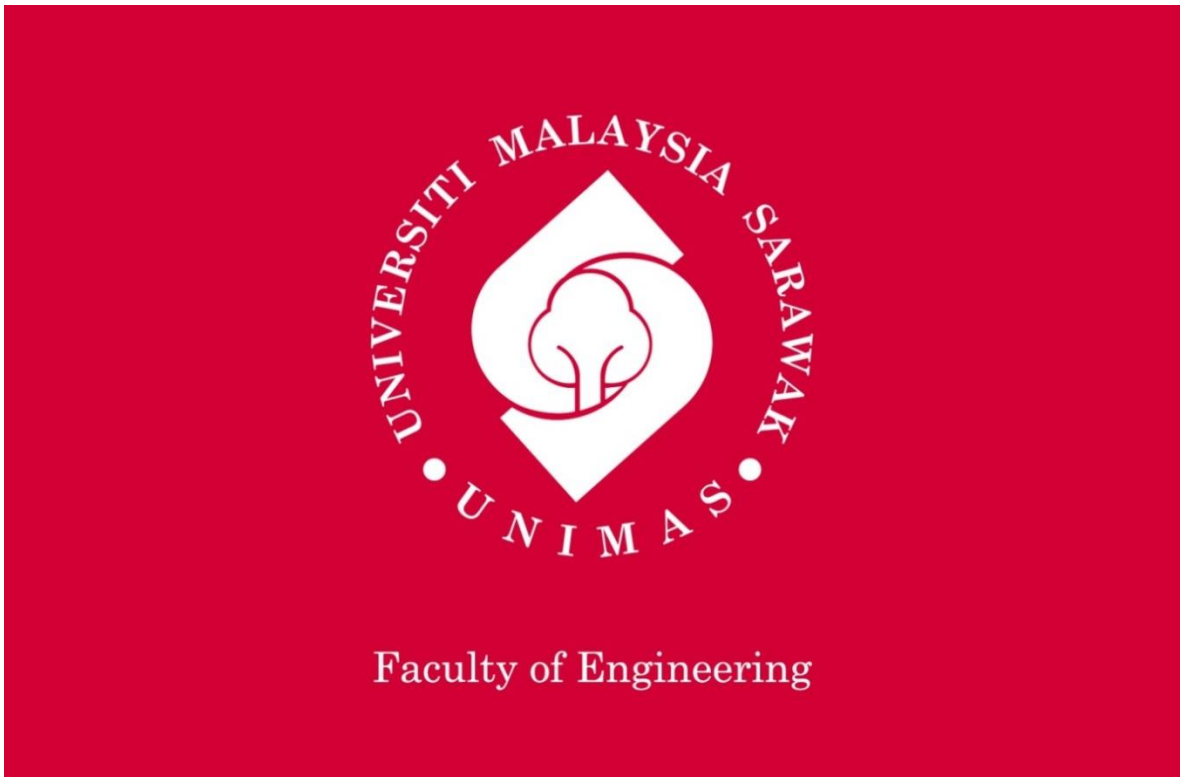

VIDEO BASED MOTION ANALYSIS FOR OVERHEAD BADMINTON FOREHAND STROKE

Luqman Bin Abdul Khalek

Bachelor of Engineering with Honours
(Mechanical and Manufacturing Engineering)
2017

UNIVERSITI MALAYSIA SARAWAK

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Final Year Project Report ☑

Masters ☐

PhD ☐

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VIDEO BASED MOTION ANALYSIS FOR OVERHEAD BADMINTON FOREHAND STROKE

LUQMAN BIN ABDUL KHALEK

A dissertation submitted in partial fulfillment

of the requirement for the degree of

Bachelor of Engineering with Honours

(Mechanical and Manufacturing Engineering)

Faculty of Engineering

Universiti Malaysia Sarawak

2017

To my beloved family and friends

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ABSTRACT

Badminton is a game that involved a lot of quick movements and fast response. It is the fastest racket sport in the world where the badminton forehand smash can lead the shuttlecock speed to reach up to 223kph.Research shows that the arm movement contributes a lot during the overhead badminton forehand stroke. The objective of this study is to use a low cost alternative for video based motion analysis on overhead badminton forehand stroke, especially on finding the arm angle and the velocity and acceleration of the badminton player. Findings of this project will help badminton players to come out with a training system or protocol that help to improve the effectiveness of training and enhance their performance. Furthermore, the study was also conducted to observe the movement of player's upper limb while playing the overhead badminton forehand stroke.

