Speed Target Arcade

Divide and Conquer 2.0

Senior Design I

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Group 1

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Project Members

The proposed project is the “Speed Target Arcade”, a game that allows players to take turns shooting a laser gun at different lit up targets, where the goal is to hit as many targets within the amount of time given. The four members in the group are Travis Hughes, Caleb Dobias, Triston Hernandez, and Edward Plummer. Travis, Triston, and Edward are all computer engineering majors. Caleb Dobias is a photonic science and engineering major. There are no outside sponsors; therefore, the project will be funded by the members involved in building this project.

Motivation and Goals

The motivation of this project is primarily entertainment, and we want to cater to that. Obviously, there’s some side benefits to the project such as hand eye coordination practice and reaction time improvement, but that’s not a huge motivator. It’s easy for people to respond to a challenge, especially when it seems so approachable. A challenge of hitting flashing targets is one that can be easily appreciated by many people. The goal is to create a fun, interactive, and competitive game for all users who play. We will create a “Target Board” with multiple targets, each of which will send points to an application when the target is hit, dependant on how accurately the target was hit.

Project Description

The Laser Gun

The laser gun itself will consist of a 3D printed shotgun shaped model filled with a power supply, a laser diode, a microcontroller, and a lens if necessary. The power supply be connected directly to the microcontroller, which will then control the power the laser. The reason the power is directed through the microcontroller is to put limits on how often the laser can be fired and how long a laser pulse lasts. This way, wreckless pulling of the trigger in the arcade would be punished with missed opportunities to score points. The laser diode itself may diffract larger or smaller than what we would like, and as such, we would use a beam collimating system to allow the gun to be used at a multitude of ranges. Additionally, an aperture should be used to control the gaussian distribution of the laser.

The Board

The board itself will be a simple cardboard display piece with 5 targets aligned in an x pattern. The target is a small 2 inch hole where a laser will be fired into. Inside each hole is a set of four photoresistors in a quadrant. Each target will be highlighted by a set of LEDs. When a target is meant to be hit, the surrounding LEDs will light up. The photodiodes, when hit, will send an electrical signal to the attached bluetooth microcontroller, where the accuracy and points

can be calculated by the response of each of the four photodiodes in the system. The more similar the response on the target, the more centered the shot was, and thus, we can calculate accuracy on hit. Targets are meant to be hit one at a time and appear at random after each target is hit.

The Bluetooth Microcontroller

The Bluetooth chip will be connected to all five of the boards, which are each connected to a target. When the boards register a target as a hit, this will then send a signal to the bluetooth chip. Once the bluetooth chip registers a hit, data will be sent to the web application that we will create. We will track the accuracy of the shot as well as how many targets are hit within the given amount of time. Depending on the accuracy of the shot, a specific set of points will be given.

The Web App

The Web App will receive data transmitted by the Bluetooth microcontroller and parse the data accordingly. Depending on the data received, a score will be assessed based on the margin of error found relative to the distance from the center of the board. Under the allotted time frame given to the user, the score will be updated in real time to track their progress. Once the run is complete, users will be able to compare their scores with previous attempts in order to track their progress. Along with personal records we will implement a leaderboard that allows the user to compare their scores with that of a database of other users.

Project Constraints and Standards

The gun is going to be a long barreled shotgun, barrel approximately 22 inches, weighing about 5 pounds, to be held with two hands. . The laser diode itself will be eye safe, and will have a spot diameter of about 2 inches at 15 feet away, such that the spot size will be about to hit all four photodetectors at once. The power supply for the gun should be 5V and provide enough power to the gun for at least 2 hours. The PCB, the laser diode, and the power supply should fit completely encased by the gun housing.

