

AQUATIC GARBAGE MANAGEMENT SYSTEM

Submitted in partial fulfillment of the requirements for the award of Bachelor
of Engineering degree in ELECTRONICS AND COMMUNICATION ENGINEERING

by

A.JAYANTH VARMA(39130184)

G.V.V.PRASAD(39130143)



DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING SCHOOL OF ELECTRICAL AND ELECTRONICS

SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

Accredited with Grade "A" by NAAC

JEPPIAARNAGAR, RAJIV GANDHI SALAI, CHENNAI-600119

APRIL-2023



SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY (
DEEMED TO BE UNIVERSITY)

Accredited with "A" grade by NAAC.

Jeppiaar Nagar, Rajiv Gandhi Salai, Chennai-600119 www.sathyabama.ac.in

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

ON A FIDECERTIFICATE

This is to certify that this Project Report is the bonafide work of A. JAYANTH VARMA (39130184) and G.V.V.PRASAD (39130143) who carried out the project entitled "**AQUATIC GARBAGE MANAGEMENT SYSTEM**" under our supervision from July 2022 to April 2023.

Internal Guide

Dr. R. PANDIAN, M.E., Ph.D.

Associate Professor, Department of ECE

Head of the Department

Dr. T. RAVI, M.E., Ph.D.

Submitted for Vivavoce Examination held on 19.04.2023

Internal Examiner

External Examiner

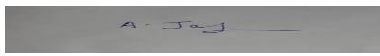
DECLARATION

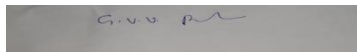
We **A. JAYANTH VARMA (39130184)** and **G.V.V. PRASAD (39130143)** hereby declare that the Project Report entitled "**AQUATIC GARBAGE MANAGEMENT SYSTEM**" done by us under the guidance of **Dr. R. PANDIAN, M.E., Ph.D.** is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering degree in Electronics and Communication Engineering.

DATE: 15.04.2023

PLACE: CHENNAI

SIGNATURE OF THE CANDIDATE(S)

1. 

2. 

ACKNOWLEDGEMENT

We are pleased to acknowledge our sincere thanks to **Board of Management of SATHYABAMA** for their kind encouragement in doing this project and for completing it successfully. We are grateful to them.

We convey our thanks to **Dr. N. M. NANDHITHA, M.E., Ph.D.**, Professor & Dean, School of Electrical and Electronics and **Dr. T. RAVI, Ph.D.**, Professor & Head, **Department of Electronics and Communication Engineering** for providing us necessary support and details at the right time during the progressive reviews.

We would like to express our sincere and deep sense of gratitude to our **Project Guide**

Dr. R. PANDIAN, M.E., Ph.D., for her valuable guidance, suggestions, and constant encouragement paved the way for the successful completion of our project work.

We wish to express our thanks to all Teaching and Non-teaching staff members of the **Department of Electronics and Communication Engineering** who were helpful in many ways for the completion of the project.

We express our gratitude to our parents for their constant encouragement and support for the completion of the project.

Abstract

An Aquatic Garbage Management System is a proposed solution to the problem of plastic and other waste materials in water bodies such as rivers, lakes, and oceans. The system involves the use of floating barriers and a collection mechanism to capture and remove garbage from the water surface. The collected waste is then transported to a processing facility for proper disposal. The design of the system takes into account the environmental impact of the garbage collection process, ensuring that the barriers used do not harm aquatic life or disrupt the natural flow of water. The system is also designed to be cost-effective and easy to maintain. The proposed Aquatic Garbage Management System has the potential to significantly reduce the amount of waste in water bodies, which can have a positive impact

on the environment and the organisms that depend on these water sources. The system can be implemented in different bodies of water around the world, providing a scalable solution to the problem of aquatic pollution. Sea waste management is one of the serious challenges for future generations. The main reason behind sea pollution is due to Rainwater and Wind. They carry waste through streams, rivers, and drains. But we human beings are the main pollutant responsible for this aquatic damage. The Ocean Cleanup was the first scalable solution to effectively intercept plastic in rivers before it reaches the Ocean. FRED is a solar-powered semi-autonomous marine robot capable of collecting marine plastic pollution. Proper garbage collection and disposal facilitates improved recycling. On-time data log can be maintained for a future brief study. Aquatic garbage collection plays an important role in realizing the environmental impacts. This awareness and a constrained set of rules allows us to take part in social awareness for upcoming generations. The ability to walk to a clean environment will make us lead an unpolluted life.

