

# Laser Target Gallery

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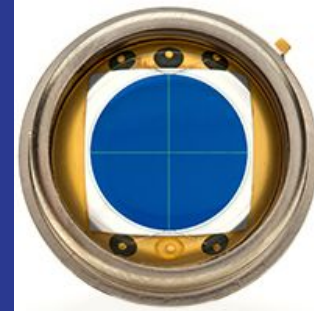
Group 1

# Project Motivation

- Design a competitive arcade game that challenges the users reaction and accuracy.
- Fun and entertainment is the main goal of the project.
- Secondary applications are the training and strengthening of hand eye coordination and response time.

# Similar Designs

- Quadrant Photodiodes
  - Uses photodiodes instead of photoresistors
  - Much Smaller Target
  - More commonly used for laser alignment
- LaserLyte
  - Offers only one target
  - \$300



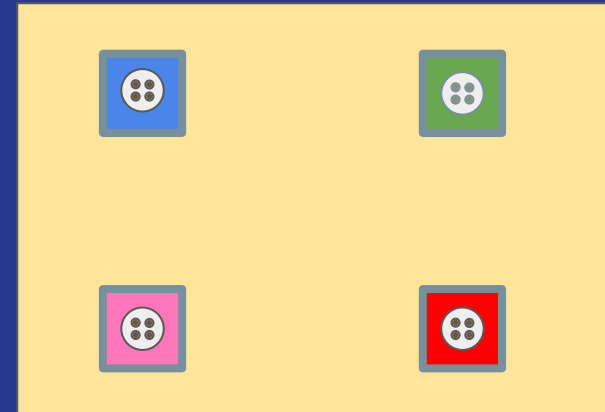
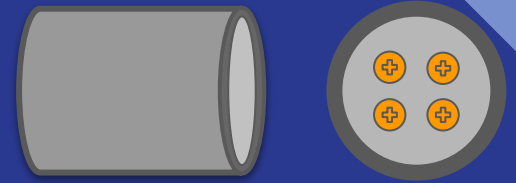
# Project Goals

- Satisfy all specifications and requirements
  - 4 working targets that receives and sends light responsive signals
  - A phone application that the game uses with Android compatibility
  - Working distance of 10-20 feet
- Stay close to/under our budget
  - Expected budget is \$400

