



**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**STUDY TO IMPROVE PRODUCT DEVELOPMENT OF RIVER  
TRASH COLLECTOR SYSTEM BY APPLYING DESIGN OF  
EXPERIMENT APPROACH**

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Mechanical Engineering Technology (Automotive Technology) with Honours

By

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**TAJUK: STUDY TO IMPROVE PRODUCT DEVELOPMENT OF RIVER TRASH COLLECTOR SYSTEM BY APPLYING DESIGN OF EXPERIMENT APPROACH**

**SESI PENGAJIAN: 2019/2020 SEMESTER 1**

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## DECLARATION

I hereby, declared this report entitled “Design and Development of a New River Trash Collector System (RTCS) “is the results of my own research except as cited in references.

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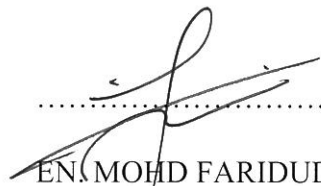
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## APPROVAL

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:

Signature:



.....

Supervisor:

EN. MOHD FARIDUDDIN MUKHTAR

## ABSTRACT

In recent years, the issue of river pollution has captured the public's attention and has become a matter of concern to the entire world. Rivers have contributed to the growth of civilization since the very beginning of civilization as it is used as a means of transport and as a connection of natural resources for domestic and agricultural purposes. In addition, it provides a source of protein for humans. Even though the world has modernized, the public still has a group of people who are unable to follow the flow of the modern world. The growth of the economy also contributed to the pollution of the city and the Malacca River by the construction of unregulated factories. The state government of Malacca obliged to launch a radical program to transform the state of Malacca to 'Bandar Teknologi Hijau' or Green Technology City. The River Waste Collection System (RTCS) concept was implemented from this issue to reduce water contamination in the areas of the Melaka River. The RTCS needs big space to trap waste in the Melaka River. Thus, an Inner Frame and Outer Frame is designed to trap waste in greater quantities. The results of the data collected in the Melaka River helped to design the Inner Frame and the Outer Frame to facilitate the flow of waste into the RTCS. In addition to expanding the Inner and Outer Frame space, the strength and weight of the materials to be used also play an important role in ensuring the load is acceptable to the Inner Frame and Outer Frame. By using Solidwork as well as Solid Thinking Inspire, Inner Frame and Outer Frame designs can be made easier and faster.

## **DEDICATION**

To my beloved family  
Norhisham bin Puteh,  
Fadzilah binti Ramli,  
Siti Norhafizzah binti Norhisham,  
Siti Hasanah bin Norhisham

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

To my honored supervisor  
Mohd Fariduddin Mukhtar  
and my co-supervisor,  
Encik Mohd Idain Fahmy Rosley

All UTeM's lecturers

To my teammates,  
Noor Shuhada binti Yuzni  
Kannan a/l Pandian

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



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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. 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. They have encouraged me and giving full thought during this project. First, I wish to express my sincere thanks 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. Without his guidance and persistent help this project 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. I am extremely thankful and indebted to him for sharing expertise, and sincere and valuable guidance and encourage extended to me. By spending his valuable time, he shared his knowledge with his full attentions in carrying out this project. I also want to express my gratitude towards my beloved parents and families for the unceasing encouragement, support and attention while carrying out this project. Not forgetting to my team members who have helped me in completing 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. Once again, thank you so much for all to be part of help in my final project.

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# CHAPTER 1

## INTRODUCTION

### 1.1 Research Background

Nowadays, most of the river is heavily polluted by trash and non-disposable waste. It contributes many types of disease which affects human being and living organism on Earth. Mostly trash comes from people because they do not throw rubbish in a rubbish bin or recycling bin but on the ground. As we know most of river in Malaysia is been polluted. Malacca River also not been exceptional for this problem.

Malacca river cruise is one of the main attractions for tourist that come to visit Malacca. When it rains, water will bring garbage into the river Malacca. Therefore, authorities of Malacca River wanted to maintain the cleanliness and the environment of the river.

River Trash Collector System (RTCS) is a design to solve the problem of rubbish in the waters. RTCS is a semi-auto design technology to collect debris without the need for a lot of manpower. Besides collecting floating trash on the Melaka river, RTCS also helps to improve water quality. Based on data obtained from Perbadanan Pembangunan Sungai dan Pantai Melaka (PPSPM) which is a company trusted to manage the river, water index quality of water of the river still at moderate performance.

Deployment of RTCS would help PPSPM to collect floating trash faster within the time frame. It is autonomous and responds whenever it detects debris going through the bin.

