UNIVERSITI MALAYSIA PAHANG

BORANG PENGESAHAN STATUS TESIS

JUDUL: DESIGN AND FABRICATION OF RELIABILITY TEST DEVICE FOR TELEPHONE CORD PULLING STRENGTH AND SLIP DOWN TEST

SESI PENGAJIAN: 2009/2010

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DESIGN AND FABRICATION OF RELIABILITY TEST DEVICE FOR TELEPHONE CORD PULLING STRENGTH AND SLIP DOWN TEST

SYAHIDAH NAFISA BTE ABDUL MALIK

UNIVERSITI MALAYSIA PAHANG

DESIGN AND FABRICATION OF RELIABILITY TEST DEVICE FOR TELEPHONE CORD PULLING STRENGTH AND SLIP DOWN TEST

SYAHIDAH NAFISA BTE ABDUL MALIK

A report submitted in fulfillment of the
requirement for the award of the Diploma
of Mechanical Engineering

Faculty of Mechanical Engineering
UNIVERSITI MALAYSIA PAHANG

NOVEMBER 2009

SUPERVISOR DECLARATION

I hereby declare that I have read this project report and in my opinion this project report is sufficient in terms of scope and quality for the award of the Diploma in Mechanical Engineering.

Signature :

Name of Supervisor : MOHAMAD ZAIRI B BAHAROM

Date :

STUDENT DECLARATION

I declare that this report entitled "*Design and fabrication of reliability test device for telephone cord pulling strength and slip down test"* is the result of my own research except as cited in the references. The report has not been accepted for any diploma and is not concurrently submitted in candidature of any other diploma.

Signature :

Name : SYAHIDAH NAFISA BTE ABDUL MALIK

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Date :

DEDICATION

This report is dedicated to Allah Subhanahu wa Ta`aalaa whose guidance, help and grace was instrumental in making this humble work a reality. To my parents, friends, without whom and his/her lifetime efforts, my pursuit of higher education would not have been possible and I would not have had the chance to study for a mechanical course.

Also to my supervisor, Mr Mohamad Zairi b Baharom and mechanical staff, without whose wise suggestion, helpful guidance and direct assistance, it could have neither got off the ground nor ever been completed.

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I would like to express my gratitude and appreciation to all those who gave me the possibility to complete this report. Special thanks is due to my supervisor Mr. Mohamad Zairi b Baharom whose help, stimulating suggestions and encouragement helped me in all time of fabrication process and in writing this report.

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Many thanks go to the all lecturer and supervisors who have given their full effort in guiding the team in achieving the goal as well as their encouragement to maintain our progress in track. My profound thanks go to my DMM students and my family for their continuous support and confidence in my effort.

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ABSTRACT

This project is to design and fabricate reliability test device for telephone cord pulling strength and slip down test. The main problem is the reliability test of curl-cord pulling strength and slip down test at Panasonic Company does not have test device specifically. When measures the length of the curl cord at 45°, the curl cord was bending and makes the result not precise. It also happen for slip down test where it difficult to define the exactly view or moment when the base unit start moving. It is important to further improve the current design of reliability test device for curl cord pull strength test and also slip down test to make the result from the test is more precise and accurate. The first stage is design or sketch a few concepts the reliability test device. Second stage is made a conceptual process which is selecting the best design as a final design before further to fabrication process. For this stage, to choose the best concept the concept selection were done. And the last stage is fabricating the device by using the final design that has been chosen. A few processes involved to fabricate the device which are measuring and marking, cutting, joining, drilling, finishing, assembling and lastly is spraying process.

ABSTRAK

Projek ini adalah untuk mereka dan menghasilkan sebuah alat menguji untuk ujian kekuatan tarikan tali telefon dan ujian gelincir ke bawah bagi telefon model Panasonic ITS KX-TS500. Masalah utama yg dihadapi oleh syarikat Panasonic ini adalah alat yang sedang digunakan untuk menguji kekuatan tarikan tali telefon dan ujian gelincir ke bawah di syarikat tidak spesifik kegunaannya. Apabila ujian menguji kekuatan tarikan tali telefon dijalankan pada 45°, tali telefon tersebut melengkung dan membuatkan keputusan yang diperolehi tidak tepat. Ini juga berlaku pada ujian gelincir ke bawah dimana penguji sukar untuk melihat detik bermulanya asas telefon bergerak. Jadi, alat penguji yang baru sangat penting untuk memastikan kepuusan bagisetiap ujian yg dijalankan adalah lebih tepat dan jitu. Langkah yang pertama adalah mereka atau melakar beberapa bentuk atau corak alat penguji ini. Langkah yang kedua adalah melakukan proses pemilihan konsep yang terbaik untuk dijadikan konsep atau reka bentuk yang terbaik untuk proses pembentukan. Dalam peringkat ini, untuk memilih konsep yang terbaik, pemilihan konsep telah dilakukan. Dan langkah yang terakhir adalah membuat alat penguji yang sebenar dengan berpandukan reka bentuk yang telah dipilih. Terdapat beberapa proses yang terlibat dalam proses membuat alat penguji ini. Antaranya ialah proses mengukur dan menanda ukuran, proses pemotongan, proses penyambungan, proses menebuk lubang, proses pencantuman dan akhir sekali proses penyemburan cat.

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LIST OF ABBREVIATIONS

ITS	Integrated Telephone System
MIG	Metal Inert Gas Welding
PPE	Personal Protective Equipment
SMAW	Shielded metal arc welding
SOP	Standard Operation Procedure
UMP	University Malaysia Pahang

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CHAPTER 1

INTRODUCTION

1.0 INTRODUCTION

This chapter explained about the problem statement, project background, and the objective of the project, project scope, project flow, and the planning of the project.

1.1 PROBLEM STATEMENT

Nowadays reliability test of curl-cord pulling strength and slip down test at Panasonic Company doesn't have test device specifically. So, for test pulling strength test, there is no specific device to do the test. When measures the length of the curl cord at 45°, the curl cord was bending and makes the result not precise. It also happen for slip down test where it difficult to define the exactly view or moment when the base unit start moving.

It is important to further improve the current design of reliability test device for curl cord pull strength test and also slip down test to make the result from the test is more precise and accurate.

1.2 PROJECT BACKGROUND

In the world of industry, reliability test is one of important procedure. The concept of reliability tests the process of using quantitative methods and qualitative methods to evaluate consumer response to a product idea prior to the introduction of a product to the market. It can also be used to generate communication designed to alter consumer attitudes toward existing products. To give the consumer satisfaction, the product must be good in function. This project is deal with one of the customer satisfaction value while using Integrated Telephone System (ITS) which are pulling the telephone cord at 45° to measure the length of the cord when the telephone base unit start moving and also measure the angle of the telephone base unit from the surface when it start moving.

1.3 OBJECTIVE

The objective of this project is to design and fabricate reliability test device for telephone cord pulling strength and slip down test.

1.4 SCOPES

This project will be limited within the following scopes, which are:

1.4.1 This study is focused on Integrated Telephone System (ITS) model of Panasonic KX-TS500.

1.4.2 Focused on measure the length of the telephone cords when the telephone base unit starts moving for telephone cord puling strength test.

1.4.3 Focused on measure the angle of the telephone when the telephone base unit starts moving for slip down test.

1.4.4 Focused on four different surfaces which are glass, plywood, zinc and aluminum surface.

1.5 PROJECT FLOW

Figure 1.1 shows the flow chart of this project.