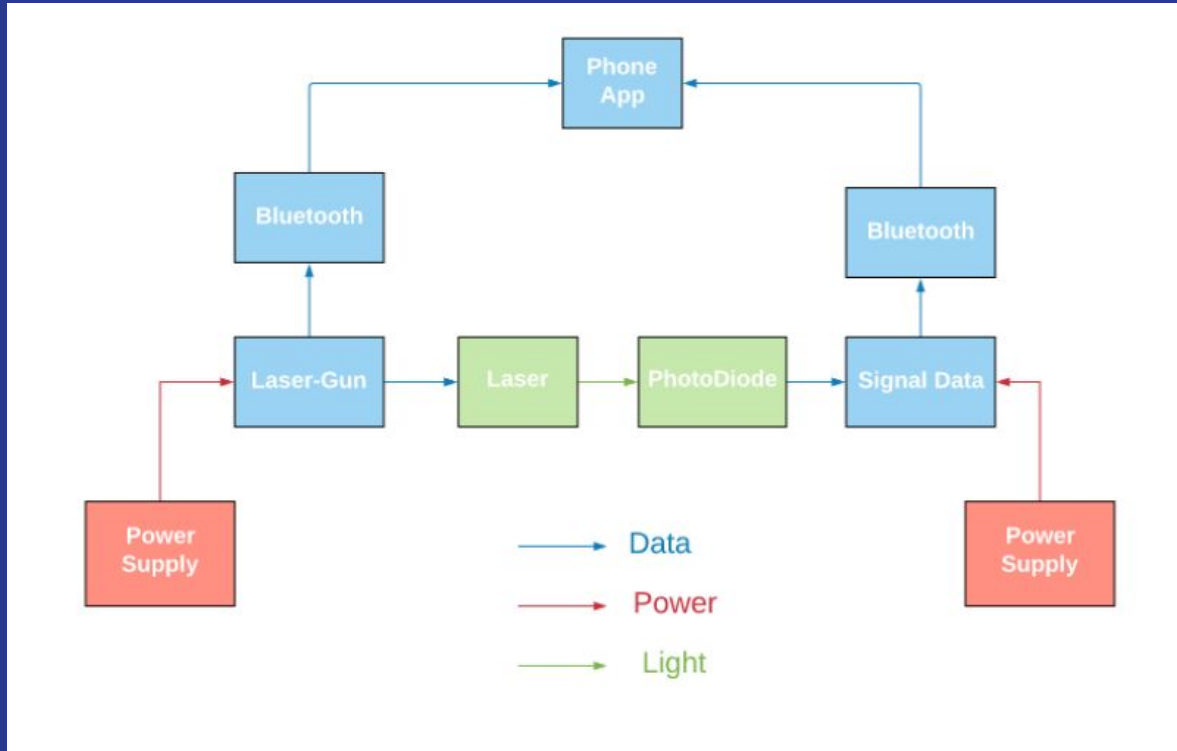
# Overall Design

5 Components of the project:

1. Gun Electrical System
2. Gun Optical System
3. Photoresistive Targets
4. Target Board MCU
5. Mobile Application

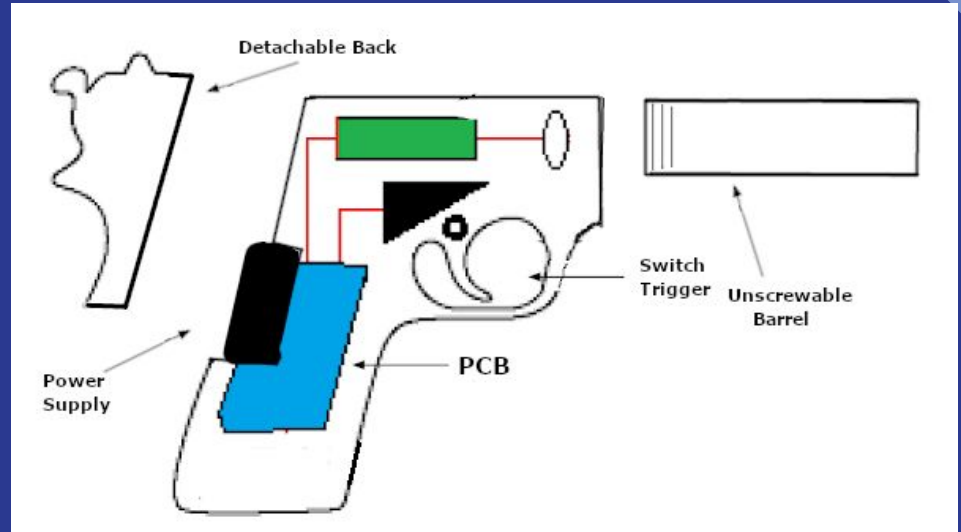


# Overall Diagram Flow



# Laser Gun Diagram

- Gun barrel is detachable
- for lens adjustments, and repair.
- Holes are down the barrel to secure lens in place
- Back comes off gun for recharging and replacing batteries



# Power Supply and Case Clips



- 2x LC 16340 Lithium Rechargeable Batteries
- 3.7 V
- 1300 mAh
- Case clips can be attached with M3 screws and has solder points on the end of each side

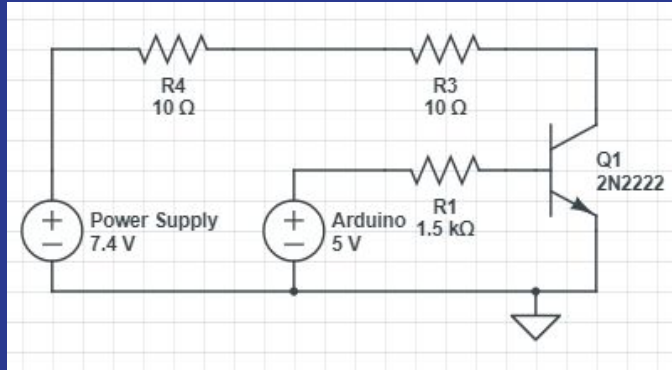


# Hammer Trigger System



- Dimensions: 5.5 x 4 x 1.5cm
- Weight: 21 grams
- Work in exclusive on/off state

