

Final Project Report
CSCI 4739
SUAS Team 8

Erik Fong
Christopher Ngo
Mark Nilov
Aaron Roberts

Project Overview-

This question serves as the central premise for the SUAS project.

The main objective of this project was to design and implement an application for our clients at Leidos that would allow the DJI Mavic Air drone to navigate through a maze on its own. However, given the constraints that we encountered following the transition to remote learning, the team decided along with our clients that the best course of action was to pivot to a similar project that involved designing a solution to a maze emulator program that was provided by the client.

The Original Project-

The requirements of our original project outlined that the algorithm that we were to design would be implemented via a mobile application designed in Android Studio. Accordingly, we created an application with a sleek, simple GUI that provided users with a way to tell the drone to take off and begin its mission as well as land in case of emergency.

Additionally, the scope of the original project required that our application would allow the drone to perform object detection and avoidance by using the drone's sensors. Our implementation of these functionalities would play a critical role in achieving the final requirement of the project which was the application giving the drone the ability to navigate through a maze designed by our clients.

Design-

In terms of our design process, we first took the approach of implementing the desired features of the application piece by piece. By the end of the Fall 2019 semester, our team successfully delivered an Android Studio application that met all of the goals that we had set with our clients for the first two releases. Our algorithm allowed the drone to take off, fly forward, and detect objects before navigating around them by itself.

With this strong foundation, we entered the Spring 2020 semester prepared to refine our algorithm and further develop the application to eventually meet the goal of allowing the drone to navigate through a maze by itself. After the initial tasks of integrating object detection and avoidance into our algorithm, the next steps were to refine the movement of the drone and incorporate the additional features of mission creation and execution.

Before we were able to get these last features fully functional, the unprecedented circumstances of the Covid-19 pandemic presented us with several unforeseen obstacles. We soon realized that we were severely limited by only having access to one drone while all of our group members had to work separately from home. As a result,

the team decided in conjunction with our clients that we should switch to a completely digital implementation of a maze solving algorithm. Using an emulator provided by the client that randomly generated different mazes, our new task was to design a Java program that could solve any maze generated by the emulator. Our team eventually succeeded in implementing an optimal maze solving algorithm that followed a set of very simple rules:

- Move forward until an obstacle is detected
- Attempt to navigate around the obstacle's left side
- In the event a dead end is encountered, backtrack and attempt to navigate around the obstacle's right side
- Repeat until the goal is found

Although simple, our program is able to complete every maze that was generated by the emulator.

Testing-

The application that we designed for the original project underwent user testing onsite at Leidos with our clients. We were able to demonstrate that the project requirements outlined for the release of the Fall 2019 semester were met. Additionally, we sent them a Google survey so that we could obtain feedback on our application.

Due to the nature of the project once we transitioned to the maze emulator, user testing wasn't as much of a necessity since the emulator was provided by the clients and the only testing involved was checking the Java implementation that our team provided against their emulator.

Technology Transfer-

All of the code that is pertinent to both our original project and our new project has been uploaded to a GitHub repository that is owned by our clients at Leidos. Our team has also provided the clients with all of the documentation associated with the project that will facilitate further development of our application by future teams.