ENGINE POWERED WHEELBARROW

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MECHANICAL ENGINEERING DEPARTMENT

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STATEMENT OF AUTHENTICITY AND PROPRIETARYRIGHTS

ENGINE POWERED WHEELBARROW

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Thank you.

ABSTRACT

A wheelbarrow is a small car with one wheel in front, two support legs and two handles on the back, used usually to carry loads in construction and daily use. The use of a wheelbarrow, especially for use in the home area is one of them an important element to ensure the ease of a job. However, wheelbarrow functions on the market today use manual methods which the user need to lift the handle of the wheelbarrow to move it to another place. This method takes a longer time to complete the work and requires more energy when lifting a full load wheelbarrow to another place. Users need tools and equipment that can help daily work is done easily, quickly and effectively. Motorized stroller designed to assist users in saving time and maximum workload. 49cc A 2-stroke pocket bike pull start engine is installed to power the wheelbarrow. Flat rubber tire used and placed in front like a regular wheelbarrow. Bicycle brakes are used to control the speed and stop the wheelbarrow when it reaches the destination. The wheelbarrow bucket available in the market is used to carry the load and the handle is used to control the motor. A wheelbarrow is like a regular wheelbarrow holder. Use of motorized wheelbarrow chain drive to move. One set of sprockets are mounted between the motor and the wheel. The 428-15T sprocket set is matched to the motor and matched to the 428-38T sprocket that moves the wheel. In addition to saving the user's time in doing a job, the goal to be achieved from this project is to benefit the user especially in terms of ergonomics. By achieving the goal, the benefit that the user can get is to be able to reduce extreme physical effects such as back pain, scoliosis and slipped disc. Next, it can make the user aware of the importance of taking care of the body's health so that it does not have a negative effect when they are old. In addition, the footrest on this project can reduce the movement of the user while doing work in the yard.

Keywords: Ergonomic, construction equipment.

ABSTRAK

Kereta sorong ialah kereta kecil dengan satu roda di hadapan, dua kaki sokongan dan dua pemegang di belakang, biasanya digunakan untuk membawa beban dalam pembinaan dan kegunaan harian. Penggunaan kereta sorong khususnya untuk kegunaan di kawasan rumah adalah antara elemen penting untuk memastikan kemudahan sesuatu pekerjaan. Bagaimanapun fungsi kereta sorong di pasaran hari ini menggunakan kaedah manual yang mana pengguna perlu mengangkat pemegang kereta sorong untuk mengalihkannya ke tempat lain. Kaedah ini mengambil masa yang lebih lama untuk menyiapkan kerja dan memerlukan lebih tenaga apabila mengangkat kereta sorong muatan penuh ke tempat lain. Pengguna memerlukan alatan dan peralatan yang boleh membantu kerja harian dilakukan dengan mudah, cepat dan berkesan. Kereta sorong bermotor direka untuk membantu pengguna menjimatkan masa dan beban kerja maksimum. 49cc Enjin permulaan tarik basikal poket 2 lejang dipasang untuk menggerakkan kereta sorong. Tayar getah pancit digunakan dan diletakkan di hadapan seperti kereta sorong biasa. Brek basikal digunakan untuk mengawal kelajuan dan memberhentikan kereta sorong apabila sampai ke destinasi. Bakul kereta sorong yang terdapat di pasaran digunakan untuk membawa beban dan pemegang digunakan untuk mengawal motor. Kereta sorong adalah seperti pemegang kereta sorong biasa. Penggunaan pemacu rantai kereta sorong bermotor untuk bergerak. Satu set *sproket* dipasang di antara motor dan roda. Set *sproket* 428-15T dipadankan dengan motor dan dipadankan dengan *sproket* 428-38T yang menggerakkan roda. Selain menjimatkan masa pengguna dalam melakukan sesuatu kerja, matlamat yang ingin dicapai daripada projek ini adalah untuk memberi manfaat kepada pengguna terutamanya dari segi ergonomik. Dengan mencapai matlamat, faedah yang boleh diperolehi pengguna ialah dapat mengurangkan kesan fizikal yang melampau seperti sakit belakang, *scoliosis* dan *slipped disc*. Seterusnya dapat menyedarkan pengguna tentang kepentingan menjaga kesihatan tubuh badan agar tidak mendatangkan kesan negatif apabila sudah tua. Selain itu, tempat letak kaki pada projek ini dapat mengurangkan pergerakan pengguna semasa melakukan kerja di halaman rumah.

Kata kunci: Ergonomik, peralatan pembinaan.

TABLE OF CONTENT

LIST OF TABLE

LIST OF FIGURE

LIST OF SYMBOL

SYMBOL	
π	pie

LIST OF ABBREVATION

kg	kilogram
N	newton
HP	horsepower
km/h	kilometer/hour
m	meter
rpm	rotation per minute
teeth/num	number of teeth

CHAPTER 1:
INTRODUCTION

1.1 INTRODUCTION

Malaysia is a country that cares about the harmony of neighboring lives, and cares about the cleanliness of the surrounding area. With that, this is in line with the goal of maintaining the safety and health of the people in Malaysia.

Malaysians face various challenges in terms of ergonomics when doing work. One of them is that the tools and equipment that are used are outdated. Engine powered wheelbarrows in Malaysia can meet ergonomics for all levels of society. Unlike old wheelbarrows, they must exert energy while lifting and pushing wheelbarrows from one place to another. In addition, engine powered wheelbarrow can stimulate economic growth, create jobs, and position Malaysia as a leader in user-friendly technology.

Internationally, slipped disc cases are increasing day by day. One of the causes is the work factor that involves lifting, pushing and turning the body. Engine powered wheelbarrow ready to contribute to the reduction of joint and spine pain.

1.2 BACKGROUND PROJECT

The use of normal and manual wheelbarrows used by the community in residential areas in villages or housing estates to lift garbage, tidy up the yard and others. This study is done because most of them need to use a lot of energy and time when doing work. Usually, they must dispose of garbage in a garbage collection area that is quite far from their house. The method that is often used is to walk while lifting and pushing a manual wheelbarrow that carries a lot of loads.

1.3 PROBLEM STATEMENT

Now, cases of spinal pain are increasing over time such as scoliosis and slipped disc due to extreme daily activities. According to a study made on July 30, 2021 titled "Source of Low Back Pain (LBP) at Workplace" published by Abdul Shukor, the percentage of back pain cases caused by manual handling work is 39%. The main reason why the percentage increases is due to manual lifting, pulling and pushing of heavy loads**.** In addition, the results of those activities will also adversely affect the health of the body and disturb a person from working smoothly. So, to deal with that problem, we have created a design called engine powered wheelbarrow. This engine powered wheelbarrow is used to minimize movement and force on a person while saving time. (LOW BACK PAIN (LBP) - Penyakit berkaitan yang paling banyak terjadi di Malaysia! Amat derita & siksa., 2021)

1.4 PROJECT OBJECTIVES

1. To design a wheelbarrow that works with engine power.

2. To provide a wheelbarrow that has the function of a brake system and footrest.

1.5 IMPACT OF THE PROJECT

1. Can save significant time on the job site, allowing users to accomplish more work in each amount of time.

2. Reduces physical strain on the operator, leads to less fatigue and possible injury, and allows individuals to handle heavy loads.

1.6 SCOPE OF PROJECT

This product is suitable for use by users who are skilled at carrying motorcycles**.** The wheelbarrow set with safety features will be designed for use in the agriculture and construction industries. To move the wheelbarrow, it uses a 2-stroke engine that can move the wheelbarrow from one place to another. In addition, the pedaling part is an important part to reduce the movement rate of the wheelbarrow user. The brake part is to grip the tire and stop the wheelbarrow when it reaches the desired place. The maximum weight that this product can accommodate is 150 kg and the maximum speed that can be reached is 40km/h.

1.7 SUMMARY

In summary, the engine-powered wheelbarrow project aims to design and make a wheelbarrow that can move with the help of engine power and footrest. The scope of the project includes conducting a literature review on engine powered wheelbarrow, optimizing wheelbarrow design to reduce energy consumption, and proposing a form that can be used to reduce cases of back pain. The expected result is that this engine powered wheelbarrow works well and contributes to sustainability agricultural community, development and landscaping.

CHAPTER 2:
LITERATURE REVIEW

2.1 INTRODUCTION

Nowadays, many of the products or materials that have been innovated to be made into such materials are of higher quality. One of which is wheelbarrow. The innovation in the creation of the wheelbarrow has grown rapidly over the past five years. There are many designs that have been developed and they provide great benefits to users, especially in the field of home construction. Wheelbarrows are commonly used in the construction and gardening industries to move such materials as dirt, gravel, stones, plants and concrete. The worker normally uses manual handling to lift, hold, carry, push and pull to move, assemble and to transmit work material from one place to another. The current design of the wheelbarrow can be physically difficult on the user when performing tasks where they must bend forward or pull a load backwards can cause strain to the user's back.

2.2 EARLY RESEARCH

It's one of those ideas that seems so self-evident, once you have seen it in action. Rather than carrying heavy loads on your back or burdening a pack animal with them, you can put them into a tub or basket that has a wheel and long handles for pushing or pulling. The wheelbarrow does most of the work for you. (*Sejarah Penciptaan Kereta Serong - The Patriots*, no date).

The first wheelbarrows seem to have been created in China with the first gunpowder, paper, seismoscopes, paper currency, magnetic compasses, crossbows, and many other key inventions.