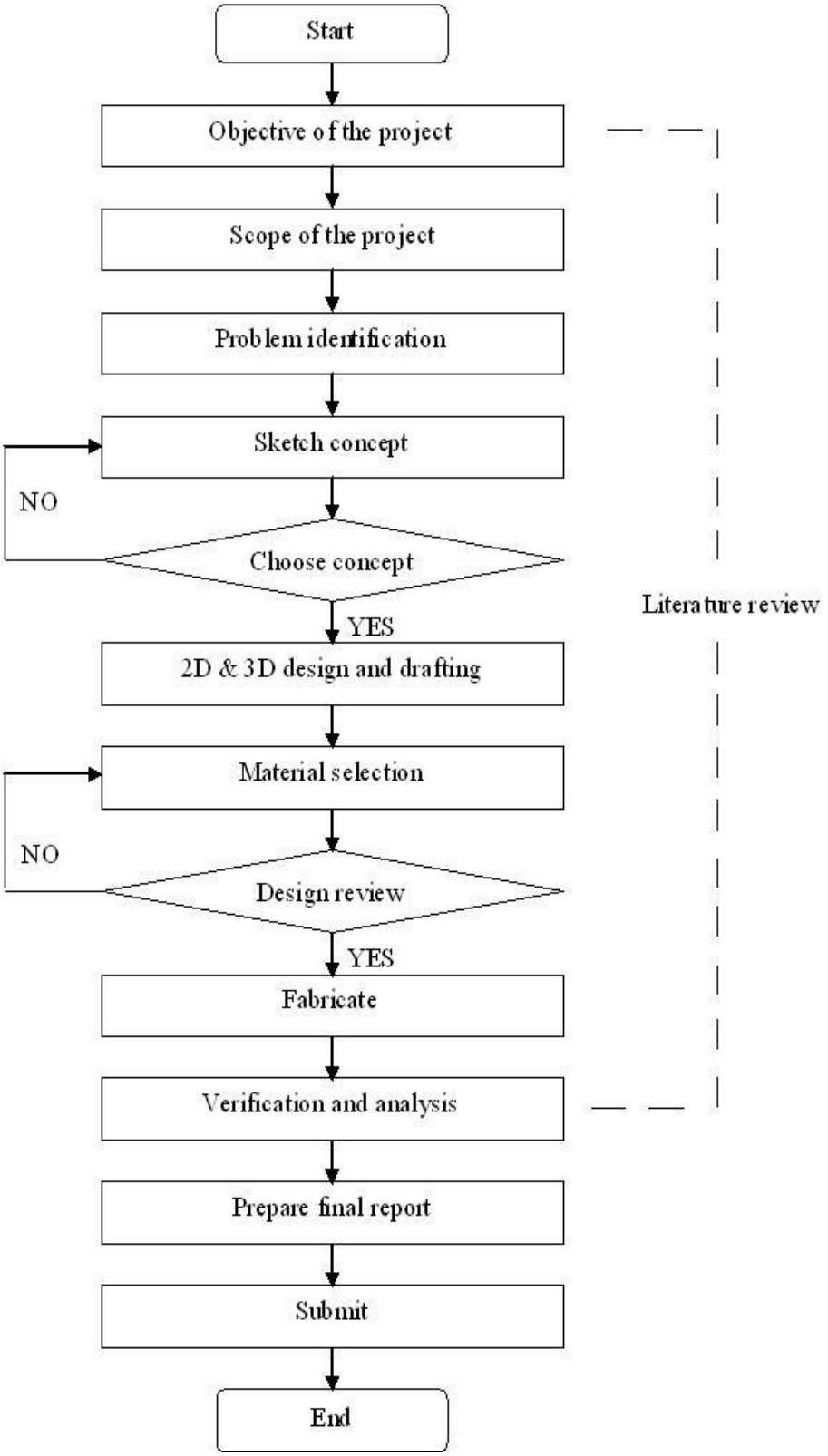

Figure 1.1 Project flow chart

This project started with made a research and literature review. It is from internet, magazines, public areas and my supervisor that related with my project. All of this literature review takes about eight weeks. This literature review concludes with objectives, scopes and problem identification for this project. A also made a schedule management or Gantt chart for my project.

After gathering all the relevant information, the project undergoes with the design process. I started with the sketching idea for make this device. I have sketched 3 ideas before I decide the best idea that I choose for PTA project after discuss with my supervisor. This sketching takes about 3 weeks to be done.

The selected design sketched is then transfer to solid modeling and engineering drawing using Solidworks program that have full dimension.

The next task is preparation of progress presentation or mid presentation, both of these tasks takes one week to be done. These mid presentations have been done at week 8. On this week I have to prepare the slide presentation and speech for the presentation.

The fabrication process is started on week 9. First, a list material that needed to use in this project must be listed. After the needed material is listed, acquisition step take places. There are only a few materials that need to buy such as pulley, sensor, protractor, and padlock. Some of the needed material is well-prepared by the university.

After all the parts needed had been gathered, the project proceeds to next step that is fabrication process. The finished drawing and sketching is used as a reference by following the measurement and the type of materials needed. The fabrication process that involved is cutting, welding, and others. If all the parts had been processed, the parts are joined together to produce. After all the parts had been processed, the parts are joined together to produce a reliability test device for telephone

cord pulling strength and slip down test. Here come the testing and verification process.

After all the parts had been joined together, here comes the last phase of process that is data discussion. In data discussion, the draft report and all the related articles are gathered and hand over to the supervisor for error checking. The finish product will be compared with the report to make sure that there is no mistake on both project and report.

Lastly, the final report has been written and prepared for presentation. This will take about one week to prepared and accomplish. A report is guided by UMP thesis format and also guidance from supervisor. All task scheduled takes around fourteen weeks to complete.

1.5 PROJECT PLANNING

Figure 1.2 shows the Gantt chart of this project.

