UNIVERSITI TEKNIKAL MALAYSIA MELAKA

A STUDY TO DESIGN AND FABRICATE A PROTOTYPE OF RIVER TRASH COLLECTOR SYSTEM (RTCS)

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Manufacturing Engineering Technology (Process and Technology) with Honours.

by

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SESI PENGAJIAN: **2016/17 Semester 1**

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APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Manufacturing Engineering Technology (Process and Technology) with Honours. The member of the supervisory is as follow:

Encik Mohd Fariduddin Bin Mukhtar

(Project Supervisor)

ABSTRAK

Kebelakangan dekad ini telah menyaksikan pencemaran air sebagai isu penting untuk seluruh dunia. Ia mengancam kesejahteraan dan kemakmuran masyarakat, tumbuh-tumbuhan, dan makhluk. Ketika dunia ternyata menjadi lebih moden dan lebih kecil kerana persimpangan dan pertukaran, ia menambahkan risiko kepada isu pencemaran laut dan sungai. Semua pencemaran air adalah berbahaya kepada kesihatan organisma hidup, tetapi pencemaran laut dan sungai boleh menjadi sangat negatif kepada kesejahteraan rakyat dan makhluk. Sungai dan laut akan digunakan sebagai sumber penting untuk semua populasi hidupan di seluruh dunia. Dari masalah pencemaran air ini, konsep sistem pengumpul sampah sungai diperkenalkan untuk mengurangkan pencemaran di kawasan air. Idea umum datang dari konsep Seabin yang bertindak sebagai pemungut sampah di kawasan laut. Tetapi, terdapat beberapa penambahbaikan dalam sistem pengumpul sampah sungai iaitu berdasarkan konsep teknologi hijau. Ia meringkaskan beberapa jenis sistem kuasa seperti penjana tenaga yang boleh diperbaharui, turbin air dan panel solar. Selain itu, mekanisma terapung juga penting untuk memastikan sistem pengumpul sampah sungai mempunyai kecekapan untuk terapung dengan menggunakan sistem apungan dan konsep tangki balast. Projek ini mengkaji spesifikasi konsep pengumpul sampah di dalam air dan kajian sebelumnya menerangkan tentang ciri-ciri yang digunakan dalam peranti ini. Dalam usaha untuk menyelesaikan kes-kes pencemaran air, pemungut sampah sungai direka berdasarkan beberapa konsep idea dan cadangan bahan yang akan digunakan. Setiap reka bentuk mempunyai ciri-ciri tertentu, kebaikan dan keburukan. Tambahan pula, SolidWorks adalah perisian yang digunakan untuk mereka bentuk sistem pengumpul sampah sungai dan menggunakan Rapid Prototyping untuk mereka-reka model skala sebahagian fizikal atau pemasangan menggunakan reka bentuk bantuan data (CAD) tiga dimensi.

ABSTRACT

Recent decades have seen water pollutions as a significant issue for the whole world. It threatens the wellbeing and prosperity of people, plants, and creatures. As the world turned out to be more modern and littler because of interchanges and exchange, coincidental and purposive risky dumping has added to the issue of sea and river pollution. All water pollution is dangerous to the health of living organism, but sea and river pollution can be particularly negative to the wellbeing of people and creatures. River and sea are utilized as essential wellsprings of consumable water by populaces everywhere throughout the world. From this problem of water pollution, the River Trash Collector System (RTCS) is introduced in order to reduce pollution in water area. The general idea comes from Seabin concept which acts as a trash collector in sea area. But, there a several improvements necessarily in River Trash Collector System (RTCS) based on green technology concept. It summarizes a few types of power system such as renewable energy generator, water turbine and solar panel. Besides, floating mechanism is also important to make sure the River Trash Collector System (RTCS) has an efficiency to float by using buoy system and ballast tank concept. This project reviewed on the River Trash Collector System (RTCS) conceptual specifications and previous study about characteristics that are used in this device. In order to solve water pollution cases, River Trash Collector System (RTCS) is designed based on several concept ideas and suggestion of material to be used. Each design has a specific characteristics, advantages and disadvantages. Furthermore, SolidWorks is a software that used to design River Trash Collector System (RTCS) and using Rapid Prototyping to fabricate scale model of a physical part or assembly using three-dimensional computer aided design (CAD) data.

DEDICATION

To my beloved parents

Hanizat Mohammad

Asparina Amir Hamzah

Muhammad Mirza Hanizat

Nur Aleya Hanizat

Thank you for all support, sacrifices, patient and willingness to shared with me..

To my honoured supervisor and co supervisor,

Encik Mohd Fariduddin Mukhtar, Encik Mohd Idain Fahmy Rosley

and all UTeM lecturers

thank you for always giving me a guidance and persistent help to complete this project thesis.

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All praise belongs to ALLAH (SWT). Without the health, strength and perseverance He gave, I would not be able to complete this project thesis. I have taken efforts in this project and spend time wisely to complete this thesis. However, it would have not been possible without the kind support and help of many individuals. In particular, I want to thank to anyone that contributed in my project thesis. They have encouraged me and giving full thought during this project. First, I would like to express the deepest appreciations to my supervisor Encik Mohd Fariduddin Bin Mukhtar for his patient and endless supports that continually teaching me throughout my project. He gave me a necessary suggestions and constant supervision as well as for providing information regarding the project thesis. Without his guidance and persistent help this project thesis would not complete successfully. Besides that, I would like to thank to my co supervisor Encik Mohd Idain Fahmy Bin Rosley who introduced me to this project and he gave me an inspiration idea about the project. He also provides me an opportunity to cooperate with him on designing a project. By spending his valuable time, he shared his knowledge with his full attentions in carrying out this project thesis. I also want to express my gratitude towards my beloved parents and families for their kind motivation to go through all the hard works and they gave me their supports and positive vibes while carrying out this project. In addition, I am very grateful for those giving me a chance to ask information from basic conceptual idea of the project. My big appreciations also go to the people who are directly or indirectly helped me in developing this project thesis. Once again, thank you so much for all my supporters.

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CHAPTER 1
INTRODUCTION

1.0 Research Background

There has so many kind of pollution nowadays. One of them is water pollution. Pollution is the introduction of contaminants into the natural environment that causes adverse change. Pollutants, the components of pollution, can be either foreign substances or energies or naturally occurring pollutions. A study by Salah in 2014, the water pollution is a physical, chemical, or natural change of a water asset that adversely influences the living beings that makes water unacceptable for the desired use. The issues are greater in the creating nations, where customary wellsprings of contamination. For example, modern discharges, poor sanitation, deficient waste administration, debased water supplies and exposures to air contamination from biomass fuels influence extensive quantities of individuals.

Water pollution can be characterized from multiple points of view. Usually it implies one or more substances have developed in water to such a degree, to the point that they bring about issues for creatures or individuals. Seas, lakes, rivers, and other inland waters can actually tidy up a specific measure of pollution by scattering it harmlessly. On the off chance that some dark ink filled a river, the ink would rapidly vanish into the river much larger volume of clean water. The ink would at present be there in the river, yet in such a low focus, to the point that it would not have the capacity to see it. At such low levels, the chemicals in the ink most likely would not present any genuine issue. Be that as it may, if gallons of ink filled a stream like clockwork through a channel, the river would rapidly turn dark. The

chemicals in the ink could rapidly affect the nature of the water. Thus, it could influence the strength of all the plants, creatures, and people whose lives rely on upon the stream.

A research by Li in (2009), a major barrier to water pollution forecasting is the absence of a proficient system for water pollution checking. Customary water pollution examining is tedious, costly, and must be taken for little sizes. Water pollution has turned into a wellspring of human disease. On the other hand, water which sustains human has ended up undetectable killer of humankind. Besides that, there has a lot of trash in water. Trash float at water level, permitting ocean water bound with trash, oil, and cleansers persistently to spill into it. Thus, water pollution is about amounts of polluting substance discharged and how enormous a volume of water is released. A little amount of a harmful synthetic may have little effect on the off chance that it is spilled into the sea from a boat. Be that as it may, the same measure of the same synthetic can have a much greater effect pumped into a lake or river, where there is less perfect water to disperse it.

Water pollution quite often implies that some harm has been done to a sea, river, lake, or other water source. Individuals once expected that the sea was large to the point that all toxins would be weakened and scattered to safe levels. Modest creatures at the base of the evolved way of life, for example, microscopic fish in the seas, retain the chemicals as they nourish. Since they don't separate effortlessly, the chemicals amass in these living beings, turning out to be significantly more moved in their bodies than in the encompassing water or soil. These living beings are eaten by little creatures, and the fixation rises once more. These creatures are thusly eaten by bigger creatures, which can travel vast separations with their significantly facilitate expanded synthetic burden. Creatures higher up the natural way of life, for example, seals, can have tainting levels a large number of times higher than the water in which they live.

1.1 Problem Statement

Water pollution has increased every year. It has been estimated that there are over 5 trillion pieces of plastic floating in the world's oceans and 10,000 times more in the deep sea. This project of River Trash Collector System (RTCS) is to design a prototype that can remove floating trash, oil, fuel and detergents from the water to decrease water pollution so that water life is not affected by harmful contaminants. The threats faced by sea planet particularly in the ocean may appear to be overpowering. Notwithstanding contamination, environmental change, overfishing, and other overwhelming issues, it has watched that having any kind of effect is finding out about the sea and how actions have an effect.

To reach the objective of water environment quality, water pollution control arranging must be from watershed administration point of view and in light of the comprehend of financial improvement, hydrology, geology and water states of watershed and on the entire water environment control and administration through taking complete measures.

Other than that, compost spill over from homesteads and yards is an enormous issue for beach front zones. The additional supplements causes eutrophication and thriving of algal blossoms that exhaust the water's broken down oxygen and suffocate other marine life. For example, solid garbage also makes its way to the ocean. Plastic sacks, inflatables, glass bottles, shoes, bundling material make the sea polluted. Plastic refuse, which breaks down gradually, is regularly mixed up for sustenance by marine creatures. High convergences of plastic material, especially plastic sacks, have been discovered hindering the breathing sections and stomachs of numerous marine species, including whales, dolphins, seals, puffins, and turtles. This garbage can also come back to shore, where it pollutes beaches and other coastal habitats. Because of the water pollution, River Trash Collector System (RTCS) needs to be designed in order to reduce water pollution.

1.2 Research Objectives

The objectives of this research were as follows:

i. To generate a concept design of River Trash Collector System (RTCS).
ii. To design a concept of River Trash Collector System (RTCS).
iii. To prototype the finalize concept of River Trash Collector (RTCS) by using Rapid Prototyping, handmade and machining process.

1.3 Scope of the Research

The aim of this project is to focus about River Trash Collector System (RTCS) which is this device is very important in water area to make sure that there is clean of debris and hazardous substances that cause water pollution. Besides that, River Trash Collector System (RTCS) is to help rid the oceans of plastics and pollution. This device develops from the most sustainable materials and processes available. In order to create this trash collector, specific location is chosen. Malacca River is the most nearest area to be part of this device to be launched after finish the prototype. Based on this water cleaning project, this device can educate people and cultures about being more responsible with the use and disposal of plastics.

1.4 Significance of Research

Research embarked on the water pollution cases. A research of this River Trash Collector System (RTCS) is identified from the rate of pollution in water quality. In order to overcome the problem of water pollution especially in Malacca River, the River Trash Collector System (RTCS) is based on green technology concept that can help on reducing pollution. This concept of design can considered new and there has improvement characteristics to make sure the River Trash Collector System (RTCS) can reduce pollution in the water area.

CHAPTER 2
LITERATURE REVIEW

2.0 Introduction

This chapter reviews on water pollution, Seabin concept, trash collector system at Malacca River, improvement characteristics based on green technology, power system, and floating mechanism. Besides, this chapter brief more description about types of power system and floating mechanism.

2.1 Water Pollution

Pollution is anything that is available or brought into a situation which causes hurt. In the ocean there are numerous sorts of pollution, for example, garbage, oil and chemicals. In the most recent ten years, our waters have borne the brunt of genuine pollution mischances, yet these are turning out to be less basic as advancements create and the influences turn out to be better caught on. Be that as it may, there is still a horrendous parcel to find out about the impacts of dirtying our marine surroundings. Frequently the pollution can't be seen by the exposed eye, and here and there pollution will never vanish from the water.

(Barnes & Barnes 2008) states that toxins released to freshwaters may posture risks for species, populaces and eventually biological systems which conventional checking methods can't sufficiently identify. This obviously has suggestions for water asset administration and eventually human wellbeing which is reliant on viable checking of water quality and proper treatment frameworks.

From multiple points of view it is our own particular activities that prompt pollution and now and again it can make changes. For instance, purchasing neighbourhood items decreases the interest for sustenance from abroad, diminishing the measure of boats expected to convey this nourishment, and thus lessening the pollution they cause on the seas and the waste they discard. Ocean pollution happens when unsafe, or conceivably hurtful, impacts result from the section into the sea of chemicals, particles, mechanical, agrarian and private waste, clamour, or the spread of intrusive living beings. Eighty per cent of ocean pollution originates from area. Air pollution is likewise a contributing variable via stealing away pesticides or soil into the sea. Land and air pollution have turned out to be unsafe to marine life and its living spaces.

Fish are conceivably significant bio-markers of water quality as an outcome of their high trophic position and direct monetary and recreational worth. The impacts of toxins on fish populaces in this way have quick and unmistakable ramifications for people whether through intense circumstances, for example, one-off fantastic fish executes or long haul interminable impacts, for example, crumbling development and death rates by referring to (Barnes and Barnes 2008).

The pollution frequently originates from non-point sources for example, horticultural overflow, wind-blown flotsam and jetsam and dust. Supplement pollution, a type of water pollution, alludes to tainting by over the top inputs of supplements. It is an essential driver of eutrophication of surface waters, in which overabundance supplements, normally nitrogen or phosphorus, fortify green growth development. Numerous possibly poisonous chemicals stick to little particles which are then taken up by microscopic fish and benthos creatures, a large portion of which are either store or channel feeders. Along these lines, the poisons are thought upward inside sea evolved ways of life.

Numerous particles join artificially in a way exceptionally depletive of oxygen, making estuaries get to be anoxic. At the point when pesticides are consolidated into the marine biological system, they rapidly get to be retained into marine sustenance networks. Once in the nourishment networks, these pesticides can bring about changes, and in addition sicknesses, which can be hurtful to people and

additionally the whole sustenance web. (Salah et al. 2015) states that water pollution administration characterized as an arrangement of situations for variables that can't be straightforwardly affected by the leader of water quality examples constituting the situation and populace development detailing an interest on the situation and the utilization of one or more water administration mediations.

Poisonous metals can likewise be brought into marine nourishment networks. These can bring about a change to tissue matter, natural chemistry, conduct, propagation, and smother development in marine life. Likewise, numerous creature bolsters have a high fish supper or fish hydrolysate content. Along these lines, marine poisons can be exchanged to land creatures, and seem later in meat and dairy items.

2.2 Seabin Concept

Seabin idea was presented by two Australian boat builders who disappointed with sea pollution and mariner surfer Andrew Turton that imagined the Seabin idea. He joined forces with kindred Australian and surfer Pete Ceglinski, a modern architect in the yachting business, to co-found Seabin and tackle the issue. Figure 2.1 below shows Turton and Ceglinski with Seabin device.

Figure 2.1: Seabin Device

Turton and Celinski made a model that can expel gliding flotsam and jetsam, oil, fuel and cleansers from the water, even in difficult to achieve places. The Seabin is bound to be introduced on a coasting dock whether in a marina, an inland conduit, a private lake, a harbour, a port, a yacht club, or on a private boat and is plumbed into a shore-based water pump. Its edge sits equitably with the surface of the water, and the pump brings water into the canister. A characteristic fibre get pack finds the coasting trash before the water is drained out of the base of the canister and up to the water pump, where it is pumped over into the marina. Oil with water separator can be incorporated into the framework for extra filtration. Garbage is currently being collected by costly trash boats, which scoop up debris with built-in nets by driving around harbours and marinas. Workers often walk around to collect trash that converges in corners. Turton and Ceglinski were told that the boats and workers were not effective and simply cannot keep up with the pollution. If widely distributed, the Seabin could offer a viable, lower-cost solution. Figure 2.2 below shows the Seabin working system.

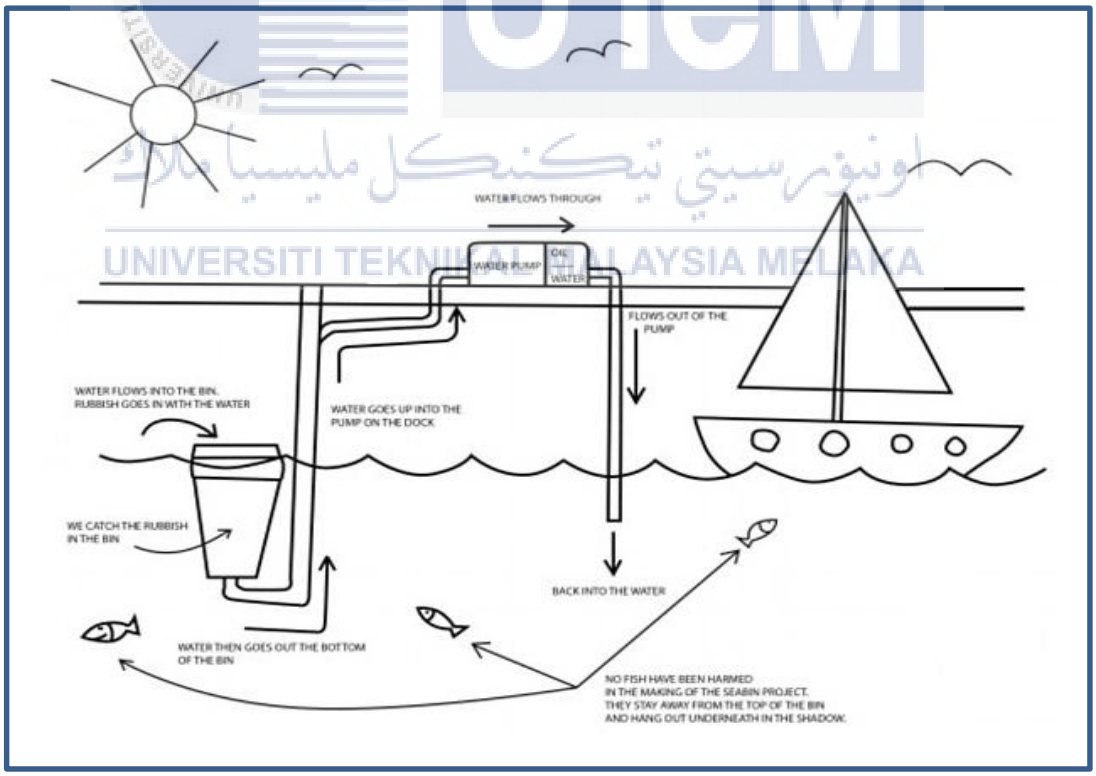

Figure 2.2: Seabin Working System

(Salah et al. 2015) carried out that in the water administration system, different complex basic leadership procedures are included with basic and non-auxiliary practices that can be attempted to streamline drinking water assets, avert water pollution, and expansion profitability through proficient drinking water that is utilized by people. Seabin device can avoid the pollution from occur.

The two Australian arrangements to make an Ocean Clean up Array that could evacuate 7,250,000 tons of plastic waste from the world's seas. The gadget comprises of a secured system of coasting blasts and preparing stages that could be dispatched to junk patches far and wide. Rather than traveling through the sea, the exhibit would traverse the sweep of a waste patch, going about as a monster pipe. The point of the blasts would drive plastic toward the stages, where it would be isolated from tiny fish, separated and put away to recycle. Seabin is one of the gadgets that made for sea pollution. It's a container whose edge glides at water level, permitting ocean water bound with waste, oil, and cleansers consistently to spill into it. A pump at the base of the gadget gives back the now-clean water to the sea while waste keeps on gathering inside the Seabin. With respect to cleaning, the procedure is as basic as purging the characteristic fibre refuses pack that hangs inside.

With just a limited number of these gadgets are being sent, the endeavour confronts a daunting task given the unfathomable measure of refuse littering the world's seas. In any case, with quite a bit of that waste originating from ports, marinas, and yacht clubs, the organization trusts that setting Seabin at these areas will assault the issue at the source. Furthermore, these zones aren't liable to the monstrous swells and damaging tempest states of the vast ocean. It's not an exhaustive arrangement, but rather a keen, outstanding initial step. To sweeten the deal even further, the great people at Seabin have long haul yearnings of assembling future Seabin utilizing the disposed of plastic caught by their gadgets.

2.2.1 Function of Seabin

Figure 2.3: Seabin Concept Design

Example of Seabin concept design as shown in Figure 2.3 above. The Seabin is arranged at the water surface and is plumbed into a shore construct water pump in light of the dock. The water gets sucked into the Seabin bringing all coasting flotsam and jetsam and gliding fluids into the Seabin. At that point, individuals who required in water support find all the gliding trash inside the Seabin and the water then streams out through the base of the container and up into the pump on the dock. The water then moves through the pump where there has the choice of introducing an oil or water separator and clean water then streams once again into the sea. Example of trash that can be collected by Seabin includes plastics, bottles and polysterenes as in figure 2.4.

Figure 2.4: Trash Collected by Seabin

Inside the Seabin it has a characteristic fibre get pack which gathers all the skimming trash. When this is full or close to full, the marina labourer essentially changes the catch pack with another. The gathered flotsam and jetsam is then discarded mindfully, the catch pack cleaned and now it is prepared to swap again for the full one in working Seabin. Andrew Turton and Pete Ceglinski have planned the span of the Seabin and catch sack for safe working burden for one individual to securely change the catch pack. In the event that the Seabin is full despite everything it works. The stream of the water essentially pulls all the encompassing coasting garbage against the Seabin and keeps it there. The marina specialist would basically gather up the encompassing garbage and afterward change the catch sack as ordinary.

2.3 Trash Collector System at Malacca River

In recent year, the Malacca River has been tidied up and restored from one of the dirtiest river in Malaysia turned into a good example of other state. The Malacca River has enhanced to grad B and they are attempting to enhance it to grad A. The water will be discharge once it water level tallness achieved 7 meters. Generally the water will be discharge amid 2-3am consistently as this is high tide period. At that point, they let sea water into the river and close the entryway to give the river a chance to water blend with sea water. The blending procedure of sea water expels smell of river brought on by natural matter found in waterway. At that point, the water will be discharged to the sea through the door worked between Malacca River and sea. This flushing procedure evacuates the terrible stench of Malacca River utilizing sea water. Figure 2.5 below shows the water quality index by 2015. From the figure, it shows that water quality for June, July and August need a water supply with a conventional treatment.

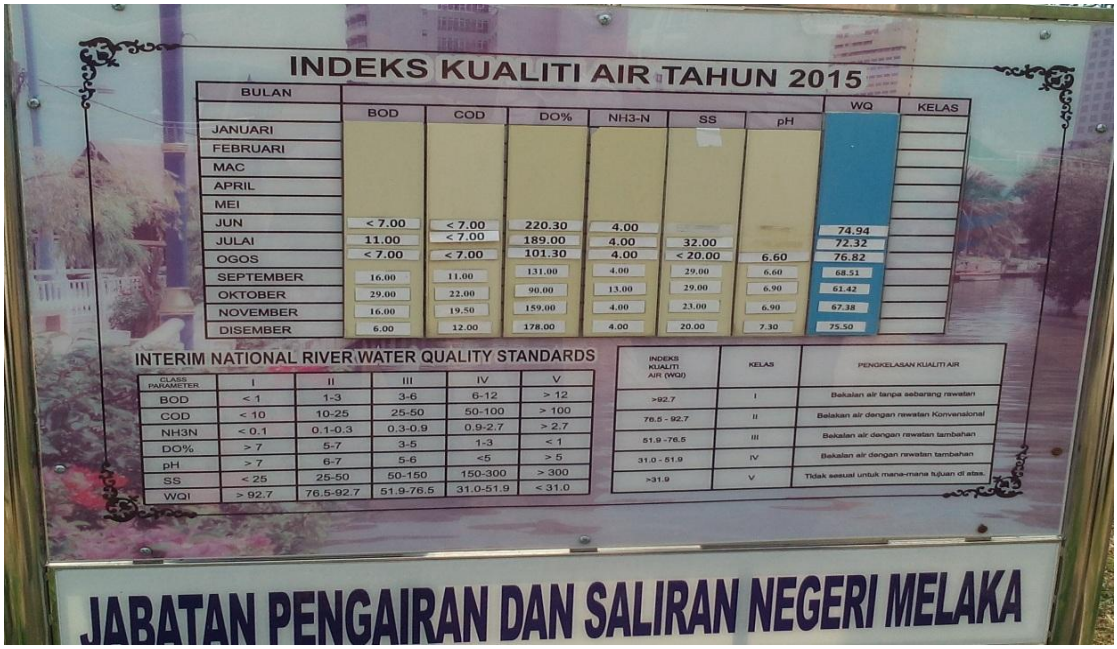

Figure 2.5: Water Quality Index in 2015

As demonstrated, (Hua 2016) said that water defilement in the Malacca River had influenced neighbourhood inhabitants in completing every day exercises, for example, angling, showering, washing and so on. Through history of humanity, the prior settlement was concentrated along rivers for evident reasons. At that point early towns started to develop, some of which have formed into towns. The convergence of settlement is generally because of the significance of water supply in life. Individuals need water to do essential exercises, for occurrence such as drink, cook, wash and shower. It likewise got to be as a method for transportation whereby strolling for a long separation was no more important when flatboats were designed. Rivers moreover give water to the area other than being utilized by nearby ranchers for watering fields.

(Hua 2016) also indicated that utilization of strategy in controlling and dealing with the water assets in Malacca River can be effectively actualizes. Be that as it may, the arrangement will take a long haul to actualize. Furthermore, the Malacca River that loaded with refuse and plastics bottles in the past is currently being spotless utilizing trash collector boat which is changed by them. This cleaning boat has a gap with a net in front to trap the garbage into it. This procedure just needs one watercraft driver and another gatherer. The gatherer is mindful to gather the huge

waste into the receptacle to anticipate blockage. The garbage will be gathered once per day, and every procedure just takes around 3 hours for the entire river. This garbage authority vessel made the procedure of gather trash simple and quick if contrast with last time. Figure 2.6 below shows the trash collector boat in operation system.

Figure 2.6: Trash Collector Boat

Besides that, Malacca River which already dark, smelly and brimming with trash is presently cleaner with the assistance of University Putra Malaysia. UPM has presented them a compelling water treatment which is low in expense and reasonable. This is practical if contrast with privately owned business which cost them around RM 25000 every weeks. Presently, the effectively accomplish water nature of grad B.

