<u>Divide and Conquer 1.0</u>

Helicopter Collective Control for Flight Simulators

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Group 20

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2.0 Project Narrative Description

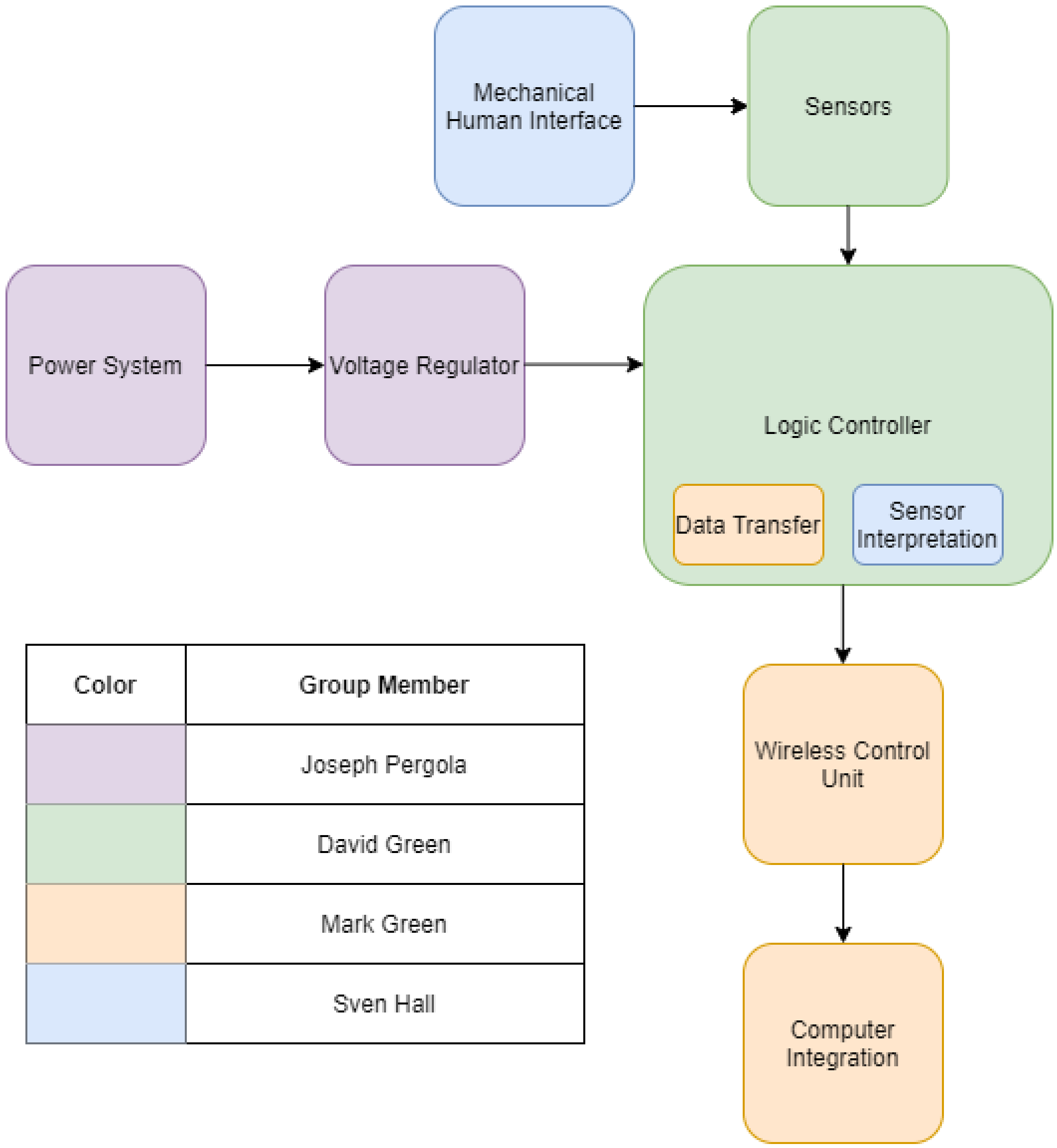
Among the world of flight simulators, there exists a desire for affordable and realistic controller options in order to better simulate the experience of flying a plane or helicopter in a virtual environment. While a plethora of options exist for consumer plane flight simulator controls that range from simple and affordable to complex and expensive, there is a marked lack of affordable yet realistic options available for helicopter controls aimed at flight simulators. This may be in part due to the rather niche experience required to operate a helicopter in a flight simulator and the relatively more complex control scheme of a typical helicopter when compared to average plane controls. The most common kind of controller available for flight simulators to the average consumer are HOTAS (“hands on throttle-and-stick”) style devices which implement a throttle lever, flight control stick, and an array of buttons, simulating generic airplane controls that can be applied to many types of airplanes in various flight simulators. These kinds of HOTAS controllers can be acquired at varying price points with varying capabilities easily. However, as mentioned earlier, this is not the case for helicopter flight controls which are unique enough in their functionality that acquiring helicopter flight controls for use in a simulator can be prohibitively expensive and difficult. It is for this reason that the goal of this project is to develop a relatively low cost, portable, accurate, and modular controller to specifically implement the functionality of a helicopter collective lever for use in a flight sim.

