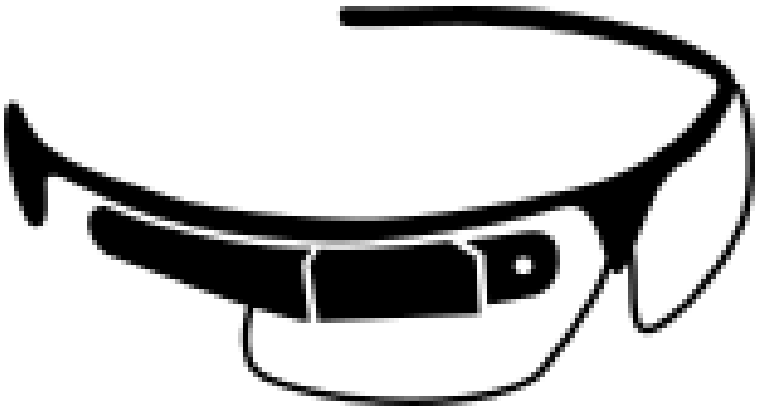
Department of Computer Science & Engineering
The University of Texas at Arlington

Project Charter
CSE 4316: Senior Design I
Spring 2020



Looking Glass (WIP)
Looking Glass

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Revision History

Revision	Date	Author(s)	Description
0.1	03.06.2021	MS, MA, PS, AW	document creation
0.2	03.07.2021	MS, MA, AW	document creation cont.
0.3	03.08.2021	MS, MA, PS	document creation cont.

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1 Vision

Looking Glass is an augmented reality software intended to provide additional context for art exhibits. It allows users to participate in a more comprehensive and detailed viewing experience, allowing artists to even include direct commentary if desired.

2 Mission

The Looking Glass system utilizes smart glasses to scan QR codes to display additional information to the viewer alongside corresponding works of art. Upon being scanned, the glasses will provide textual and optionally enabled audio context for the art.

3 Success Criteria

Upon completion of the prototype system, we expect the following success indicators to be observed on patrons using the Looking Glass software:

- Users walk away from exhibit learning at least one additional piece of knowledge
- 10% increased engagement time with exhibits.
- an average of a minute of material per exhibit with less than 25% of exhibits having no material

Within 6 months of release

- 15% greater average engagement time
- all exhibits having at least one piece of recorded material and an average of two minutes of material on average

4 BACKGROUND

Beautiful art comes with great history and unfortunately in the physical space of a museum it can be difficult to relay the storied past. In the age of information, people often desire to know as much as they can by obtaining said details as easily as possible. The Looking Glass aims to give patrons all the information they could ever desire without having to lift a finger.

Although many museums offer a small handheld device, these are an inferior solution that are limited to the museum's expense and lack the adaptability that Looking Glass offers. As their entirety depends on their viewers' enjoyment, museums thrive on providing varied methods for visitors to interact with the exhibits they offer and Looking Glass offers many different solutions. From textual insight to portable audio learning, the Looking Glass aims to both educate and delight museum-goers.

By additional methods to engage material helps cover the spectrum of different learning styles. By offering recorded audio as part of a tour even provides inclusivity towards those visually impaired, allowing them to partake in the museum's offerings. Educators find increased retention in students who both listen and read material simultaneously and ultimately the Looking Glass aims to provide a tailored experience to increase satisfaction overall.

With being centered around scannable QR codes, the Looking Glass also aims to uniquely provide an extremely adaptable and customizable experience. Pre-existing exhibits can simply add a small QR code to the side of their installations and adding or removing others is a straightforward process. This allows museums to provide content for any and everything they desire that is not limited by the size of a device or physical space available.

Most importantly, the easy simple and engaging method to activate the elements maximizes the chance that users will engage with more elements and for longer. The increased quantity and specificity of elements allows users to seek out information they wish to expand on, the Google Glass implementation makes activating the elements as easy as just looking at the thing you are curious about and finding out more, and the entirely hands free method means that exhaustion has far less of an impact with users continued engagement with an element. Lastly, the Google Glass implementation allows those with impairments that would make maneuvering a smart phone to scan each element has a far more accessible experience by having a hands free easy to direct way to activate the elements.