The earliest evidence of Chinese wheelbarrows is found in illustrations dated around 100 years, during the Han dynasty. These wheelbarrows had a single wheel at the front of the load, and the operator holding the handles carried about half the weight. A wall painting in a tomb near Chengdu, in Sichuan Province and dated to 118 years, shows a man using a wheelbarrow. Another tomb, also in Sichuan Province, includes a depiction of a wheelbarrow in its carved wall reliefs; that example dates to the year 147. (*Sejarah Penciptaan Kereta Serong - The Patriots*, no date).

The main structural component of the pushchair consists of a strong 'hollow metal' with a pair of handles at the end of the iron. The handle is usually wrapped with soft rubber for comfort and has a strong and non-slip grip. The role of the handle is important to stabilize the stroller when carrying heavy loads through uneven road surfaces.

At the bottom of the wheelbarrow there is a 'pair of legs' made of flat iron to stabilize the wheelbarrow when parked. The height of the feet is usually about 1-1.2 feet where it will not touch the ground when the wheelbarrow is pushed. The important part of the wheelbarrow is the Filling Container (Container) which is placed between the tires and a pair of handles that will be filled with loads (Crop Products, Soil, Organic Fertilizers, Agricultural Tools, Construction Materials, Cement, Mining Minerals and so on). This container is open at the top and has a suitable design for filling and pouring out the contents inside. These containers are usually made of thick zinc that is painted to be durable and light. There are also wheelbarrows that use plastic and wooden containers. In the agricultural sector, the wheelbarrow is a very critical agricultural tool. This tool is used from the beginning of land preparation work to harvesting and marketing agricultural products. For palm oil growers, these tools are very important to bring palm oil bunches from under the trees on the roadside to be collected and loaded onto lorries to be sent to the factory. Without a wheelbarrow, it is difficult for farmers to carry heavy and thorny bunches of palm oil and located in uneven areas, hillsides and areas of peat land that easily sink. (*Anim Agro Technology: KERETA SORONG (Wheelbarrow)*, 2021).

Figure 2.1: Wheelbarrow

Figure 2.2: Old wheelbarrow

2.3 WHEELBARROW IN MALAYSIA

There are many wheelbarrows in Malaysia, and they can be distinguished in terms of various shapes, sizes and materials used. Wheelbarrows lighten the weight of goods or materials being lifted because the load is transferred to the wheel and handle system. The wheelbarrow has the Components of One Wheel, a Pair of Handles, a Pair of Legs and a Filling Container. The main structural component of the wheelbarrow consists of a strong 'hollow iron' with a pair of handles at the end of the iron. The handle is usually wrapped with soft rubber for comfort and has a strong and non-slip grip. The role of the handle is important to stabilize the stroller when carrying heavy loads through uneven road surfaces. At the bottom of the wheelbarrow there is a 'pair of legs' made of flat iron to stabilize the wheelbarrow when parked.[1] (*Wheelbarrow - Definition, Meaning & Synonyms | Vocabulary.com*, no date).

The importance of choosing the material and design in a wheelbarrow is the durability and stability of the wheelbarrow. It can also reduce the cost of making a wheelbarrow. When we have done research to identify on the internet about the shortcomings and advantages of existing or already produced designs, we will get more effective and quality designs and results.[2] (Needham, 1959)

2.4 PART OF WHEELBARROW

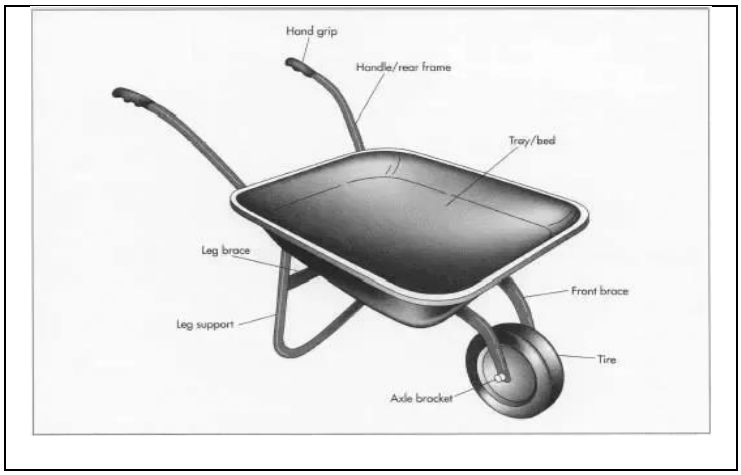

Figure 2.3: Part of wheelbarrow

Axle bracket	2
Leg support	1
Leg brace	1
Tire	1
Front brace	2
Tray/bed	1
Handle/rear frame	2
Handle grip	2

Table 2.1: Parts of wheelbarrow

2.5 WHEELBARROW INNOVATED ON THE INTERNET

Made by	Design and shape	Operation	Advantage	Disadvantage
(1) Aisyah Wardina binti Azman	Wheelbarrow with hoverboard	Move a wheelbarrow using a hoverboard	-Easily moved -Reduce manpower	-Expensive -Difficult to use -use batteries
(2) Sanjivani	Wheelbarrow with electric wheel	Move an item to another place with using electric wheel	-Safety -Easy of unloading -Comfortable than existing one	-Use batteries -Not durable and tough
(3) Nora Wei	Wheelbarrow with hydraulic	Hydraulic function for pushing and removing items from the wheelbarrow	-Reduce physical strain -Easily to use -Increase efficiency	-Expensive -Safety is not guaranteed -Have a limit to lift items

Table 2.2: Innovated wheelbarrow from internet

Figure 2.4: Innovated wheelbarrow

2.6 COMPARISON BETWEEN EXISTING PRODUCTS

After doing research on wheelbarrows that have been innovated on the internet, there are various research designs that have been found, among them wheelbarrows that have engines.[1] (*Motorized Wheelbarrow | Multidisciplinary Applied Research and Innovation*, no date)wheelbarrows that use electric engines cannot last long because the engines use batteries [2] (*Motorized Wheelbarrow | Multidisciplinary Applied Research and Innovation*, no date), while wheelbarrows that move using hoverboards are very difficult to use because the way to use the hoverboard is very difficult and it takes time to learn how to use the hoverboard. This makes it difficult for people who are old to use it. Both innovations are very expensive. In addition, the wheelbarrow that has hydraulic is also very difficult to create and expensive.[3] (Hughes, 1993).

CHAPTER 3:
METHODOLOGY

3.1 INTRODUCTION

Methodology is one of the chapters that describes the activities that can be done to solve a problem. Methodological selection to build a project is an important aspect to ensure a project is built in a structured and systematical manner. Therefore, this chapter will explain steps taken to solve the "Engine Powered Wheelbarrow" problems. For a clearer understanding about its implementation, the methodology will be indicated in a flow chart.

This engine powered wheelbarrow design is self-design based on group member discussion. The innovations made must consider aspects and theories of origin in building this Engine Powered Wheelbarrow. The design produced must be not very complicated, lightweight and easy to carry. Component selections are based on studies and tests so that Engine Powered Wheelbarrow can work perfectly. Even the safety and comfort aspects are also should be considered.

3.2 FLOW CHART

To make this project a success, several steps need to be taken as well as needing to be adhered to ensure that the project to be done is smooth and successful. If there is a problem, this flowchart should be re-referenced to help before or while the project is carried out. With this flowchart in place, it promotes more orderly and systematic use of time as it can follow all the instructions accurately and perfectly. Among the measures the ones to follow are as follow.

