UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF A PROTOTYPE FOR SOLAR POWERED SMART WATER WASTE UNIT (OVERALL STRUCTURE)

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

by

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DECLARATION

I hereby, declared this report entitled "Development of a Prototype for Solar Powered Smart Water Waste Unit (Overall Structure)" is the results of my own research except as cited in references.

Signature	:	…….
Author"s Name	:	…….
Date	:	…….

APPROVAL

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

……

(Project Supervisor

ABSTRACT

The title of this project is development of a prototype for solar powered Smart Water Waste Unit (overall structure) .Basically this project is focused on the overall structure of the machine in a way the maintenance of the machine is taken into account as well as the position of the solar panel, water wheel, conveyor, trash bin, and structure of the Smart Water Waste Unit. In this project, a solar powered Smart Water Waste Unit is to be designed and placed on the Malacca river cruise. The purpose of this project is to help clean trash pollution in Malacca river cruise, and designed Smart Water Waste Unit that using natural resourced energy which is energy saving and eco friendly compared to using machines. 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. Therefore authorities of Malacca river wanted to maintain the cleanliness and the environment of the river. At the end of this project prototype of Smart Water Waste Unit be able to function properly and simulate real life operations of all functions and be able to help promote the tourism sector in Malacca

ABSTRAK

Tajuk projek ini adalah pembuatan prototaip struktur Smart Water Waste Unit (keseluruhan struktur). Pada asasnya, projek ini memberi tumpuan kepada keseluruhan struktur produk dengan mengambil kira cara-cara penyelengaraan produk serta kedudukan panel solar, roda air, penghantar, tong sampah, dan struktur Smart Water Waste Unit. Smart Water Waste Unit akan direka dan dihasilkan untuk diletakkan di sungai Melaka. Tujuan projek ini adalah untuk membantu membersihkan pencemaran sungai di Melaka, dan untuk menghasilkan satu produk yang menggunakan sumber semula jadi seperti cahaya matahari dan arus sungai untuk menjana kuasa supaya lebih mesra alam berbanding menggunakan mesin. Seperti yang kita tahu kebanyakan sungai di Malaysia telah tercemar, Sungai Melaka juga mengalami masalah yang sama. Melaka River cruise merupakan salah satu tempat tarikan utama pelancong. Oleh itu pihak berkuasa harus menjaga kebersihan dan persekitaran sungai. Di akhir projek ini, prototaip Smart Water Waste Unit dapat berfungsi dengan baik dan dapat membantu mempromosikan sektor pelancongan di Melaka.

ACKNOWLEDGEMENT

In this section, I would like to give my deepest gratitude to my parents, Muhaiyuddin Bin Ahmad and also Madam Zaini Binti Baba that always support and believe in the thing that I am done. Very special thanks to my dearest supervisor, Madam Umi Hayati Binti Ahmad whose help, guide and encourage me to coordinate my project especially in completing this report. Without her patience, advices, and also guidance, I might be stuck and lost from the project that I am doing. As this project is my last task before I stop my journey as a bachelor student, I fell honoured to express my appreciation to all those who gave me the possibility to comprehend this project report especially my dear housemate. They keep reminding me to settle down my work in an appropriate way and also help me in generating a new idea for the Solar Panel Smart Water Waste Unit (Overall Structure). Further ado, I also want to deliver a special thanks to my classmate that helps me in making this project done. I also would like to thanks to the other supervisors as well as the panels especially in my project presentation in helping me to improve my presentation skills with their statement, comment, and tips.

Sincerely,
Muhammad Yusran Bin Muhaiyuddin

DEDICATION

Especially for beloved father and mother:

Muhaiyuddin Bin Ahmad

Zaini Binti Baba

To all my siblings:

Muhammad Hilman Bin Muhaiyuddin

Muhammad Syukran Bin Muhaiyuddin

Muhammad Dzarfan Bin Muhaiyuddin

Syajaratul Dur Binti Muhaiyuddin

Rabiatul Dur Binti Muhaiyuddin

To my supervisor:

Puan Umi Hayati Binti Ahmad

TABLE OF CONTENT

LIST OF TABLE

LIST OF FIGURES

LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

SMWU	-	Smart Water Waste Unit
FB	-	Buoyancy Force
FG	-	Gravitational Force
FEA	-	Finite Element Analysis
MPa	-	megapascal
B	-	Buoyancy
M	-	Metacentre
Kg	-	Kilogram
N	-	Newton
CAD	-	Computer Aided Design
Kn	-	Kilonewton
CAE	-	Computer Aided Engineering
GRT	-	Gross Register Tons
L_S	-	The average length of the principal deck
BS	-	The average breadth of the principle deck
DS	-	The average depth of the principle deck s
“	-	Feet
V	-	Volume
A	-	Area

CHAPTER 1
INTRODUCTION

1.0 Introduction

In this project, a solar powered Smart water waste unit is designated to be placed on the river, referring to a similar project, the Inner Harbour Water Wheel at Baltimore City, United States of America. This waste water unit will be collecting floating trash on the river. Not only as an initiative to improve the condition of Malacca River, it is also hoped that the prototype for solar powered Smart water waste unit will be able to promote the tourism in Malacca by creating cleaner environment and act as an attraction itself.