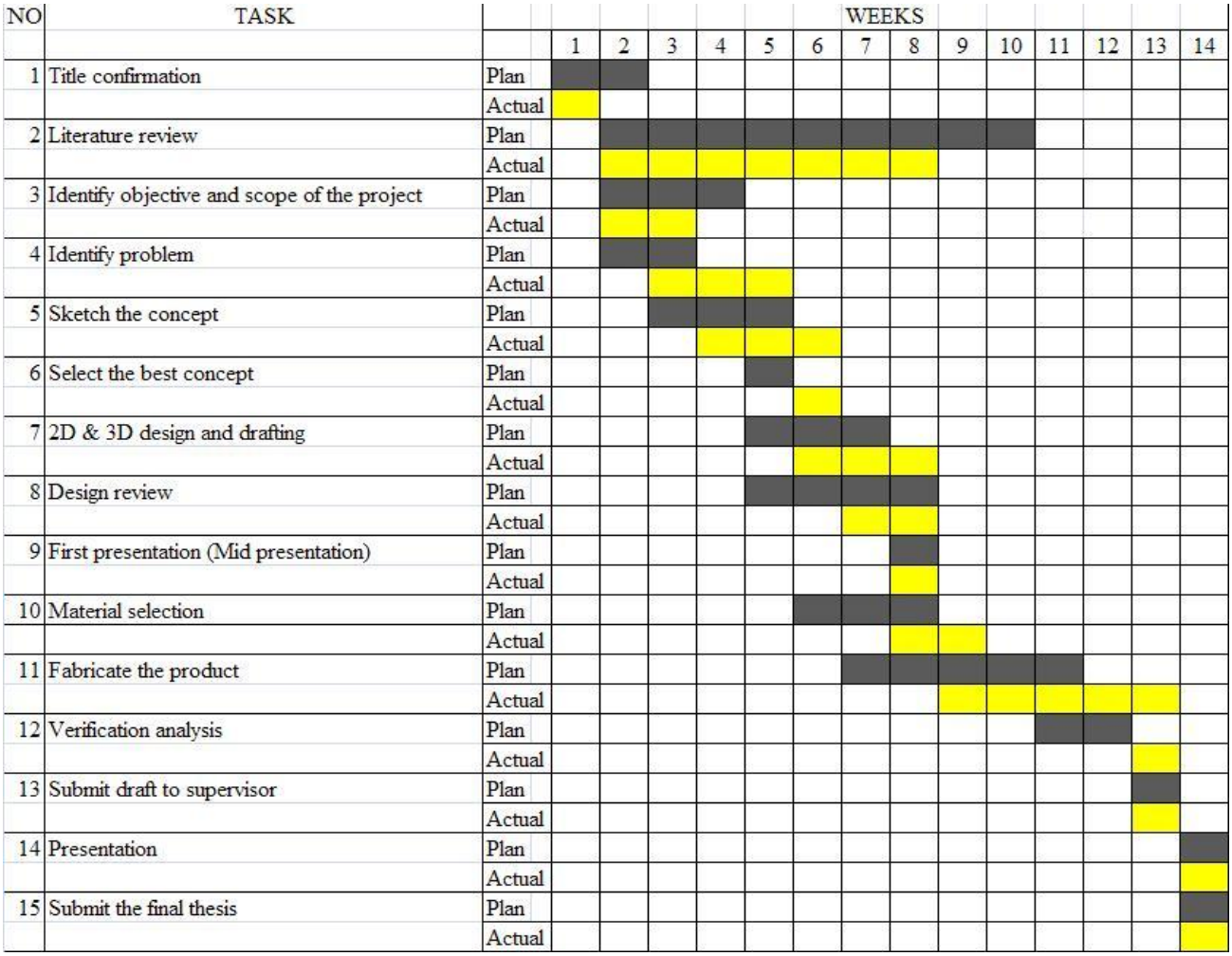

Figure 1.2 Project Gantt chart

Figure 1.2 shows the project planning (Gantt chart). This project started with research and literature review. It is from internet, magazines, public areas and my supervisor that related to my project title. All of this literature review takes about seven week. The schedule of the project was also planned. This is done by using Microsoft Excel Worksheet using Gantt chart system. The next week, the project title acceptance form was submitted and the research in reliability test device for curl cord pulling strength test and slip down test was continued.

After all of literature review done, the objectives, scopes and also identify the main problem for this project has been identified. Then, the sketching of my ideas and concepts for making a new features design has been designed. Three concepts have been sketched before and the best ideas that I choose for PTA project was selected. The sketching of the device takes about three weeks to be done.

After sketch the concepts, the best concept to be the final concept for fabricate and make it as the concept for my PTA project were review and discussed by my supervisor. So, after decide the best concept that have been choose, the manual sketching hand and Solid work that have the full dimension were changed.

The next task is preparation of progress presentation or mid presentation, both of these tasks takes one week to be done. These mid presentations have been done at week 8. On this week, the slide presentation and speech for the presentation had been prepared.

After mid presentation, the chosen of material for my product was started. Then, the fabrication process was started on week nine. Fabrication stage is taking a much time to complete. This task scheduled takes five weeks to finish.

Lastly, the final report has been written and prepared for presentation. This will take about one week to prepared and accomplish. A report is guided by UMP thesis format and also guidance from supervisor. Due to any problems that student face, the management has agreed to extend the time of submission of the report and presentation. All task scheduled takes around fourteen weeks to complete.

CHAPTER 2

LITERATURE REVIEW

2.0 INTRODUCTION

The telephone is a telecommunications device that transmits and receives sound, most commonly the human voice. It is one of the most common household appliances in the developed world, and has long been considered indispensable to business, industry and government. The word "telephone" has been adapted to many languages and is widely recognized around the world.

The device operates principally by converting sound waves into electrical signals, and electrical signals into sound waves. Such signals when conveyed through telephone networks and often converted to electronic or optical signals enable nearly every telephone user to communicate with nearly every other worldwide. Graphic symbols used to designate telephone service or phone-related information in print, signage, and other media.

The telephone consists of an alerting device, usually a ringer which remains connected to the phone line whenever the phone is on hook, and other components which are connected when the phone is off hook. These include a transmitter (microphone), a receiver (speaker) and other circuits for dialing, filtering, and amplification.

2.1 MODEL TELEPHONE PANASONIC KX-TS500

Figure 2.1 show the Panasonic KX-TS500 integrated corded phone system is a basic corded phone designed for users who don't need a lot of bells and whistles. A corded phone with single line operation, it is call waiting compatible and requires no batteries to operate.

Handset and ringer volume controls allow consumer to adjust levels to they liking and can switch between tone and pulse dialing modes. A redial button lets users quickly dial the last outgoing number, while the flash button provides access to call waiting. This Panasonic KX-TS500 phone is wall-mountable and allows users to keep countertop space free from unnecessary clutter.

This phone system can be hung on a wall to free up desk or counter space. This is especially helpful in kitchens or offices, where desk and counter space is at a premium. The other Panasonic KX-TS500 features are corded phone, single line operation, call waiting, hearing aid compatible, wall mountable, flash, and one touch redialing.

Figure 2.1 Model telephone Panasonic KX-TS500

Source: DigitalGiftStore 2000

2.2 SURFACES

In this project, I use four different surfaces to test the telephone quality. There are zinc, aluminum, plywood, and glass. I use these surfaces because users always or the annual place that they will put the telephone on that surface.

2.2.1 Zinc

Zinc also known as spelter, is a metallic chemical element; it has the symbol Zn and atomic number 30. It is the first element in group 12 of the periodic table. Zinc is, in some respects, chemically similar to magnesium, because its ion is of similar size and its only common oxidation state is +2. Zinc is the 24th most abundant element in the Earth's crust and has five stable isotopes. The most exploited zinc ore is sphalerite, a zinc sulfide. The largest exploitable deposits are found in Australia, Canada, and the United States. Zinc production includes froth flotation of the ore, roasting, and final extraction using electricity (electro winning).

Zinc is an essential mineral of exceptional biologic and public health importance. Zinc deficiency affects about two billion people in the developing world and is associated with many diseases. In children it causes growth retardation, delayed sexual maturation, infection susceptibility, and diarrhea, contributing to the death of about 800,000 children worldwide per year. Enzymes with a zinc atom in the reactive center are widespread in biochemistry, such as alcohol dehydrogenises in humans. Consumption of excess zinc can cause ataxia, lethargy and copper deficiency.

Zinc also referred to in nonscientific contexts as spelter, is a bluish-white, lustrous, diamagnetic metal, though most common commercial grades of the metal have a dull finish. It is somewhat less dense than iron and has a hexagonal crystal structure. The metal is hard and brittle at most temperatures but becomes malleable between 100 and 150 °C. Above 210 °C, the metal becomes brittle again and can be pulverized by beating. Zinc is a fair conductor of electricity. For a metal, zinc has

relatively low melting (420 °C) and boiling points (900 °C). Its melting point is the lowest of all the transition metals aside from mercury and cadmium. Many alloys contain zinc, including brass, an alloy of zinc and copper. Other metals long known to form binary alloys with zinc are aluminum, antimony, bismuth, gold, iron, lead, mercury, silver, tin, magnesium, cobalt, nickel, tellurium and sodium.

2.2.2 Aluminum

Aluminum or aluminum is a silvery white and ductile member of the boron group of chemical elements. It has the symbol Al. Its atomic number is 13. It is not soluble in water under normal circumstances. Aluminum is the most abundant metal in the Earth's crust, and the third most abundant element therein, after oxygen and silicon. It makes up about 8% by weight of the Earth’s solid surface. Aluminum is too reactive chemically to occur in nature as a free metal. Instead, it is found combined in over 270 different minerals. The chief source of aluminum is bauxite ore.

Aluminum is remarkable for its ability to resist corrosion due to the phenomenon of passivation and for the metal's low density. Structural components made from aluminum and its alloys are vital to the aerospace industry and very important in other areas of transportation and building. Its reactive nature makes it useful as a catalyst or additive in chemical mixtures, including being used in ammonium nitrate explosives to enhance blast power.