Figure 2.7: Effective Microbe (EM) Biodegrador Pump System

Figure 2.7 shows the Effective Microbe (EM) Biodegrador Pump System which is used to clean and expel the scent of the river. EM is made by blending Ikan bilis, nanas, belacan, red sugar, and new drain with standard proportion. It will be keep for 1 week before it can be used. The red sugar contains organism that can help the maturation procedure. It must have to shake the blend regular and discharge gasses from the compartment to avert blast. The EM will be partitioned into 2 layers after time. The upper layer will be channel out and to blended to mud and paddy husk to wind up mud ball. The fluid that settles in the base will be disintegrating in water in 1 to 3 proportions. At that point the fluid or mud ball will be discharge to certain area that with awful smell and messy relies on upon the circumstance.

To date, different water pollution version and decrease controls had been defined to avert and control the release of pro fluent from dirtying point sources. In battling water pollution and improving the nature of our inland waters, other than the requirement exercises completed in agreement with the necessity of those pollution anticipation controls. By referring to (Hua & Kusin 2016), water is among the regular assets that required by living beings, for example, human. Quick improvement through human exercises prompting the water pollution existed in waterway, for instance Malacca River. Subsequently, a monitoring is carried out

regularly to recognize the adequacy of utilizing remote detecting towards water quality in Malacca River.

2.4 Improvement Characteristics Based On Green Technology Concept

The uses of green innovation are additionally had zero or low greenhouse gasses (GHG) emanations. In order to develop the River Trash Collector System (RTCS), green technology concept is characterized by their own advantages and uses. It is for utilizations and advances solid and enhanced environment for all type of life. The term innovation is alluded to the application for down to earth purposes. It is spread a constantly extending a gathering of strategy and material, from strategies for creating vitality to non-dangerous cleaning item. Green Technology outline practice is another arrangement that must be material to save a nature and reduce the pollution. There are so much advancement could be used to in the improvement of the recreation centre to decrease the power use, eco-accommodating and liveable for the group (Saffuan et al. 2012).

(Mathur et al. 2016) state that to give answer for such parameters, ordinary advances were utilized. Some of those are still in use because of cost, simple accessibility and trouble in intersection the limit of adjusting a change. At the point when studies were done, it was found that a large portion of these customary innovations are influencing the nature of item adversely. Environmental change issues significantly affect our surroundings while advancement and utilization of creative green innovation items to meet the present squeezing geo natural difficulties are introduced. The situations tended to incorporate debased water streams, landfills, testing establishments, reusing squanders, thruway slant disappointments and produced totals. Green innovation creates and underpins a methodology to address supportability in nature (Ismail et al. 2013).

(Dornfeld 2014) study that because of the late development in joined items, innovation clients and customers must pick among various distinctive applications that can be seen as either utilitarian alternately hedonic. The world is moving towards actualizing green assembling in a push to accomplish manageable

assembling. Organizations are figuring it out that maintainability is an appealing technique for both business hone which are sparing vitality and different assets, reacting to government controls, diminishing inventory network danger and instability additionally to react to buyer requests and look after aggressiveness.

2.5 Power System

An electric power system is a system of electrical parts used to supply exchange and utilize electric force. The River Trash Collector System (RTCS) uses some kind of power systems such as renewable energy generator, water turbine and solar panel. A case of an electric power system is the system that supplies an area's homes and industry with force for sizable areas, this power system is known as the network and can be extensively partitioned into the generators that supply the force, the transmission power system that conveys the force from the creating focuses to the heap focuses and the circulation power system that bolsters the ability to close by homes and commercial enterprises. Littler power system is additionally found in industry, doctor's facilities, business structures and homes. The greater part of these power systems depend upon three-stage AC control which is the standard for huge scale power transmission and dissemination over the present day world. Particular power systems that don't generally depend upon three stage AC force are found in air ship, electric rail frameworks, sea liners and vehicles.

Besides that, (Adhikari et al. 2016) has performed a study that the utilization of fossil fuel based electrical power generation affects the earth because of overabundance CO2 emanation. Solar power and wind force are the real wellsprings of renewable vitality that can be utilized to diminish the utilization of fossil fuel for electrical power generation. Electric force is the result of two amounts which are current and voltage. These two amounts can fluctuate regarding time (AC control) or can be kept at steady levels (DC power).

Most fridges, ventilation systems, pumps and modern hardware use AC power while most PCs and advanced gear use DC control that computerized gadgets which connect to the mains normally have an inside or outer force connector to

change over from AC to DC power. Air conditioning power has the benefit of being anything but difficult to change amongst voltages and can be produced and used by brushless hardware. DC power remains the main down to earth decision in advanced frameworks and can be more prudent to transmit over long separations at high voltages.

(Fathabadi 2016) states that high precise sensor less double axis solar tracker controlled by the most extreme force point following unit accessible in every photovoltaic framework is proposed. The most extreme force point following controller constantly figures the most extreme yield force of the photovoltaic module and uses the height and azimuth points deviations to track the sun heading where the best estimation of the most extreme yield force is extricated. The capacity to effortlessly change the voltage of AC force is vital for two reasons. Firstly, power can be transmitted over long separations with less misfortune at higher voltages. So in power systems generation is far off from the heap, it is alluring to venture up the voltage of power generation point and after that progression down the voltage close to the heap. Besides, it is frequently more temperate to introduce turbines that create higher voltages than would be utilized by most machines, so the capacity to effectively change voltages implies this confound between voltages can be effortlessly overseen. Figure 2.8 below shows the electrical delivery power system.

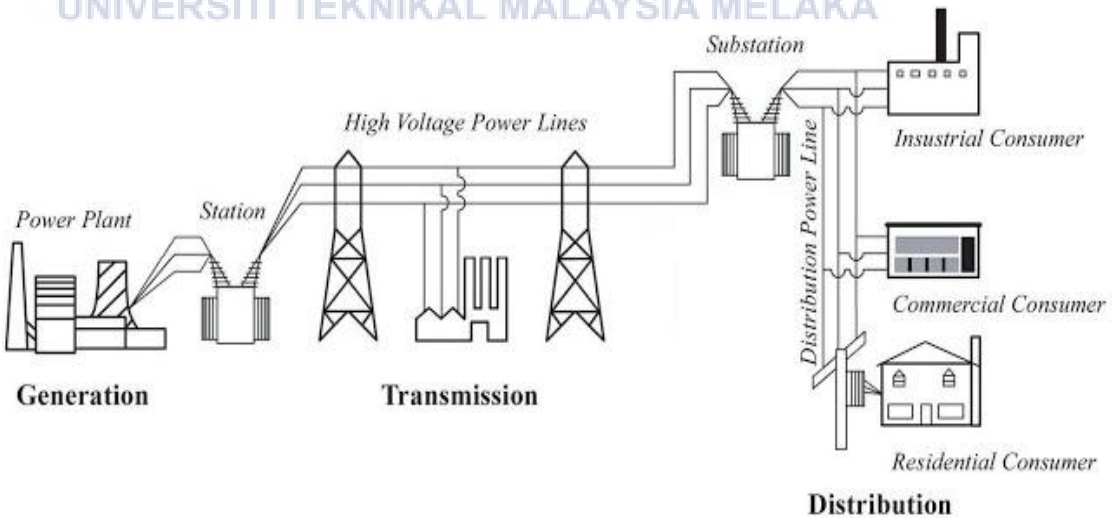

Figure 2.8: Electrical Delivery Power System

2.5.1 Renewable Energy Generator

The expression renewable energy is energy derived from an expansive range of assets, all of which depend on self-re-establishing energy sources, for example, daylight, wind, streaming water, the world's inward warmth, and biomass. These assets can be utilized to create power for every monetary part which is powers for transportation, warmth for structures and modern procedures. Renewable energy technologies offer imperative advantages contrasted with those of ordinary energy sources.

(Bull 2001) has performed a study that the most renewable energy systems are secluded, permitting adaptability in coordinating burden development. Today's business sectors for renewable energy innovations range from particular specialty markets to brought together energy generation. For brought together energy generation, renewable energy systems are generally capital concentrated contrasted with contending traditional advances for example, common gas joined cycle power plants. Be that as it may, after the underlying ventures have been made, the financial matters of renewable vitality innovations make strides in correlation with traditional advances in light of the fact that working and upkeep expenses are low contrasted and those brought about utilizing traditional powers. This is particularly valid in the areas of the world where world fuel costs are moderately high, and will be particularly valid later on as fuel costs increment.

Consistently individuals depend on energy to provide electricity, high temperature of water, and fuel for cars. A large portion of this energy originates from fossil fills, for example, coal, oil, and normal gas. These are non-renewable energy sources, which implies that if use all of them up, it can never get all the more amid individuals lifetime. Fossil fills likewise contribute extraordinarily to worldwide environmental change by discharging carbon dioxide into the air when they are copied. Since fossil powers can run out and are awful for the earth, it is imperative that individuals begin

changing to other vitality sources, as renewable vitality sources. These are vitality sources that are always being renewed. For example, daylight, wind, and water. Furthermore, renewable energy sources are typically substantially more ecologically benevolent than fossil energizes.

The utilization of energy resources assets is progressively being sought after as a supplement and a contrasting option to substantial traditional focal force stations. (Carrasco et al. 2006) said the detail of a power electronic interface is liable to prerequisites related not just to the renewable vitality source itself additionally to its consequences for the power-framework operation, particularly where the irregular vitality source constitutes a critical part of the aggregate framework limit. Furthermore, liberalization of the lattices prompts new administration structures, in which exchanging of energy and force is turning out to be progressively energy. The force electronic innovation assumes an energy part in conveyed generation and in joining of renewable energy sources into the electrical power systems. Besides it is generally utilized and quickly growing as these applications turned out to be more coordinated with the grid-based systems.

In recent years, the generous increment of exploration and improvement work in the range of photovoltaic power generators has made a practical option energy asset that supplements other energy sources in crossover energy power systems. The pattern of quick increment of the power generator use is identified with the expanding productivity of sunlight based cells as well as the changes of assembling innovation of sun oriented boards. The power generators can either be lattice associated or can work in stand-alone systems. With the improvement of conveyed power system generation, the renewable power from power generator sources turned into an asset of energy in extraordinary interest (Bialasiewicz 2008).

(Barton & Infield 2004) has introduced energy storage systems inside power electricity can be given by a scope of advances and can change it up of ways. Sometimes, the matrix at the point of association of the implanted

renewable energy can't assimilate the whole yield of the generator, then yield must be diminished and the estimation of the overabundance is successfully zero. At different times, interest is high and costly generators are used to take care of that demand, then the cost will be high. Another wellspring of wage results from supplying subordinate administrations, for illustration, responsive force, voltage, and recurrence control and crisis power amid a force blackout.

2.5.2 Water Turbine

In this project, water turbine is one of the power source for River Trash Collector System (RTCS). The floating water turbine is for taking the dynamic vitality from straight momentum current flow and changing over it into mechanical energy along these lines into electrical energy. The turbine is built of a light material to bolster itself on top of the water, consequently disposing of any drag from the contraption. A vertical pivot wind turbine is bolstered by a casing held set up by a circling arrangement of bow formed tubular diverter vanes. The vanes extend towards the turbine centre, focusing the wind. The wind is caught immediately on entering the turbine pits. Air can be supplied to such depressions from a compacted air source driven by wave activity on a waterway.

By referring (Hwang et al. 2009), water turbines can be arranged by the kind of generator utilized, on the other hand the water assets in the introduced place. A water-head turbine is the most by and large utilized systems, and this makes the turbine turn by changing over the potential energy of the water into active energy. This turbine has the upside of high productivity. However the development cost for a dam or conduit is high and can bring about noteworthy natural issues. There are two sorts of water stream turbines which are level pivot turbines and vertical hub turbines. Figure 2.9 below shows the concept of water turbine.

Figure 2.9: Water Turbine Concept

As indicated by the innovation in its more extensive viewpoint, a vertical pivot turbine having a turbine rotor with vertical impeller surfaces is given an encompassing circumferential arrangement of vertically conveyed redirector vanes, each of which is tubular in the most broad geometric sense fit as a fiddle, reaching out from an edge at its external circumferential limit and broadening towards the focal hub of the turbine to frame a by and large three-sided cross-segment. This cross-segment ends with a base situated at the internal circumferential limit of the arrangement of redirector vanes, fixing situated alongside the external circumferential way limit of the turbine rotor. This three-sided cross-segment is specially bended in a semi-bow structure to both concentrate the stream of a liquid, for example, air or water, entering the turbine past the fixation emerging from the spiral shutting of the diverter vane's dynamic surface and redirect the liquid stream to direct it against the dynamic surfaces of the turbine impellers at an all the more almost opposite introduction.

(Tian et al. 2016) was done a study that water turbines, which have been broadly utilized for hydrokinetic power generations, can be arranged into two classifications contingent upon the introduction of turbine hub with respect to the water flow direction. The vertical axis water turbine, otherwise called the cross-flow water turbine, turns around a hub opposite to the current. Alternately, the level hub water turbine has a pivot of turn parallel to the present course. This kind of turbine commonly has a propeller-sort plan with a few sharp edges with rotational torque made by the lift created on the

edges. The vertical axis water turbines are commonly less proficient when contrasted and their level counterparts. Figure 2.10 below shows an example of mini water turbine.

Figure 2.10: Mini Water Turbine

On the other hand, (Akimoto et al. 2015) expanded the research about water turbine that the energy of sea wave exists generally close to the water surface and reductions exponentially with profundity. In this way, in the scaling up of energy converter, the caught wave energy increments gradually in extent to the wave front width of the gadget while its cost tends to increment in a pace quicker than the square of gadget size. To conquer the issue, the creators propose a drag sort cross-stream water turbine with its rotational pivot lying on a level plane and parallel to the wave front. Since the gadget will be light-weight and straight extendable in the wave front bearing, the bigger converter can get the benefits of scale for higher financial execution. The state of proposed turbine is not axisymmetric for specifically using the orbital liquid molecule movement in wave. The essential unit of the gadget is minimal and the distance across of turbine is in the request of wave tallness.

2.5.3 Solar Panel

Solar panel is a sun powered energy sources which is gotten from the sun. Each sun oriented force board contains a wide range of silicon cells or sun based cells. Solar panel is to store energy to use at night for this River Trash Collector System (RTCS) besides it also use during daytime as a power system. They are building squares of sunlight based boards. The vitality from the sun is consumed by these sunlight based cells. Sun powered board for use in a rooftop mounted exhibit of sun based boards, every board having edges distending ostensibly and neighbouring the side edges for accepting a standing crease top between side-adjoining boards. Each sunlight based board is shaped as a necessary structure having a photovoltaic module an edge of which is fixed by a base substrate. The base substrate is arranged to have lipped top and base edges which interlock to frame a watertight seal between top-contiguous and base adjoining sunlight based boards.

(Rizk & Chaiko 2008) extracting useable electricity from the sun was made possible by the discovery of the photoelectric mechanism and subsequent development of the solar cell of semi conductive material that proselytes noticeable light into a direct current. By utilizing sun oriented clusters, a progression of sunlight based cells electrically associated. A DC voltage is created which can be physically utilized on a heap. Sun oriented clusters or boards are being utilized progressively as efficiencies achieve larger amounts, and are particularly prominent in remote regions where position of power lines is not monetarily practical. Figure 2.11 below shows a schematic diagram of heat-collecting plate.

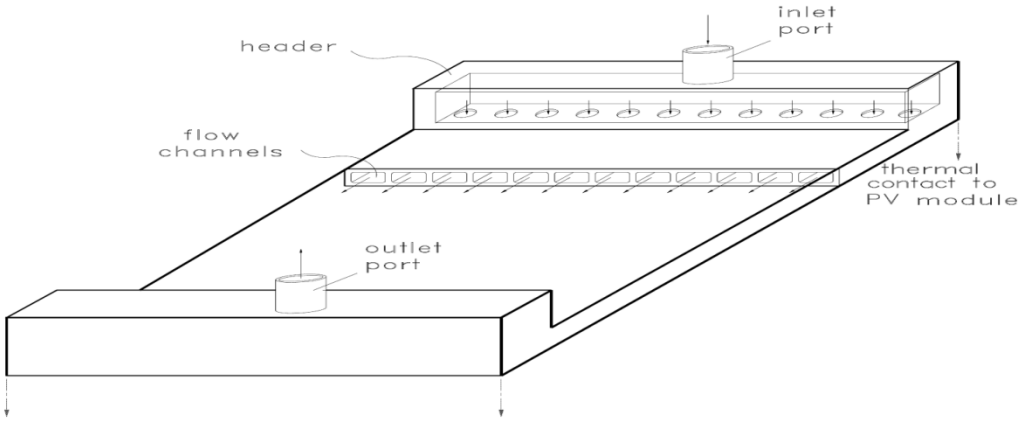

Figure 2.11: Schematic Diagram of Heat-Collecting Plate

Solar energy has been considered as a promising arrangement for the energy and ecological difficulties of worldwide warming risk. The hypothetical energy change proficiency breaking point of the system has been examined for archiving the capability of this cross breed sun powered board plan. Given the material a property of every layer, the real energy transformation productivity relies on upon the sun based illumination and surrounding temperature and water flow temperature (Yang & Yin 2011).

In another way, (Yang & Yin 2011) also found that solar thermal technology provide thermal energy of solar insolation. Solar thermal collectors have been applied to domestic and commercial sectors. However, the applications of solar thermal collectors are limited by heat demand and architectural aesthetics. Solar insolation is a measure of how much solar radiation given solar panel or surface receives. The more noteworthy the insolation, the more sun energy based can be changed over to power by the sun oriented board.

Different elements that influence the yield of solar panel are climate conditions, shade brought on by impediments to direct daylight and the point of position at which the solar panel is introduced. Solar panel work the best when set in direct daylight, far from impediments that may cast shade, and in zones with high provincial sunlight based insolation appraisals. Solar panel productivity can be streamlined by utilizing dynamic mounts that take after the position of the sun in the sky and pivot the sunlight based board to get the

greatest measure of direct presentation amid the day as could be expected under the circumstances.

The present development has been made in perspective of the above circumstances and has as an article to give rooftop mounted sunlight based board exhibit that is built to empower simple substitution of harmed solar panel. Figure 2.12 below shows an example of solar panel.

Figure 2.12: Solar Panel

2.6 Floating Mechanism

River Trash Collector System (RTCS) has a floating mechanism in their concept to make sure that trash collector can float in the water area. A connector having a floating structure incorporates a floating holder for coupling segment associated with a compact electrical contraption to a base through a drifting instrument. The floating holder is shaped of plastic as a different part from a connector fundamental body that gave the fitting coupling segment. The coasting holder has a first holder and a second holder for squeezing and supporting a coupling deck of the connector principle body from inverse sides. The principal holder and the second holder have locking snares and are coupled to each other specifically or through the connector fundamental body. Also, the principal holder and the second

holder have necessarily shaped bolster parts for supporting the coupling deck of the connector primary body. So it can connect all the sides of floating mechanism for River Trash Collector System (RTCS).

2.6.1 Buoy System

A buoy is a floating device that can have many purposes. It can be anchored or allowed to float in water area. A floating buoy is produced to screen sea situations by means satellite and a technique is proposed to build estimation exactness of ocean water temperature with basic low cost temperature sensor. A buoy design has been created which fulfils the necessities of a multi-reason vessel for unmanned or kept an eye on conditions.

The buoy is described by a high proportion of lightness to manufactured weight. The outline incorporates a middle segment get together, which can be raised permitting access to a dock in shallow water and brought down for dependability seaward. The inside section get together houses settled counterbalance in its base and gives roll and hurl damping to lessen increasing velocities and in general movements.

(Haun 2002) studied that the essential configuration has experienced tank testing and has been appeared to be reasonable for an assortment of seaward applications counting profound water, high momentum situations, and sea tempests. Outline highlights which have been concentrated on and determined incorporate the hydrodynamics, mooring choices, scantling outline, raising and bringing down systems for the inside section, and self-tensioning systems for pre-introduced mooring. Figure 2.13 below shows floating buoy mechanism.

Figure 2.13: Floating Buoy Mechanism

Deck burden is generally corresponding to the 3D square of the structure measurement over the water line. The altered stabilizer is situated at the base of the middle section get together and alternatively the base of the frame. Temporary weight would be utilized for shallow water transport at the point when the middle section get together couldn't be in part conveyed to bring down the focal point of gravity. The temporary stabilizer would be situated in the structure base inside and the inside of the middle segment individuals. Because of the expansive lightness managed by the structure shape, noteworthy settled stabilizer can be suited to move the focal point of gravity well beneath the water line. The length of the focus section get together and the greatness of the settled weight give the chance to likewise adjust the move span of gyration (Haun 2002). The floating buoy is well control in deep water fields.

2.6.2 Ballast Tank

A ballast tank is a compartment within a boat, ship or other floating structure that holds water, which is used as ballast to provide stability for a vessel. Using water in a tank allows for easier adjustment of weight than stone or iron ballast as was used in older vessels. It also allows for ballast to be pumped out to temporarily reducing the draft of the vessel when required to enter shallower water. Ballast water taken into a tank from one waterway and released in another waterway can present obtrusive types of amphibian life. The taking in of water from stabilizer tanks has been in charge of the presentation of species that bring about ecological and monetary harm. It used to create a floating mechanism for River Trash Collector System (RTCS) float in water area. Figure 2.14 below shows ballast tank concept.

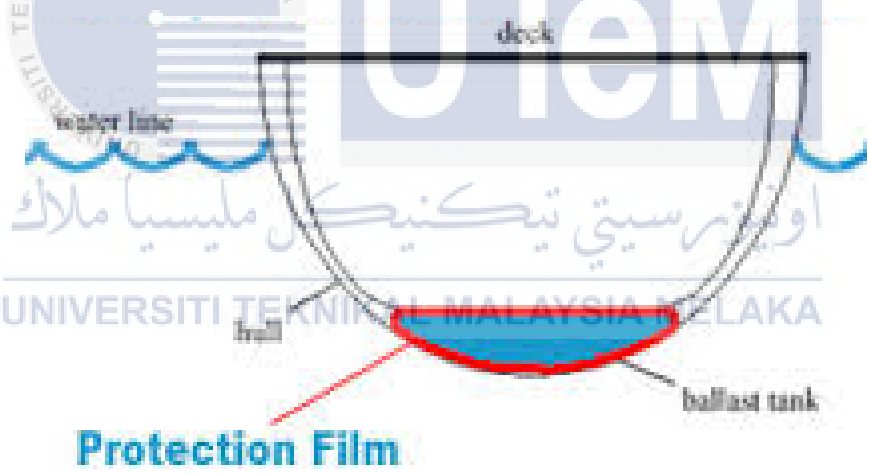

Figure 2.14: Ballast Tank Concept

A self-ballasting floating decoy waterfowl involves a floating hollow body representing to the waterfowl and a water weight tank orchestrated beneath the water line of the floating hollow body, said tank being joined to the bottom or underside of the coasting hollow body by method for an appropriate associating rib. The ballast tank is as a prolonged hollow body gave in correspondence of its base with an opening for the inflow and surge of the counterweight water, and in correspondence of its top with a breather or air escape pipe. At whatever point the distraction waterfowl is put into the water, the water fills the ballast tank. This floating mechanism is one of the characteristic of River Trash Collector System (RTCS). Figure 2.15 below shows the ballast tank system.

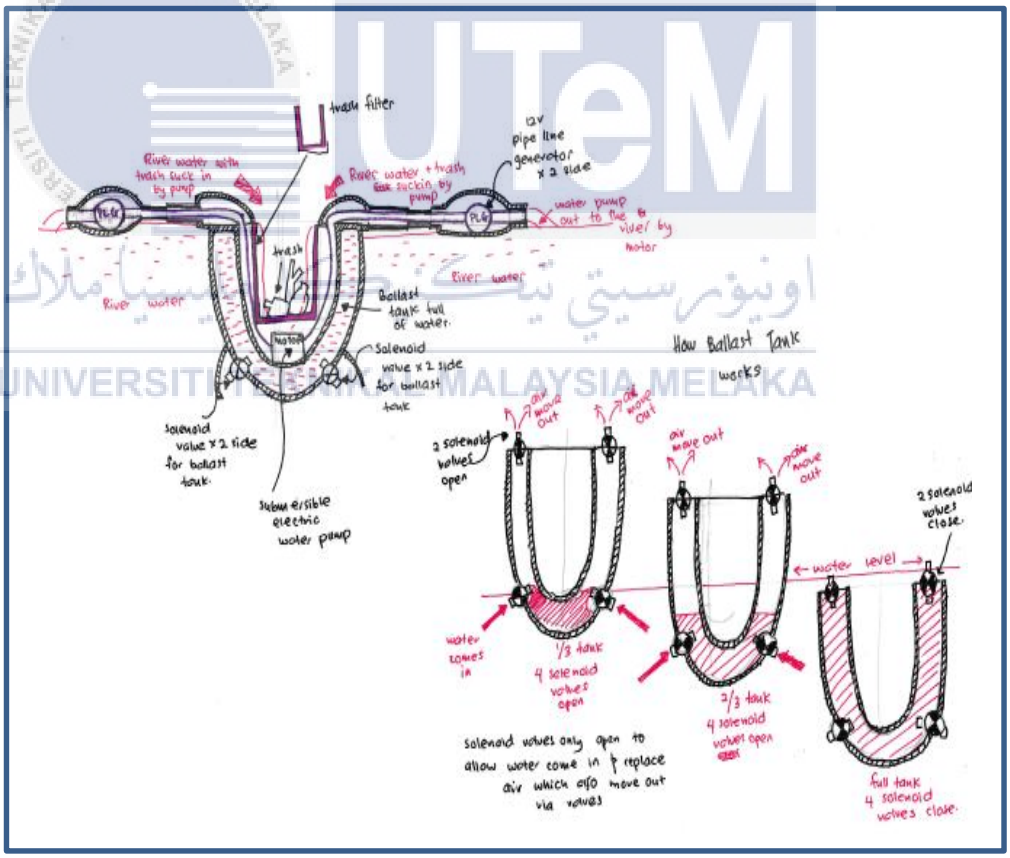

Figure 2.15: Ballast Tank System

(Woods et al. 2012) state that the water level in ballast tanks is typically manually set for neutral buoyancy before each mission, while the vehicle is on the surface. The difficulties with controlling the profundity and trim of a submerged vehicle incorporate nonlinear hydrodynamic strengths, and in addition inborn time delays connected with water tank level changes and valve modification. The ballasting systems comprises of two water tanks situated rearward and forward of amidships. The counterweight tanks are then naturally filled or purged of sea water as sought.

Furthermore, ballast water is basic for the boat route as a result of it uses the change of boat draft and keeping to the boat mobility. Seawater is utilized for counterbalance water and it is charged in balance tanks at shipment port, inlet and so forth waterfront ocean. Also, after the end of route for transportation port, this water is discharged. And after the end of navigation for shipping port, the water is released (Kamada et al. 2004).

2.7 Conclusion

From this chapter, this project reviewed on the River Trash Collector System (RTCS) conceptual specifications and previous study about characteristics that are used in this device. There has a few of articles and journals that describe a case study on this literature review to give more explanation of basic concepts of River Trash Collector System (RTCS).

