ECE 4400: Project Proposal

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1 Motivation

The motivation for this project is to investigate the network design that flight simulator systems rely on. We will be studying the network and software architecture of these systems to understand how their design has an impact on the performance. Conversely, we will explore how system requirements and regulations affect the network design.

2 Project description and background

Flight simulators are vital components in aviation. They allow users to experience a realistic environment during flight, and gain the skills necessary to control aerial vehicles. Typically, there are four types of flight simulators: A, B, C, D. Type D is as close as the actual aircraft as possible. For our project, we plan to model the type D basic network architecture that can be found in these simulators.

3 Software architecture

In general, Level D flight simulators can be broken down into six main subsystems:

- Host
- Motion System
- Visual System
- Flight Management System (FMS)
- Instructor Station
- Cockpit I/O

The Host can be viewed as the most important part of the system because it controls all interaction between other systems. The motion system handles motion response using six degrees of freedom and hydraulic or electric motion legs. The visual system handles all image generation and the cockpit display. The FMS controls simulated aircraft systems, and the instructor station and cockpit I/O allow the instructor and pilot trainee to manipulate the aircraft simulation in different ways.

The software architecture on many flight simulators works by using a combination of synchronous and asynchronous modules working to manipulate the state of the simulation. Synchronous modules are run at different priority levels called "bands". Modules belonging to lower bands are run more frequently than those belonging to higher bands, but these events occur equally spaced out in time and run at regular intervals. Asynchronous modules occur less often, commonly as a result of user input, but often take higher priority than synchronous modules when they do occur.

4 Network architecture

Each of the subsystems of a level D full flight simulator are interconnected through the Host system. The Host services the network traffic received from all other subsystems and redirects the packets to the appropriate subsystem. The only path to each of the simulator subsystems is through the host, therefore it is a vital part in determining the efficiency of the simulator network.

Once traffic is received from the host, the host uses the received data to compute physics and system behavior, then sends packets to the appropriate system with the output information that is used to update the total simulation state.

5 Significance/relation to networking

To comply with government regulations, the system needs to have specific behaviors to meet these requirements. Each of the various subsystems must communicate through a host machine within a given time frame of about 100ms to comply with government regulations. One aspect that will have to be modeled by this system is the latency of communicating through the host. Each subsystem can only be accessed through the host; therefore, all the subsystems will be unable to communicate if the host is down. This system would also need to handle synchronous packets with varying priority levels and variable-length asynchronous packets.

6 Detailed team member responsibilities

Record Keeper (Tyler Benton) - The record keeper will be responsible for collecting and organizing notes about project details, results, conclusions, and challenges from other group members. At the close of the project, the record keeper will author and polish the final report for submission.

Presentation Designer (Anthony Dimalanta) - The presentation designer will collaborate with the record keeper in order to organize and build the proposal, milestone, and final presentations. If the record keeper is absent from a team meeting, the presentation designer will take over the role of writing notes for the group.

Model Designers (Griffin Dube, Bradley Selee) - These two team members are responsible for designing a model for examination of the problem at hand. They will work with the demonstration designers in order to promote a seamless transition from the model design into a tangible demonstration for the target audience.

Demonstration Designers (Cavender Holt, Austin Repp) - Like the model designers, two team members will be assigned the role of demonstration designers. They will be the members that work closest with the model designers in order to develop a pragmatic way to show off the results of our team's experiment.

Note: Members may offer assistance to others and are not constrained to work solely on their assigned tasks.

7 Detailed timeline for completing each task

Proposal	
Team Organization	3/22/2021
Primary Research Started	3/28/2021
Proposal Presentation	4/1/2021
Proposal Report	4/2/2021
Milestone	
Basic Demo Started	4/10/2021
Geni Topology Created	4/13/2021
Software Plan Finalized and Implementation Started	4/13/2021
All Research and Scope Completed	4/17/2021
Initial Architecture Finalized	4/17/2021
Presentation for Milestone Completed	4/19/2021
Final Presentation and Demonstration	
Final Demo Completed	4/27/2021
Presentation and Written Report Completed	4/27/2021