Aluminum is a soft, durable, lightweight, malleable metal with appearance ranging from silvery to dull grey, depending on the surface roughness. Aluminum is nonmagnetic and no sparking. It is also insoluble in alcohol, though it can be soluble in water in certain forms. The yield strength of pure aluminum is 7–11 MPa, while aluminum alloys have yield strengths ranging from 200 MPa to 600 MPa. Aluminum

has about one-third the density and stiffness of steel. It is ductile, and easily machined, cast, and extruded.

Corrosion resistance can be excellent due to a thin surface layer of aluminum oxide that forms when the metal is exposed to air, effectively preventing further oxidation. The strongest aluminum alloys are less corrosion resistant due to galvanic reactions with alloyed copper. This corrosion resistance is also often greatly reduced when many aqueous salts are present however, particularly in the presence of dissimilar metals.

Aluminum is a good thermal and electrical conductor, by weight better than copper. Aluminum is capable of being a superconductor, with a superconducting critical temperature of 1.2 Kelvin and a critical magnetic field of about 100 gauss.

2.2.3 Plywood

Plywood is a type of engineered wood made from thin sheets of wood, called plies or wood veneers. The layers are glued together so that adjacent plies have their grain at right angles to each other for greater strength. There are usually an odd number of plies, as the symmetry makes the board less prone to warping.

A common reason for using plywood instead of plain wood is its resistance to cracking, shrinkage, twisting/warping, and its general high degree of strength. In addition, plywood can be manufactured in sheets far wider than the trees from which it was made. It has replaced many dimensional lumbers on construction applications for these reasons.

Plywood is used in many applications that need high-quality, high-strength sheet material. Quality in this context means resistance to cracking, breaking, and shrinkage, twisting and warping.

Exterior glued plywood is suitable for outdoor use, but because moisture affects on the strength of wood, optimal performance is achieved in end uses where woods moisture content remains relatively low. On the other hand subzero conditions don't affect on plywood's dimensional or strength properties which opens some special application possibilities.

Plywood is also used as an engineering material for stressed-skin applications. It has been used for marine and aviation applications since WWII. Most notable is the British De Havilland Mosquito bomber, which was primarily made out of wood. Plywood is currently successfully used in stressed-skin applications. The American designers Charles and Ray Eames are famous for their plywood-based furniture, while Phil Bolger is famous for designing a wide range of boats built primarily of plywood.

2.2.4 Glass

A glass is an amorphous (non-crystalline) solid material. Glasses are typically brittle, and often optically transparent. Glass is commonly used for windows, bottles, or eyewear and examples of glassy materials include soda-lime glass, borosilicate glass, acrylic glass, sugar glass, Muscovy-glass, or aluminum oxynitride. The term glass developed in the late Roman Empire. It was in the Roman glassmaking center at Trier, now in modern Germany, that the late-Latin term glesum originated, probably from a Germanic word for a transparent, lustrous substance

Strictly speaking, a glass is defined as an inorganic product of fusion which has been cooled through its glass transition to the solid state without crystallizing. Many

glasses contain silica as their main component and glass former. The term glass is, however, often extended to all amorphous solids (and melts that easily form amorphous solids), including plastics, resins, or other silica-free amorphous solids. In addition, besides traditional melting techniques, any other means of preparation are considered, such as ion implantation, and the sol-gel method. Commonly, glass science and physics deal only with inorganic amorphous solids, while plastics and similar organics are covered by polymer science, biology and further scientific disciplines.

Glass plays an essential role in science and industry. The optical and physical properties of glass make it suitable for applications such as flat glass, container glass, optics and optoelectronics material, laboratory equipment, thermal insulator (glass wool), reinforcement fiber (glass-reinforced plastic, glass fiber reinforced concrete), and art.

2.3 FABRICATION METHOD

2.3.1 Joining Method

Joining involves in assembly stage. Commonly used method to join metal part is Metal Inert Gas (MIG) welding. MIG (Metal Inert Gas) or as it even is called GMAW (Gas Metal Arc Welding) uses an aluminum alloy wire as a combined electrode and filler material. The filler metal is added continuously and welding without filler-material is therefore not possible. Since all welding parameters are controlled by the welding machine, the process is also called semi-automatic welding.

The figure 2.2 and figure 2.3 show that the MIG-process uses a direct current power source, with the electrode positive. By using a positive electrode, the oxide layer is efficiently removed from the aluminum surface, which is essential for avoiding lack of fusion and oxide inclusions. The metal is transferred from the filler wire to the weld

bead by magnetic forces as small droplets, spray transfer. This gives a deep penetration capability of the process and makes it possible to weld in all positions. It is important for the quality of the weld that the spray transfer is obtained.

There are two different MIG-welding processes, conventional MIG and pulsed MIG which is the first is conventional MIG. Conventional MIG uses a constant voltage DC power source. Since the spray transfer is limited to a certain range of arc current, the conventional MIG process has a lower limit of arc current (or heat input). This also limits the application of conventional MIG to weld material thicknesses above 4 mm. Below 6 mm it is recommended that backing is used to control the weld bead. And second is pulsed MIG. This type uses a DC power source with superimposed periodic pulses of high current. During the low current level the arc is maintained without metal transfer. During the high current pulses the metal is transferred in the spray mode. In this way pulsed MIG is possible to operate with lower average current and heat input compared to conventional MIG. This makes it possible to weld thinner sections and weld much easily in difficult welding positions.

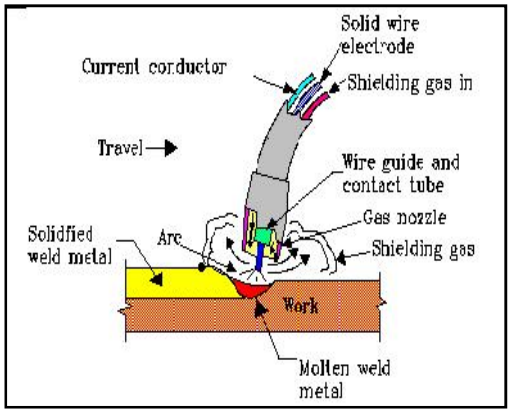

Figure 2.2 The MIG welding process

Source: weldingengineer 2007

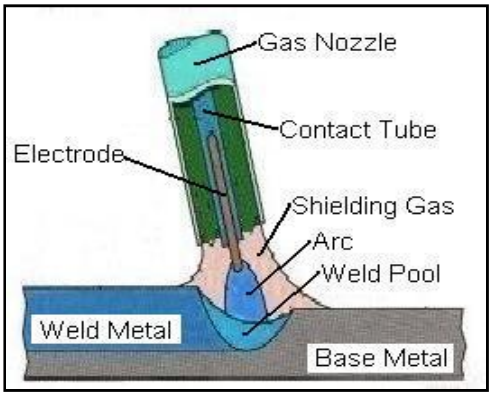

Figure 2.3 Schematic of Metal Inert Gas (MIG) Welding

Source: weldingengineer 2000

Gas Metal Arc Welding (GMAW) is frequently referred to as MIG welding. MIG welding is a commonly used high deposition rate welding process. Wire is continuously fed from a spool. MIG welding is therefore referred to as a semiautomatic welding process.

There are some advantages and disadvantages in using MIG welding. The advantages of MIG welding are all position capability, has higher deposition rates than SMAW , less operator skill required, long welds can be made without starts and stops and has minimal post weld cleaning is required. The disadvantages of MIG welding are costs money of consumable, such as tips and nozzles, is not worth a dang on paint, rust, or dirty surfaces and lastly it is not good for thick steel because it does not get the proper penetration.

Mechanical fastening is two or more components may joined or fastened in such a way that they can be taken apart sometime during the products service life or life cycle. Numerous product (including mechanical pencils, watches, computers, appliances, engines, and bicycle) have components that are fastened mechanically. Mechanical fastening may be preferred over other methods for the following reasons, ease of assembly, maintenance, parts replacement, or repair, ease in creating design

that require moveable joints, such as hinges, sliding mechanism, and adjustable components and fixtures and lastly lower overall costs in manufacturing the product.

