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LOCKHEED MARTIN

# Build A Submarine Fire Control System Simulator

Background

For our Senior Year Project, we had to design a submarine fire control simulator. It was requested by Lockheed Martin and it is intended to be used for training military personnel. Simulators are a safer and much cheaper alternative to training. For this project we were assisted by Travis Lefebvre who was our external supervisor from the company. Our intended goals for the project were

- Display submarine and periscope visuals as DIS entities
- Pan the periscope visuals left/right/up down using Xbox 360 controller
- Display video on separate screen running a submarine Human-machine interface
- Fire torpedo and view it as a DIS entity

Design Process

- We met two times a week in the Lockheed Martin Facility
- We were provided a laptop by our client which contained VR Vantage which is a simulation software.
- We had to use VR vantage to display the submarine as a Display Interactive Simulation(DIS) entity.
- Then we attached an observer in the submarine's periscope.
- Followed by that, we used an Xbox 360 controller to pan the periscope visuals up/down/left/right.
- Our final product consists of a single script which will open VR Vantage and display the Submarine and the periscope visuals


Details of Design

- Our Submarine fire control simulator is designed in VR-Vantage software. The simulator allows two players to control periscope motion and fires torpedo to enemy target. Player I controls periscope motion with Xbox 360 controller and able to view periscope visual through monitor. Player II can also view periscope visual and has ability to fire torpedo when needed.
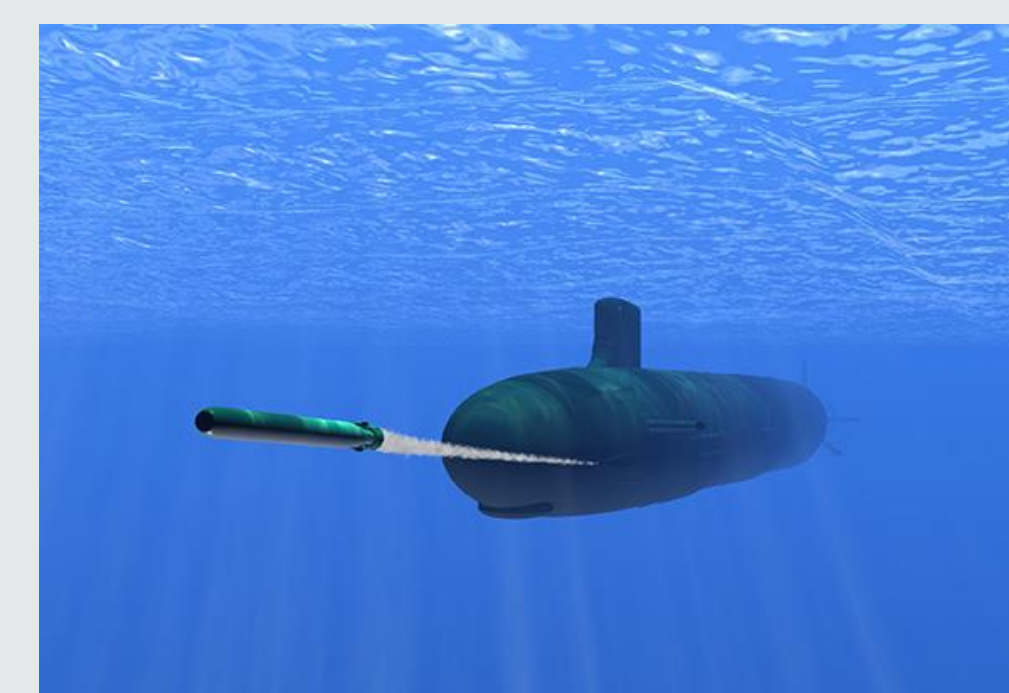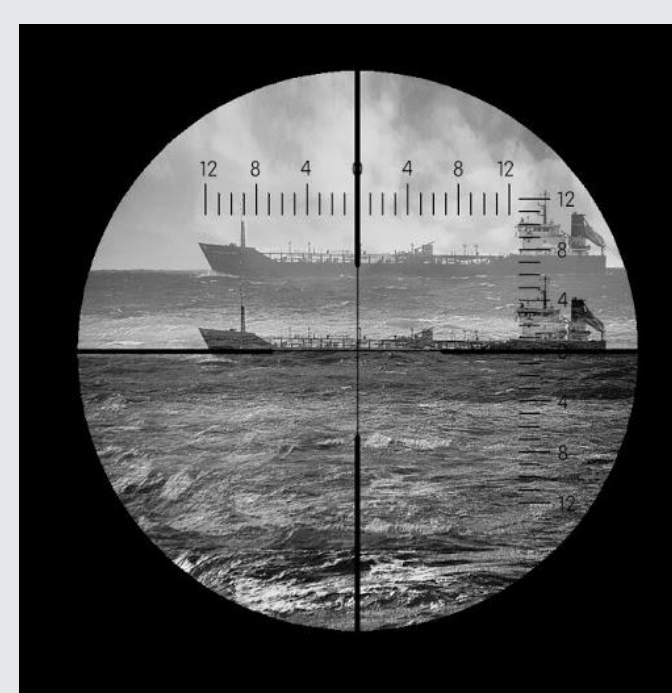
- For our system architecture, we have the master computer that runs the actual simulation in VR-Vantage, and a virtual-PC that connect to the master computer through a virtual ethernet connection. We used the connection between two systems to stream periscope visual, also transfer torpedo firing signals between two systems. We also inquired the Xbox 360 controller which directly connects to the master computer to control the periscope motion in the simulation. Aside from hardware needed, we also need few more coding script to help the hardware working together. Details are shown in the picture below.

