4.0 Results and Discussions

In regards to the software, our project worked perfectly given that our code worked as it needed to. Both in terms of the backend connectivity with server and frontend interaction with the user. The user was able to interact with the database through the application and their play data was stored for future analysis. Our prototype regarding the hardware is incomplete as unforeseen circumstances prevented us from getting the required components from Humber College to fully build the machine. The group managed to learn quite a bit throughout the process of working on the group project. Firstly, the group was able to learn to combine all the pertinent hard skills, such as programming and circuit building, in a more concrete and visibly useful manner. The group learned how to collaborate and communicate effectively with one another, in terms of delegating and organizing tasks, in terms of when to get each done, and how long each task would take in accordance with what the professors outlined in the course schedule. The need to communicate effectively became even more useful after the campus closed as there was a necessity to keep one another informed on each other's progress verbally and visually through various programs, as we no longer had the privilege of working together in person. The group was able to organize and update all pertinent information through Trello, and Github, which served a similar purpose, but was useful in keeping the professor informed of our progress as well as keeping a centralized version control of all the documentation, PCB designs, mechanical designs and source code for both the app and the machine. We also had the privilege throughout the year of collaborating with an industry professional, Sebastien Dwornik. We managed to communicate with him regularly through a messaging program, Slack, in addition to regular video

conferences to discuss our progress with him. This allowed him to make recommendations or suggest new ideas to help our project develop in a more efficient manner, providing us a more nuanced perspective in working in a professional work environment and improving our communication skills even further. In terms of developing the actual project, we were able to use various programs such as Fritzing and Android Studio that managed to expand upon various concepts that we learned about from previous semesters. Fritzing gave us a more convenient way to develop and rework our circuits based on schematic criteria using one or more essential sensors or motors. It also helped immensely with developing Printed Circuit Boards (PCB's), as we went from just connecting wires according to circuit design to designing, building and testing one ourselves. During the project, we had to work concurrently between creating the code for our sensors and motors and creating the code for our application. In order to develop the code for the sensors and motors, it was required that we had to learn basic Python, enforcing the need to keep our minds adaptable and flexible to be willing to learn new skills as the project went along. We were also able to expand our knowledge in working with databases as we had to implement databases with different programs such as Cloud Firestore, in addition to implementing the necessary code in our Android Studio application code. In order to develop our application, we used Android Studio, and the Firebase tool supported by it that easily helped us connect to our Firebase Databases. I felt that the project was an overall success, barring a few setbacks that occurred from unforeseen circumstances.

5.0 Conclusions

The project was started with the idea of mass producing the prototype in mind. It was designed this way because of the problem specified for the project to be solved was, making a cheaper and competitive machine and bring it to market. The prototype was built using the basic components, but was run using advanced and refined methods in respect of the machines available in the market. The advanced methods like using a mobile application to control the machine, storing user data in Firebase database to keep track of progress, and running the machine on a Broadcom platform like the Raspberry Pi that has higher capabilities in term of memory and processing speed that are levels higher than simple built PLC chips. These methods were implemented so that it can accomplish the mark of competitive gameplay, instead of just randomly throwing balls at the user.

Hence, all the materials used are easily available and can be produced like in a production line, creating thousands of the different parts separately and assembling them and packaging them to make a marketable product.

For the goal of keeping the product cheap, the product needed to be based on limited number of components, but we believe that every product needs to be upgraded after some time. So, for further progress of the machine, we could still keep improving the application like, analyzing player history and display the growth in forms of charts and tables. We could also keep improving the firmware, which can be updated remotely on already sold machines. The improvements to the machine could entail more complexity in the process of setting up and launching the ball by adding more spin and lob shots.

Therefore, like all the innovations in history we need to keep improving on this idea and we may end up creating a device that leads to inspiration for some engineer in the future generation.