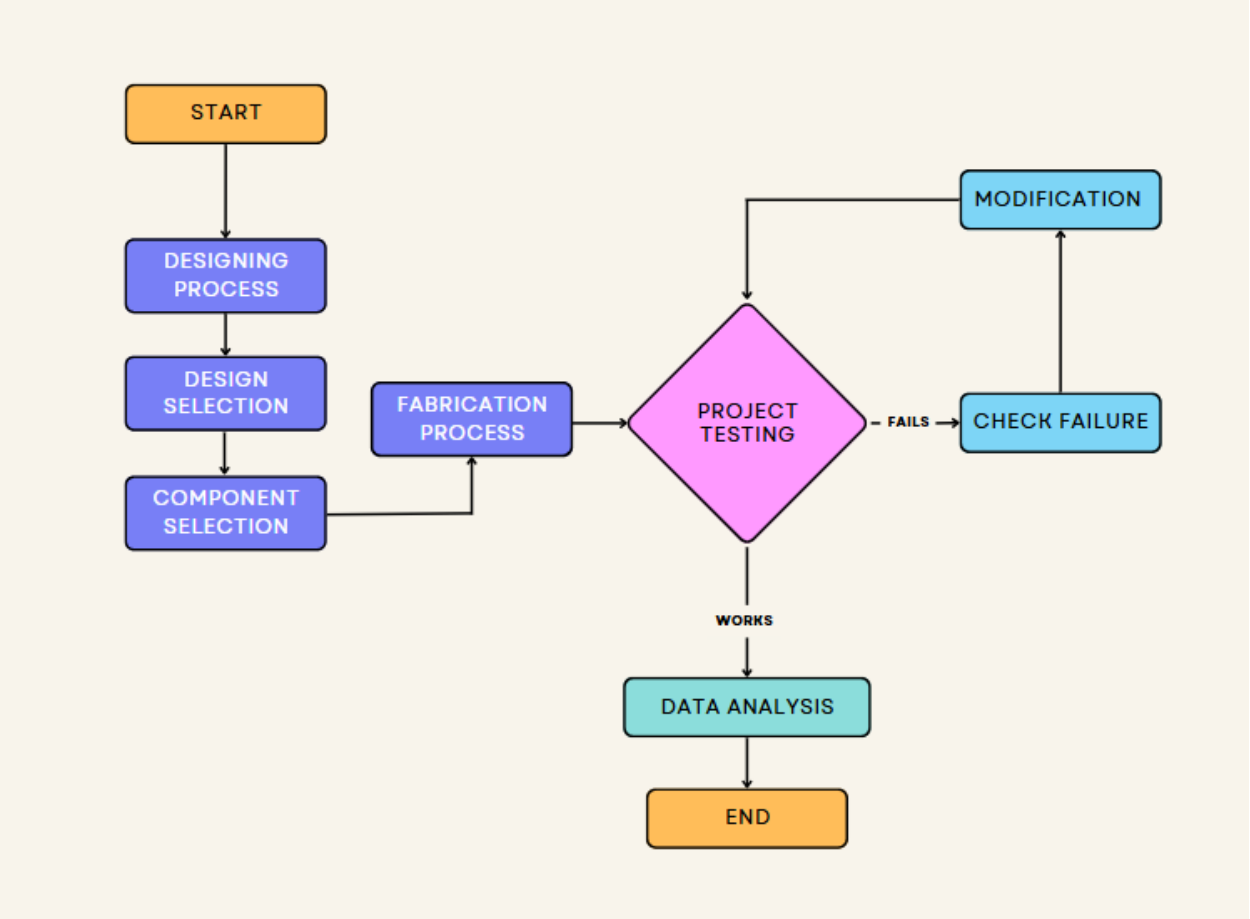

Figure 3.1: Flowchart of project implementation plan

3.3 SELECTIONS OF CONCEPTS AND DESIGN

A detailed Engine Powered Wheelbarrow design drawing will describe clearly the layout of parts or design components of this project. Even the location or place of each component on this wheelbarrow can be identified based on the size of the components and the suitability of the components it's connected and placed. Here the initial design planning is done before the selection is carried out.

3.3.1 First sketch

Figure 3.2 shows the early design of engine powered wheelbarrow. This design uses a grass cutter engine as the power source and uses sprocket and chain as the mechanism to move the wheelbarrow.

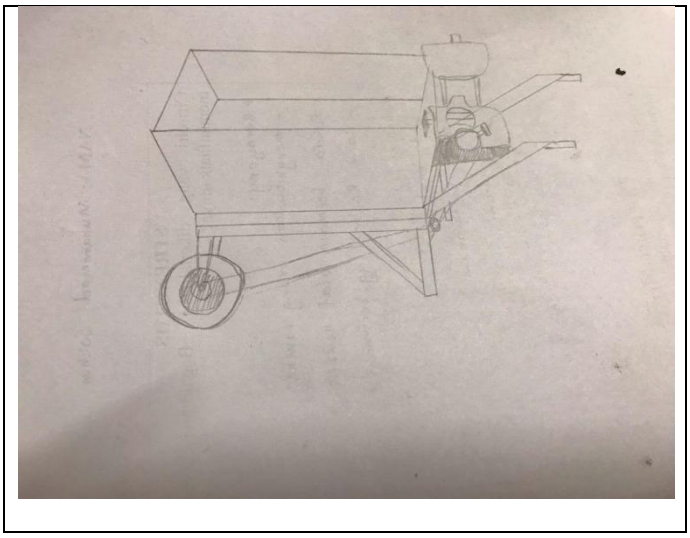

Figure 3.2: First early sketch

Advantages	Disadvantages
Simple design	High injury risk
Lightweight	Not durable

3.3.2 Second sketch

The second early sketch shows that this design uses the whole scooter motorcycle engine that uses belting and comes with tire.

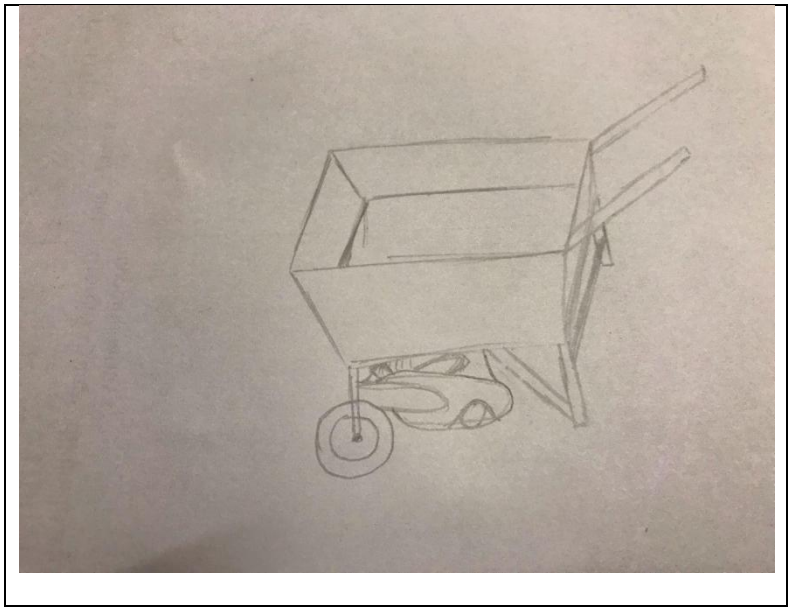

Figure 3.3: Second early sketch

Advantages	Disadvantages
Injury risk is not too high	Expensive because of high powered engine
Easy to use	High-cost engine maintenance

3.3.3 Third sketch

The last early design shows that we use the same design as before, but we added a platform to stand of while maneuvering this engine powered wheelbarrow.

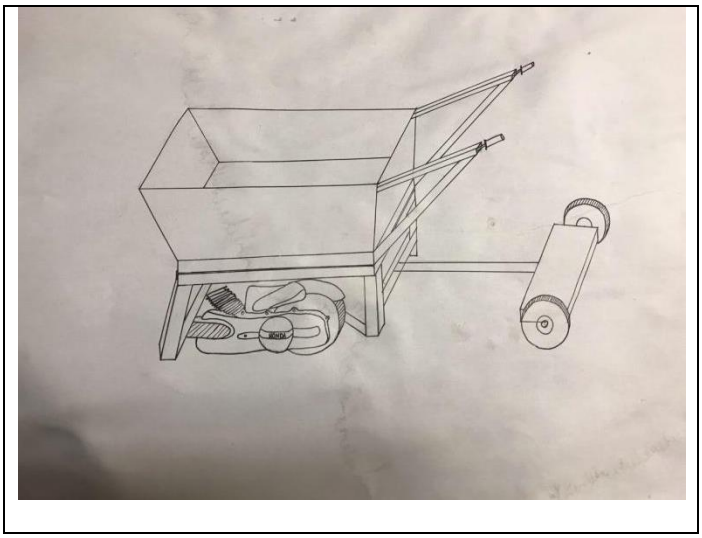

Figure 3.4: Third early sketch

Advantage	Disadvantages
Has a platform to stand on	Risk of falling from platform
Lower manpower needed	Bucket cannot move to take out loads

3.3.4 Final design

Figure below shows our final design which is we usus 49cc engine with a platform for user to stand on while maneuvering engine powered wheelbarrow.

Figure 3.5: Final design (overview)

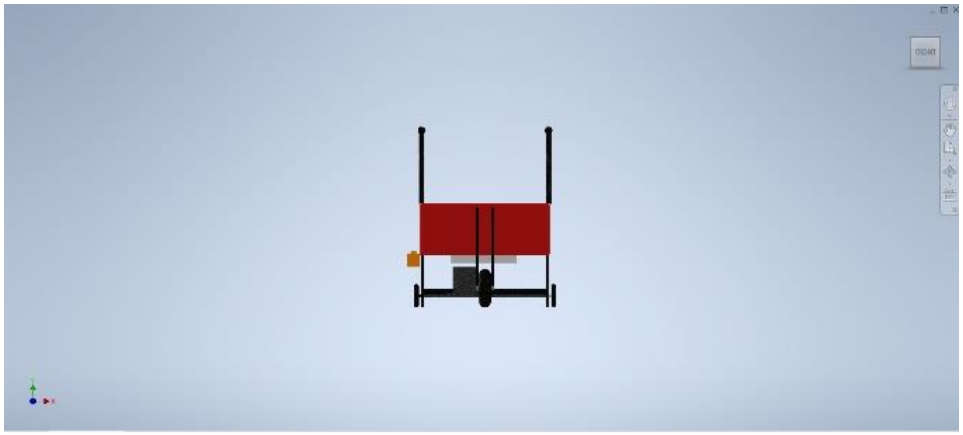

Figure 3.6: Final design (front view)

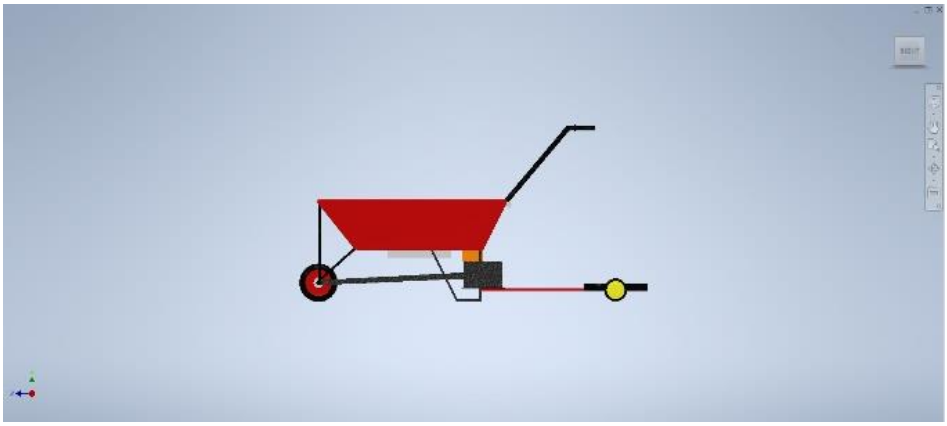

Figure 3.7: Final design (side view)

3.4 COMPUTER AIDED DESIGN

Computer-Aided Design (CAD) is a technology that uses computer software to facilitate the creation, modification, analysis, and optimization of a design. CAD is widely used in various fields, including engineering, architecture, and manufacturing, to produce precise drawings and models.