ABSTRAK

Badminton adalah permainan yang melibatkan banyak pergerakan cepat dan tindak balas yang cepat. Ia adalah sukan raket yang paling cepat di dunia di mana pukulan depan smash badminton boleh membawa kelajuan bulu tangkis untuk mencapai sehingga 223kph.Kajian menunjukkan bahawa pergerakan lengan yang banyak menyumbang semasa lejang badminton pukulan depan atas. Objektif kajian ini adalah dengan menggunakan alternatif kos rendah untuk video berdasarkan analisis usul overhead strok badminton pukulan depan, terutama kepada mencari sudut lengan dan halaju dan pecutan lengan pemain badminton. Hasil projek ini akan membantu pemain badminton untuk keluar dengan sistem latihan atau protokol yang membantu untuk meningkatkan keberkesanan latihan dan meningkatkan prestasi mereka. Tambahan pula, kajian ini juga dijalankan untuk melihat pergerakan anggota badan atas pemain semasa bermain strok badminton pukulan depan atas.

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INTRODUCTION

1.1 Background of Research

Biomechanical engineering is combination of mechanical engineering, biological knowledge principles. It also involved with creating and producing variety of products in our life such as environment material.

To promote optimum performance, all sports use movement sequence throughout play. Sport biomechanics is a quantitative study and analysis of professional athletes and sports activities in general. In this project we will examine the study of overhead badminton forehand stroke of badminton. Through computer simulation, measurement and mathematical modeling, we can gain a better understanding of athletic performance which is why sports biomechanics is important. It is the study of the biological system which means we analyze the physics involving analysis of the action of forces, which may involves kinematics variable such as time, displacement, velocity and speed of movement.

Since 1950's Malaysia is one of the successful nations when it comes to badminton sports. Malaysia badminton team has won many international tournament, such as Thomas Cup and All England. Every era since 1950's until today, Malaysia badminton team has created a high prestige player such as Dato' Lee Chong Wei, Hafiz Hashim, Dato' Misbun Sidek and others. Expectations were very high for the Malaysian Badminton players to win the first Olympic medals for the country. Hence, the reasons we conduct this project

because we want to improve and try to help badminton player in Malaysia to achieve our dream to make Malaysian badminton even better than before.

The overhead badminton forehand stroke is mostly used in badminton games. The efficient of a badminton forehand stroke comes from a good technique. The larger the swing motion, the more momentum generated which will produce more power. The overhead badminton forehand stroke can refer to any position of human body, especially the muscle activity on the upper limb.

1.2 Problem Statement

Badminton is a non-contact racquet sport that required fast in changing direction, and quick arm movements from a wide variety of postural positions such as overhead, smash, service and others (Wang S. et al., 2013). They combine strength, power, agility and endurance capacities. One of the most fundamental movement of badminton is the overhead badminton forehand stroke. Therefore, shuttlecock's velocity is widely used as a standard to determine the quality of badminton stroke. In the previous study, (Tsai, 2011) mentioned that the professional player would able to performed up to 20% higher shuttle velocity compare with the collegiate player (Shan, Ming, Rahman, & Fai, 2015).In sports competition such as badminton asked for high performance, analysis including a detailed motion is important (Nagasawa M. et al.,2012).High levels of skill across a variety of shots are needed for success in badminton .Therefore, investigating the kinetics and kinematics of the overhead badminton forehand stroke tasks may offer biomechanical information on enhancing athletic performance and provide coaches and players with a reference to make smash effective and profound.

1.3 Objectives

The main aim of this project is to study the video based motion of pattern analysis of overhead badminton forehand stroke. The objectives of this research work therefore are to:

1. To observe the movement of player's upper limb while doing the overhead badminton forehand stroke.
2. To analyze the best angle of the arm while doing the overhead badminton forehand stroke
3. To analyze 2D biomechanical variable including the acceleration, angular velocity of the arm. Also the time taken for the shuttlecock to land on loading points of the subjects when the subjects performing the overhead badminton forehand stroke.
4. To use a low cost alternative for video based motion analysis on overhead badminton forehand stroke.

1.4 Scope of Studies

This research will help badminton players to come out with a training system that help to improve the effectiveness of training and enhance their performance. As the upper limb body has many complicated part of joint muscle, this research is only focusing on upper limb that only cover arm region. In this research, the overhead badminton forehand stroke is analyzed by video motion and then analyzed by Kinovea software. This research will be beneficial for the sports scientists, badminton coaches and players to study the applied mechanics.

1.5 Organization of Report

Chapter 1: Introduction

From this chapter, we briefly know what this project is going to cover. We also know the background, problem statement and objectives that can be obtained from the project.

Chapter 2: Literature Review

Based on journal, books and articles, we make more detail what a project is about and conclude it into theoretical literature. From this theoretical literature, application of the theoretical findings to the problem, the explanation of theory based on the problem and overview of the theory with further explanation.

