UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Design, Analysis and Development of Tennis Ball Collector Machine

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Mechanical Engineering Technology (Automotive Technology) with honours

by

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DECLARATION

I hereby, declared this report entitled "Design, Analysis and Development of Tennis Ball Collector Machine" is the results of my own research except as cited in references.

Signature : ……

Author's Name : **NOOR MIRZA SYAMIMI BINTI HJ MORTADHA**

Date : 25/12/2017

APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelors of Mechanical Engineering Technology (Automotive Technology). The member of the supervisory is as follow:

……

(HERDY RUSNANDI)

ABSTRAK

Tenis telah menjadi sukan yang sangat terkenal dan bilangan orang yang terlibat dalam bidang ini semakin banyak hari demi hari. Walaubagaimanapun, untuk menjadi pemain tenis hebat, pemain memerlukan banyak latihan. Biasanya, sesi latihan memerlukan banyak bola tenis dan selepas latihan, bola akan bertaburan di permukaan gelanggang tennis. Mengutip semua bola akan mengurangkan masa sesi latihan dan ia adalah pekerjaan yang sangat membosankan. Mesin pemungut bola tenis diciptakan untuk mengumpul bola dengan lebih mudah. Dengan mengumpul bola menggunakan mesin, ia akan mengurangkan masa untuk mengumpul bola yang telah bertaburan. Selain itu, sesi latihan biasanya sangat melelahkan. Dengan menggunakan mesin ini, pemain tidak perlu menggunakan banyak tenaga mereka untuk mengumpul beratus-ratus bola secara manual. Semua bola boleh dikumpul dengan menggunakan mesin ini dalam masa yang singkat dengan hanya memandu mesin melalui bola yang bertaburan di atas permukaan gelanggang. Mesin ini telah dihasilkan melalui beberapa jenis proses. Setelah melalui proses-proses yang sepatutnya, setiap bahagian yang telah diproses akan digabungkan untuk menjadikan nya satu bahagian yang sempurna. Mesin pengumpul bola tenis ynag telah lengkap kemudian menjalani proses ujian. Data untuk mengumpul bola tenis yang bertaburan telah diambil semasa proses ujian. Bahagian kritikal mesin telah dipilih dan dianalisis dengan menggunakan perisian Pemikiran Solid untuk mendapatkan hasil von misses stress, stress ricih dan faktor keselamatan terhadap mesin yang dicipta.

ABSTRACT

Tennis has become a very popular sport and the number of people who involved in this sport is increasing day by day. Somehow, to be a great tennis player require a lot of practice and training. Usually, training session require a lot of tennis balls and after training, the balls will scattered on the surface court. Picking up all the balls will reduce the time of training session and it is very tedious job. Tennis ball collector machine was developed to make the collecting ball easier. By using the ball collector machine, the time of collecting the scattered balls will be reduced. Besides that, drilling and training session is usually very tiring. By using this machine, the player will not have to use much of their energy to collect hundreds of the balls manually. All of the balls can be collected by using this machine in a short time by just driving the machine through the balls. This machine has been through a fabrication process and all of the part were assembled to form a complete machine. The complete tennis ball collector machine is then undergo testing process. Data of collecting the scattered tennis ball was taken during the testing process. The critical part of the machine was chosen and analysed by using Solid Thinking software to obtain the result of von misses stress, shear stress and safety factor of the fabricated machine.

DEDICATION

Special dedication to my beloved parents and family,

FARIDAH BINTI HAZEMI

MORTADHA BIN ABDULLAH

REHAL BIN ANIS

HJ HAZEMI BIN LEE

HJH MORDIAH BINTI HJ SAPALI

MOHD RASHDAN BIN HAZEMI

FARAH NUR IZZATI BINTI HJ MORTADHA

To my supportive and kind supervisor,

HERDY RUSNANDI

My supportive and lovely friends,

MUHAMMAD TIRMIDZI AL BAKRI BIN ROSLI

NOR SHAMIMI ZUNIKA BINTI MAZLAN

For their

Love, Sacrifice, Encouragement and Best Wishes

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CHAPTER 1

INTRODUCTION

1.0 Background

Tennis is an interesting sport which can be played by many range of age. It can be play single or doubles. The court is 23.77 meter long and a width of 8.23 meter for single matches and 10.97 meter for double matches. Tennis balls are fluorescent yellow at major sporting events. It also a very good sport which can make people sweats and healthy at the same time.

In order to be a good player, many balls are required for training session. Training session is very important as it will improve the player skills. Usually, many balls are used in the tennis session. A few full basket is used in the training session and the balls need to be collected after finish one basket of the ball. The balls are then need to be collected repeatedly until the training session is over. Therefore, the balls will scatter on the tennis court which the court is quite wide enough that required so much time to collect them all one by one. The time taken to collect all the balls absolutely will reduce the training time and the quality of the training session itself.

