SHUTLECOCK FEEDER AND COLLECTER
(SHUFLEC)

PATRICK A/L PETER (08DKM20F1006)
MUHAMMAD HAMIZAN HAIQAL BIN MAZLAN (08DKM20F1052)

JABATAN KEJURUTERAAN MEKANIKAL

SESI 1 2022/2023

NAMA PENYELIA: PUAN NOOR HAZNIDA BINTI ABU BAKAR

POLITEKNIK MALAYSIA
SULTAN SALAHUDDIN ABDUL AZIZ SHAH

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This report was submitted to the Department of Mechanical Engineering as partially meet the requirements for the award of an Engineering Diploma Mechanical.

JABATAN KEJURUTERAAN MEKANIKAL

SESI 1 2022/2023

AKUAN KEASLIAN DAN HAK MILIK

SHUTTLECOCK COLLECTOR AND FEEDER (SHUFLEC)

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PATRICK A/L PETER

(NO.KP: 020105050521)

……

MUHAMMAD HAMIZAN HAIQAL BIN MAZLAN

(NO.KP: 991026065313)

…….

Di hadapan saya,

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(NO. KP;)

…….

Sebagai Penyelia projek pada tarikh …….

DEDICATION

Alhamdulillah pray to Allah because favor and grace from Allah, this work is dedicated to Polytechnic Sultan Salahuddin Abdul Aziz Shah who's without their requirement's these final projects wouldn't be possibly conducted. Besides that, this work is dedicated to our parents who have pass on love of giving and respect on the educations that has demanded us to become a responsible and educated student.

Never forget a lecturer who would like to our project supervisor, Puan Noor Hazninda Binti Bakar from the department of mechanical engineering who has given us courage, support and guidance along my final project. Not forget to Encik Zulkhairi bin Khairuddin for giving us knowledge and ideas on improvise our project

By all the above who has contributed support and courage in us who's without these courage's dedicating us over and over, we would had doubtfully lot of confidence and wouldn't be brave enough to had end our project perfectly and smoothly.

ABSTRACT

In this report a wireless shuttlecock launcher and mechanically operated collector (SHUFLEC) system is designed and fabricated to help badminton athlete and coach improve their training session. The major issue that all athletes encounter during training is that at least two people are required as well as that they cannot train on their own. Other than that, after the training session, wasting time and energy collecting shuttlecocks around the badminton court. This product can be applied in the badminton training to facilitate the player training without the support of another player and no need to waste the time to collect the shuttlecocks around the badminton court that were used during the training session. The initial project design with the aid of Autodesk AutoCAD 2020 and Autodesk Inventor Professional 2020 to revamp the project's design with suitable material selections. The joints of the mainframe are attached through MIG Welding. This project is based on an Arduino Uno. In this project, we perform the following operations using an Android device and an Arduino Uno so we can control the machine using appliances via Android app through HC-05 Bluetooth module. The result for average distance taken of the shuttle feeder part is 8.65m when the machine is operating in the voltage of 1.2V and for the collector part the average time taken to collect shuttlecock using machine is 5.7 minutes while the manual method is 8.8 minutes. This shows that this SHUFLEC machine can make a player to master skills, learn to hit back the shuttle in a correct manner and also can shorten the process as the manual method require the person that collecting to collect the shuttlecock to bow down as they need to collect the shuttlecock on the floor. By developing this SHUFLEC machine can overcome all the issues that we listed before.

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Badminton is one of the hot games to the country to get achieve in higher ranking for player. Many of the other sports support and equipment was provided to produce the world class players. The badminton game can divide into two or four players games. In general, there have many types of shot or service while playing the sport. The shuttlecock is a feathered or (in informal matches) plastic projectile which flies differently from the balls used in many other sports. The flight of the shuttlecock gives the sport its distinctive nature. Shuttlecocks have a high-top speed compared to the balls in other racquet sports. Aside from that, the athlete will face a problem since they will require training help and will be unable to do it on their own or practice alternative shots. Aside from that, at the end of the session, they must gather the shuttlecocks that have strewn throughout the court floor.

In recent years, several advanced machines/tools have developed on this world. One example ofa comparable issue that we may present is an automated shuttle launcher. Furthermore, there are only manually operated shuttlecock collectors on the market. The automated shuttlecock feeder and collectorproject was created so that the athlete can overcome the problem they're having since they'll need training assistance and won't be able to accomplish it on their own or practice alternate shots and collecting the shuttlecocks that have strewn around the court floor at the end of the session.

However according Al Ries et. al, the shifting market place conditions generate endless possibilities to construct new brands and gain wealth. They also mentioned that, in addition to flexible or responsive concept development, pure design efforts may be necessary to fulfillcustomers' demands.

As a result, we have investigated as much research as possible in order to

satisfy the customer's requirements, which are to design a machine that can be controlled by the user and could also adjust speed, angle, and direction, as well as collect shuttlecock after training.

1.2 BACKGROUND OF THE PROJECT

In general, there have many types of shot or service while playing the badminton. The basic shot that must be known is smash, drop shot, middle court and lob shot. Smash shot happened when the opponent gives the ball at high level in the mid court area and hitting back with strong shot to the opponent's floor. For drop shot, we hit the shuttlecock downward and past the net toward the front areas of the opponent. Middle court, we hit the shuttlecock to the opponent mid court and lob, we hit the shuttlecock and over the opponent. Other than that, players will be fed with a large number of shuttlecocks and the training must be stopped to collect all the shuttlecocks. It's not only costing a lot of manpower but it is also delaying the training time. These are several reasons why the automatic shuttlecock feeder and collector SHUFLEC machine needs to be highlighted.

The first reason is through the invention of this product, this machine can deliver the shuttlecocks at different speeds, angle and also able to collect the shuttlecocks after the training session done. The machine also includes a shuttlecock dispenser, a feeding mechanism, automated transmission mechanism so it can collect around the court automatically and an actuator unit. The actuator unit consists of two motors-driven recoiling counter-rotating wheels being fed successively by the feeding mechanism there is gripping the shuttlecock's cap or nose and propelled the shuttlecock in the path of the plane of the wheel. The shuttlecock dispenser comprising a pair of parallel or spiral bar spaced apart and set at an incline to queue shuttlecocks with the noses side down over the feeding mechanism. The feeding mechanism consists of a motor powered by a battery that draws the shuttlecocks from its dispenser and delivers one by one into the ejecting device. Apart from that, according to the data gathered, manually collecting badminton takes a long time and has a serious impact on a person's health,causing back pain and other concerns. As a result, the purpose of the study is to discuss about how to deal with this problem.

Consequently, this will keep players focus on their swing and helps them to hit the shuttlecock inthe right way without having to worry about what their training partner is doing. Players can use this machine anytime they like and anywhere.

They are easy to travel with and mean that players do not have to rely on anybody else to get a decent training session when the time suits them.

1.3 PROBLEM STATEMENT

Nowadays, badminton is one of the most popular sports in the world. It is estimated that there are more than a billion admirers of badminton, particularly in world-class competitions. As a result, thenumber of new players in badminton has increased significantly. Two people are usually required for a training session to be successful. The shuttlecock was fed by one of them, while the serve was returned by the other. There aren't many shuttlecock launchers provided for newcomers or beginners to train andimprove their skill. Furthermore, mastering fundamental shots and knowing how to hit back the shuttle in the proper manner are the most vital qualities. Thus, a support tool can be applied in the badminton training to facilitate the player training without the support of another player. Other than that, there are lot of similar applications in the market today, for example tennis ball launcher. It can be seen that tennis ball launcher plays a huge role in improving the player's performance and development.