TABLE OF CONTENTS

Chapter No	TITLE	Page No
	ABSTRACT	v
	TABLE OF CONTENTS	vi
	LIST OF FIGURES	ix
1.	INTRODUCTION	1
	1.1 Outline	1
	1.2 Blynk	2
	1.3 IoT	3
	1.4 General	4
	1.4.1 Plastic Pollution Facts	5
	1.4.2 Plastic Products	6
	1.5 Objectives	7
	1.6 Project Goals	8
	1.7 Scope	9
	1.8 Problem Statement	10
	1.9 Working Methodology	11
2	LITERATURE SURVEY	13
	2.1 General	13
	2.2 Review of Literature Survey	13

3	METHODOLOGY	18
	3.1 BLYNK	18
	3.1.1Introduction	18
	3.1.2History	18
	3.1.3DesignPhilosophy&Feature	19
	3.1.4SyntaxandSemantics	20
	3.2StatementsandControlFlow	21
	3.2.1Expressions	21
	3.2.2Methods	22
	3.2.3WorkingProcess	23
	3.3 Internetofthings	24
	3.4 ArduinoIDE	24
	3.5ExistingSystem	26
	3.5.1Drawbacks	27
	3.6ProposedSystem	27
	3.6.1DataAcquisition	28
	3.6.2DataAnalysis	28
	3.6.3Advantages	29
4	HARDWAREANDSOFTWAREDESCRIPTION	31
	4.1NodeMCUESP8266WI-FIDevelopmentBoard	31
	4.2SingleChannelRelayModulewithOpto-Couper	32

	4.3AsideShiftDCMotor	34
	4.4 Proximity MetalDetector	35
	4.5SR04ULTrasonicModule	37
	4.6SoftwareList	38
	4.6.1ArduinoIDE	38
	4.6.2Blynk	40
5	RESULTSANDANALYSIS	44
	5.1Result	44
	5.2LimitationsoftheProject	46
6	CONCLUSIONANDFUTURE WORK	48
	6.1Conclusion	49
	6.2Futurework	49
	REFERENCES	50

LISTOFFIGURES

1.3	Processof IOT	02
1.4	AquaticGarbageandDebris	04
1.4	Marineplasticwaste	05
1.4.2	PlasticGeyerproduction	07
1.8	FredRobot	11
4.1	NodeMCUESP8266Wi-FiDevelopmentBoard	31
4.2	SinglechannelRelayModulewithopto-coupler	33
4.3	AsideshaftDCmoto	35
4.4	Proximitysensor NPNtype	36
4.5	UltrasonicModule	37
4.6.1	ArduinoIDE	39
4.6.2	BlynkApplicationsupportandInterface	41

CHAPTER – I

INTRODUCTION

1.1 OUTLINE

An outline for an aquatic garbage management system would typically include the following components. Assessment of the problem: This involves identifying the types of debris present in the water, the quantity, and the distribution. This can be done through visual surveys, remote sensing, and other methods. Design and planning: Based on the assessment, a plan is developed to address the problem. This includes identifying the most appropriate tools and technologies for the cleanup, setting

goals and targets, and determining the logistics of the operation. Implementation: The plan is put into action, with crews deploying tools such as skimmer boats, trash barriers, or other technologies to collect debris from the water.

Sorting and processing: The collected debris is then sorted to separate recyclable materials from non-recyclable waste. The recyclable materials are then processed for reuse, while the non-recyclable waste is disposed of in an environmentally

friendly manner. Monitoring and evaluation: The effectiveness of the cleanup effort is evaluated to determine whether the goals and targets were met. This may involve additional surveys to assess the extent of the cleanup, as well as ongoing monitoring to ensure that debris does not accumulate again in the area.

Continuous improvement: Based on the evaluation, adjustments may be made to the system to improve its effectiveness. This could involve exploring new technologies, changing cleanup strategies, or modifying the design of the system.

Overall, an effective aquatic garbage management system requires careful planning, implementation, and ongoing monitoring and evaluation to ensure that it is achieving its objectives in a sustainable and efficient way.

1.2 BLYNK

Blynk is a platform for building and managing Internet of Things (IoT) projects. It allows users to create custom mobile apps to control and monitor IoT devices, without

the need for extensive programming skills. Blynk provides a simple drag-and-drop interface for creating user interfaces, and supports a wider range of hardware platforms, including Arduino, Raspberry Pi, ESP8266, and others. With Blynk, users can create custom interfaces for controlling and monitoring their IoT devices, such as sensors, switches, and actuators. The platform provides a wide range of widgets, including buttons, sliders, graphs, and gauges, which can be easily added to the mobile app interface. Blynk also provides cloud-based storage and analytics for data collected from IoT devices, making it easy to track and analyze performance over time. Blynk is designed to be flexible and customizable, with support for a wide range of hardware platforms and programming languages. It also provides a library of pre-built templates and examples to help users get started quickly, as well as an active community forum for sharing ideas and troubleshooting issues. Overall, Blynk provides a user-friendly platform for building and managing IoT projects, making it accessible to a wider range of users, including hobbyists, students, and professionals.

