

PROJECT 2: DJJ50193

Diploma in Mechanical Engineering

Title	Handicap Gaming Controller
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We highly appreciate every helpful advice and comment given as we conduct the research and study for our project “Handicap Gaming Controller”.

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ABSTRACT

Our current gaming controller doesn't let video games playable for their user that has a disability that can use it only with their right hand. Handicapped gaming controller is a project which will bring great benefits to people whose left hand is handicapped. Because the project is an attachment that could be perfecting the idea within the existing disability gaming controller inventor community ideas by making an attachable disability tool which are fully mechanical with a case cover protection onto the controller that allowed handicapped users to play the game. A survey was carried out to find out people opinions regarding the handicapped gaming controller. The results came out overwhelmingly great towards the introduction of a handicapped gaming controller.in addition to that, the PLA/CFRP material that being used on the handicap gaming controller is fabricated by a 3d printer .It was designed to withstand a falling impact and to be fully mechanical to assist the left side of the ps4 controller and tranfer its function to the right hand side for it users. Other than that ,some lights that can be controlled using the internet of things (IoT) with MohuanLED apps are added to the attachment to keep up with the trend in the market as a gaming invention.In general, this invention could help for those who don't have a left hand to play video games as a hobby, not just that it also can build a career in the field of gaming amongst the disability community.in the hope for the future prospect,if this project could be work on in a bigger scale, our team is gladly to do some improvement on this project innovation by creating another disable gaming controller tool that can be used for disable users, which can only controll the it with their left hand.

Keywords: *handicap, console, gaming controller, improvement.*

CHAPTER 1 : INTRODUCTION

1.1. INTRODUCTION

Handicap gaming controller is a project that will benefit people whose left hands are handicapped. A survey was conducted to find people's opinions regarding handicapped gaming controllers. The results came out overwhelmingly great towards the introduction of a handicapped gaming controller. A quantitative method was used in which we create a google form to gather the responses we needed for our project. A total of 23 responses were recorded. The results were 87% would purchase the handicapped gaming controller if were handicapped and 13% would not purchase the product if were handicapped. The responses' results strongly agree that the handicapped gaming controller is a great product and will make their gaming interest dream come true for people whose left hands are handicapped. Last but not least, the results from this survey strongly suggest that the handicapped gaming controller has to be in the market for the well-being of the people whose left hand is handicapped.

1.2. BACKGROUND

However, there a lot of progress has been made in the gaming industry in recent years, and there are still challenges in the most inclusive experience for those living with disabilities, from a lack of basic in-game features. In order to move forward to greater accessibility in gaming, we must continue to create games with assistive technology, challenge ableist beliefs surrounding gaming, and dismantle stigmatized perceptions of disability.

In this project, we want to produce a handicapped gaming controller. This device operates one hundred percent using an attachable mechanical device. This allows users with no left-hand disabilities to use their right hand without tiring their bodies. Next, the Bluetooth LED application control system built into this project can be controlled as far as 500 meters from the controller. This can provide an aesthetic as the users wish when using the gaming controller just like the other gaming big tech companies where LED lights are applied to the gaming device for aesthetic purposes.

1.3 PROBLEM STATEMENT

PROBLEM	SOLUTION
Console controllers are made for two-handed.	Invent a console controller for 1 handed user.
Console controllers are useless if the controller itself is broken.	Invent an attachment on a console controller so it can be attached to a different console controller to replace the old ones.
Most Wireless console controllers do not up to date with the trend.	Install an extra light to upgrade how the way it looks just like other tech gaming companies in the market nowadays. For example. Razer gaming.

1.4 OBJECTIVE

Listed below are the research objectives:

1. To invent a disability tool within the gaming community for example (a handicap gaming controller).
2. To test the durability and effectiveness of the innovation to the left less hand disability community.
3. Assisting the disable user whos have no control on their left hand and thus the design of the project is to fully to create the mechanical attachment that tranfer its function to the right hand side for it users on the ps4 controller.

1.5 PROJECT QUESTIONS

The Final Year Project of this semester is one of the most important requirements for the students in the DJJ50193 Project course to obtain the Diploma in Mechanical Engineering. To implement the Final Year Project, the students in each group have to go through some procedures according to the Gantt Chart Project provided by the Project supervisor. Before getting into the procedures of the project, the students are given the freedom of method to complete the project. First, the students in each group will select their supervisor to guide them through the project on week 1. Our supervisor is Mr. Khirudin. Second, the students are given the freedom to choose their idea and plan the project from Week 2 to Week 14. Third, the students will carry out their project presentation for the PITEC panel on Week 15. Then, the students in each group will update the log book and report on the final weeks.

1.6 PROJECT SKOP

1. Order an exact copy of the cheap console controller outframe so it could be used as a test.
2. Invent a code to make a 3d model for a controller attachment.
3. Create the 3d model using a 3d printer service.
4. Run multiple of test, wheater if the cover and the main structure of the handicap gaming controller attachment itself can withstand a pressure when get drop from a users waist height.
5. The controller attachment will undergo a couple of tests on a test controller to see if the 3d printed attachment could be attached to the controller.
6. The controller attachment will be used on the functional controller.
7. Few tests will be done on a functional controller while playing certain games.
8. The test is being run on 3 different type of game which are 1st person shooter (Cyberpunk 2077),3rd person shooter (Spiderman ps4),and combat games (UFC 4).
9. Disassemble the functional controller to install the extra lights.
10. Run another test on a controller so that the lights are working correctly.
11. Setting up the Bluetooth receiver on the LEDlights so that It can be controlled from an apps (MohuanLED).
12. Get 2 volunteers that never use the project before .
13. Instruct briefly on how to assemble the handicap gaming controller attachment as a manual.
14. Take the time taken for them to assemble the project .
15. Run a test 2 times a week before the date of PITEC just make sure its still working .
16. Preparing PITEC booth simple presentation with slides ,poster and video for deeper understanding for the panel .