The most common method of mechanical fastening is by use of bolts and nuts. These operations are known also as mechanical assembly. Mechanical fastening generally requires that the components have holes through which the fasteners are inserted. These joints may be subjected to both shear and tensile stresses and should be designed to resist these forces.

2.3.2 Drilling Machines

A drill is a tool with a rotating drill bit used for drilling holes in various materials. Drills are commonly used in woodworking, metalworking, and construction,

The drill bit is gripped by a chuck at one end of the drill, and is pressed against the target material and rotated. The tip of the drill bit does the work of cutting into the target material, either slicing off thin shavings (twist drills or auger bits), grinding off small particles (oil drilling), or crushing and removing pieces of the workpiece.

Figure 2.4 Press drilling machine

Source: Engineering Dartmouth, Drill Press Machine 2004

A drill press Figure 2.4 (also known as pedestal drill, pillar drill, or bench drill) is a fixed style of drill that may be mounted on a stand or bolted to the floor or workbench. A drill press consists of a base, column (or pillar), table, spindle (or quill), and drill head, usually driven by an induction motor. The head has a set of handles (usually 3) radiating from a central hub that, when turned, move the spindle and chuck vertically, parallel to the axis of the column. The table can be adjusted vertically and is generally moved by a rack and pinion; however, some older models rely on the operator to lift and reclamp the table in position. The table may also be offset from the spindle's axis and in some cases rotated to a position perpendicular to the column. The size of a drill press is typically measured in terms of swing. Swing is defined as twice the throat distance, which is the distance from the center of the spindle to the closest edge of the pillar. For example, a 16-inch (410 mm) drill press will have an 8-inch (200 mm) throat distance.

A drill press has a number of advantages over a hand-held drill which is less effort is required to apply the drill to the workpiece. The movement of the chuck and spindle is by a lever working on a rack and pinion, which gives the operator considerable mechanical advantage. The second advantage is the table allows a vise or clamp to position and lock the work in place making the operation much more secure. And the last advantage is the angle of the spindle is fixed in relation to the table, allowing holes to be drilled accurately and repetitively.

Speed change is achieved by manually moving a belt across a stepped pulley arrangement. Some drill presses add a third stepped pulley to increase the speed range. Modern drill presses can, however, use a variable-speed motor in conjunction with the stepped-pulley system; a few older drill presses, on the other hand, have a sort of traction-based continuously variable transmission for wide ranges of chuck speeds instead, which can be changed while the machine is running.

Drill presses are often used for miscellaneous workshop tasks such as sanding, honing or polishing, by mounting sanding drums, honing wheels and various other rotating accessories in the chuck. This can be dangerous on many presses, where the

chuck arbor is held in the spindle purely by the friction of a Morse taper instead of being held securely by a drawbar.

2.3.4 Grinding process

Grinding is a finishing process used to improve surface finish, abrade hard materials, and tighten the tolerance on flat and cylindrical surfaces by removing a small amount of material. Information in this section is organized according to the subcategory links in the menu bar to the left.

Figure 2.5 shows the grinder machine. In grinding, an abrasive material rubs against the metal part and removes tiny pieces of material. The abrasive material is typically on the surface of a wheel or belt and abrades material in a way similar to sanding. On a microscopic scale, the chip formation in grinding is the same as that found in other machining processes. The abrasive action of grinding generates excessive heat so that flooding of the cutting area with fluid is necessary.

Figure 2.5 The grinder

Source: Tradevv, Grinder 2005

2.4 SENSOR

A sensor is a device that measures a physical quantity and converts it into a signal which can be read by an observer or by an instrument. For example, a mercury-in-glass thermometer converts the measured temperature into expansion and contraction of a liquid which can be read on a calibrated glass tube. A thermocouple converts temperature to an output voltage which can be read by a voltmeter. For accuracy, all sensors need to be calibrated against known standards. Sensors are used in everyday objects such as touch-sensitive elevator buttons and lamps which dim or brighten by touching the base. There are also innumerable applications for sensors of which most people are never aware. Applications include cars, machines, aerospace, medicine, manufacturing and robotics.

A sensor's sensitivity indicates how much the sensor's output changes when the measured quantity changes. For instance, if the mercury in a thermometer moves 1 cm when the temperature changes by 1 °C, the sensitivity is 1 cm/°C. Sensors that measure very small changes must have very high sensitivities. Sensors also have an impact on what they measure; for instance, a room temperature thermometer inserted into a hot cup of liquid cools the liquid while the liquid heats the thermometer. Sensors need to be designed to have a small effect on what is measured; making the sensor smaller often improves this and may introduce other advantages. Technological progress allows more and more sensors to be manufactured on a microscopic scale as micro sensors using MEMS technology. In most cases, a micro sensor reaches a significantly higher speed and sensitivity compared with macroscopic approaches. Figure 2.6 shows the example of the sensor. This sensor are use at the house or place to detect the motion. If there had motion, the sensor will be alarmed.

Figure 2.6 Eternalite Motion sensor.

Source: Sensor Technology 2005

CHAPTER 3

DESIGN

3.0 INTRODUCTION

In the design stage, the device needs to undergo a several design aspects and the compliance of design needs to follow step by step. It also concludes about the design that had been chosen to be as the final idea to be producing or fabricate.

3.1 DESIGN

When doing design process, consideration of design must be done carefully and properly to make sure the design can be applied in fabrication stage and the system are been functioning. Designing the device needs to consider a several aspect, such as concept of designs, material, strength of material, and cost of the whole system. For concept of design, it is important to make sure the design can be fixing and suitable with the telephone and the test while for the material, it is one of important criteria in designing of device and showing the toughness of design. For the strength of material, the availability of material is one of aspects that have been considered. The material available can be used depend on their purpose and for the cost, the cost of the whole

system must not exceeded budget given and must be reasonable. The design cost must also efficient and reduce waste and losses.

3.2 DRAWING

The drawings are divided into two categories, which are sketching and Solidwork drawing. For sketching, all the ideas for the device fabrication are sketched on the paper first to ensure that idea and concept selection can be made after this and transfer to Catia software to sketch the design. After choose the best concept, the final idea is drawn into the Solidworks drawing format with details features.

3.3 DESIGN CONCEPT

There are 3 design concepts in this project. Each concept had advantages and disadvantages.

3.3.1 Concept A

Figure 3.1 shows the concept A. The advantages of this concept are easy to use, and small. The disadvantages are not adjustable, not stable and hard to fabricate.

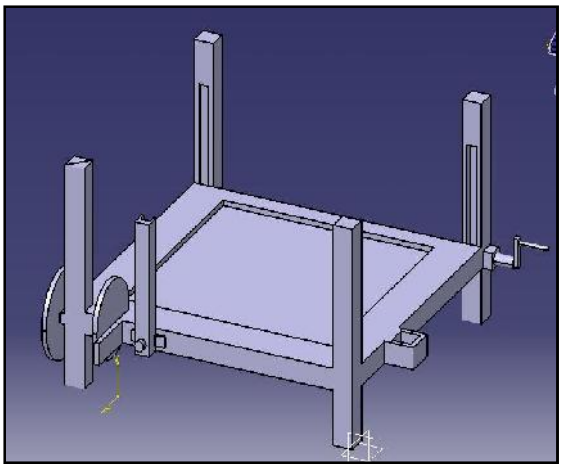

Figure 3.1 Concept A

3.3.2 Concept B

Figure 3.2 shows the concept B. In this concept, it was stable then concept A, and adjustable to right and left movement. But it is large more then concept A and not flexible.