Other than that, wasting time and energy collecting shuttlecocks around the badminton court. During training, a large amount of shuttlecock is fed to players. The training has to be stopped before the shuttlecocks can be gathered using a wide mop or broom. Players need to squat down, pick up the shuttlecock and place it into the container. They must go across the badminton court to fetch the shuttlecock, which can be a waste of time and energy. By using a mop or broom to push and gather theshuttlecock may also damage the shuttlecock.

So, this invention allows the user to collect a large quantity of shuttlecocks in the shortest time without causing much damage to shuttlecock. Aside from that, the currently available machine is somewhat expensive, costing roughly RM15000. It will be more difficult to buy the machine, especiallyfor low-income families and others who are newcomers. Furthermore, the delay time for the available machine, where they must modify the height to change other shots to smash, is substantially longer. In the market, there isn't a lot of design choice. Existing design reveals a deficiency in terms of product design and development criteria such as ergonomics, functionality, safety, and ease of use.

1.4 OBJECTIVE

1. To design and fabricate for user friendly shuttlecock feeder and collector machine.
2. To find the correlation between the total distance by the shuttlecock and the speed of dual roller.
3. To identified proper oscillating movement to feed the shuttlecock.

1.5 RESEARCH'S QUESTION

1) Will the objectives of this project be fulfilled?
2) Will this project be able to solve the problems?
3) Will the materials used to be in accordance with the project's specifications?
4) Will the project that has been developed help badminton players in their training?

1.6 SCOPE

In today's world of modern technology, many products are modified to make them easier and faster for people. The SHUFLEC project aims to ensure that the project is carried out in a way that achieves the required goals. The purpose of the project is to be able to adjust the shuttlecock's speed, angle, and direction based on the badminton player's inputs. Apart from that, this machine can collect 50 shuttlecocks at once and recycle them for the following game. It has actual dimensions of (*70x76x121cm*) and can be disassembled and reassembled in small portions.

1.7 PROJECT'S IMPORTANCE

Due to the problems that badminton players have when practicing and collecting shuttlecocks on the badminton court, the idea for "SHUFLEC," an automatic shuttlecock feeder and collector machine, was founded. With the usage of Arduino Uno, users will be able to practice on their own, enhance their skills and abilities by practicing different shots, and save time by automatically collecting shuttlecocks. As a result, all of the problems that badminton players have during training sessions can be solved with it as well.

1.8 CONCLUSION

In conclusion, the background projects, problem statements, and objectives based on the problems stated have all been explained in Chapter 1. Hopefully, this idea will be successful enough tobe tested and manufactured in the end. Lastly, we hope that our project will be useful to all users and will make it easy for people who are new to badminton to get involved.

CHAPTER 2

LITERATURE REVIEW

PART A: SHUTTLECOCK FEEDER
PATRICK A/L PETER (08DKM20F1006)

2.1 INTRODUCTION

The literature study and other relevant information of this SHUFLEC machine will be discussed in this chapter as part of the project's objective. We intend to identify the concepts that are possible for the project in this chapter, and we'll provide users an overview of the resources we investigated through. As a guideline, this chapter will analyze past publications, patents, and initiatives relevant to this project. On the basis of preference data and project relations, research and investigations have been performed. It is important to ensure that the information obtained is adaptable and useful for the next step.

Nowadays, there are several shuttlecock launchers have been developed. However, the existingshuttlecock design is excessively expensive and lacks the variety of alternatives that our product provides. As a result, we decided to reduce the prices and build a new launcher that is both cost- effective and more useful to players when practicing on the court. The shuttlecock dispenser, shuttlecock loading mechanism, and ejecting wheel are the three most significant elements of a shuttlecock launcher. As a result, the research of the following will be presented in this report's literature review:

i. Shuttlecock dispenser

ii. Shuttlecock loading mechanism

iii. Ejecting wheel

According to the research, many sports such as tennis, ping pong, takraw, and paintball have developed launcher machines for training purposes. The machine's system was then examined. Then compare it to an existing shuttlecock

launcher to see which is more effective.

i. Shuttlecock dispenser

A shuttlecock dispenser with a pair of bars separated apart less than a shuttlecock's maximumdiameter, and capable of storing a plurality of shuttlecocks for queued dispensing.

ii. Shuttlecock loading mechanism

A shuttlecock loading mechanism for retrieving shuttlecocks from shuttlecock dispenser andfeeding each shuttlecock to a desired launching position one at a time.

iii. Ejecting wheel

An ejecting wheel assembly comprising a pair of ejecting wheels for gripping and propelling a shuttlecock cap at launching position by friction, thereby launching shuttlecocks fed by loading mechanism, each wheel defining a respective wheel plane, indexing means for selectively indexing the pitch of the wheel plane about a wheel horizontal axis, and recoiling means for allowing ejecting wheelsto recoil laterally at various wheels.

2.2 PREVIOUS RESEARCH

Table 1: Shuttlecock Feeder

About	Description
NAME OF PRODUCT	Shuttlecock Feeder
MECHANISM	When practicing badminton, this toolshould be draped around the player's neck to make it simpler for him to retrieve the shuttlecock from the storage. 
ADVANTAGE	➢ Easy to take the shuttlecock out fromthe storage. ➢ Can practice alone without any helpfrom others.

DISADVANTAGE	➢ Only a little amount of shuttlecock may be placed at one time. ➢ During a training session, a device worn around the neck distracts theplayer.

Table 2: Smart Badminton Shuttlecock ShootingMachine

About	Description
NAME OF PRODUCT	Smart Badminton Shuttlecock ShootingMachine
MECHANISM	The shuttlecocks are loaded into their designated dispensers, and the wheelmotor is turned in the other direction. Theshuttlecock will be supplied to the wheelsfrom the dispenser using a stopper to ensure that each shuttlecock enters the wheel one at a time. 
ADVANTAGE	➢ The shuttlecock is launched using an automated system. ➢ Toss the shuttlecock effectively up to a distance of 10.3 metre. ➢ The quality of the ball thrown in the constructed machine is superior to that of manual training.
DISADVANTAGE	➢ Only a little amount of shuttlecockmay be placed at one time.

	➢ During a training session, a device worn around the neck distracts the player.

Table 3: Badminton Shuttle Feeder

About	Description
NAME OF PRODUCT	Badminton Shuttle Feeder
MECHANISM	Operators must accompany these dispensers in order to handle and feed the shuttlecocks via the moving wheels. When the shuttlecock passes through it, the battery will power both the motor that turns the horizontal arrangement wheel and produces a force. 
ADVANTAGE	➢ The shuttlecock is launched with great force. ➢ Using motor resources, the feeder may be placed almost anyplace ➢ The person feeding the shuttlecock through the feeder determines the shuttlecock launch timing.

DISADVANTAGE	➢ To put this feeder at the proper angle,you'll need a stand support tool. ➢ Requires someone to reload theshuttlecocks and feed it to the feeder.

