

# REFLX: REACTION ENHANCEMENT IN FITNESS USING LIGHT-BASED EXERCISES FOR UPV ATHLETES

A Special Problem  
Presented to  
the Faculty of the Division of Physical Sciences and Mathematics  
College of Arts and Sciences  
University of the Philippines Visayas  
Miag-ao, Iloilo

In Partial Fulfillment  
of the Requirements for the Degree of  
Bachelor of Science in Computer Science by

CELESTIAL, Christian Dale  
YEBAN, Mark Rensel

Francis DIMZON  
Adviser

October 24, 2025

## **Abstract**

From 150 to 200 words of short, direct and complete sentences, the abstract should be informative enough to serve as a substitute for reading the entire SP document itself. It states the rationale and the objectives of the research. In the final Special Problem document (i.e., the document you'll submit for your final defense), the abstract should also contain a description of your research results, findings, and contribution(s).

Suggested keywords based on ACM Computing Classification system can be found at [https://dl.acm.org/ccs/ccs\\_flat.cfm](https://dl.acm.org/ccs/ccs_flat.cfm)

**Keywords:** Keyword 1, keyword 2, keyword 3, keyword 4, etc.

# Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
1.1	Overview of the Current State of Technology . . . . .	1
1.2	Problem Statement . . . . .	2
1.3	Research Objectives . . . . .	3
1.3.1	General Objective . . . . .	3
1.3.2	Specific Objectives . . . . .	3
1.4	Scope and Limitations of the Research . . . . .	3
1.5	Significance of the Research . . . . .	4
<b>2</b>	<b>Review of Related Literature</b>	<b>5</b>
2.1	Theme 1 Title . . . . .	5
2.2	Theme 2 Title . . . . .	6
<b>3</b>	<b>Research Methodology</b>	<b>7</b>
3.1	Research Activities . . . . .	7
3.2	Calendar of Activities . . . . .	8
<b>4</b>	<b>Preliminary Results/System Prototype</b>	<b>9</b>

<b>A</b>	<b>Appendix</b>	<b>10</b>
<b>B</b>	<b>Resource Persons</b>	<b>11</b>
	<b>References</b>	<b>12</b>

# List of Figures

# List of Tables

3.1	Timetable of Activities . . . . .	8
-----	-----------------------------------	---

# Chapter 1

## Introduction

### 1.1 Overview of the Current State of Technology

In the realm of sports science, the enhancement of athletes' response time and agility remains a critical focus, as these attributes directly influence performance in dynamic, unpredictable environments such as team sports and combat disciplines (Hassan et al., 2023). Traditional training methods, including cone drills and ladder exercises, have long been employed to improve these skills, yet they often fall short in replicating the rapid, stimulus-driven demands of real-game scenarios. Over the past decade, light-based reaction training systems—devices utilizing visual stimuli like LED lights to prompt immediate motor responses—have emerged as innovative tools to bridge this gap. Systems such as FITLIGHT, BlazePod, and XLiGHT have been critically analyzed for their design features, including sensor connectivity, battery life, and operational reliability, revealing strengths in portability and customization but limitations in diagnostic precision and validity (Ezhov et al., 2021).

Empirical studies have demonstrated that these systems can significantly enhance visual-motor coordination, reaction speed, and cognitive functions. For instance, interventions using FITLIGHT in small-sided games have led to marked improvements in harmonic abilities (e.g., rhythmization and responsiveness) and basic skills like dribbling among young basketball players (Hassan et al., 2023). Similarly, a 10-week FITLIGHT program improved reaction times and dribbling speeds in female basketball athletes, with effect sizes indicating substantial neural adaptations (Hassan, 2025). In motorsport contexts, light-based reactive agility training has boosted selective attention, cognitive flexibility, and cardiorespiratory capacity in car racing drivers (Horváth et al., 2022). A systematic review

of visual training interventions, including light board and stroboscopic methods, further corroborates these benefits, reporting 5-27% reductions in reaction time across various sports, with greater efficacy in elite and younger athletes (Jothi et al., 2025). Reliability assessments of systems like BlazePod have also affirmed their validity for measuring simple and complex reactions in mixed martial arts (MMA) athletes, with high intraclass correlations supporting their use in training protocols (Polechoński et al., 2024).

Despite these advancements, significant gaps persist in the literature. While light-based systems show promise in controlled settings, their predictive value for field-based reactive agility remains limited, as evidenced by weak correlations between laboratory reaction speeds and on-field performance in soccer players (Broodryk et al., 2025). This suggests a disconnect between isolated visual stimuli and the multifaceted perceptual-cognitive demands of sports, highlighting the need for more integrated, sport-specific designs. Moreover, comparative analyses underscore inconsistencies in system performance, such as variable Bluetooth stability and sensor delays, which could undermine training reproducibility (Ezhov et al., 2021). Long-term efficacy studies are scarce, and few investigations explore the interdisciplinary integrations between sports science and engineering to optimize these technologies.

## 1.2 Problem Statement

While traditional methods such as cone and ladder drills have been widely used to enhance reaction time and agility, they often fail to simulate the complex, stimulus-driven conditions of real-game scenarios (Hassan et al., 2023). Recent light-based reaction training systems have shown potential in improving visual-motor coordination and cognitive response (Horváth et al., 2022; Jothi et al., 2025). However, these systems remain limited by high costs, connectivity issues, and questionable transferability of laboratory-based improvements to on-field performance (Broodryk et al., 2025; Ezhov et al., 2021).

