


'Saya/~~Kami~~* akui bahawa telah membaca karya ini dan pada pandangan saya/~~kami~~* karya ini adalah memadai dari segi skop dan kualiti untuk tujuan penganugerahan Ijazah Sarjana Muda ~~Kejuruteraan~~ Mekanikal (Rekabentuk dan Inovasi)'

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** Potong yang tidak berkenaan*

**DEVELOPMENT OF CONTROL SYSTEM FOR SEPAK TAKRAW
LAUNCHER MODEL**

MOHANDAS SAGARAN

Laporan ini dikemukakan sebagai
memenuhi sebahagian daripada syarat penganugerahan
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“Saya akui laporan in adalah hasil kerja saya sendiri kecuali ringkasan dan petikan yang tiap-tiap satunya saya telah jelaskan sumbernya”

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Dedicated to my beloved mom and dad

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ABSTRACT

One of the difficulties associated with practicing Sepak takraw is that it requires at least two players. It is impossible for an individual to practice serving and kicking the Sepak takraw ball without the assistance of another player. Thus, a sepak takraw ball launcher has been proposed and developed to launch the balls that have been previously loaded into them. Studies had been carried out on other similar types of ball receiving and launching machines in order to understand the mechanisms involved in the feeding system, launching system and control system. This project focuses on the development of the control system of the sepak takraw ball launcher using Programmable Logic Controller, PLC. This PLC makes sure the loaded balls transferred to the launcher one at each time when triggered by a remote. Studies had been conducted on designing Ladder diagram and programming a PLC. It was found that PLC is suitable to be applied in the control system of Sepak takraw ball launcher.

ABSTRAK

Salah satu kesukaran yang dikenalpasti dalam menjalankan latihan sepak takraw adalah permainan ini memerlukan sekurang-kurangnya 2 pemain. Ia adalah mustahil bagi seseorang untuk berlatih bermain sepak takraw terutamanya latihan menendang dan merembat bola takraw tanpa bantuan pemain lain. Maka, sebuah mesin telah direka untuk melontarkan bola-bola yang telah dimasukkan ke dalam mesin tersebut. Kajian dan penyelidikan telah dijalankan terhadap mesin-mesin menerima dan melontar bola yang sedia ada di pasaran. Ini bertujuan untuk memahami mekanisma-mekanisma yang terlibat dalam sistem lontaran bola, sistem penerimaan bola dan sistem kawalan. Projek ini memfokuskan perkembangan sistem kawalan mesin lontaran bola takraw menggunakan *Programmable Logic Controller*, PLC. PLC ini memastikan bola-bola yang dimasukkan ke dalamnya dipindahkan satu per satu ke pelontar ball setiap kali alat kawalan ditekan. Kajian dan pembelajaran dijalankan terhadap rekaan diagram *Ladder* dan pengaturcaraan PLC. PLC telah dikenalpasti sesuai untuk digunakan di dalam sistem kawalan mesin pelontar bola takraw.

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CHAPTER 1

INTRODUCTION TO PROJECT

1.1 Introduction

Sepak takraw is a native sport to Southeast Asia, resembling volleyball except that it uses a rattan ball and only allows players to use their feet, knee, chest and head to touch the ball. It is a popular sport in Thailand, Malaysia, Philippines, Brunei, Laos and Indonesia. Sepak takraw believed to been brought to Malaysia and Thailand by the early 1400s. Back then, it was called takraw in Thai or „Sepak Raga“ in Malay and played mainly as a recreational activity. The game became such a cherished local custom that it has been commercialized to be a tournament. In order to prepare the players to the tournaments, practice or training will be essential to sharpen their skills.

At the moment there is no device or support tool has been designed to assists the players in their training. Therefore, one model of automatic sepak takraw ball launcher controlled by a control system (Programmable Logic Controller, PLC) will be developed for the players to conduct their training on their own. This sepak takraw ball launcher can be a trigger point in sepak takraw development in the future. It will influence the sepak takraw player performance where with the assists of support tool will improve the player’s skill. One example of such device or support tool is the tennis ball launcher. The main aim of this project is to provide a suitable control system that can transfer the sepak takraw balls from the ball container to the ball launcher automatically one at each time. This control system will be controlled by a PLC to ensure that this device works properly.

1.2 Objectives

Following are the objectives set in this project:

- Study the characteristic of programmable logic controller, PLC and the control system from the ball container to the launcher.
- Design a suitable PLC ladder logic diagram simulation to transfer the sepak takraw ball from the container to the launcher. Several ladder logic diagram will be designed and tested before the best circuit diagram is selected.
- Develop the model of the control system to test the ladder logic diagram and to illustrate the operation of the system.

1.3 Problem Statement

At the moment, there is no support tool involved in sepak takraw training to make the training session to be conducted much more easily and more efficiently. Besides that, this training is usually conducted manually with the support of other players for example to help to toss the ball or to set the ball for the player. Thus, a support tool can be applied in the sepak takraw training to facilitate the player training without the support of other player. This support tool will be controlled by a control system (using programmable logic controller, PLC). In other words, an automatic system will replace the conventional practice manual system. There are a lot of similar applications in the market today, for example tennis ball launcher. It can be seen that this tennis ball launcher plays a huge role in improving the player performance and development.

1.4 Scopes

The scopes of the project are as follows:

- To design a control system model for sepak takraw ball launcher using PLC.

- The control system is design specially to transfer the ball from the container to the launcher automatically using PLC.
- This project focuses on development of a PLC ladder logic diagram.