CHAPTER 3
RESEARCH METHODOLOGY

3.0 Introduction

This chapter reviews on the method used in this study. The research methodology requires gathering relevant ideas and information from the specified methods. This methods section describes the rational for the application of specific procedures or techniques used to identify, select and determine the information applied to understanding the research problem in River Trash Collector System (RTCS). For this research methodology, there has an elaboration about SolidWorks Software Applications, Rapid Prototyping, Product Design Specification (PDS), Concept of River Trash Collector System (RTCS), Concept Selection, Material and Cost, Design Process Flow and Operational Framework.

3.1 SolidWorks Software Application

For this project, SolidWorks Software is applied to create 3D solid models for mechanical and product designing application of River Trash Collector System (RTCS). SolidWorks Software is a solid modelling, computer-aided design (CAD) and computer-aided engineering (CAE) computer program that runs on Microsoft Windows. Besides that, SolidWorks is a solid modeller, and utilizes a parametric feature-based approach to create models and assemblies. This SolidWorks Software provides design with maximum productivity because it gives various data and technical communication in order to design River Trash Collector System (RTCS) easily and validate with standards. Furthermore, SolidWorks Software improved collaborative feature when draw the part and assemble them together.

3.2 Rapid Prototyping

Rapid prototyping is a group of techniques used to quickly fabricate a scale model of a physical part or assembly of River Trash Collector System (RTCS) using three-dimensional computer aided design (CAD) data. Construction of the part or assembly is usually done using 3D printing or additive layer manufacturing technology. The term rapid prototyping (RP) refers to a class of technologies that can automatically construct physical models from Computer-Aided Design (CAD) data. Besides that, the main advantage of the system is that almost any shape can be produced. Since, there have many ideas of concept design of River Trash Collector System (RTCS), rapid prototyping techniques are chosen in order to reduce material waste and no tooling is necessary during this process. Figure 3.1 below shows the basic process of Rapid Prototyping.

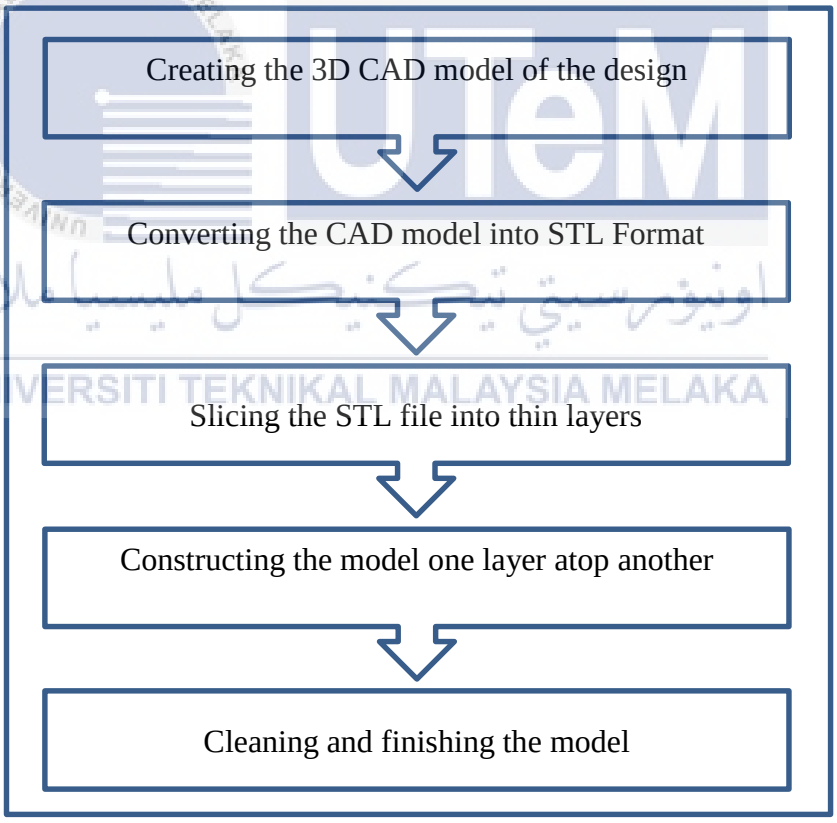

Figure 3.1: Basic Process of Rapid Prototyping

3.3 Product Design Specification (PDS)

Design A

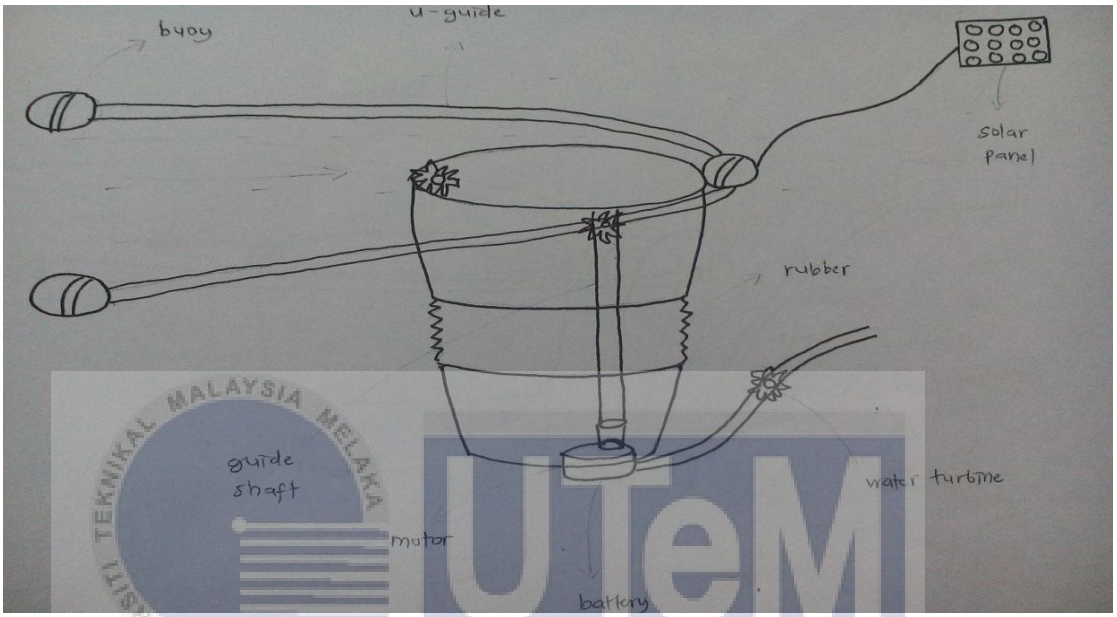

Figure 3.2: Design A

Functions	• Water and trash flow into the bin and water turbine generate electrical energy to the motor. This device using solar panel during daytime and water turbine at night.
Advantages	• Saving cost which is not too expensive to develop. • Using solar panel in term of green technology. • Saving electricity.
Disadvantages	• Solar panel cannot functions when rainy day.

Design B

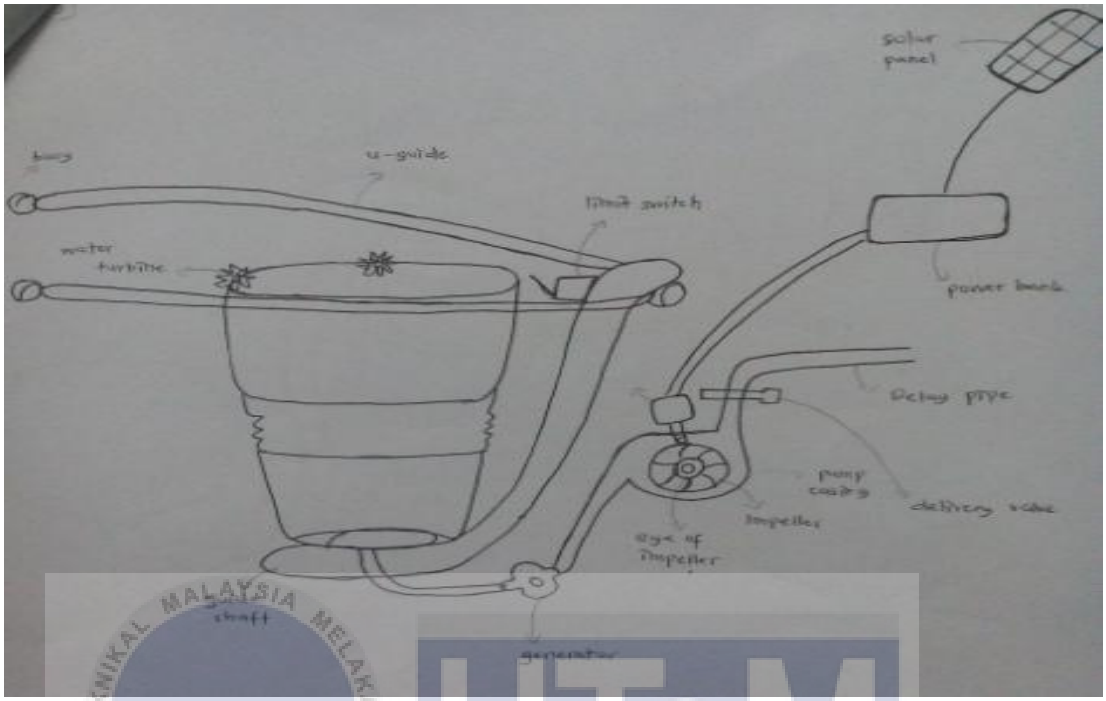

Figure 3.3: Design B

Functions	• Water and trash flow into the bin. • Limit switch functions automatically during high speed water flow. • Energy is saving in the power bank. • Daytime, solar panel generate energy in the power bank to use at night. • Generator will generate water impeller during low speed of water flow.
Advantages	• Power bank can use at night. • Limit switch functions automatically. • Saving cost. • If limit switch damage, generator and water turbine still can functions.
Disadvantages	• Limit switch can damage anytime and affect the power bank to functions at night. • If motor damage, trash cannot removed by the process.

Design C

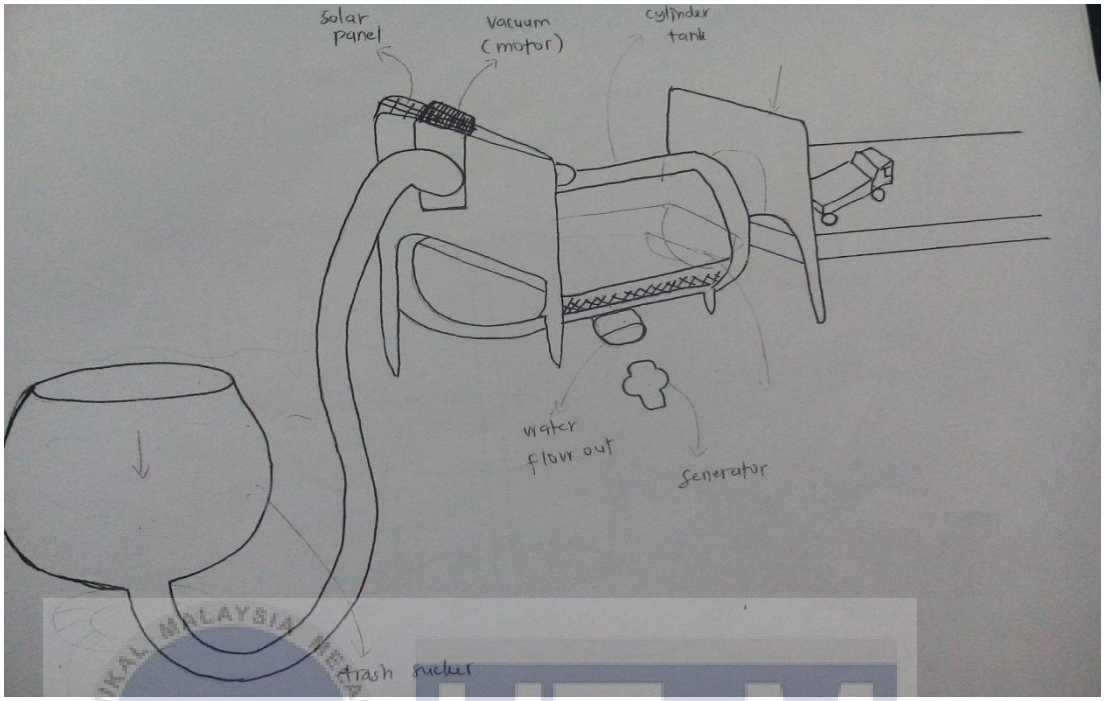

Figure 3.4: Design C

Functions	• Water and trash flow into the trash sucker then flow into the bin. • Cylinder container including bin and filter. • Function of generator is to supply electrical energy to the motor. • Door provided for collecting trash.
Advantages	• Easy to collect trash. • Stable system and safe.
Disadvantages	• Need a high cost and maintenance. • Difficult to develop.

Design D

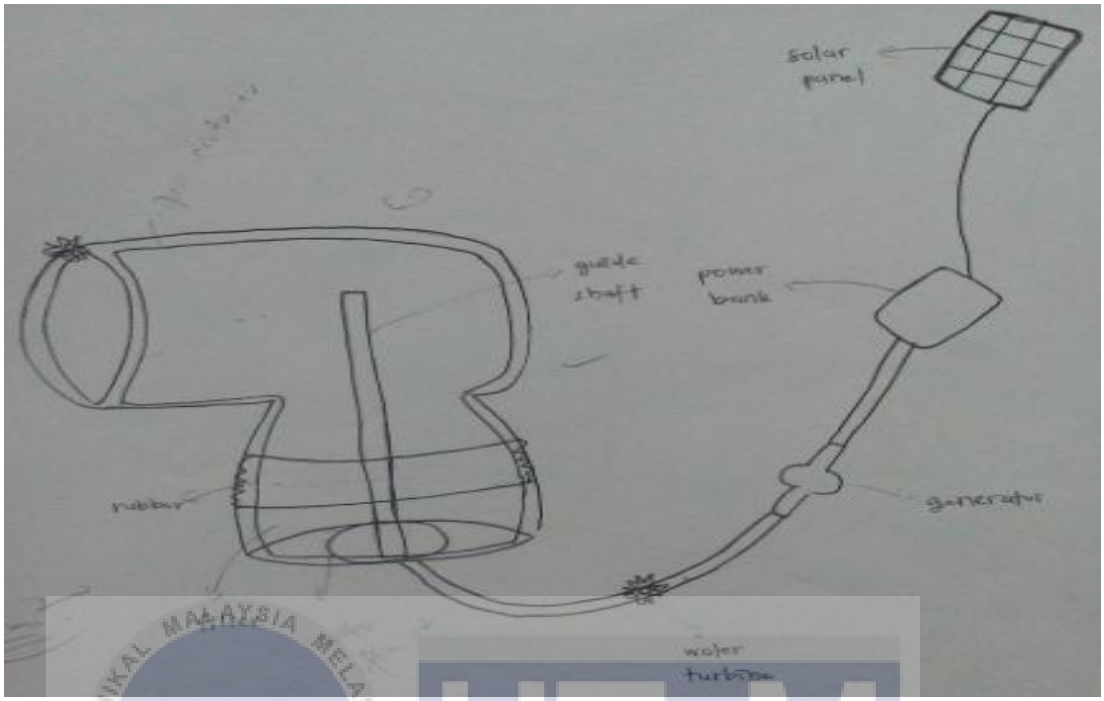

Figure 3.5: Design D

Functions	• Water and trash flow into the open container and pass through the bin while the trash is trapped at the filter. Water flows out at the bottom of the bin. • Water turbine will functions since water flow into the bin and generator supply electrical energy to the power motor. • Solar panel provides energy during daytime and keeps the energy source in power bank to use at night.
Advantages	• Require low cost to develop. • Lightweight.
Disadvantages	• Cannot use at deep sea area. • Trashes have difficulties to flow into the container.

Design E

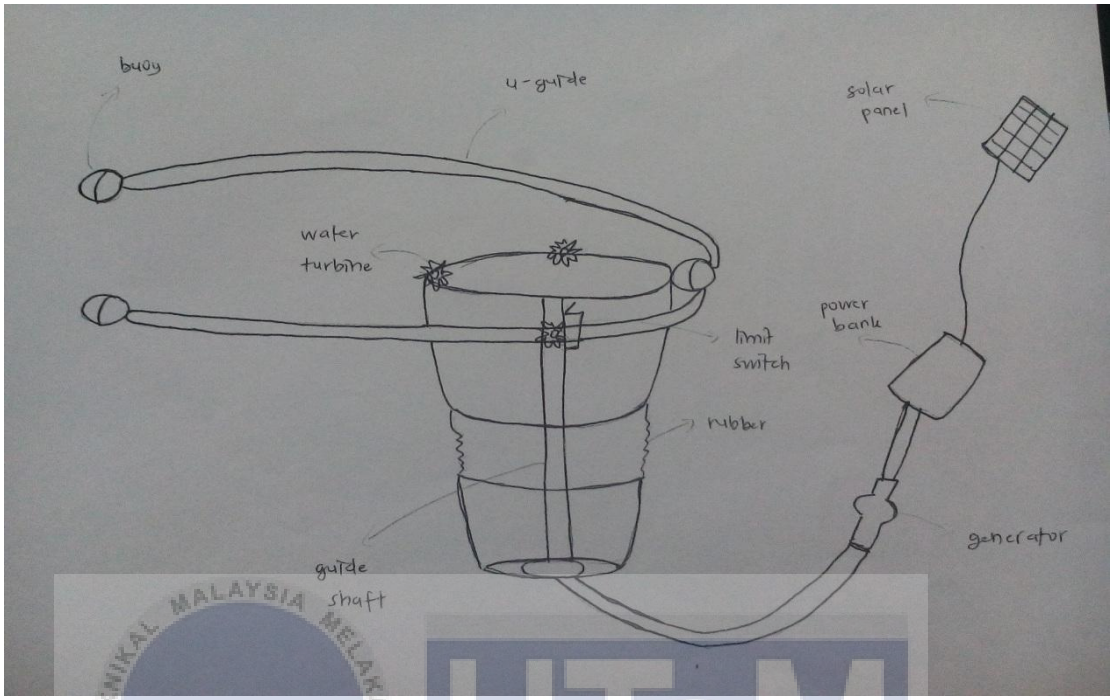

Figure 3.6: Design E

Functions	• Water and trash flow into the bin. • Generator provides electrical energy. • Using limit switch to functions automatically during high speed of water flow. • Using solar panel to generate energy source and transfer into power bank for night use.
Advantages	• Trash easier to flow. • Simple design. • Easier to build and not too complex. • Variety source of energy such as water turbine, generator and solar panel.
Disadvantages	• Cannot use at deep sea area. • Difficult to collect trash. • Filter easy to damage.

Design F

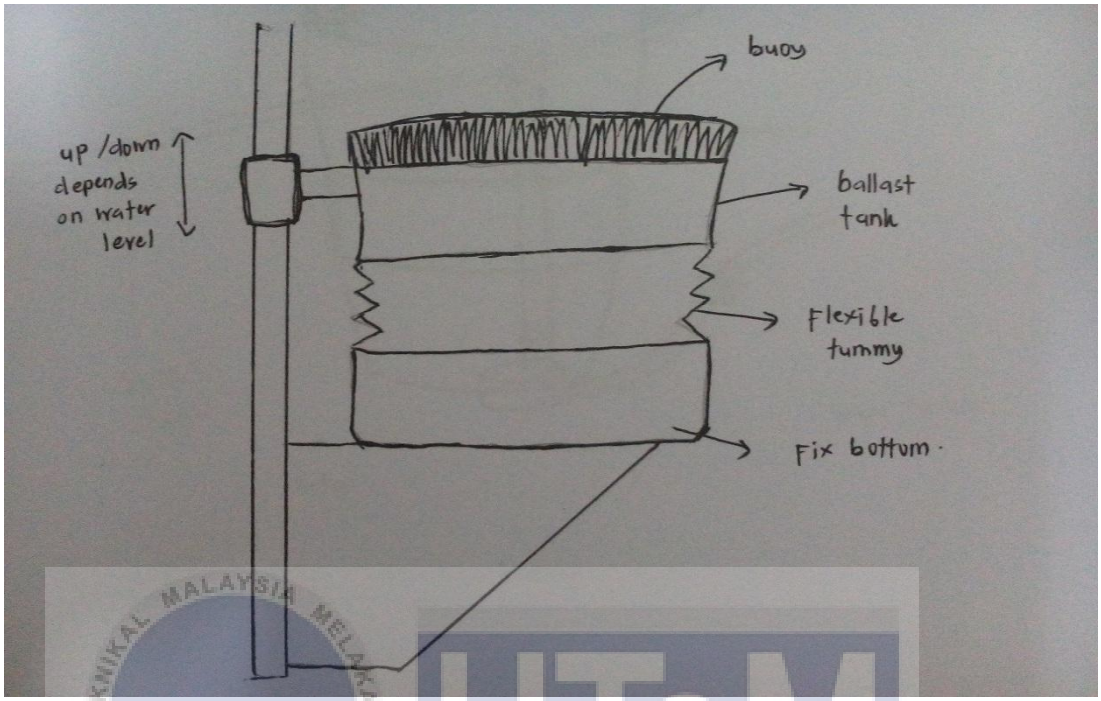

Figure 3.7: Design F

Functions	• Water and trash flow into the bin. • Trash is trapped in the bin when motor is function and there has a power system that generate from water turbine and solar panel.
Advantages	• Simple design. • Low manufacturing cost due to its simplicity. • Can be ran 24/7 with minimum monitor. • Minimum effect on water tide. • Minimum risk to get hit by boats due to its place near to the river bank wall. • Operator can collect the accumulated trashes straight away from the river bank. • Trashes can be collected from all around direction.
Disadvantages	• Only can be fixed on the wall.

Design G

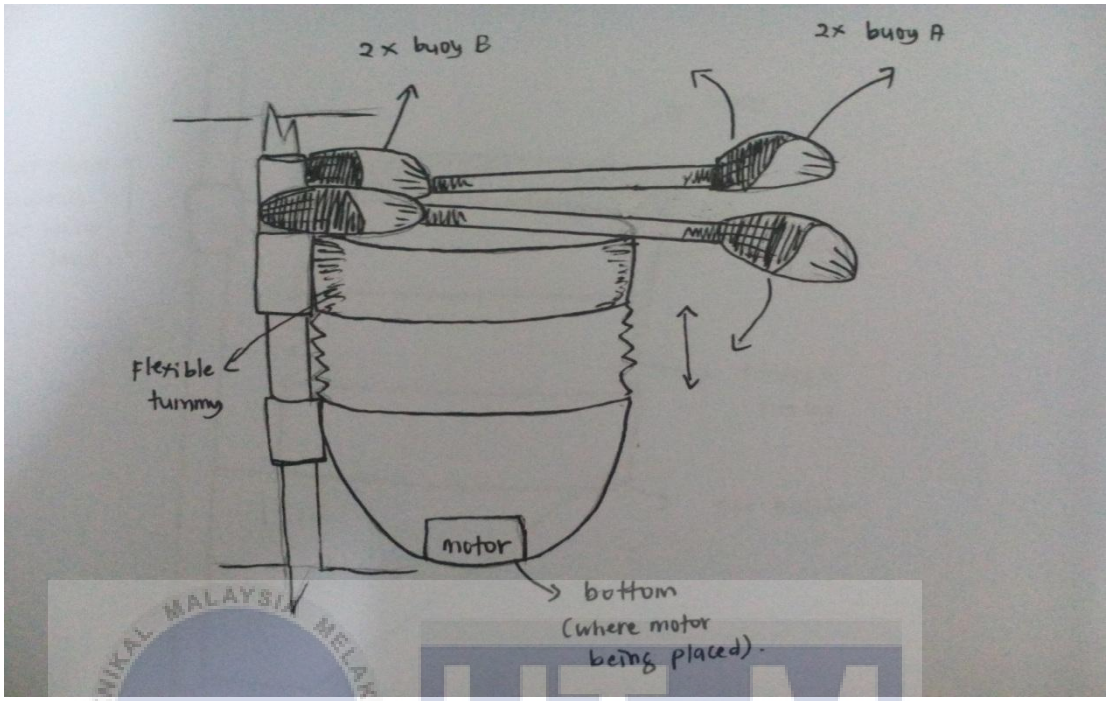

Figure 3.8: Design G

Functions	• Water and trash flow into the bin. • Trash is trapped in the bin when motor is function and there has a power system that generate from water turbine and solar panel.
Advantages	• Artistic and futuristic • Easy to store has got adjustable legs. • Can be ran 24/7 with minimum monitor. • Can be a design icon or as part of tourist attraction items. • Minimum effect on water tide. • Minimum risk to get hit by boats due to its obvious design and place near to the river bank wall. • Operator can collect the accumulated trashes straight away from the river bank.
Disadvantages	• Trashes only can be collected from 1 direction. • Only can be fixed on the wall.

Design H

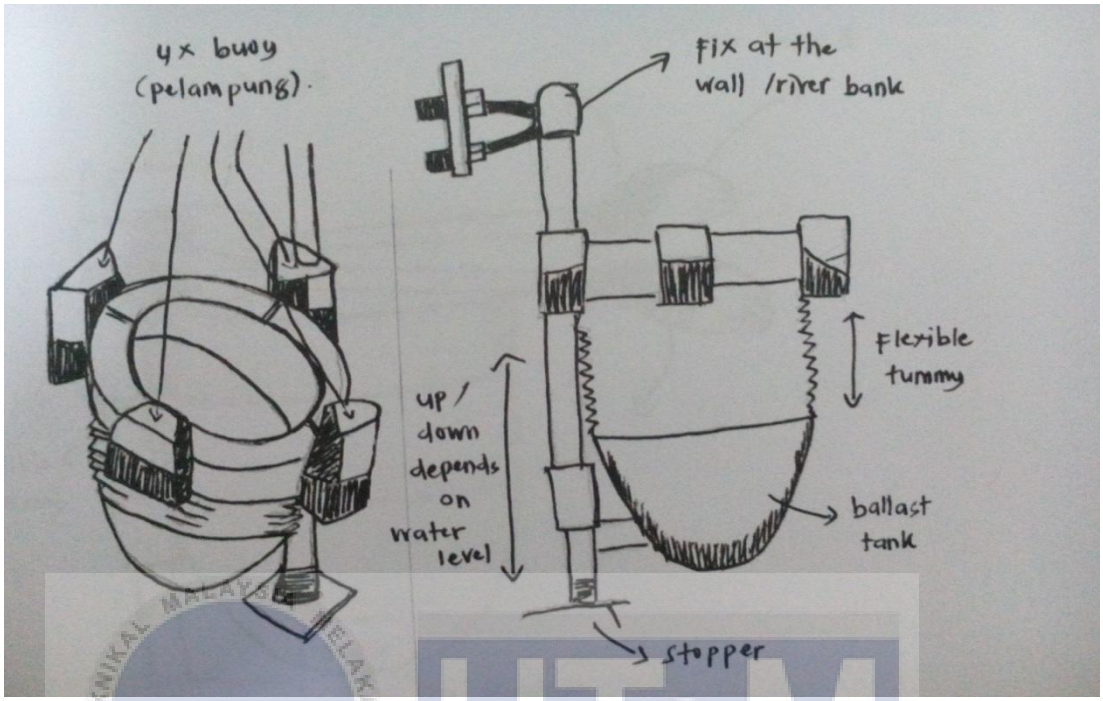

Figure 3.9: Design H

Functions	• Water and trash flow into the bin. • Trash is trapped in the bin when motor is function and there has a power system that generate from water turbine and solar panel.
Advantages	• Simple design. • Easy to manufacture and less cost. • Smooth flow has got a plenty of opening area. • Will come in 2 versions: with normal steel bar as guide or with anchor. • Can be ran 24/7 with minimum monitor. • Minimum effect on water tide. • Trashes can be sucked from any different directions.
Disadvantages	• High risk to get hit by boats due to its low profile design.