5 RELATED WORK

Currently, there are a few related pieces of technology that are occupy a similar space to the Looking Glass.

ARtGlass is an augmented reality tour software designed to make historic sites come to life. Launched in Italy in 2018, it offers 3D holograms, videos, pictures, and text alongside the environment to help provide rich context to viewers [3]. While capable of providing content similar to the Looking Glass, ARtGlass is more focused on specific historical environments whereas Looking Glass seeks to more easily implemented across any number of exhibits utilizing its QR codes that can be simply added anywhere.

A more direct comparison, Experiencia de GuiARt, developed in 2015 by NeoSenTec and Fernando Milla, offers a similar experience offering additional content based on image recognition and user position [4]. It offers sound effects, music, video, and other information based off tour items. In contrast to Looking Glass, Experiencia de GuiARt utilizes the position and specific painting via image recognition to trigger each prompt as it is tailor-made for specific tours.

AR+T is a smartphone-based application that allows users to scan works of art for additional content including video, audio, and text [1]. It offers the owner multiple packages depending on number of art installations and visitors per year. The primary contrast to Looking Glass is the usage of different hardware, utilizing smartphones in lieu of smart glasses.

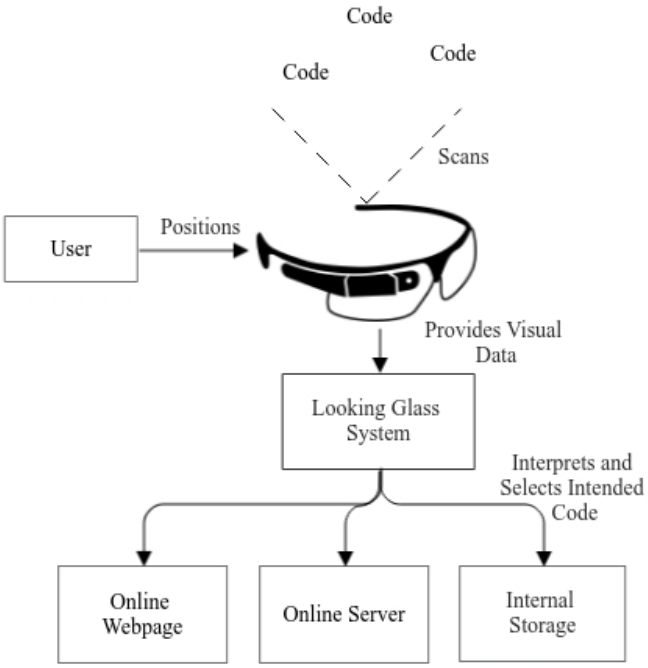
GuidiGO is another tour augmentation software that tracks users on their tour and also provides

additional viewing material for users [2]. Unlike Looking Glass, GuidiGo uses a preconfigured tablet that patrons use to scan various installations.

PandaSuite is an application-based tour software that allows users to construct their museum experiences for patrons. It utilizes mobile phones for its tour augmentation gives access to digital versions of collections not present in the museum [5]. While it promotes the adaptability that Looking Glass is focused on, it opts for a smartphone-based approach.

6 System Overview

The system will at a basic level take in visual data from a camera built into a Google Glass device, process that data identifying a scannable code such as a QR code, and redirect the user to an associated audio/visual page either online or stored on the device. The system will minimize user inputs beyond the direction of the camera, relying on the length of time that a scannable code has been seen by the system and how central it is to the image to deduce when and which code the user is intending to activate.



When the code has been selected the system will direct the user to text and audio data from the location associated with that code, either a web page through the museum's local wi-fi, an online server, or from storage within the device itself. The system will then process that text and audio presenting it to the user depending on the type of link, presenting the form of a web page, subtitled audio, or any other intended format.

7 Roles & Responsibilities

The primary stakeholders for this project are museums and their patrons as the software developed will provide an enriched experience for museum-goers.

This project is not a directly sponsored project, so the sponsor for this project is Dr. Chris Conly, the professor of the Senior Design class.

