



Faculty of Electrical and Electronic Engineering Technology



**DEVELOPMENT OF RIVER CLEANING ROBOT USING IOT
TECHNOLOGY**

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Bachelor of Electronics Engineering Technology (Telecommunications) with Honours

2023

DEVELOPMENT OF RIVER CLEANING ROBOT USING IOT TECHNOLOGY

NUR SYAIDATINA FARAHIN BINTI ANUAR

**A project report submitted
in partial fulfillment of the requirements for the degree of
Bachelor of Electronics Engineering Technology (Telecommunications) with Honours**



Faculty of Electrical and Electronic Engineering Technology

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DECLARATION

I declare that this project report entitled “Development of River Cleaning Robot Using IOT Technology” is the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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APPROVAL

I hereby declare that I have checked this project report and in my opinion, this project report is adequate in terms of scope and quality for the award of the degree of Bachelor of Electronics Engineering Technology (Telecommunications) with Honours. The member of the supervisory is as follow:

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Date :

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DEDICATION

Specially dedicated to my supportive and lovely parents, Mr Anuar bin Kamarudin, and Mrs Roziah binti Muhammad Ramly, siblings and friends that always gave me full support, encouragement, and advice throughout this project and throughout my degree journey.



ABSTRACT

In our country, it is getting increasingly difficult to obtain clean drinking water. Human survival and the functioning of the global ecosystem depend on the availability of potable water. Aquaculture, fishing, industry, and transportation are all made possible by the availability of water. One of the many things that contribute to river pollution is the dumping of rubbish from residential areas near rivers, lakes, and the ocean. Eventually, the water supply will be polluted because of the unregulated dumping of debris, such as garbage, and oil. A garbage collecting system, a robot for cleaning up rubbish from rivers, channels, and lakes, will be created experimentally for real-world application, and this project aims to build and model such a system. A robot that can be operated through an Android app has been developed for the purpose of cleaning water bodies. The NODE MCU-ESP8266 micro-controller and the accompanying Android application have been programmed in the Arduino IDE and communicate with one another using the micro-Wi-Fi controller's module. Microcontrollers can function on small amount of power. A microprocessor only requires 3.3V of power, while a motor needs 12V. Powering the motor is a microcontroller board motor driver circuit. The motor driver circuit boosts Node-MCU 3V to 12V to power the motor. The motor driver circuit spins the two propellers. An Android IoT app may adjust propeller direction. The robot will collect and measure water quality using the TDS sensor on ESP32 and the ThingSpeak app. This idea proposes a low-cost, safe, and successful floating garbage disposal technology with low maintenance, easy management, and a monitoring system to reduce river pollution.

ABSTRAK

Di negara kita, semakin sukar untuk mendapatkan air minuman bersih. Kelangsungan hidup manusia dan fungsi ekosistem global bergantung kepada ketersediaan air minuman. Akuakultur, memancing, industri, dan pengangkutan semuanya dimungkinkan dengan adanya air. Salah satu perkara yang menyumbang kepada pencemaran sungai ialah pembuangan sampah dari kawasan kediaman berhampiran sungai, tasik dan lautan. Akhirnya, bekalan air akan tercemar kerana pembuangan serpihan yang tidak terkawal, seperti sampah, minyak, dan najis. Objektif projek ini adalah untuk mereka bentuk dan mensimulasikan sistem pengumpulan sampah yang merupakan robot untuk membersihkan sisa dari sungai, saluran, dan tasik yang akan terus dibangunkan secara eksperimen untuk kegunaan dunia sebenar. Untuk membersihkan badan air, robot yang boleh dikawal oleh aplikasi android telah dicipta. Persekitaran pengaturcaraan Arduino IDE dan modul Wi-Fi dalam pengawal mikro telah digunakan untuk menyalurkan aplikasi NODE MCU-ESP8266 dan Android. Voltan dan arus tahap rendah digunakan oleh pengawal mikro untuk beroperasi. Walaupun motor kerja hanya memerlukan 12V, mikropengawal hanya memerlukan 3.3V untuk beroperasi. Litar pemandu motor disambungkan ke papan mikropengawal untuk menggerakkan motor. Litar pemandu motor membantu memandu motor dengan meningkatkan 3V dari Node-MCU hingga 12V. Kedua-dua kipas yang disambungkan ke litar pemandu motor digerakkan oleh mereka. Arah kipas boleh ditukar dengan menggunakan aplikasi Android yang dibina untuk Internet of Things. Di samping itu, sensor TDS akan dilampirkan pada ESP32 dan disambungkan ke aplikasi ThingSpeak, yang membolehkan robot mengumpul dan mengukur kualiti air. Dengan idea ini, kaedah pelupusan sisa terapung yang kos rendah, selamat dan berkesan, dengan kos penyelenggaraan yang rendah, pengurusan mudah, dan sistem pemantauan, dibentangkan sebagai penyelesaian yang berdaya maju terhadap pencemaran sungai.