3.4.1 Installation drawing

Figure below shows the installation drawing of the engine powered wheelbarrow. Part one is the wheelbarrow base that is made from mild steel plate and hollow steel. Part two is the handle of the wheelbarrow that is made from cylindrical hollow mild steel. Part three is the rubber tires of the wheelbarrow. Part four is the engine of the engine powered wheelbarrow and part five is the fuel tank to supply power for the engine.

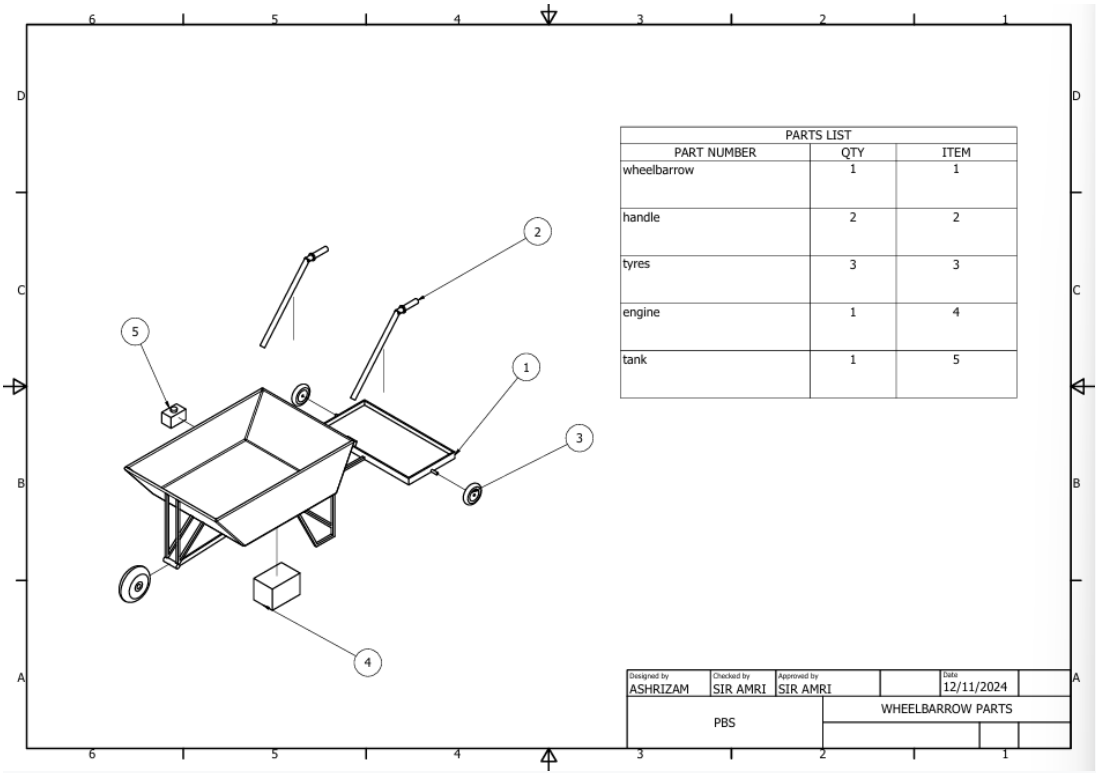

Figure 3.8: Installation drawing

3.4.2 Isometric drawing

Figure below shows the isometric drawing of the engine powered wheelbarrow which is the overview, side, top and front view. Through the top view, we can see the measurement of the project which is length and width of the project. From the side view, we can the height of our engine powered wheelbarrow.

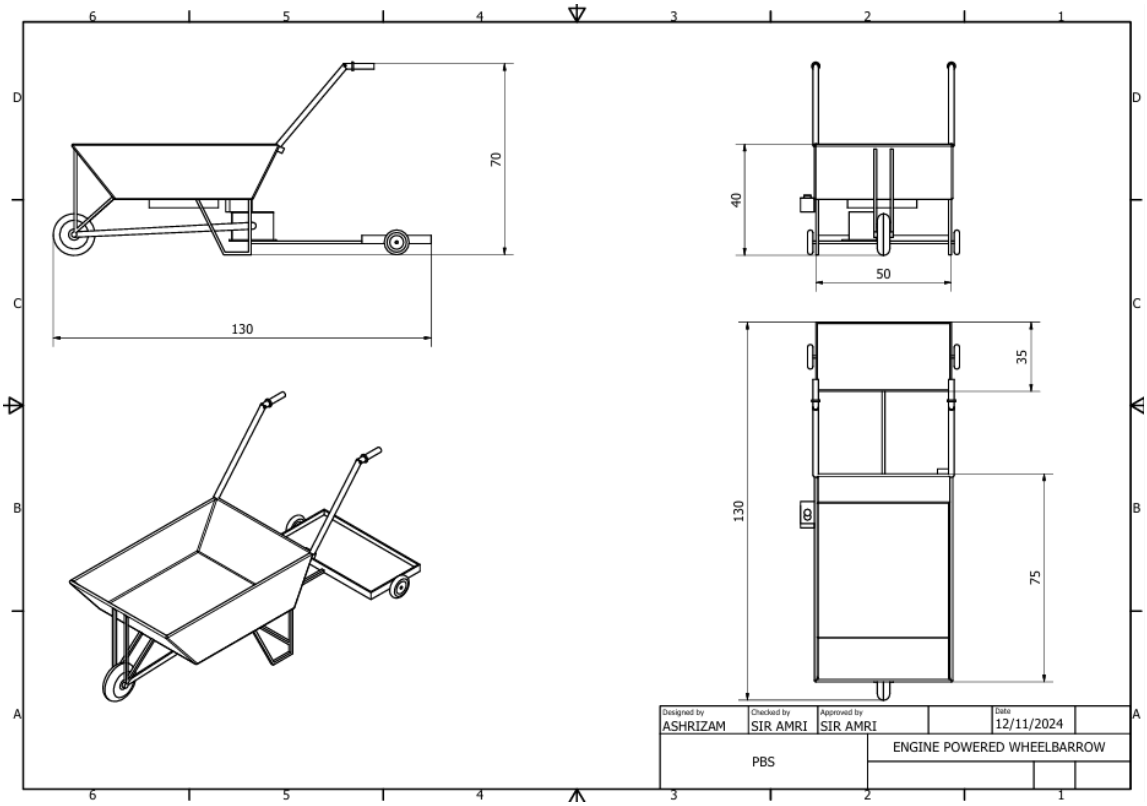

Figure 3.9: Isometric drawing

3.4.3 Overall project drawing

Figure below shows the overall drawing of the engine powered wheelbarrow that has been assembled all the components into one machine.

