



UCF Senior Design I

EEL 4914 Fall 2017

Laser Skeet

College of Optics and Photonics(CREOL)
And
Department of Electrical Engineering and Computer Science
Dr. Lei Wei

Initial Project Document
Divide and Conquer

Group-8 Creol

Alexander Spencer	Electrical Engineer
Clayton O'Rourke	Photonics Engineer
Kevin Ratliff	Computer Engineer
Sean Brown	Electrical Engineer

Project Description

Skeet is a sport that is modeled after fowl hunting. People participate to practice for hunting, for competition, or just for fun. During skeet shooting circular clay targets are thrown or launched into the air and the player attempts to hit the target using a shotgun. Skeet shotguns have a pellet radius of 30 inches at 21 yards. However, this pattern may be tighter or spread out more depending on player preference. Typical range for skeet is 62 yards, but can exceed 70 yards. Trap shooting is very similar but with different rules. Both Skeet and Trap are applicable to our project.

Our project aims to take the worries of a firearm out of the sport of skeet and trap shooting. This will be done by replacing Lead pellets powered by gunpowder with a safe IR laser. The standard clay disk used as a target will be a puck with IR sensors that can communicate with the shooter and indicate a hit along with some other functions to improve the overall experience with the device. The project would also allow the integration of features not available in conventional skeet, such as automatic score keeping.

The project will be implemented in a manner to meet the CREOL required technology. Additionally we intend to gain experience in the implementation remote wireless sensor technology and microprocessors used in IOT and industrial applications.

There is a wide range of laser tag type devices on the market. A search of the internet revealed a price range of \$25 to over \$400 per device depending on the products features and quality. While these are similar in technology they are focused on implementing a different type game/sport. The beginnings of alternative skeet games go back to 1973 Nintendo video game. There, however was a very limited selection found when searching for products that utilize actual flying skeet. Only two were initially found. A very cheap limited toy for \$80 and a commercial business franchise offering from <http://www.laserskeet.com/> that comes at the cost of 100's thousands for start up. This leaves a large middle ground for product price and only limited competition on the high end product.

The down side of the cost of the electronic skeet versus the 11 cent cost of conventional skeet could be an issue in pricing considering that 25 skeet are required for a full round. Less skeet could be used if the player was retrieving them during the round. The fact that the electronic type will be reusable will help offset this difference, but still require a larger upfront cost.

Marketing potential towards enthusiasts who can't shoot in their own backyard, people who want to play it indoors, people who want a "safe" gun to teach their children how to handle firearms.

