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DEVELOPMENT OF AUTOMATED RIVER TRASH MANAGEMENT SYSTEM

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree In Electrical Engineering Technology (Industrial Automation And Robotics) (Hons.)

by

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I hereby, declared this report entitled "Development Of Automated River Trash Management System" is the results of my own research except as cited in references.

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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 Electrical Engineering Technology (Industrial Automation And Robotics) with Honours. The member of the supervisory is as follow:

…………………………………

(Project Supervisor)

ABSTRAK

Berdasarkan pemantauan yang dijalankan oleh Jabatan Alam Sekitar Malaysia (JAS) pada tahun 2013, 341 daripada 473 sungai di Malaysia didapati telah tercemar. Ia menyumbang kepada pelbagai jenis penyakit yang boleh menjejaskan kesihatan manusia serta semua organisma yang hidup. Tambahan pula, ia akan memberi kesan kepada industri pelancongan di negara ini. Untuk menjadikan Malaysia sebuah negara berpendapatan tinggi menjelang tahun 2020, sektor pelancongan merupakan sebahagian daripada Bidang Ekonomi Utama Negara (NKEA) dalam Rancangan Malaysia Ke-10 (2011-2015). Sistem Pengurusan Sisa Sungai Automatik digunakan untuk membersihkan sungai daripada sampah sarap. Sistem ini menggunakan tenaga solar sebagai sumber tenaga. Dengan menggunakan penderia jarak sebagai input dan Arduino Uno R3 sebagai pengawal mikro, sebuah sistem pengumpulan sisa sungai automatik telah dapat dibina. Data yang diperolehi adalah hasil daripada beberapa ujian yang dilakukan di bawah sinaran matahari. Prototaip ini dapat menyumbang idea tentang bagaimana untuk membina suatu sistem yang boleh mengurangkan pencemaran sungai. Secara realitinya, projek ini dapat membersihkan sungai dengan lebih berkesan.

ABSTRACT

Based on monitoring conducted by Department of Environment Malaysia (DOE) in 2013, 341 out of 473 rivers in Malaysia were found polluted. It contributes many type of disease which affects human being and living organism on Earth. Furthermore, it will affects tourism industry in this country. To transforms Malaysia into a high income nation by 2020, tourism sector is a portion of National Key Economic Areas (NKEA) in 10th Malaysia Plan (2011-2015). The Automated River Trash Management System is used to remove trash and debris floats on the river. This system used solar energy as its power source. By using distance sensor as an input and Arduino Uno R3 as microcontroller, an automated river trash collecting system was developed. The result of data is obtained from real test condition under the sun. This prototype may contributes some idea on how to build a system that will reduces river pollution. In real situation, this project will be able to clean our river more effectively.

DEDICATION

First of all, I would like to express my gratitude to Allah S.W.T for His blessing and guidance. He's the One who fulfill my invocation. Alhamdulillah. And then, I would like to dedicate my thesis to family. Their endless love, encouragement and supplication is the most important things happened in my life. In addition, I would like to dedicate this work to my beloved project supervisor, Ms. Intan Mastura binti Saadon. She had given a lot of guidance, encouragement, assistance and support to me in completing this project. Finally, I would like to dedicate my thesis to all lecturers and friends who gives me support and guidance in any situation.

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TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

DC	-	Direct Current
AC	-	Alternate Current
PWM	-	Pulse Width Modulation
MPPT	-	Maximum Power Point Tracking
PV	-	Photovoltaic
VMP	-	Maximum Power Voltage
IMP	-	Maximum Power Current
NKEA	-	National Key Economic Areas

CHAPTER 1

INTRODUCTION

1.0   Background Of The Study

Nowadays, most of the river is heavily polluted by trash and non-disposible waste. It contributes many type of disease which affects human being and living organism on Earth. Furthermore, it will affects tourism industry in this country. To transforms Malaysia into a high income nation by 2020, tourism sector is a portion of National Key Economic Areas (NKEA) in 10th Malaysia Plan (2011-2015). Therefore, an Automated River Trash Management System is used to reduce river pollution. In Europe, they have developed this system since a long time ago. However, in Malaysia, it is a new system. Moreover, this prototype may contributes some idea on how to build a system that will reduces river pollution.

Basically, this system is solar powered. Solar energy produced by the sun will be absorbed by module and change into DC output. When the system is ON, the water pump will pumps out water from the river itself with high velocity to rotate the water mill. After that, the water mill will moves the conveyor to pick up trash and rubbish floated on river surface. And then, all trash and rubbish will be stored inside an automated dumpster barge. If distance sensor detects dumpster barge is full, the system will automatically shuts the water pump and stops the conveyor from operate. In real situation, this project will be able to clean the river more effectively.

