Smart Ping-Pong Ball Machine

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# Declaration of Joint Authorship

We, Gurwarris Singh Sohi, Nicolas Cristiano, and Shubham Sharma, confirm that this work submitted is the joint work of our group and is expressed our own words.  Any uses made within it of the works of any other author, in any form (ideas, equations, figures, texts, tables, programs), are properly acknowledged at the point of use. A list of the references used is included. The work breakdown is as follows: Each of us provided functioning, documented hardware for a sensor or effector. Gurwarris provided the functioning for a TB6621FNG Dual Motor Driver. Nicolas Cristiano provided the functioning for a SG90 micro Servo Motor. Shubham Sharma provided functioning for ROB11015 Solenoid. In the integration effort Nicolas Cristiano is the lead for further development of our mobile application, Gurwarris Sohi is the lead for the Hardware, and Shubham Sharma is the lead for connecting the two via the Database.

# Proposal

We have created a mobile application, worked with databases, completed a software engineering course, and prototyped a small embedded system with a custom PCB as well as an enclosure (3D printed/laser cut). Our Internet of Things (IoT) capstone project uses a distributed computing model of a smart phone application, a database accessible via the internet, an enterprise wireless (capable of storing certificates) connected embedded system prototype with a custom PCB as well as an enclosure (3D printed/laser cut), and are documented via this technical report targeting OACETT certification guidelines.

Intended project key component descriptions and part numbers  
Development platform: Raspberry Pi 4 B+  
Servo Motor SG90: Used to adjust the horizontal rotation of the ping-pong machine  
TB6621FNG Motor Driver: Used to adjust the launch speed of the machine in addition to its vertical launch properties  
ROB 11015 5V Pull Solenoid: Used to control the time interval between balls launching

We will continue to develop skills to configure operating systems, networks, and embedded systems using these key components to cooperate with one another so they can be integrated into a fully functional ping-pong machine in addition to the ping-pong Smartphone application.

Our application will contain several play options to optimize the amount of success the player will have in being able to develop their skills, including adjustable difficulty, launch interval and horizontal launch. The application will also allow the user to save and access the user’s settings from the last 30 play sessions. These settings are stored into the application’s database after each session has ended.

During the play session, when the ball enters the machine, the solenoid will pull in the ball for however long the user has set the time interval for. Once the ball has launched, it will be able to get launched horizontally within a 180 degree radius, while the difficulty will determine the ball’s launch speed and elevation.

Our project description/specifications will be reviewed by Sebastian Dwornik, ideally an employer in a position to potentially hire once we graduate. They will also ideally attend the ICT Capstone Expo to see the outcome and be eligible to apply for NSERC funded extension projects. This typically means that they are from a Canadian company that has been revenue generating for a minimum of two years and have a minimum of two full time employees.

The small physical prototypes that we build are to be small and safe enough to be brought to class every week as well as be worked on at home. In alignment with the space below the tray in the Humber North Campus Electronics Parts kit the overall project maximum dimensions are 12 13/16" x 6" x 2 7/8" = 32.5cm x 15.25cm x 7.25cm.

Keeping safety and Z462 in mind, the highest AC voltage that will be used is 16Vrms from a wall adapter from which +/- 15V or as high as 45 VDC can be obtained. Maximum power consumption will not exceed 20 Watts. We are working with prototypes and that prototypes are not to be left powered unattended despite the connectivity that we develop.

# Executive Summary

Our team has worked towards, creating an affordable and competitive Ping Pong Ball machine. This project was started with comparing the various Ping Pong Ball machines in the market currently. The common observation was that the machines present in the market right now are either too expensive or don’t give you much competitive play features. Our Smart Ping Pong ball machine will incorporate a feasible product that allows a user to play at various difficulties, with the new smart features like database and statistic support and be controlled by an app run on any android device. This machine will achieve complex play settings using minimal and cheaper hardware but, also using smart and intricate firmware. Using less and cheaper hardware allows us to keep the cost down, and compete with currently sold machines in the market. To make manufacturing easier, we can sell the product in the form an assembly kit to keep the manufacturing costs low. Even if, the cost is low, this product can compete with the most competitive and expensive products in the market.