Submarine Fire Control System Simulator Architecture
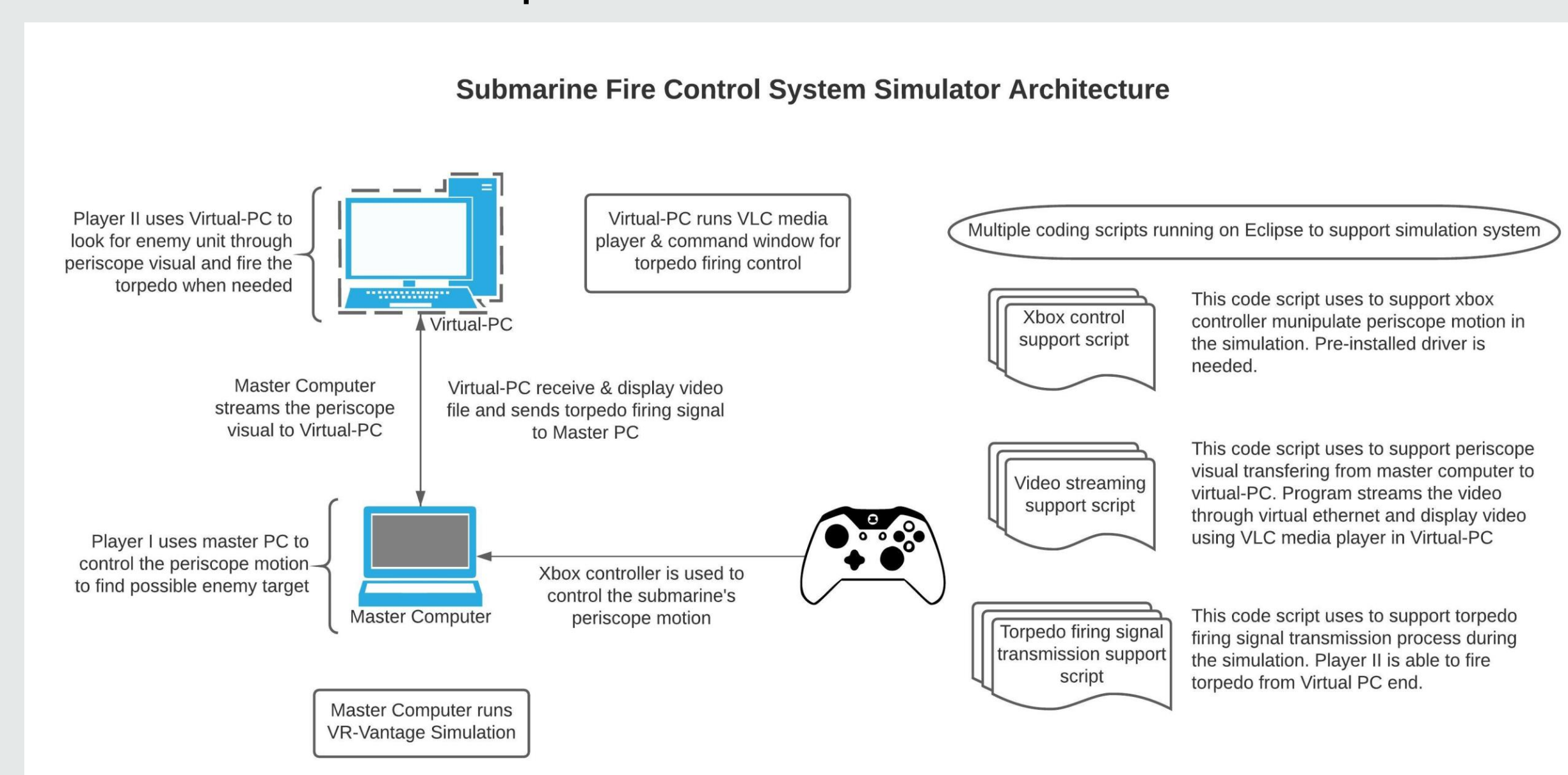
- In terms of our task allocation, we first set up the development environment together to get familiar with the environment we would work on. In the meantime, we tried to break down our project objectives into smaller pieces and planned out steps we should do after the completion of environment setup. After environment has set up, two of our team members work on terrain formation, props and entity editing in the VR-Vantage software. Another team member configured ways to connect Xbox controller to the master computer. After simulation environment has set up and Xbox controller successfully connect to the master computer. We worked together to pan periscope visual using Xbox controller and find possible solution for streaming periscope visual to the second system. Later, we created HMI for torpedo firing control on the second system and edit torpedo as a DIS entity. On the final step, we finalize our project by testing all features are function on our simulation project.

