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Team 315

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Targets

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## Introduction

The goal of our senior design project is to develop a low-cost drone simulator that is accessible to K-12 students, providing them with an interactive and educational platform to explore drone technology. Drones are playing a growing role in fields such as agriculture, surveillance, and delivery, introducing students to drone operations at an early age can inspire future learning and innovation. Our simulator will feature user-friendly controls and AI integration, allowing students to simulate real-world drone scenarios like object recognition and tracking in a safe, virtual environment. By focusing on affordability and ease of use, we aim to make drone technology more approachable for younger audiences, encouraging STEM education. This document outlines the specific targets we aim to achieve in terms of functionality, performance, and educational value.

## Targets

Target: The controller appropriately translates the flight movements of the drone into simulation movements.

Justification: One purpose of the simulation is to show people how to fly a drone. The absence of a controller takes away from the learning experience.

Method of validation: Move controller joysticks and see if the drone responds in the correct way.

Importance: High

Consequence of failure: The drone won't be able to fly within the simulation using the controller.

Target: The entire system can fit in a car or van

Justification: Customers request the system to be portable because the system must be able to move around the community or schools to provide a demonstration.

Method of validation: Able to fit in a car or van

Importance: Medium

Consequence of failure: Unable to move the system around and failed to meet customer need

Target: Simulation runs appropriately with FPV when connected to a VR headset

Justification: The VR aspect is supposed to resemble a camera attached to the drone

Method of validation: FPV is shown through a VR headset.

Importance: Medium

Consequence of failure: Inability to see where the drone is going within the simulation.

Target: Able to implement AI models

Justification: Customer request that the simulation be able to use AI integration

Method of validation: The simulator will successfully incorporate pre-trained AI models, and tests will be run to ensure accurate image detection and object tracking during simulated flights.

Importance: Low

Consequence of failure: If AI integration fails, the simulator will lack advanced features, reducing its appeal and limiting the potential for enhanced user interaction. This could result in unmet customer expectations.

Target: Controller Feedback

Justification: The simulation has to provide more than physical flight feedback.

Method of validation: Controller vibrates

Importance: Low

Consequence of failure: Simulation will only have visual feedback

Target: Simulation contains 3D terrain

Justification: The simulation should be able to simulate flying a drone in real life. To simulate this experience more accurately, the presence of a 3D environment is important.

Method of validation: Run the Simulation and see if it includes a 3D environment.

Importance: High

Consequence of failure: The user can't accurately simulate a drone.

Target: Process and collect user data

Justification: The user is supposed to be able to reflect on decisions made during the simulation

Method of validation: The user receives feedback based on flight performance

Importance: Low

Consequence of failure: Limited learning experience for the user, as they won't receive actionable insights on their decisions. This could result in reduced educational value and a less engaging simulator experience.

Target: Simulate basic drone flight.

Justification: Simulating basic flight functions provides users with essential piloting skills and familiarizes them with real-world drone behavior in a safe environment. This is crucial for both beginners and experienced users to practice and improve their control

Method of validation: Simulation can takeoff, hover, land, throttle, roll, pitch, and yaw.

Importance: High

Consequence of failure: System does not accurately simulate drone flight and user gets an unrealistic representation of a drone.

Target: Keep production costs low to allow a retail price under budget.

Justification: Part of the goal is to make the system accessible to the average person as well as schools for educational purposes. This group of people don't usually have the expenses to buy expensive systems.

Method of validation: Review budget spending for the entire project at the end.

Importance: Low

Consequence of failure: System might be too expensive for the target group of interest to access.

## Metric Ranking

Metric no.	Need	Metric	Imp.	Units	Marginal Value	Ideal Value
1	6	The controller appropriately controls the flight directions of the drone in simulation	High	N/A	N/A	N/A
2	3	The entire system can fit in a car or van	Medium	$ft^3$	$2 ft^3$	$15 ft^3$
3	2,5	Simulation runs appropriately with FPV when connected to a VR headset	Medium	N/A	N/A	N/A
4	4	Able to implement AI models	Low	N/A	N/A	N/A
5	6	The controller should be able to provide feedback based on simulation etc. vibration	Low	N/A	N/A	N/A
6	1	Simulation contains 3D terrain	High	N/A	N/A	N/A
7	4	Process and collect user data	Low	N/A	N/A	N/A
8	1	Simulate basic drone flying	High	N/A	N/A	N/A
9	7	Keep production costs low to allow a retail price under \$500	Low	\$	\$50	\$500

Importance high = critical target

## Functions Matched to Targets

Metric No	Metric	Functions
1	The controller appropriately controls the flight directions of the drone in simulation	Control Drone Flight
2	The entire system can fit in a car or van	N/A
3	Simulation runs appropriately with FPV when connected to a VR headset	Simulate Environment
4	Able to implement AI models	Integrate AI
5	The controller should be able to provide feedback based on simulation etc. vibration	Simulation Physics
6	Simulation contains 3D terrain	Simulate Physics
7	Process and collect user data	Control Drone Flight Integrate AI
8	Simulate basic drone flying	Control Drone Flight Simulate Physics
9	Keep production costs low to allow a retail price under \$500	N/A

## Appendix

### Target:

1. The controller appropriately controls the flight directions of the drone in simulation
2. The entire system can fit in a car or van
3. Simulation runs appropriately with FPV when connected to a VR headset
4. Able to implement AI models
5. The controller should be able to provide feedback based on simulation etc. vibration
6. Simulation contains 3D terrain
7. Process and collect user data
8. Simulate basic drone flying
9. Keep production costs low to allow a retail price under



## Summary

In conclusion, the defined targets serve as the foundation for achieving the intended functionality and performance of the drone simulation project. By establishing clear target values and utilizing appropriate validation methods, I have ensured that each critical aspect of the simulation is accounted for and measurable. The levels of importance assigned to each target emphasize their role in the project's success, while the discussion of potential consequences highlights the risks of failing to meet them. Together, these elements create a structured approach to the project's development, ensuring that it remains on track to meet its goals. The compiled spreadsheet in the appendix provides a concise reference for all targets, aiding in future evaluation and adjustments as needed.