Chapter 3: Methodology

Methods and tool handling are shown through this chapter. The procedures on how the project is being conduct is shown accordingly together with clear explanation of each steps.

Chapter 4: Result and Discussion

All the result after conducting the methods are being shown and discussed further. Also, the simulation results are shown.

Chapter 5: Conclusion

The summary of the project are shown in this chapter. The results are included in this chapter and from there, we can identify whether the objectives are reached.

CHAPTER 2

LITERATURE REVIEW

2.1 Badminton History

The sport of badminton evolved from the ancient game of battledore and shuttlecock as shown in Figure 2.1. A game played by adults and children for at least 2000 years in ancient Greece, China, Japan and India. Peasant played it in Medieval England by the late 16th century, where it had become a popular children's game .By the 17th century, battledore had become a pastime of the leisured classes in many European countries. The game simply involved two players using bats to hit a shuttlecock back and forth as many times as they could without letting it hit the ground. In Figure 2.1,where Battledore and Shuttlecock found its way to colonial America because of the European influence.

Figure 2.1: Battledore and Shuttlecock (England et al., 2000)

The existence of battledore in America has made two colonial pieces of art that give further evidence. It shows a man holding a racquet and shuttlecock painted by Williams which given by a title as Portrait of Master which has been completed in the early 18th century. In the late 18th century, the other piece is a fabric hanging in Williamsburg,Va, that showing a childhood diversions. It can be seen that two young boys are depicted hitting a shuttlecock back and forth.

It is still unknown the game of battledore shuttlecock changed to require court boundaries as it evolved into the sport of badminton is not known (England et al., 2000).It is known that the badminton sports takes its name from the Duke of Beauforts estate in Gluocesershire,England.A new generation of battledore had evolved by the end of the 1850s.The first rule of badminton were compile India in the 1860s and 1870s.

In the 1870,the game of badminton is known for its slow paced that appeared in the United States of America. It required a little effort on the part of the player to hit the shuttle because the fast shuttle was used. Because of the design of the court is an hour glass shaped, it made less area for the player to play and it nearly impossible to do a smash. The player also had an issue to run effectively because of the formal suits worn by the player.

In 1878,the first ever badminton club is created in the United States of America which was the Badminton Club of the city of New York. The activity of the club mainly focused on social gathering only for the elite player .Badminton poles, colored pennants, and multi colored shuttlecocks were very similar to the games at the club.

In 1987,the sport of badminton USBA as the National Governing Body officially recognized by the USOC. The first ever badminton game debut at the U.S.A Olympic festival was held in Oklahama City in 1989. In 1992 the sports of badminton made its first ever appearance in Olympic event. In that year ,the U.S athletes advanced to the second round of the tournament. In 1995,the badminton sport first appeared on the Pan American Games program in Argentina.(England et al., 2000)

2.2 Rules and Regulations of Badminton

Badminton can be play either as a single or doubles with one or two players on each side. To hit the shuttlecock back and forth with a racquet across a net five feet high at is center is the main objective of the game(Doubles, 1992). To make an opponent unable to return the shot, the player should hit the shuttlecock with such speed and accuracy. The badminton game can be either fast or slow pace, depend on the skill level of the players. They are 3 categories for badminton game, which area singles, doubles and mixed doubles. Below are the criteria of each game.

1. Singles game – one player on each side of the court.

2. Doubles game – two players on each side of the court.

. 3, Mixed Doubles game – one male and one female partner versus another male and female opponent.

If a player strikes the shuttlecock with the racquet and it lands within the opposing side's half of the court, then the points are obtained. It is important to keep in mind that each player is only allowed to strike the shuttlecock once per possession. There are several ways to end a play in badminton. They are:

- Once the shuttlecock has struck the floor
- Fault called by the umpire
- Fault called by the service judge

After the play ends, player who scored point for the previous play will serve the shuttlecock. This sequence of play will continue until a set point of 21 points is achieved by one player. If the score reaches 20-20, the game will be "deuce". This means that either one side must lead by 2 points to win the set. Player which wins two sets will be the winner of the game. Figure 2.2,show is the dimension for badminton court lines.