## 1.2 Problem Statement

Malacca river has been polluted due to the rubbish that been throw by the people and it required a lot of manpower and time in order to keep and maintain the cleanliness of the river. The river spans over around 10 km and it is not easy to maintain the cleanliness of the river. By using RTCS, it can solve pollution and reduce usage of manpower to keep the Malacca river cruise clean. Besides, the product is easy to be maintain and friendly user.

However, main problem in the early design of RTCS is the filter tank, which the tank is not capable of collecting the desire amount of trash. To improve the filter tank, we must analyse load to be received by RTCS. RTCS's design consists of a body part which is the main bin, and support by pontoon as the floating mechanism. The increase in waste collected will impact RTCS to operate, so pontoon should be modified to ensure RTCS not submerged.

Besides that, the body frame of RTCS should be overlook. This is because due to heavy load collected by RTCS, the current frame might not be able to withstand the load. Frame are a relatively important role to hold the lifter. due to increased waste quantity, the frame must be stronger to meet the burden of garbage that will be given over by the lifter. Therefore, the material to be used for the frame must be strong, not brittle and not rusty. This is because, the frame must accommodate the burden of waste collected and the frame will also be exposed to the weather and river water.

In addition, the weight of the frame one of the factors to be considered because by reducing the weight of the frame can increase the quantity of garbage that can collected. By using SolidWork, we can make an analysis on the frame and make a worthy design like the original, the reduction of material could provide cost savings. reducing the weight of the frame can increase the quantity of garbage that can collected.

### **1.3 Research Objective**

This study will embark the following objectives;

- i) To investigate the optimized design of RTCS as to reduce costs and material used.
- ii) To redesign body frame of RTCS and analyses using Solid Work Inspire.
- iii) To fabricate new RTCS body frame using desired material.

### **1.4 Scope of Research**

This project gives an idea of how to control and manage the rest of the trash in the waters of Melaka river. Cleaning will be done from place to place using the RTCS along the Melaka river. This task is performed to produce body frame durable whilst in the Malacca River. The new design of body frame focuses on cost reduction, type material and weight of RTCS. Furthermore, we must ensure the RTCS can support the overall weight of the component. Then, the overall structure of RTCS must be suitable for Malacca river cruise.

### **1.5 Significant of Research**

This study helps researcher to find the best material to withstand desired load. It is important to know how much load does be able to collect. If the load was too heavy, RTCS would breakdown. But if it is too light, RTCS itself would not be operated.

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.1 Introduction**

This project focuses on the design and fabrication of creating a machine that makes it easy to collect garbage in the river Malacca. River Trash Collector System (RTCS) is a design to solve the problem of rubbish in the waters. This design makes it easier to collect litter without the need for a lot of manpower. This is because RTCS is a semi-auto design technology. Besides collect litter in the waters of Melaka river, RTCS also helps improve the quality of water in the Melaka River. Based on research, the quality of water in the Melaka River is below a predetermined level. The RTCS is still in the study to ensure that it works perfectly and has a great impact on the environment.

#### **2.2 Water Pollution**

Natural phenomena cause major water quality changes and water's ecological status because of volcanoes, algae blooms, storms, and earthquakes. Water is typically referred to as polluted when it is affected by anthropogenic contaminants. Because either it not suitable human use, such as drinking water, or it is not suitable experiencing a marked shift in its to biotic communities, such as marine life.

Human activity usually causes a water bodies contamination or be called water pollution. a part of the water bodies like lakes, rivers, oceans, aquifers and groundwater.



mostly people who living at downstream will facing problem of public health when water pollution materialized into the natural environment. it because, they use polluted river water to drink, bathing or irrigation. Water pollution also the main reason of death and disease. Furthermore, water pollution because of a wide range of chemicals, substances that are organic and inorganic and high temperatures also. thermal pollution makes a high temperature, it because use of water coolant by power plants and industrial

(Philip, 2018) The Lancet Pollution and Health Commission found that pollution – air, water, soil, and chemical pollution – caused 940,000 deaths in children around the world in 2016, two-thirds of them in children under 5 years of age. In low- and middle-income countries, mostly deaths in children caused by pollution occurred like air and water polluted. These two types of pollution resulting in respiratory and gastrointestinal diseases. Furthermore, non-communicable diseases also are on the rise cause of pollution. Chemical pollution mostly gives a full impact of pollution.

(Ashraf, Maah, Yusoff, & Mehmood, 2010) Giving explanation, contaminated water is made up of industrial wastewater, sewage, and rainwater discharged. Using water in agriculture is a common practice. The estimate shows that over 50 countries worldwide are treated with 20 million hectares of contaminated or partially contaminated water. (Owa, F.D. 2013) Contributor to the degradation and pollution of the environment is human activities. This adversely affecting the water bodies that are a necessity for life. Water pollution has negative effect on living and surroundings especially to people and aquatic communities. Wastewater untreated in developing countries cause an increase death. Water pollution can be managing and controlling by various ways likes prevention, practice or join a program to regulating and monitoring or taking control measures by reducing or minimizing waste.