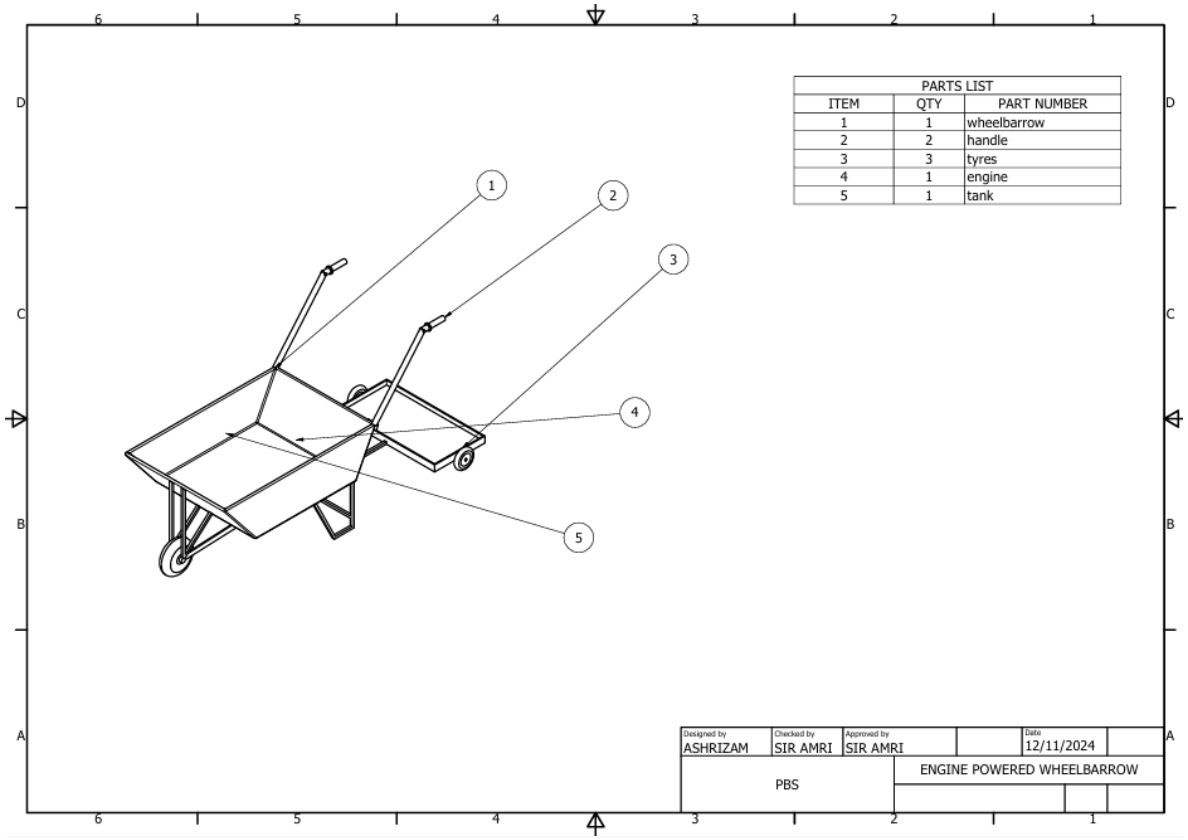

Figure 3.10: Overall drawing of the project

3.5 MATERIALS AND EQUIPMENT

The right selection of components is crucial in designing Engine Powered Wheelbarrow to prevent any misuse of substances or components used. Among the components used are:

3.5.1 Material

1. Engine

Figure 3.11: Engine

The engine is capable of moving the wheelbarrow to transfer load from one place to other places that hanging on the wheelbarrow body. A two-stroke or two-cycle engine is a type of internal combustion engine which completes a power cycle with two strokes which is up and down movements of the piston during only one crankshaft revolution. In a two-stroke engine, the end of the combustion stroke and the beginning of the compression stroke happen simultaneously, with the intake and exhaust or scavenging functions occurring at the same time. Two stroke engines often have a high power-to-weight ratio, power being available in a narrow range of rotational speeds called the power band. Compared to four-stroke engines, two-stroke engines have a greatly reduced number of moving parts, and so can be more compact and significantly lighter. (*Engine: Function, Type, Overview | SchoolWorkHelper*, 2022).

2. Flat tire (rubber)

Figure 3.12: Tire

The tire is functional to help the motorized wheelbarrow move forward. Its position is at the front like a normal wheelbarrow. (*Run Flat Tires: How They Work*, 2021).

3. Wheelbarrow bucket

Figure 3.13: Wheelbarrow bucket

The bucket is used to put the load into the bucket. (*How Does a Wheelbarrow Work? Using Compound Machines*, 2020).

4. Bicycle brake

Figure 3.14: Bicycle brake

A bicycle brake reduces the speed of a bicycle or prevents the wheels from moving. It can also guarantee the safety of the user to stop the vehicle. (CLASSIFICATIONS AND FUNCTIONS OF THE BICYCLE BRAKE LEVER | by Jumpochina | Medium, 2023).

5. Handle

Figure 3.15: Handle

The handle that is used to control the motorized wheelbarrow is like a normal wheelbarrow. But, in this project, we can control the wheelbarrow with throttle (*Wheelbarrow Handles - The #1 Handle That Increases Work & Safety*,2021). The handles are attached to the tray or bucket and are used to lift and maneuver the wheelbarrow. They are usually made of wood or metal and can be straight or curved. The handles are designed to provide leverage and balance when lifting and moving the load. (*How Does a Wheelbarrow Work? Using Compound Machines*, 2021).

6. Sprocket and chain

Figure 3.16: Sprocket and chain

A sprocket is a profiled wheel with teeth or cogs that mesh with a chain, track or other perforated or indented material. It is distinguished from a gear in that sprockets are never meshed directly and differs from a pulley in that sprockets have teeth and pulleys are smooth. Sprockets and chains can be used to change the speed, torque, or original direction of a motor. A sprocket is a toothed wheel that fits onto a shaft. A chain is used to connect two sprockets.[1] (*Chain Drives & Types of Chains | Fractory*, no date). Chains that are used to transmit motion and force from one sprocket to another are called power transmission chains. For sprockets and chain to be compatible with each other they must both have the same thickness and pitch. For the sprockets and chain to work effectively, all the sprockets should be on parallel shafts with their corresponding teeth on the same plane.[2] (*Chain & Sprocket Drives at MPT Drives*, 2021).

7. Mild steel (plate, hollow)

Figure 3.17: Mild steel

Mild steel is a type of carbon steel with a low carbon content, generally less than 0.25%. It's known for its **ductility, weldability**, and **corrosion resistance.**

8. Bolt and nut

Figure 3.18: Bolt and nut

It is used to bind two or more components. It has a variety of sizes and is suitable for use for fastening components. It is removable easily compared to welding.

9. Hinges

Figure 3.19: Hinges

A hinge is a mechanical bearing that connects two solid objects, typically allowing only a limited angle of rotation between them. Two objects connected by an ideal hinge rotate relative to each other about a fixed axis of rotation, with all other translations or rotations prevented thus, a hinge has one degree of freedom. Hinges may be made of flexible material or moving components.

3.5.2 Equipment

1. TIG welding machine

Figure 3.20: TIG welding machine

Gas tungsten arc welding (GTAW, also known as tungsten inert gas welding or TIG, and heliarc welding when helium is used) is an arc welding process that uses a non-consumable tungsten electrode to produce the weld. The weld area and electrode are protected from oxidation or other atmospheric contamination by an inert shielding gas (argon or helium). Filler metal is normally used, though some welds, known as 'autogenous welds', or 'fusion welds' do not require it. A constant-current welding power supply produces electrical energy, which is conducted across the arc through a column of highly ionized gas and metal vapors known as plasma.

2. MIG welding machine

Figure 3.21: MIG welding machine

Gas metal arc welding (GMAW), sometimes referred to by its subtypes metal inert gas (MIG) and metal active gas (MAG) is a welding process in which an electric arc forms between a consumable MIG wire electrode and the workpiece metal(s), which heats the workpiece metal(s), causing them to fuse (melt and join). Along with the wire electrode, a shielding gas feeds through the welding gun, which shields the process from atmospheric contamination.

3. Hand drill

Figure 3.22: Hand drill

A hand drill could also be used as a tool for drilling holes in hard materials such as wood, stone, or bone. For either use, the hands must also exert downward pressure while spinning the rod. As a result, the hands drift down the rod, and must be periodically raised to the top again.

4. Angle grinder

Figure 3.23: Angle grinder

A grinding machine is a tool or piece of equipment used for removing material from a workpiece via abrasion. They typically employ rotating abrasive wheels to shape, smooth, or finish workpieces through grinding. The machining process uses abrasive particles to remove material from a workpiece's surface. As the moving abrasive particles meet the workpiece, they function as minuscule cutting instruments, with each particle shearing off a small chip from the workpiece.

5. Disc cutter

Figure 3.24: Disc cutter

A disc cutter is a specialized, often hand-held, power tool used for cutting hard materials, ceramic tile, metal, concrete, and stone for example. This tool is very similar to an angle grinder, chop saw, or even a die grinder, with the main difference being the cutting disc itself (a circular diamond blade, or resin-bonded abrasive cutting wheel for a disc cutter vs. an abrasive grinding wheel for an angle grinder). This tool is highly efficient at cutting very hard materials, especially when compared to hand tools.

6. Drill press

Figure 3.25: Drill press

A drill press is a powerful tool commonly used in woodworking and metalworking applications. It is designed to drill precise holes with great accuracy and control. Unlike a handheld drill, a drill press is a stationary machine that allows you to secure your workpiece and bring the drill bit down onto it vertically. This ensures consistent drilling depth and eliminates the risk of the drill bit wandering off course.

3.6 FABRICATION PROCESS

1. The hollow steels measured, cut and sections are positioned for welding.

Figure 3.26: Measuring and cutting process

2. The hollow steel welded and grinded to get a smoother surface.

Figure 3.27: Welding and grinding process

3. Hollow steel combined into a single engine frame.

Figure 3.28: Frame fabrication

4. The engine frame is welded to join the original frame of the wheelbarrow.

Figure 3.29: Engine frame welding

5. Plate is measured to be part of the engine base and footrest.

Figure 3.30: Plate measuring

6. Welded plates for the footrest part.

Figure 3.31: Plate welding

7. Sprockets are attached to the wheelbarrow tires.

Figure 3.32: Sprocket welding

8. Wheelbarrow bucket with new base, tires and engine installed on the wheelbarrow frame.

Figure 3.33: Wheelbarrow assembling

9. Install the tire on the footrest and connect it to the back of the wheelbarrow frame.

Figure 3.34: Footrest installation

10. Install brakes, throttle and fuel tank.

Figure 3.35: Brake, throttle and tank installation

11. After successfully installing all components, we are testing our project to see if it works.

Figure 3.36: Project testing

3.7 TESTING OPERATION

To operate the engine-powered wheelbarrow, begin by checking the engine, ensuring there is enough fuel and oil and that key components such as the carburetor and air filter are clean and functioning well. Start the engine by turning on the switch or pulling the start cord, allowing the engine to warm up for a few moments to reach optimal performance. Once the engine is ready, test the wheels by moving the control to ensure the wheels rotate smoothly at the expected speed and torque. Next, perform a load test by placing weight in the wheelbarrow to simulate actual use, then move the wheelbarrow to ensure the engine can handle the load without issues. Test the braking system by stopping the wheelbarrow on uphill and downhill paths to ensure it can operate safely on various surfaces. Finally, turn off the engine using the power switch or key, making sure the engine stops completely, and check for any signs of overheating or leaks. This procedure ensures the wheelbarrow is ready for safe and reliable heavy-duty use.