Collecting balls are very tiring, tedious job and can cause backpain problem to the collector. Many scattered ball on the court have to be collected once all the balls have been use to continue the training session. Collecting hundreds of the balls one by one is tiring since the court is big enough that the balls scatters in such many ways. However, having balls collected one by one manually is very tedious because of the repeating action in order to collect hundreds amount of tennis ball. It is also can cause backpain to the

player which is bad for the players' well being as it will affect the player's performance while training and playing.

Existing machine of tennis ball collector are very expensive. Therefore, it will cost customers a high price in order to have the machine. Having this kind of product will reduce the tennis ball collectors' cost. At the same time, this product is easier to handle as it comes in a very suitable size and very portable to handle by anyone. It is very portable as we can assemble and disassemble the tennis ball collector machine.

1.1 Problem statement

Collecting all the scattered tennis ball on the court surface is very tedious. It takes longer time to pick up the balls manually. Picking up the balls also is very tiring as the person have to bend all the time when picking up the balls. The product of tennis ball collector machine at the market seems to be very expensive to get. Moreover, existing product is comes in a bigger size and cannot be handle easily.

1.2 Objective

The objective of this project are:

- To design a tennis ball collector machine
- To analyze mechanism of a tennis ball collector machine
- To develop a machine that can collect tennis ball

1.3 Scope

The scope for this project are:

- Study the collecting mechanism to collect tennis ball
- Design the ball collector system of the machine
- Analyses the mechanism and design of the machine
- Fabricate the tennis ball collector after finalizing the all the criteria needed
- Assemble the collector part to achieve the objective of the project
- Test and evaluate the prototype

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

Tennis has been played since a long time ago in various surfaces such as grass, clay, carpet and hard. Ball speed, ball bouncing, game style and length of game are influenced by the type of tennis court surface as each surface has their own character. Besides that, lacking of fitness leads to inaccuracy, unforced errors, and mental mistakes begin to creep in serve, decline stroke velocity and decrease speed of running to the ball. It is confirmed that the tennis players should prepare fitness level according to surface type. Daily practice in specific surface will adapt to particular physical and physiological condition of the tennis player (Kandasamy Kuganesan 2015).

Since its origin in the 19th Century, the sport of tennis has become increasingly popular to the point where tennis courts are generally found in public parks, High Schools and Middle Schools, hotels and other resorts, and on the grounds of many residences. There are many occasions when a single player may desire to practice his serve or other strokes. Where a serve is being practiced and the player is alone on the court, he will serve a large number of balls from one side of the court, and thereafter proceed to the other side to pick up the balls and serve back to the side from which he originally started serving. On other occasions, where the player is practicing strokes with a ball machine, the player may hit a large number of balls directed at him by the ball machine to the other side of tennis court. Practice of this nature is quite desirable where a player desires to improve

his tennis game. The player is then confronted with having to proceed to the other side of the court to retrieve a very large number of balls which he may have hit to such other side of the court (James Madrazo 1995).

When a tennis player is receiving a lesson, an instructor will serve the tennis balls to the student, or a tennis player will practice with the aid of an automated tennis ball serving machine. In both cases many balls are distributed on a tennis court. Picking up tennis balls one by one manually or even baseballs is not a desirable activity because of resulting back aches, and it is just not fun (Charles J. Mailman 2012).

A large number of tennis balls will be used in any tennis lesson or practice session. All of these tennis balls must be retrieved from the tennis court during and at the end of the lesson or session. Tennis players typically need a tennis ball retrieving device to gather the tennis balls because of the difficulty and inconvenience of bending down to pick up each tennis ball individually. A number of such tennis ball retrieving devices have been developed to date (Kurt G. Beranek 1994).

2.1 Product Review

There are some existing machine of tennis ball collector in the market. In this part, it will show some types of tennis ball collector available in market.

2.1.1 Eagnas Roller Ball Collector

Figure 2.1.1 below shows an Eagnas roller ball collector. Eagnas roller ball collector can help user to quickly and easily gathering up tennis balls on the tennis court. The balls pop up through the bars and get into the barrel section as it is rolled along. The collector can be change up-ended and sits upon the handle once all the balls are collected. However, so much man power is needed to roll the roller ball collector. As much ball is collected, the heavier it will be. So it would be tiring to roll it all over the court. This product can only provide collector but no dryer to dry a wet court.