1.3 INTERNET OF THINGS

IoT stands for the "Internet of Things." It is a network of physical objects, devices, vehicles, buildings, and other items that are embedded with sensors, software, and network connectivity, allowing them to collect and exchange data over the internet. The data collected by IoT devices can be analyzed to improve efficiency, reduce costs, and create new opportunities for innovation. Some examples of IoT devices include smart thermostats, wearable fitness trackers, home security systems, and self-driving cars. IoT is a rapidly growing field with significant potential to transform industries and improve people's lives.

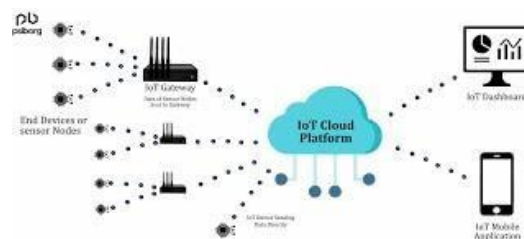


Fig1.3: Process of IoT

From Fig 1.3 IoT stands for Internet of Things, which refers to the connection of everyday physical objects to the internet, allowing them to send and receive data. These objects can include anything from home appliances, wearable devices, and vehicles to industrial machinery, healthcare equipment, and smart city infrastructure. The concept of IoT is based on the idea of embedding sensors, actuators, and other electronic components into objects, enabling them to collect and transmit data to other devices or systems. This data can then be analyzed and used to make informed decisions, automate processes, and improve efficiency. One of the key benefits of IoT is its ability to create smart environments that are more responsive and efficient. For example, IoT-enabled homes can automatically adjust temperature and lighting based on occupancy and weather conditions, while IoT-enabled factories can optimize production processes and reduce downtime by predicting equipment failures before they occur.

IoT also has the potential to transform industries such as healthcare, transportation, and agriculture by enabling real-time monitoring and analysis of data. For example, IoT-enabled medical devices can monitor patient health remotely, while IoT-enabled vehicles can improve traffic flow and reduce congestion. Overall, IoT is a rapidly growing field that has the potential to revolutionize the way we live, work, and interact with the world around us. The features of IoT can vary depending on the application and implementation. However, here are some of the common features of IoT:

- Connectivity: IoT devices are connected to the internet, allowing them to send and receive data in real-time.
- Sensors and actuators: IoT devices are equipped with sensors to detect changes in the environment, and actuators to respond to those changes.
- Cloud computing: IoT devices can store and process data in the cloud, making it accessible from anywhere with an internet connection.
- Data analytics: IoT devices generate large amounts of data that can be analyzed to extract valuable insights and inform decision-making.

1.4 GENERAL

Ocean plastic can persist in sea surface waters, eventually accumulating in remote areas of the world's oceans. Here we characterize and quantify a major ocean plastic

accumulation zone formed in subtropical waters between California and Hawaii. The Great Pacific Garbage Patch (GPGP). Our model, calibrated with data from multi-vessel and aircraft surveys, predicted at least 79 (45–129) thousand tons of ocean plastic floating inside an area of 1.6 million km² which is four to sixteen times higher than previously reported. We explain this difference through the use of more robust methods to quantify larger debris. Over three-quarters of the GPGP mass was carried by debris larger than 5 cm and at least 46% was comprised of fishing nets. Microplastics accounted for 8% of the total mass but 94% of the estimated 1.8 (1.1–3.6) trillion pieces floating in the area. Plastic collected during our study has specific characteristics such as a small surface-to-volume ratio, indicating that only certain types of debris have the capacity to persist and accumulate at the surface of the GPGP. Finally, our results suggest that ocean plastic pollution within the GPGP is increasing exponentially and at a faster rate than in surrounding waters.



Fig 1.4 Aquatic Garbage and Debris

As shown in Fig 1.4 Plastic accumulating in our oceans and on our beaches has become a global crisis. Billions of pounds of plastic can be found in swirling convergences that make up about 40 percent of the world's ocean surfaces. At

current rates plastic is expected to outweigh all the fish in the sea by 2050. Plastic pollution has a direct and deadly effect on wildlife. Thousands of seabirds and sea turtles, seals, and other marine mammals are killed each year after ingesting plastic or getting entangled in it. Endangered wildlife like Hawaiian monk seals and Pacific loggerhead sea turtles are among nearly 700 species that eat and get caught in plastic litter. It's time to get at the root of this ocean crisis. The Centre has petitioned the Environmental Protection Agency to begin regulating plastics as a pollutant and is working to stop plastic pollution at the source before it ever has a chance to reach the ocean. We're surrounded by plastic. It's in the single use packaging we discard, the consumer goods that fill our stores, and in our clothing, which sheds microplastic fibers in the wash.