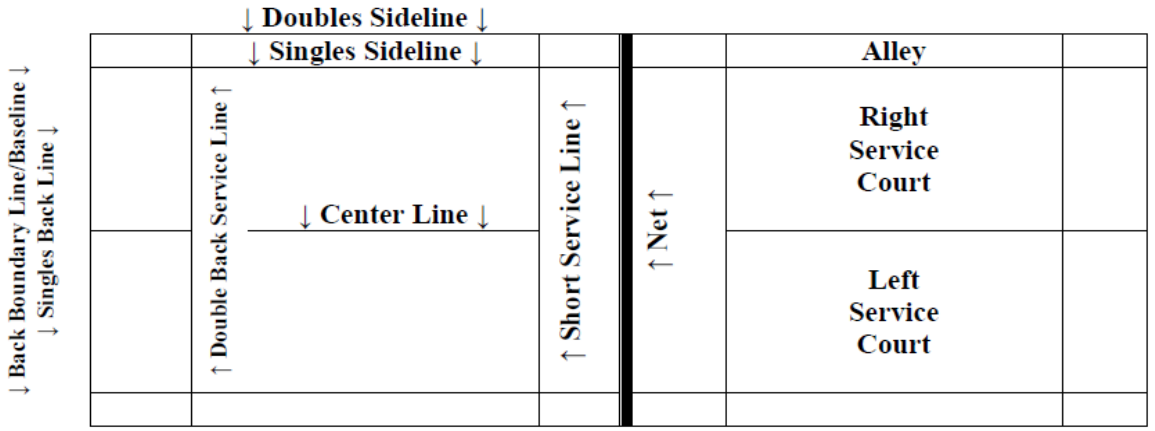

Figure 2.2 : Badminton court lines (Doubles, 1992)

2.3 Overhead Badminton Forehand Stroke

The overhead badminton forehand stroke is very popular and is used most often in badminton. Figure 2.3,show the movement pattern of the overhead badminton forehand stroke. In badminton, this stroke is one of the most efficient moves. The purpose of the overhead badminton forehand stroke is to force the opponent to the rear court. This move can be played as an attacking or as a defensive shot. The defensive clear is much more higher than attacking move.

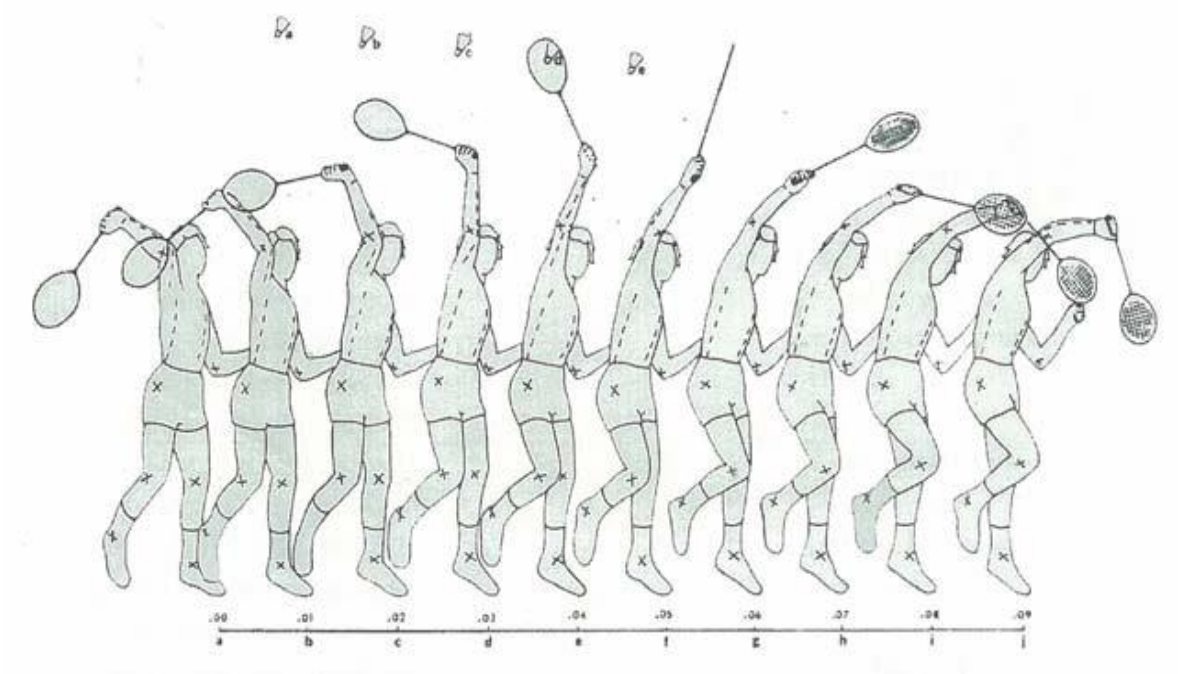

Figure 2.3 : The stroke for overhead badminton forehand stroke (Doubles, 1992)

2.3.1 The step for overhead badminton forehand stroke

It is important for badminton player to know the movement pattern of each stroke to have a better accuracy and a good technique when doing this stroke.

2.3.1.1 The Preparation Phase

For this step the badminton players need to adopt the forehand grip and the attacking stance.In Figure 2.4,it show the position of an attacking stance.