17. Executing the plan that has been prepared for the present day of PITEC.
18. Completing the log book as the ending task for Final Year Project 2.
19. Compiling a report and submit it to supervisor
20. End

1.7 PROJECT IMPORTANCE

The Handicap controller offers satisfying results in reducing the burden of handicapped users by reducing the energy and difficulties used in controlling the ps4 controller by operating disability tools and the exorbitant cost of purchase for ps4 controller in the market nowadays. Aside from that, this product can overcome the problem of an overpriced gaming disability controller because of its overapplied complicated accessibility control that is not even being used by the user when they have the accessibility. In addition, the prototype creates a more easy-to-use disability tool gaming controller and a cheaper option for the disabled user.

1.8 TERM AND OPERATION DEFINITION

3d print service :

3D printing, also known as additive manufacturing, is a method of creating a three-dimensional object layer-by-layer using a computer-created design. 3D printing is an additive process whereby layers of material are built up to create a 3D part.

PITEC :

PSA Innovation Technology and Commercialization

PSA :

Polytechnic Premier Sultan Salahuddin Abdul Aziz Shah

Gantt Chart :

A chart in which a series of horizontal lines shows the amount of work done or production completed in certain periods of time in relation to the amount planned for those periods.

Razer Gaming :

Razer™ is the world's leading lifestyle brand for gamers. The triple-headed snake trademark of Razer is one of the most recognized logos in the global gaming and esports communities.

LED :

LED is known as Light Emitting Diodes and its major uses are to illuminate objects and even places. Its application is everywhere due to its compact size, low consumption of energy, extended lifetime, and flexibility in terms of use in various applications.

CONSOLE :

console, gaming console, and video game console. a computer system specially made for playing video games by connecting it to a television or other display for video and sound.

MOHUAN LED :

Its enable the access of IOT for its user so that it can be control trough the apps which called Mohuan LED to change the colour of the LEDlights.

PS4 :

The PlayStation 4 (PS4) is a home video game console developed by Sony Interactive Entertainment. Announced as the successor to the PlayStation 3 in February 2013.

CONSOLE CONTROLLER :

It was an input that being use where button is attached to a device to controlled the video games as the user wish.

1.9 CHAPTER SUMMARY

In this chapter (CHAPTER 1: INTRODUCTION) we are giving an introduction to our project. Throughout the chapter, this report has briefly explained the handicap gaming controller uses and its purposes.

To ensure these projects succeed, each group members have their own role to play including our supervisors that have been cooperating in supervising and giving advice for the final year project. Work distribution is the key to completing this project without anyone from our group being left out. Each one of us carries a significant role in order to succeed our objectives.

And eventually, we manage to finish the project objectives in time. Research and planning have been made so our project was able to work smoothly.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction


A digital accessibility specialist from Ontario, Canada, 15% of people in the world live with a disability or chronic illness, according to a study by the World Health Organization and World Bank. However, 35% of Malaysian people identify as disabled per research firm Newzoo. While a lot of progress has been made in the gaming industry in recent years, there are still challenges in the most inclusive experience for those living with disabilities, from a lack of basic in-game features. In order to move forward to greater accessibility in gaming, we must continue to create games with assistive technology, challenge ableist beliefs surrounding gaming, and dismantle stigmatized perceptions of disability

Recently, there are two gaming equipment companies that have started to have their own design for disabled gamers. Such as the Logitech Adaptive Gaming Kit and Xbox Adaptive Controller, which allow players to customize their gaming experience with programmable buttons and external peripherals. Meanwhile, there's also a mouth-operated controller, which gives gamers a hands-free way to play which is called the Quad stick.

But despite all the effort that has been made by all of these companies, it's clear that they were being marketed to the public to those who only could afford it. In fact, this is the statement that has been made by a disabled gaming streamer "Oftentimes, the people who most need accessible tech are the ones least able to access it," says Little Navi. Well, the reason for that is because most of the gamers in the disabled community have been getting access to most of this up-to-date adaptive gaming equipment on government assistance. Which are the Organizations like Special Effect and Able Gamers.

This chapter discusses previous studies resulting from our project. A literature review is a search and evaluation of the literature found in a chosen area or topic. This review is based on the latest document on the topic we wrote about.

2.2 Existing Technology

Bil 1	PRODUCT	ADVANTAGES	DISADVANTAGES
1	<p>Forge gaming controller</p>  <p>Price : Unknown / not release yet</p>	<ul style="list-style-type: none">• Easy to use• Efficient• Compact	<ul style="list-style-type: none">• Fewer function buttons.• Can't play certain games.• Not in the market yet (prototype)

Introduction

Forge gaming controllers were invented by one of the product and design students from MFA. The creation has not yet been published in the market, but it is, however, has been presented at an event called MFA Products of Design 2018 5IFTH Thesis Presentations as a thesis.

But so far, the only test that has been made on this gaming controller is a driving game called Forza Horizon 5. And so far, those are the only information that has been made on their latest development based on the official websites

<https://www.smrutiadya.com/upgrade-mfa-thesis/>

2

**Nintendo Switch one-handed
Joy-Con adapter**



Price : Us\$ 20

- Easy to use.
- Can play a verity of games
- Expensive.
- Can't be used in PlayStation (Nintendo console only)

Introduction

Nintendo is a Japanese multinational video game company headquartered in Kyoto, Japan. It develops video games and video game consoles. In Japan, Nintendo was one of the cultural icons in the gaming community in the 80s.