# Load Bearing Resistors and BJT



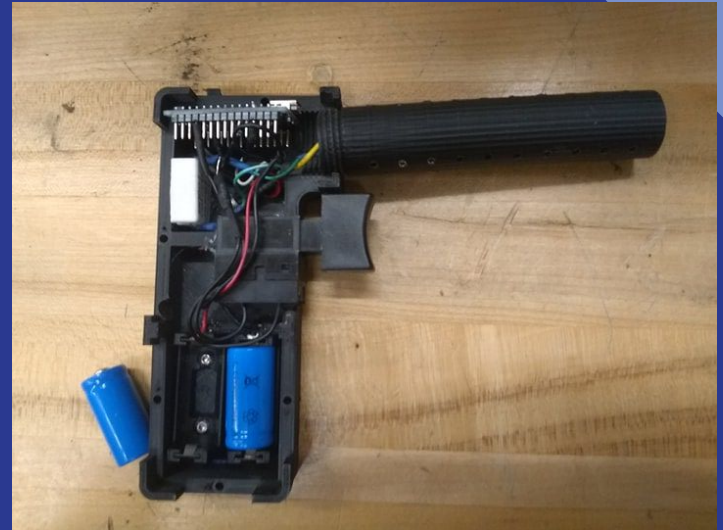
- The Arduino cannot supply enough current to the laser
- Use of a 2N2222A NPN transistor was chosen
- To reduce the load over the transistor, two 20 Ω 5W ceramic resistors were used in parallel.



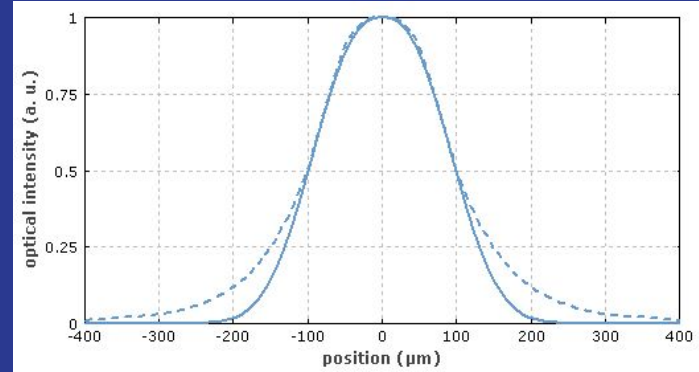
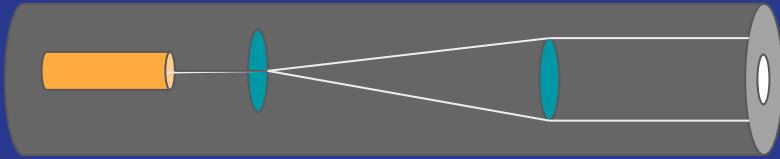
# Laser Gun Design

4 main components of the gun:

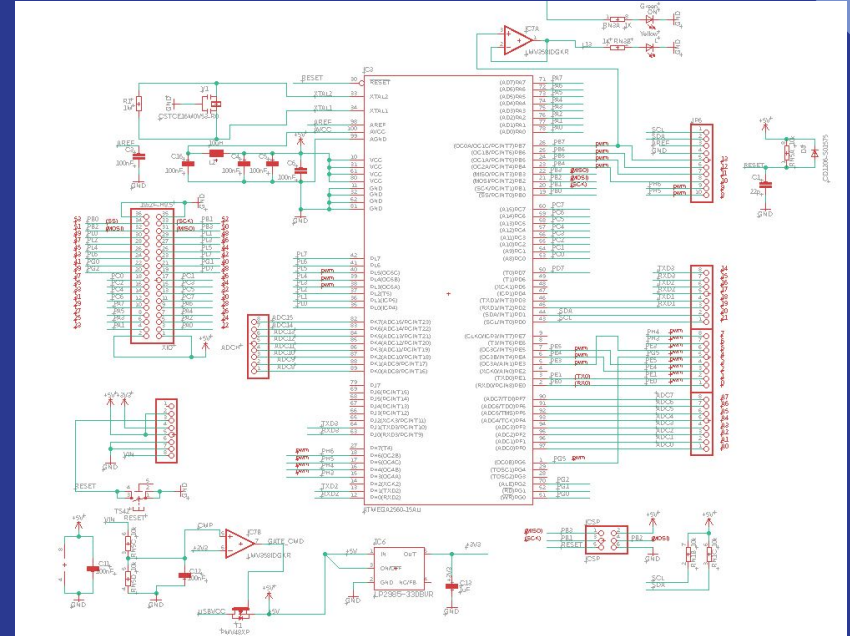
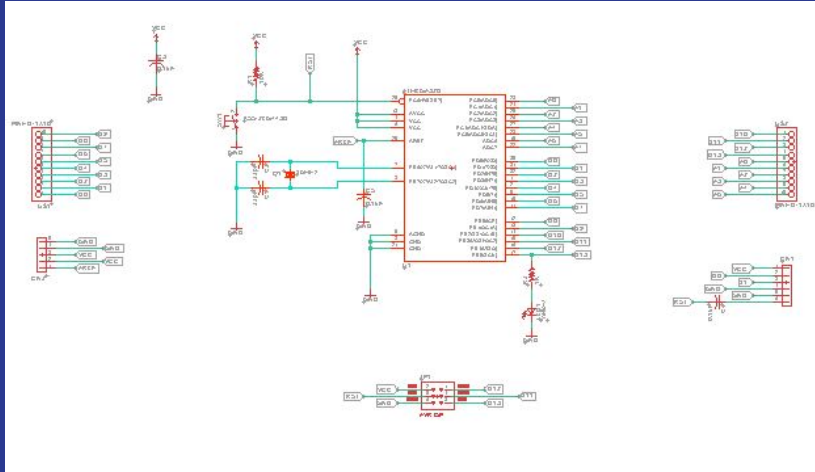
1. PCB controlled by a ATmega328P microcontroller
2. The Mxfans Electric non lock switch driven trigger
3. The Laser Diode
4. The Power Supply