If these limitations persist, athletes may continue to rely on training tools that inadequately reflect actual gameplay conditions, hindering optimal skill development and competitive performance. Addressing these gaps necessitates the development of a customizable, low-cost, and scientifically validated light-based reaction training system that bridges engineering innovation and applied sports performance research, which our study aims to do as well as evaluate the effectiveness of said system.



## **1.3 Research Objectives**

### **1.3.1 General Objective**

The goal of this study is to develop and evaluate a light-based reaction training system that enhances the response time and agility of athletes, specifically in racket sports such as badminton, tennis, and table tennis.

### **1.3.2 Specific Objectives**

1. To design and construct a device equipped with infrared sensors, RGB lights, and speakers for accurate motion detection and response measurement, as well as a better user experience.
2. To develop a software application that manages the device operations, records performance data, and functions both online and offline.
3. To calibrate and test the system to ensure precision, responsiveness, and synchronization between hardware and software components.
4. To conduct experimental trials assessing the system's effectiveness in improving athletes' response time and agility compared to traditional training methods.
5. To evaluate the system's usability, functionality, and overall user satisfaction based on feedback from athletes and coaches.

## **1.4 Scope and Limitations of the Research**

This study focuses on the design, development, and short-term evaluation of a programmable light-based reaction training system specifically tailored for racket sports, including badminton, tennis, and table tennis. These sports were selected because they demand rapid visual processing, anticipatory decision-making, and fine motor control—abilities strongly linked to reaction time and agility.

Experimental trials will be conducted in controlled indoor training environments, using drills that simulate racket-sport scenarios such as serve returns, directional changes, and split-step reactions. The prototype system will incorporate

LED visual cues and integrated speakers to deliver multimodal stimuli, allowing assessment of both single and dual sensory response conditions.

The evaluation will be limited to short-term performance outcomes, measuring pre-post changes in reaction and movement response metrics following exposure to the prototype system. Long-term effects, such as learning retention, in-game transfer, or perceptual-cognitive adaptations, are beyond the scope of this research.

## 1.5 Significance of the Research

This research integrates engineering, computer science, and sports science by developing a light- and sound-based reaction training system that enhances athletes' response time and agility through multimodal stimuli and data-driven feedback. Through a technical lens, the study contributes to the computer science community by implementing real-time sensor processing, audio-visual cue synchronization, and a user-centered software design. The inclusion of both infrared sensors and speakers allows for dynamic and varied training scenarios that engage multiple sensory pathways, thereby improving cognitive-motor coordination. Compared to existing systems that rely solely on visual cues or require expensive proprietary hardware, this design offers a more versatile, customizable, and cost-efficient solution.

From a societal perspective, the system democratizes access to advanced reaction training technologies by providing an affordable and portable tool suitable for athletes, coaches, and educational institutions. It can also serve as a supplementary device for rehabilitation programs that aim to improve motor control and sensory processing. By combining technical innovation with accessibility, this research promotes evidence-based athletic development and supports the broader integration of smart, adaptive technologies in sports and human performance training.

# Chapter 2

## Review of Related Literature

This chapter discusses the features, capabilities, and limitations of existing research, algorithms, or software that are related/similar to the Special Problem.

The reviewed works and software must be arranged either in chronological order, or by area (from general to specific). Observe a consistent format when presenting each of the reviewed works. This must be selected in consultation with the adviser.

**DO NOT FORGET to cite your references.**

### 2.1 Theme 1 Title

This chapter contains a review of research papers that:

- Describes work on a research area that is similar or relevant to yours
- Describes work on a domain that is similar or relevant to yours
- Uses an algorithm that may be useful to your work
- Uses a software / tool that may be useful to your work

It also contains a review of software systems that:

- Belongs to a research area similar to yours

- Addresses a need or domain similar to yours
- Is your predecessor

## **2.2 Theme 2 Title**

# Chapter 3

## Research Methodology

This chapter lists and discusses the specific steps and activities that will be performed to accomplish the project. The discussion covers the activities from pre-proposal to Final SP Writing.

### 3.1 Research Activities

Research activities include inquiry, survey, research, brainstorming, canvassing, consultation, review, interview, observe, experiment, design, test, document, etc. Be sure that for each method, process, or algorithm used, there is a justification why that method was chosen. The methodology also includes the following information:

- who is responsible for the task
- the resource person to be contacted
- what will be done
- when and how long will the activity be done
- where will it be done
- why should be activity be done

## 3.2 Calendar of Activities

A Gantt chart showing the schedule of the activities should be included as a table. For example:

Table 3.1 shows a Gantt chart of the activities. Each bullet represents approximately one week worth of activity.

Table 3.1: Timetable of Activities

Activities (2009)	Jan	Feb	Mar	Apr	May	Jun	Jul
Study on Prerequisite Knowledge			••	••••			
Review of Existing Racing Strategies	••	••••	••••	••••			
Identification of Best Features				••••	••		
Development of Racing Strategies				••	••••	••	
Simulation of Racing Strategies				••	••••	•••	
Analysis and Interpretation of the Results					••••	••••	•
Documentation	••	••••	••••	••••	••••	••••	••

## Chapter 4

# Preliminary Results/System Prototype

This chapter presents the preliminary results or the system prototype of your SP. Include screenshots, tables, or graphs and provide the discussion of results.

# Appendix A

## Appendix



# Appendix B

## Resource Persons

**Mr. Firstname1 Lastname1**

Role1

Affiliation1

emailaddr1@domain.com

**Ms. Firstname2 Lastname2**

Role2

Affiliation2

emailaddr2@domain.net

....

## References