Fig1.4 Marine Plastic Waste

From Fig 1.4 in the first decade of this century, we made more plastic than all the plastic in history up to the year 2000. And every year, billions of pounds of more plastic end up in the world's oceans. Studies estimate there are now 15–51 trillion pieces of plastic in the world's oceans from the equator to the poles, from Arctic ice sheets to the seafloor. We need urgent action to address the global plastic pollution epidemic. Unfortunately, plastic is so durable that the EPA reports that “every bit of plastic ever made still exists.” All five of the Earth's major oceans are inundated

with plastic pollution. The largest one has been dubbed the Great Pacific Garbage Patch. The Great Pacific Garbage Patch is a gyre of plastic debris in the north-central Pacific Ocean. It's the largest accumulation of plastic in the world. Just how big is it? Using the map below, click and drag around the garbage patch shown in red. If you're on mobile, zoom in and use two fingers to drag more easily. The Centre for Biological Diversity is tackling this problem on multiple fronts. We've sued companies that turn plastic into consumer goods to better control their runoff. We're challenging the permits needed to build those new ethane cracker plants and organizing grassroots resistance to stop them. There's still a lot of work to do, but we're committed to the long struggle to reduce ocean plastic pollution.

1.4.1 Plastic Pollution Facts

As new research on the production, life cycle, and impacts of plastic debris become available, Surfrider Foundation continues to assemble this list of credible plastic pollution statistics and figures, sourced mainly from peer-reviewed, published studies. Though many of the figures are estimates, their approved calculation methodologies are provided in the cited literature. The more we learn, the more it becomes clear that the issue of marine and coastal plastic pollution is severe and widespread. Fortunately, the education and engagement of passionate coastal defenders, citizens, and community members can help stop the flow of plastic at the source, by switching to reusables and supporting legislation that bans the production and use of single-use plastic.

1.4.2 Plastic Products

Plastic production, first developed in the 19th century soared during the 20th century, from 2 million metric tons in 1950 to 348 million metric tons in 2017 and is expected to double in capacity yet again by 2040. An estimated 8.3 billion metric tons of plastics had been produced as of mid-2017. The US produces more plastic waste than any other country in the world, at an estimated 42 million metric tons each year. Plastic is problematic throughout its whole lifecycle from the point of raw material extraction to its eventual disposal and dispersion. Roughly two thirds of all

plastic

ever produced remains in the environment today either as pollution in oceans and other

landscapes, as microparticles in air, soil, and rain, or as microparticles in humans and animals. A 2019 study found that 79% of incinerators are located in Black Indigenous and people of color (BIPOC) communities and the pollutant fumes produced by incinerating plastic have toxic effects when inhaled.

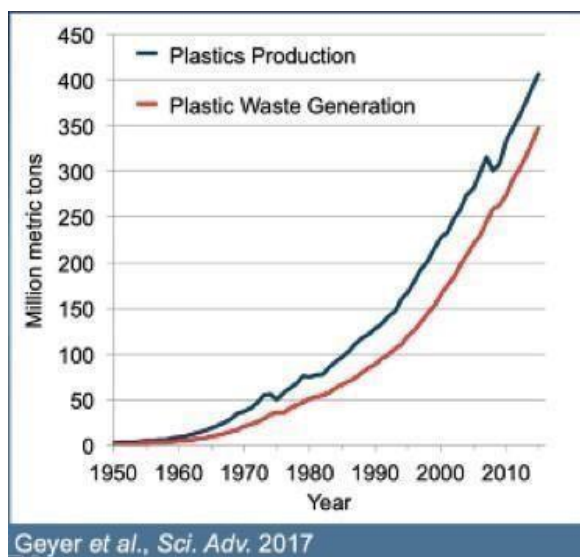


Fig1.4.2 Plastic Geyer Production

From Fig 1.4.2 at current levels, greenhouse gas emissions from the plastic lifecycle threaten the ability of the global community to keep global temperature rise below 1.5°C degrees. By 2050, the greenhouse gas emissions from plastic alone could reach over 56 gigatons 10-13% of the entire remaining carbon budget.