# Laser Chamber Plan



# Laser Gun PCB | Target Board PCB Design



# Laser Gun PCB Specifications

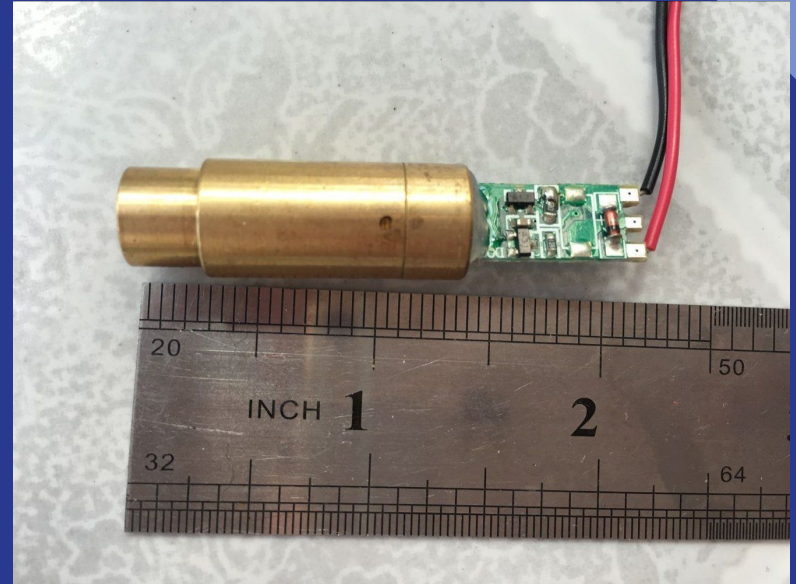
Microcontroller	ATmega328P
Operating Voltage	5 V
Input voltage	7-12 V
Input voltage (limit)	6-20 V
Digital I/O pins	14
Analog Input Pins	8
DC current per I/O pin	40 mA
Flash Memory	32KB
Clock Speed	16 MHz
Size	18 x 45 mm

# Diode Comparisons

	Green Diode	Red Diode
Wavelength	534 nm	650 nm
Voltage	3-5V	5-7 V
Current	350 mA	50 mA
Challenges	High Current Demand	Beam Shaping

# Laser Diodes

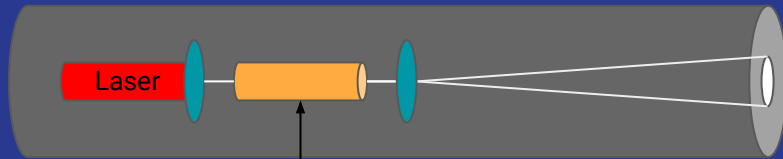
- 534 nm Green Laser Diode
- Uses frequency doubling crystal to convert 1068 nm infrared light into green light
- Infrared filter placed at end of diode to filter out the unconverted 1068 nm light
- Operates at 3.7 V and 250mA



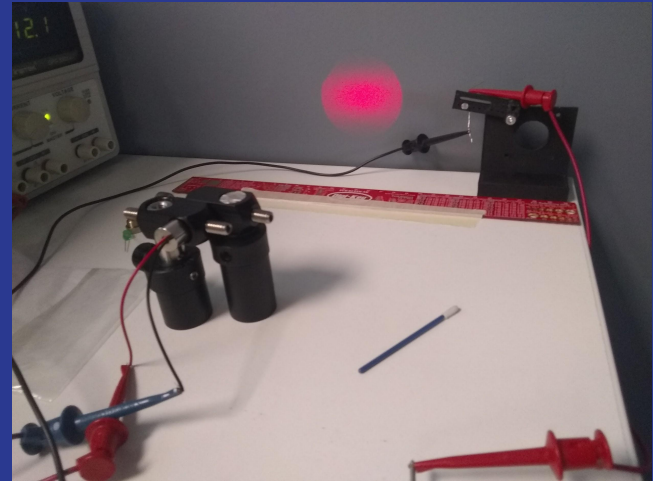


# Alternate Laser Diode

- 650 nm 5mW Red Laser Diode
- Operates at 3-5V and 50mA
- Output beam is much more rectangular and less friendly to work with.