(Subramanyan Vasudevan, 2013) Pd, Cd, Ni, Hg and other metals and cyanide as well as organic pollutants is main pollutants. The cause of electrochemical water pollution is due to effluents from various electrochemical industries such as mecury, heavy metals and organic contaminants, contaminants from corrosion processes, synthesis, use of pesticides, dyes and pharmaceuticals. Based on the electrochemical principles, most pollutants can eliminate or converted to non-toxic materials.

## 2.3 Efforts to Control Water Pollution

Different parties have made many efforts to overcome the river's pollution. Various ways of controlling laurels, such as the presence of anatomy, street gathering, and creating machines for collecting rubbish in the river. High-conscious parties have created various machine designs to eradicate this pollution. This can have a major impact on the river's pollution control.

### 2.3.1 River Harvesting & Trash Cleaning Machine (2016) Rajendra Patil

Aquatic Harvester is a barge, it used for a variety of tasks, like management of aquatic plants and removal of waste from rivers. This machine will collect and unload vegetation below the surface of the water. It can track up to 6 feet below the surface of the water using a conveyor system. Aquatic Harvester can adjustable to the appropriate cutting height according to circumstances. Cutter bars collect Using the conveyor, cutter bars collect rubbish and pulled into the aboard the vessel. After the barge has full, cut material is transferred to a disposal site and discharged using the conveyor.

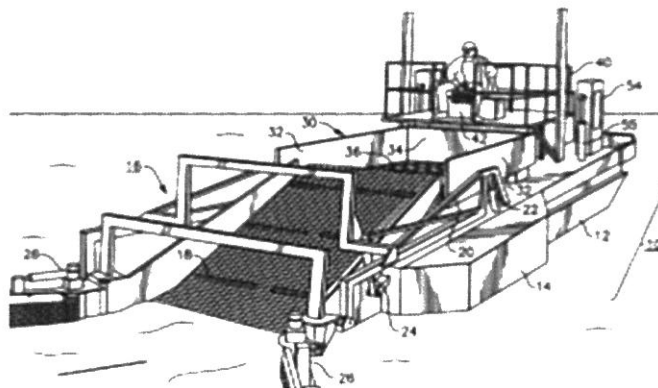


Figure 2.1: River Harvesting & Trash Cleaning Machine

### 2.3.2 Baltimore's Mr. Trash Wheel (2016) Adam Lindquist

Mr. Trash Wheel was invented by John Kellett, he has the ingenious idea to combining new and old sustainable technologies to collect trash. This machine will collect trash cleanly and efficiently in the waters until Baltimore Harbour and Chesapeake Bay's open waters.

Mr Trash Wheel using a 14-foot steel water wheel for their primary engine and it powered by the rivers current. The water wheel that pulls floating litter and debris from the river into a dumpster barge dominate a rake and conveyor system is powered to Instead of powering a mill. When the river's current is slow, the machine can continue to operate because it has an of thirty solar panels to power pumps that pump water onto the wheel. The publica dan track their trash collection by online on [www.MrTrashWheel.com](http://www.MrTrashWheel.com).

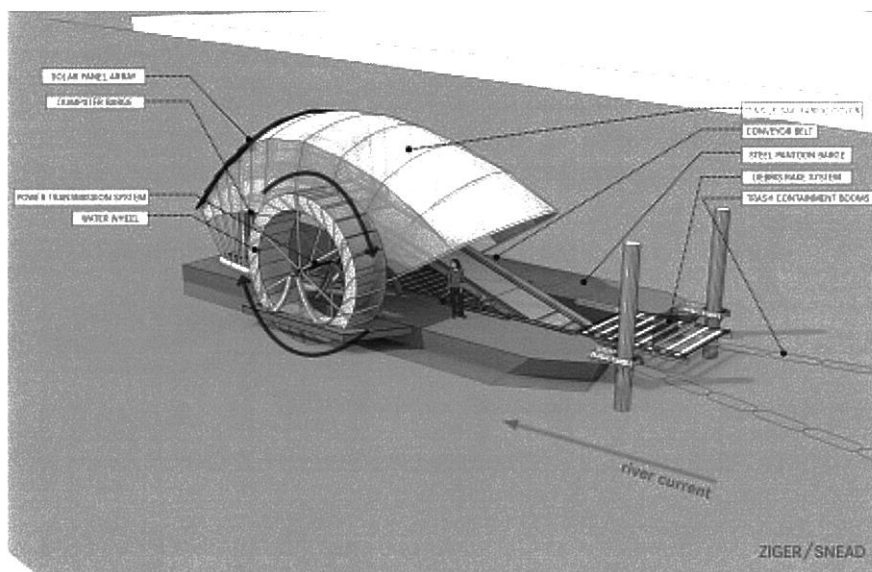


Figure 2.2:Diagram for Mr Trash Wheel



### 2.3.3 Aquatic Multi-Robot System for Lake Cleaning (2015) Pranay Agrawal And Bishakh Bhattacharya

Aquatic Vehicle Multi-Robot System is designed based on autonomous operation used for lake cleaning and fisheries maintenance. It is using tactile sensors and wireless communication to traverse autonomously. This machine will be clearing operations such as removing surface impurities, pumping oxygen into water, spraying chemicals and distributing food. By using this strategy to use a multi-robot system, effective and rapid cleaning of aquatic waste is possible.