The surge in natural gas fracking has helped drive the increase in "cracking" facilities, used to manufacture plastics. Many are still in construction, meaning instead of reducing our plastic production, we are increasing the capacity to produce millions of tons more. For additional information, check out this 2017 article and this 2019 NPR interview. In 2015, about 730,000 tons of high-density polyethylene (HDPE) plastic "bags, sacks, and wraps" were

1.5 OBJECTIVES

The goal of an aquatic garbage management system is to prevent and reduce the accumulation of garbage in aquatic ecosystems, such as oceans, rivers, lakes, and other water bodies. The system aims to achieve this goal by implementing various

waste management strategies, including Prevention The first goal is to prevent the generation of waste and garbage that could potentially enter aquatic ecosystems. This involves reducing the use of single-use plastics, promoting the use of reusable and biodegradable products, and increasing public awareness about the proper disposal of waste. Collection The second goal is to collect the waste and garbage that has entered the water bodies, using various methods such as manual and automated collection systems, and floating barriers. Segregation The third goal is to segregate the collected waste based on its type and nature, such as plastics, organic waste, and hazardous waste. Recycling and disposal: The final goal is to recycle and dispose of the segregated waste in an environmentally responsible manner, such as recycling plastics and other materials, composting organic waste, and safely disposing of hazardous waste. By achieving these goals, an aquatic garbage management system aims to protect aquatic ecosystems, promote public health, and ensure the sustainable use of aquatic resources for present and future generations.

1.6 PROJECT GOALS

The goal of an aquatic garbage management system is to prevent and reduce the accumulation of garbage in aquatic ecosystems, such as oceans, rivers, lakes, and other water bodies. The system aims to achieve this goal by implementing various waste management strategies, including Prevention The first goal is to prevent the generation of waste and garbage that could potentially enter aquatic ecosystems. This involves reducing the use of single-use plastics, promoting the use of reusable and biodegradable products, and increasing public awareness about the proper disposal of waste. Collection The second goal is to collect the waste and garbage that has entered the water bodies, using various methods such as manual and automated collection systems, and floating barriers.

Segregation The third goal is to segregate the collected waste based on its type and nature, such as plastics, organic waste, and hazardous waste. Recycling and disposal the final goal is to recycle and dispose of the segregated waste in an environmentally responsible manner, such as recycling plastics and other materials, composting organic waste, and safely disposing of hazardous waste. By achieving these goals, an

aquatic garbage management system aims to protect aquatic ecosystems, promote public health, and ensure the sustainable use of aquatic resources for present and future generations

1.7 SCOPE

The scope of an aquatic garbage management system includes all aspects of managing waste and garbage in water bodies, including prevention, collection, segregation, recycling, and disposal. The system's scope also includes Identification of sources of waste and garbage that enter the water bodies, such as coastal areas, industrial and commercial activities, and residential areas. Developing and implementing strategies to prevent the generation of waste and garbage that could potentially enter the water bodies, such as promoting the use of biodegradable products and increasing public awareness about the proper disposal of waste. Collecting and removing the waste and garbage that has entered the water bodies, using various methods such as manual and automated collection systems, and floating barriers. Segregating the collected waste based on its type and nature, such as plastics, organic waste, and hazardous waste. Recycling and disposing of these segregated waste in an environmentally responsible manner, such as recycling plastics and other materials, composting organic waste, and safely disposing of hazardous waste. Developing and implementing monitoring and evaluation mechanisms to assess the effectiveness of the system and identify areas for improvement. The scope of an aquatic garbage management system also includes working with various stakeholders, including government agencies, local communities, NGOs, and private sector entities, to ensure that the system's objectives are achieved. Overall, the scope of an aquatic garbage management system is broad and encompasses all aspects of waste and garbage management in water bodies.

1.8 PROBLEM STATEMENT

The problem statement for an aquatic garbage management system is that there is a significant amount of waste and garbage that accumulates in aquatic ecosystems, such as oceans, rivers, lakes, and other water bodies. This waste and garbage pose

a threat to the aquatic ecosystem and its inhabitants, including marine life and plants. The problem is further exacerbated by the increasing human population, industrial and commercial activities, and the use of non-biodegradable products.

The waste and garbage in water bodies can cause water pollution, degrade the water quality, and disrupt the natural habitat of aquatic plants and animals. Furthermore, the accumulation of waste and garbage in water bodies can lead to the spread of water-borne diseases, causing health hazards to humans and animals alike. The

lack

of proper waste management in water bodies can also have severe economic consequences, including damage to fishing and tourism industries.