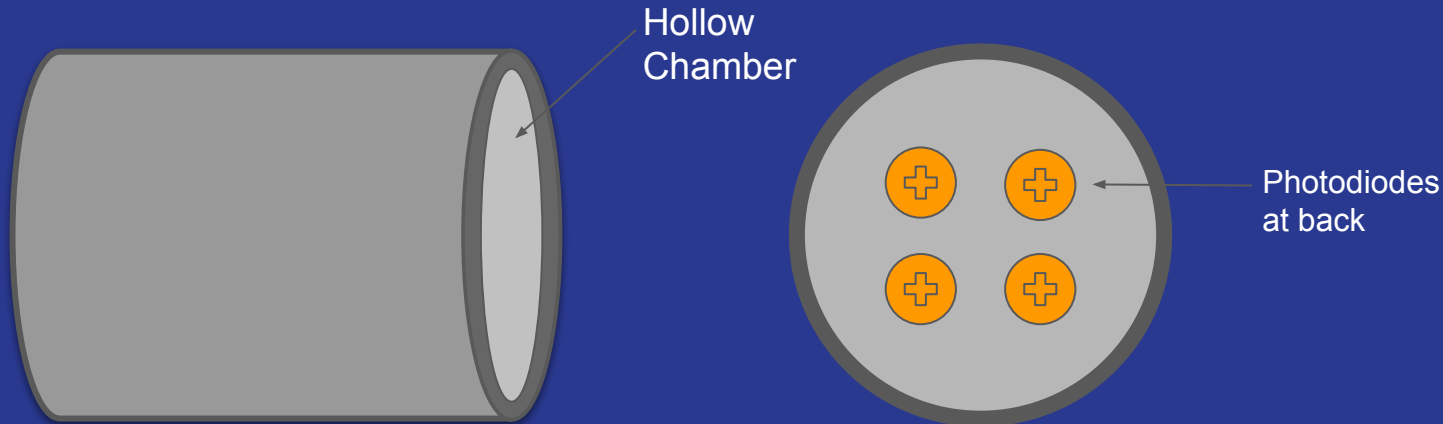


3D Print With  
Fiber Optic



# Target Board Design

- The Target board was made out of a 2 x 2 plywood sheet.
- There are 4 holes throughout the board, each with an led strip above
  - One LED strip will be turned on at a time to signal which target should be shot.
  - Each hole has a diameter of approximately 3 inches



# LEDs

Part Number	Ws2182b	2835-60d
Size	1 meter	4.9 metres (16ft)
Working Voltage	3.3 -5 V	8-12V
Price	30\$	13\$
Individually Controllable	Yes	No

# Controlling the LED strips

- The chosen LED operate at a voltage of 8-12 V.
- The max voltage supplied by our PCB is 5 volts.
- For this reason we used a transistor:
  - Allows us to to turn on the LEDs using the PCB as desired

# Target Board PCB

- PCB Specifications:
  - 16 Analog inputs to gather data from every photo resistor
  - 5 digital inputs for all LED strips that are being used
  - 3.3 output voltage to power the HM-10 bluetooth module
  - tx/rx pins to transfer data to the mobile application

# Green Light Target Filter

- Photography studio green gel filter
- Filter out as much light that is not green as possible
- Many filters are very expensive



# Wireless Technology

Bluetooth module	DSD TECH HC-05	DSD TECH HM-10
Dimensions	1.1 x .6 x .1	1.2 x .6 x .1
Working voltage	3.6-6 V	3.6 - 6V
Compatibility	Android	IOS and Android
Price	8.99	9.99

# Determining Score

Horizontal Component:

$$(\text{avgLeftSide} + \text{avgRightSide}) / 2$$

Vertical Component:

$$(\text{avgTopSide} + \text{avgBottomSide}) / 2$$

$$\text{Total Score} = 10 * (\text{horizontalComponent} + \text{verticalComponent} / 2)$$