A helicopter collective lever, known more simply as a collective, is the controller that is primarily responsible for adjusting the pitch angle of all blades on the main helicopter rotor at the same time, or collectively. This essentially enables the control of the amount of lift experienced by every blade on the main rotor at the same time, controlling vertical ascent or descent. This is used in conjunction with, but is not to be confused with, a control called a cyclic control that tips the entire rotor into a direction in order to tilt the helicopter forward and back or left and right, resulting in horizontal movement. The collective also usually implements a throttle control and a varying number of buttons or other inputs on the collective head (the top portion of the collective). The main goal of this project is to create a controller to implement the functionality of a generic helicopter collective (the collective lever control and throttle control) as well as specific functionality in the form of modular collective heads that can be swapped out to better represent different helicopter designs in a flight simulator. It is also a primary objective that this functionality be implemented in such a manner that the final result is not prohibitively costly, as this is the primary barrier of entry when attempting to obtain similar commercial products. The relatively low cost and modular capabilities that we aim to achieve are the aspects of this project which make it stand out from other available options in the commercial market for flight simulator controls.

3.0 Requirement Specifications

No.	Requirement	Specification
1	**Cost**	< $500
2	**Weight**	< 20 lbs.
3	**Line of Sight Wireless Connection Range**	≥ 15 ft
4	**Idle Runtime (Wireless)**	> 6 hours
5	**Collective Base Size**	< 1 cu. ft
6	**Minimum Measurable Change of Lever Angle**	< 1°
7	**Angular Variance at Idle**	±5% of total angular travel
8	**Number of Unique Collective Heads**	≥ 2

4.0 Block Diagram



Color	Group Member
	Joseph Pergola
	David Green
	Mark Green
	Sven Hall

Block	Status
Power System	Research
Voltage Regulator	Research
Mechanical Human Interface	Research
Sensors	Research
Logic Controller	Research
Data Transfer	Research
Sensor Interpretation	Research
Wireless Control Unit	Research
Computer Integration	Research

5.0 Estimated Budget and Financing

This project will be self-financed by the members of our group.

Component	Estimated Cost ($)
Input Devices and Sensors	
Collective Shaft Angle Sensor	25-75
Throttle Twist Sensor	5-50
Switches, Joysticks, Buttons	10-20
Mechanical	
3D Printing Filament	10-40
COTS Hardware	50-75
Electronics	
Batteries	25-50
Circuit Components (Resistors, Capacitors, Inductors, etc.)	10-25
Logic Controllers	5-25
Wireless Communication Module	5-15
PCB Manufacturing	5-30
Total Estimated Cost Range	**150-405**

6.0 Project Milestones

Semester 1

Milestone	Deadline
Divide and Conquer 1.0	01/29/2021
Divide and Conquer Advisor Review Meeting	02/03/2021
Divide and Conquer 2.0	02/12/2021
Research Input/Sensor Devices	02/15/2021
Research Logic Controller Options	02/19/2021
Research Wireless Communication Standard	02/22/2021
Research Power Design Options	02/26/2021
Initial Circuit Design	03/15/2021
Software Design/Programming	03/26/2021
Initial Mechanical Design	04/09/2021
Initial Prototyping	04/16/2021
PCB Design	04/26/2021

Semester 2

Milestone	Deadline
Finish Prototyping	May 2021
Completed Mechanical Design	June 2021
PCBs Manufactured	June 2021
Mechanical and Electrical Integration	July 2021

Product Assembly	July 2021
Function Testing	July 2021
Final Product	August 2021