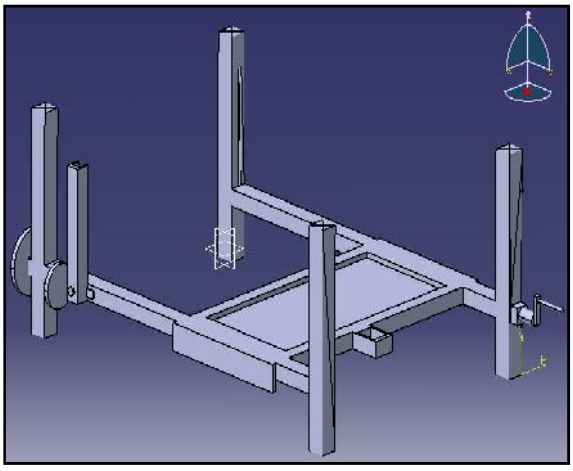

Figure 3.2 Concept B

3.3.3 Concept C

Figure 3.3 shows the concept C. This concept more stable then other 2 concept, more adjustable to left and right side, easy to use, and more flexible. But the disadvantage of this concept is large.

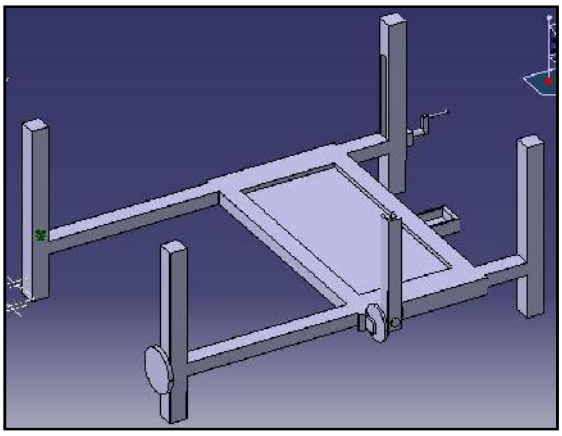

Figure 3.3 Concept C

3.4 CONCEPT SELECTION

To choose the best concept among these three concepts, the concept selection was done. This is to make the concept that will be chosen is more accurate and less weakness. Figure 3.4 shows the concept selection.

NO	CRITERIA	CONCEPT		
		A	B	C
1	Stable	-	+	+
2	Adjustable	-	+	+
3	Easy to use	+	0	+
4	Flexible	0	-	+
5	Size	+	-	-
6	Easy to fabricate	-	0	0
	PLUS	2	2	4
	SAME	1	2	1
	MINUS	3	2	1
	NET	-1	0	3
	RANKING	3	2	1
	FABRICATE	NO	NO	YES

Figure 3.4 Concept selection

Note:

+ Better than

- Worse than

0 Same as

3.5 FINAL DESIGN

After done the concept selection, the concept C is the best concept among the other concepts. So, concept C is the final concept for this project. But, after discuss more about concept C to alter the weakness; some pattern of the design must be changed. It is because, when we transfer to fabricate process, some part at the old design can not function. It is also must be change the design because the material that will be use. So, after redesigned the old design, figure 3.5 is the new design and the final design. This design will transfer to real devise. This design will be fabricated.

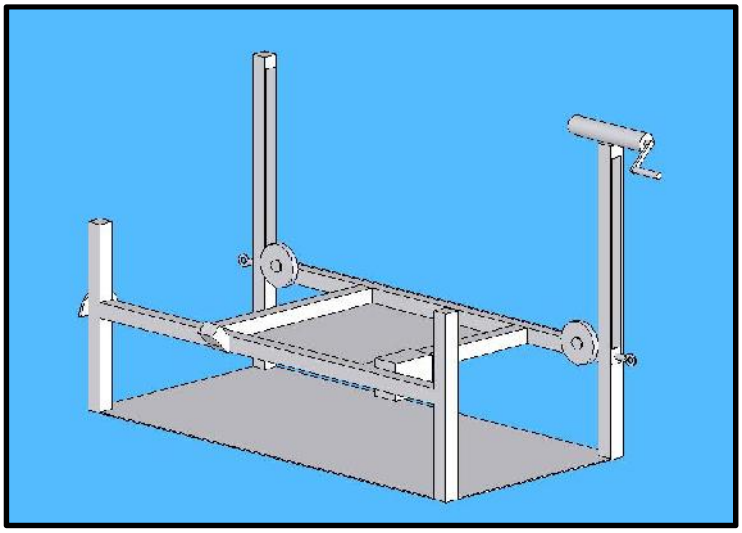

Figure 3.5 Final design

3.6 BILL OF MATERIALS

Figure 3.6 shows the bill of materials that will be use to fabricate this device.

BIL	TYPE	DIMENSION (mm)	QUANTITY
1	Steel hollow	500 x 25 x 25	2
2	Steel hollow	300 x 25 x 25	2
3	Steel hollow	700 x 25 x 25	1
4	Steel hollow cylinder	Diameter 15, Length: 700	1
5	Steel hollow	300 x 30 x 30	2
6	Steel hollow	400 x 30 x 30	2
7	Pulley	Diameter 70	2
8	Pulley cabel	Length: 2000	1
9	Steel cylinder	Diameter 30, Length: 75	1
10	Sensor		1
11	Measuring tape		1
12	Protractor		1
13	Glass, aluminum, zinc, plywood, pieces	230 x 390 x 3	1

Figure 3.6 Bill of materials

CHAPTER 4

FABRICATION PROCESSES

4.0 INTRODUCTION

Fabrication process is a stage after designing process. These processes are about using the material selection and make the product base on the design and by followed the design dimension. Most of a product produce was made by steel. In fabrication stage, a lot of method can be applied to produce the products such as welding, cutting, drilling and more method. Manufacturing process is difference from fabrication process in term of production quantity. Manufacturing in term of the process that will be focused on a large scale of production rather then fabrication process, it is a stage to make only one product. Fabrication finish until the last component was assembled.

4.1 PROCESS INVOLVES

In making the design become a real system, several processes have been used to fabricate the tensile test specimen, which are;

a) Measuring: Measuring the material into dimension needed.
b) Marking: All measured materials need to be marked to give precise dimension.
c) Cutting: Cutting the material into part according to dimension needed.
d) Joining: Materials joined by the method of welding and also by using bolt and nut to join part with another part.
e) Drilling: Marked holes are then drilled to make holes for joining it with another part.
f) Finishing: Any rough surface cause by welding spark were grind to give smooth and safe surface.
g) Assembly: Assemble parts to another part.
h) Spraying: Using black spray color to the whole product.

4.2 PROCESSES

The fabrication process is start with measuring and marking the material into the dimension needed. Firstly, all the part need to measure because the identification of the truss frame can be making easily. This process is done by using measuring tape. Next, the types of material identification needed to make sure all part can be assembling with correct way. After measuring and marking process, the marked material goes to next process, cutting. Firstly the hollow steel is cut into parts according to its length. This process is done using disc cutter and. The cutting is done according to the marking by using hand grinder with cutting tool. This process which are measuring and marking shows in figure 4.1 while the cutting process shows in figure 4.2.

Figure 4.1 Measuring and marking process

Figure 4.2 Cutting process by using grinder

Next step is joining the part by using the arc welding to make the main frame. It shows in figure 4.3. After the main frame had fabrication, we must make the frame that places the different surfaces. This frame can move along the truss. To make this frame easily move, I using the hollow metal that had a bit small than the truss diameter. After the main frame and frame to place the surfaces finished, I join the surface frame with the aluminum surface as the frame base by using bold and nut.

Figure 4.3 Welding process

After finished the frame process, I start to fabricate the part for slip down test which is to make the frame or base surface can make angle. So, I put the pulley at left and side at the back truss to make the base surface can move to upward. For this part, I join the pulley with the back truss by welding it.

After finished this slip down test part, I start to put sensor at the side of the base surface frame. To put the sensor, I make a platform to place the surface. So, I cutting the metal into the dimension needed and welding it at the side of the base frame. After that, I put the sensor on the platform by using double tape. This sensor functions as to detect the movement when the telephone starts moving after we pull the pulley.