# Mobile Application

- Accessibility to Android phones
- Pair and Collect data from the bluetooth module.
- Local database to store data
- Record creation, editing, and deletion

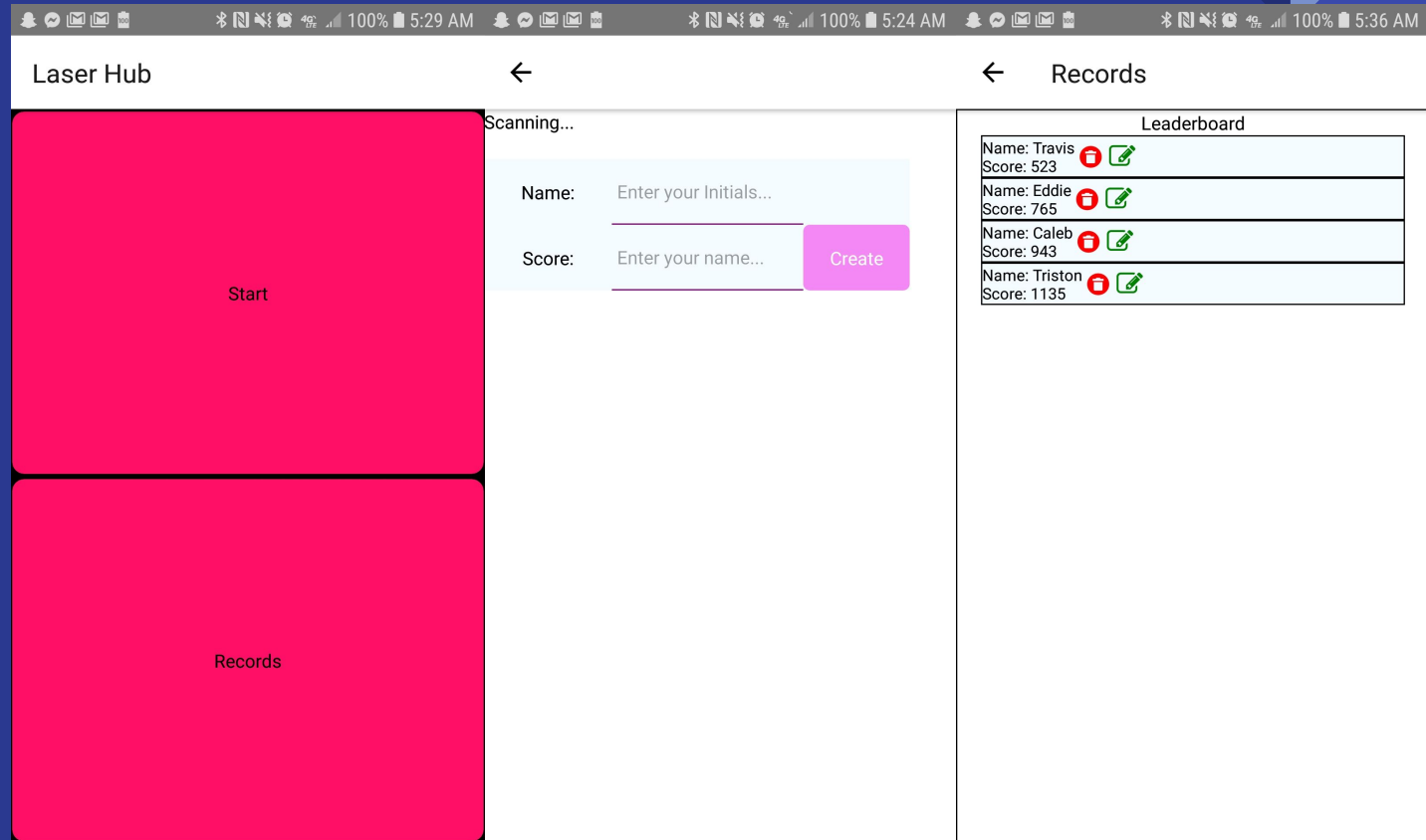
# Framework

	React Native	Ionic
Platforms	iOS and Android	iOS, Android, Web browser
Native	Yes, with JavaScript Design	Yes, with native wrappers
Community	Extensive	Extensive
Code Reusability	Different UI codebases with shared logic	Shared Ui codebase across platforms
User Interface	Native elements specific to selected platform	Web Ui elements work across platforms
Documentation	Extensive	Extensive