Therefore, there is a need to develop and implement an aquatic garbage management system that addresses the problem of waste and garbage in water bodies. The system should include strategies for prevention, collection, segregation, recycling, and disposal of waste and garbage in an environmentally responsible manner. The goal of the system should be to protect aquatic ecosystems, promote public health, and ensure the sustainable use of aquatic resources for present and future generations. Clear Blue Sea's optimal architecture for its Floating Robot for Eliminating Debris (the ideal FRED) requires multiple oceanographic and navigation instruments for their marine robot to be semi-autonomous in performing plastic debris clean-up in the ocean gyres. The gyres are where massive areas of floating plastic pollution, often referred to as "garbage patches" or "plastic soup" have accumulated over the decades. This White Paper identifies and assesses ocean conservation organizations and their innovations to learn how they have approached the challenge of semi-autonomous operations far at sea. Six specific marine instruments are evaluated for their function and effectiveness, providing engineering guidance to Clear Blue Sea in its design, build, and operation of their FRED innovation for cleansing the oceans of plastic pollution.



Fig1.8 FredRobot

As shown in Fig 1.8 the Fred robot will move in the sea. The earth has five major ocean gyres, meaning gigantic circular oceanic surface currents that have high concentrations of plastic pollution. These garbage patches are a human-made problem generated by the ever-increasing production of plastic and society's improper disposal and low level of recycling to trillions of microplastic particles. The largest is the Great Pacific Garbage Patch which is estimated to be the size of Texas. This extensive number of marine debris in all our oceans substantially affects the ecosystem, whether by injuring marine mammals which encounter its mass or by killing marine animals which ingest this plastic when mistaken for food.

1.9 Working Methodology

Two companies were researched based on their innovations in autonomous vessels having instrumentation relevant to Clear Blue Sea's requirements for FRED. Liquid Robotics deploys a surfboard-like robot (Energy Harvesting Ocean Robot) that converts wave motion into propulsion and uses solar energy as its power source. This vessel does not require an onboard pilot but does require remote control by a human operator. Hydroid deploys a submarine robot (REMUS Marine Robot Submarine) that identifies underwater objects and notifies operations via satellite of the object's geographical coordinates. Similar to Liquid Robotics' innovation, there is no onboard

pilot and the vessel is remote-controlled using advanced software. This submarine has embedded instruments to enable vessel autonomy and to collect data on submarine performance and its environmental conditions. Tony dePaolo, Senior Engineer at Scripps Institute of Oceanography, was contacted for advice on further research and analysis. He suggested specific instruments relevant to FRED's mission, and a review of Woods Hole Institute's website for additional information resources.

CHAPTER –

II LITERATURE SURVEY

2.1 GENERAL

The general purpose of a literature review is to provide a comprehensive summary of existing research and knowledge on a particular topic. A literature review aims to identify and evaluate all relevant sources of information, including academic articles, books, reports, and other published materials, to gain an understanding of the current state of knowledge and identify gaps in the research.

A literature review typically involves a systematic search of relevant databases and sources, followed by a critical analysis of the literature to identify key themes, trends, and issues. The review should also include a synthesis of the findings from the literature and a discussion of the implications for further research and practice.

Overall, the purpose of a literature review is to provide a comprehensive and critical overview of the existing research on a topic, identify gaps in the knowledge base, and suggest avenues for future research. A literature review is an essential component of any research project, as it helps to establish the context and rationale for the study and provides a foundation for the development of research questions and hypotheses.

2.2 REVIEW OF LITERATURE SURVEY

A literature review is a critical and systematic analysis of existing research and knowledge on a particular topic. It involves a comprehensive search and analysis of relevant literature sources to identify key themes, trends, and issues related to the topic. The purpose of a literature review is to provide a summary of the current state of knowledge on a topic, identify gaps in the research, and suggest directions for future research. It can also help to establish the context and rationale for a research study and provide a foundation for the development of research questions and hypotheses.

A well-conducted literature review involves a rigorous and systematic process of identifying relevant literature sources, evaluating their quality and relevance, and synthesizing the findings to develop a coherent and comprehensive overview of the research on the topic. It should also include a critical analysis of the strengths and limitations of the existing research and highlight areas where further research is needed. A literature review can be conducted as a standalone project or as part of a larger research study. It can be qualitative or quantitative and may involve a range of methods for searching and analyzing the literature, including database searches, citation tracking, and manual searching.

Overall, a literature review is an essential component of any research project, as it helps to establish the context and rationale for the study and provides a foundation for the development of research questions and hypotheses. It also serves as a valuable resource for researchers, practitioners, and policymakers seeking to understand the current state of knowledge on a particular topic.

Nor Anum Zu Raimi Md Noar and Mahanijah Md Kamal, ICSIMA "The Development of Smart Flood Monitoring System Using Ultrasonic Sensor with BLYNK Applications", IEEE Transaction on Smart Instrumentation 2017.