And now Nintendo has become accessible to the whole world. And since then, an engineer has made himself known on the internet has designed simple 3d prints which are free 3D-printable download for everyone to use, however yet there is still no huge marketing for these attachable accessories' ideas.

3

Xbox Adaptive Controller



Price : Us\$ 1000

- Easy to use
- No need to hold while playing games
- Expensive
- Can't be used in PlayStation (Xbox console only)

Introduction

The Adaptive Controller works with Xbox consoles and Windows PCs. Using just the Adaptive Controller without any external controls or switches, user will be quite restricted in the number and types of games they can play, as it's limited to a direction pad and A/B buttons. Users won't find the joysticks, bumpers, or triggers that are standard on regular Xbox controllers. This is largely because the Adaptive Controller is designed to be used with accessories.

2.3 3d Printing System (3d Printing)

3D printing is a process of creating objects directly, by adding materials layer by layer in various ways, depending on the technology used from CAD models or digital 3D models.

This innovation has many advantages compared to other manufacturing methods. Among them is being able to produce flexible designs. 3D printing enables the design and printing of more complex designs than traditional manufacturing processes. More traditional processes have design restrictions that no longer apply with the use of 3D printing. Also, able to produce prototypes quickly. 3D printing can produce parts in hours, which speeds up the prototyping process. This allows each level to be completed faster. Compared to prototyping, 3D printing is cheaper and faster in creating parts because the part can be completed in hours, allowing each design modification to be completed at a more efficient rate. Next, fast design and production times. Depending on the design and complexity of a part, 3D printing can print objects in hours, which is much faster than molded or machined parts. It is not only the manufacturing of parts that can offer time savings through 3D printing but also the design process can be very fast by creating STL or CAD files ready for printing. In addition, the use of 3D printers can reduce waste. The production of the part requires only the material required for the part itself, with little or no waste compared to alternative methods that are cut from largely non-recyclable materials. Not only does the process save resources but it also reduces the cost of materials used.

However, there are also drawbacks to this technology. Among them are limited materials. Although 3D Printing can create items in a selection of plastics and metals, the choice of raw materials available is not extensive. This is since not all metals or plastics can be temperature controlled enough to enable 3D printing. In addition, it has a limited build size. 3D printers currently have a small print space which limits the size of parts that can be printed. Anything larger needs to be printed in separate sections and spliced together after production. This can increase cost and time for larger parts because the printer has to print more parts before manual work is used to connect the parts. Next, the difficult packaging process. Most 3D printed parts require some form of cleaning to remove support material from the build and to smooth the surface to achieve the required finish. Finishing processes used include water jetting, sanding, chemical soaking and rinsing, air or heat drying, assembly and others. The amount of finishing process required depends on factors including the size of the part being produced, the intended application

and the type of 3D printing technology used for production. This packaging process slows down the speed of component manufacturing.

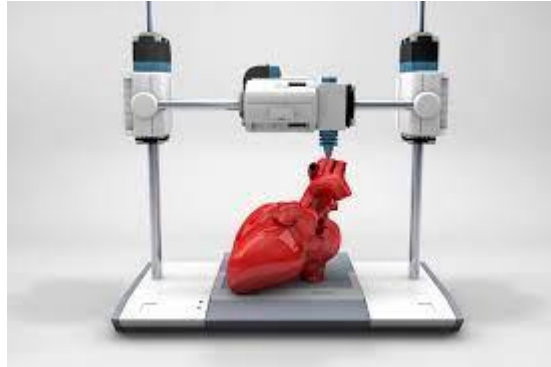


Figure : 3D printing process.

2.4 Poly(lactic acid) (PLA) Filament.

Poly(lactic acid), also known as **poly(lactic acid)** or **polylactide (PLA)**, is a thermoplastic polyester with backbone formula $(C_3H_4O_2)_n$ or $[-C(CH_3)HC(=O)O-]_n$, formally obtained by condensation of lactic acid $C(CH_3)(OH)COOH$ with loss of water (hence its name). It can also be prepared by ring-opening polymerization of lactide $[-C(CH_3)HC(=O)O-]_2$, the cyclic dimer of the basic repeating unit.

PLA has become a popular material due to it being economically produced from renewable resources. In 2021, PLA had the highest consumption volume of any bioplastic of the world, although it is still not a commodity polymer. Its widespread application has been hindered by numerous physical and processing shortcomings. PLA is the most widely used plastic filament material in 3D printing. Its low melting point, high strength, low thermal expansion, good layer adhesion, and high heat resistance when annealed make it an ideal material for this purpose. Without annealing, however, PLA has the lowest heat resistance of the common 3D printing plastics.

Although the name "poly(lactic acid)" is widely used, it does not comply with IUPAC standard nomenclature, which is "poly (lactic acid)". The name "polylactic acid" is potentially ambiguous or confusing, because PLA is not a polyacid (polyelectrolyte), but rather a polyester.

2.5 Carbon Fiber Polylactic Acid (PLA) Filament

Carbon fiber filaments are composite materials formed by infusing fragments of carbon fiber in a polymer base, similar to metal-infused filaments but with tiny fibers instead. The polymer base can be of different 3D printing materials, such as PLA, ABS, PETG, or nylon, among others.

While true carbon fiber materials have long continuous fiber strands that improve mechanical resistance, these filaments contain short particles of around 0.01 mm in diameter. Although this is enough for improving the strength of printed parts, such filaments cannot compare to the actual material.

Unfortunately, straight carbon fiber isn't printable on basically any consumer-grade 3D printer because it isn't as malleable and easy to melt as normal printing materials. So, carbon fiber composite filaments are our best bet to take advantage of the material properties it has to offer.