Then, I prepare to make the part for pulling strength test. For this part, I use measuring tape to measure the length of the curl-cord when it pulls at 45°. So, I make the platform at 45° at the front of the base surface frame. To join them together, I welding it. After that, I put the measuring tape on the platform by using double tape.

Next step is to make the hole at the front truss by drilling method like in figure 4.4. This hole is to join or claim the protractor to the base surface for measuring angle for slip down test. Before start drilling, the holes must be marked

first. After the holes has been marked, the holes now ready to be drill. Drilling process for those two clamps is done using hand drill. The drilling process used two size of drill bit. Firstly, small drill bit size 3mm is used to drill all the holes position. This is because to reduce centre positioned error while drilling. After all the holes are drilled, the holes drill again using the exact size of drill bit 5mm. So, after finish drill the hole, I stamp the protractor by using bolt and nut to stick together with the base frame.

Figure 4.4 Drilling process by using press drill machine

Then, I cutting the sheet metal to make it as a base for the truss or for the easy word, its function as to make the all frame in stable condition. So, I welding the sheet metal to the truss.

The last process for those part and material is finishing and assemble process. The finishing process is use to making a good and smooth looking in appearance by using grinder machine. I also assembly measuring tape and sensor at the device by using double tape. This process show at figure 4.5 and figure 4.6. After all the part had finishing, I spray the part with black color to make it appearance neat and tidy.

Figure 4.5 Assembly measuring tape

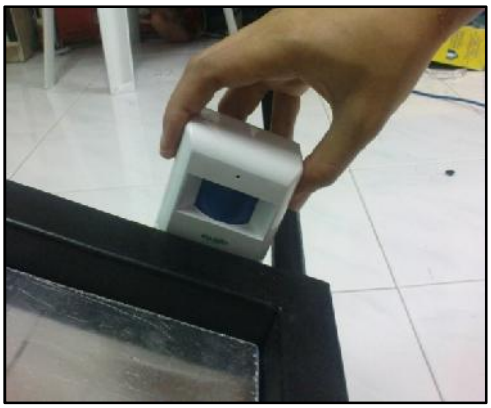

Figure 4.6 Assembly sensor

CHAPTER 5

RESULT AND DISCUSSION

5.0 INTRODUCTION

In this chapter, it will show the full product that have been fabricate. It also contains the product features and standard op procedure (SOP) to handle this device.

5.1 PRODUCT

Figure 5.1 show the product of reliability test device. This is the device after fabricate.

Figure 5.1 Full view of the product

Figure 5.2 and figure 5.3 show the view of the product from side and top view.

Figure 5.2 Side view of the product

Figure 5.3 Top view of the product

5.2 PRODUCT FEATURES

Figure 5.4 show the product features. The product endured with the features like one platform to put the telephone. Then, it has two pulleys that can make the platform upward and downward. This is will be using for slip down test. Then, it has a protractor to measure the angle. A measuring tape is using for measure the length of curl cord for pulling strength test. This device has different surfaces for do the test which are plywood, glass, zinc, and aluminum and has a base to support the device. And lastly, this device has a sensor to detect movement when the telephone starts moving.

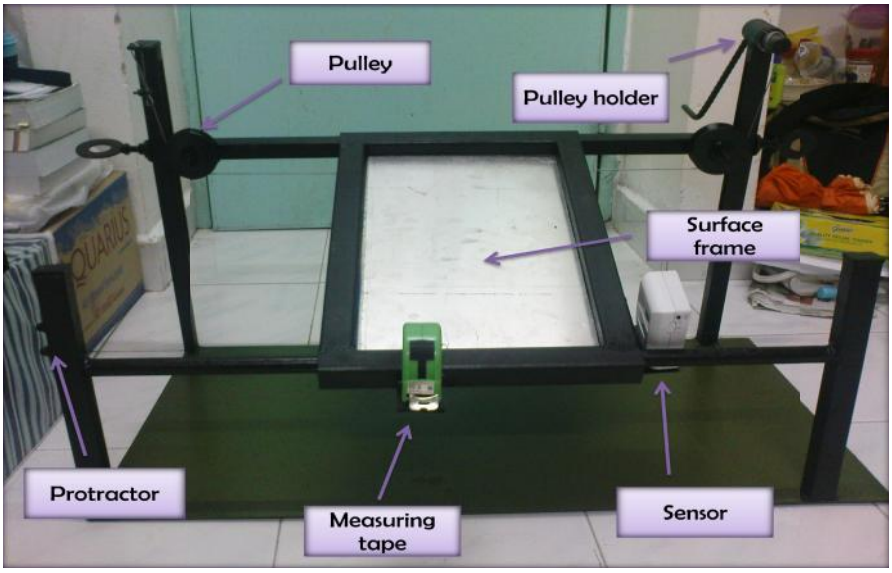

Figure 5.4 The product features

Pulley in this product functioned as place cable to make the platform going upward and downward for slip down test. This pulley will be handling by the pulley holder. For surface frame, it is functioned as a place to put the different surfaces which are glass, aluminum, zinc and plywood on it. To detect the movement of the base telephone for slip down test and pulling strength test, the sensor will detected it. The

measuring tape will be as a ruler to measure the length of the curl-cord telephone for pulling strength test while the protractor will measure the angle of the surface frame for slip down test.

5.2 STANDARD OPERATION PROCEDURE (SOP)

Appendices' D show the standard of procedure how to handle this device. The basic operation, before start using this device, makes sure the flat frame of the device at 0° position. It is because to make sure the reading will be accurate. The sensor also must be switch on and the screw at the pulley must loose to make the pulley going upward and downward smooth.

The procedure for pulling strength test, the first step is put the glass piece on the frame of surface. Then, put the telephone on that surface. The next step, take the telephone cord and put it on the measuring tape. That measuring had fix to 45°, parallel to the test term. Then, pull the cord. After the sensor alarmed, stop pulling the cord and take the reading at the measuring tape. Then record the data. The, the same procedure will be repeating by using the aluminum, zinc and plywood pieces.

For slip down test, the first step is put the glass piece on the frame of surface. Then put the base telephone on that surface. Then, rotate the pulley to make the frame of the surface going upward. When the sensor alarmed, stop rotate the pulley and tight the screw at the side of the pulley for make sure the reading is accurate. Next step is taking the reading of angle at the protractor that placed side of the device. This angle is taken from the base frame. Then record the data. The same procedure will be repeating by using the aluminum, zinc and plywood pieces.

The safety precautions that must be followed when operating this device is make sure the screw at the pulley is tightened. So, the data will be easy to take. Then, keep guards in place and in proper working order. It is follow the 5'S system. The

other safeties that must follow is avoiding dangerous working environment and keep work areas clean and well lit. And lastly, always wear gloves and safety boot when handling the device because to beware if the surface such as glass piece suddenly broke or crush when we did the test and take on or off the surface carefully to avoid accident.

CHAPTER 6.0

CONCLUSION AND FUTURE RECOMMENDATTION

6.0 INTRODUCTION

This chapter is about problems the project encounter before, during and after the project. This chapter also will discuss about the conclusion of the project. Problem that will be discussed here is the entire problem encountered in every task in the project.

6.1 PROBLEM ENCOUNTERED

Many problems encountered when did this project such as from literature review research, design of the concept, and the fabrication process.

The problem encountered during literature review is mainly about the difficulty to get the material to be used in this project. The problem is like, limited resources to get the relevant material such as books and internet connection problem. The problem also comes from the material itself such as many non relevant literature reviews about the project title. The concept and ideas review for this project are not very wide because it is not widely modified by the manufacturer. Students should come with their ideas on the project.

At design part, many problems come at this stage. The problems came during decision making to select the best design and concept of the reliability test device. During this period many design have been sketched but to pick one design that have all the criteria needed by the specification is hard. After a design is selected, another problem encountered is dimensioning designs; the problem is about how big does the real device. After the modification at the design the problem is solved. Because of the idea were from the student directly, so there are no references that can be referred.