Design I

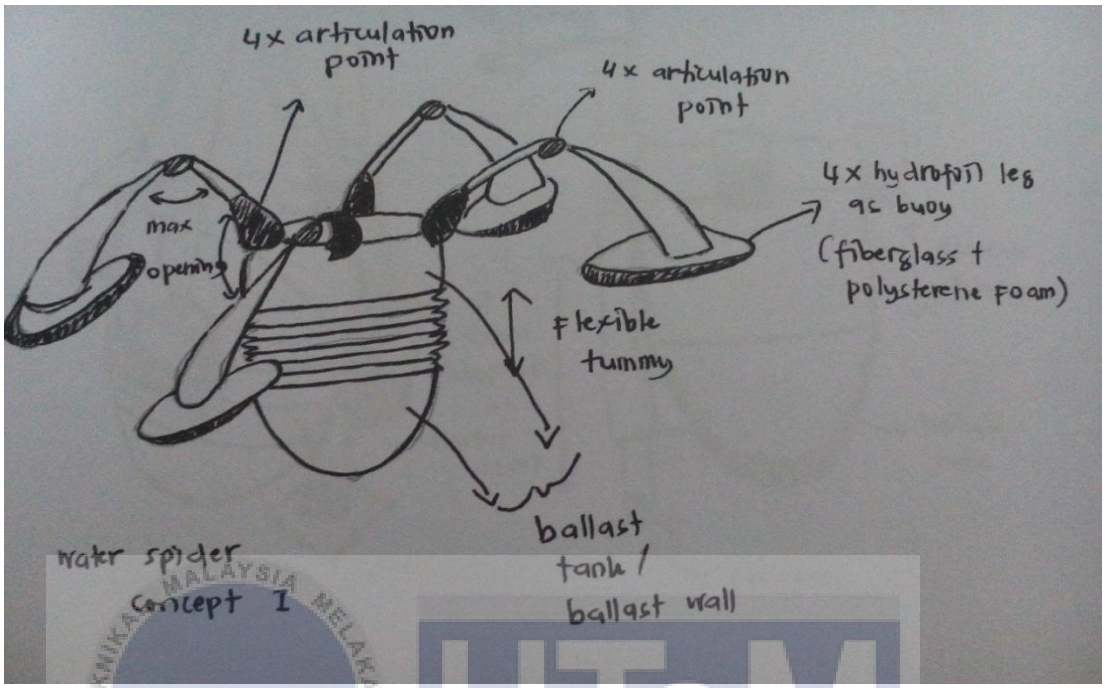

Figure 3.10: Design I

Functions	• Water and trash flow into the bin. • Trash is trapped in the bin when motor is function and there has a power system that generate from water turbine and solar panel.
Advantages	• Artistic and futuristic. • Stable as got 4 legs. • Smooth flow has got a plenty of opening area. • Easy to store has got adjustable legs. • Will come in 2 versions: with normal steel bar as guide or with anchor. • Can be ran 24/7 with minimum monitor. • Can be a design icon or as part of tourist attraction items. • Minimum effect on water tide. • Trashes can be sucked from any different directions. • Minimum risk to get hit by boats due to its obvious design.
Disadvantages	• Manufacturing cost possibly higher compare to other designs due to its futuristic design. • Quite difficult to manufacture due to its curvy legs.

Design J

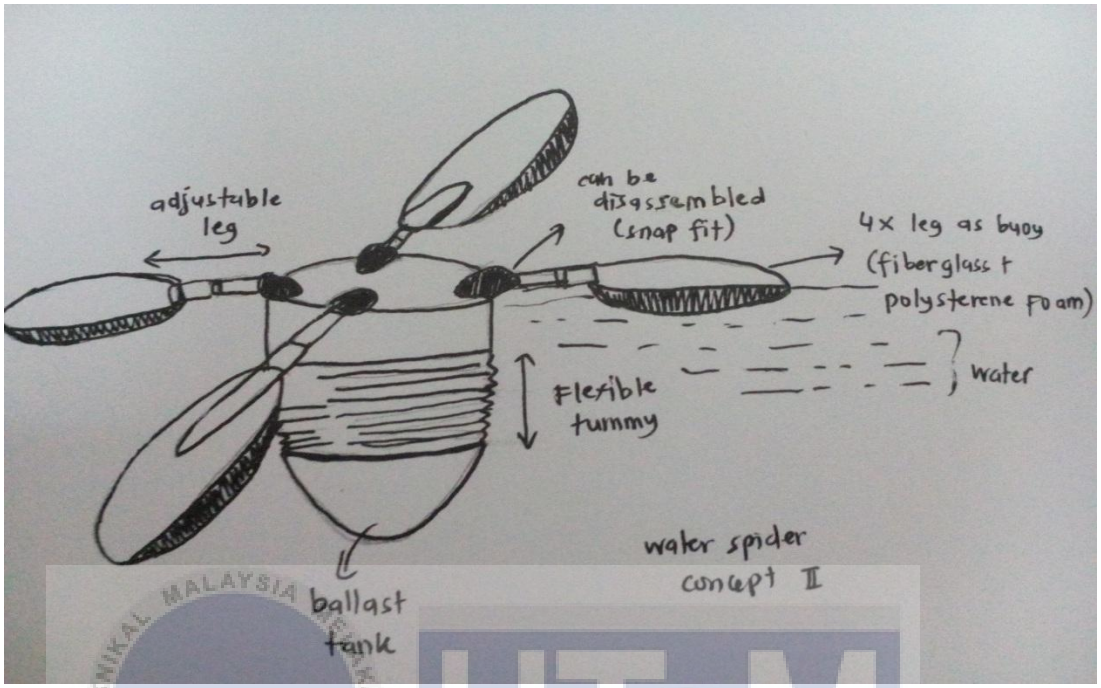

Figure 3.11: Design J

Functions	• Water and trash flow into the bin. • Trash is trapped in the bin when motor is function and there has a power system that generate from water turbine and solar panel.
Advantages	• Artistic and futuristic. • Stable as got 4 legs. • Smooth flow has got a plenty of opening area. • Easy to store has got adjustable legs. • Will come in 2 versions: with normal steel bar as guide or with anchor. • Can be ran 24/7 with minimum monitor. • Can be a design icon or as part of tourist attraction items. • Minimum effect on water tide. • Trashes can be sucked from any different directions.
Disadvantages	• Minimum risk to get hit by boats due to its obvious design.

3.4 Concept of River Trash Collector System (RTCS)

River Trash Collector System (RTCS) is designed based on Green Technology Concept idea. Figure 3.12 below shows the concept of River Trash Collector System (RTCS).

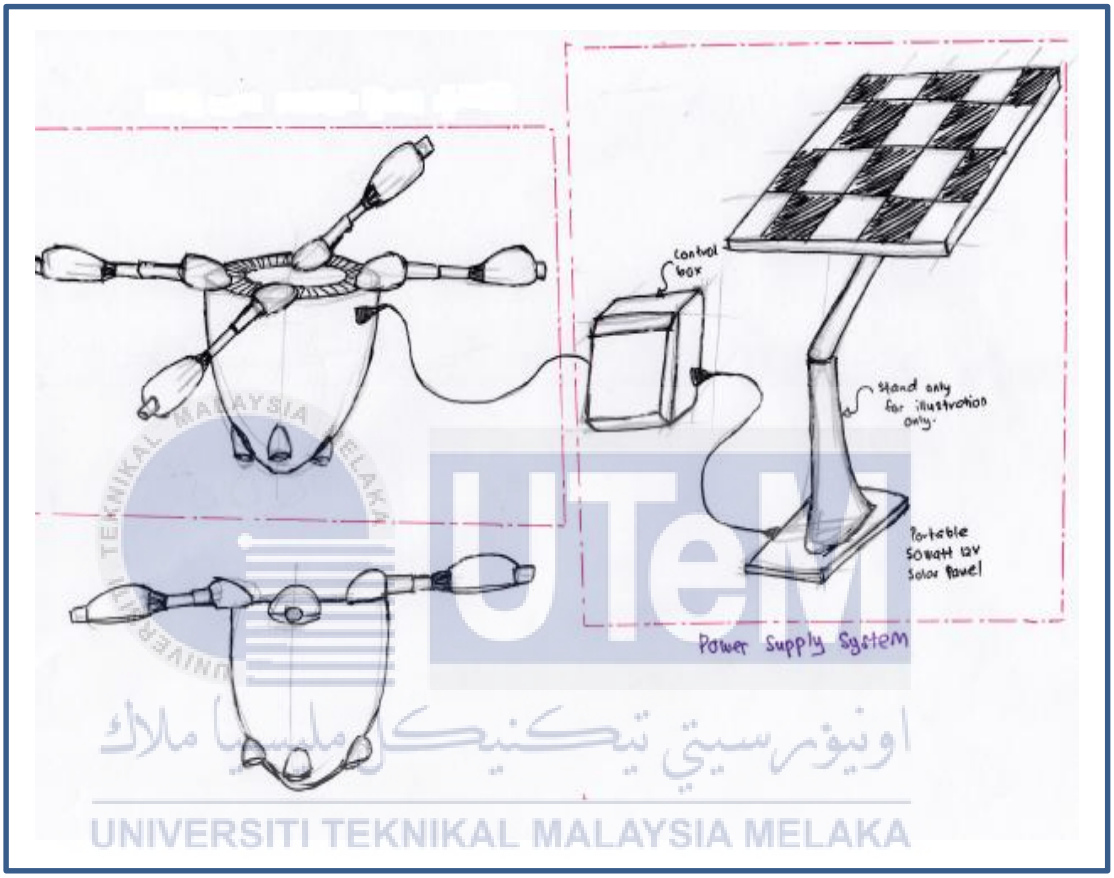

Figure 3.12: Concept of River Trash Collector System (RTCS)

3.5 Concept Selection Method

Concept selection is one of the methods that will be used in the next chapter to analyse the best design of River Trash Collector System (RTCS). After Product Design Specification (PDS) is finalized, all the concepts are examined at the same time.

3.5.1 Preferred Concept Selection Process

Concept selection process is following the decision matrices which start with Product Design Specification (PDS), examine all concepts at the same time and it can be weighted or unweighted. Table below shows an example of decision matrices.

		Concepts				
		A (reference)	B	C	D	E
Selection criteria	1	0	+	-	0	-
	2	0	+	+	-	-
	3	0	-	0	+	0
	4	0	+	0	0	+

Table 3.1: Example of Decision Matrices

3.5.2 Stages of Concept Selection

There have two stages of Concept Selection, Concept Screening and Concept Scoring. Concept Screening is reducing the many River Trash Collector System (RTCS) concept ideas generated to a relative few that will get additional refinement and analysis. Figure 3.13 below shows an example of Concept Screening Matrix.

	Concepts						
Selection Criteria	**A Master Cylinder**	**B Rubber Brake**	**C Ratchet**	**D (Reference) Plunge Stop**	**E Swash Ring**	**F Lever Set**	**G Dial Screw**
Ease of handling	0	0	–	0	0	–	–
Ease of use	0	–	–	0	0	+	0
Readability of settings	0	0	+	0	+	0	+
Dose metering accuracy	0	0	0	0	–	0	0
Durability	0	0	0	0	0	+	0
Ease of manufacture	+	–	–	0	0	–	0
Portability	+	+	0	0	+	0	0
Sum +'s	2	1	1	0	2	2	1
Sum 0's	5	4	3	7	4	3	5
Sum –'s	0	2	3	0	1	2	1
Net Score	2	–1	–2	0	1	0	0
Rank	1	6	7	3	2	3	3
Continue?	Yes	No	No	Combine	Yes	Combine	Revise

Figure 3.13: Example of Concept Screening Matrix

After Concept Screening has been examined, Concept Scoring needs to apply to finalize the concept idea of River Trash Collector System (RTCS). Concept Scoring is the concept to use the objective methods to select consensus final concept selection. Figure 3.14 below shows an example of Concept Scoring.

		Concept							
		A (Reference) Master Cylinder		**DF Lever Stop**		**E Swash Ring**		**G+ Dial Screw+**	
Selection Criteria	**Weight**	**Rating**	**Weighted Score**	**Rating**	**Weighted Score**	**Rating**	**Weighted Score**	**Rating**	**Weighted Score**
Ease of handling	5%	**3**	0.15	3	0.15	4	0.2	4	0.2
Ease of use	15%	**3**	0.45	4	0.6	4	0.6	3	0.45
Readability of settings	10%	2	0.2	**3**	0.3	5	0.5	5	0.5
Dose metering accuracy	25%	**3**	0.75	3	0.75	2	0.5	3	0.75
Durability	15%	2	0.3	5	0.75	4	0.6	**3**	0.45
Ease of manufacture	20%	**3**	0.6	3	0.6	2	0.4	2	0.4
Portability	10%	**3**	0.3	3	0.3	3	0.3	3	0.3
	Total Score	2.75		3.45		3.10		3.05	
	Rank	4		1		2		3	
	Continue?	No		Develop		No		No	

Figure 3.14: Example of Concept Scoring

3.6 Material and Cost

There have a several types of materials that will used to make a prototype of River Trash Collector System (RTCS). Figure 3.15 below shows the materials and cost for River Trash Collector System (RTCS).

Material	Cost
Jetting Buy 12V Submersible Electric Fishing Boat/Marine Bilge Water Pump 1100 GPH 	2 x RM 56.00 (RM78.40)
12V 10W Pipeline DC Generator Micro-hydro Water Turbine Generator Water Charging Tool 	4 x RM 35.00 (RM50.00)
12V 50w Monocrystalline Solar Panel 	2 x RM 300 (RM420)

20A 12V/24V Solar Panel Charge Controller Battery Regulator Safe Protection 	RM 28.10 (RM40.00)
Fiberglass resin + mat + Brush + roller 	RM 350 (RM500)
12V Battery 7.2AH 	4 x RM85

Figure 3.15: Materials and Cost for River Trash Collector System (RTCS)

3.7 Design Process Flow

To contribute the idea and concept of design, basically there are several steps as a guideline to create the design of River Trash Collector System (RTCS). The design process flow is as follows:

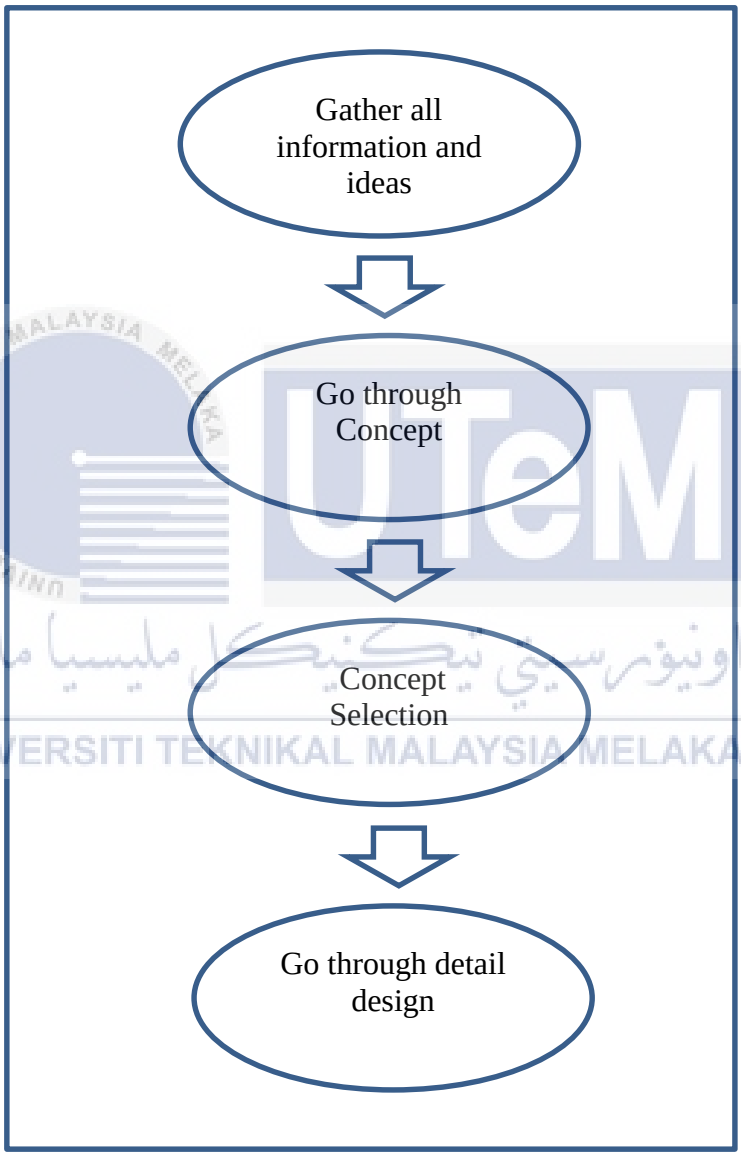

Figure 3.16: Design Process Flow

3.8 Operational Framework

Research direction is as follows:

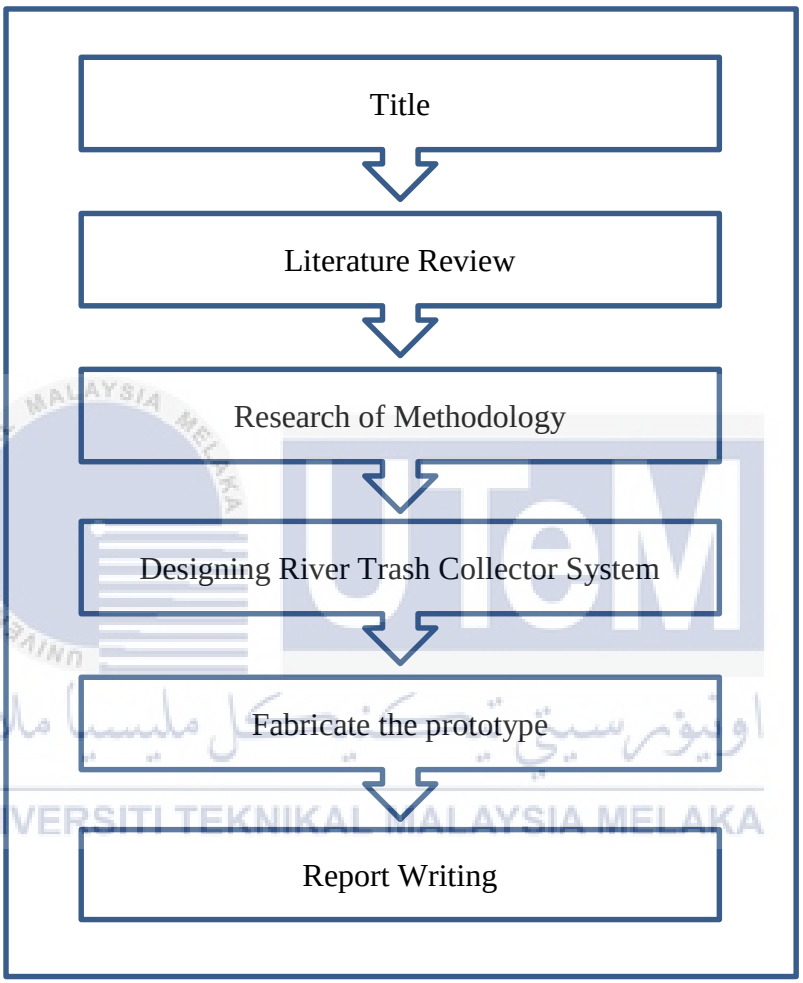

Figure 3.17: Operational Framework

3.9 Conclusion

This chapter had outlined several methods that will be used in this research. Next chapter will discuss the result and discussion of concept design of River Trash Collector System (RTCS).

CHAPTER 4
RESULT & DISCUSSION

4.0 Introduction

This chapter reviews on the result and discussion of River Trash Collector System (RTCS) concept idea. The research findings is based on concept selection that introduced two stages of selection, Concept Screening and Concept Scoring. Concept Screening will reduce the ideas of River Trash Collector System (RTCS) that have been generated to a relative few to be analyse. After done the Concept Screening, Concept Scoring needs to apply to finalize the concept idea of River Trash Collector System (RTCS). It has to prepare the selection matrix that optimize version of the Concept Screening Matrix. Concept Scoring is the concept to use the objective methods to select final concept selection to be proved.

4.1 Concept Selection of River Trash Collector System (RTCS)

Stage 1: Concept Screening Matrix

Selection Criteria	Design Concept									
	A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**
Ease of handling	0	-	-	-	+	+	0	-	+	+
Ease of use	+	-	-	-	+	+	+	-	+	+
Ease of manufacture	+	-	-	+	+	0	0	0	0	0
Durability	0	0	+	-	-	-	+	+	+	0
Attractive design	-	0	0	-	-	-	0	+	+	+

Sum +'s	2	0	1	1	3	2	2	2	4	3
Sum 0's	2	2	1	0	0	1	3	1	1	2
Sum –'s	1	3	3	4	2	2	0	2	0	0
Net score	1	-3	-2	-3	1	0	2	0	4	3
Rank	4	9	8	9	4	6	3	6	1	2
Continue?	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**	/	/

Table 4.1: River Trash Collector System (RTCS) Concept Screening Matrix

Table 4.1 shows the Concept Screening Matrix for River Trash Collector System (RTCS). The Concept Screening is based on a few types of selection criteria. Each of design concept is determined by the characteristics needed such as ease of handling, ease of use, ease of manufacture, durability and attractive design. From the Concept Screening Matrix, design concept for design I and J has mostly achieved a criteria for River Trash Collector System (RTCS). Both design concept I and J will be comparing in Concept Scoring stage to finalize the best concept idea in order to develop a prototype of River Trash Collector System (RTCS).

Stage 2: Concept Scoring Matrix

		Design Concept			
		Design I		**Design J**	
Selection Criteria	**Weight**	**Rating**	**Weighted Score**	**Rating**	**Weighted Score**
Ease of handling	25 %	3	0.75	3	0.75
Ease of use	20 %	3	0.60	2	0.40
Ease of manufacture	15 %	2	0.30	2	0.30
Durability	25 %	3	0.75	3	0.75

Attractive design	15 %	3	0.45	2	0.30
	Total Score	2.85		2.50	
	Rank	1		2	
	Continue?	**Develop**		No	

Table 4.2: River Trash Collector System (RTCS) Concept Scoring Matrix

Relative Performance	**Rating**
Ok	1
Good	2
Very Good	3

Weighted Score = Weight x Rating

Total Score = ∑ Weighted Score

Table 4.2 shows the Concept Scoring Matrix for River Trash Collector System (RTCS). Each of selection criteria has been weighted to observe the importance characteristic to develop a prototype of River Trash Collector System (RTCS). Rating has been made by following the relative performance for both design I and J. The Weighted Score is calculated by using a formula, (Weighted Score = Weight x Rating) and the summation of Weighted Score shows the Total Rank for each design. The Concept Scoring Matrix has defined a final concept of River Trash Collector System (RTCS) based on Total Score which is Design I. Design I has followed all the specific characteristics needed compared to Design J. The final concept idea will be develop to make a prototype of River Trash Collector System (RTCS).

4.2 Analysing the Basic Concept of River Trash Collector System (RTCS)

For basic concept of River Trash Collector System (RTCS), a sample activity has been made to find the estimation of size and weight of load that can make a River Trash Collector System (RTCS) fully submerged into water. By using a medium size of stone as a load, it fills the container to observe the weight of load. The example of medium stone used has shown in figure 4.1 below.

Figure 4.1: Example of medium stone used

The medium stone has filled the container and around twenty five stones used to make the container fully submerged into water. The stone is considered as trashes that will be trap into the bin.

Figure 4.2: Fully submerged container

Figure 4.2 above shows that the medium stone filled the container has make it fully submerged into water and this is the basic concept for River Trash Collector System (RTCS) to be develop. It will specify the characteristics based on the generated concept idea. After the container and the load that fully submerged has been observed, the load is weighted to identify the weight of load that River Trash Collector System (RTCS) can trap at certain time of monitoring process. The load that can be trap by the bin is about 42 kilogram weight. Figure 4.3 below shows the weight of the load.

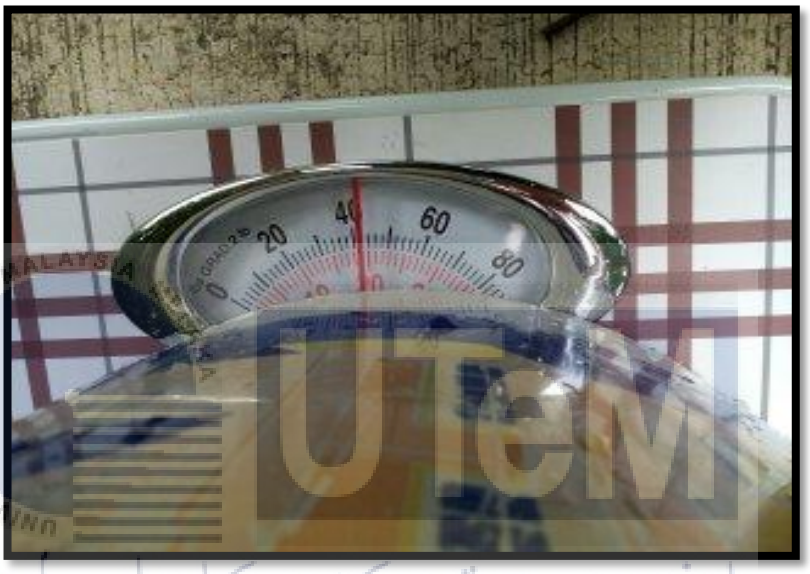

Figure 4.3: 42 kilogram weight of load

4.2.1 Basic Calculation for the concept of River Trash Collector System (RTCS)

Buoyancy Force Equation

$$Fb = Vs \times D \times g$$

Fb = Buoyancy Force
Vs = Volume Submerged
D = Density of Fluid
g = gravity

1) First, find the volume of the cylinder container by using the formula :

   $Volume = \pi r^2 h$
   $Vs = \pi (25.5/2)^2 (35)$
   $Vs = 17874.68045\ cm^3$

= 0.01787 m^3

2) Density of water, D = 1000 kg/ m^3

3) Gravity = 9.81 N/kg

Apply this formula: Fb = Vs x D x g

= (0.01787) (1000) (9.81)
= 175. 3047 Newtons

Buoyancy Force with Load

The load that River Trash Collector System (RTCS) can support is about 42 kilogram. So the buoyancy force with load on land is calculated as follows:

Buoyancy Force On Land:

Weight in kilogram (kg)	**Weight in Newton (N)**
20 kg	196 N
20 kg	196 N
2 kg	19.82 N
Total = 42 kg	Total = 411.82 N

Table 4.3: Buoyancy Force on Land

Therefore, the buoyancy force for River Trash Collector System (RTCS) on land is 411.82 N.