2.3 PRODUCT IN MARKET

Table 4 show, three main existing products. Knight Trainer is the first, Apollo Trainer is the second, and LNX-F1000 is the third. We compare the full feature to see what significant bits are in each computer based on the information we received.

The Knight Trainer Pro is far more advanced with unique control features and versatility, capable of feeding smashes, drives, clears, drops, net shots, short serves and long serves in continuous sequences, whether random or in your chosen order, for up to 250 shots before refilling. Meanwhile, The LNX-F1000 is mounted on a sturdy telescopic base that enables you to manually raise or lower the shooting head. The trajectory of shuttlecock feeding can be further adjusted by manually directing the feeding wheels to the desired position. We obtained that the Apollo Trainer was too slow because its feed rate is a maximum of 1 in 1.2 seconds.

Table 4: Product in Market

Feature	Knight Trainer	APOLLO TRAINER	LNX-F1000
Model			
Randomizes	YES	YES	YES
Price	RM 15 000.00	RM 17 000.00	RM 12 325.00
Shuttlecock dispenser	200	250	200
Max Velocity (m/s)	44.3	58.1	38.8
Method	Two rotating wheels	Two rotating wheels	Two rotating wheels
Height (m)	1.0-1.8	1.0-1.7	0.2-0.7
Launch degree	-18-30	-15-65	No limitation
Portability	Portable	Portable	Portable

Actuator driver	Motor	Motor	Motor
Type of shot	1) Net shots 2) Mid court 3) Cross court net shot 4) Lob smash	1. Drop shot 2. Lob 3. Smash	1) Drop shot 2) Lob 3) Smash
Remote control	No	Yes	Yes

2. 3 COMPONENTS

2.3.1 AC to DC Power Converter 12V – 13.8V

Figure 1: AC DC Power Converter

AC to DC power converters is an electrical circuit that transform alternating current (AC) input into direct current (DC) output. They are used in power electronicapplications where the power input a 50 Hz or 60 Hz sine-wave AC voltage that requires power conversion for a DC output.

2.3.2 Rechargeable Battery 12V

Figure 2: Rechargeable Battery 12V

This battery is frequently utilized in a variety of outdoor applications that demand more energy to function properly. If the electronic product is used frequently,however, it may be preferable to utilized a rechargeable battery.

2.3.3 Rack and Pinion

Figure 3: Rack and Pinion

A rack (or “linear gear”) and a pinion (or “circular gear”) compensate a rack and pinion transmission system. Straight or helical teeth can be used in a rack and pinion drive, however helical teeth are more commonly utilized due to their higher load capacity and quieter operation. The greatest force that can be delivered by a rack and pinion drive system is mostly governed by the tooth pitch and pinion size.

2.3.4 DC Motor

Figure 4: DC Motor

A rotating electrical machine that transforms direct current electrical energy into mechanical energy is known as a DC motor. The most popular varieties rely on magnetic fields to create forces. Almost all DC motors contain an internal mechanism,either electromechanical or electronic, that changes the direction of current flow in a portion of the motor on a regular basis. The Fleming left hand rule is used to operate DC motors. Tools, toys, and appliances all employ small DC motors.

2.3.5 Servo motor

Figure 5: Servo motor

This mechanism will launch the shuttlecock by depending on the volt that powered the motor. The wheel motor will rotate in opposite direction to throw the shuttlecock. A substantially straight shuttle flight will be delivered from this machine when both wheels are rotated at the same speed.

2.3.6 Heavy Duty Wheel with Locking

Figure 6: Heavy duty wheel with locking

Due to their excellent durability, heavy duty type wheels were chosen for this project. Furthermore, this project's idea makes use of wheels to move the project and accommodate the load while moving. It is located at the bottom of the four-piece SHUFLEC Machine. The wheel may also be rotated 360 degrees and locked for further safety.

2.3.7 Galvanized Hollow Iron

Figure 7 : Galvanized hollow iron

This hollow iron is used to serve as a frame at the base of the machine. The strength of this material is able to withstand the weight of the machine. So, this machine will stand firm without any problem.

2.3.8 Aluminium Plate

Figure 8: Aluminium plate

The aluminum plate serves as the material to be welded into the rectangular box to house the main mechanisms of this machine such as the rotating wheels, feeders, motors and other component related. It was a low-cost material and durable, so it was very suitable for use as a storage box for this machine.

2.3.9 Arduino

Figure 9: Arduino Uno

It provides with everything user need to get started with a micro controller, all have to do is plug it into a computer with a USB connection or turn it off using an adapter or an AC-to-DC battery.

2.3 SUMMARY

Based on our research, we believe that the project we're working on can provide a variety of benefits to users, such as assisting players in gathering all of the shuttlecocks in the lowest amount of time feasible without wasting time and energy going around the badminton court, and so on. As a result, the players no longer require a training partner or coach and can practice more accurately on their own.

PART B : COLLECTOR
MUHAMMAD HAMIZAN HAIQAL BIN MAZLAN (08DKM20F10052)

2.1 INTRODUCTION

In this chapter, we analyze shuttlecock collectors in extensive detail. With the aid of cutting-edge technology, this product can move around the badminton court and collect badminton after training. Additionally, it can make picking up shuttlecocks after exercise on badminton courts easier.

2.2 PREVIOUS RESEARCH

Observation to generate new ideas with the goal of simplifying tasks, reducing workload, and most importantly avoiding wastage of resources like time, money, and energy. Talking with friends can also help to generate innovative thinking.

2.2.1 TYPES OF TIRES

PRODUCT	ADVANTAGE	DISADVANTAGES
 **RC TIRE**	▫ This tire is one of the tire types that is suitable for this project because it is light in weight and has a suitable width.	▫ Small size and also no specific measurements for this project.

 **LAWNMOWER TIRE**	▫ The tires are small and light, and they also have excellent floor grip. Quality materials were also used to make these tires.	▫ In comparison to other tires, these high-quality tires are expensive.
 **WHEELBARROW TIRE**	▫ Due to its significant surface area and low cost, this kind of tire is ideal for use in this project.	▫ These tires need to be combined with an appropriate motor because they are too heavy to move on their own.

2.2.2 TYPE OF MOTORS

I. BRUSHLESS MOTOR

FIGURE 10: BRUSHLESS MOTOR

A motor converts supplied electrical energy into mechanical energy. Various types of motors are in common use. Among these, brush less DC motors (BLDC) feature high efficiency and excellent control ability, and are widely used in many applications. The BLDC motor has power-saving advantages relative to other motor types..

II. MOTOR AC

FIGURE 11: MOTOR AC

AC motor is an electric motor driven by an alternating current (AC). AC linear motors operate on similar principles as rotating motors but have their stationary and moving parts arranged in a straight-line configuration, producing linear motion instead of rotation. This motor provides continuous flow but the more the electromagnetic interference and the more the energy consumption.

III. PAPER CORE TUBE

FIGURE 12: PAPER CORE TUBE

This component is used as a shuttlecock's dispenser. The diameter of the paper core tube can fix with the shuttle cock diameter.

IV. CATGUT STRINGS

FIGURE 13: STRINGS

To raise the shuttlecock, they will be mounted or linked to the wheels. Additionally, it will be installed on six sections to raise three shuttlecocks at once.