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CHAPTER 1

INTRODUCTION

1.1 Background

Water is a vital resource for human survival on Earth; it covers more than 70% of its surface, but just 3% of that is potable. All living organisms on the Earth need to survive. Seawater makes up most of the world's water, yet it can't be utilized without human intervention. The sole source of freshwater that can be used for drinking is groundwater. However, provided it is of high quality, the proportion of its volume is sufficient to supply the needs of living creatures [1]. Aside from that, water is known as a universal solvent since it can dissolve a wide range of compounds, including toxic industrial waste, sewage, chemicals, and so on. Human activities have entirely poisoned the water as a result. According to a WWF-Malaysia report, river pollution is one of the most critical hazards to rivers. A reduction in water quality is a clear indicator of river basin environmental health. River contamination has far-reaching consequences. In humans, it can cause various water-borne severe infections, including diarrhea, trachoma, and hepatitis. According to the WHO, water-borne infections account for 22% of all infectious diseases [2].

Furthermore, in 2017, the Deputy Minister of Energy, Green Technology, and water declared numerous rivers in West Malaysia "dead" due to pollution, resulting in a decrease in dissolved oxygen, resulting in critical conditions for fish and other species in those rivers [3]. As a result, a solution that would at the very least enhance its state, such as a river cleaning robot, is essential.

1.2 Problem Statement

One of the challenges that can affect rivers is water pollution or the introduction of foreign substances into a body of water. The dumping of sewage, rubbish, and liquid waste from households and the chemical industry is the primary water contamination source. Many aquatic life species are on the verge of extinction as a result of this. Without the help of technology, sanitation staff and volunteers are now cleaning the lake. This initiative aims to provide an alternative approach by cleaning up garbage with robotic technology. Besides that, some communities dumping garbage into nearby rivers have had long-term negative impacts on both the species and habitats of the area and the local environment. With the help of the TDS sensor, the data from the ThingSpeak application can be used to evaluate the performance quality of the river.

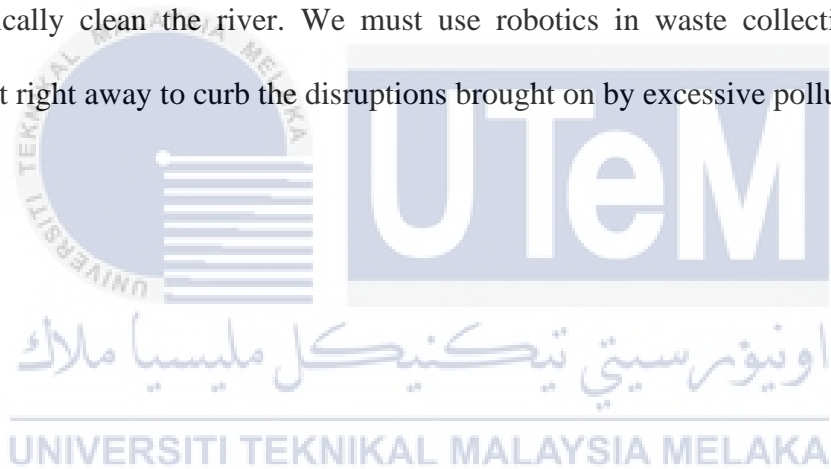
1.3 Project Objective

The objectives of this project are:

- a) To design and prototype a trash collection system that will be further refined experimentally for usage in the real world and used to clean up garbage from rivers
- b) To creating a Wi-Fi connection between a Blynk app and a Arduino Uno is required for system integration.
- c) The collected data from the ThingSpeak app will be used to assess the water's performance quality.

1.4 Scope of Project

The main purpose of this study is to make a cost-effective remote-controlled robot with advanced control characteristics that can assist humans in eliminating floating water waste easily and safely, thereby making work easier and more environmentally friendly. This project is the integration of the software component and hardware. For the software part, the circuit design was created with Proteus software to get a simulation before constructing the mechanism, and Arduino Compiler was used to write the necessary coding for the river cleaning robot on the microcontroller. A microcontroller based IoT application running on Android is used to operate this robot. This robot helps the staff and volunteers thoroughly and hygienically clean the river. We must use robotics in waste collection and green management right away to curb the disruptions brought on by excessive pollution.



CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter provides background research and a literature review throughout the project, with articles, book reviews, and journals as sources. This study will elaborate on the issues that have been raised in relation to the river cleaning machine. River pollution can be solved with the use of a river cleaning robot. With the help of a literature study and project-related assessment, this section will go into further detail, making it easier to understand the entire project.