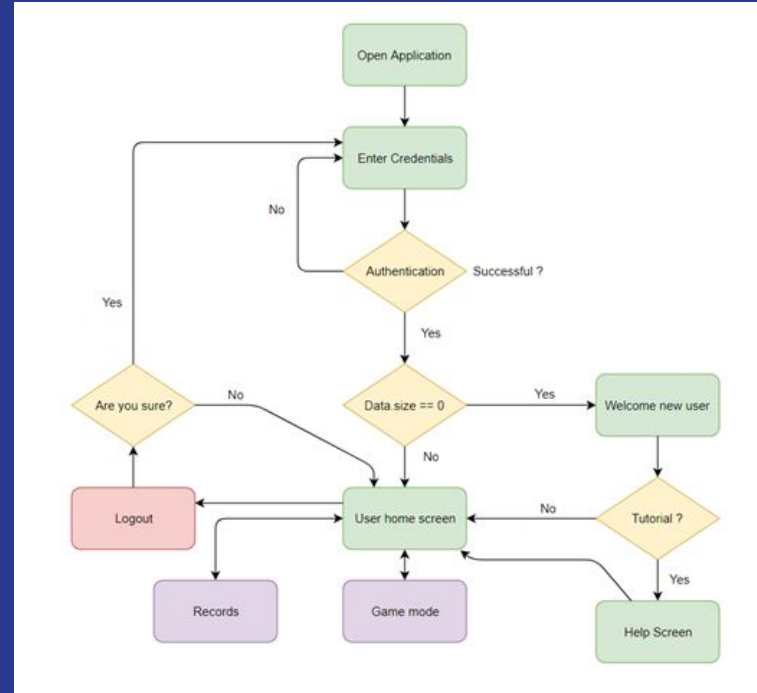
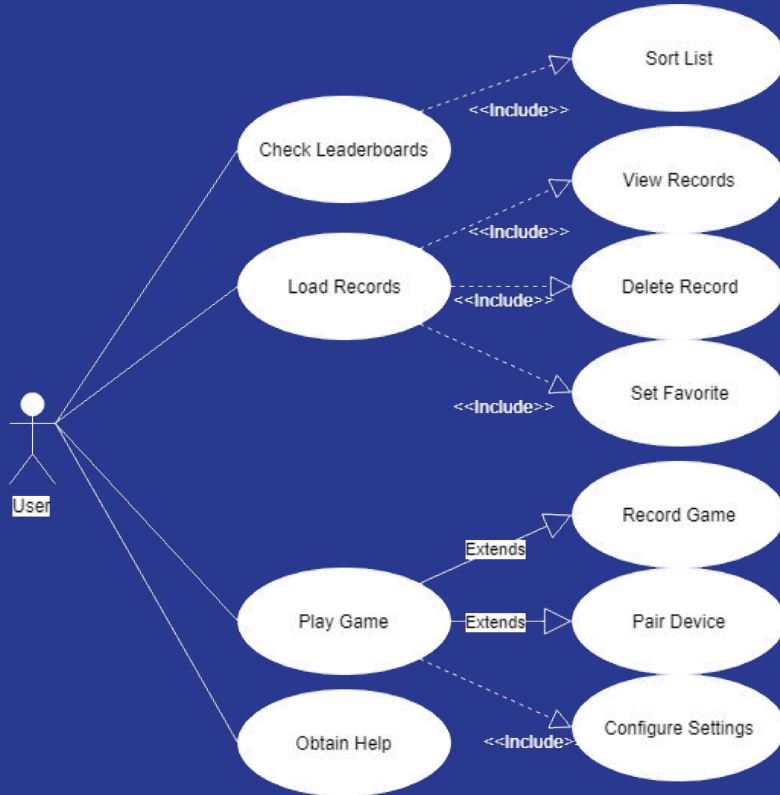
# Database

	Realm	Google Firebase	SQLite
Price	Free	\$25/month	Free
Database Type	Object Oriented	Document Store	Relational
Documentation	Extensive	Extensive	Extensive
Cloud-based	No	Yes	No
Ease of use	Simple	Moderate	Moderate