Features and Specifications

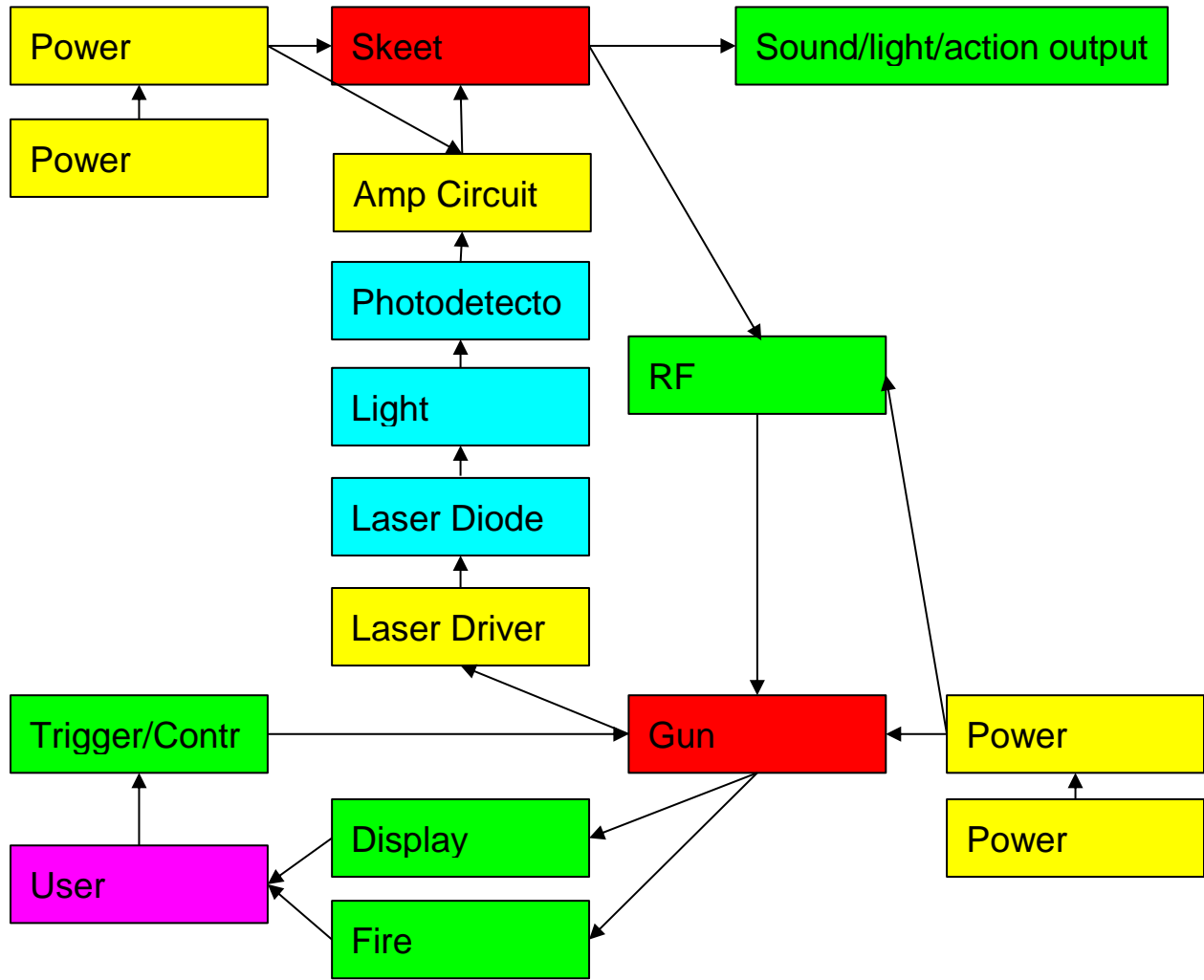
Laser Gun

- Power by 9V or less of battery power
- Laser and optics
 - Simulate shotgun shot spread ~ 0.5 to 1 inch per yard
 - Effective power at range of 15 meters minimum.
- Wireless signaling receiver from skeet
- MCU
 - Hit/Miss counting, score keeper
 - Mode select (2 shot (double barrel), manual reload (pump), auto)
 - Shot delay timer to simulate shot flight time.
 - Laser pulse timer
- Display screen. Small LCD.
 - Displays User Interface and hit response statistics
- Shot feedback (sound and/or bumper)
- Control input switches. (Trigger, load, mode, reset)
- Safety markings
 - Orange barrel band
 - Laser warnings
 - Active laser indicator

Skeet (target)

- Power by 9V or less of battery power
- Laser detectors
 - Capable of detection at at least 15 meters
- Wireless signaling back to gun control of hits detected
- Circuit Board able to fit in 4 ¼ inch diameter (standard clay target size)
- Hit detection output from electronics
 - Visual signal of a hit and or physical sub-system to destabilize target trajectory
- Low cost considering multiple devices would be desirable
 - Use of not-destructible parts

Gun and Skeet Block Diagram
(Figure #1)



