AeroVis - Mixed Reality Wire Harness

Ryan Monast and Rudy Ferrera

Computer and Electrical Engineering, Sacred Heart University Jack Welch School of Business and Technology
5151 Park Avenue, Fairfield, Connecticut, 06825, United States of America
monastr@mail.sacredheart.edu
ferrerar2@mail.sacredheart.edu

Abstract **- Overview: AeroVis aims to revolutionize the design process and maintenance in the aviation industry through the implementation of mixed reality. This is done by converting a schematic into a binary map and using the A* algorithm to optimize the pathfinding of the components in the harness.**

Methods: We utilized the Unity Engine in order to develop our Mixed Reality (MR) application. The application is loaded onto a Microsoft HoloLens2 for use in Mixed Reality. The application is developed using C# and Python inside of the Unity Engine v2022.3.45f1. Using a user-uploaded schematic, a python script will convert that image into grayscale. This grayscale image will be used to make a binary map of the schematic. This binary map will use an A* algorithm in order to route out the most efficient paths for the wire harness and display the result to the user.

Keywords - Mixed Reality, Unity Development, HoloLens2, A* Algorithm

I. Introduction

A. The Problem

The problem that AeroVis seeks to solve is a problem that every individual in any manufacturing, design, or engineering field has experienced before: the requirement to walk away from our work to look at the schematics. We aim to solve that problem by implementing the use of Mixed Reality into the manufacturing process through the eyes of Microsoft's HoloLens2 Mixed Reality Headset. We aim to display an accurate, to scale, schematic that can be seen and interacted with while the user is still able to engage with the world around them in real time.

B. Our Literature Search

We really began to begin our work on AeroVis when we had our literature search[1]. We managed to find nine sources that aligned very closely with our goals for AeroVis. Using the foundation set by these sources we hope to not only understand our task better, but also gain insight into how others went about solving similar tasks and how we can build off of their work for our goal. The search results highlight diverse applications of advanced algorithms and mixed reality (MR). They include improving helicopter safety with the city based A* Algorithm, enhancing industrial training with MR, and using MR glasses for robotic pathfinding. Research also covers object-centered UIs in MR, interactive learning tools for aircraft engineering, and personalized RV design with HoloLens 2. Additionally, advancements in the A* Algorithm and its application in game pathfinding are discussed, showing improved performance in various scenarios.

C. Personality Tests

In order to build team chemistry from the get-go, we decided to see how our group's personality types aligned. Using Carl Jung's and Isabel Briggs Myers' typology, we concluded that Ryan resulted in a typology of INFJ (Introverted, iNtuitive, Feeling, Judging); and Rudy had resulted in a type of ESTJ (Extroverted, Sensing, Thinking, Judging). These results showcase how we as a group compliment the other. This allows us to cover a large spectrum of the typology and reach as large of an audience as possible.

D. Complex Engineering Problem

We decided that a current problem plaguing the STEM world currently is the usage and training of Artificial Intelligence in the workplace and commercially. The big focus currently is regarding the training data, the limitations of when and when not to use artificial intelligence, and how we should monitor the exponential knowledge growth of these systems. How can we track the knowledge of these systems and potentially have access to prevent these systems from surpassing the human brain when the time comes? Engineering concerns include how we would keep up with artificial intelligence when it inevitably surpasses human capabilities. Science issues arise when artificial intelligence is coming up with their own breakthroughs and we as humans need to prove the complex solutions these computers will create. This is also true for mathematics since proofs are one of the hardest mathematical standards to meet.

1. Literature search was performed on September 5, 2024 in correspondence with Sacred Heart University's Librarian Kristina D'Agostino

E. Engineering Solution

We decided the best method to begin brainstorming our solution for the task was to create a box diagram displaying what features we would want for our application. For the project this year one of the main areas of interest, in my opinion, is one centralized user-interface (UI). This would make navigation and operation of the application itself more efficient, and make it look more presentable; regardless of the finished project.Since the team from last year did not have a universal solution to the problems at hand, anysort of foundation we set will be set firmly. For our project this year, rather than building off of what the group last year left us, we will be using their work and their failures to determine points of most significance. We will outline those concepts and tackle those in order from essentially scratch, using the code and notes from last year's group, in order to have the best product possible come the end of the school year. Ideally, we would implement a central interface that would guide the user around the application and streamline the schematic process. I would also like to potentially have calibration settings for all potential users saved and be able to be called back

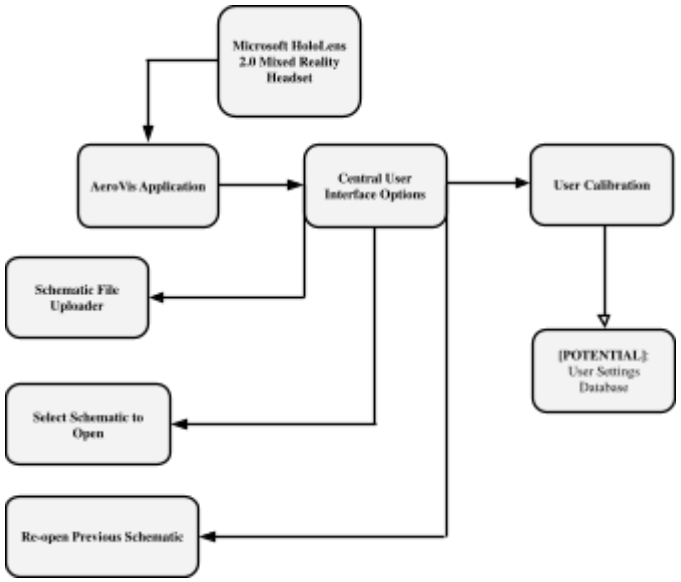

Figure 1: Box diagram displaying our initial plans for the project direction.

F. Team Charter

Team Charter

Mixed Reality (MR) Aircraft Wiring Harness Assembly

Purpose

- This project's purpose is to integrate Mixed Reality (MR) technology into the aircraft wiring harness assembly process to enhance efficiency, accuracy, and reliability.

Goals

- Develop a hardware and software interface for compatibility between existing assembly tools.
- Ensure high accuracy and reliability of MR overlays in varying conditions.
- Optimize the layout and routing of wiring harnesses to minimize material usage and assembly time.

Team Members and Roles

- **Rudy Ferrera**: Develop hardware and software interfaces and ensure compatibility with MR technology.
- **Ryan Monast**: Develop hardware and software interfaces and ensure compatibility with MR technology.

Timeline and Milestones

- **Phase 1**: Research and Planning - Identify existing tools and techniques and assess MR technology requirements.

Meeting Schedule

- **Team Time**: Every Thursday at 5:30 PM.
- **Mentor Meetings**: Every Tuesday at 11:00 AM.

Figure 2: Our team charter outlining roles and goals for the team this semester.

G. Meeting Minutes

Week Three

- **Time:** 11:30am
- **Discussion:** Our discussion this week centered around planning the upcoming semester and making sure our goals were not only attainable but reasonable. This discussion also included our mentors.
- **Attendees:** Ryan, Rudy, Michael, and Ryan
- **Means of Communication:** Met in person.
- **Advancements Made:** We have set definitive landmark dates for throughout the semester, and after meeting with our mentors have plans for when we want to meet during the rest of the semester.
- **Goals for Next Week:** Gantt Chart, Progress Report #1 Completed, Progress Report Presentation #1 Completed, and a functional HUD to demo for the mentors next week.
- **Other:** We currently sit one week ahead of our schedule and hope to use this momentum to succeed early on.

Figure 3: How we documented our teams meeting minutes every week.

II. References

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