This paper presents the development of a smart flood monitoring system using the Blynk platform as a medium of data transmission. This system is based on two NodeMCU development boards integrated using the Blynk application (iOS or android). The first NodeMCU is placed in the flood area, whilst the second NodeMCU acts as the control unit. The Transmitter unit consists of the first NodeMCU, an ultrasonic sensor that will detect the water level during flooding and display it on the LCD. Then, the data detected from the ultrasonic sensors will be sent to the Blynk application via the wireless connection. The data are instantly collected and stored in a dedicated database for recording purposes. In order to alert the person in charge of the control unit, the data then will be sent to the second NodeMCU via the Blynk bridge to trigger the buzzer and the LED. Based on the findings, the access to the system between the first NodeMCU and second NodeMCU can be made within less or more than 50 meters. The findings revealed that the system works well when the

data is sensed by the ultrasonic sensor display on the Blynk application and both buzzer and LED are functioning.

Chandra Afriade Siregar, Dudung Mulyadi, Agung Wahyudi Biantoro, Heri Sismoro, Yanti Irawati, IEEE "Automation and Control System on Water Level of Reservoir based on Microcontroller and Blynk", IEEE Transactions on Cloud Computing, 2020. This research aims to utilize simple technology using water level sensors, automatic switches, and the Blynk application to detect water levels automatically. The tools used are infrared switch sensor, ultrasonic sensor, ESP 8266 module, Arduino Nano, Blynk application, and mini submersible pump machine to replace automatic water filling. The results showed that the IoT method by retrieving data sent to a smartphone, using an internet connection and the Blynk application, can display data from the sensor without being limited by the distance between the data sender and receiver. The automatic water tank filling system tool has succeeded in measuring the height of the water level in the reservoir which has been implemented properly.

Afzal A, Hari Krishnan K V, Hari Krishnan R, IEEE "River Mapping Using Ultrasonic and Flow Matching Sensor", ICSSIT Transactions on Smart Systems, 2020. This work aims to develop a simple and low-cost method to determine the flow happening across a river which is used to determine the feasibility of a small-scale hydroelectric project. Measurement of parameters like depth of river and flow velocity of water is done with the help of a drone. A turbine flow meter is used to measure flow velocity and an ultrasonic sensor is used for depth measurement and is attached to the drone using an aluminum shaft. The instruments are carefully selected based on their capacity and output range. They are tested in artificial environments to check their reliability and effectiveness and are calibrated to work in real-world environments. The sensors are attached to the drone using special mounting structures. Drone transports the sensors to pre-identified sites, which are most difficult to reach for humans to take measurements. The readings are transferred wirelessly to a mobile phone. Further, the calculations and analysis are performed based on river parameters. This method allows economical and eco-friendly measurement of depth.

and flows velocity remotely in difficult terrains and locations that remain inaccessible to man.

Aashiq Aziz, IEEE, "Coastal alerting IoT system in response to high tides and turbulent weather", ICCCN Transactions on Networking, 2019. This research paper discusses the design and implementation of a coastal alerting system in response to tide levels at the shore and turbulent weather conditions based on the Internet of Things. There are two IoT platforms used in this project to showcase the results from the model namely ThingSpeak and the Blynk Application. The proposed model setup comprises a cylindrical structure with a water inlet, a float, a microcontroller circuit configuration with an ultrasonic sensor as well as a large water container to simulate onshore conditions. The water level readings are measured by the ultrasonic sensor as one of the inputs for the microcontroller. This is achieved using the float placed in the cylindrical structure that is displaced by the water that flows in through the water inlet. The ultrasonic sensor which is placed above the float measures the distance between itself and the float with the change in the water level. The other inputs comprise the weather information from the weather API service provided by OpenWeatherMap.org. The microcontroller makes decisions on the weather situation at the shorefront based on a set of algorithms that take all the inputs into consideration. In addition, data on nearby storms are pulled in from another API service powered by DarkSky.net. This is done so as to issue appropriate responses through the IoT platforms indicating the nature of the situation on the shorefront and the possibility of storms in the vicinity.

Yuliarman Saragih, Fajar Eko Kurnia Setia Aji, Agatha Elisabet, Hasna Aliya Roostiani, Abdul Aziz Hafeel, Chia Chee Ming, IEEE, "Prototype of Radio Frequency Identification Technology Utilization for Monitoring of BTS Room Using of IoT (Internet of Things) System", IEEE Transactions on System Security, 2019. The level of battery theft in the BTS room often occurs. RFID prototype is used to open the BTS room replacing the conventional key. To improve the BTS room security system, a vibrating sensor is used which is applied to the BTS room door, if anyone wants to break or damage the BTS room door by force then the alarm sounds, and use an ultrasonic sensor to detect whether there is a person or object in front of the BTS room, if a

person or object is blocking in front of the BTS shelter 100 cm, the alarm will sound continuous. Also, the BTS shelter can be monitored via a smartphone as well as getting notifications both in email, smartphone and in the Blynk application.