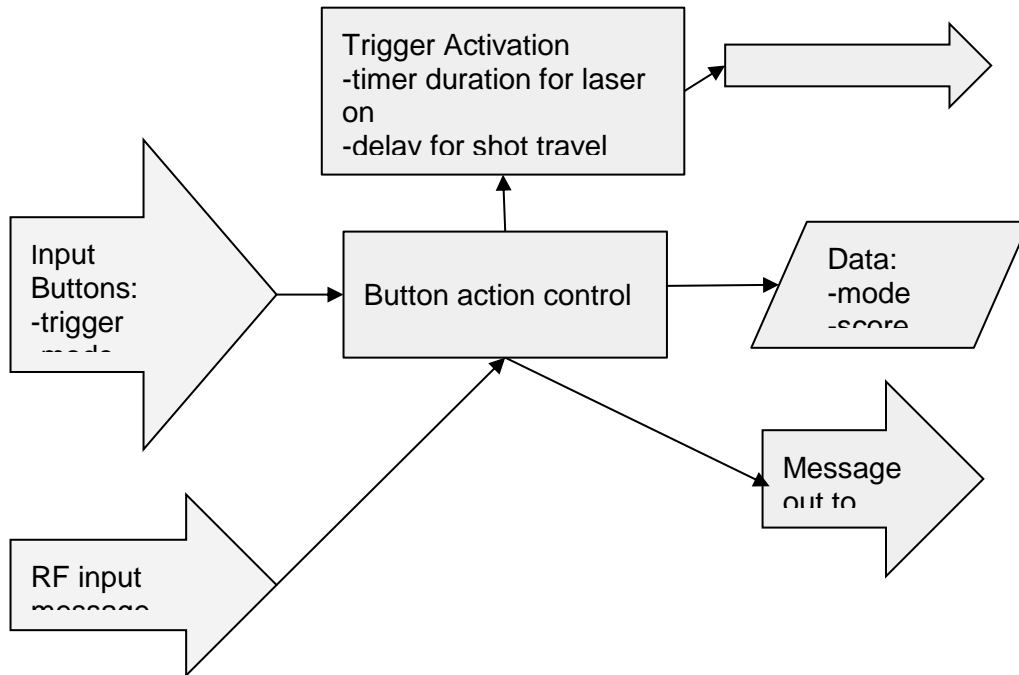
Legend:

Color: System Type: Person(s) Responsible

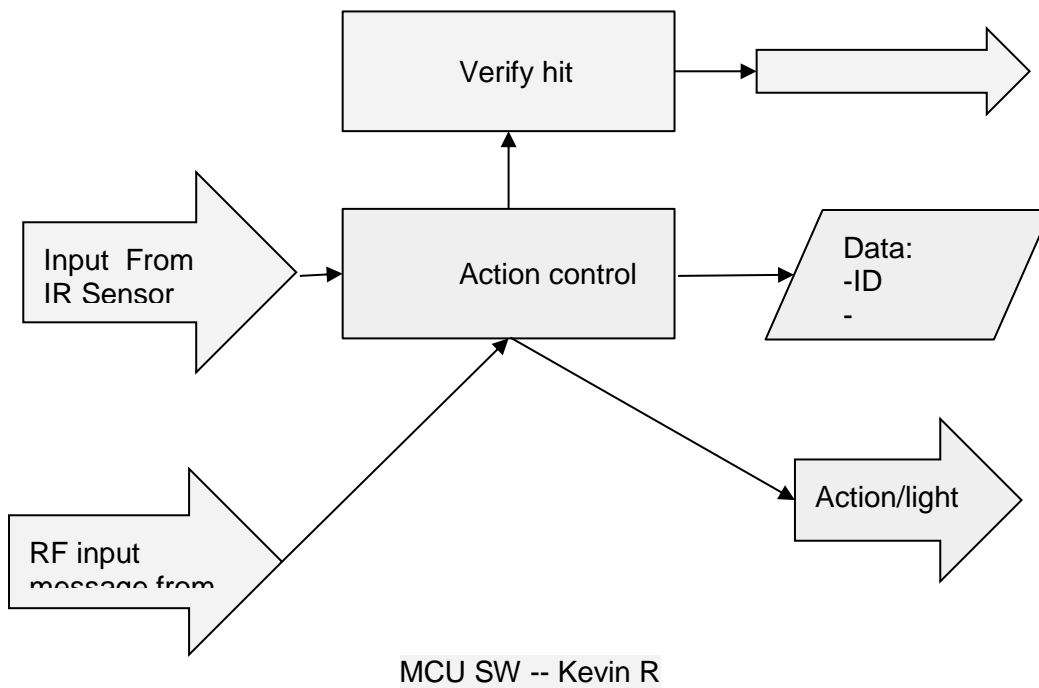
<table border="0"> <tr> <td style="width: 20px; height: 10px; background-color: cyan; border: 1px solid black;"></td> <td>Photonics System</td> <td>Clayton O'Rourke</td> </tr> <tr> <td style="width: 20px; height: 10px; background-color: red; border: 1px solid black;"></td> <td>Control System</td> <td>Kevin Ratliff</td> </tr> <tr> <td style="width: 20px; height: 10px; background-color: yellow; border: 1px solid black;"></td> <td>Power System</td> <td>Alexander Spencer</td> </tr> <tr> <td style="width: 20px; height: 10px; background-color: green; border: 1px solid black;"></td> <td>Communication System</td> <td>Sean Brown</td> </tr> </table>		Photonics System	Clayton O'Rourke		Control System	Kevin Ratliff		Power System	Alexander Spencer		Communication System	Sean Brown	<div style="width: 20px; height: 10px; background-color: green; border: 1px solid black; margin-left: 10px;"></div>
	Photonics System	Clayton O'Rourke											
	Control System	Kevin Ratliff											
	Power System	Alexander Spencer											
	Communication System	Sean Brown											