1.1 Background

Mostly trash comes from people who throw rubbish on the ground instead of putting it in a trashcan or recycling bin. When it rains, water carries the rubbish off streets and into the Malacca river cruise. Within this project consists of four parts, each part conducted by a student. The four parts divided into overall structural, mechanical, sensor trash can, and solar system. For this project is focussing on the overall structure which includes the scope of work to modify the Smart Water Waste Unit structure, which can be used in the Malacca River in size of prototype. The prototype machine needs to meet safety criteria for machine and users. A solar panel array provides additional power to keep the machine running even when there is not enough water current. There is a sensor at the dumpster so that when the dumpster is full, it will give a signal to workers.

1.2 Objective

(a) To produce prototype of smart water waste unit that help clean trash pollution in Malacca River cruise.

(b) To study about the suitable structure of Smart Water Waste Unit for Malacca River cruise.

(c) To produce a product that can reduce the workers work load

1.3 Scope

(a) Focuses on the overall structure of the Smart Water Waste Unit.

(b) The overall structure of Smart Water Waste Unit must be suitable for Malacca river cruise.

(c) The design layout of the Smart Water Waste Unit consist of conveyor, water wheel, dumpster, solar panel, and water pump

(d) To ensure the Smart Water Waste Unit structure can support the overall weight of the component.

1.4 Problem Statement

(a) The current problem statements for this proposal are Malacca river has been polluted due to the rubbish that been throw by the people and its required a lot of manpower and time in order to keep and maintain the cleanliness of the river.

(b) Comparing whether the current river trash collector and Smart Water Waste Unit are suitable for Malacca river cruise.

(c) Malacca river cruise is one of the main attractions for tourist that come to visit Malacca. Therefore authorities of Malacca River wanted to maintain the cleanliness and the environment of the river. As we know most of river in Malaysia is been polluted. Malacca River also not been exceptional for this

problem. The river spans over a distance of around 10 km and it is not easy to maintain the cleanliness of the river. It takes a lot of main power and time to clean the river at one time.

(d) By producing Smart Water Waste Unit it can solve pollution and reduce usage of man power to keep the Malacca river cruise clean. Besides, the product is easy to be maintain and friendly user.

CHAPTER 2
THEORETICAL BACKGROUND

This chapter covered with a fully-referenced review of the relevant literature. This chapter provides a review of the concept based on the previous citation using the journals, books and previous data before. An all through review of information case study is distributed in this chapter for all fields and regulation of study needed for this project. The case study conducted comprise of general definitions, historical data, previous case studies and white papers done by experts. This chapter will guide the planning and implementation of the whole project, which are the design of the Smart Water Waste Unit structure. The reviews on the mentioned topics generally consist of the type, design criteria, and relevant calculations and formulas to make the best design.

2.1 Hull Structure Design

2.1.1 Hull Structure Design Policy

Design policy must be verify and established to design a vessel. The principle of hull structure design is shown in Figure 2.1, high reliability, excellent production, and easy maintenance. Those three elements extremity to be considered from the user‟s point of view in which manage ships and contributes to worldwide frugality. Easy maintenance signifies less repair expense and easy perceptibility for examination. High reliability can be obtained by reliable design stated after. Good performance means the structure is well balanced that can carry out the given duty. Reliability considered about the safeness of the vessel, and crew member. To gain a

good balance of those three elements a rational design must be develop based on theoretical approach and plentiful experience. (Yasuhisa Okumoto, 2008).

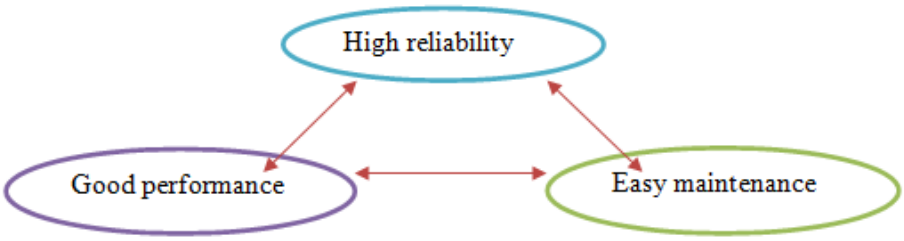


Figure 2.1: Hull structure design policy.