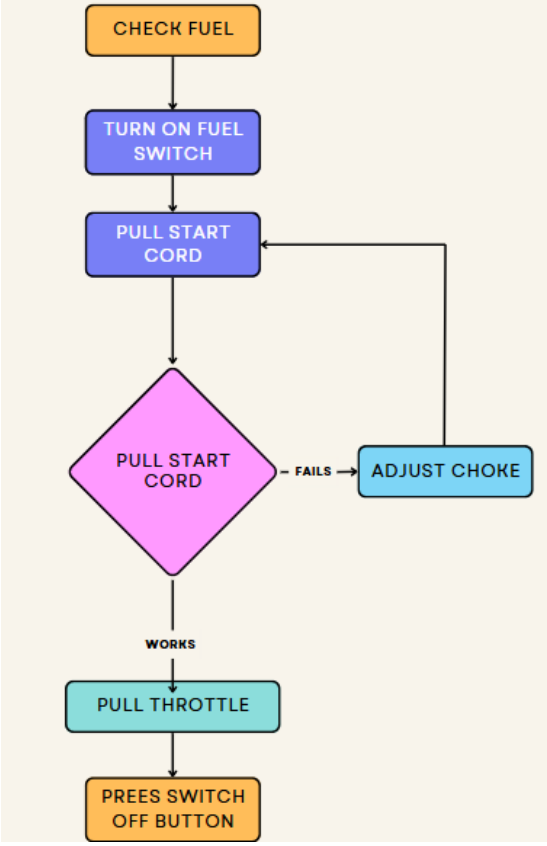

Figure 3.37: Testing operation flow chart

3.8 PROJECT GANTT CHART

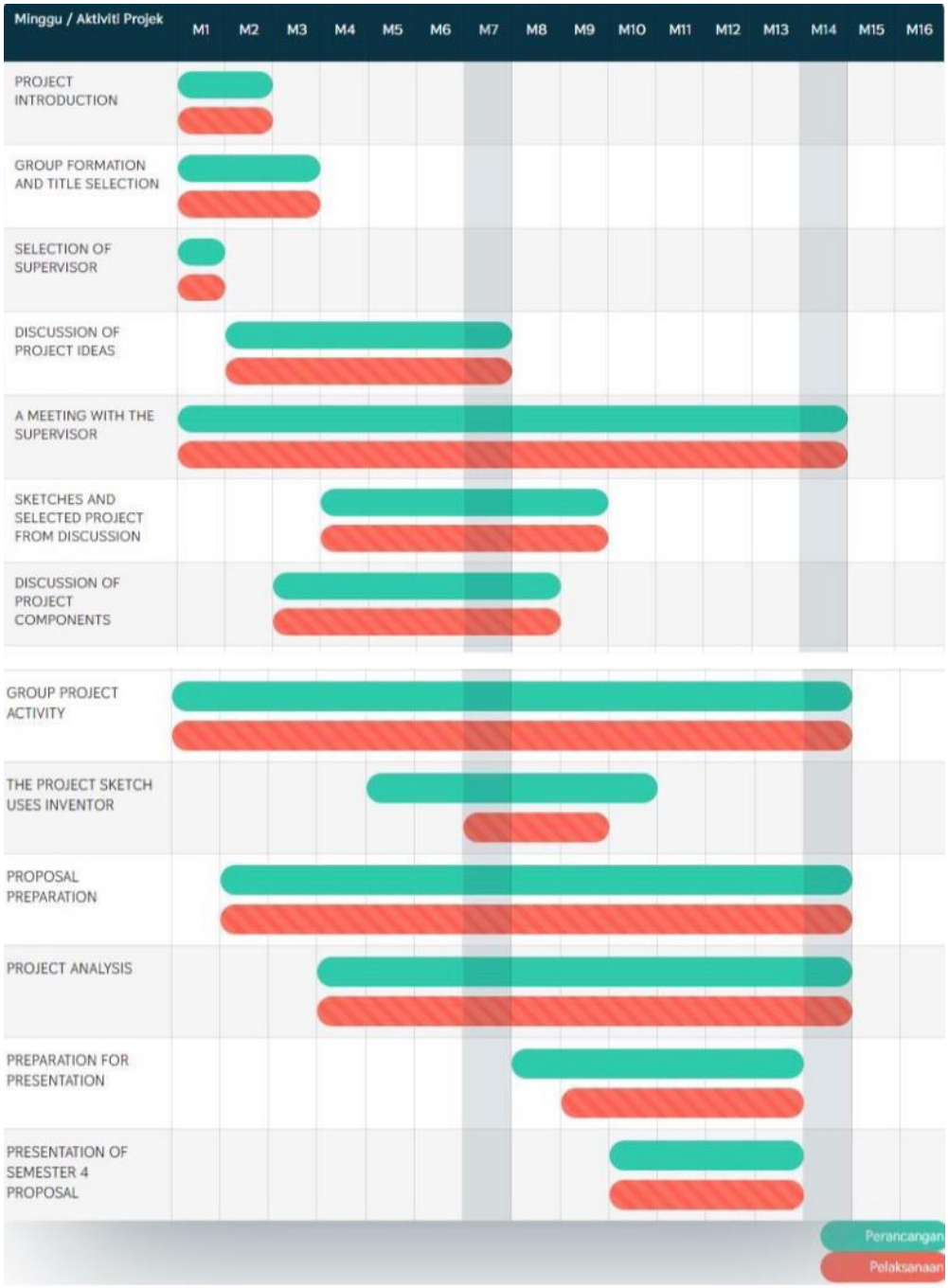

Figure 3.38: Project 1 Gantt chart

The Gantt chart below shows the entire activity and process of forming an engine powered wheelbarrow starting from the search for ideas, selecting the title, project fabrication, data analysis testing until the project is fully completed.

Figure 3.39: Project 2 Gantt chart

3.9 DATA ANALYSIS METHOD

The data collection and analysis for engine powered wheelbarrow involves measuring and recording parameters such as maximum loads in the bucket and on the platform, engine power, sprocket ratio. Statistical analysis techniques may be applied to identify relationships and assess performance variations. By interpreting the collected data, insights can be gained into the scrubber's efficiency, limitations, and performance, leading to conclusions and recommendations for potential improvements.

3.10 SUMMARY

In the initial stage, the design of the study, the method of collection data, study instruments, data sampling techniques and data analysis methods made systematically in the study of the methodology to find out the facts and information to support the instruments of study and illustrate more clearly in this study.

After the analysis of the data is performed, it is important to formulate or inference to the same results and hypotheses there are such pitfalls effective or not.

CHAPTER 4:
RESULTS AND DISCUSSION

4.1 INTRODUCTION

This chapter will explain about each result obtained based on the objectives set in Chapter 1. There are three objectives for this study, which are starting the engine powered wheelbarrow and riding it, carrying load while riding and testing the bucket lock and braking system. As well as testing the effectiveness of the engine powered wheelbarrow compared to the manual wheelbarrow. We also have conducted a survey to gain feedback. This chapter will report analysis of each objective that has been set.

4.2 PROJECT FINDINGS

The survey that we conducted which is 'The effectiveness of Engine Powered Wheelbarrow' that was held in Politeknik Banting Selangor. Below are some of the charts of our finding which is 'The effectiveness of Engine Powered Wheelbarrow'.

4.2.1 Survey finding

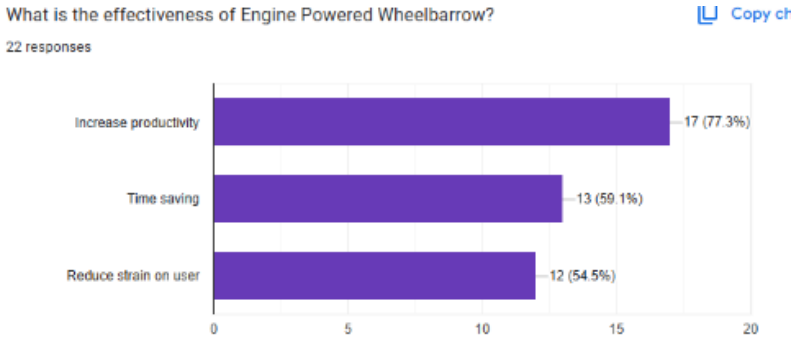

Figure 4.1: Bar chart of the first question of the survey

Bar chart above shows some of the effectiveness of using engine powered wheelbarrow. Most of the respondent agreed that our project can increase productivity of works, flowed by the second most responded answer which is time saving and the last selection which is reduce strain on user. Our study has proven that our project can solve the problems regarding the usage of using manual wheelbarrow.

