begin playback on the phone screen.

The video will lock in place over the target image preselected in development. This feature will be used to transfer important media to the student and used sparingly as not to overwhelm the user.

**Figure 5. AR Video**



This shows the AR map feature in action. The user tapped on the "i" icon near TUC which then displayed the image of TUC. This feature will allow students to more easily navigate campus.

The user may also tap on the TUC image to be taken to the campus building directory of the building. On this webpage the student can learn more about the building and get directions through Google Maps. Once done the user simply taps the "i" icon again to hide the image.

**Figure 6. AR Map**

## **Security**

Head StARt is a very secure application since there are minimal interactions where the user could attempt a malicious attack. The user's experience is directly controlled from the moment the user opens the application. The limited scope of the application only being designed around a single pamphlet will aid in this. Being aware of the most common forms of attacks like SQL injections will direct how the application is developed. Finally, only using trusted tools and external sources will ensure Head StARt is a secure application. Utilizing the most up to date version of Unity and a trusted AR library like Easy AR.

## **USER INTERFACE**

### **Welcome Screen**

Most of the application will simply be operated through the user's camera view. Removing the need for a traditional user interface. Prompts can be sent to the user as they look around the pamphlet. For example, "place camera over map for interactive experience". That said, a traditional welcome page is used so that the user isn't surprised when the camera immediately launches. On the following page in figure 6, you can see what this welcome page looks like. It aims to be simple with basic instructions telling the user to have the designated pamphlet in front of them. It also explains the two icons the user will see when using the application and how to interact with them.



# Head StARt

An interactive augmented reality experience

## Welcome!

Have your "Welcome to UC" pamphlet in front of you.  
Simply hold your camera over a page  
to interact with the pamphlet.



Tap to display Image  
or 3D model. Then tap  
the object to learn more!



Tap to follow a link  
and learn more!


---

## Tap to Begin!

**Figure 7. Welcome Screen**

## Poster

Below in figure 8 is the poster created for the IT Tech Expo. The poster aims to deliver a snapshot view of our entire project from problem to solution. Someone can quickly look at the poster and understand the general idea of our application.



Head StARt

# HEAD START

Team 3: Brian Dougher and Nic Bandy  
 Technical Advisor– Abdou Fall  
 College of Education, Criminal Justice, and Human Services - School  
 of Information Technology

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### Problem

- 34.6 percent of incoming college freshmen felt overwhelmed during orientation
- College's struggle to effectively provide information to new students

### About

Head StARt is an interactive Augmented Reality (AR) application designed to aid incoming freshmen going through college orientation.

- Paired with a brochure or document of choice
- Allows you to use your phone to scan the document and bring up interactive AR experiences, helping students better understand and retain key information.
- Head StARt can take any brochure or pamphlet to the next level by engaging the audience in an exciting way and helping new students better retain important information.

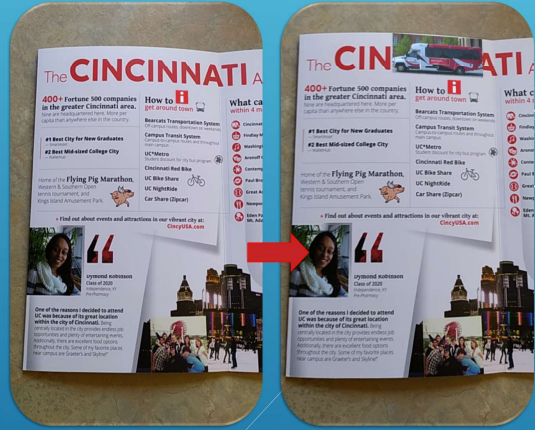
### Screenshots

The phone camera recognizes the pages in the brochure, and displays the "I" icon on the page. The user can then tap the icon to pull up an image that links to a website when tapped.

### Solution


An augmented reality companion application to be paired with existing freshman orientation pamphlet.

- AR has been proven to increase content understanding, student motivation, and long term memory retention




### Software Used


3D Modeling




AR SDK



IDE








Figure 8: Tech Expo Poster

## **PROJECT REFLECTIONS**

### **Problems Encountered**

As to be expected in any major software development problems were encountered constantly during development. As mentioned in the abandoned goals section, the issue of cross platform development to IOS was a problem encountered and never solved due primarily to time constraints. Aside, from that most problems were solved as they came. For example, the use of Easy AR led to some issues in documentation. Easy AR is developed by Chinese developers and while sufficient English instruction and documentation is out there it can be difficult to find since the original documentation is written in Chinese. Learning to properly leverage the Easy AR SDK was eventually solved thanks to helpful video tutorials. Another more project based problem was the ability for the team to work simultaneously on the project. This was eventually solved as the team learned how to use GitHub efficiently for a Unity project.

### **Future Recommendations**

Looking back as always there are plenty of things the team could have done differently to make the project better. Limiting scope from the beginning to focus on Android would have saved many hours of wasted development time and allowed the team to better refine some of the AR experiences within the pamphlet. With more time an IOS version would be pursued and more complex AR within the application. For example, including built in integration with Google Maps and more smooth animations throughout the application. Currently there are not plans for the project in the future, but we believe our project proved the viability of a University incorporating AR into orientation materials and beyond.

## CONCLUSION

### Fall Semester 2019

The process of creating an augmented reality application has been an interesting and challenging experience. Lessons learned so far include the challenges that come with taking on a project of this size. Skills like planning, research and time management have been vital skills in the process of the creating the Head StARt application. Unlike other assignments which can usually be completed in a smaller window of time, embarking on a project of this size has forced these skills to be used and practiced extensively. Being able to run into unforeseen issues whether they be technology or personal and adjusting has been an essential skill for us this semester. With planning and refining our project idea mostly squared away we moved into the development phase.

This Fall semester has served primarily as an opportunity to compare existing AR technologies and learn to work with these libraries within Unity. Working with a new and upcoming technology like augmented reality comes with many unique problems. For one, there are not as many resources out there for every little thing you may want to do. This has caused us as developers to need to practice and sharpen our problem solving skills. After completing the learning phase and developing out prototypes of our primary features the Spring semester and break will serve as our primary development time.

Looking forward into the Spring semester, features will be further developed, and a finished application delivered for the Expo. The mock user interface seen in figure 7 will be built and tested. An augmented reality assisted map feature will work in companion with a physical map on the pamphlet to provide extra information, well beyond that of an overhead 2 dimensional map. The entire pamphlet will be filled with

interesting and educational augmented reality experiences to take your average college orientation to an exciting new level.

### **Spring Semester 2020**

Finishing up the Spring semester and preparing for IT Tech Expo over this unique Spring semester has provided some interesting challenges and learning opportunities.

While last semester included a lot of brainstorming and planning along with some prototypical development this semester has been much more focused on building out our final product. Since the Fall semester a few prototypes have become a finalized application that was developed progressively over the past few months. Spending multiple months of development time on the same project allowed us as developers to practice our programming and problem solving skills. Proper version control with both of us working simultaneously as developers was vital to the success of our project. Regularly scheduled meetings for the team to discuss any problems encountered and troubleshoot together allowed for development to go much more smoothly than it otherwise would have. As developers, this project has allowed us to gain a deep understanding of augmented reality and the tools used to develop it.

Finally, over this semester the team has been able to practice presentation skills. The ability to properly explain and pitch an application is almost as important as the application itself. Between the final presentation and IT Tech Expo, the team has had the opportunity to learn the process of taking an application and giving a clear, interesting explanation. The entire process of developing Head StARt from an idea to a complete application at IT Tech Expo has been an extremely valuable learning experience for the team.

## APPENDIX A. REFERENCES

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