BOSS

Badminton Open Source System

McMaster University

ENGINEERING
Electrical & Computer Engineering

Motivation

Badminton is a growing sport in Canada and is popular worldwide. A common limitation for players is the lack of consistent training scenarios. The BOSS is an open source programmable Arduino device that will act as an accurate launcher for all!

Badminton Knowledge

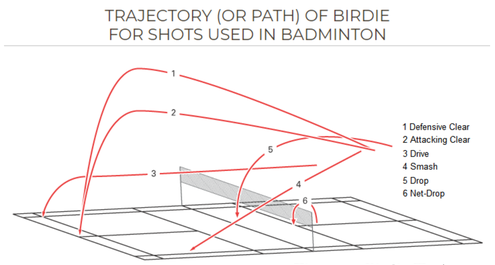

Figure 1: Birdie Trajectory

There are six main types of badminton shots. The BOSS can currently shoot three (#4-6) types: smash, drop, and net-drop, in three different lateral positions: left, center, right. User can choose their difficultly by choosing patterns that exploit the wide left and right regions of the court or by decreasing timing between shots.

Timeline

Milestone Descriptions	Start Date	End Date	H
M1: Build launching mechanism	October 2018	December 2018	50
M2: Prototype wheels to reduce slip	October 2018	March 2019	10
M3: connect Arduino to brushless and stepper motors	December 2018	February 2019	40
M4: Android app development with Bluetooth capabilities	January 2019	April 2019	40
M5: Build launch tube and birdie ramp	March 2019	March 2019	15
M6: Assemble all components and build final design	March 2019	April 2019	30

Project Description

The BOSS (Badminton Open Source System) is a badminton birdie launching system that reduces training obstacles for players of all socio-economic backgrounds. This system contains the physical launching device and a user-friendly android app that when paired together create a training environment for all! Within the app, user will have the option to select either pre-programmed launching patterns or create their own based on the type of shot, and the lateral location they wish to receive it.

Technical Drawings

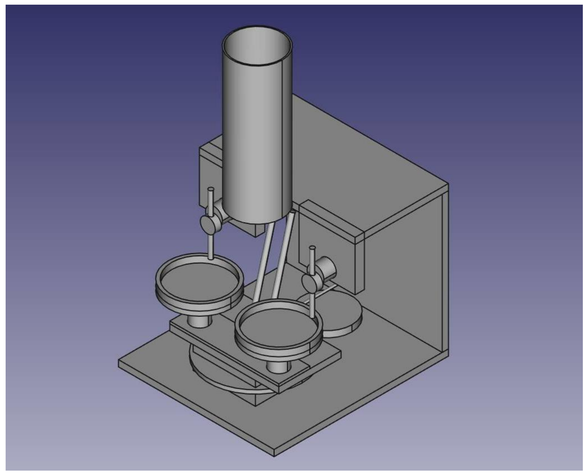

Figure 2: Isometric View

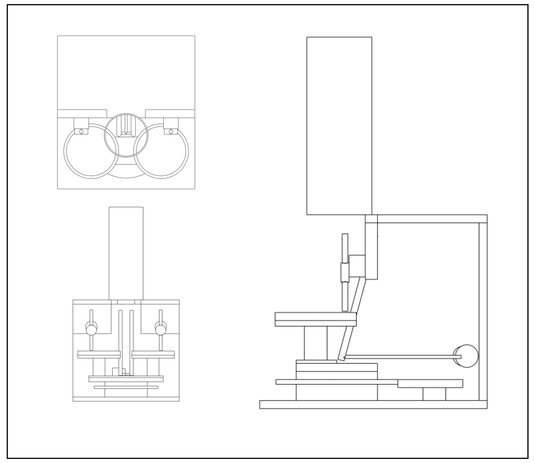

Figure 3: Engineering Drawing

Mechanical Design Process

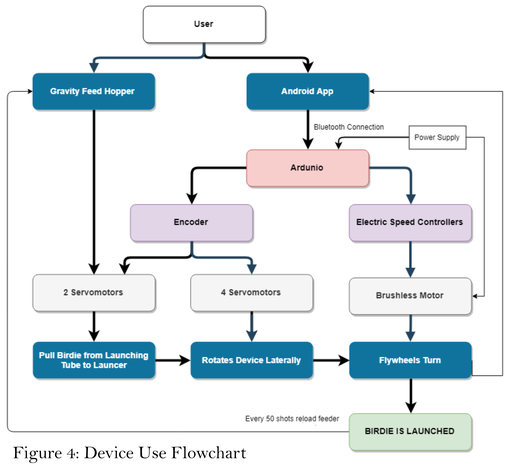

Figure 4: Device Use Flowchart

The BOSS device is loaded and steered by four servomotors controlled by an Arduino (which is controlled via a Bluetooth connection from the Android App). The BOSS device then uses the Arduino that is connected to an electronic speed controller to spin two brushless motors which are connected to flywheels to launch the birdies. Two additional servomotors are used to pull one birdie at a time from the gravity fed hopper and load them onto the track. The track position and launch distance is determined by a servomotor controlled piston mechanism. The two brushless motors are steered using a servomotor connected to a gear train under the brushless motors to rotate the device depending on the shot direction. When the birdie slides down the track, it is launched when it makes contact with the rotating flywheels

Microcontroller

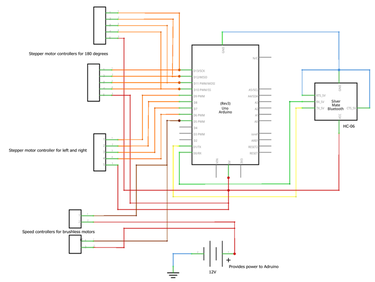

Figure 5: Arduino Technical Drawing

The Arduino is the control unit of the entire device. It is controlled via Bluetooth (HC-06 module) with an App. When it receives data of from the App, which was built in Android Studio, our basic protocol is designed to decide its next actions. It communicates with the stepper motors through an encoder and the stepper.h library. This allows it to position anywhere from 0° to 360° based on its relative position. It communicates with the brushless motors through the electronic speed controller. The speed controller accepts PWM of varying duty cycles, which is why the given pin is chosen. The speed of the motors is controlled by duty cycle so higher duty cycles result in a higher speed. Lastly, everything is powered by battery capable of 12V because this the required voltage for the brushless motors.

Final Device

#	Parts	Cost
2	Brushless Motors	$40
4	Servomotors	$15
1	Ardunio	$15
1	Bluetooth Module	$5
1	3D Printed Device Components – Flywheels (2), Gears (2), Housing Unit	$40
1	Tripod Stand	$25
1	Lazy Susan Bearings	$7
1	Power Supply	$30

Deliverables

- Bluetooth enabled launching device
- Open Source Device SLT Files
- Open Source Arduino Code
- Android Studio Public App Template

We would like to acknowledge Dr. Shirani for all his support, Gavin Crasto for his assistance 3D printing components, and all women in the engineering, for without equal representation we will always fail in our duty to society.

Engineering Design – ELECENG 4OI6

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