Buoyancy Force in water:

Weight in kilogram (kg)	Weight in Newton (N)
20 kg	98 N
20 kg	98 N
2 kg	9.93 N
Total = 42 kg	Total = 205.93 N

Table 4.4: Buoyancy Force in Water

Therefore, the buoyancy force for River Trash Collector System (RTCS) in water is 205.93 N. Figure below shows the example of buoyancy force by using PhET Interative Simulation.

Figure 4.4: Load before apply into water

Figure 4.5: The buoyancy force in the water

4.2.2 Design of River Trash Collector System (RTCS)

The concept design of River Trash Collector System (RTCS) is finalized. Several views of design has provided to interpret the detail design. The concept design of River Trash Collector System (RTCS) are as follows:

Top View

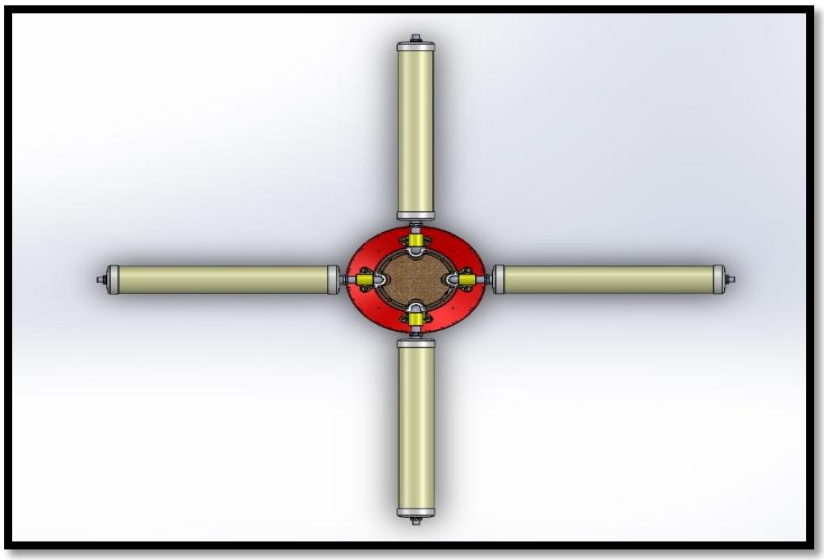

Figure 4.6: Top view of River Trash Collector System (RTCS)

Side view

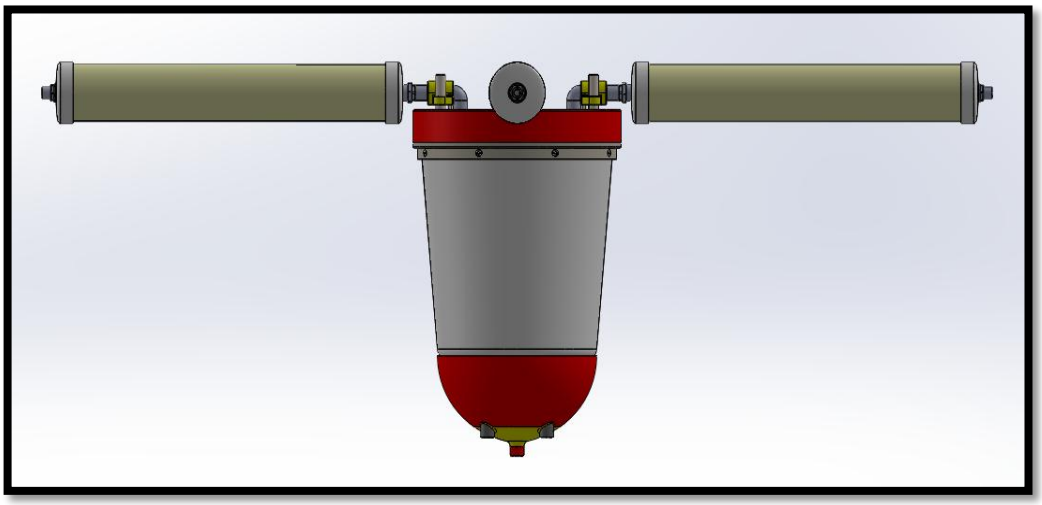

Figure 4.7: Side view of River Trash Collector System (RTCS)

Isometric view

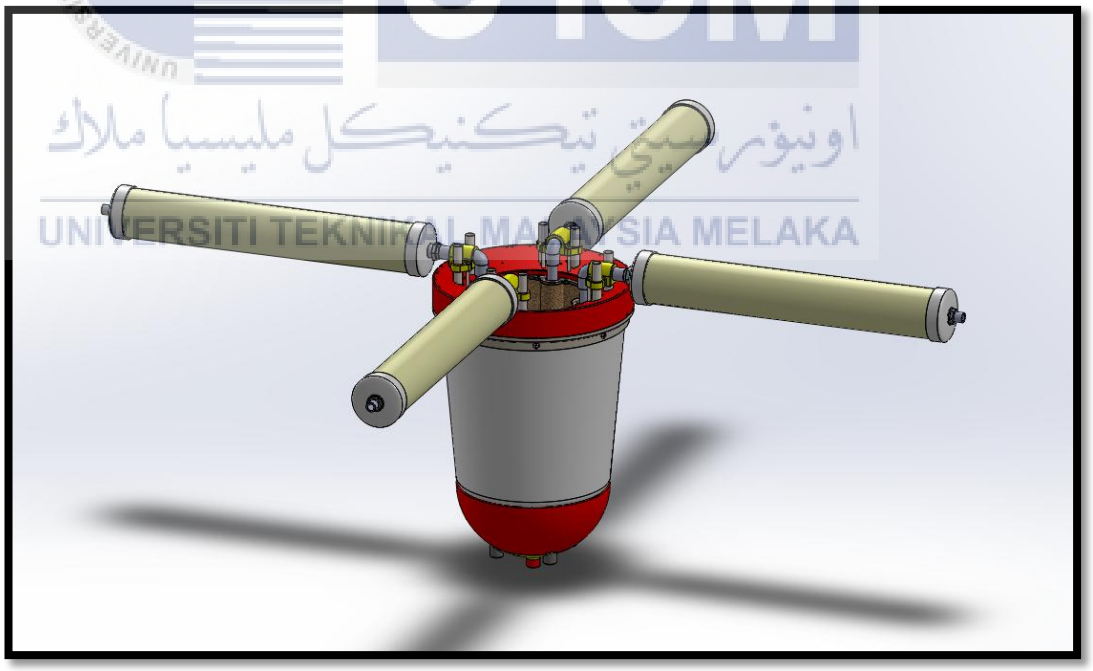

Figure 4.8: Isometric view of River Trash Collector System (RTCS)

Bottom view

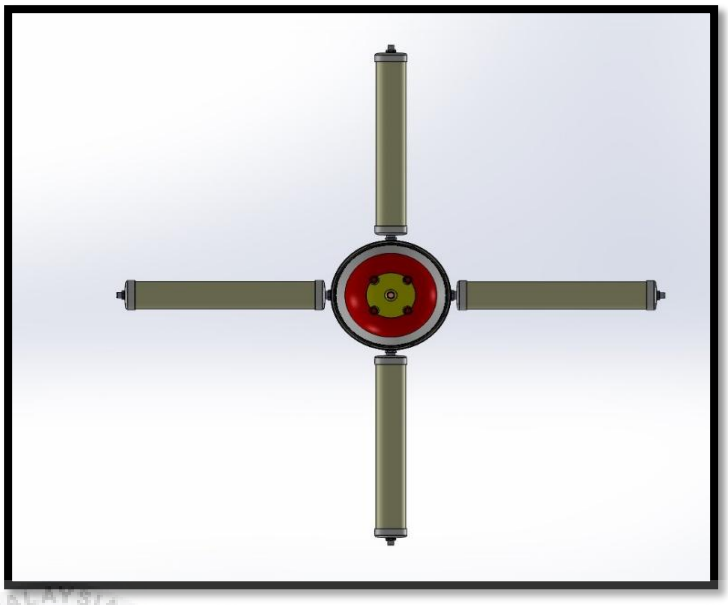

Figure 4.9: Bottom view of River Trash Collector System (RTCS)

4.2.3 Cross sectional of River Trash Collector System (RTCS)

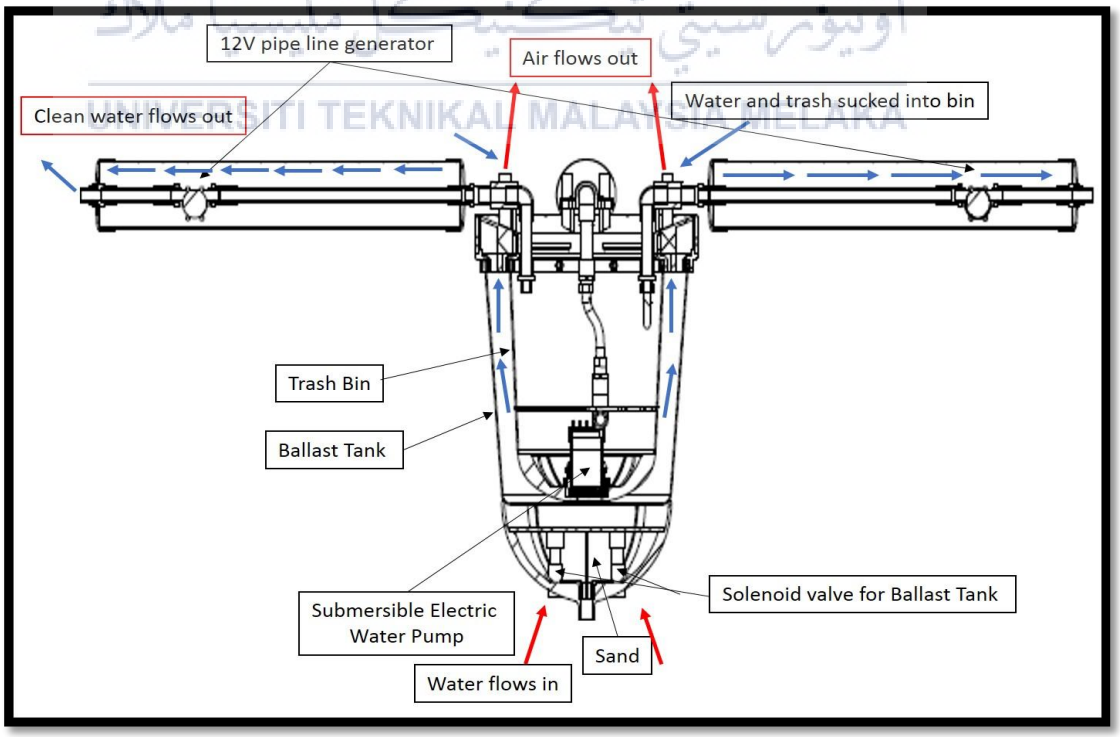

Figure 4.10: The cross sectional of River Trash Collector System (RTCS)

The process of River Trash Collector System (RTCS) are as follows:

i. Water flows in at the bottom side when the water pump functions by using power source such as water turbine generator and solar panel.
ii. Trashes will flows in at the top side of the bin and trapped at the trash bin inside. Then, clean water flows out by passing through the four corners buoy system.
iii. Air in the water flows out from the River Trash Collector System (RTCS).

Figure 4.11 below shows the water orientation for River Trash Collector System (RTCS).

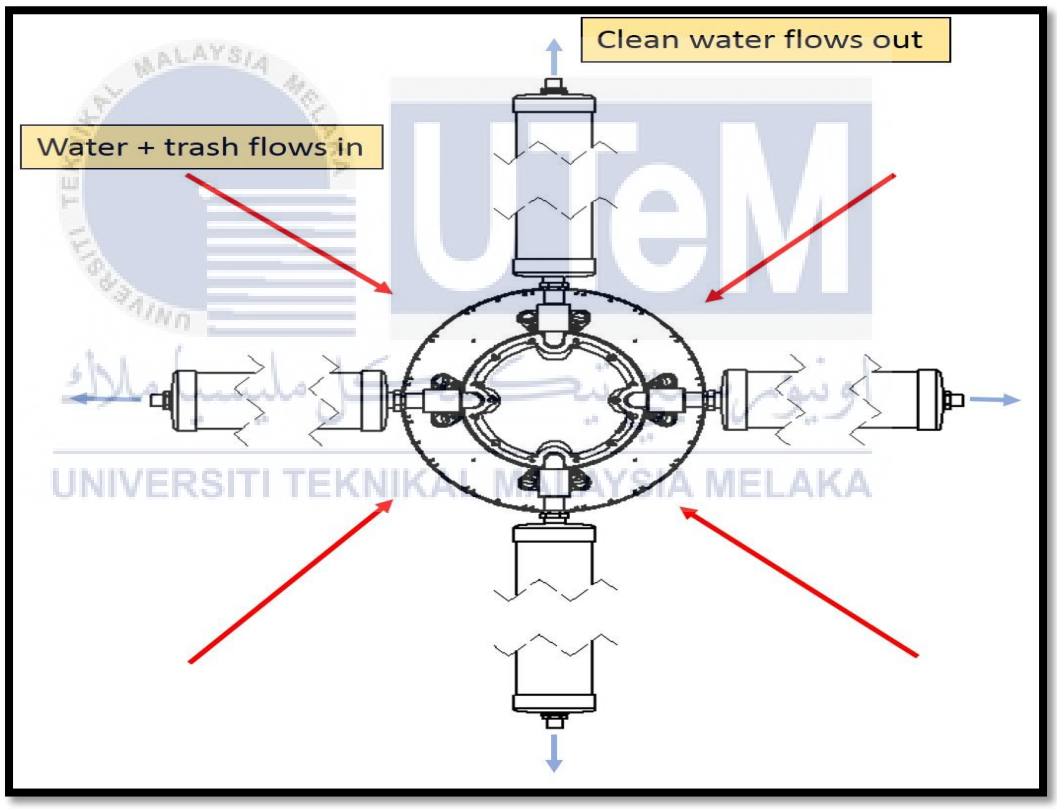

Figure 4.11: Water orientation of River Trash Collector System (RTCS)

4.3 Types of Machines Used

In order to fabricate the prototype of River Trash Collector System (RTCS), there are four types of machines used. Among of them are Water Jet Cutting Machine, 3D Printer UP Plus, Cube Pro Duo and CNC Wood Router machine. 3D Printer UP Plus and Cube Pro Duo machines are the kind of Rapid Prototyping machine. The difference between them is the size of the machine plate which is the plate for print the part by using 3D Printer UP Plus is smaller than Cube Pro Duo. Figure below shows the four types of machines used.

Figure 4.12: Water Jet Cutting Machine

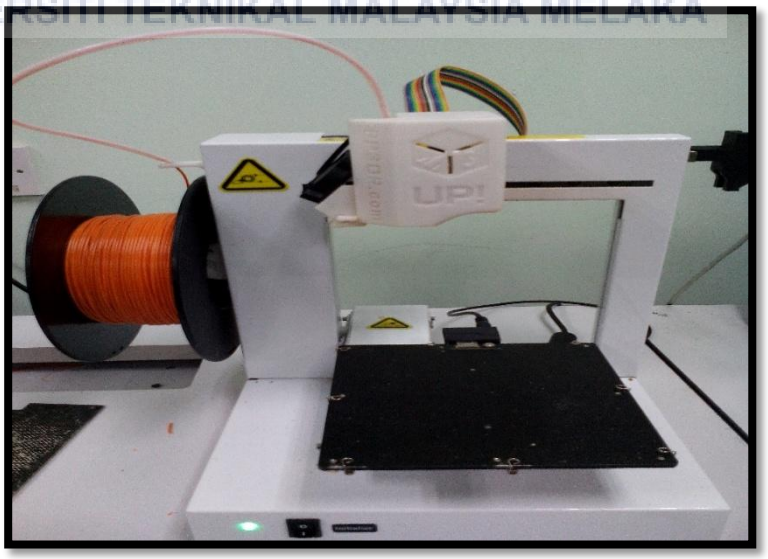

Figure 4.13: 3D Printer UP Plus

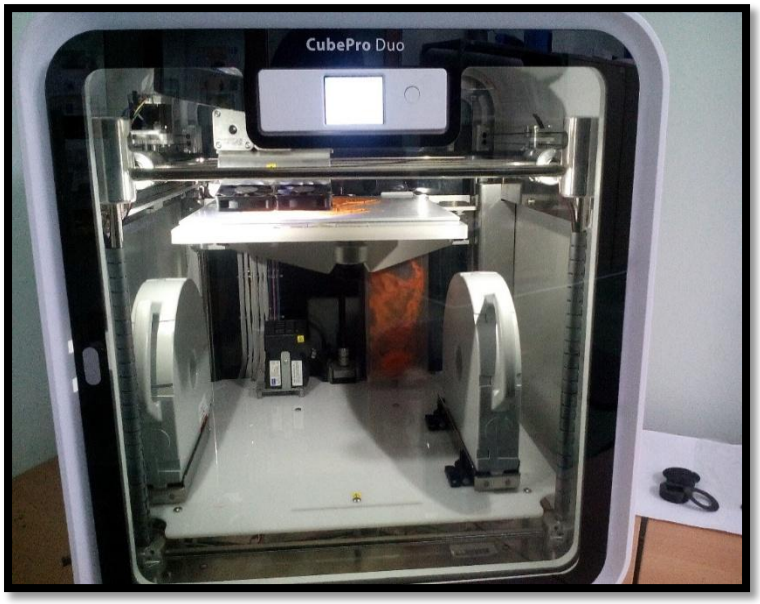

Figure 4.14: Cube Pro Duo machine

Figure 4.15: CNC Wood Router machine

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4.4 Fabrication Process

For manufacturing process of River Trash Collector System (RTCS), there are several processes involved to fabricate each component of the prototype. The body part of the River Trash Collector System (RTCS) is using manual process to get the desired shape. Water Jet cutting machine is used to produce the frame as a support system. There has two types of Rapid Prototyping machine which are 3D Printer UP Plus and Cube Pro Duo to produce parts with easier and simple setting of machining process. They also provide the accurate dimensionally of 3D printer types. Other kind of manufacturing process is using CNC Wood Router which used wood as a material to fabricate the component parts such as inner bottom and top cover for River Trash Collector System (RTCS).

4.4.1. Manual Process

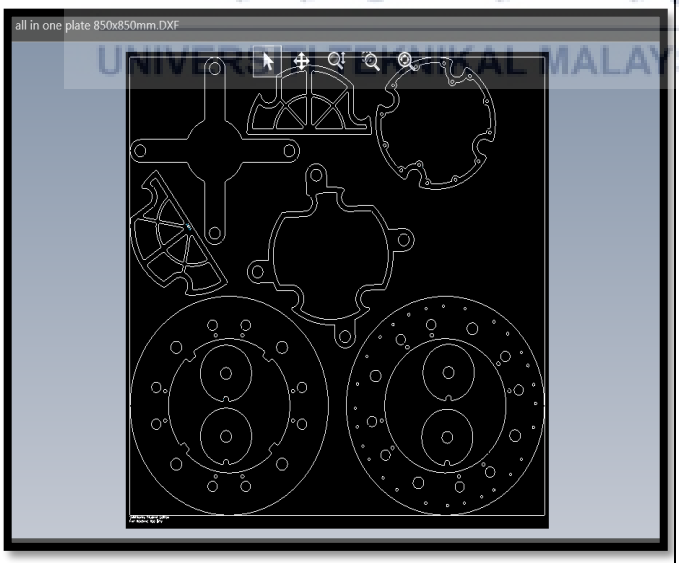
Component Part	Description
	• By using trimmer set, the bin for the River Trash Collector System (RTCS) is custom made by the desired shape. • The top part of the inner bin is removed.

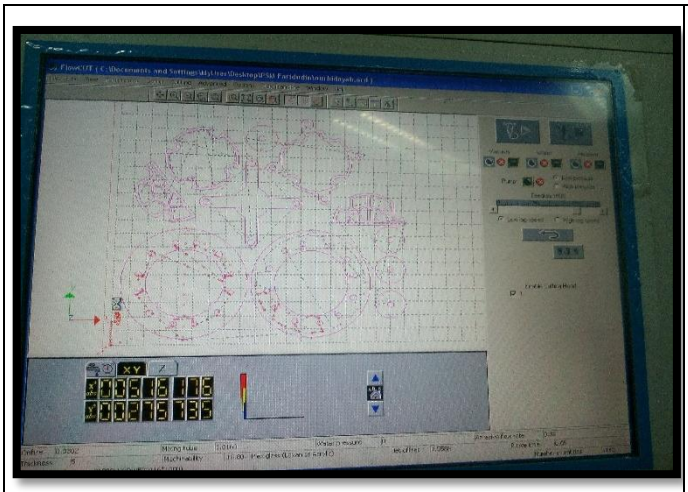
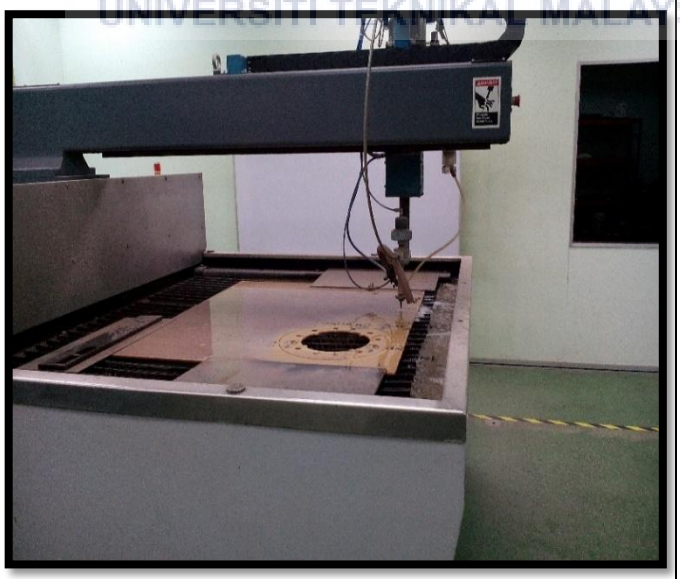
	• The bottom part of inner bin is drilled by using end mill to make a hollow at the bottom for connecting the inner and outer bin with support system.
	• Both top and bottom part of the inner bin is removed.
	• The size for outer bin of River Trash Collector System (RTCS) is bigger than inner bin. • Same as inner bin, the top and bottom part of outer bin need to be removed.

	• The top and bottom part of outer bin is removed by using drilling process followed the desired shape of River Trash Collector System (RTCS).

Table 4.5: Manual Process

4.4.2 Water Jet Cutting Machine

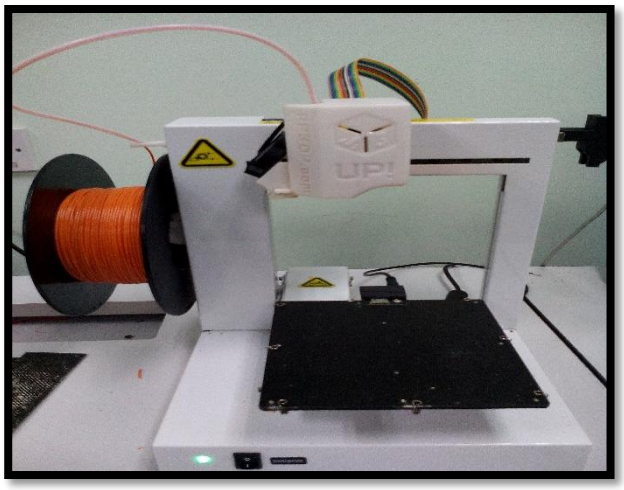
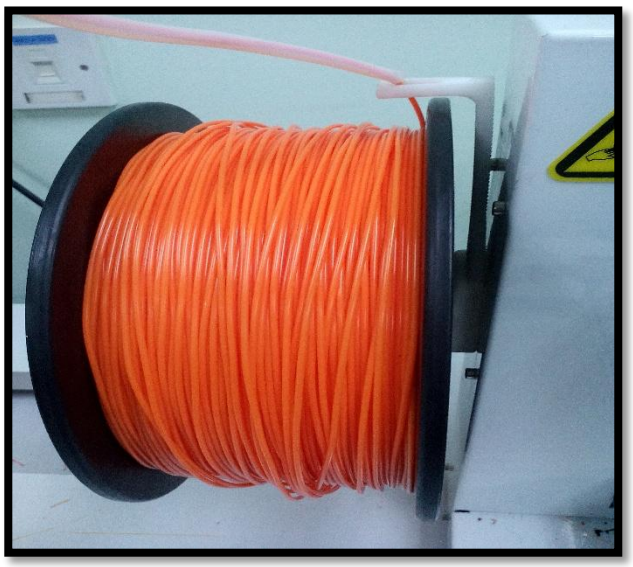
Component Part	Description
	• Acrylic material is used as a frame for support system of River Trash Collector System (RTCS). • The thickness of acrylic material is 5 mm. • All the support drawing is arranged in one plate acrylic with dimension of 850mm x 850 mm.

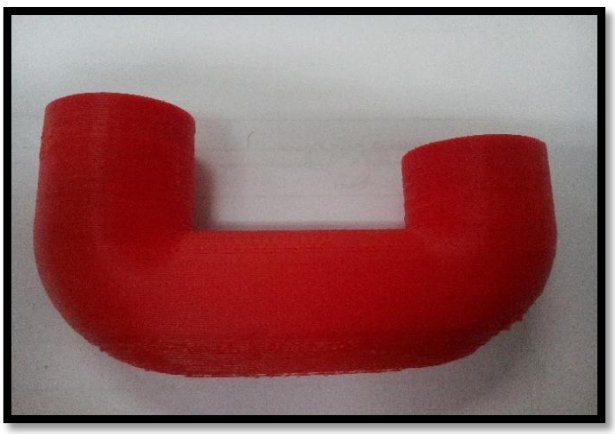
	• The drawing is transferred into the computer setting machine. • The drawing is arranged by taking a gap each of the part to make it easier for cutting process.
	• After all the machine is set up properly, the acrylic plate is placed on the machine. • Make sure that the safety preparation have been made before start the machining process.
	• The Water Jet machine starts running to produce the support system part.

	• One of the support system for River Trash Collector System (RTCS).
	• Acrylic material as a frame to support the River Trash Collector System body.
	• The illustration of the support system for River Trash Collector System (RTCS) by using acrylic material.