For those seeking tougher 3D printing materials, carbon fiber filament presents a relatively easy alternative to the more expensive and demanding materials, such as polycarbonate (PC) or PEEK. Moreover, the increased strength provided by the carbon fiber particles contributes to greater dimensional stability, helping to avoid warping and shrinking.

3D printing these materials, however, does present some issues. The infused carbon fiber particles aren't melted by the nozzle during extrusion, which may lead to frequent clogging. In addition, these particles work as abrasive agents during extrusion, which over time will wear down a brass nozzle's internal bore. This is why special nozzles like hardened steel are strongly suggested for printing with composite materials.

PROS

- Increased strength and stiffness
- Good dimensional stability
- Overall nice surface finish
- Lightweight

CONS

- Frequent clogging
- Abrasive filament that wears down brass nozzles (requires special hardware)

- Polymer/carbon fiber mixture increases the material's brittleness

The **Carbon Fiber PLA filament** is a material composed of a matrix of **PLA polymer (85 - 90 %)** and **carbon fibers (10 - 15 %)**.

It is a synthetic fiber made up of very fine filaments composed almost entirely of carbon atoms. These filaments are so fine that several thousand of them must be assembled to form a single carbon fiber. These carbon fibers are made from polyacrylonitrile. Carbon fiber reinforcement improves the overall mechanical properties of the base plastic.

In this case, a much stiffer PLA filament is achieved at the cost of **less flexibility**, which makes this material ideal for making parts that are not intended to bend, such as supports, tools, propellers or drone housings or similar. This carbon fiber filament stiffness provides **excellent structural strength** and **good inter-layer bonding** with very **low distortion**.

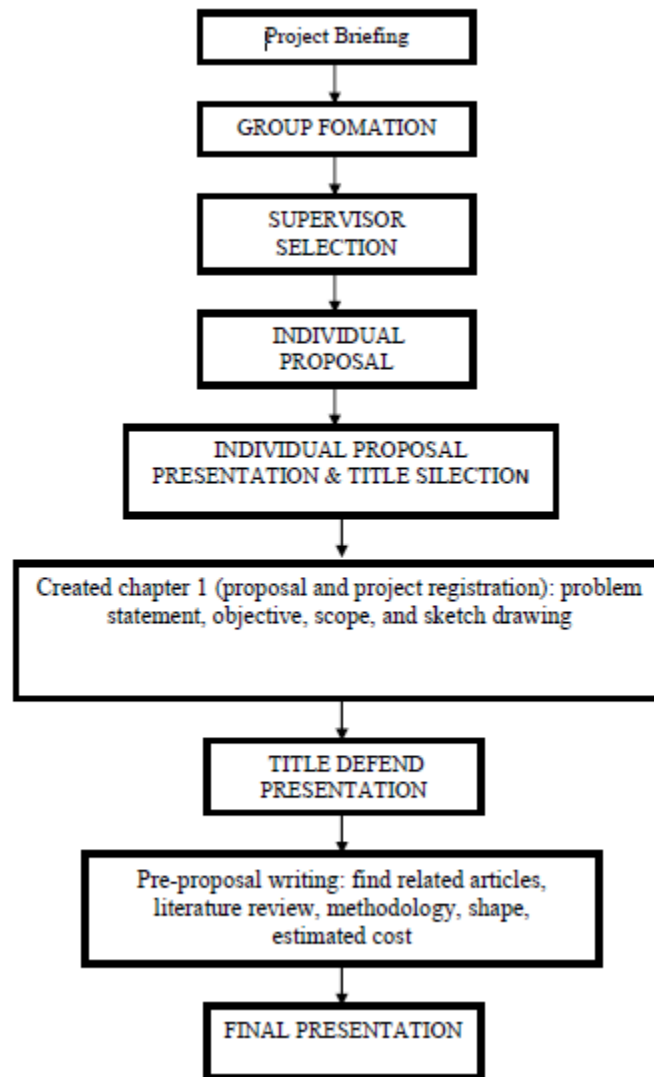
2.6 Chapter Summary

In this chapter (CHAPTER 2: Literature Review) we are Stating our research that we did for our project. Throughout the chapter, this report has briefly explained the relevance of the project, the material used in the project and the fabrication method.