The team will be comprised of the following members:

- Alexander West
- Suman Raman Poudel
- Michael Aiyedun
- Matthew Speer

Each team member will have an equal amount of responsibility throughout the entirety of the project. As a result, the team will utilize a rotating scrum master with each sprint as well as assign different team members different duties. These duties include but are not limited to: document accuracy checking, communication handling, and material review.

In order to attempt to provide all team members with equal opportunity of experience, the team will also be looking to shift periodically between which team members are working on the front end and the back end of the code.

8 Cost Proposal

The primary expenses of the project will be a pair of Google smart glasses as the software is structured around their usage. In order to test the project, ink and the capability to print QR codes will be necessary. Potentially the project may also require storage for a small amount of data as well in order to provide the content from scanned QR codes.

8.1 Preliminary Budget

Item	Cost Percentage
Digital Hardware	90%
Online Data Hosting	7%
Printing	3%
Software Licenses	0%

8.2 Current & Pending Support

Due to the fact that this project is not sponsored, it will not receive any additional funding other than the already designated amount from the University of Texas at Arlington's Computer Science and Engineering department.

9 Facilities & Equipment

The equipment for this project will be using the google glass product line and software used to run the device. The Mirror API released by google to used by third party developers will be utilized towards the Glass App development along side the project.

The Glass Development Kit will be the add on software development kit used to create the Glass wear that will run on the Google Glass. This product will be supplied to us by our sponsor along with the lab space and testing grounds as well.

The lab space that will be used for this project will be a lab room located at the University of Texas at Arlington's Engineering and Research Building. The lab will also be functioning as our testing ground for the Looking Glass project. The Google Glass along with the lab space will be given to us for temporary access for the course of 6 months of March to August.

10 Assumptions

The following list contains critical assumptions related to the implementation and testing of the project.

- Google smart glasses provided to implement software
- Access QR code creator and printer in order to create QR codes to ensure proper scanning and prompting of software
- An online server will be available to store data necessary for content provided by scanning art installations
- Access to the wireless connection to allow smart glasses to retrieve data
- Ability for team members to collaborate on technology in a virtual environment

11 Constraints

The following list contains key constraints related to the implementation and testing of the project.

- Final prototype demonstration must be completed by August 2021
- The project will need to be developed virtually due to the ongoing pandemic
- The software will be designed to be easily implementable in order to modify tour experiences
- Total development costs must not exceed $800
- The software will need to be developed with the Mirror API to run on Google Glass

12 Risks

Risk description	Probability	Loss (days)	Exposure (days)
Availability of Google glass software being up to date/compatible	0.50	20	10
University testing grounds are not available	0.20	21	2.8
Internet access not available at individual worker's home	0.30	9	2.7
Delays in receiving the Google Glass and needed Software	0.10	20	2.0
Implementation delays at testing facility	0.15	10	1.5

Table 1: Overview of highest exposure project risks

13 Documentation & Reporting

13.1 Major Documentation Deliverables

13.1.1 Project Charter

The Project Charter will be submitted on March 8, 2021, and will be reviewed at the beginning of each month and updated if any major elements of the project change. The final version will be submitted in August.

13.1.2 System Requirements Specification

The System Requirements Specification will be submitted on March 26, 2021, and will be reviewed at the beginning of each month and updated if any major elements of the project change. The final version will be submitted in August.

13.1.3 Architectural Design Specification

The Architectural Design Specification will be submitted on April 14, 2021, and will be reviewed at the beginning of each month and updated if any major elements of the project change. The final version will be submitted in August.

13.1.4 Detailed Design Specification

The Detailed Design Specification will be submitted in June, 2021, and will be reviewed at the beginning of each month and updated if any major elements of the project change. The final version will be submitted in August.

13.2 Recurring Sprint Items

13.2.1 Product Backlog

When products are added to the backlog, they will be reviewed by the team prior to being added to the list based on priority and difficulty. Discord will be used to keep track of the product backlog between team members.

13.2.2 Sprint Planning

Sprints will be planned around the current product backlog. With approximately 7 sprints, the team will look to try and divide the planned work amongst them in order to achieve a suitable final prototype by the end of the second semester.