V. HOLLOW IRON

FIGURE 8: HOLLOW IRON

This component is applied as a project framework due to its hollow design, which makes it ideal for use on various parts. especially on the component that requires drilling only on one surface.

2.3 SUMMARY

I have discussed the main parts of this project in this sub-topic. Despite the large number of products on the market, we think that ours has a privilege. This is so because the product satisfies all necessary requirements. Subsequently, this sub-topic can provide some basic information on one of the parts of our project

CHAPTER 3:
METHODOLOGY

PART A: SHUTTLECOCK FEEDER
PATRICK A/L PETER (08DKM20F1006)

3.1 INTRODUCTION

A methodology is a process or a method used to more thoroughly carry out thetasks. It also includes a methodical, theoretical review of the approaches used in the field research. This includes knowledge of branch-related methodologies and system theory analysis. It often involves ideas like paradigms, theoretical models, processes, and quantitative or qualitative methodologies. This phase of the development of a project is important for making sure it is completed on time.

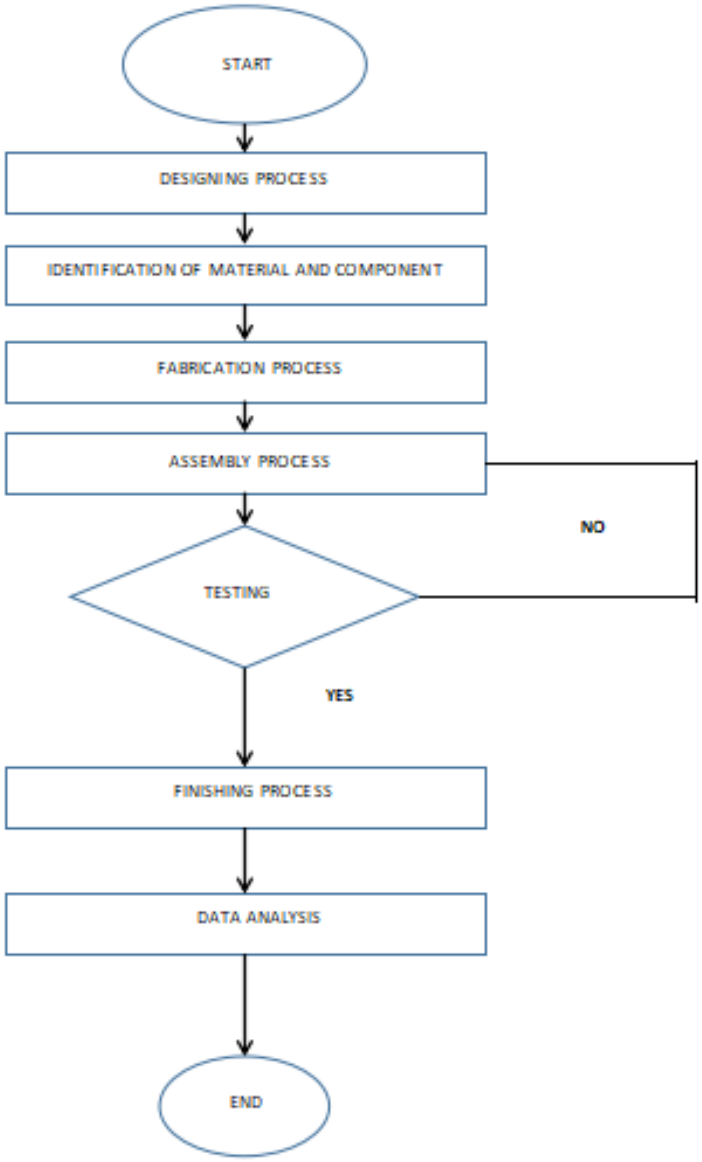
There are two important things that will be combined to develop the wireless- controlled shuttlecock launcher which are hardware mechanics and software. The hardware mechanics consists of the feeder, the launcher, the wireless-controlled micro-controller, and the prototype base. The software part consists of codes that will control movements such as the launcher elevation, the launcher rotation, and the launcher rotation speed. The code is developed by using Arduino IDE because Arduino is the micro-controller of choice.

To ensure the project runs successfully, methodology plays an important role. The technique also makes it simpler for anyone to study about a project that is alreadyunderway because it includes all the steps necessary to structure a project, which takeslonger to prepare.

In this chapter, I have been through the research study, data collecting techniques, research tools, project development procedures, data analysis techniques, and chapter summaries.

3.2 FLOW CHART

A flowchart is used to choose and identify the best design while choosing a design. Based on the findings that might pass through this flow chart, the researcher's design was chosen.



3.3 TECHNIQUES FOR PROJECT REVENUE

The prototype of a shuttlecock launcher wireless system was used the dual roller type by referring from past researches as this can launch shuttlecocks consistently as compared to other methods. To control the operation of the hardware actuators, a wireless control method will be implemented.

Apart from that, the shuttlecock trajectory launch angle must be accurately set so that the shuttlecock will shoot to the desired destination by adjusting the motor's rotation. A micro-controller is needed to manipulate the angle of variance to adjust themotor speed. Since Arduino is cheap and readily. Available, it will be used as the controller since the Arduino offers fast deployment and has better features than the traditional PIC. All hardware trigger operation is controlled by a wireless method via smartphone communication.

3.2.1 Hardware development

In this subtopic, the component's specifications and functioning will be discussed. There are four main components that are split into two portions for the creation of mechanical hardware. The launcher portion is stated with a DC brush motor, servo motor, Arduino micro-controller, and BTS 7960 module.

Table 5: Table of component

Component	Function
DC brush motor 	A motor with high speed is needed to propel a shuttlecock far away. Therefore, it is suggested to utilize a DC brush motor with a rating current of 24 Volts and 3.4 Amps. Given that the shuttlecock weighs around 5.2 grams and has a specification of 0.125Nm torque, 52-watt output power, and a maximum speed of roughly 5000 RPM without load, this is a decent motor to utilize for the launcher.
Servo motor 	Since the MG995 servo motor requires 5V and 0.3A, the same power source as the Arduino, it must be utilized to drive the feeder separator. This servo motor's specifications include 0.32 N/m torque, 133 watts of power output, and dimensions of 95 mm in length and 650 grams in weight.

Arduino micro-controller 	A complete stack TCP/IP capable micro-controller is included in the low-cost Wi-Fi chip NodeMCU ESP32. Open-source, interactive, re programmable, affordable, Wi-Fi enabled, and easy plug-and-play are a few of its features. Six of the 14 digital input/output pins of the Arduino Uno may be utilized to output PWM. In addition, this micro-controller has a 16 MHz crystal oscillator, an ISP header, a power socket, a USB port, and a reset button to clear all of the programming and the circuitry. The recommended input voltage range is 5V–7V, and the recommended DC current per I/O pin is 40mA.
BTS7960 module 	This module is a half-bridge motor controller that can determine clockwise oranti-clockwise motor rotation. The operating voltage is up to 24 volts and formaximum usage it can operate at a continuous current of 43 amps.

3.2.2 Concept of a feeder

The feeder plays a crucial role in the shuttlecocks' successive launch. The feeder mustrelease each shuttlecock in a continuous stream. The shuttlecocks must be kept in a cylindrical or tubular-shaped casing. The shuttlecocks will be held horizontally so thatthey may be released to the launcher using gravity.