Gun Controller SW Block Diagram

(Figure #2)

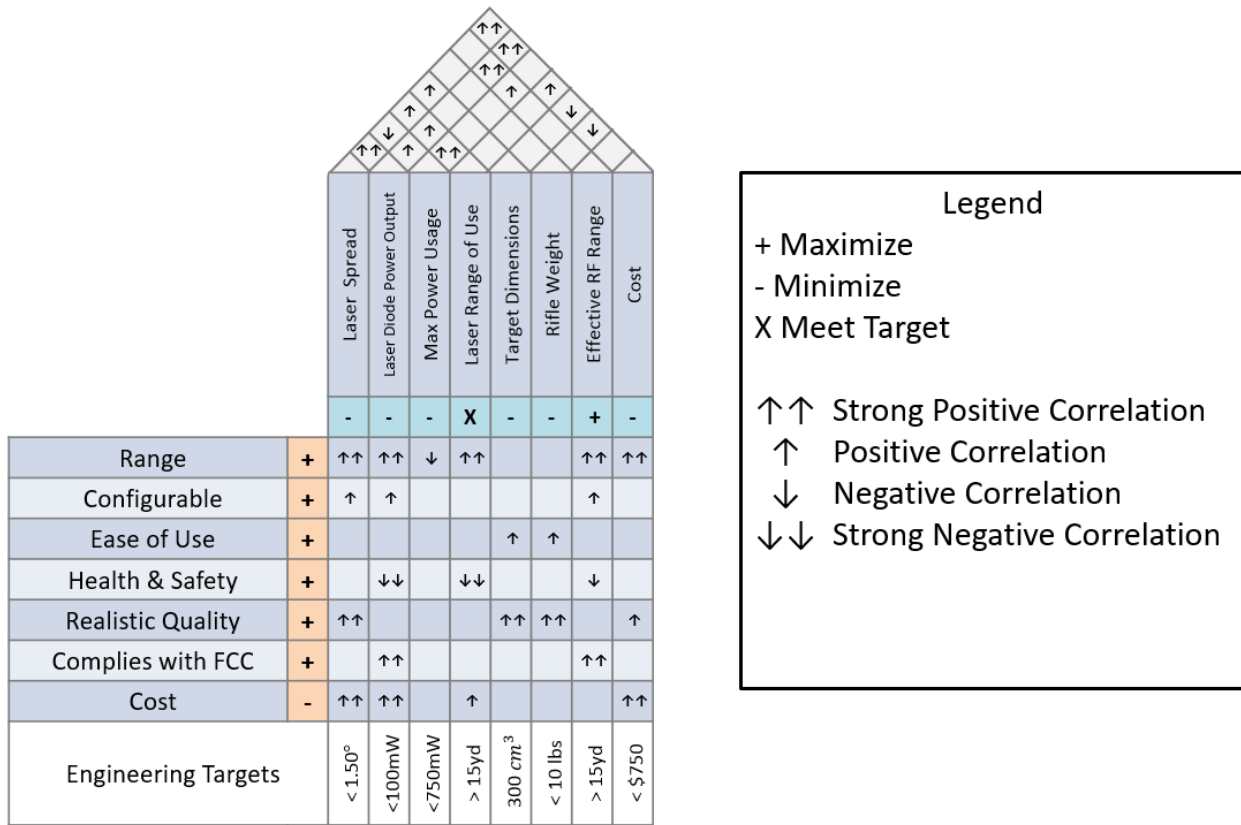


Skeet Controller SW Block Diagram
(Image #3)



House of Quality

(Figure #4)



* An effective design is to be achieved by retaining a low cost at higher ranges, due to the inherently higher cost and complexity of distance sensitive precision components.