2.2 What exactly is Water Pollution?

Water is one of the essential natural resources given to humans. Rivers, on the other hand, are not immune to pollution. Rivers are divided into three categories based on their pollution level: low, medium, and high. The rapid expansion of civilization and numerous human activities have accelerated pollution and the deterioration of the water supply. Aside from that, the pollution of freshwater resources caused by wastewater discharge and garbage disposal is the root cause of freshwater scarcity. Water is one of the essential natural resources given to humans. Rivers, on the other hand, are not immune to pollution. Rivers are divided into three categories based on their pollution level: low, medium, and high. The rapid expansion of civilization and numerous human activities have accelerated pollution and the deterioration of the water supply. Aside from that, the pollution of freshwater resources caused by wastewater discharge and garbage disposal is the root cause of freshwater scarcity. As well as natural causes like acid rain. Water pollution happens when

organic and inorganic compounds and biological compounds build up to dangerous levels and contaminate water.

2.3 Factor and effect of Water Pollution

Water pollution is widely regarded as the world's leading cause of death and disease caused by human activity. Water pollution is caused by various chemicals, microorganisms, and physical factors. Both organic and inorganic compounds can be contaminated. High temperatures can also cause water pollution. Power plants and industrial enterprises that use water as a coolant are typically the sources of heat pollution [4]. Rising water temperatures reduce oxygen levels, kill fish, alter the food chain, reduce biological diversity, and promote the invasion of new thermophilic species.

Furthermore, sewage disposal is one of the sources of water pollution. Sewage disposal pollutes the public's immediate environment and causes water-borne diseases such as diarrhea, which killing 525,000 children under the age of five each year [5]. Sewage comprises a wide range of compounds, including pharmaceutical drugs, paper, plastic, and other contaminants dumped into toilets. When humans become ill with a virus, the pathogen is spread throughout the environment by the sewage they produce. Diseases such as hepatitis, typhoid, and cholera can spread through waterways [6]. Farmers' chemical fertilizers feed the soil, which then flows into rivers and the sea, enhancing the effect of sewage fertilization. Combinations of sewage and fertilizers can cause a significant increase in algae or plankton growth, destroying vast areas of oceans, lakes, and rivers. These toxic algae flowers are known as. It is hazardous because it depletes the oxygen in the water, kills other forms of life, and creates a "dead zone." [7].

Lastly, plastics and garbage are significant contributors to global water pollution. Every year, 1.4 billion tons of waste are produced [7]. Plastic accounts for 10% of this annual

waste. Experts estimate that 4.8–12.7 million tons of waste enter the ocean each year due to the widespread use of plastics. The plastic is lightweight and floats effortlessly, allowing it to travel long distances. Because most plastics are non-biodegradable (they do not decompose naturally in ecosystems), items like the tops of plastic bottles can linger in the ocean for a long time. While not as dangerous as toxic chemicals, Plastics are still a significant threat to seabirds, fish, and other marine species. Plastic fishing lines, for example, can suffocate or strangle fish. As a result, the UN estimates that plastic debris in the oceans kills over a million seabirds each year. Plastic debris is also to blame for the deaths of over 100,000 marine mammals each year [8].

2.4 River Water Pollution in Malaysia

The problem of river pollution in Malaysia is no longer minor. It must be stopped and addressed early so that it does not worsen and harm the ecosystem. The rivers listed below have experienced water pollution in Malaysia.

Plastic, garbage, and heavy metal are released into the aquatic environment due to a variety of human-made activities, including chemical manufacturing, mining, municipal effluents, and other human-made activities. Chemical manufacturing, municipal effluents, and other human activities along the Perak River have all contributed to the degradation of the heavy metal content of this water source [9].



Figure 2.1 Condition of Perak River [10]

The Klang River has become a critical resource because of river pollution and ineffective water management. Industrial discharge, inappropriate sewage treatment, residential discharge, land development, and soil erosion are significant sources of pollution in the Klang River Basin.



Figure 2.2 A solid waste wall piled up in the Klang River [11]

The river water quality and during the Movement Control Order (MCO) in Malaysia. Over the years, river pollution has increased, and the number of rivers has also decreased as most of the rivers are polluted. Most of the river pollution is caused by industrial factories, residential areas, farms, and agriculture.