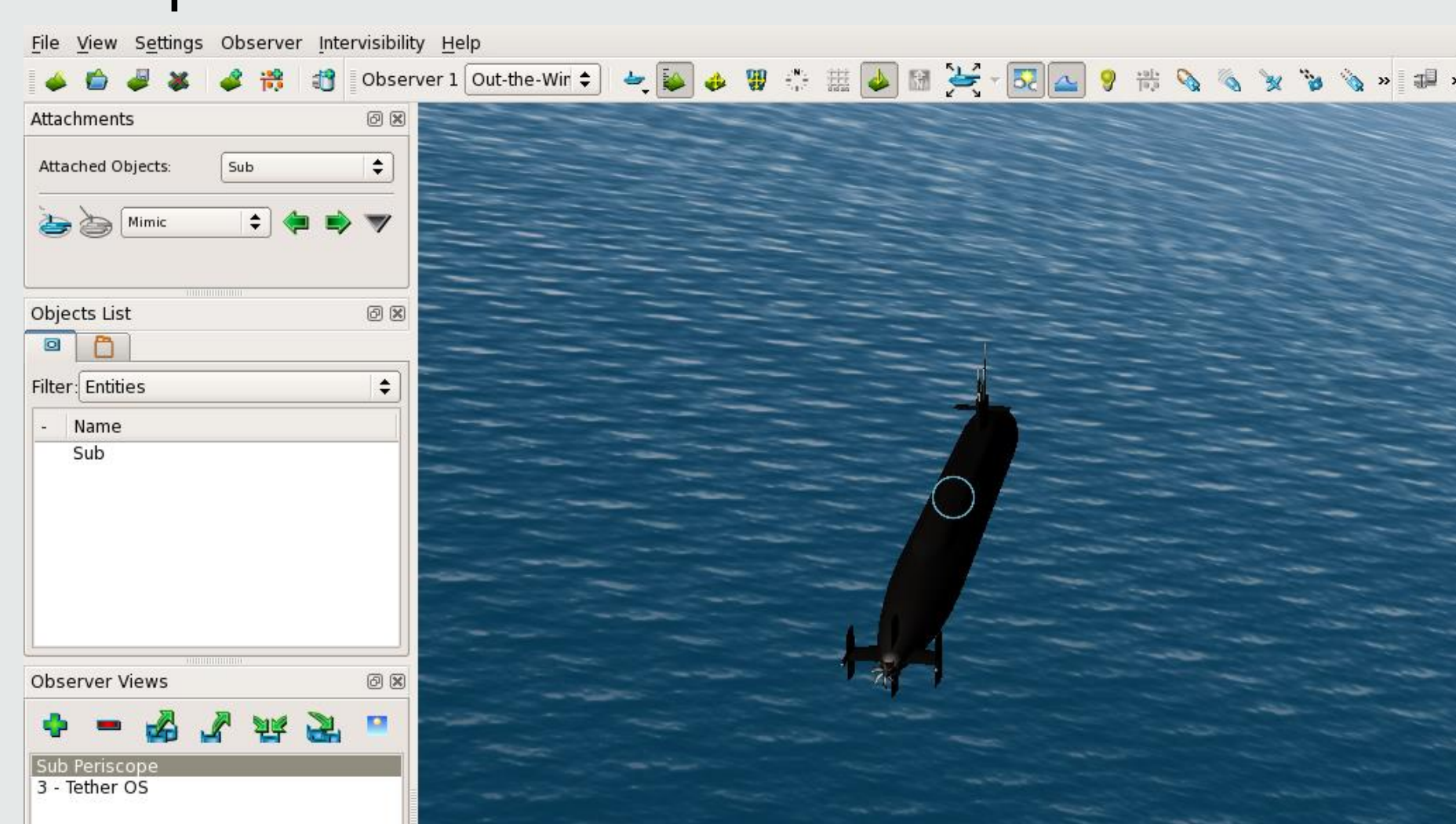Submarine Fire Control System Simulation Gantt Chart
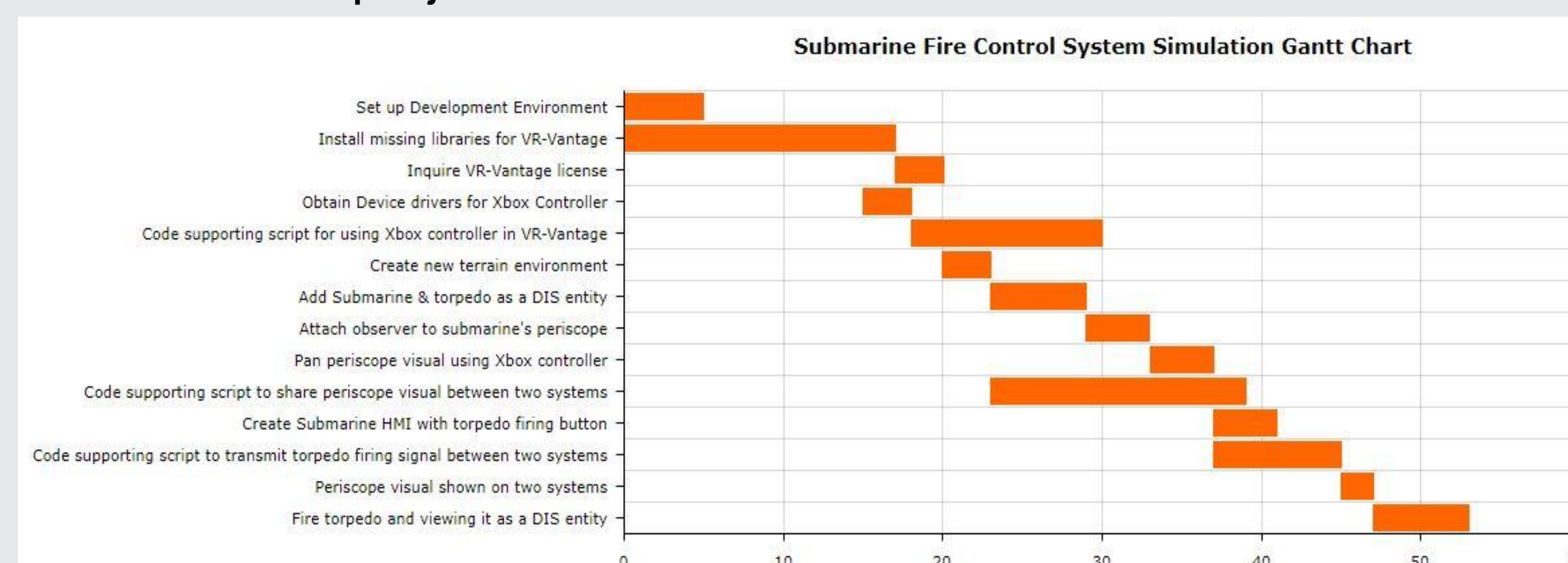
Conclusion and Recommendations

If we were to do this project again, we would recommend using a different simulation software. Due to the expensive nature of VR Vantage, there are very limited resources available and its connectivity with external hardware is also not the best. It also tends to crash a lot and there was this issue which caused our submarine to float in the sky instead of the water. We would also use a newer controller as the Xbox 360 is more than 10 years old. A more updated Operating System may allow better developer experience.

Even though there were some challenges throughout our project, we would like to thank Lockheed Martin for giving us this amazing opportunity where we gained invaluable experience as engineers. This project allowed us to gain insight regarding the various steps of a project, how to troubleshoot properly and most importantly, it made us more excited than ever to enter the industry as upcoming engineers.

References

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