



A LOW COST AUTOMATED TABLE TENNIS LAUNCHER

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ABSTRACT

The purpose of this project is to innovate a low-cost table tennis robot with unique control system. Currently, the available table tennis robots are very expensive, and almost all of them are with wired controller where the player himself cannot control the machine when training sessions. A new design and concept are developed in order to solve these problems. This innovation called automated table tennis launcher, a self-table tennis training kit prototype which is integrated with a microcontroller better known as Arduino. This machine is controlled by the use of Android smart phones to enhance the user-friendliness and the use of wooden support and PVC pipes to fabricate greatly reduces the manufacturing cost. A 3D virtual prototype is developed by using SolidWorks software before the fabrication process and tested for function ability. This fabricated prototype can shoot the ball in three different directions and with adjustable spinning direction, which helps the user to practice almost all types of strokes in this sport. The machine is being tested and analyzed in terms of ball speed, ball shooting coverage, feeding rate and shooting distance. The results show reliable data where this machine could develop a player's ability to return the ball with proper strokes as well as improve the player's reaction. Furthermore, this machine is considerably very cheap for its function compared to the currently marketed products. As a conclusion, this automated table tennis launcher able to function as expected and can perform better when fabricated into the real products by using the customized size for every part.

Keywords: low cost table tennis machine; ping pong; table tennis robot; training kit; sports engineering.

INTRODUCTION

Table Tennis can be classified as a major sport worldwide, with millions of participants, major tournaments and many other things that make a sport truly a class of its own. The sport of table tennis played in Olympic since 1988 ("Table Tennis", 2011) and since then many advancement in terms of self training machines occurred. Table tennis launcher is recently manufactured for self-training purpose which provides automatic shooting of ping pong ball for professionals to improve their skills.

Table tennis sports having multiple types of strokes to be mastered such as push, block, kill and counter drive (Ivan, Roberto, and Franco, 2010) where each of this strokes means a lot when returning the ball to the opponent. The strokes anyhow can be defined in terms of winning, transitional and losing (Ivan, Rocco and Franco, 2011). In February 2000, the ball size becomes another factor that came into consideration to improve the rally game by reducing the ball speed (Takeuchi, Kobayashi, Hiruta and Yuza, n.d.). 40mm diameter ball is then adopted to be the official ball in all table tennis sport worldwide. The ball experiences projectile motion when being hit or launched. During projectile motion, the ball is considered to have both vertical and horizontal component of velocity ("Projectile motion", n.d.) which explains the distance and height the ball covers.

In the upcoming trend, table tennis ball launcher brings together an expensive price tag. Other than that, currently available table tennis machines in market also having less shooting modes. Training with multi-ball concept with the aid of table tennis machine can be very effective (Dinesh and Rajath, 2013). Besides, manually operated table tennis machines does not reflects current

trend of technology that makes currently available machines dull. Nevertheless, certain cheap table tennis machines provide poor stability and lack of functionalities.

METHODOLOGY

A 3D virtual prototype was designed and then fabricated in order to put into real life testing. Both virtual and fabricated prototype is shown in the Figures 1 and 2. The servomotor (M. F. İşik, 2010), stepper motor and DC motor were attached in order to activate the mechanism. The mechanism was mainly controlled by a programmable microcontroller, Arduino with the aid of electronics such as motor driver, resistor and switch. The motor driver functions to control the flow of electric current and also the polarity which enables the DC motor spins in 2 different directions and in few modes. Other than that, the microcontroller is programmed is such way that it takes input signals from Android smartphones. A Bluetooth module is attached which act as a bridge between the Android smartphone and the Arduino microcontroller that enables the user to control the machine by using Android smartphones. An Android application also developed which act as interface for the user to control the machine. The application interface is shown in the Figure-3. The machine is powered by 5V DC power adapter or 5V battery supply. The machine able to shoot the ball in 3 different directions and in 2 different spins which concluded as 7 modes in the interface. These 7 modes cover for almost all types of strokes that a player should acquire.