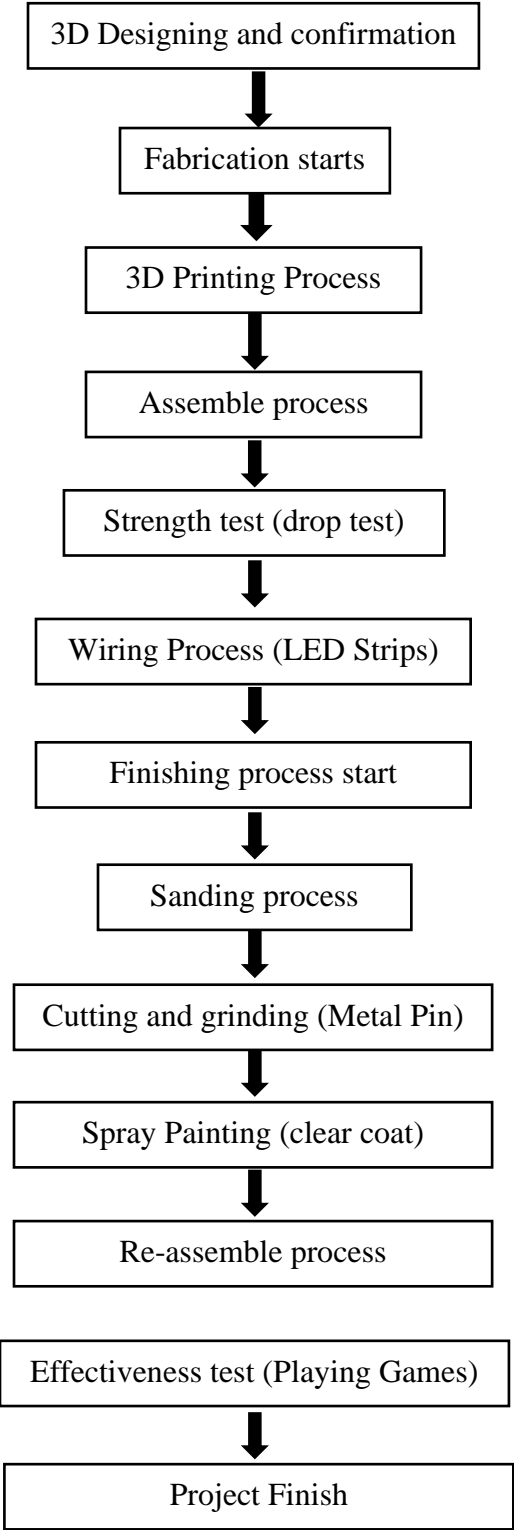
CHAPTER 3: METHODOLOGY

3.1 Flow Chart.

1. Final year Project 1.



II. Final year Project 2.



3.2 Design of Right-handed Gaming Controller.

The process shape Right-handed Gaming Controller is divided into 3 phases main namely design 1, design 2, and the final design. Each phase of this has its characteristics, advantages, and disadvantages. The table and diagram below show information for each phase of the Right-Handed Handicap Gaming Controller.

Idea 1

Figure 3.2.1 shows the initial design of this project



Features:

- i. Clean cover design
- ii. Proper button position

Advantages:

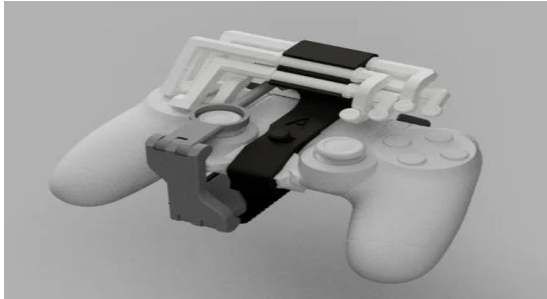
- I. Easy to access the button
- II. The mechanical components are protected.
- III. Seamless electronic setup.

Disadvantages:

- I. Movement is limited
- II. Hard to do Computer design for 3D printing.
- III. Take a long printing duration

Idea 2

Figure 3.2.2 shows the second design of this project



Features:

- I. Free mechanical movement
- II. Minimalist look
- III. Lightweight.

Advantages:

- I. Cheaper to fabricate.
- II. Easy to design
- III. Easy to install once printed.

Disadvantages:

- I. No protection. (Can break if fall)
- II. No surface to mount the electronics.

Final idea

Figure 3.2.3 shows the final design of this project



Features: -

- I. Combining idea 1 and idea 2
- II. Replaces a complex cover design

Advantages: -

- I. Easy to design.
- II. Cheap to fabricate
- III. The mechanical components are protected
- IV. Seamless electronic setup.
- V. Easy to install once printed.

3.3 PROJECT FABRICATION PROCESS.

NO	METHOD NAME	METHOD TOOLS	FUNCTION
1	3D Designing	<ul style="list-style-type: none"> • 3d Printer. • Scrapper 	<ul style="list-style-type: none"> • Translate 3d design to the physical item.
2	Rough sanding	<ul style="list-style-type: none"> • Sandpaper (300 grit) 	<ul style="list-style-type: none"> • Sanding the surface to remove some material to make sure the clearance of the moving parts is enough. • To make sure the movement is smooth.
3	Wiring	<ul style="list-style-type: none"> • Multimeter • Soldering tools • Led light with Bluetooth receiver. • Heat Shrink tube • Hot gun blower • Soldering flux 	<ul style="list-style-type: none"> • To attach the LED light to the project
4	Cutting & grinding	<ul style="list-style-type: none"> • Grinding machine. • Steel rod. • Wire cutter. 	<ul style="list-style-type: none"> • Cut and resize the pin.
5	Finishing	<ul style="list-style-type: none"> • Sandpaper (3000 grit) • Clear coat spray paint • Rope. 	<ul style="list-style-type: none"> • To make sure the final product is clean and attractive. • To protect the surface of the product



Figure 3.2.1: shows the progress of 3d printing process



Figure 3.2.2: shows the progress of wiring process



Figure 3.2.3: shows the progress of rough sanding process



Figure 3.2.4: shows the progress of metal pin cutting process

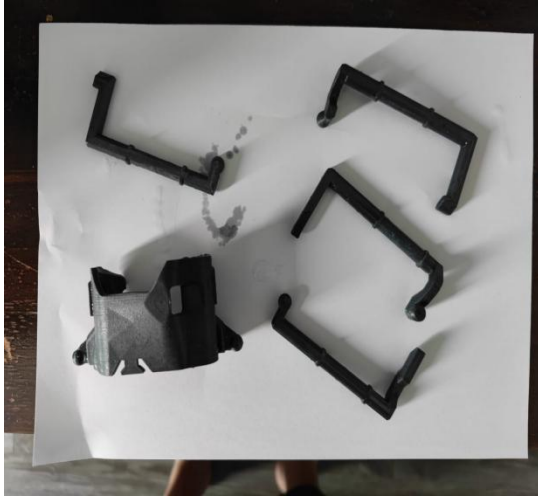


Figure 3.2.3: shows the progress of finishing process



Figure 3.2.4: shows the tools needed for wiring Process



Figure 3.2.5: shows the tools needed for sanding Process



Figure 3.2.6: shows the tools needed for finishing Process

3.4 Right-handed Gaming Controller Materials and Components

Materials and Components	Details
<p>Carbon Fiber PLA Filament</p>  <p>Figure 3.4.1 shows the material used in 3D printing for the button mechanism</p>	 <p>Figure 3.4.2 shows the button mechanism of the project</p> <ul style="list-style-type: none"> • Used for the button mechanism and mounting component because it's flexible
<p>Pure PLA Filament</p>  <p>Figure 3.4.3 shows the material used in 3D printing for the protective cover.</p>	 <p>Figure 3.4.2 shows the button mechanism of the project</p> <ul style="list-style-type: none"> • Used for the protective cover because it's stronger than Carbon fiber PLA filament

2pcs AAA battery pack.