3.2.3 Concept of trajectory launcher

Due of its low cost and high efficiency rate, the launcher will employ a twin roller. Onthe 12V DC brush motor, this twin roller is installed. The roller is 7 mm thick and has a radius of around 45 mm. To allow the shuttlecock to pass between the two rollers using frictional force, there is a 20 mm space between them. The configured PWM circuit and Arduino micro controllers will regulate the roller speed.

3.2.4 Software development

The initial idea is then simulated using software, and once simulation is successful, the electrical circuit design is finalized. This is important to ensure that all the connection goes in the right direction. The following section describes the software used in this stage.

To develop Arduino board, we used C and C++ programming language based micro-controller. The Arduino IDE is used in development as it is very easy to useand has a vast library of open source coding. Arduino IDE is downloaded from their website free of charge as shown in figure 10.

Figure 10: The Arduino Software

Apart from that, one of the main requirements for this project is the smartphone app that will be used to manage the functioning of the entire hardware prototype. Using Bluetooth and radio frequencies, the app will wirelessly connectwith the prototype. The advantage of wireless communication is that it makes a gadget genuinely portable and free of heavy cords. Since the prototype may be used remotely, the user won't be harmed by any unexpected events that may happen whileit is in use.

Figure 11: Blynk applications

Auto-Cad is a three-dimensional (3D) drawing software (INVENTOR) used to create prototype drawings and simulate the operations. Universities and industries alike have adopted this software as the main design software. Some parts of the project will be 3D-printed in which Auto-Cad software is used to create the design as shown in figure below;

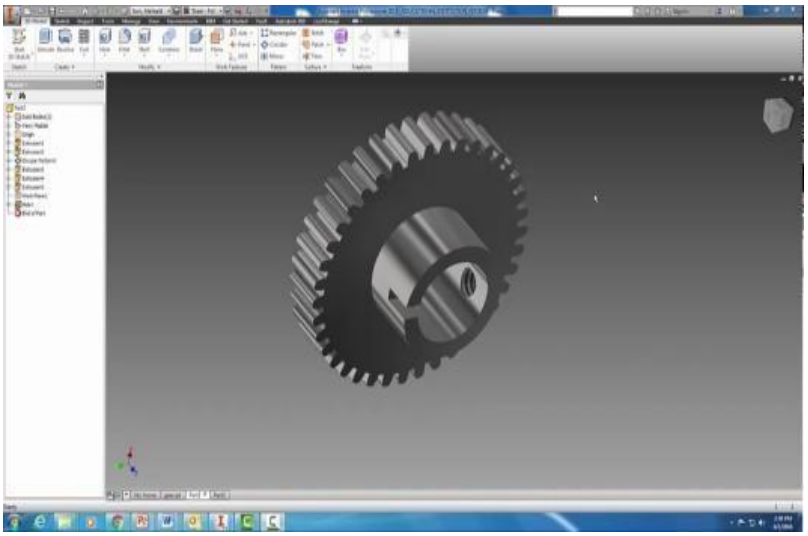


Figure 12: Inventor Software

3.4 SUMMARY

The components in project production are the main emphasis of this chapter. This technique allows us to learn in depth how product innovation is carried out. The approach also covers the guidelines and practices of a manufacturing project.

PART B: COLLECTOR
MUHAMMAD HAMIZAN HAIQAL BIN MAZLAN
(08DKM20F1006)

3.0 INTRODUCTION

A methodology is a process or approach used to more thoroughly carry out a job. In this chapter, I'll go through the first process of analysis that was put in place, covering material costs and other expenses directly connected to the SHUFLEC machine's deployment.

3.1 TECHNIQUES FOR PROJECT REVENUE

A preliminary sketch of the shape has been discussed with the group members once all the design-related information has been established and debated in order to come up with a design that is adequate in terms of strength and safety characteristics. It is also necessary to consider the evaluation of all the preparations made as well as the suitable size measurement variables. It is essential to give attention to the design and assessment of materials. To ensure that only appropriate and pertinent materials are utilized, the soldering procedures and wire connections on the circuit must also be examined.

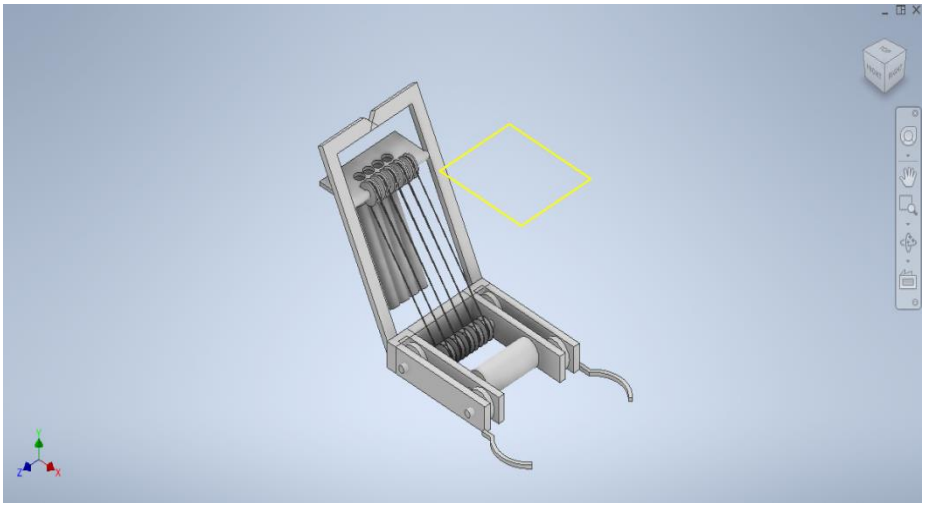


Figure 13: A badminton collector's look as seen from left.

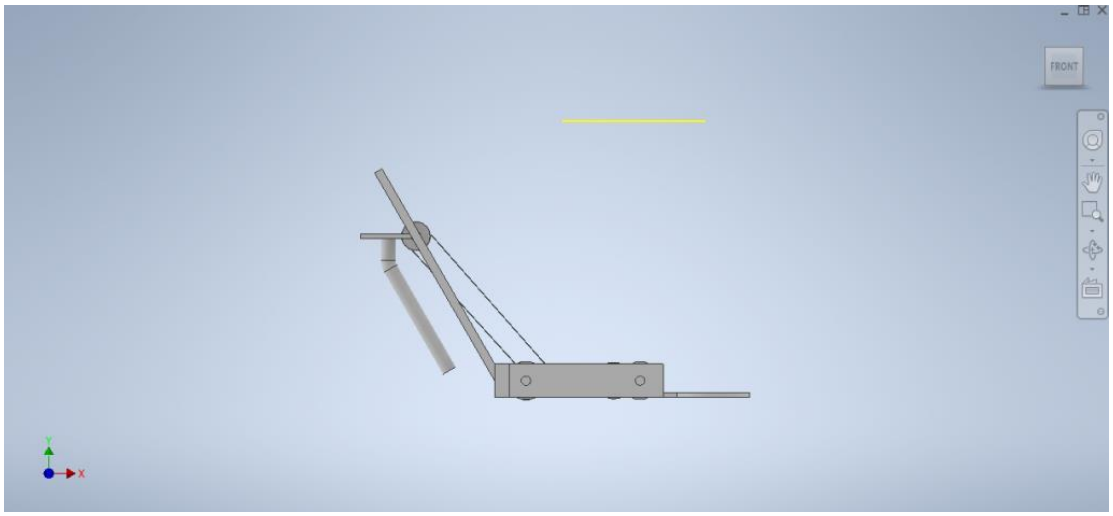


Figure 14: A badminton collector's side view.