1.1 Problem Statement

In recent times, there are many people who tends to litter into the river. Based on monitoring conducted by Department of Environment Malaysia (DOE) in 2013, 341 out of 473 rivers were found polluted, although there is a law which protects cleanliness of the river. Furthermore, the trash that floats on a river is difficult to clean by human. Some of them spreads throughout the river. It may affects the ecosystem of nature and living organism in the river. This waste contains various of disease-causing organisms including E-coli which can leads to many health issue ie. diarrhea and abdominal pain. Moreover, it may indicates bad image to tourist from oversea that came to Malaysia.

To prevent this problem, a prototype of Automated River Trash Management System is build. In Europe, this project have been developed. However, the water pump is controlled manually by human. Therefore, a new system which control the water pump automatically is designed. The water pump will stop automatically when the dumpster barge is full. Arduino Uno R3 is used as microcontroller for the system.

1.2 Objective Of The Study

The objective of this project are:

1) To design and develop a solar powered water pump system.

2) To develop a prototype of river trash collecting system.

3) To develop an automated trash collecting system.

1.3   Work Scope Of The Study

This project will be focused on the way to sets maximum height of trash inside the dumpster barge and how the system stops water pump automatically when the dumpster barge is full. Moreover, programming codes for Arduino Uno R3 microcontroller and distance sensor should be considered. However, the cost, mass production and marketing of this project will be not covered in this task.

To design and develop a solar powered water pump system, determine the capacity of battery and module sizing of solar system components. And then, design a prototype of river trash collecting system using SketchUp and development of prototype using water wheel, conveyor belt and dumpster barge. By using distance sensor as an input and Arduino Uno R3 as microcontroller, the automated river trash collecting system can be developed.

1.4   Process Flow of Automated River Trash Management System

Figure 1.1 depicts the process flow of Automated River Trash Management System. At first, battery is fully charged by PWM charger controller, provided by PV array. And then, water pump is activated when ON button is pushed. The water jet produced by water pump will flow through the water wheel, causes it to rotate and runs the conveyor belt. The water current produced by the water wheel rotation attracts the trash to conveyor belt. After that, the conveyor belt will carries the trash and collects it into dumpster barge. When the dumpster barge is fully-loaded, the water will be deactivated automatically. At this condition, the water wheel and conveyor belt will stop from operates.

```
                    ┌─────────┐
                    │  Start  │
                    └─────────┘
                         │
                         ▼
              ┌────────────────────────┐
              │ Battery is fully charged │
              └────────────────────────┘
                         │
                         ▼
              ┌────────────────────────┐
              │ Water pump is activated │
              └────────────────────────┘
                         │
                         ▼
           ┌──────────────────────────────┐
           │ Water flow through water wheel │
           │   and run the conveyor belt    │
           └──────────────────────────────┘
                         │
                         ▼
           ┌──────────────────────────────┐
           │ Current flow produced attract  │
           │   the trash to conveyor belt   │
           └──────────────────────────────┘
                         │
                         ▼
           ┌──────────────────────────────┐
           │    The trash was carried by    │
           │ conveyor belt and collected    │
           │    into the dumpster barge     │
           └──────────────────────────────┘
                         │
                         ▼
           ┌──────────────────────────────┐
           │     The motor pump will        │
           │ stop when the dumpster         │
           │       barge is full.           │
           └──────────────────────────────┘
                         │
                         ▼
           ┌──────────────────────────────┐
           │    The conveyor belt will      │
           │  stop when the motor           │
           │    pump is deactivated         │
           └──────────────────────────────┘
                         │
                         ▼
                    ┌─────────┐
                    │   End   │
                    └─────────┘
```
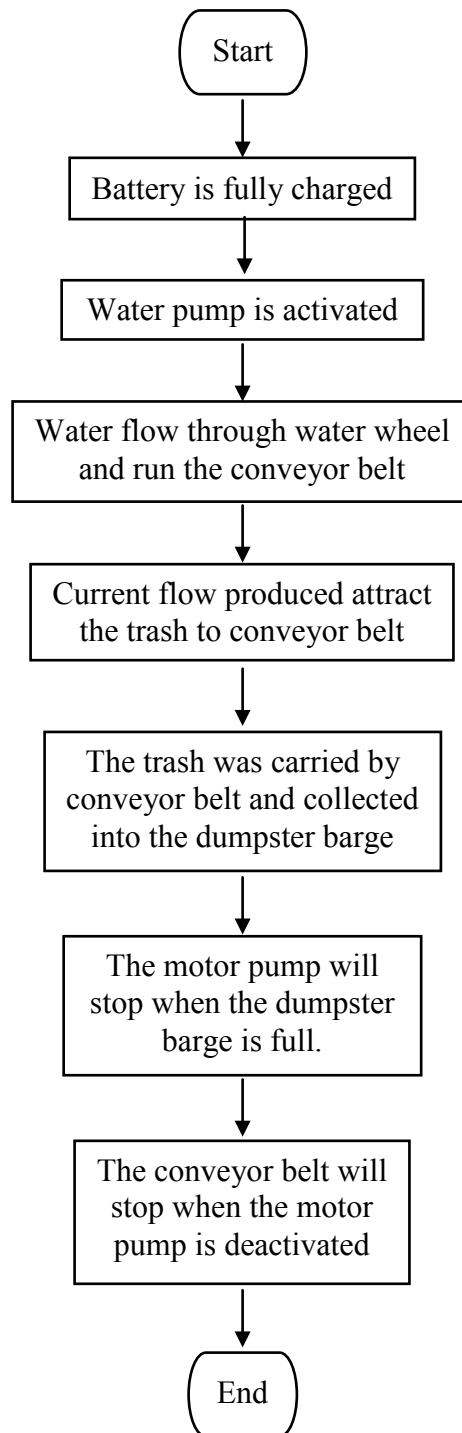
Figure 1.1: Process Flow of Automated River Trash Management System