Another problem encountered during design process is material selection for the system, this happen because, the project budget is disclose, so the material selection is hard to done because no limit is given. The material selection also hard to done because no specific information about available material at the market.

Problem during this stage which is in the fabrication process, it is very critical that make the project schedule is delayed. The problem comes when the material buying is undergoing strict procedure and the budget for the project is in unknown situation. Because of this problem the fabrication process can be run according to schedule. This is because, no material needed is ready to fabricate. As an alternative the group members has decided to use recycle material that found around the lab to start the fabrication process while waiting the material needed is arrive.

Due to material and component arriving problem, many change made to the design. The design changed according to material and component availability. At this stage redesign has to be made due to restriction of time to wait for the component to arrive.

The changing of the design is also because of several matter encounters during the fabrication process. After several component is fabricated, I realize that some component of the suspension system will not working properly when fabricated, The component need another component to support it to make those component functioned.

Because of budget restriction and problem mentioned before some component of the propose design have to be discarded.

6.2 RECOMMENDATION AND FUTURE WORK

Several recommendations and the future work I would like to express for myself and the faculty for future this project are the future planning for the reliability test device is to upgrade the apparatus so it can be functioned more efficient. The upgrade should involve, using more good material (example all aluminium or titanium) that have high corrosion resistance and good component part. If the upgrade can be done the apparatus for test device it will be more durability and longer life. It also makes the upgrade for the pulley that can made angle at 90° for slip down test. The sensor is also can be upgrade like using more accurate sensor like infrared sensor that can detect movement more efficient. It is also change the manual pulley to automatic pulley which is by using motor for slip down test to make the base surface going upward.

6.3 CONCLUSION AND PROSPECT

For the conclusion, the project achieves several objectives but several objectives are not achieved due to several problem. If more time and good budget is given the project will be complete. However, overall perception of the project carried out was good. Due to some confusion, my project was started late but still finish on time.

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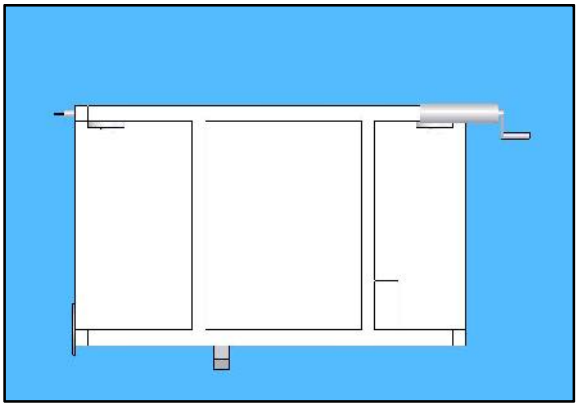
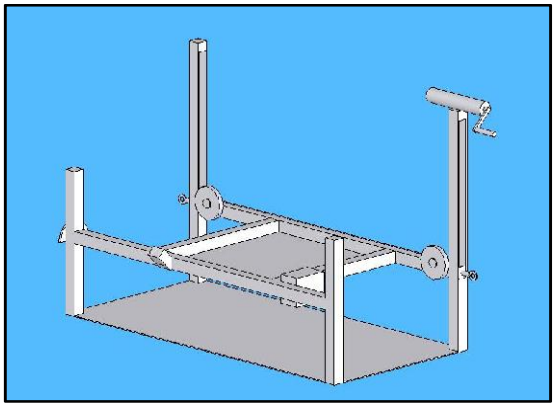
APPENDIX A

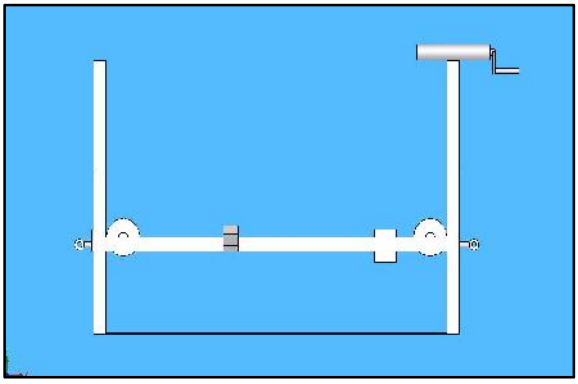
PROJECT DESIGN



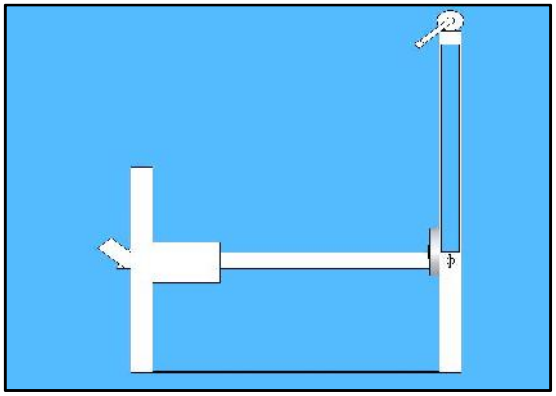
A1 Top view



A2 Isometric view



A3 Front view



A4 Side view

APPENDIX B

PRODUCT FEATURES

B1 Pulley holder

B2 Surface frame

B3 Sensor

B4 Pulley

B5 Measuring tape

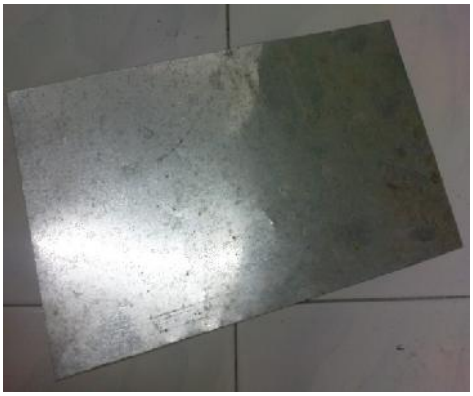
APPENDIX C

SURFACES

C1 Aluminum

C2 Plywood

C3 Glass



C4 Zinc

APPENDIX D

STANDARD OPERATION PROCEDURE

Universiti Malaysia PAHANG	STANDARD OPERATION PROCEDURE (SOP) PAGE : 1 SOP NO : 03		
MACHINE NAME	RELIABILITY DEVICE (PULLING STRENGTH AND SLIP DOWN TEST)		
MAIN FUNCTION	MEASURE LENGTH OF THETELEPHONE CORD AND ANGLE OF SURFACE FRAME		
PREPARED BY:	SYAHIDAH NAFISA BTE ABDUL MALIK	APPROVED BY	DATE:
REVIEW COMPLETED BY:	MR MOHAMAD ZAIRI B BAHAROM	APPROVED BY	DATE:

A) BASIC OPERATION METHOD PROCEDURE

1) BEFORE START:

- The flat surface frame at 0°
- The screw at pulley had loose to make the pulley easy to upward.
- Turn on the sensor switch

2) PROCEDURE TO USE

a) Pulling strength test

- Put the glass surface on the base unit
- Put the telephone on that surface
- Put the telephone cord on measuring tape
- Pull the telephone cord at 45°
- Stop pull the cord when the sensor was alarmed
- Measure the length of the telephone cord
- Record the data

b) Slip down test

- Put the glass surface on the base unit
- Put the telephone on that surface
- Pull the pulley. The base unit will be upward, in slope position
- Stop pull the pulley when the sensor was alarmed
- Measure the angle of the base unit
- Record the data

B) SAFETY PRECAUTIONS THAT MUST BE FOLLOWED WHEN OPERATING THE DEVICE

a) Make sure the screw at the pulley is tightened. So, it easy to take the data.
b) Keep guards in place and in proper working order.
c) Avoid dangerous working environment. Keep work areas clean and well lit.
d) Always wear gloves and safety bootwhen handling the device. Take on or off the surface carefully.