In the process of producing a badminton collector at SHUFLEC, various components or parts need to be carefully designed before it can be carried out in order to be completed in the planned time. These parts will be produced based on the finalized design drawings. Each part will follow the measurements that have been set to avoid unexpected problems from occurring. Figure 15 shows the steps from the beginning of the production of the drawing to the testing process

STEP 1: Drawing Process in The Inventor

The process of sketching and drawing a project is used as a guide and reference facilitate manufacturing as well as installation work. In this step I have drawn this drawing on a laptop using the Autodesk Inventor 2020 application. The resulting drawings are in 2D and 3D form so that the project illustrations can be seen clearly from various angles and views.

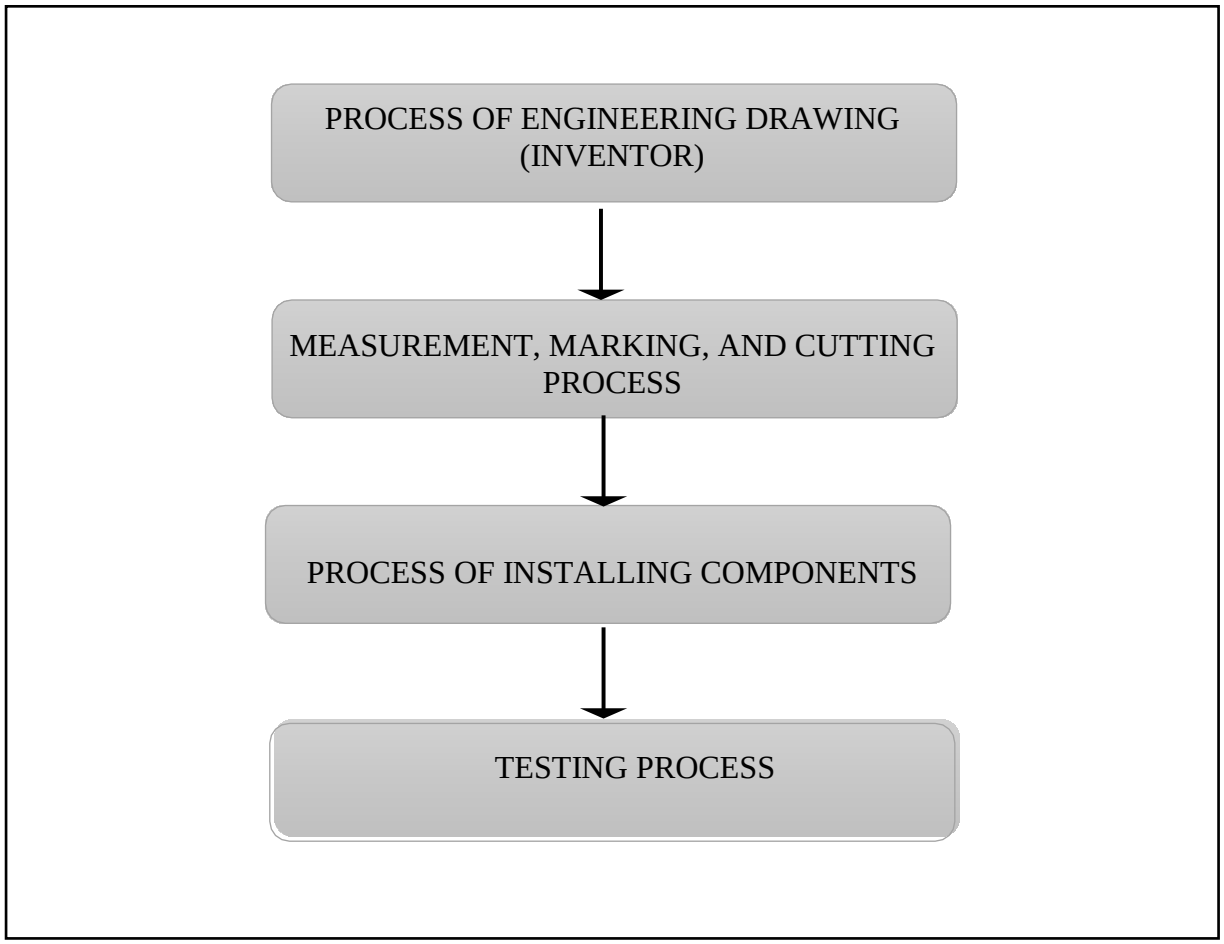


Figure 15: A badminton collector's process

STEP 2: The Process of Measuring, Marking and Cutting

This process is done to get the right size. Marking and measuring work should be done accurately and meticulously as slight inequalities can affect the size of a project to be produced. In this process, the 'paper core tube' and the hollow iron that will undergo all the processes of measuring, marking and cutting according to the length in the already drawn design. While other components will undergo the process of measuring and marking only.

STEP 3: Component Installation Process

The component assembly process for this badminton collector is started by installing the tires and also connected to the brush section as well as the rope actuator.

From the rotating tire, other components will also move once. Not forgetting also, the part of the frame that uses hollow iron. On the skeletal part it requires a high degree of expertise to connect with other components. The tires also require repulsive force from the motor connected to the Arduino board as well as the battery.

STEP 4: Testing Process

After all the installation processes have been completed, the process of testing the circuit run and connecting the electrical equipment will be done to identify its smoothness and weaknesses. If there are any problems such as brushes or badminton not going up on the ropes, this matter needs to be addressed immediately.

3.2 MATERIALS AND EQUIPMENT

BIL	MATERIAL	QUANTITY	PRICE
1	Galvanized hollow iron	1	RM25
2	Motor 12 dc	1	RM35
3	Wire	1	RM15
4	Paper core tube	1	RM5
5	Arduino	1	RM45
		TOTAL	RM125

The collected data and information underwent analysis and processing to provide findings and problem-solving research. To discover correlations between the data and make comparisons between the data, this data and information were evaluated. To make it easier for the reader to grasp the findings of the data analysis and draw conclusions about the study, the results were further displayed in the form of graphs.

3.3 SUMMARY

The stages involved in producing a project are the main emphasis of this chapter. We can learn more about the specific procedure for our innovative items using this technique. The approach also explains how the project manufacturing guidelines and practises work.

CHAPTER 4: RESULT AND DISCUSSION

4.1 MARKETING SURVEY

After collecting responses from strangers and some students from Politeknik Sultan Salahuddin Abdul Aziz Shah's mechanical engineering department, the analysis of the data was completed as figure 12 below.