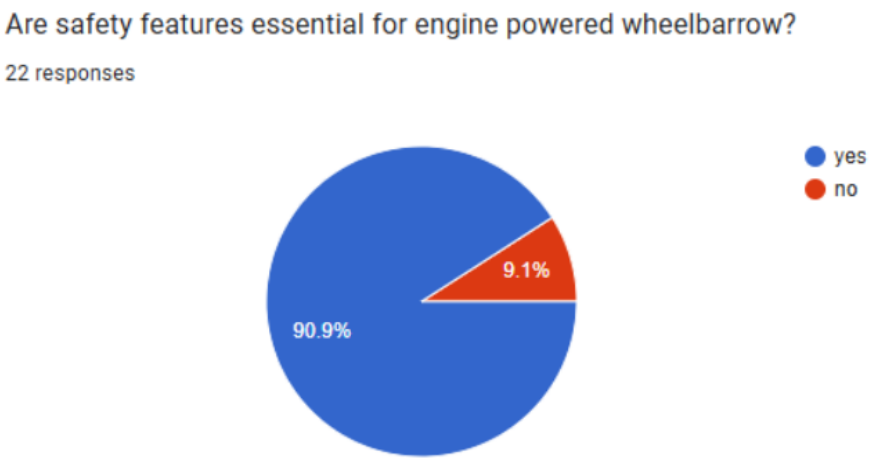

Figure 4.2: Pie chart of the second question of the survey

The pie chart above shows that 90.9% of the respondent agreed that safety features are essential for engine powered wheelbarrow. This is one of the reasons why we prioritize the safety features of our product which brake systema and bucket lock mechanism.

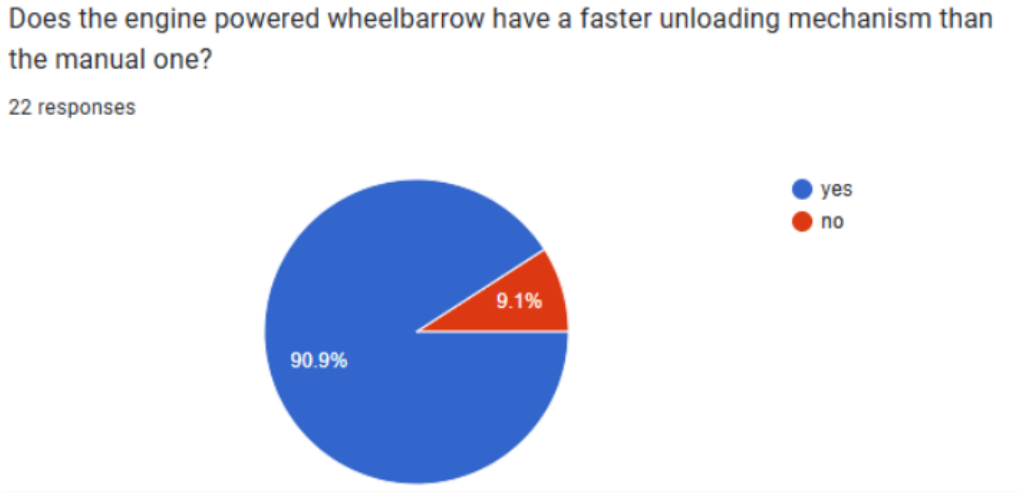

Figure 4.3: Pie chart of the third question of the survey

Another pie chart above shows that 90.9% of the respondent agree that our engine powered wheelbarrow have a faster unloading mechanism than the manual one. This is because the force required to unload the manual wheelbarrow are higher than our engine powered wheelbarrow.

4.2.2 Survey conclusion

The survey conducted on the effectiveness of engine-powered wheelbarrows revealed several significant insights regarding their performance, usability, and overall impact on productivity in various applications.

In conclusion, the survey indicates that engine-powered wheelbarrows are effective tools that enhance productivity and reduce physical labor in various applications. However, addressing environmental concerns and incorporating user feedback for improvements could further increase their adoption and effectiveness in the market. Future developments should focus on sustainability and user-centric design to meet the evolving needs of users.

4.3 MATHEMATICAL CALCULATIONS IN PRODUCT DESIGN

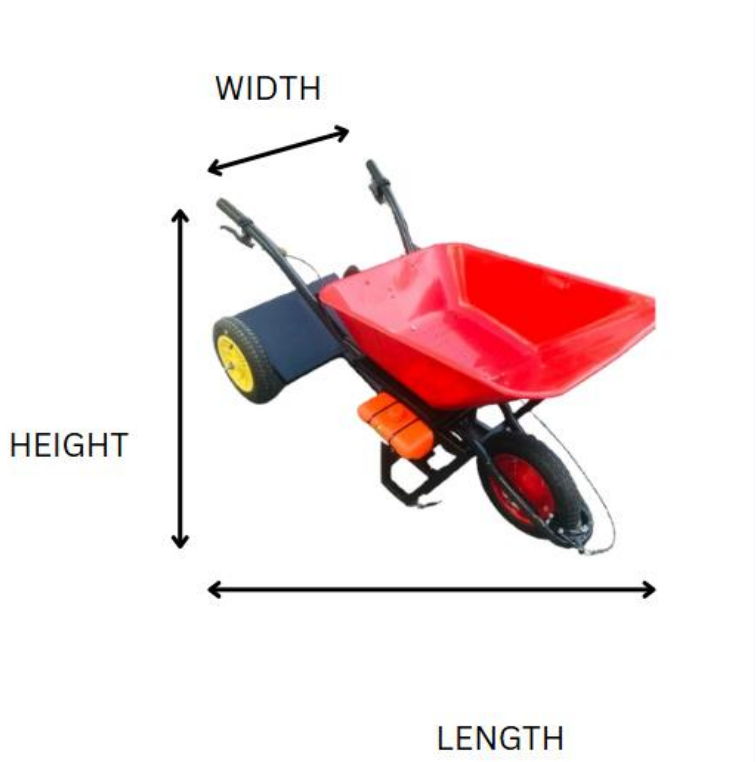

Figure 4.4: Engine powered wheelbarrow measurement

4.3.1 Analysis data

Below shows the analysis and measurements on Engine powered Wheelbarrow:

1. Height: 700mm
2. Length: 1300mm
3. Width: 500mm
4. Driving sprocket size: 6 teeth
5. Driven sprocket size: 60 teeth
6. Engine rpm: 8000
7. Tyre size(diameter): 33cm

4.3.2 Calculation

1. Sprocket ratio = Num of driven sprocket teeth/Num teeth of driving sprocket

=60/6 = 10

2. Tyre rpm = engine rpm/sprocket ratio

= 8000/10 =800rpm

3. Tyre circumference = π x 0.33m

=1.04m

4. Linear speed = Tyre rpm x circumference

= 800 x 1.04

=832 meter per minute

5. Convert to kilometre/hour (max speed) = 49.92 km/h

6. Engine power = 3HP

= 3 x 745.7

=2237.1 Watt

7. Efficiency = 85% = 0.85

8. Effective power output = engine power x efficiency

= 2237.1 x 0.85

= 1901.54 Watt

9. Force to move load = power/ velocity

=1901.54/1

=1901.54 N

10. Wheelbarrow weight = 50kg = 490.5N

11. Maximum load = 1901.54 - 490.5

=1411.04 =143.84kg

4.4 COST ANALYSIS

Material	Price per unit (RM)	Quantity	Total price (RM)
49cc Engine	250	1	250
Sprocket	13	1	13
Mild steel plate	35	1	35
Hollow mild steel	25	2	50
Wheelbarrow	95	1	95
Tires	25	3	75
Nut	1	4	4
Shaft	15	1	15
Chain	15	2	30
Bolt and nut set	4	2	8
		Total	575

Table 4.1: Quantity and cost of material

First, from the total amount of our project is RM575 we have spent to make our project, so we want to sell our project to others in the estimated cost of RM750 to sell because we have calculated the results of our hard work to complete the project and the cost of vehicle oil to buy item and materials.

4.5 TESTING OUR PROJECT

One of the primary methods we used to gather data on the speed and durability of our engine-powered wheelbarrow involved conducting two distinct tests to assess its performance under different conditions. In the first test, we focused solely on the user's weight, evaluating how the wheelbarrow performed when carrying just the operator across a flat surface. For the second test, we introduced a significant challenge by adding additional load to the wheelbarrow, simulating a more realistic scenario where the user is tasked with transporting both themselves and a substantial amount of cargo. These tests provided critical insights into the wheelbarrow's handling, speed, and overall durability, allowing us to assess its capabilities under varying levels of stress.

i) Test the engine powered wheelbarrow while just carrying the user.

Figure 4.5: Testing without load

Date	Time	Speed
18 October 2024	5.00 pm	23km/h

Table 4.2: Testing without load

ii) Test the engine powered wheelbarrow while carrying the user and add load.

Figure 4.6: Testing with load

Date	Time	Speed
18 October 2024	5.30 pm	12 km/h

Table 4.3: Testing with load

The results of our tests revealed that the engine-powered wheelbarrow retains its ability to move even under a substantial load of 110 kg, though its speed is slightly reduced. However, when the load is reduced to 55 kg, the wheelbarrow operates more swiftly and remains easy to control. These findings confirm that our project has successfully met its design goals: the wheelbarrow demonstrates both impressive strength and durability while effectively handling varying loads. Even with heavier cargo, the wheelbarrow continues to perform reliably, validating the robustness of our design.