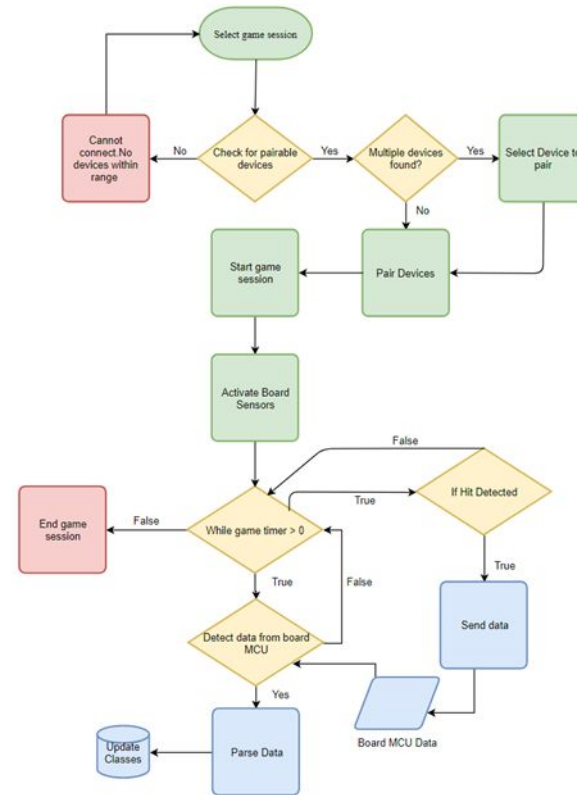
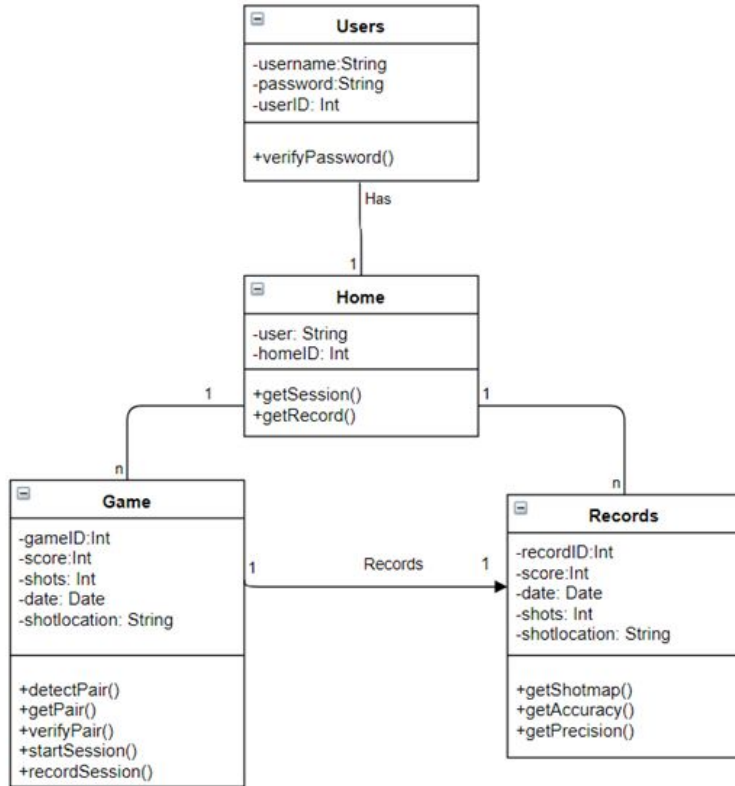
# Phone Views



# Use Case Diagram and Software Flowchart



# ERD And Session Flowchart



# Challenges

- Mobile App connection to Hm-10 module
- Powering LED strips
- Transferring system from development boards to PCBs
- Laser Gun Transistor Failures & Voltage modulation
- Maintaining a stable development environment.

# Challenges Continued

- Overcame laser shape issues with a frequency doubled laser.
- Overcame transistor burnout and load issues with high load resistors.
- The number of pins on the back of the board made us have to redesign a shield, which will allow us to handle all the I/O for the entire game.





# Administrative Content

# Budget

Item	Purchase Location	Manufacturer	Price
PCBs/ Boards	<a href="https://jlcpcb.com/">https://jlcpcb.com/</a>	JLPCB	150\$
Wires and PCB Components	<a href="https://www.mouser.com/">https://www.mouser.com/</a>	Mouser	40\$
Photoresistors	<a href="https://www.amazon.com">https://www.amazon.com</a>	XLX	10\$
Bluetooth Microcontroller	<a href="https://www.amazon.com">https://www.amazon.com</a>	DSD TECH	25\$
3D Printed Laser Housing	nScript	nScript	30\$
Laser Diodes	<a href="https://www.amazon.com">https://www.amazon.com</a>	lights88	30\$
Lens	<a href="https://www.amazon.com">https://www.amazon.com</a>	lights88	10\$
Total			315\$

# Work Distribution

Name	Laser Gun	Targets	Target Board	Software
Triston	S		S	S
Caleb	P	P		
Travis		S	P	
Edward			S	P



Questions?