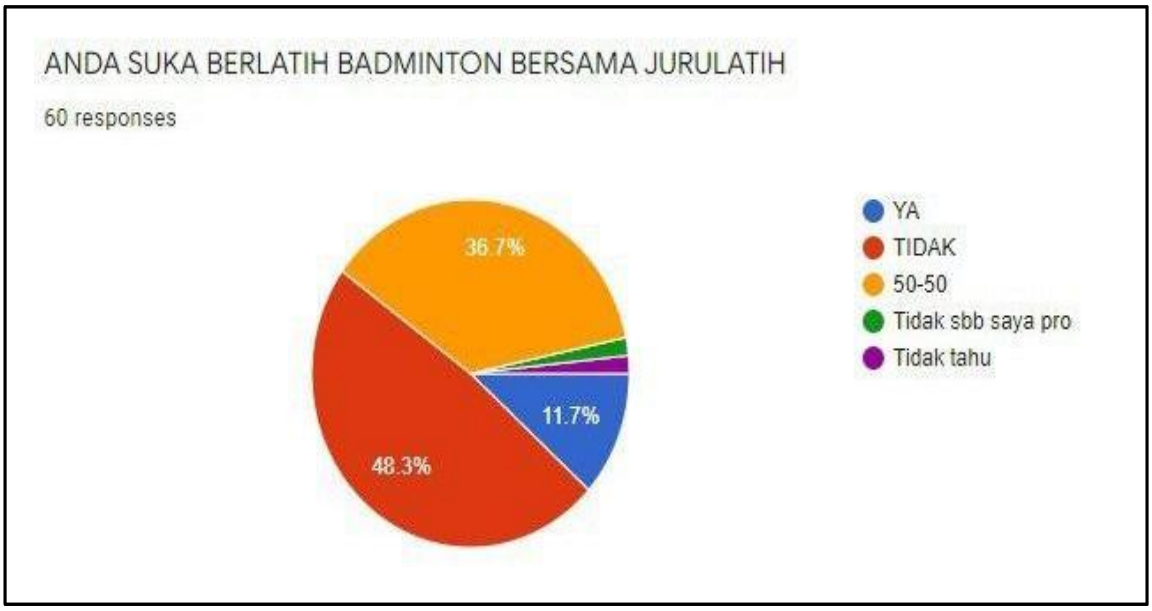


Figure 16: Feedback from user

As is common knowledge, a partner is necessary to play badminton. We still need assistance servicing the shuttlecock so we can hit it, even during a practice session. Therefore, it is not unexpected that many of the respondents, 48.3% of them said they dislike training with their trainer. Hopefully, our effort will aid in solving their issues.

Figure 17: Feedback from user

According to **Figure 17**, 73.3%, or 44 out of 60 respondents, expressed with using the SHUFLEC machine so they could train independently. Additionally, the majority of launchers available were for takraw, tennis, handball, volleyball, and othersports. A shuttlecock launcher for badminton practice was hard to come by.

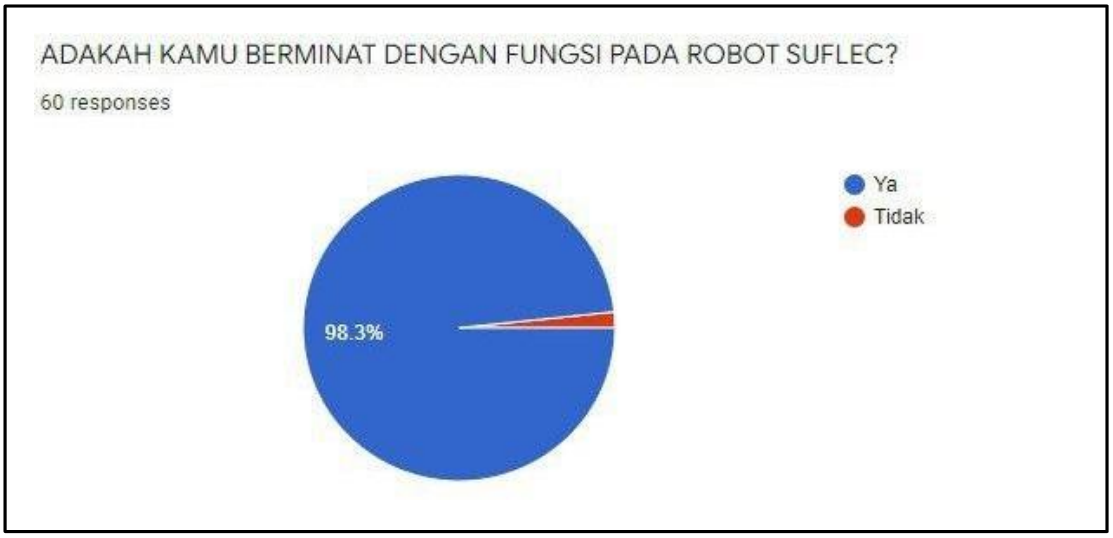


Figure 18: Interested to use Automatic Shuttle Feeder Machine

The **Figure 18** shown 98.3% or 58 over 60 of respondent agreed that they were interested to use Automatic Shuttle Feeder Machine. The respondent also can increasetheir skills in badminton when they training the shot using this machine.

We can conclude from this survey that the majority of respondent's favor having a machine that can help them in training their badminton abilities as well as collecting the shuttlecocks when the training is completed. As a consequence, our project will be very useful to someone who is struggling with a similar problem. This is due to the fact that it may help badminton players in overcoming back discomfort when collecting shuttlecocks, as well as improving their training efficiency.

4.2 ANALYSIS

The data and information obtained are analyzed and processed to obtain conclusions and problem solving in research. In attempt to discover correlations and similarities between the data, these information and data have been evaluated. To make it easier for the reader to comprehend and draw conclusions about this study,the findings of the data have been more thoroughly evaluated in the form of bar graphs. Table below shows the correlation between the total

distance by the shuttlecock and the speed of the dual roller discs.

Table 6: The analysis data

Shuttlecock	Voltage	Distance (m)
1	0.5	2.5
2		3.6
3		3.2
4		3.5
	Average	3.2
5	0.75	6.2
6		7.1
7		6.6
8		6.5
	Average	6.6
9	1.2	8.2
10		8.5
11		9.2
12		8.7
	Average	8.65

The correlation between the total distance by the shuttlecock and the speed of dual roller discs is completely proportional, according to the results. The greater thespeed of the two roller discs, the greater the distance travelled by the propelled shuttlecock.

4.3 ASSEMBLY RESULT

Figure 15: Finish product

4.4.1 Objective Project 1

As a result, the results show that the speed of twin roller discs and the overall distance travelled by the shuttlecock are inversely related. The propelled shuttlecock travels a larger distance the faster the two roller discs are spinning.

4.4.2 Objective Project 2

Apart from that, the Shuttlecock Collector Machine is able to carry out its

intended function. By carefully organizing the shuttlecocks and saving 35% of the time normally spent picking them up off the floor. The shuttlecock is already stacked when it is retrieved by the machine, thus there is no need for players to manually stack the shuttlecock, which protects the feathers of the shuttlecock and saves time. The machine's pulley design will take care of the feathers, and the wheel will make moving the machine simpler. The fact that this collector machine doesn't require a large staff to run will also be a huge plus for the gamer.

4.4.3 Objective Project 3

Last but not least, it is advised that users press the shuttlecock collection device gently to prevent shaking, which will result in the shuttlecock falling out and failing to stack into the container. The user may find it simpler to transport the collecting machine from one location to another if lighter materials are used to reduce the weight of the device. Allowing the Shuttlecock Collector Machine to travel about the court without requiring human power will make it easier.