Table 4.6: Water Jet Cutting Machining Process

4.4.3 3D Printer UP Plus

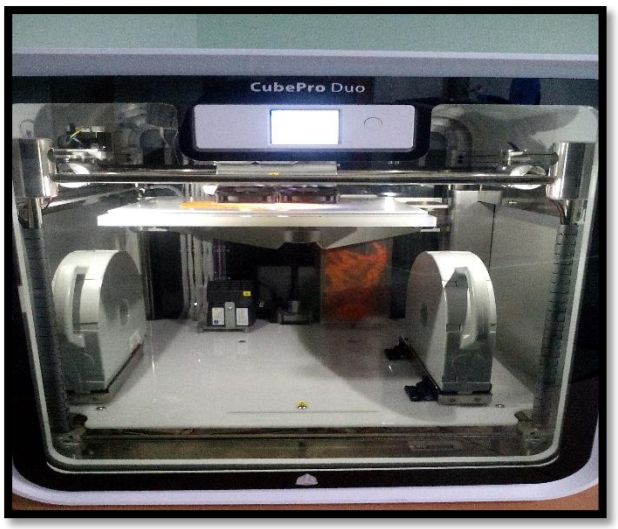
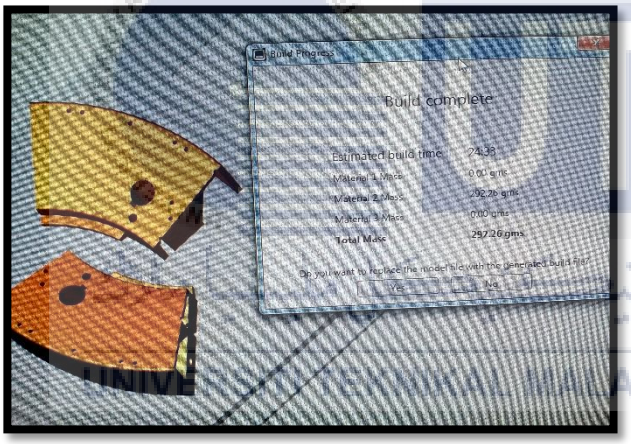
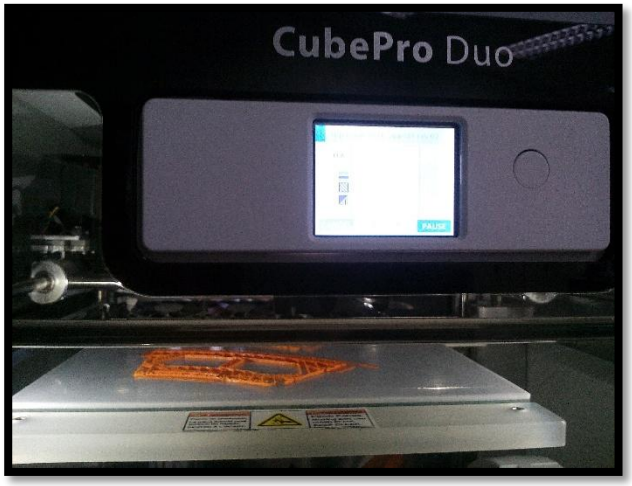
Component Part	Description
	• 3D Printer UP Plus is a type of Rapid Prototyping machining. • It can customize the products follow the design requirements. • 3D Printer UP Plus enable quick production of prototypes which produce a part with a short time processes.
	• The material used for 3D Printer UP Plus is ABS filament. • The size of material is 1.75 mm. • The weight of the material is 1.0 kilogram.
	• ABS filament material is arranged to the 3D Printer UP Plus for printing process.

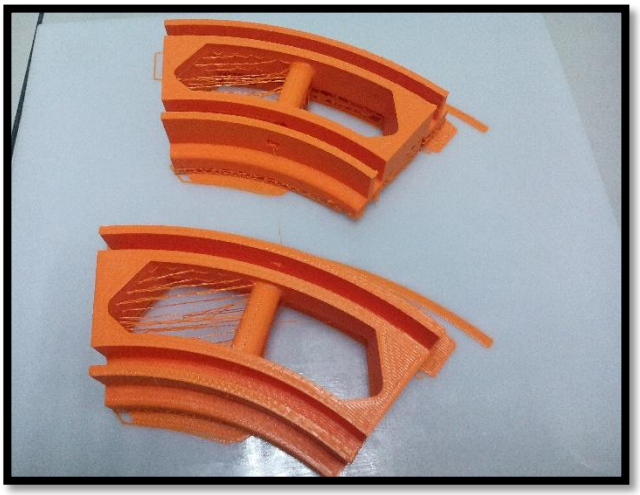
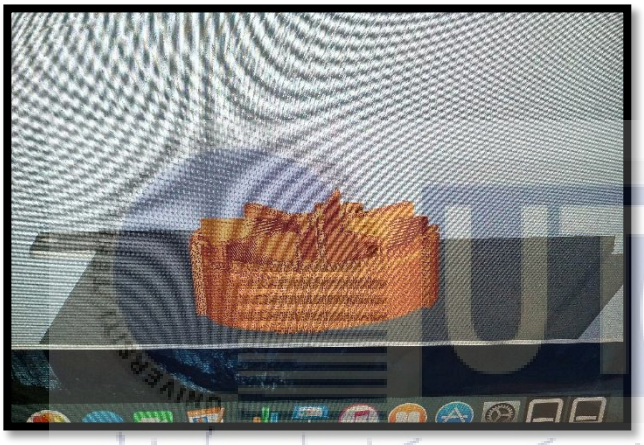
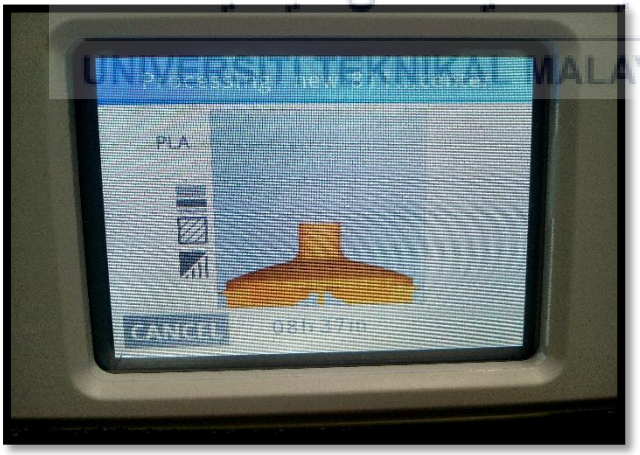
	• The drawing in Solid Work is converted into STL file. • After that, the drawing file is opened in UP Plus software. • The part is arranged in a plate followed the requirement size of the plate and the nozzle of 3D printer. • When the position of the part being initialized that shows the support system, the part is ready to print.
	• This outer bottom part split into eight pieces due to the size of the plate that not be able to support for the whole size. • The part is printed one by one for right and left side of the split bottom part.
	• For the other part, they still used the same process as outer bottom part. But they is not split because the size is smaller than the bottom part. • L- Joint is printed for one piece.

	• Connector is printed for 3 pieces.
	• Support holder is printed for 4 pieces.
	• Plate locker is printed for 5 pieces.

Table 4.7: 3D Printer UP Plus Machining Process

4.4.4 Cube Pro Duo

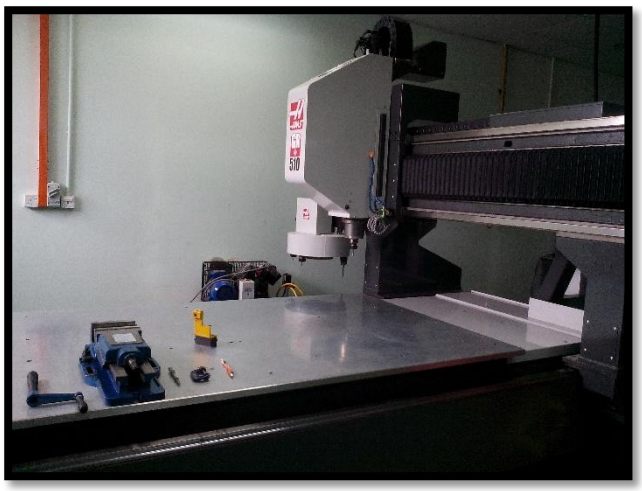
Component Part	Description
	• Cube Pro Duo cartridges is a 3D Printer that produce an advanced 3D model part. • The plate size of Cube Pro Duo is larger than 3D Printer UP Plus. • The material used for this machine is PLA filament.
	• Same as 3D Printer UP Plus, the drawing is converted into STL file. • Then, the file is arranged in Cube Pro Duo software. • The drawing part position is adjusted and the running process shows the time complete process.
	• The top cover bottom part split into eight pieces because the whole size of the part is larger than the plate size. • The top cover bottom is arranged by two pieces in a plate for printing process.

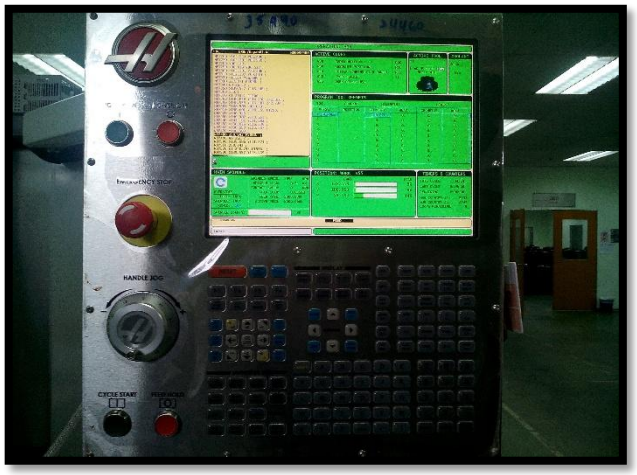
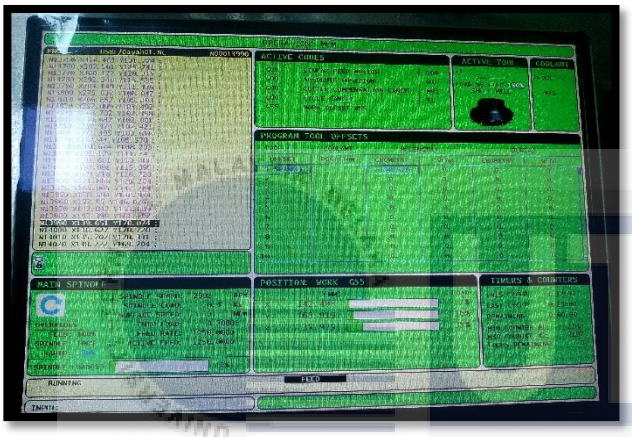
	• The result of top cover bottom. • Two pieces takes about 13 hours for printing process.
	• The centre bottom part with their support system.
	• The screen shows the running process for centre bottom part. • Runs about 8 hours 37 minutes.

	• The result of centre bottom part. • Removed the support system that cover the top part follows the desired shape.
	• Running process for T-Joint part. • Printing a part layer by layer with a longer time due to the thickness of the part.
	• The result for T-Joint part.

Table 4.8: Cube Pro Duo Machining Process

4.4.5 CNC Wood Router

Component Part	Description
	• For CNC Wood Router machine, the drawing of the part need to program by using CATIA Software. • This CNC machine works under X, Y, Z coordinate system for 3D motion control.
	• Wood is a material that used for CNC Wood Router. • The raw size of material is measured for each part of the inner bottom and the top cover part. • The raw material size for top cover is 430 x 480 x 40 mm.
	• The size of raw material for inner bottom is 440 x 360 x 190.5 mm.

	• Then, the CNC Wood Router program is set up.
	• The parameter is set up and the CNC Wood Router machine is ready to run.
	• Wood cut into the desired shape by referring the CNC program. • The tool used for cutting process is end mill T16.

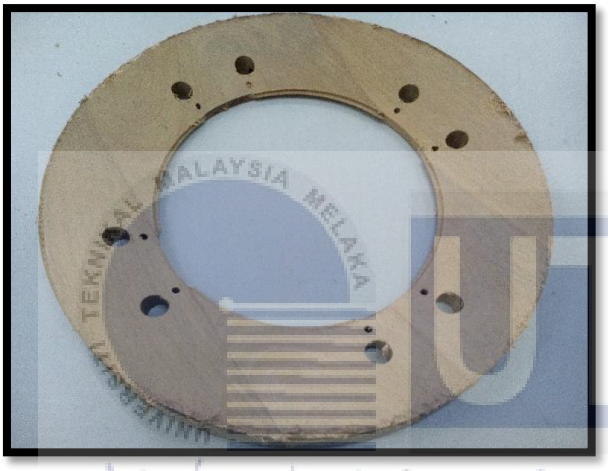
	• Roughing process has be done.
	• The finished part of top cover (top side).
	• The finished part of top cover (bottom side).

Table 4.9: CNC Wood Router machining process

4.5 Assembly Process

Connector Assembly

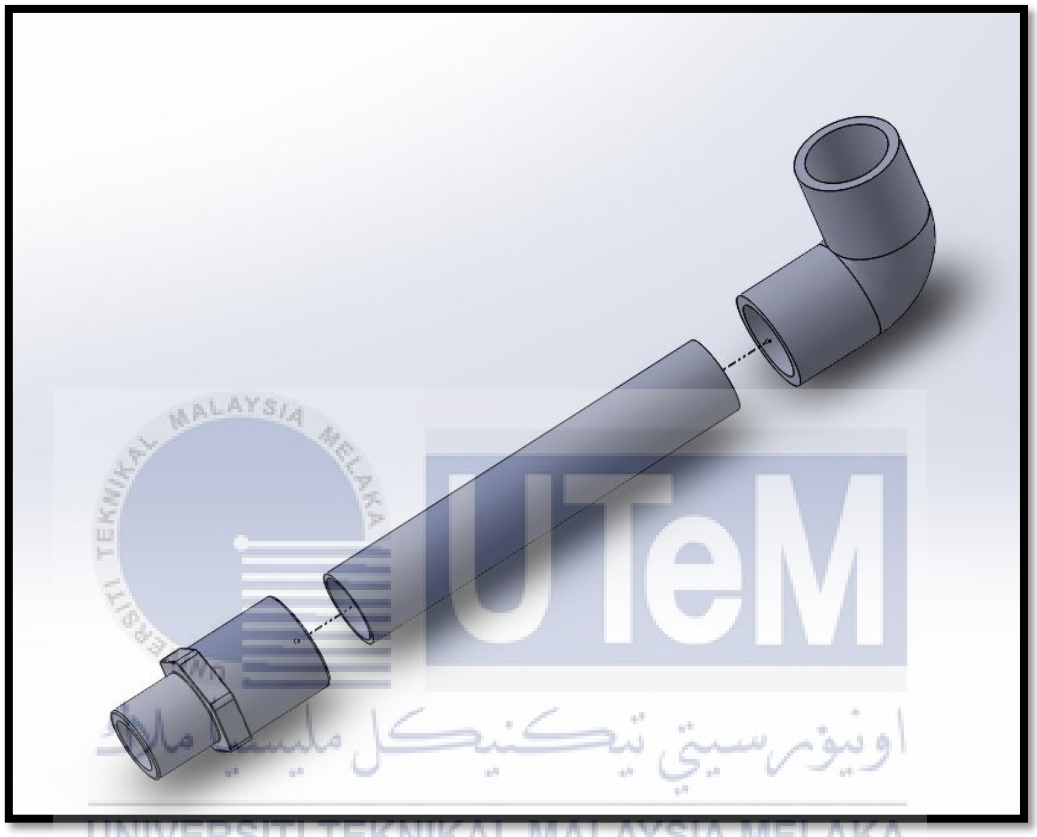


Figure 4.16: Connector Assembly

i. L-joint glued to PVC pipe.
ii. The glued of L-joint and PVC pipe is assembled to Converter by using glue.

Bildge Motor and Pump Assembly

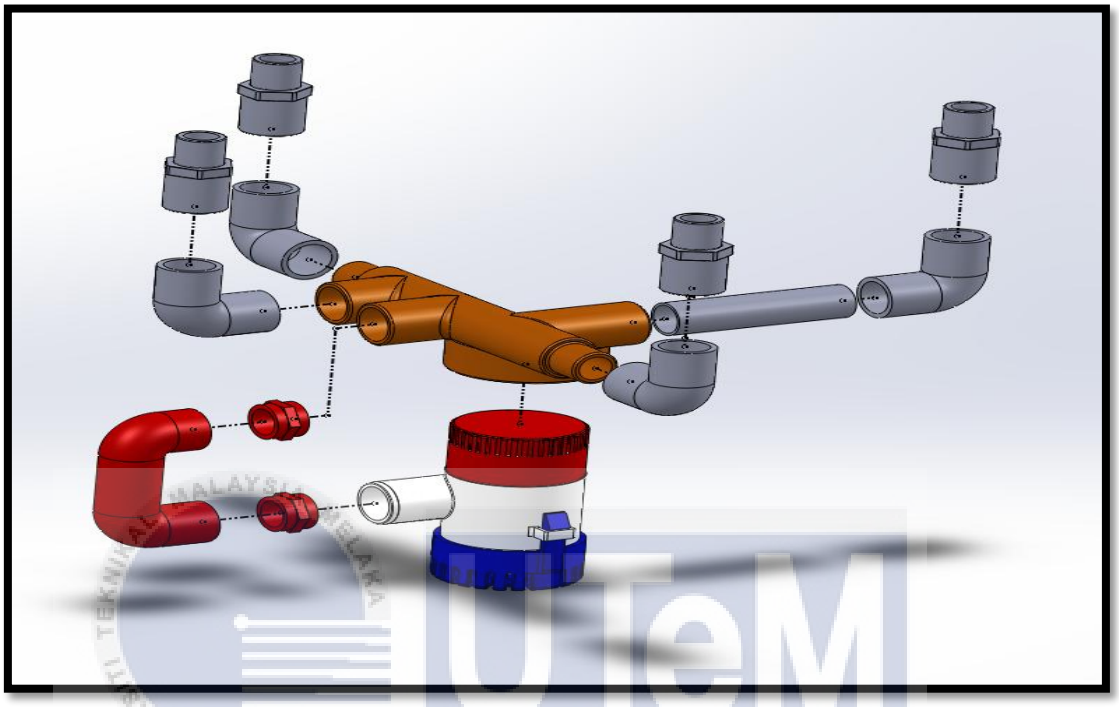


Figure 4.17 : Bildge Motor and Pump assembly

i. Converter glued with L-joint. One set of glued Converter and L-joint assembled with PVC Pipe.
ii. 3 set of glued Converter and L-joint assembled to T-joint custom with glue.
iii. 2 Connector glued to L-joint custom.
iv. Glued L-joint custom and Connector assembled to T-joint custom and Bildge Pump.

Top Cover Sub Assembly

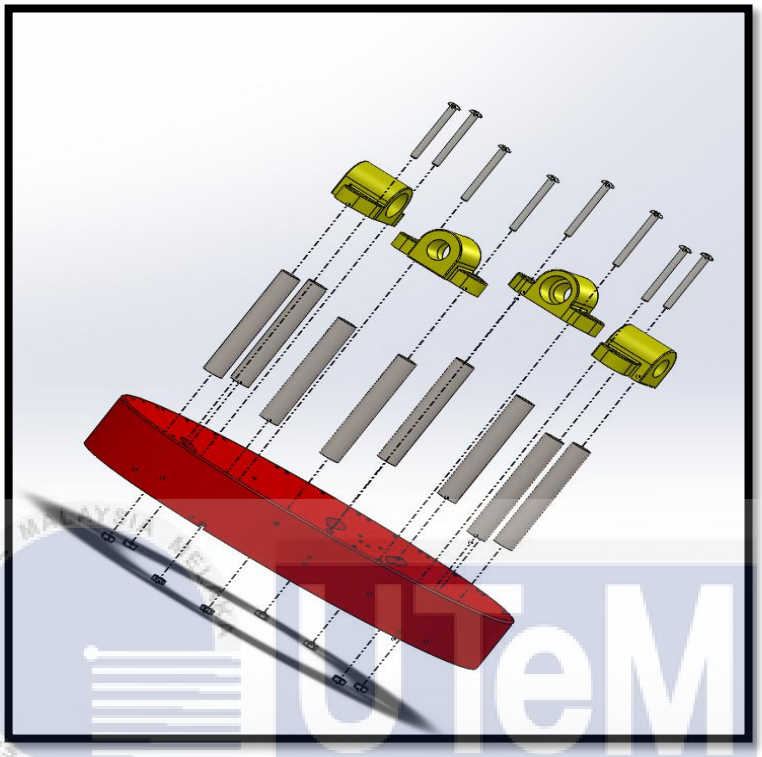


Figure 4.18: Top cover sub assembly

i. Eight pieces of Stainless Steel Hollow Bar glued to Wood.

ii. Eight pieces of Bolt and Nut assembled together with 3D Printing to Wood and Stainless Steel Hollow Bar.

Outer Bottom Assembly

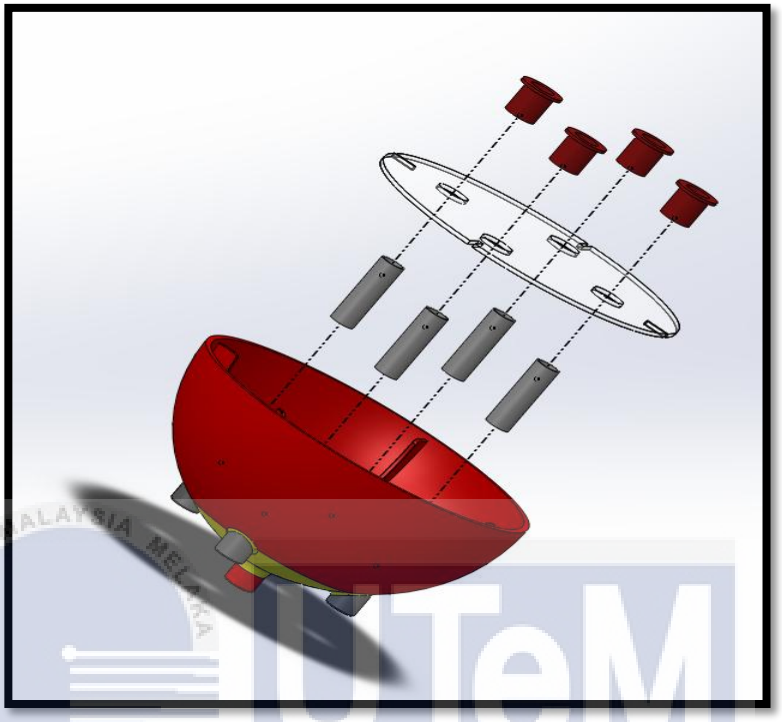


Figure 4.19: Outer bottom assembly

i. Four pieces of PVC Pipe assembled to Wood by using glue.

ii. Acrylic plate assembled to four pieces of 3D Printing with glue.

iii. Glued 3D Printing and acrylic plate assembled to item PVC Pipe with glue.

Buoy Assembly

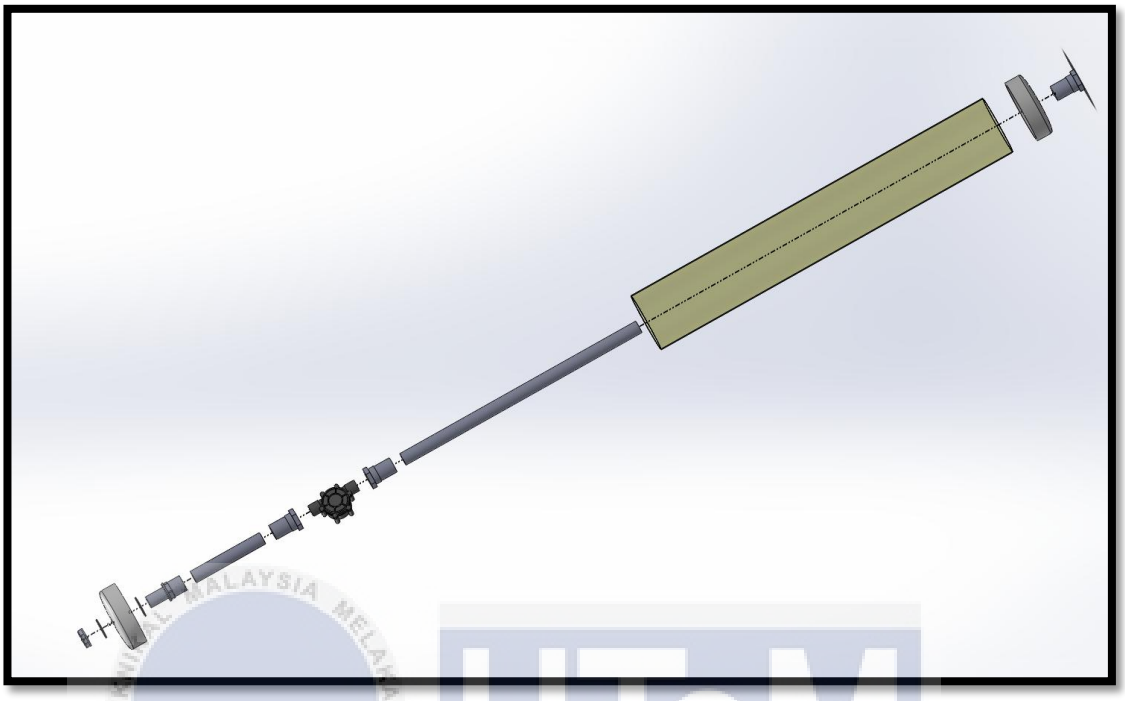


Figure 4.20: Buoy Assembly

i. The Connector Hex Head Seal (Type 2) and Bolt (Type 2) connected to the Cap (outlet).
ii. The Connector Hex Head (Type 2) is assembled to the assembly of the Cap and Connector Hex Head Seal and Bolt.
iii. The Conncetor Hex Head (Type 1) assembled to Mini Hydro Generator and then connected to PVC Pipe.
iv. The Cap (inlet) assembled to the Container.
v. Then, the assembly of Cap and Container assembled together to the assembly of Connector Hex Head.

