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Research Proposal

Flight simulators set many limiting conditions and strictly follow mathematical models. This raises the concern whether some outcomes in real life circumstances are overlooked. This research proposal aims to take acute and emergency situations into consideration and have the simulator’s view behave like it’s really happening. The intended audience of this proposal is the academic and engineering departments of the school, defense contractors and software engineering companies in the flight simulation industry.

Flight data downloaded historically from such emergency situations containing variables such as altitude, angle of attack, thrust, compressor and fan speed, intake and exhaust temperatures can all be used statistically as input variables in the development of this new simulator. By integrating flight data as a sequence of conditions set for a specific emergency situation, pilots can get a more realistic visual and sensory effects when a plane is for example, hit by a rocket in the simulator and now he has to egress under stress.

In modern aviation, flight simulation plays a huge role in mitigating risks and cutting the cost of a real flight. It’s used for training pilots, testing the performance of a new technology, or even providing military pilots an advantage during combat. Many defense contractors and aviation companies have jumped on the simulation train. Military organizations today are really sensitive to flight simulators since they understood the benefits of such fairly costly technological devices, capable to “replicate the response’’ of 5TH generation fighters which are typically very expensive to operate. (Simulation and Training Bosses 36)

The current trend in the research of flight simulation focuses on setting limiting conditions as input, building mathematic models based on the input, transforming it into computer algorithms and finally visualizing the output using various software. The output of these simulators may be a simple graph that analyzes data, or a fully simulated virtual environment. Thus this field overlaps greatly with the areas studied in computer science. But amongst these researches, non-linear aerodynamic forces and moments as well as extreme angle of attack conditions are overlooked. (Frantis and Cuzzolin 67) What that means is, in emergency situations where a steep climb, a steep dive, or spin recovery is required, this system will not reflect accurately and realistically on the screen, and thus pilots will not get the training they are looking for. Because of this reason, most pilots still prefer to simply train in the flight line and up in the air than in the simulator because the conditions posed in the simulator are in effect, not the flight conditions, but cockpit conditions. (Jeon 50)

In order to conduct this research, I will need access to existing flight data downloaded after each flight, then use statistic functions to extract the mean, average and standard deviations to account for the fluctuations happening during an emergency situation in flight. Next, I am going to research the

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existing simulators to find one that uses an aerodynamic model that is able to take the flight data as inputs and therefore replay them as commands in flight. This way, instead of having the simulator just saying “You are hit, good luck!” it now flies in a realistic path as if the rocket has hit the plane and now you have to egress and save yourself before the plane crashes. The simulator will be able to achieve that by adding the statistic functions into its existing flight path algorithm to “fine-tune the edges” during the trigger of an emergency event. And of course, the triggering of such events such as low fuel, egress, spin recovery, negative-G, will also need to be added into the program’s loop.

On the graphics end, more powerful GPU(Graphic Processing Units) will be needed to process the huge amount of statistical data being rendered on the screen to detect the fine tune movements. And since flight simulators are essentially serious video games, a high end game engine will be needed to render these graphics accurately. Unreal Engine with a C++ code base offers free distributions to colleges. This will be the graphics engine used to render our flight simulator.

Other equipment needed are: Internet connection, laptop computers to code the flight simulator, one embedded flight simulator platform to test the software, helmet mounted displays(similar to an oculus rift goggle), headphones, a monitor software that calculates and displays data on the screen in real time, for the trainers, while the pilot is in the cockpit.

The first phase of the development will mainly focus on improving an existing flight simulating software. Microsoft Flight Simulator X will be used since it’s a very popular one that’s open to the public. The scale of this phase will be small. A subject matter expert with 2 software engineers, a systems administrator and an aerospace engineer to handle the business requirements, rendering, data analysis, hardware maintenance, and flight model formulation.

Once the software is developed, the next phase will be to contact companies that work in the industry to get more funding for a more sustained research operation. Many defense contractors such as Lockheed Martin, Boeing, Northrup Grumman, can provide such funding and more advanced flight simulation platforms to test the rendering of the software on the simulator screen. Lockheed Martin’s Prepar3D flight simulator has full support of Microsoft Flight Simulator X software.

In conclusion, I propose our computer science department to grant us $4,000 dollars of funding to commence the first phase of our research operation. This will further the accuracy of flight simulators for training in acute and emergency conditions and will be of great aid for the training of future pilots.

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Works Cited

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