

McMASTER UNIVERSITY

SMARTSERVE

SOFTWARE & MECHATRONICS CAPSTONE

Hazard Analysis

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Date	Revision	Comments	Author(s)
Dec ?, 2017	1.0	Main content done for all sections	Christopher McDonald

Figure 1: Revision History

1 Introduction

1.1 Project Overview

SmartServe is an autonomous table tennis training system for table tennis players with various skill levels. SmartServe aids in diagnosing and improving a player's performance over time. The system trains table tennis players by shooting table tennis balls towards the player and detects successful returns from the player. The system can further adapt to the player's weaknesses and help them overcome it through further training. Importantly, SmartServe alleviates the problems of finding and working with a coach for players, as well as coaches trying to train multiple players simultaneously. The system will be deemed a success if the table tennis players and coaches can enjoy and see some value added by using SmartServe.

The project started at the beginning of the Fall 2017 academic term and will conclude at the end of the Winter 2018 term. In addition, the core project team consists of final year Software and Mechatronics Engineering students who are enrolled in the MECHTRON 4TB6/SFWRENG 4G06 capstone project course.

1.2 Document Overview

The purpose of this document is to provide an overview of the system design which meets the system requirements as specified in the [Requirements Document](#). The system will be decomposed into subsystems, where each has responsibilities and is designed to fulfill certain requirements. The subsystems will have their intended input, expected output and description of how the module will be used. In further documentation, each will be designed in a way which is abstracted from this document's perspective. The expected use cases will also be detailed to understand the expectations of the user and how each subsystem interacts with one another. A more detailed view of this including timing as a factor will be detailed in the Sequence Diagram section.

For each subsystem, its purpose will be defined with respect to the overall system. After doing so, detailed input and output parameters will be defined. How each subsystem is architected is out of scope for this document and will be defined in further documentation.

1.3 Naming Conventions and Terminology

The following terms and definitions will be used throughout this document:

- **ACID:** a database transaction which is atomic, consistent, isolated and durable

- **CV:** computer vision
- **FPS:** frames per second
- **FSM:** finite state machine, shows transitions between states
- **GUI:** graphical user interface
- **IPO:** input process output
- **Pitch:** rotation along the y-axis; this rotation angle primarily dictates the range of the ball from the net to the edge of the table on the user side
- **Roll:** rotation along the x-axis
- **Shooting Mechanism:** refers to the part of the system that shoots the table tennis balls towards the user side (player) Please refer to Figure 2 for visual illustration
- **System:** encompasses both the hardware and software parts of SmartServe
- **System Side:** the side of the table where the electromechanical system is placed; it is the opposite side of the User Side Please refer to Figure 2 for visual illustration
- **TCP:** transmission control protocol
- **Team:** all team members of the core capstone project, as noted in the list of Authors
- **User Side:** the side of the table where the user (player) is standing
- **Yaw:** rotation along the z-axis; this rotation angle primarily dictates the panning functionality of the shooting mechanism from the right side to the left side of the table

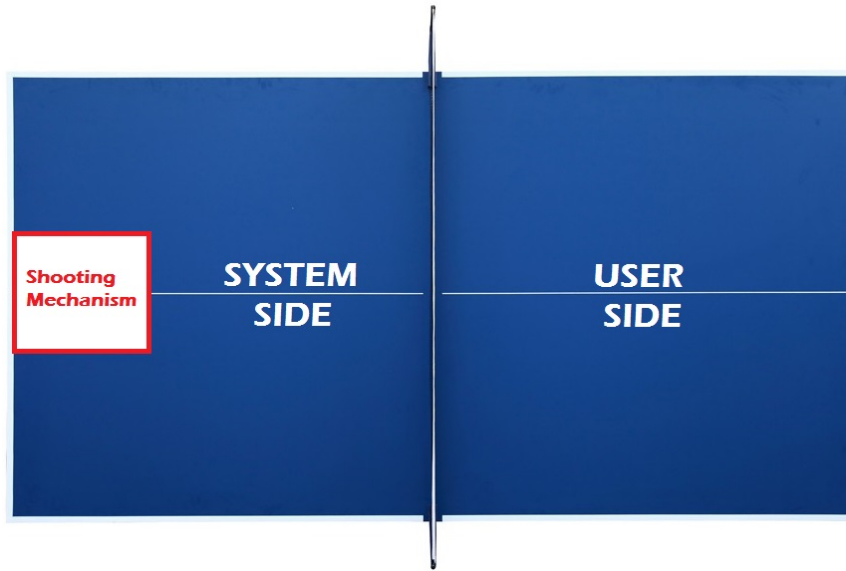


Figure 2: Top View of the Tennis Table

1.4 Project Scope

The system will only attempt to shoot balls from the shooting mechanism straight towards the user side. Notably, the system will not attempt to return any shots from the user. After the user has returned a shot, the Computer Vision (CV) subsystem will be utilized to determine if the user's shot lands on the table or not. Additionally, the characteristics of the shot following any return will be determined by the system's mode and the proficiency of the player if available.