2.1.2 Basic Idea of Hull Structure Design

A ship will break when the load applied is bigger than the ships strength, when a failure such as crack, buckling and collapse happen at a ship; it is regarded as a good chance to gain engineering knowledge, though the damage is not pleasing in itself:

(a) To go the spot on board
(b) To see the appearance of the failure
(c) To consider the phenomenon at the locality

It is important to check carefully the detail such as size, figure, direction to estimate the magnitude, direction, source, and transmitting route of the force. Experiments also require to be carried out if necessary, analysis will be predicted the failure or the damage at the product to be make, and countermeasure are determined in accordance with the calculation. The worst case is to calculate using a complex model such as the FEM program without seeing the actual damage. (Yasuhisa Okumoto, 2008.

2.1.3 Design Flow

The design of a hull structure is generally carried out in three stages that is:

(a) Basic design

(i) Following the purpose of a previous structural arrangement in the project step, the mid ship part drawing are ready, followed by the rule-based calculations, strength, and wavering calculation, and hull steel weight estimate.

(ii) Rough shape of boundaries, plate thickness, materials, outline of slot, arrangement of web stiffeners.

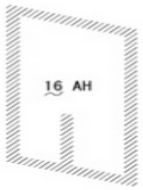


Figure 2.2: Basic design

(b) Detail design

(i) Following the accomplishment of the detailed mid ship part drawing, which also contain the production process: the bow, stern, engine room, and super structure are design in detail. These designs take into account the suitable arrangement and hull block assembly procedure.

(ii) Determination of the 2-dimensional design which is explain by the mould line, shapes of slots and scallops, as a result examination of the cutting, welding, and block assembly process.

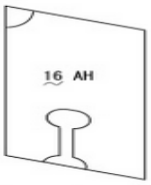


Figure 2.3: Detail design

(c) Production design

(i) To the above detailed design further information for structured manufacturing is added, and all the information about the fabrication process is listed.

(ii) The 3-dimensional design is developed taking into examination of elongation to compensate for welding shrinkage, the readiness of plate edges. This is assign to the precision guide and detail work practice.

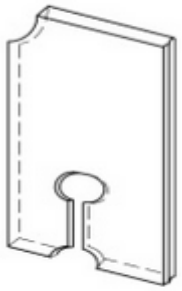
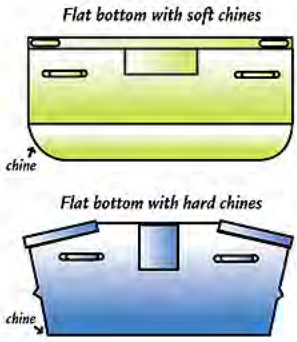
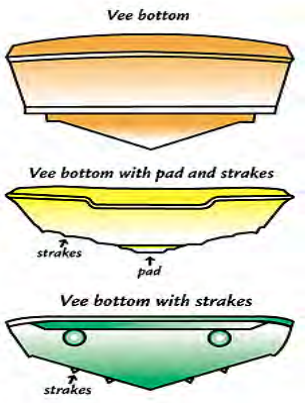


Figure 2.4: Production design

2.1.4 Boat Hull Design

Hull design is a continual research and development project. Selection of Hull design need to consider the type of water the boat to be used (Alex Zidock Jr, 2011). Table 2.1 shows types of hull design.

Table 2.1: Types of hull design

Types	Descriptions
	Flat-bottom boats • Large bottom area • Less Stable • Create rough ride • Old design
	Tri-hull, tunnel hull • Tri-hull is more stable than the "V"-bottom • Tunnel boats have been designed to trap a cushion of air beneath the hull to reduce drag on the outside hulls.
	Round-bottom hull, "V" bottoms • Common hull design • Good ride in rough water • Stable

2.1.5 Gross Tonnage Formulation (Twin Hull Vessels)

According to Coast Guard Marine Safety Center Tonnage Division (2004) the basic simplified tonnage formula for gross register tons of a twin hull vessel is :

$$GRT = \frac{(2 \times Hull\ Volume + Deckhouse\ Volume)}{100}$$

Where, Gross Tonnage Formulation (GRT), Hull Volume = S x K x L x B_1 x D, Deckhouse Volume = Ls x Bs x Ds

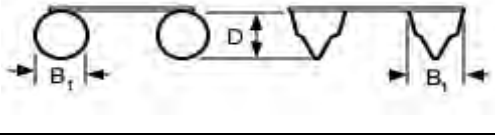


Figure 2.5: D and B_1

The shape factor (S) is as follows:

- S = 0.5 for hulls designed for sailing (finest hull form)
- S = 0.67 for powerboats, ship-shape and circular hulls
- S = 0.84 for barges and boxed-shaped hulls (fullest hull form)

Figure 2.6: shape factor (s)

The keel factor (K) is as follows:

(a) K = 1.0 for all hull configuration except those designed for sailing wherein the Overall Depth includes the keel

(b) K = 0.75 for hulls designed for sailing wherein the Overall Depth includes the keel

Figure 2.7: Keel factor (K)