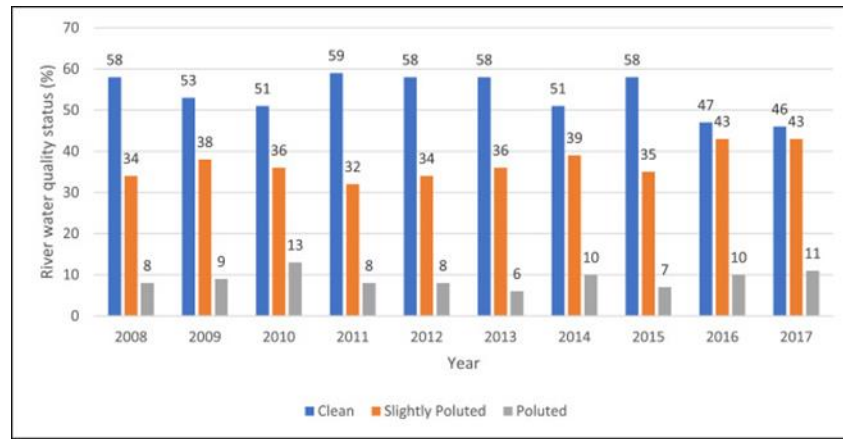


Figure 2.3 River water quality status (%) vs Year [10]

Based on Figure 2.4 below, the research carried out has shown that the highest contribution is from suspended solids load from piggery.

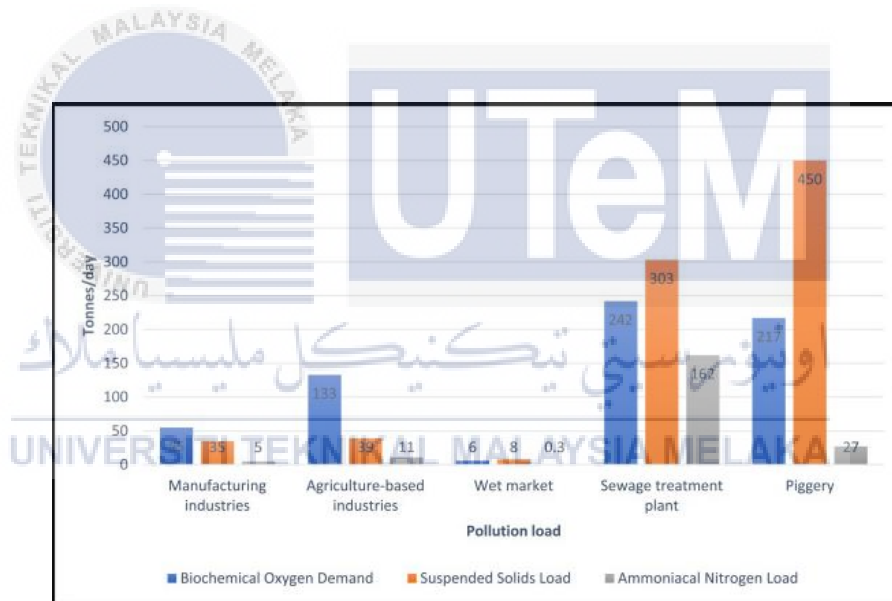


Figure 2.4 Tons/day vs Pollution Load

The rate of pollution that is increasing each year is alarming on the ecosystem. Most countries are rich in aquatic ecosystems where now, it is starting to deplete with time [11]. Water supply is needed every day in Malaysia as well as every other country. Locals still face water issues from time to time where with pollution it disrupts the supply and decreases the quality of drinking water.

2.5 River Water Pollution in Malacca River

Melaka's water catchment includes River Putat, Cheng, Durian Tunggal, Tampin, and Batang Melaka. Because of water quality issues such as fish fatalities, foul-smelling rivers, and a lot of waste, Sungai Melaka was chosen to host the river cleaning robot. As evidenced by fish deaths and river erosion, rivers have been overused as a result of fast expansion [12]. Rapid expansion can also pollute river water, causing the spread of infectious illnesses, the loss of aquatic species, the degradation of landscapes, the production of foul odors, and the disturbance of human engagement with the environment, such as through recreational activities. Large-scale operations in the Melaka River have resulted in water contamination and deterioration of river water quality [12]. At the mouth of the Melaka River, a number of fish died.

The safety of drinking water is crucial as water is drunk daily. One of the ways to ensure that the water resources are well taken care of is to implement water related policies and programs for awareness also to teach people to use water efficiently to avoid undersupply and wastage [11].

2.6 Health impact of river water pollution in Malaysia

The Department of Environment (DOE) is the person in-charge of monitoring the quality of the river [13]. Water pollution affects consumers' health which will also cause rage among people as well as higher expenditure in purchasing filters. Rage from the infectious diseases that will occur due to unclean water. As the country grows, the expectation of services as well as basic needs such as water has to be improved.

In Segamat, a study has shown that the river has been polluted due to the palm oil plantation and the lack of quality of water during the dry season. It stated that contaminated