13.2.3 Sprint Goal

The sprint goal will be decided by each scrum master and take into consideration the voices of all other team members as a collective. The sponsor, the professor, will be included at request.

13.2.4 Sprint Backlog

The team will collaboratively determine which product backlog items will make their way into the sprint backlog. The backlog will be maintained via Discord and will be modified as the project progresses.

13.2.5 Task Breakdown

Tasks will be volunteered for by team members initially. Any necessary tasks that are not claimed will be assigned by the current scrum master. Each team member will document the amount of time they spend on a task in a time table.

13.2.6 Sprint Burn Down Charts

The current scrum master will be responsible for generating burn down charts for each sprint. Team members will document their accomplishments and the scrum master will be able to cross-reference the documented accomplishments with the time tables in order to construct the burn down charts.

13.2.7 Sprint Retrospective

The sprint retrospective will be held after each sprint with team members discussing the events of the sprint, giving each other constructive feedback, and determining how the next sprint can be improved. The current scrum master will take meeting notes to document the sprint retrospective.

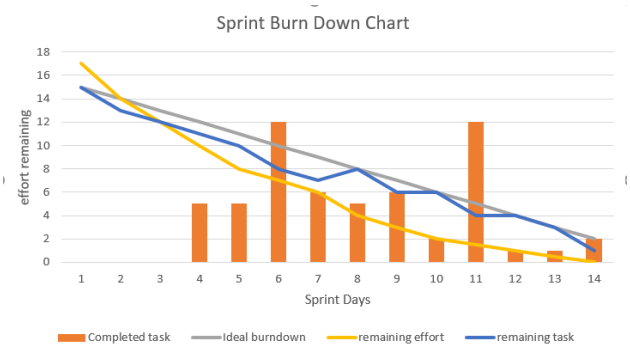


Figure 1: Example sprint burn down chart

13.2.8 Individual Status Reports

Individual members will report every other week discussing the amount of time they have spent on different tasks, what they have finished or are still working on, any requests for assistance on a task, and any difficulties they have encountered. The report will contain key items such as the time spent and current task progress.

13.2.9 Engineering Notebooks

Engineering notebooks will be updated at least biweekly with one page for each interval. Team members will be responsible for providing their own "witnesses".

13.3 Closeout Materials

13.3.1 System Prototype

The final system prototype will include a pair of Google Glass with the Looking Glass software. The team has currently designated the system to be demonstrated in August, 2021, on the campus of the University of Texas at Arlington. Currently no PAT or FAT has been determined.

13.3.2 Project Poster

The poster will be a standard 18 x 24 inches and will contain a logo of the project, the project name, team member names, and the software description. It will be delivered in August, 2021.

13.3.3 Web Page

The project web page will include details of the application and currently has no plans to be accessible to the public. It will be delivered to the instructor at closeout of the project.

13.3.4 Demo Video

The demo video will show how to properly utilize the software as a viewing experience and how to construct tour experiences with the creation of QR codes. It will be approximately 4 to 8 minutes long.

13.3.5 Source Code

The source code will be maintained via GitHub.Source code will be provided to the customer as it is likely required for the team members to receive a good grade. The team has currently not decided to open the source code to the public but may determine to change their stance at a future date.

13.3.6 Source Code Documentation

The team will use Doxygen to generate the documentation and will provide the final documentation in PDF format.

13.3.7 Hardware Schematics

The team will not be creating any hardware. The project will utilize software loaded onto Google Glass.

13.3.8 CAD files

The project is purely software.

13.3.9 Installation Scripts

The team will deploy installation scripts for the software to distribute the project as needed.

13.3.10 User Manual

A digital manual will be provided detailing the proper set up and usage of Looking Glass.

REFERENCES

[1] A R + T - Augmented Reality Tour for museums.

[2] Augmented Reality for museums.

[3] Groundbreaking Augmented Reality Smart Glasses Tours to Bring History to Life at Iconic U.S. Historic Sites for First Time.

[4] Guiart Experience. Augmented reality App for smart glasses. Technical report, Malvado Group.

[5] Museum App Builder.