Figure 3.4.4 shows the component used to power the LED strips.

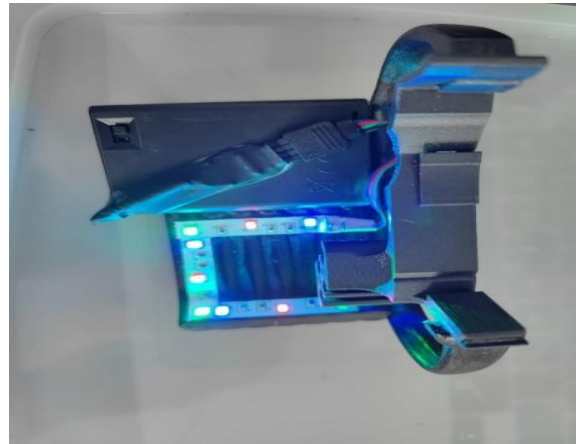


Figure 3.4.5 shows the battery powered LED strips attached to the project.

- Used for the protective cover because it's stronger than Carbon fiber PLA filament.

LED strips

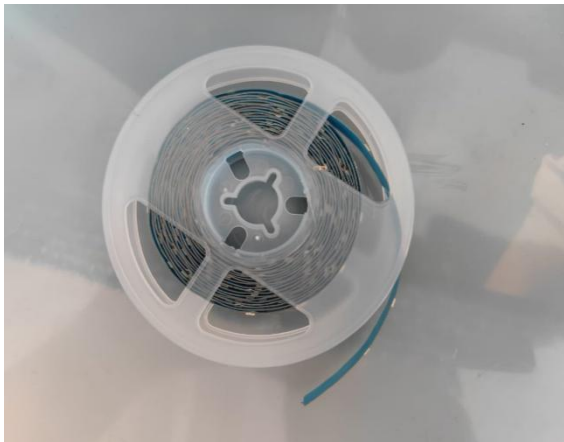


Figure 3.4.5 shows the LED strips used in this project

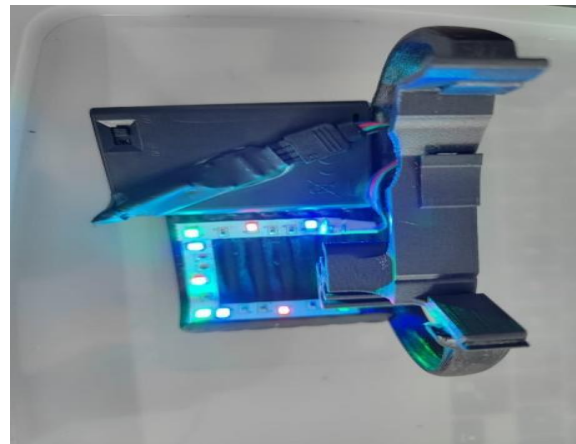


Figure 3.4.6 shows the battery powered LED strips attached to the project

- Used to give gaming looks to the project

Steel rod

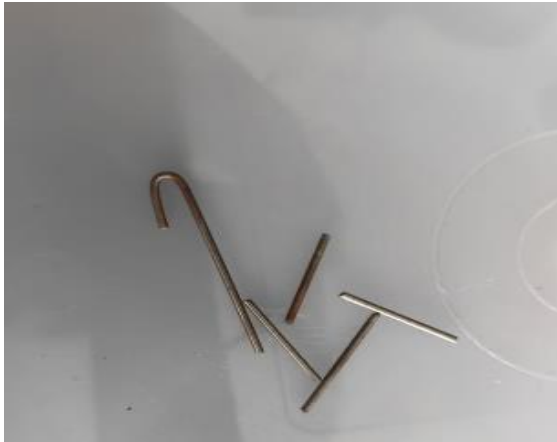


Figure 3.4.7 shows the steel rod used in this project



Figure 3.4.8 shows the steel rod attached to the joystick mover.

- Joint Pin to hold the Joystick attachment

Clear coat paint



Figure 3.4.7 shows the Clear coat spray used for the finishing process



Figure 3.4.7 shows the protective cover after sprayed 3 layers of clear coat.

- Used to protect the surface of the project and to make it looks clean and tidy

3.5 Cost of materials and components

Bill	Materials	Cost
1	3D Printing Filaments	RM 123.33
2	Eveready Super Heavy Duty Battery	RM 6.70
3	Bluetooth LED Strip Lights Tape	RM 18.04
4	Styrofoam Cutter	RM 7.50
5	Unicorn X-Glue Multi-Purpose Clear Silicon Glue	RM 4.28
6	Clear coat paint	RM 10.00
7	Sandpaper (300,600,3000 grits)	RM 5.00
8	Steel rod	RM 0.50
	Total	RM 175.35

3.6 3D Printing

We do our 3D printing for all components except the steel pin. We use Ender 3 and Ender 3 v2 machines. Our filament of choice is Carbon fiber PLA and Pure PLA. Each printed component has a unique position when on the print bed for maximum strength. The printing process took 72 hours to finish, including the extra parts.



Figure 3.6.1 Shows the progress of 3D printing process

3.7 Wiring

Wiring is an important process for the fabrication of our project because it is key to achieving our project objective. Before this process is done, we produce over first block diagram to organize the wiring journey.