1.5   Contribution

As a result, a solar-powered water pump was designed and developed. Therefore, human don't have to relies heavily on non- renewable source such as diesel and petrol. The system usage may conserves this energy source for future generation. Moreover, a prototype of river trash collecting system was developed.

This prototype will contributes idea to others in developing green technology product and awareness about the importance of river conservation for our nature. Furthermore, a fully-automated trash collecting system will be created. The prototype applicate modern and advanced technology in its system. In this project, most of theorytical knowledge and engineering technology will be applied. Furthermore, this machine can do what the human can't. It will cleans the river better and faster than human itself. Hopefully, this project will successfully achieved its goals and vision to makes the river cleaner and better for the sake of the future.

1.6   Thesis Organisation

The thesis of this project consist of five chapter,

Chapter 1: Introduction includes background, problem statement, objective, work scope, process flow, contribution and thesis organization of the study.

Chapter 2: Literature review includes water pollution, photovoltaic system (PV) and its operation, type of solar cell, stand-alone photovoltaic system, wiring connection of PV module, principle of battery, charger controller, DC to AC inverter, AC water pump, relay, Arduino Uno R3 microcontroller and distance sensor used in this project.

Chapter 3: Methodology includes flow chart, concept design, photovoltaic solar system flow, block diagram, formula to determination of load, PV module sizing, battery sizing, equipment and material, specification of solar module, solar charger controller, rechargeable sealed lead acid battery, water pump, Arduino Uno, relay and distance sensor, measuring equipment, work implementation and step in making a prototype model.

Chapter 4: Discussion and result of the project.

Chapter 5: Conclusion and recommendation of the project.

CHAPTER 2

LITERATURE REVIEW

2.0   Introduction

This project is to construct a prototype model of the Automated River Trash Management System which is a floating mobile plant specializing in the clearing and disposal of trash and debris on the surface of inland waterways such as canals and rivers and water catchment areas such as lakes and reservoirs.

This literature review is a combination of information gathered from various sources to form the basis for the development of Automated River Trash Management System. The information is collected from journal, website, book and research article to discuss the theory, basic principle and general character in the development of this project which uses the Photovoltaic system, Arduino Uno R3 Microcontroller, battery, distance sensor, DC relay and DC to AC inverter and AC water pump.

2.1   Water Pollution

Water is a vital element for the survival of all living organism on Earth. If water cleanliness is not sustained, all living things on Earth particularly human being would be facing a major consumption and health crisis. Today, water pollution is a major issue on all parts of the world particularly the industrialized nation. Water pollution is chiefly cause by waste from agriculture, domestic and industrial activities (Ramandeep Singh Gambhin, *et al*, 2012).

The increase in the manufacturing sector result in the increase of air, land and water pollution which is seriously causing health problem to all living things throughout the world. The increase cases of water pollution chiefly contributed by industrial waste in our water catchment areas which if not removed, would contribute substantially to human sickness and death. This industrial waste include packaging plastic bags and paper material. Wastes polluting our inland waterways include offcut and rotten timber material which if not removed would obstruct the movement of boats and rivercrafts (Alexandra E. V. Evans, *et al*, 2012).