4.6 SAFETY RISKS

Every product design must comply with safety specifications either during the development or operation process.

No.	Risk	Mitigation
1	If the operator loses control or if there is a malfunction in the braking system, it could lead to collisions or injuries.	Inspect the brakes before each use to ensure they're functional. Operate the wheelbarrow at a safe speed, especially on slopes or near other workers.
2.	The wheelbarrow bucket opened, causing the contents to spill out uncontrollably, all because no one took the time to secure the latch.	Ensure that the bucket latch is securely fastened before moving the wheelbarrow.
3.	Engine, bucket and tires easy to be pulled off if not installed properly.	Make sure all screws and nuts are tightened securely and correctly and are in good condition.

Table 4.4: Safety risks

CHAPTER 5:
CONCLUSIONS AND RECOMENDATIONS

5.1 CONCLUSION

In conclusion, the engine-powered wheelbarrow is a highly promising innovation that offers significant advantages to farmers, landscapers, construction workers, and rural residents. By incorporating an engine, this wheelbarrow reduces the physical strain and fatigue traditionally associated with manual labor, allowing for faster, more efficient transportation of heavy loads. This improvement in efficiency not only boosts productivity but also provides a more practical solution for individuals working in demanding environments such as farms, construction sites, or villages.

The data collected from our testing has provided valuable insights into the wheelbarrow's performance and durability. During our tests, we found that the wheelbarrow successfully handled loads of up to **110 kg**, though its speed was slightly reduced when carrying heavier loads. On the other hand, when carrying a lighter load of **55 kg**, the wheelbarrow moved more swiftly and remained easy to control, confirming its versatility and robustness. Additionally, the materials used in the construction of the wheelbarrow demonstrated excellent durability, with no significant signs of wear or failure after extended use under various conditions. This reflects the high quality of the components chosen, ensuring that the wheelbarrow can withstand the stresses of heavy-duty work and rough terrain.

Despite these successes, there are still several areas for improvement to further enhance the wheelbarrow's performance and user experience. First, upgrading to a more powerful engine will allow the wheelbarrow to carry even heavier loads without compromising speed or efficiency. This improvement will make the wheelbarrow more suitable for industrial-scale tasks and larger loads. Second, expanding the range of sizes available will cater to a wider range of users, especially farmers with larger plots of land or businesses needing to transport bulky materials in one trip. Larger models would significantly improve operational efficiency, allowing for more goods to be moved at once, thus increasing productivity.

Furthermore, we plan to enhance the safety features of the wheelbarrow by upgrading the braking system. Replacing the current system with **disc brakes** will provide more reliable stopping power, especially when carrying heavy loads or navigating downhill. Adding **brakes to the rear tires** will improve stability and control, reducing the risk of tipping and ensuring safer operation, particularly on uneven or sloped surfaces.

With continued development and further testing, we are confident that the engine-powered wheelbarrow will evolve into an even more powerful, versatile, and durable tool. By addressing these key areas of improvement—engine power, size options, and safety features—we aim to make this wheelbarrow an indispensable tool for a broader range of applications. Ultimately, our vision is for this project to not only meet the current needs of its users but also exceed their expectations, making it a long-term solution for efficient material handling and reducing manual labor across multiple industries.

5.2 RECOMMENDATION AND IMPROVEMENT

1. Replacing the engine with a faster one will help the wheelbarrow carry heavier loads and move more efficiently. This upgrade will improve both speed and load capacity, making it better for different tasks.

2. Offering different sizes will allow the wheelbarrow to meet the needs of users with larger farms or bigger jobs. Larger models will help carry more in one trip, improving efficiency and attracting more customers.

3. Upgrading **disc brakes** will make stopping easier, especially when carrying heavy loads. Adding **brakes to the rear tires** will improve stability and control, making the wheelbarrow safer to use on uneven ground or slopes.

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APPENDIX

LAMPIRAN A **Jadual Agihan Tugasan Individu Kumpulan Projek**

LAMPIRAN B **Engine Powered Wheelbarrow Google Form**

LAMPIRAN C **Turnitin Report Check**

LAMPIRAN A

DJJ50193 PROJEK 2 DJJ40182 PROJEK 1 APPENDIX A

JABATAN KEJURUTERAAN MEKANIKAL

JADUAL AGIHAN TUGASAN INDIVIDU KUMPULAN PROJEK

TAJUK PROJEK: ENGINE POWERED WHEELBARROW

SUB-CHAPTERS	DESCRIPTION
NAME OF STUDENT: MUHAMMAD HAFIZUDDIN BIN MOHAMAD AZLI (24DKM22F1052)	
CHAPTER 1	**1.1 INTRODUCTION** **1.2 BACKGROUND PROJECT**
CHAPTER 2	**2.3 WHEELBARROW IN MALAYSIA** **2.4 PART OF WHEELBARROW**
CHAPTER 3	**3.5 MATERIALS AND EQUIPMENTS** **3.5.1 MATERIALS** **3.5.2 EQUIPMENTS** **3.6 FABRICATION PROCESS** **3.9 DATA ANALYSIS METHOD**
CHAPTER 4	**4.1 INTRODUCTION** **4.4 COST ANALYSIS**
CHAPTER 5	**5.1 CONCLUSION**
NAME OF STUDENT: MUHAMMAD ASHRIZAM BIN MOHD ASHRI (24DKM22F1035)	
CHAPTER 1	**1.3 PROBLEM STATEMENT** **1.4 OBJECTIVES**
CHAPTER 2	**2.5 WHEELBARROW INNOVATED ON THE INTERNET**
CHAPTER 3	**3.4 COMPUTER AIDED DESIGN** **3.4.1 INSTALLATION DRAWING** **3.4.2 ISOMETRIC DRAWING** **3.4.3 OVERALL PROJECT DRAWING** **3.10 SUMMARY**
CHAPTER 4	**4.2 PROJECT FINDING** **4.2.1 SURVEY FINDING** **4.2.2 SURVEY CONCLUSION**
CHAPTER 5	**5.1 CONCLUSION**

NAME OF STUDENT: HILAL AZRIL BIN MAMAT (24DKM22F1050)	
CHAPTER 1	**1.5 IMPACT OF THE PROJECT** **1.6 SCOPE OF PROJECT**
CHAPTER 2	**2.6 COMPARISON BETWEEN EXISTING PRODUCTS**
CHAPTER 3	**3.1 INTRODUCTION** **3.2 FLOW CHART** **3.7 TESTING OPERATION** **3.8 GANTT CHART PROJECT**
CHAPTER 4	**4.3 MATHEMATICAL CALCULATION IN THE PROJECT** **4.3.1 ANALYSIS DATA** **4.3.2 CALCULATION**
CHAPTER 5	**5.2 RECOMMENDATIONS AND IMPROVEMENTS**
NAME OF STUDENT: MUHAMMAD SHOLIHIN BIN MAT ZIN (24DKM22F1031)	
CHAPTER 1	**1.7 SUMMARY**
CHAPTER 2	**2.1 INTRODUCTION** **2.2 EARLY RESEARCH (WHEELBARROW)**
CHAPTER 3	**3.3 SELECTION OF CONCEPTS AND DESIGN** **3.3.1 FIRST SKETCH** **3.3.2 SECOND SKETCH** **3.3.3 THIRD SKETCH** **3.3.4 FINAL DESIGN**
CHAPTER 4	**4.5 TESTING OUR PROJECT** **4.6 SAFETY RISK**
CHAPTER 5	**5.2 RECOMMENDATIONS AND IMPROVEMENTS**

Pengesahan Penyelia Projek:

…….
Nama:

LAMPIRAN B

Engine Powered Wheelbarrow Google Form

The effectiveness of using Engine Powered Wheelbarrow

Our Engine powered wheelbarrow is the result of our brainstorming. After doing some research, we have gathered information regarding the impact of using a manual wheelbarrow that can cause many problems for the user. This product has two functions, one that will move the stroller and the other that will be designed for standing users. The purpose of this product is to make it easier for users in terms of energy consumption and load pressure. With the design of this product, it can increase the ergonomic effect on users.

ENGINE POWERED WHEELBARROW

1. What is your name?

_____

2. What is your gender?

_____

3. How old are you?

_____

4. What is the effectiveness of using Engine Powered Wheelbarrow?
   - Increase productivity
   - Time saving

- Reduce strain on user
- Other: _____

5. Have you used manual wheelbarrow?
   - Yes
   - No

6. Is an Engine Powered Wheelbarrow more efficient than the manual one?
   - Yes
   - No

7. Does Engine Powered Wheelbarrow have a longer lifespan than the manual one?
   - Yes
   - No

8. Are safety features essential for Engine Powered Wheelbarrow?
   - Yes
   - No

9. Does the Engine Powered Wheelbarrow have a faster unloading mechanism than the manual one?
   - Yes
   - No

10. What is the recommendation/suggestion to improve our product?
    - Use battery powered motor
    - Add seat for user
    - Add hydraulic actuator as unloading mechanism
    - Add shock absorbing suspension
    - Add brake lock mechanism
    - Add load indicator
    - Add adjustable handle height
    - Other: _____

LAMPIRAN C

Turnitin Report Check

ENGINE POWERED WHEELBARROW (FYP REPORT PROJECT 2).pdf

by Hafizuddin Azli Hafizuddin Azli

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