Figure 2.1.1 Eagnas Roller Ball Collector

(Source: http://www.tennisballmachine.co.uk/access/index.html)

2.1.2 Vacuum Types Collecting Ball

A tennis ball collector shown in figure 2.1.2 was designed on the principle of a vacuum cleaner. Any person can handle it since it is very simple. The capacity of the collector is up to 200 balls. However, it needs human energy to push the machine all around. It also does not provide dryer and just function as a single functioned machine.

Figure 2.1.2 Vacuum Types Collecting Ball

(Source: http://www.tennisballmachine.co.uk/access/index.html)

2.1.3 Rubber Squeegee “Court Ball Collector”

Figure 2.1.3 show a squeegee which is made of aluminum, 145 cm wide, replaceable rubber blade, and 2 durable wheels in front. Rubber squeegee can collect tennis ball. All of the ball collected by the squeegee still need to be collect one by one to be insert in the basket. It will also consume much time to push the product all the way on the court. Transferring ball into the basket will need some energy and will consume time.

Figure 2.1.3 Rubber Squeegee “Court Ball Collector”

(Source: http://www.tennisballmachine.co.uk/access/index.html)

2.1.4 Tennis Ball Retriever and Storage Cart

Figure 2.1.4 shows tennis ball retriever and storage cart. Generally a ball retrieving and storage cart comprises a wheeled carriage that rollingly supports a basket in a ball retrieving position. As an exemplary embodiment, the basket has a front end and a rear end and includes a bottom wall having two side members oriented front to rear and having a normal position spaced apart less than the ball diameter and defining a slotted aperture for entrance of a ball into the basket. In the ball retrieval position, at least one of the side members is a slanted member having a front end higher from the ground than a ball radius and a rear end lower to the ground than the ball radius. Besides that, at least one of the side members is a deflectable member and is biased to the normal position but is sideways deflectable such that a ball on the ground entering the aperture sideways deflects the deflectable member sufficiently for the ball to pass into the basket. The wheels may define a rolling plane. The carriage includes a vertical frame member terminating in a push handle and the vertical frame member includes brackets for attaching a moveable basket at a serving position higher that is than the ball retrieving position (Sam H. Chen 1992).

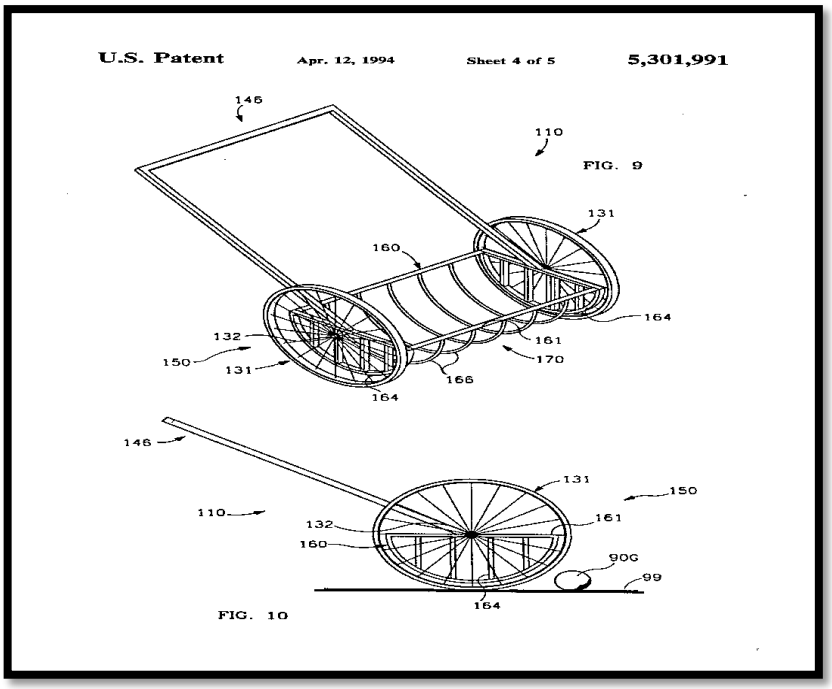

Figure 2.1.4 Tennis Ball Retriever and Storage Cart

(Source: Google Patent US5301991A)

2.1.5 Tennis Ball Vacuum Collector

Figure 2.1.5 shows tennis ball vacuum collector. Tennis ball vacuum collector which increases the speed of picking up numerous tennis balls on a tennis court. Player usually will practice by using automated tennis ball serving machine or an instructor/ coach will serve the tennis ball to the student. Thus many balls are distributed on a tennis court. Certain devices also heavy especially a hand held basket type devices as they become filled with tennis balls. This tennis ball collector generating a vacuum at a port of the ball collector which funneling a plurality of balls on a floor to a central location