The board itself is a 3 by 3 ft project board. Each of the 5 targets are placed in an X pattern in a 2.5 x 2.5 ft box around the middle of the board. Each target is made up of a hollow 1.5 in diameter cylinder angle slightly to point at a position of 15 ft away. This is such that when firing at the board, the targets itself will angle to where the gun may be held away from the body. Inside each cylinder is a PCB with four photoresistors arranged in a square with a width of 0.5 in centered around the middle of the cylinder. At the edge of each cylinder is LED ring which lights up, indicating that this target is the one to shoot. Each PCB on the target will also supply power to the LED ring around each target. The PCBs are wired behind the board to a bluetooth

controller, such that all the data channels are streamlined into one board controlling 5 targets, 4 photoresistors each, and 5 sets of LED circles.

The application should be used on both Apple and Android phones. Normally to achieve this process two different applications would need to be created using the native platforms; however, this process has the potential to cause multiple conflicts when trying to achieve cross compatibility. To try and prevent this from causing issues we will use react native, which should allow our app to run on both of these devices. To create the game to be multiplayer, we will set a timer within the app and let each user shoot for one minute. Once the minute is up, the the user will be given their score and be able to compare their score to everyone who has played before them. A scoreboard will be constantly updated for the top 10 players.

Realistic Design Constraints	
Eye Safe Laser	Below 1mW of Power
Board Size	3 Feet by 3 Feet
Gun Weight	Greater than 4 pounds but less than 10 pounds

Standards	
Laser Color	632 nm
Phone App Framework	React Native
Programming Languages	JavaScript and Python
Database	MySQL Server

Project Budget

Item	Price
PCB Boards	**150$**
Power Supply	**40$**
Wires and Components	**40$**

Photoresistors	**10$**
Bluetooth Chip	**40$**
3D Printed Laser Housing	**40$**
Board and Targets	**30$**
Laser Diode	**20$**
Total	**370$**

Schedule:

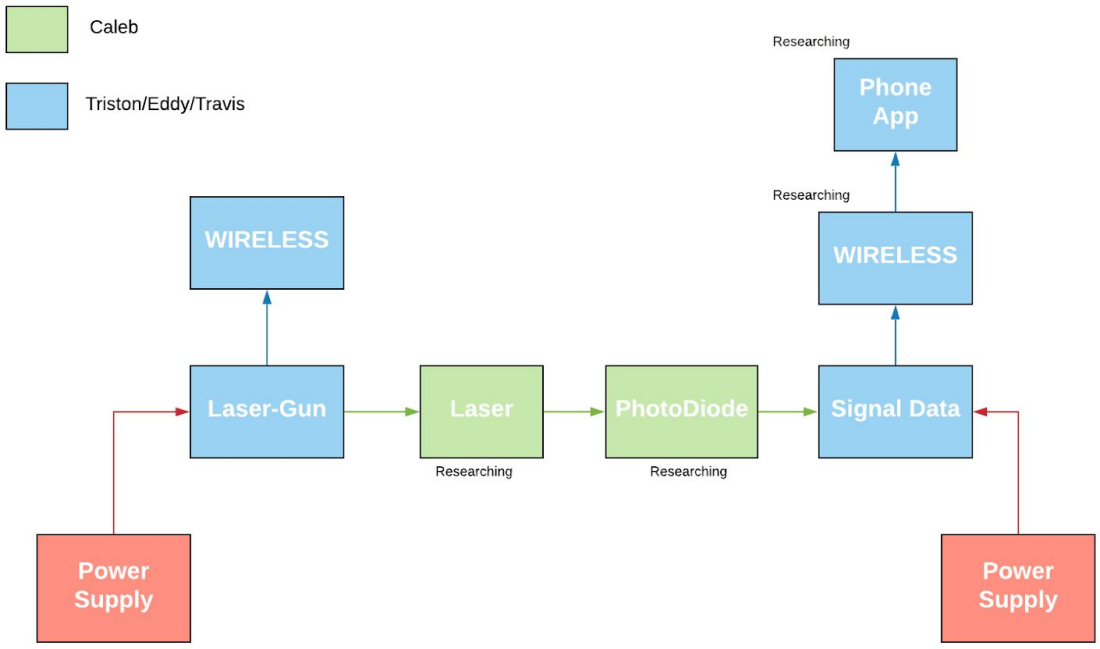
Senior Design 1

Week	Date	Task
2	30-May	Create table of contents and begin researching parts that may be used
3	6-June	Begin writing document
6	27-June	Complete half of the writing for the document
9	16-July	Have 75% of the document complete
12	30-June	Turn in final Document