4.5 SUMMARY

In conclusion, after countless discussions and exchanges of goodsto be used, it is able to set the best for all. In addition, the project that currently on going, SHUFLEC (Automatic Shuttlecock Feeder and Collector machine) can reduce the cost if the user wants to buy it because the price of the shuttlecock launcher in the market is very expensive for players and also can help them in training their badminton abilities as well as collecting the shuttlecocks when the training is complete.

CHAPTER 5
RECOMMENDATIONS & CONCLUSION.

5.1 RECOMMENDATIONS

They are typically two different types of feeding mechanisms; compressed air or electrical motors, which is are currently the most used.

The advantages of using an electrical motor are that is simple to use, essentially plug and play and if you are handy, you might be able to changes the motor on your own if something g goes wrong. The shuttle's speed will be slower with an electrical motor because most of them have a top speed of 140km/h. this speed might not be a problem if use for beginner and intermediate players. Since an electric motor shuttle feeder will always point to the spot where it will place the shuttle, the player may cheat or at least attempt to.

The collector part is able to perform in intended purpose. Its help reduces 40% of the time picking up the shuttle on the floor while also arrange it accordingly. This collector part will not damage the shuttle feathers and will save the players time because does need to manually stack the shuttle as it is already stacked when it is collected by the machine. The machine pulley concept will take care of the feathers and the wheel will help to move the machine easily.

The suggestion for the user will be the user need to push the shuttlecock collector machine slowly to prevent shaking that will make the shuttlecock fall and failed to stack into the container. Using more lightweight materiel to reduce the weight of 20kg project. Make the collector operate fully automatic to ease the user more by moving itself around the court without using any human power.

5.2 CONCLUSION

The objective of this project has its own interests and objectives. Shuflec has been developed to make it easier for badminton players to practice on their own. in addition, it can also make it easier for players to collect badminton that is littered around the court. it can also prevent serious injuries such as spinal pain and asthma

The final project is expected to be utilized fully, accepted and adopted and in accordance with the development of technology in this era as well as the results obtained from this project can meet the needs of all users

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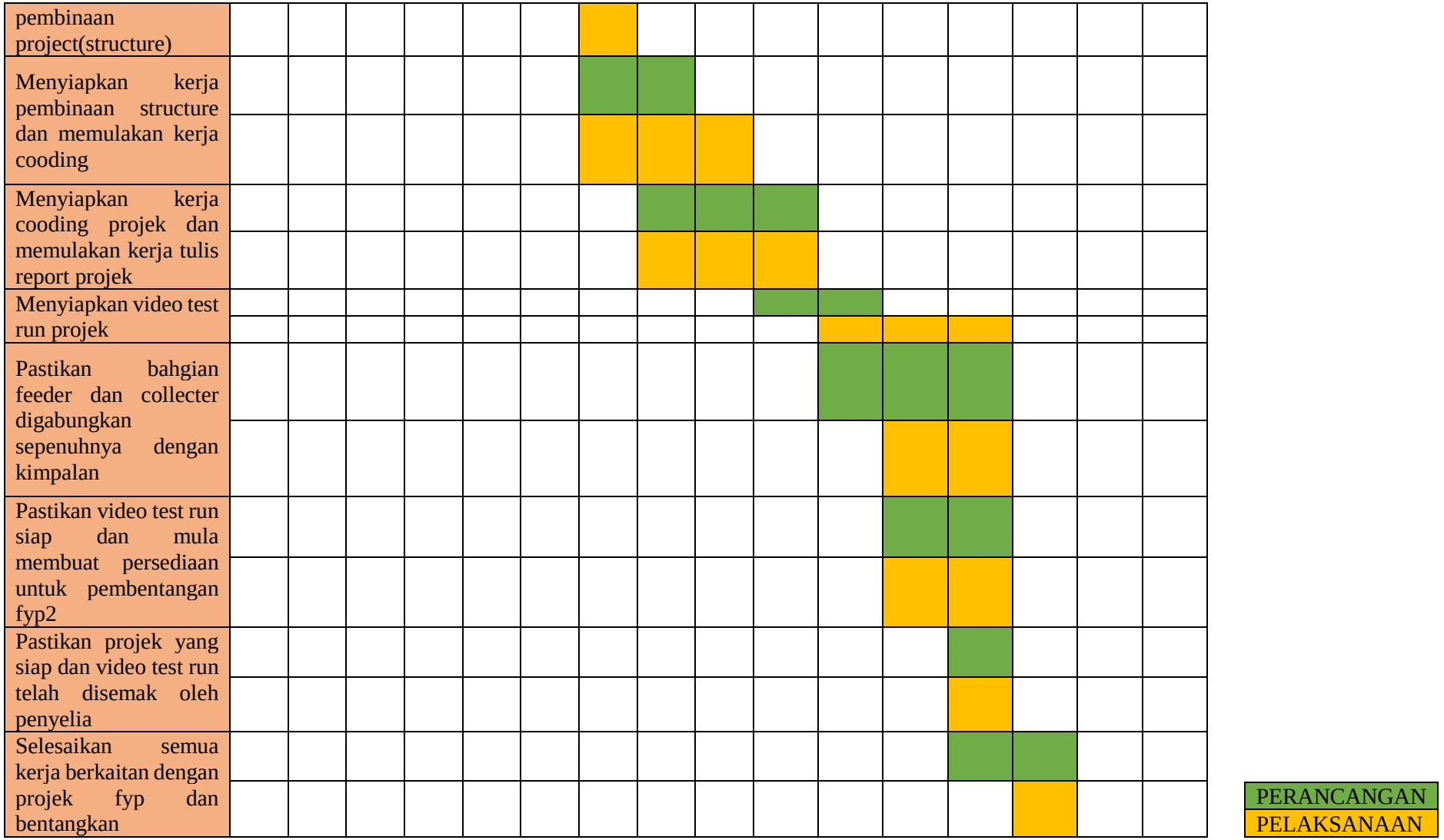
APPENDICES

MINGGU/ AKTIVITI PROJEK	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	M16
Menghadiri taklimat mengenai fyp2 dan juga taklimat tentang mendaftar Isloms																
Perjumpaan bersama penyelia dan menerangkan tentang setiap bahagian projek																
Kami telah senaraikan barang yang perlu digunakan dan tempah secara atas talian																
Kami telah bermula untuk membuat struktur projek kami iaitu bahagian shuttle feeder dan collecter																
Menghadiri program arduino untuk mengenali lebih lanjut tentang cooding																
Memulakan kerja membeli barang sepertimana yang telah disenaraaikan																
Memulakan kerja																


pembinaan project(structure)
Menyiapkan kerja pembinaan structure dan memulakan kerja cooding
Menyiapkan kerja cooding projek dan memulakan kerja tulis report projek
Menyiapkan video test run projek
Pastikan bahgian feeder dan collecter digabungkan sepenuhnya dengan kimpalan
Pastikan video test run siap dan mula membuat persediaan untuk pembentangan fyp2
Pastikan projek yang siap dan video test run telah disemak oleh penyelia
Selesaikan semua kerja berkaitan dengan projek fyp dan bentangkan
PERANCANGAN
PELAKSANAAN