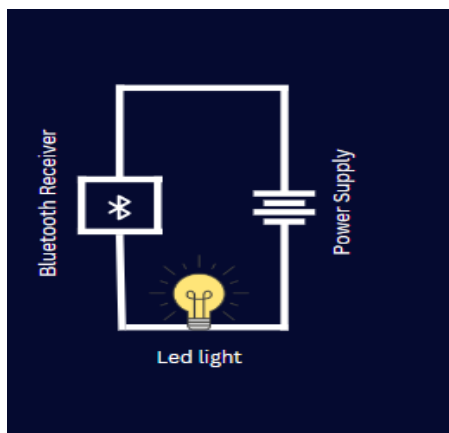


Figure 3.7.1 Shows the wiring Block diagram for this project

3.8 Chapter Summery.

In this chapter (CHAPTER 3: Methodology) we were planning and executing the process of fabricating the project. Throughout the chapter, this report has show the flow chart, the design of the project, the detail of the fabrication method, the material used, the wiring process and diagram, the function of every material on the project and the cost of the material.

CHAPTER 4 : RESULTS AND DISCUSSIONS.

4.1. INTRODUCTION

This chapter discusses the results of the test that has been done on the handicapped gaming controller. This also includes the preparation and implementation of innovations.

4.2. PROJECT TESTING AND RESEARCH

based on the diagram 4.2.1, the attachment covers are one of the important parts of our project. This is because it is the most part experience of pressure when accidents might occur. Stress analysis is intended to make sure the attachment cover is always in a good situation through experiencing great pressure when falling from a 2m drop. The figure below shows the state of the frame when receiving a load of 500N on it using a drop-test method in a fusion 360 software simulation.

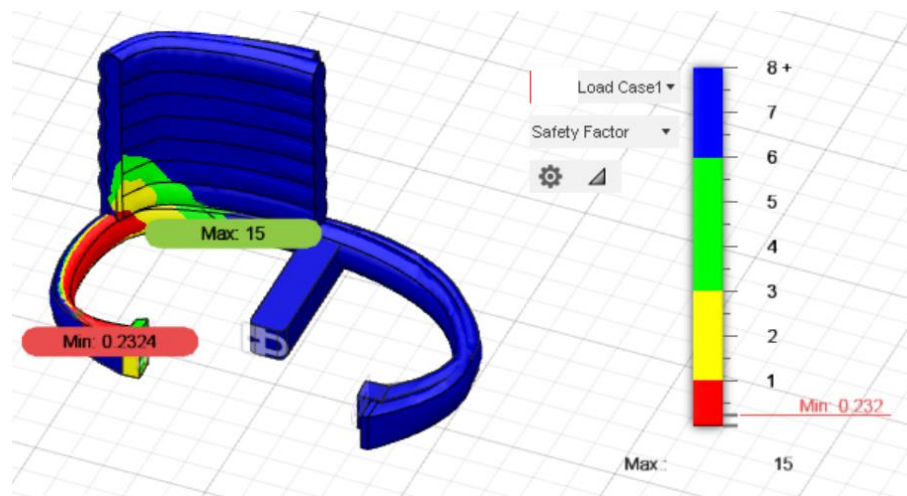


Diagram 4.2.1

4.3. DISCUSSION

But despite the running test of a simulation. It is only not sufficient for testing the durability of the handicap controller covers because there is a change as much as possible handicap controller covers properties when operating on a user. Therefore, we test handicap controller covers that have been 3D printed by using PLA and PLA CFRP as the materials. So based on the diagram below its shows the result of the test.

MATERIAL	1 ST DROP TEST	2 ND DROP TEST	3 RD DROP TEST
PLA CFRP	FINE	TEAR	DAMAGE
CFRP	GOOD	GOOD	GOOD

Instead of testing the durability of the cover, we also had another test for the attachment itself whereby its function served its purpose which is the usage of a handicapped controller is being by a handicapped user who has no control over their left hand.

Type of game	Right-hand handicapped gaming controllers difficulties
1 st person shooter	medium
3 rd person	easy
combat	easy

And for the last test based on the diagram 4.3.1, we have 2 volunteers try to assemble the handicapped gaming controller to find out that if anyone can assemble the handicapped gaming controller easily or not.

Volunteers	Time is taken to assemble the handicapped gaming controller
1 st volunteer	6.26 minutes
2 nd volunteer	6.35 minutes



1st volunteer



2nd volunteer

Diagram 4.3.1

4.4. CHAPTER SUMMARY

After doing all the fabrication activities, our final project is produced. The diagram 4.4.1 below is the final product of our project designs. This chapter (CHAPTER 4), this section of the report has concluded all the results of the test to make it clear to serve the project objective.

Not only that from here on our group has learned a lot based on the experience that has been gathered from the project fabrication process. To realize this finalization process, multiple failures had to be done and as a mechanical engineering course student, those problems can be overcome by a practical and logical way of thinking based on what we have learned in theories and practices.



Diagram 4.4.1

CHAPTER 5: CONCLUSION AND SUGGESTIONS

5.1 INTRODUCTION

In this chapter, the conclusion and suggestions to improve the flaws of **Handicap Gaming Controller** will be drawn. As a result, this chapter also discusses the chapter summary and limitations of our project in detail.

5.2 CONCLUSION

Through 3D printing, we have printed the required attachments to be attached to the PS4 console controller. This innovation helps people with disabilities to pursue their careers in the gaming industry and to fulfill their basic gaming interests in playing video games. In addition, the presence of an LED light strip fulfilled the IOT elements which needed to be in our project, and it added a gaming element to the console controller compared to normal console controllers which are plain without any LED lights. The development process of our project includes planning process, research methods such as quantitative and qualitative methods, designing and confirmation process, fabrication process, testing phases such as strength test, finishing process, re-assemble process and effectiveness test.