** Design of this Laser Skeet system is to be tested and implemented under stable laboratory conditions at a range of 5 yards. The testing environment is then to be expanded until the testable reaches are that of over 15 yards.

Estimated Project Budget

Presently the accumulated cost of this project prototype is deemed to fall under \$750.00 This cost is manageable by self funding from within the team. A party has expressed interest in acquiring the prototype after completion, but firm requirements and commitment for participation in project are not expected before completion. Estimated cost is primarily determined by the Optical and Signal Transmission Hardware requirements and further raised from the PCB and Aesthetics of Design for the Gun and Target.

(Table#1)

	Gun Controller Parts Description	Cost
	Laser diode and optics	\$150
	LCD display	\$10
	Misc. low cost components	\$25
	MCU	\$10
	Custom PCB	\$30
	Non technical mode parts (Physical)	\$40
	Development test board	\$30
	Chip programer PC adaptor	\$30
	Laser Gun Total	\$325

	Skeet Parts Description	Cost
	Laser detectors, multiple for coverage	\$25
	MCU	\$6
	Misc. low cost components	\$20
	Custom PCB	\$30
	Non technical mode parts (Physical)	\$10
	Development test board	\$30
	Skeet target Total	\$121

* If multiple devices are built are built then cost will be multiplied by that factor

Initial Project Milestones

(Table #2)

Item	Task	Start Date	End Date	Status	Assigned To
Senior Design I					
1	Project selection	08/23/17	08/30/17	Complete	Group
2	Feature List and Assignment	08/30/17	09/06/17	Research	Group
	Assignment Documents Due				
3	Divide & Conquer Document	08/30/17	09/19/17	In Progress	Group
4	Divide & Conquer Update	09/20/17	10/06/17		Group
5	Table of Contents assignment ?	TBD	TBD		Group
6	60 Page Draft Document	10/06/17	11/03/17		Group
7	100 Page Draft Document	11/03/17	11/17/17		Group
8	Final Document	11/17/17	12/04/17		Group
	R&D and Document				
9	Gun Laser and optic	09/06/17	09/27/17	In Progress	Clayton
10	Skeet Laser detectors	09/06/17	09/27/17		Clayton
11	Gun power supply	09/06/17	09/27/17		Alex
12	Signal Design	09/20/17	10/16/17		A & Sean
13	Gun & Target MCUs	09/06/17	09/27/17		Kevin
14	Gun & Target Materials	10/16/17	04/17/18	TBD	Kevin
	Breadboard testing of components		10/17/17		Team
	Schematic	10/17/17	11/17/17		TBD
	PCB layout Player controller	11/01/17	01/15/18		A S
	PCB layout Skeet detector	11/01/17	01/15/18		
	Order Parts				

Item	Task	Start	End	Status	Assigned
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		Date	Date		To
Senior Design II					
1	Assemble Circuit boards	12/06/17	01/19/18	Pending	A + Sean
2	Test Operation	01/22/18			Team
3	Physical Device construction				Team
4	Finalize Documentation			TBD	Team
5	Project presentation	TBD	TBD	TBD	Team

Additional Features Under Consideration

- Variable shot spread
- Skeet location assist (skeet audible when signaled by gun control) (requires 2 way communication)
- Multiple guns for head to head competition (requires ID embedded in laser)
- Shot Distance recording (may be difficult to do at low cost)
- Launching device. Remote/timed launching.
- Hit quality. % of detectors.
- Shot timer - captures time between
- Rechargeable power in Gun & Target
- Variable shot types (semi, automatic, spread-shots~filter)
- Target Response system to deploy parachute and or other physical demonstration of a hit/ stop function

References:

https://en.wikipedia.org/wiki/Laser_Clay_Shooting_System

https://en.wikipedia.org/wiki/Skeet_shooting

Competitive Product

<http://www.laserskeet.com/>