Top Cover Assembly

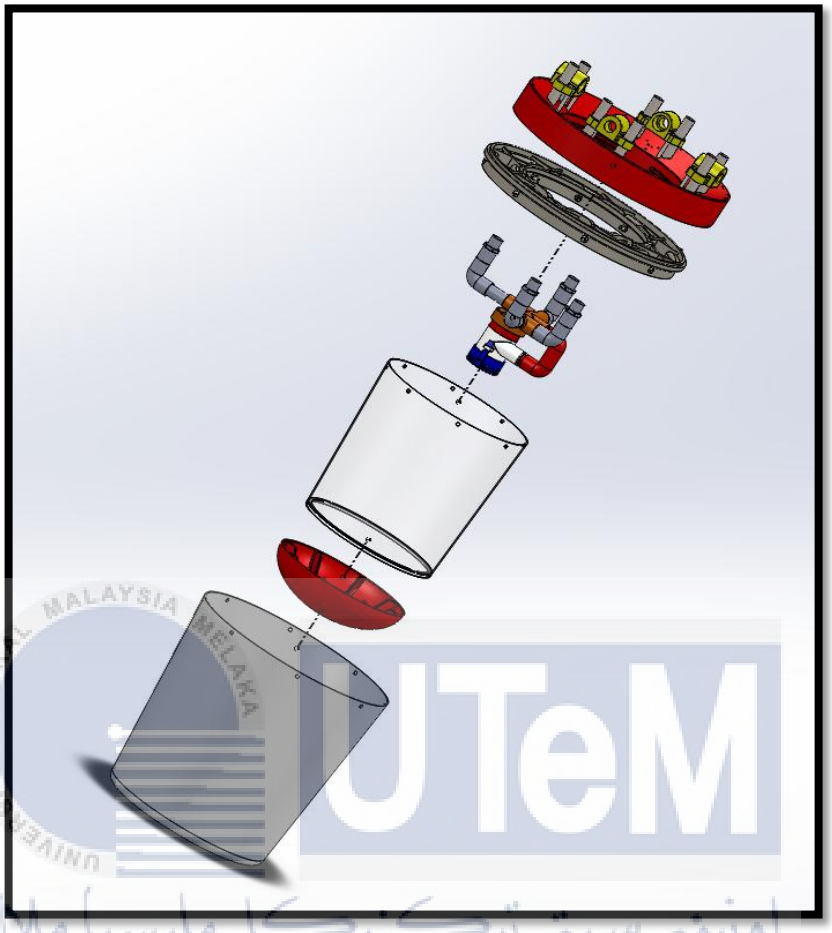


Figure 4.21: Top cover assembly

i. Bottom part glued to Internal Tank.
ii. Top Cover Bottom glued to Top Cover assembly.
iii. Bildge Motor and Pump assembly assembled with Bottom part by using glue.
iv. Top Cover Bottom assembled to Internal and Outer Tank with glue.
v. Screw and Nut assembled to Top Cover Bottom.

Main Assembly

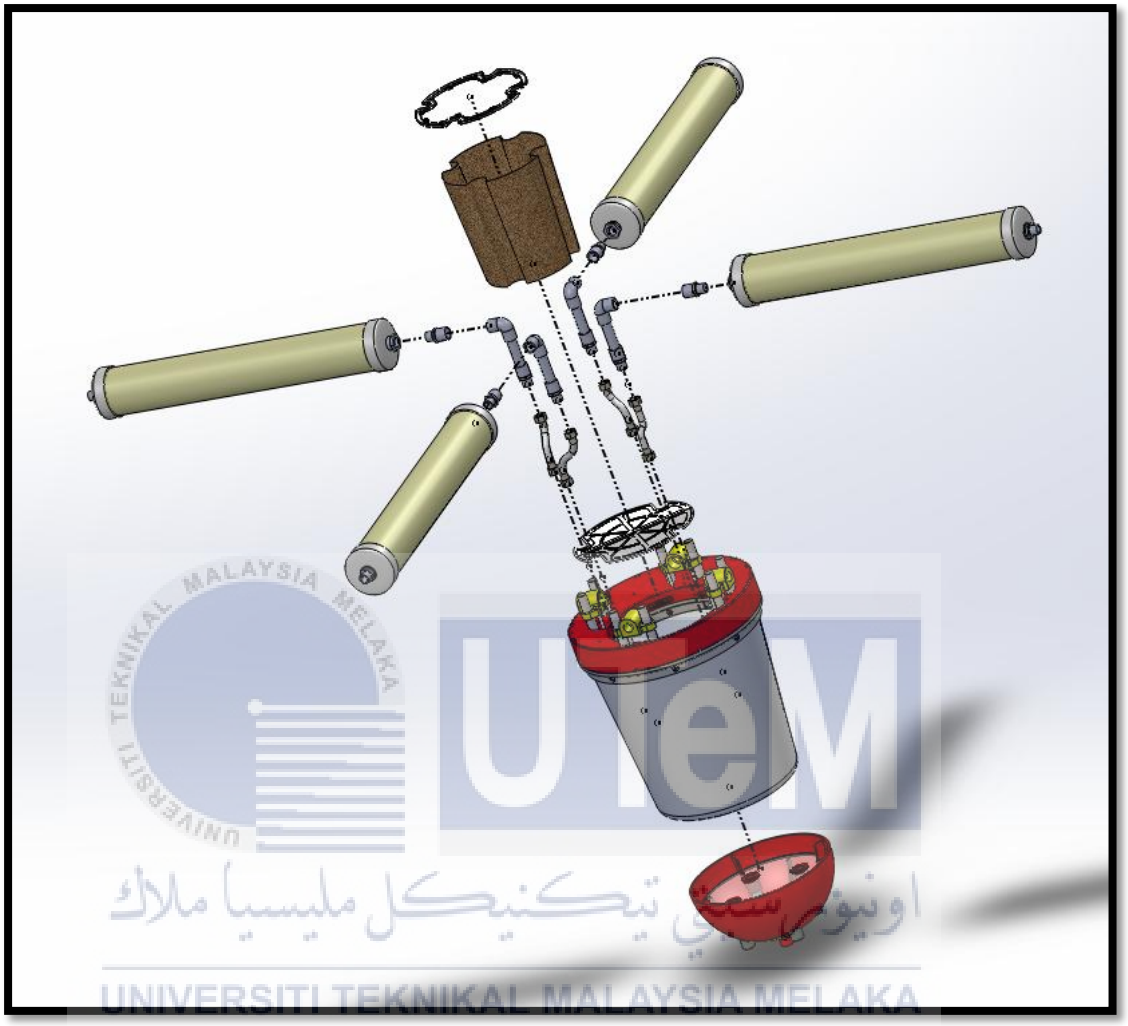


Figure 4.22: Main Assembly of River Trash Collector System (RTCS)

i. Outer Bottom assembly glued to Top Cover assembly.
ii. Plate Cover with Mesh 1 and Plate Cover with Mesh 2 being placed inside the Top Cover assembly.
iii. All the Connector Flexible Tube is assembled together with four pieces of 20mm Converter of Top Cover assembly.
iv. Four set of Connector assembly assembled to Plate Cover with Mesh 2, Filter Guide, Connector Flexible Tube and four pieces of Converter.
v. Four set of Buoy assembly assembled to Converter.
vi. Filter and Filter Guide tied together before put into the Top Cover assembly.

River Trash Collector System (RTCS) Complete Assembly

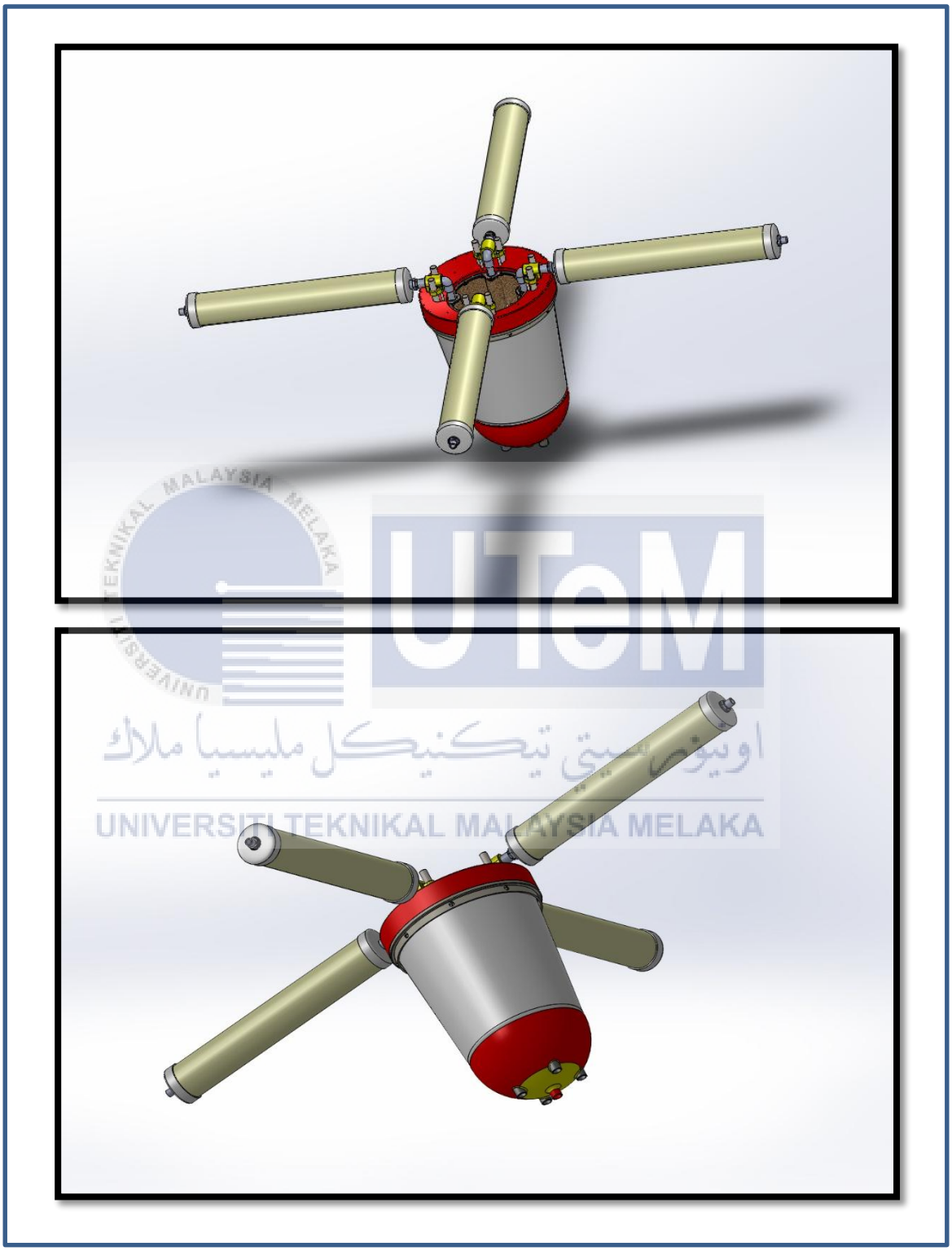
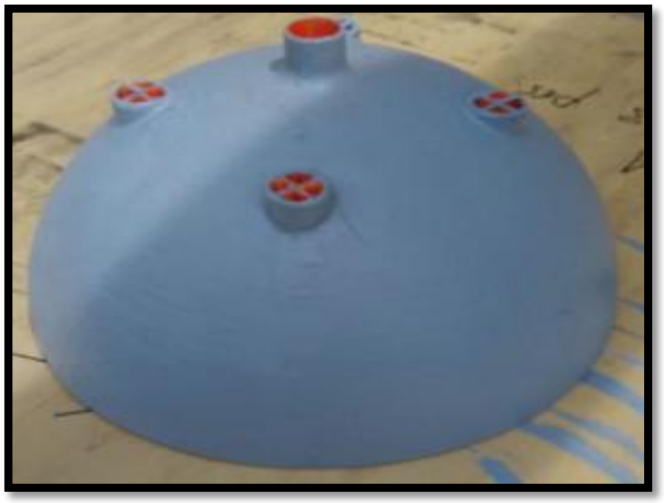
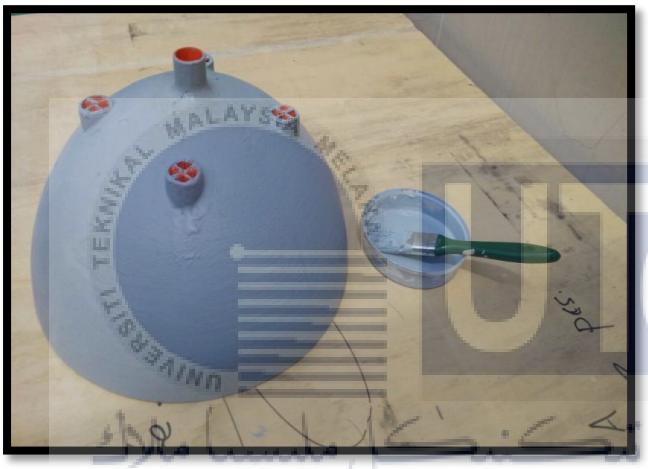
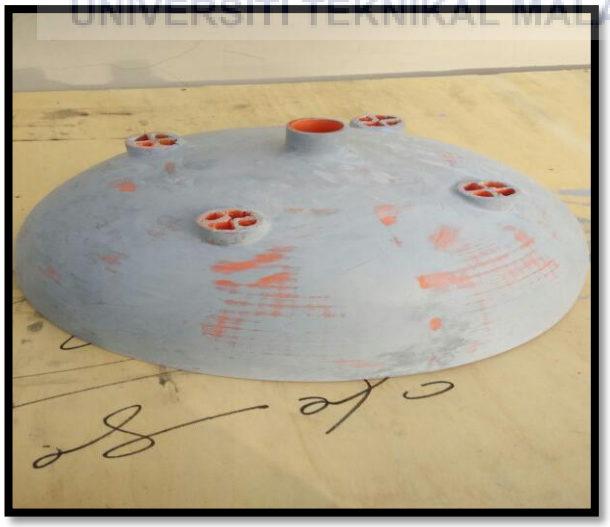


Figure 4.23: River Trash Collector System (RTCS)

4.6 Finishing Process

Figure	Description
	• Filler used for finishing process.
	• Seal for first layer of finishing outer bottom part.

	• Outer bottom after apllying first first layer of gap filler.
	• Scrubbing process for first layer. • Scrubbing the outer bottom part by using sand paper size 80 and water until smooth. • Then, used sand paper size 400 for finished part.
	• First layer of scrubbing finished part.

	• Second layer of finished part. • Wait until dry and scrubbing again for next layer of finishing process.
	• The finishing layer consist of filler and thinner that mixed together. • Applying the filler by using paintbrushes.
	• For final touch up, the outer bottom part scrubbed by using smooth sand paper and water to get the best result of finishing.

	• Smooth scrubbed outer bottom part.
	• First layer spray by using orange fluorescent colour. • Spray is repeated to a few times to get a best result.
	• After fifth layer, the outer bottom part looks shiny.

	• Outer bottom part done finishing process.

Table 4.10: Finishing process

4.7 Result of River Trash Collector System (RTCS) Prototype

Figure 4.24: Prototype of River Trash Collector System (RTCS)

Figure 4.25: Prototype of River Trash Collector System (RTCS)

4.8 Conclusion

In this chapter, the River Trash Collector System (RTCS) is selected based on the final concept design that have been determined by using Concept Selection stages. The buoyancy force is calculated based on force in land and water area. The design of River Trash Collector System (RTCS) can be viewed from top, side, isometric and bottom side. The results of the prototype of River Trash Collector System (RTCS) has been develop by using several types of manufacturing processes. Besides that, the process and the cross sectional of the River Trash Collector System (RTCS) have been described in this chapter. Next chapter will be the final part of this study where conclusion and recommendation will be presented.

CHAPTER 5
CONCLUSION & FUTURE WORK

5.0 Introduction

In this chapter, there will present the challenges of the project, recommendation for future work and the conclusion. River Trash Collector System (RTCS) is finalized from a few of design concept idea and then it selected to undergo the prototype fabrication process which used a several types of machining processes. Since there has a lot of challenges of this project, there will recommended by some of the improvement for future work.

5.1 Challenges of the Project

There has a few challenges to build a prototype of River Trash Collector System (RTCS). The first think that should be emphasized is time management. This project basically need more time to arrange all the parts that using machines to complete all the machining process. Perhaps it will take a few type of consideration to decide all the machines capability to fabricate the prototype. 3D Printer UP Plus is used to produce small parts such as plate locker, connector and L-joint. Outer bottom part also printed by using 3D Printer UP Plus but it split into eight pieces due to the size of the part that is larger than the plate size. For larger part such as T-joint and top cover bottom, they are using Cube Pro Duo machine. The top cover bottom size exceed the size of the plate in the machine. So it have to split into eight pieces and printed 2 pieces per session. The time taken to print all the part takes a longer time between eight to thirteen hours per pieces. Furthermore, the drawing of each part need to be adjusted so many times regarding the capability of the machine to produce the parts. The limitation of size for 3D printing innovation is at present restricted by

size constraints. Even large objects are still not achievable when constructed utilizing 3D printers. The resulted part produced of 3D Printer UP Plus is more tidy and achieved a good quality if comparing with Cube Pro Duo. Both are the Rapid Prototyping processes but they still have a differences in term of quality product and the time taken to print the part by using Cube Pro Duo machine is slower than 3D Printer UP Plus. The cost of material for Cube Pro Duo machine is expensive compared to 3D Printer UP Plus. But they still used filament material which is 1.75 mm and 1 kilogram weight. For 3D Printer UP Plus, River Trash Collector System (RTCS) used ABS filament and Cube Pro Duo Machine used PLA filament material. This project used a lot of material in order to print the part with the support system. Then, the support system need to be removed with pliers or cutters and just letting the desired shape only. For top cover and inner bottom part, they are fabricated by using CNC Wood Router machine. The challenges in this part is when the raw material size is limited with the actual drawing size of the part. The drawing is programmed by using CATIA Software and there has a difficulty which is the tool is very limited due to the small holes at specific part. Besides that, the inner bottom part is difficult to clamp because the semi- sphere shape. The top cover part need extra material at both side for clamping during machining process.

5.2 Recommendations

Several recommendations were listed below for future studies:

i. For this project, time management should arrange properly due to the prototype fabrication of River Trash Collector System (RTCS) takes a longer time to produce each part of the component.

ii. The design for certain part of River Trash Collector System (RTCS) should be simplify due to the capability of the machine. The tool provided at laboratory are very limited and they unable to achieve the design specification in machining processes.

iii. At the same time, the design should focus in term of clamping during machining process. Because this is very important to create parts follows the desired shape.

iv. River Trash Collector System (RTCS) need to get a budget or sponsorship from any party due to high cost in terms of material used.

v. The man power or team work between students, supervisor and co-supervisor is very important because each of team work having different expertise to develop a good idea for every single of improvement made.

vi. River Trash Collector System (RTCS) should be analysed by considering the importance of green technology system for better future work.

vii. Use three concepts of sustainability such as reuse, recycle and repair for River Trash Collector System (RTCS) in order to maintain the sustainability of environment.

viii. River Trash Collector System (RTCS) should be functional for cleaning Malacca River and other area to reduce water pollution.

ix. Besides that, this project has gained a collaboration with Perbadanan Pembangunan Sungai & Pantai Melaka (PPSPM) and hopefully there will be a good cooperation to introduce the River Trash Collector System (RTCS) to a global stage.

5.3 Conclusion

As a conclusion, this project has achieved the objectives to generate a concept design and to design the finalized concept idea of River Trash Collector System (RTCS). The prototype of RTCS is fabricated by using Rapid Prototyping, handmade and machining process. River Trash Collector System (RTCS) project has been through many challenges in order to fabricate the prototype. All the challenges can be overcome by doing a research and proper solutions. Time management has been arranged properly to settle down all the machining process for each part of the component. There has been a few kind of things that undergo a certain process of adjustment such as drawing, determination of machine used and also the material used for fabrication process.

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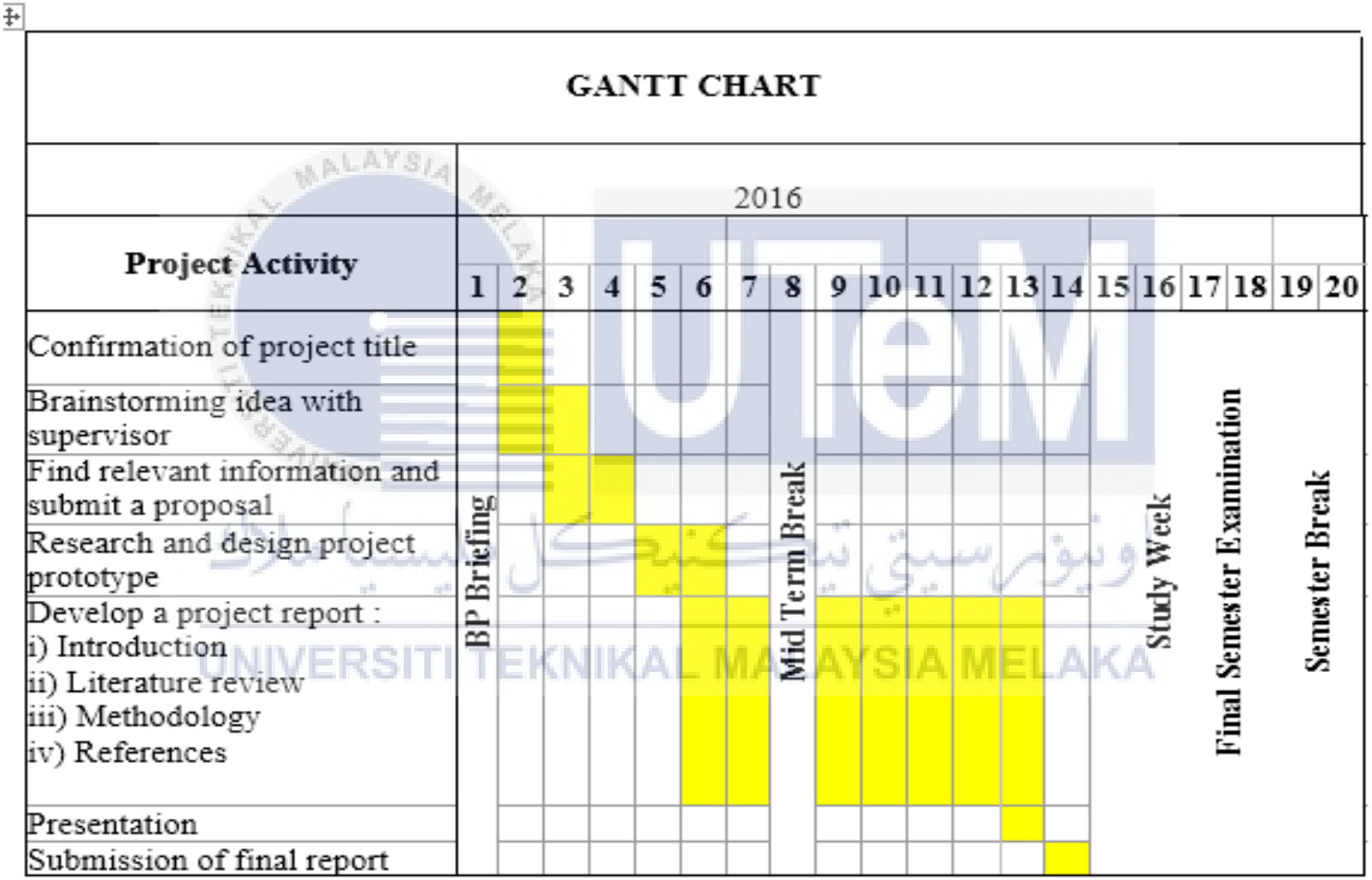
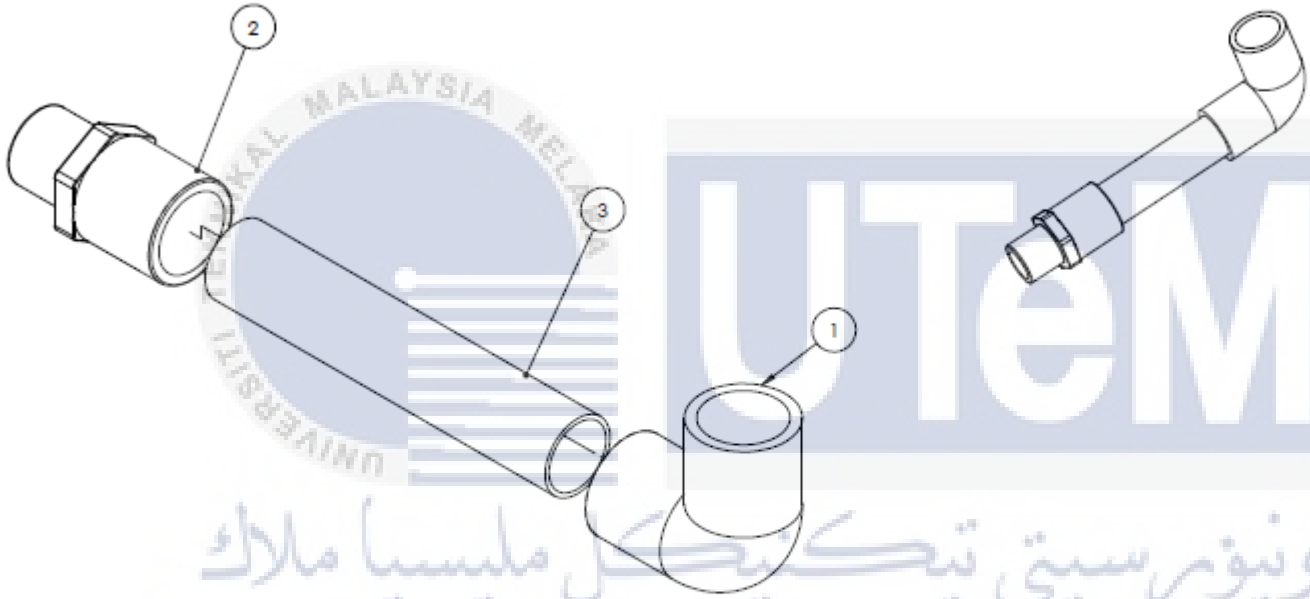
APPENDICES



Project Activity	GANTT CHART																
	2017																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	18
Designing the concept design								Mid Term Break								Study Week	Final Exam
Finalized the concept design																	
Preparation of raw material and machines used																	
Machining process																	
Assembly process																	
Finishing process																	
Presentation																	
Submission of final report																	