5.3 SUGGESTION

There are many flaws that can be improved in our project such as:

- a) A manual for controlling the console controller has to be created to ease the handling in one hand.
- b) Upgrade the current battery to a higher-watt battery to last longer and rechargeable lithium ion battery such as Keppower USB Rechargeable Li-ion AA Batteries.
- c) Improve handling of the project to be more organised such as improve project planning and quality, better communication with team members, efficient tracking of project's progressions and avoid unrealistic expectations.

5.4 PROJECT LIMITATIONS

Our project has a few limitations such as:

- a) Only suitable for people whose left hand is disabled or handicapped.
- b) The user has to master controlling the console controller in one hand.
- c) The current battery of LED light strip will die after continuous use of 4 to 5 hours.

5.5 CHAPTER SUMMARY

In this chapter, this handicap gaming controller was made to benefit the people whose left hand is disabled or handicapped. The attachments can be easily disassembled and reassembled back. The attachments can be attached to different console controllers if the existing console controller is broken or does not function. However, this Handicap Gaming Controller project needs several improvements which have to be done in order for this project can benefit the people whose left hand is disabled or handicapped. It is also very important for us as students to pay attention in class and understand the concepts of mechanicals. It helps us in building up our skills in the mechanical engineering area as we brainstorm ideas, plan the project, determine what elements and components it requires and fabricate the project. We learned that sometimes things did not work as planned and we have to find other alternatives to overcome the problems. In addition, we learned that teamwork and communication between team members and the supervisor also played a big role in this project.

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ii. Project Cost

Bill	Materials	Cost
1	3D Printing Filaments	RM 123.33
2	Eveready Super Heavy Duty Battery	RM 6.70
3	Bluetooth LED Strip Lights Tape	RM 18.04
4	Styrofoam Cutter	RM 7.50
5	Unicorn X-Glue Multi-Purpose Clear Silicon Glue	RM 4.28
6	Clear coat paint	RM 10.00
7	Sandpaper (300,600,3000 grits)	RM 5.00
8	Steel rod	RM 0.50
	Total	RM 175.35

iii. List of material

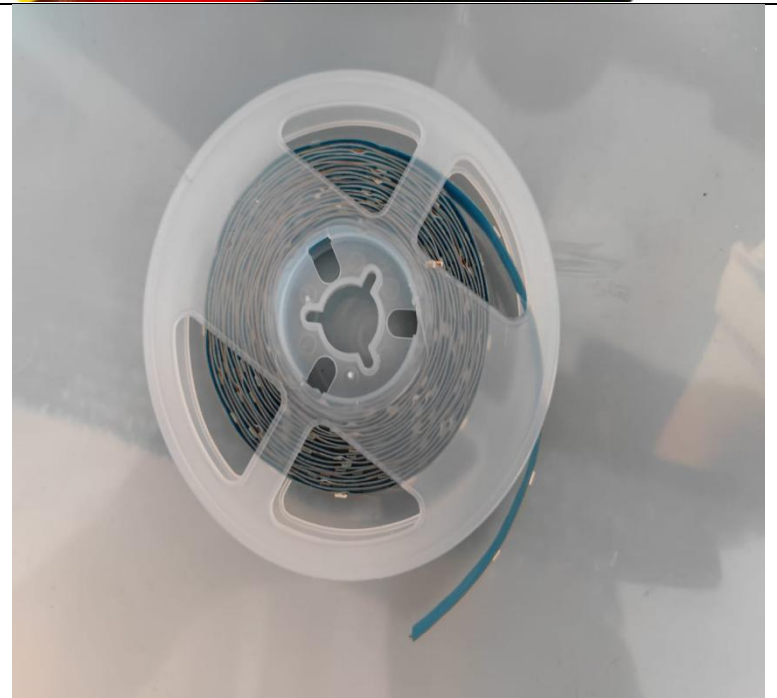
No	Materials
1	3D Printing Filaments
2	Eveready Super Heavy Duty Battery
3	Bluetooth LED Strip Lights Tape
4	Styrofoam Cutter
5	Unicorn X-Glue Multi-Purpose Clear Silicon Glue
6	Clear coat paint
7	Sandpaper (300,600,3000 grits)
8	Steel rod

No	Materials	Details
1.	3D Printing Filaments	  <p>The image shows two views of a spool of black 3D printing filament. The top view is a side profile of the spool, showing the filament wound in a dense, uniform coil. The bottom view is a top-down perspective of the spool, revealing the label. The label is black with white text and features the Hatchbox logo (a stylized 'H' and 'B' in a square) at the top. The text on the label includes:</p> <ul style="list-style-type: none"> HATCHBOX® 3D PRINTER FILAMENT BLACK PLA Diameter: 1.75 mm Tolerance: ±0.02 Net Weight: 1 kg Ext. Temp: 180°C - 210°C DEUTSCH 3D-DRUCKER FILAMENT SCHWARZ PLA Durchmesser: 1.75 mm Dauerlast: ±0.02 Nettoprodukt: 1 kg Extrudiertemperatur: 180°C - 210°C Produziert in China CONNECT WITH US Facebook: @hatchbox Twitter: @hatchbox Instagram: @hatchbox Website: www.hatchbox.com

2. Eveready Super Heavy Duty Battery



3. Bluetooth LED Strip Lights Tape



4. Styrofoam Cutter



5. Unicorn X-Glue Multi-Purpose Clear Silicon Glue



6. Clear Coat Point



7. Sandpaper (300, 600, 3000 grits)



8. Steel Rod



iii. Project Design