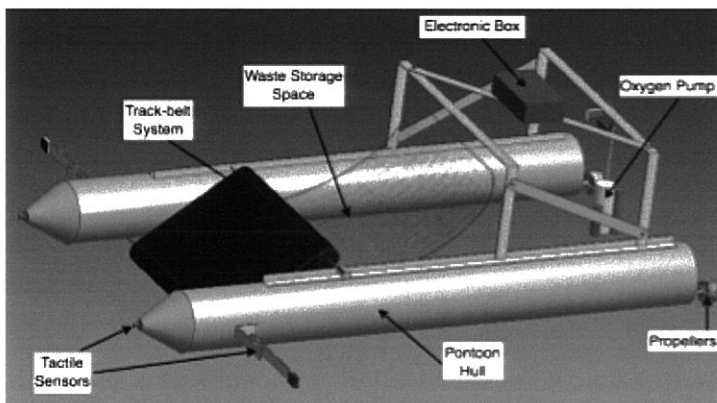


Figure 2.3: Structure of the robots used for lake cleaning

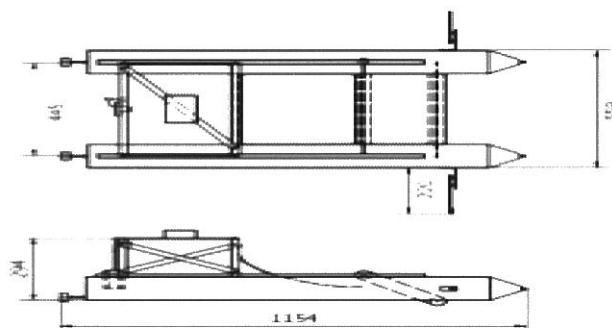


Figure 2.4: Structure of the robots used for lake cleaning

### 2.3.4 Efficient Lake Garbage Collector Using Pedal Operated Boat (2016) Akash Dambhar

The main motive for this purpose is to clean the lake water by using pedal operated boat. It will collect garbage with the conveyor attached to it by operated of pedal. This boat can collect trash at the water surface and can work at river or lake. Furthermore, also can have weed cutting equipment and it harvests lake aquatic weeds. To collect the trash in small and large lake, they attach the belt at conveyer. This conveyer will collect trash such as plastic bags, plastic bottles, drink cans, food wrappers, paper bags, straws, etc. This both also can save petrol from the source of fuel such as diesel.

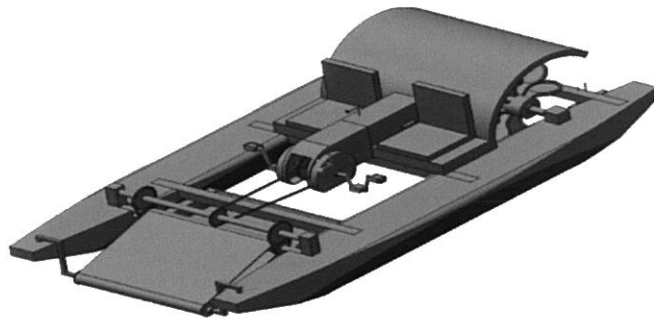


Figure 2.5: Pedal boat with conveyor

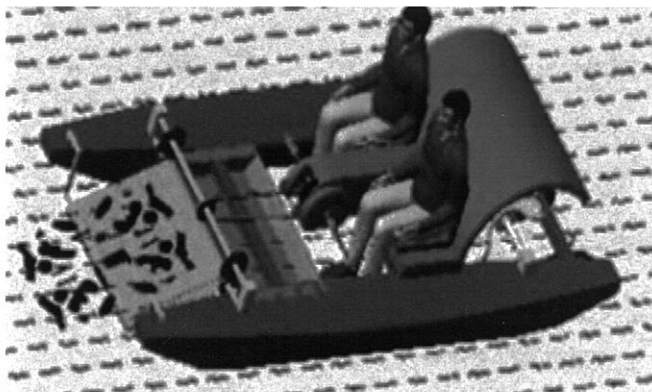


Figure 2.6: Parking of pedal boat