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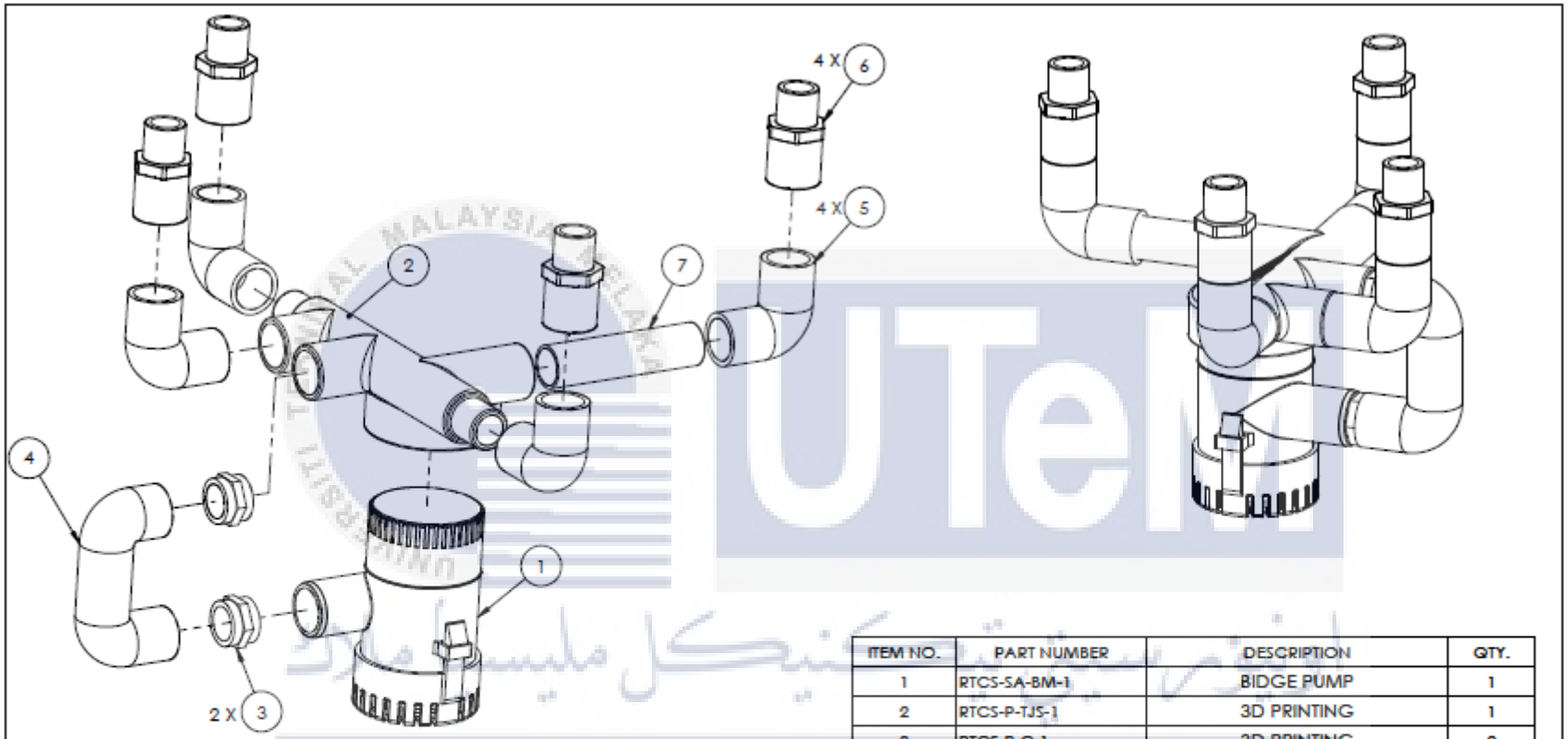
1	RTCS-P-LJ-1	20mm L-JOINT	1
2	RTCS-P-CVTR-1	20mm CONVERTER	1
3	RTCS-P-PP20mm-2	20mm PVC PIPE	1

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS SURFACE FINISH: TOLERANCES: LINEAR: ANGULAR:				FINISH: N/A	DEBUR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING
	NAME	SIGNATURE	DATE			REVISION: 0A
DRAWN	HIDAYAH					TITLE: PROJEK SARJANA MUDA
CHK'D	IDAH					CONNECTOR ASSY
APPV'D						
MFG						
Q.A				MATERIAL: N/A		DWG NO. RTCS-SA-CA-1
				WEIGHT:		SCALE:1:2
						SHEET 1 OF 1



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	RTCS-SA-BM-1	BIDGE PUMP	1
2	RTCS-P-TJS-1	3D PRINTING	1
3	RTCS-P-C-1	3D PRINTING	2
4	RTCS-P-LJM-1	3D PRINTING	1
5	RTCS-P-LJ-1	20mm L-JOINT	4
6	RTCS-P-CVTR-1	20mm CONVERTER	4
7	RTCS-P-PP20mm-5	PVC PIPE 20mm	1

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS SURFACE FINISH: TOLERANCES: LINEAR: ANGULAR:

FINISH: N/A

DEBUR AND BREAK SHARP EDGES

DO NOT SCALE DRAWING | REVISION

PROJEK SARJANA MUDA

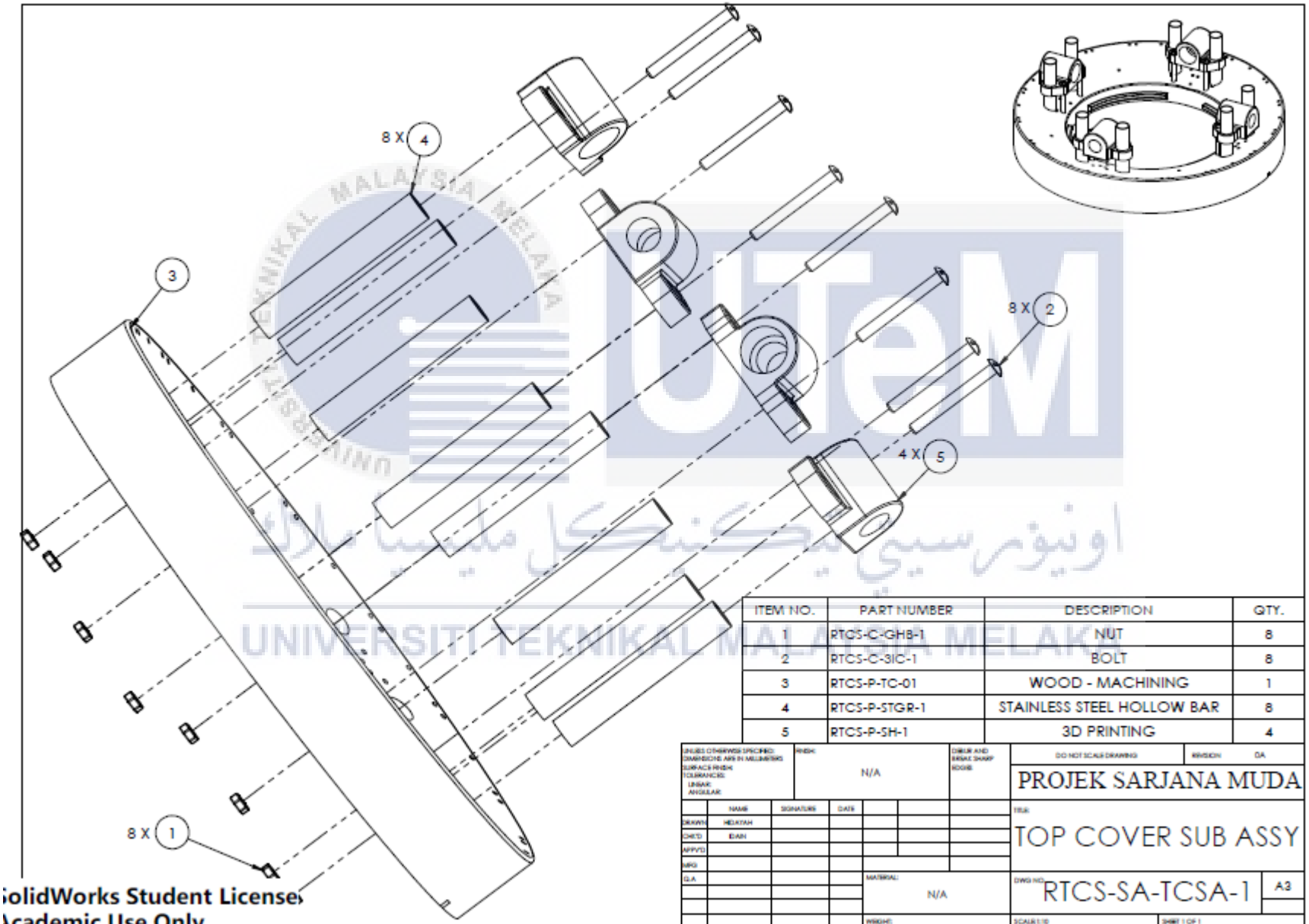
	NAME	SIGNATURE	DATE
DRAWN			
CHK'D			
APP'D			
MFG			
Q.A			

MATERIAL: N/A

TITLE: BILDGE MOTOR AND PUMP ASSY

DWG NO. RTCS-SA-BMAPA-1 | A3

WEIGHT: | SCALE:1:2 | SHEET 1 OF 1



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	RTCS-C-GHB-1	NUT	8
2	RTCS-C-3IC-1	BOLT	8
3	RTCS-P-TC-01	WOOD - MACHINING	1
4	RTCS-P-STGR-1	STAINLESS STEEL HOLLOW BAR	8
5	RTCS-P-SH-1	3D PRINTING	4

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS; SURFACE FINISH; TOLERANCES: LINEAR, ANGULAR | FINISH: N/A | DEBUR AND BREAK SHARP EDGES

DO NOT SCALE DRAWING | REVISION: 0A

PROJEK SARJANA MUDA

	NAME	SIGNATURE	DATE
DRAWN	HIDAYAH		
CHK'D	IDAIN		
APP'D			
MFG			
Q.A			

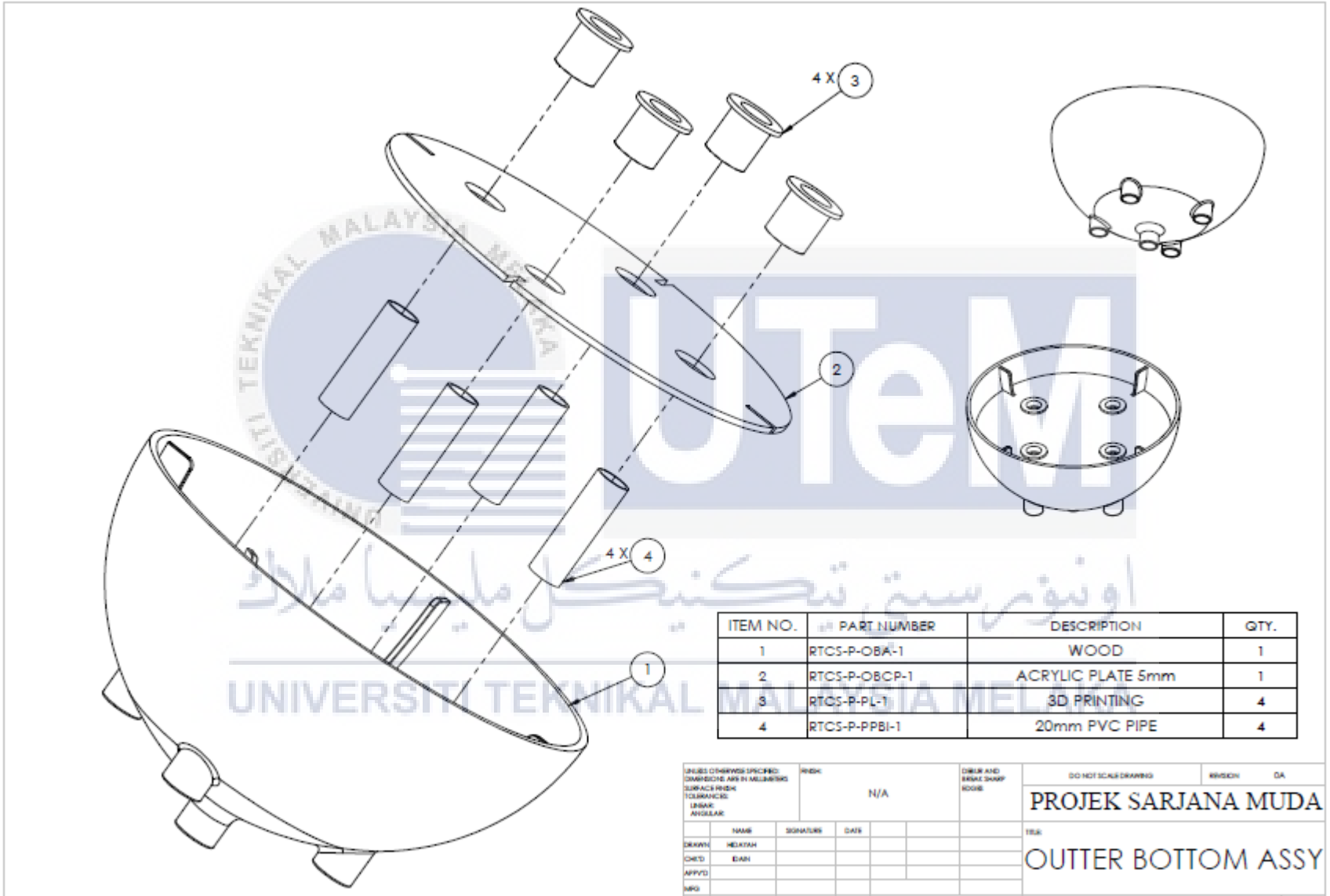
MATERIAL: N/A

WEIGHT:

TITLE: TOP COVER SUB ASSY

DWG NO. RTCS-SA-TCSA-1 | A3

SCALE: 1:10 | SHEET 1 OF 1



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	RTCS-P-OBA-1	WOOD	1
2	RTCS-P-OBCP-1	ACRYLIC PLATE 5mm	1
3	RTCS-P-PL-1	3D PRINTING	4
4	RTCS-P-PPBI-1	20mm PVC PIPE	4

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS SURFACE FINISH: TOLERANCES: LINEAR: ANGULAR:

FINISH: N/A

DEBUR AND BREAK SHARP EDGES

DO NOT SCALE DRAWING | REVISION: 0A

PROJEK SARJANA MUDA

	NAME	SIGNATURE	DATE
DRAWN	HIDAYAH		
CHK'D	EIAIN		
APP'VD			
MFG			
Q.A			

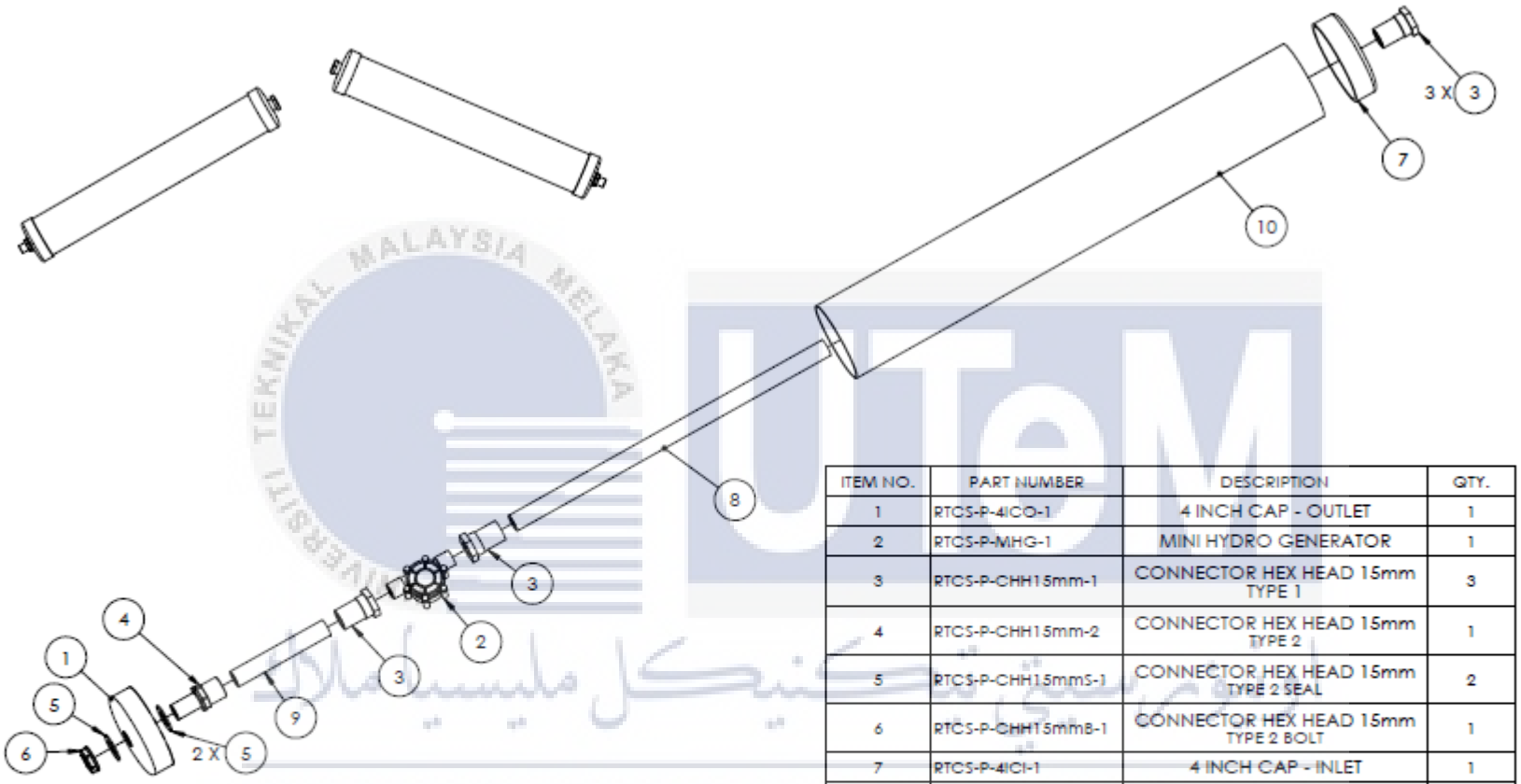
MATERIAL: N/A

WEIGHT:

TITLE: OUTTER BOTTOM ASSY

DWG NO. RTCS-SA-OBA-1 | A3

SCALE:1:10 | SHEET 1 OF 1



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	RTCS-P-4ICO-1	4 INCH CAP - OUTLET	1
2	RTCS-P-MHG-1	MINI HYDRO GENERATOR	1
3	RTCS-P-CHH15mm-1	CONNECTOR HEX HEAD 15mm TYPE 1	3
4	RTCS-P-CHH15mm-2	CONNECTOR HEX HEAD 15mm TYPE 2	1
5	RTCS-P-CHH15mmS-1	CONNECTOR HEX HEAD 15mm TYPE 2 SEAL	2
6	RTCS-P-CHH15mmB-1	CONNECTOR HEX HEAD 15mm TYPE 2 BOLT	1
7	RTCS-P-4ICI-1	4 INCH CAP - INLET	1
8	RTCS-P-PP20mm-3	PVC PIPE 20mm TYPE 3	1
9	RTCS-P-PP20mm-4	PV CPIPE 20mm TYPE 4	1
10	RTCS-P-4ICS-1	4 INCH CONTAINER	1

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS. SURFACE FINISH: TOLERANCES: LINEAR: ANGULAR:

FINISH: N/A

BREAK AND BREAK SHARP EDGES

DO NOT SCALE DRAWING | REVISION: 0A

	NAME	SIGNATURE	DATE
DRAWN	HIDAYAH		
CHK'D	IDAIN		
APPV'D			
MFG			
Q.A.			

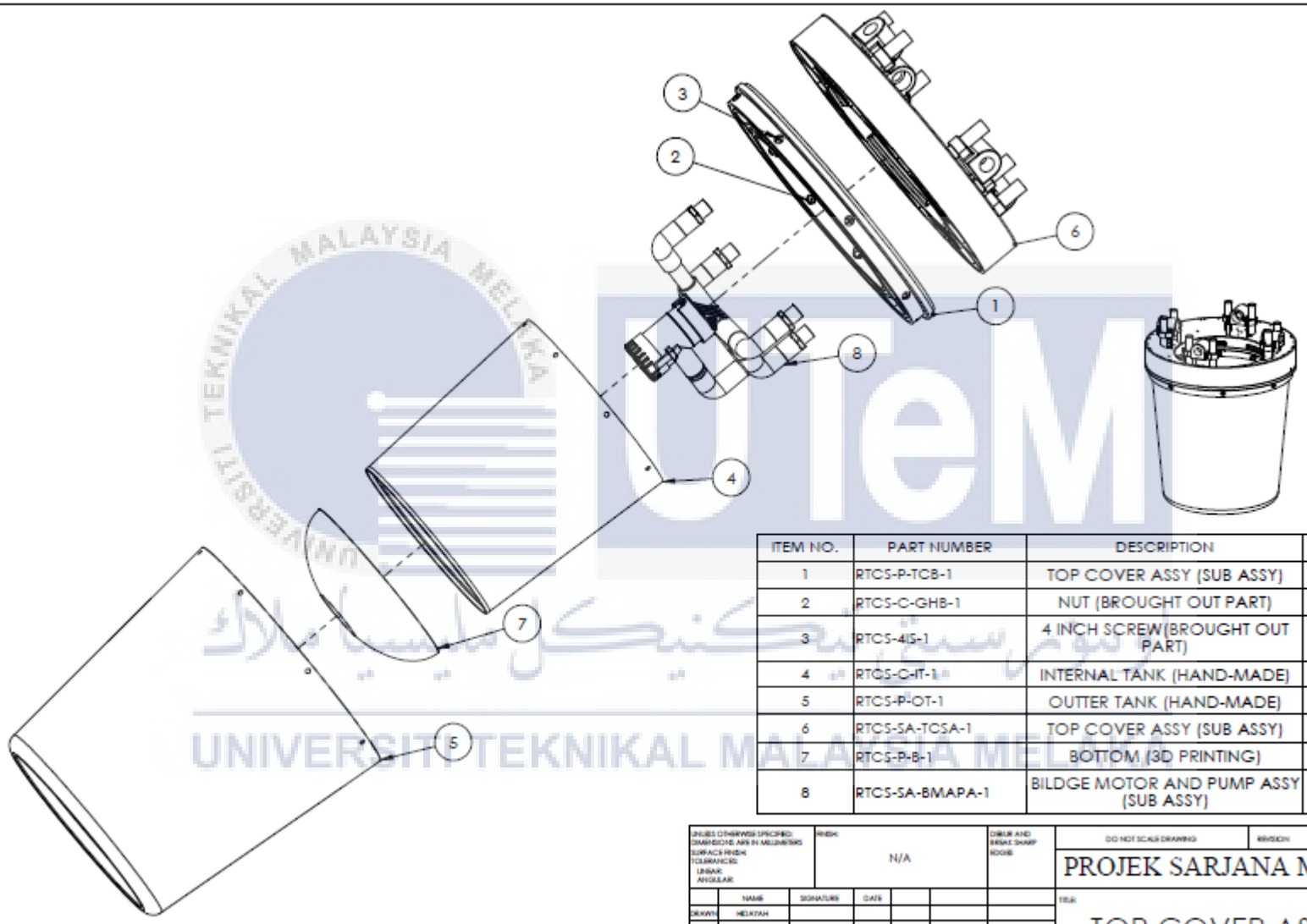
PROJEK SARJANA MUDA

TITLE: BOAY ASSY

MATERIAL: N/A

DWG NO. RTCS-SA-BA-1 | A3

WEIGHT: | SCALE:1:10 | SHEET 1 OF 1



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	RTCS-P-TCB-1	TOP COVER ASSY (SUB ASSY)	1
2	RTCS-C-GHB-1	NUT (BROUGHT OUT PART)	8
3	RTCS-4IS-1	4 INCH SCREW(BROUGHT OUT PART)	8
4	RTCS-C-IT-1	INTERNAL TANK (HAND-MADE)	1
5	RTCS-P-OT-1	OUTTER TANK (HAND-MADE)	1
6	RTCS-SA-TCSA-1	TOP COVER ASSY (SUB ASSY)	1
7	RTCS-P-B-1	BOTTOM (3D PRINTING)	1
8	RTCS-SA-BMAPA-1	BILDGE MOTOR AND PUMP ASSY (SUB ASSY)	1

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS. SURFACE FINISH: TOLERANCES: LINEAR: ANGULAR:

FINISH: N/A

BREAK AND BREAK SHARP EDGES

DO NOT SCALE DRAWING | REVISION: 0A

	NAME	SIGNATURE	DATE
DRAWN	HIDAYAH		
CHK'D	IDAIN		
APPV'D			
MFG			
Q.A			

MATERIAL: N/A

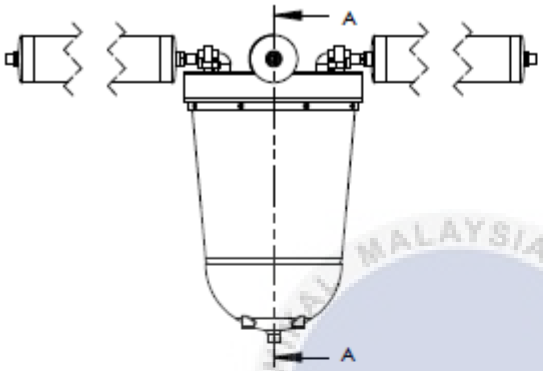
WEIGHT:

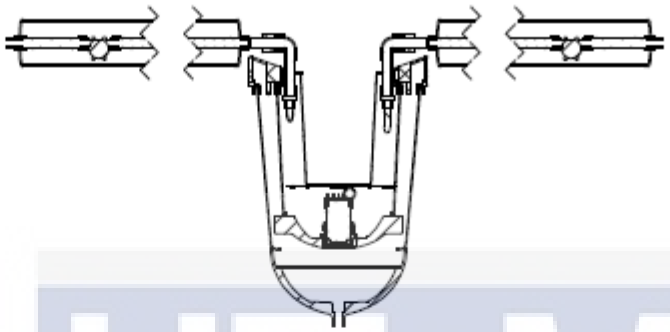
PROJEK SARJANA MUDA

TITLE: TOP COVER ASSY

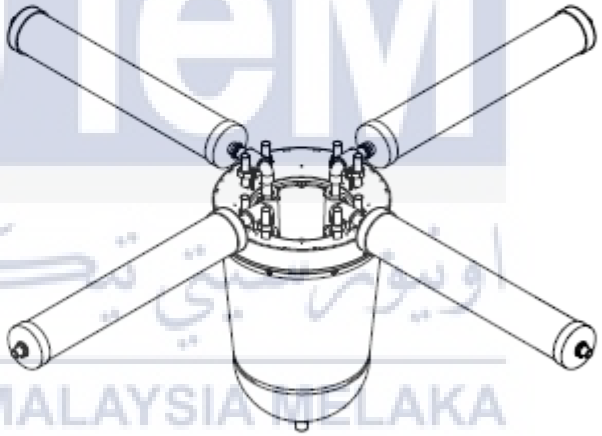
DWG NO. RTCS-SA-TCA-1 | A3

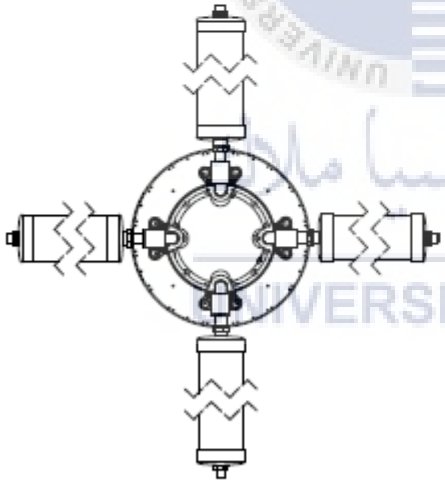
SCALE:1:20 | SHEET 1 OF 1





SECTION A-A





UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS SURFACE FINISH: TOLERANCES: LINEAR: ANGULAR:				FINISH: N/A		DEBUR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING
	NAME	SIGNATURE	DATE				PROJEK SARJANA MUDA
DRAWN							TITLE: RIVER TRASH COLLECTOR SYSTEM
CHK'D							
APPV'D							
MFG							
Q.A				MATERIAL: N/A			DWG NO. RTCS-MA-01
				WEIGHT:			SCALE:1:10 SHEET 1 OF 2