1.5 Design Background

In order to proceed with the control system of sepak takraw ball launcher design, existing design such tennis ball launcher and other types of ball receiving and launching machine needs to be studied since there a lot of similarities between the proposed sepak takraw ball launcher and the above mentioned design. All of these designs have feeding system, launching system, base and controller. These designs are used in sports to facilitate the player training and to improve the player skill and performance.

Since the control system of the proposed sepak takraw ball launcher will be controlled by PLC, the knowledge on programming and using a PLC needs to be studied. Research also needs o be done on the applications of PLC in other control systems and the benefits of using a PLC in a control system.

CHAPTER 2

INTRODUCTON TO SPORT OF SEPAK TAKRAW

2.1 Introduction

Sepak takraw is a skill ball game, which requires the use of the feet and head to keep the ball in the air and in a targeted direction. It is a popular sport in Thailand, Cambodia, Malaysia, Philippines and Indonesia. Lately, the game becomes famous outside Asia such as United States, Canada, England, Germany, Brazil and New Zealand where the game played as recreational activity and tournament. The game play described briefly as spiking a ball into the opponent court to achieve point. This game play has its own rules and requires some preparation before it can be played. These preparations include team player, court, equipments and umpire.

2.2 Players

A match is played by two „regus“ (teams), each consisting of three players. One of the three players shall be at the back; he is called a „Tekong“ (refer **Figure 1**). The other two players shall be in front, one on the left and the other on the right. The player on the left is called a “Left Inside” and the player on the right is called a “Right Inside”.



Figure 1: The ‘Tekong’ performing the service during a match.

(Source: Schnell, F. (2008))

2.3 Court

Area of 13.4 m x 6.1 m (refer to **Figure 2**) free from all obstacles up to the height of 8 m measured from the floor surface (sand and grass court not advisable). The width of the lines bounding the court should not be more than 0.04 m measured and drawn inwards from the edge of the court measurements. All the boundary lines should be drawn at least 3.0m away from all obstacles. The center line of 0.02 m should be drawn equally dividing the right and left court. At the corner of each at the center line, the quarter circle shall be drawn from the sideline to the center line with a radius of 0.9 m measured and drawn outwards from the edge of the 0.9 m radius. The service circle of 0.3 m radius shall be drawn on the left and on the right court, the center of which is 2.45 m from the back line of the court and 3.05 m from the sidelines, the 0.04 m line shall be measured and drawn outward from the edge of the 0.3 m radius.

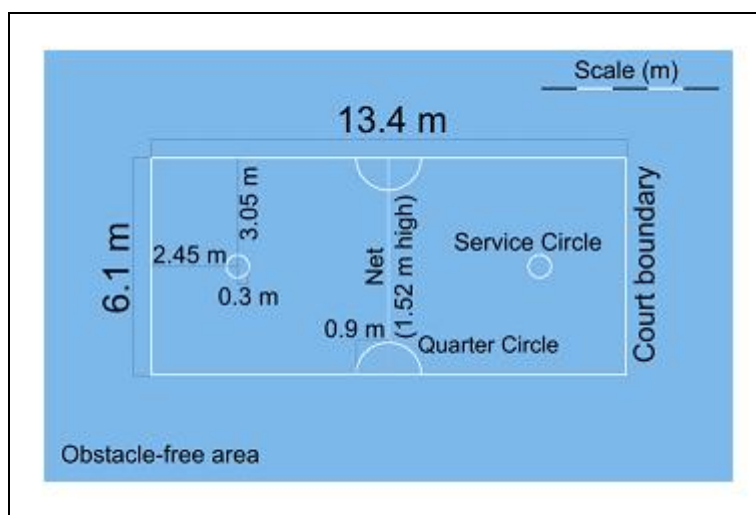


Figure 2: Sepak Takraw court diagram.
(Source: Gajah Emas Industries Sdn Bhd (2007))

2.4 Equipments

Generally, there are two main equipments used in sepak takraw game which are the takraw ball and the net. The takraw ball is a competition tool meanwhile the net is the separator between each team in tournament. Following are the details about these two equipments:-

2.4.1 Takraw Ball

The sepak takraw ball (refer to **Figure 3**) shall be spherical in shape, made of synthetic fiber or one woven layer. Sepak takraw balls without synthetic rubber covering must consist of the following characteristics; Have 12 holes. Have 20 intersections. Have a circumference measuring not less from 0.42 meters (1 ft 4.5 in) to 0.44 m (1 ft 5.25 in) for men and from 0.43 m (1 ft 5 in) to 0.45 m (1 ft 5.75 in) for

women. Have a weight that range from 170 grams (6 oz) to 180 grams (6.3 oz) for men and from 150 grams (5.3 oz) to 160 grams (5.6 oz) for women.



Figure 3: A sepak takraw ball

(Source: Gajah Emas Industries Sdn Bhd (2007))

The ball can be in plain single colour, multi-colour, and luminous colours, but not in any colour that will impair the performance of the players. The sepak takraw ball can also be constructed of synthetic rubber or soft durable material for covering the ball, for the purpose of softening the impact of the ball on the player's body. The type of material and method used for constructing the ball, or for covering the ball with rubber or soft durable covering must be approved by ISTAF (International Sepak Takraw Federation) before it can be used for any competition.

2.4.2 Net

The net shall be made of fine ordinary cord or nylon with 6 mm to 8 mm mesh. The net shall be 0.7 m in width and not shorter than 6.10 m in length and taped at 0.05 m from tape double at the top and sideline, called boundary tape. The net shall be edged with 0.05 m tape double at the top and the bottom of the net supported by a fine ordinary cord or nylon cord that runs through the tape and strain over and