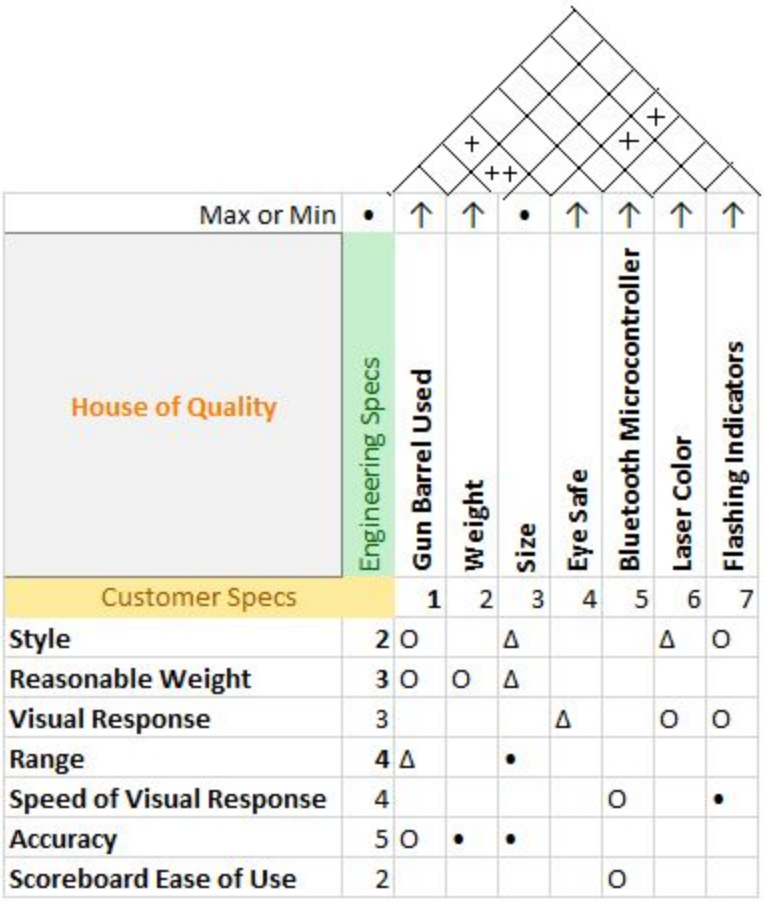
Senior Design 2

Week	Date	Task
1	2-Sep	Begin to order parts required
3	16-Sep	Test and ensure every part is functioning correctly
6	7-Oct	Build Project
10	4-Nov	Finish debugging code/ fix any issues
13	18-Nov	Create presentation
15	December	Present project

Block Diagram



House of Quality Diagram



House of Quality	Engineering Specs	Gun Barrel Used	Weight	Size	Eye Safe	Bluetooth Microcontroller	Laser Color	Flashing Indicators
Max or Min	•	↑	↑	•	↑	↑	↑	↑
Customer Specs		1	2	3	4	5	6	7
Style	**2**	O		Δ			Δ	O
Reasonable Weight	**3**	O	O	Δ				
Visual Response	3				Δ		O	O
Range	**4**	Δ		•				
Speed of Visual Response	4					O		•
Accuracy	5	O	•	•				
Scoreboard Ease of Use	2					O		

Engineering Requirements	
Target #	5
Target Size	2 inches
Microcontroller #	2
Bluetooth	Yes
Phone Compatibility	Both Android and iPhone

Citations

Martinez, Emmanuel, et al. “Drone Hunt .” *Drone Hunt*, 2015, www.eecs.ucf.edu/seniordesign/fa2014sp2015/g03/project.html.

Sivek, Ryan, et al. “Active Electronic Assault System.” *Active Electronic Assault System*, 2014, www.eecs.ucf.edu/seniordesign/fa2013sp2014/g16/.

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