Padmavathi. J, Giridharan.S, Jebastin Sonia Jas.M, IEEE, "Identification of Heavy metals in Seafood using IoT", ICSCAN Transactions on Ocean Management, 2020 In today's world, there are many contaminations of heavy metals in the foods during export. Due to many industrial pollutions, water is contaminated with industrial waste and it is mixed with the rivers and seawater. Industrial waste is mixed with the water bodies and causes health issues to both the human being and then to the organism in the water bodies. So, when the organism in the water is affected then it is consumed by the human being causing many health effects. A recent issue occurred in Japan in May 1956, four patients from the city of Mina Mata on the east coast of the southern Japanese island of Kyushu were admitted to the hospital with severe baffling symptoms. Mina Mata Disease is the methyl mercury poisoning that occurred in humans who ingested fish and shellfish contaminated by MeHg (Heavy Metal) discharged in wastewater from a chemical plant (Chisso. Co. Ltd). As of March 2001, 2,265 victims had been officially recognized (1,784 of whom had died). A second outbreak of Mina Mata disease occurred in Niigata Prefecture in 1965.

Haonan Liang, Hao Wei, Tian Zhang, Jida Huang, IEEE, "The Simulation of Marine Plastic Debris Distribution Based on Cellular Automata", INCCASM Transactions on Environmental Science 2020 Marine plastic debris is becoming an increasingly serious marine pollutant. Based on the comparative positions of marine plastic debris and marine current movement and in order to describe and comprehend the extent, density, and distribution of the plastic debris in the gyre, the cellular automata model was introduced to analyze the marine plastic debris distribution. Through simulating, the cellular automata model perfectly and truly presented the moving process and the final distribution of plastic debris in the North Pacific Ocean. At the same time, the influence of dumping quantity and dumping place of the plastic debris on the final distribution is presented.

CHAPTER –

IIIMETHODOLOGY

3.1 BLYNK

3.1.1 Introduction

Blynk is a popular platform for building Internet of Things (IoT) applications. It provides a user-friendly interface for creating custom apps that can interact with a wide range of devices, such as Arduino, Raspberry Pi, and ESP8266, among others. With Blynk, users can create mobile apps for controlling and monitoring their IoT projects, without the need for extensive programming knowledge. The platform offers a drag-and-drop interface that allows users to easily add buttons, sliders, and other controls to their apps. Blynk also provides a cloud service that facilitates the communication between the app and the devices. This means that users can remotely monitor and control their devices from anywhere with an internet connection.

In addition to the user-friendly interface, Blynk also provides a variety of libraries and code examples for popular hardware platforms, which makes it easier for developers to integrate Blynk into their projects. The platform also supports a wide range of communication protocols, including Bluetooth, Wi-Fi, Ethernet, and cellular. Overall, Blynk is a powerful and flexible platform that makes it easy for developers and hobbyists to build custom IoT applications. Its intuitive interface and comprehensive documentation make it accessible for beginners, while its advanced features and flexibility make it a popular choice for more experienced developers.

3.1.2 History

Blynk was founded in 2015 by Pavel and Dmitry Petman, two brothers from Russia who had a passion for electronics and software development. They wanted to create a platform that would make it easier for people to build and control Internet of Things (IoT) projects. Initially, the Petman brothers developed Blynk as an open-source project, which quickly gained popularity among developers and

hobbyists.

The platform allowed users to create custom mobile apps that could communicate with

their IoT devices, without the need for extensive programming knowledge. As Blynk grew in popularity, the Peterman brothers decided to turn it into a commercial product. In 2016, they launched a Kickstarter campaign to fund the development of Blynk 2.0, which would be a more powerful and flexible version of the platform. The campaign was successful, raising over \$28,000.

Since then, Blynk has continued to evolve and expand its capabilities. It has added support for new hardware platforms and communication protocols and has developed a cloud service to facilitate the communication between the app and the devices. Blynk also offers a variety of features for businesses and enterprises, such as data logging and analytics. Today, Blynk is used by thousands of developers and hobbyists around the world to build custom IoT applications. Its intuitive interface and comprehensive documentation make it accessible for beginners, while its advanced features and flexibility make it a popular choice for more experienced developers.

3.1.3 Design philosophy & Feature

Blynk is designed to make it easy for developers and hobbyists to build custom Internet of Things (IoT) applications without the need for extensive programming knowledge. Its design philosophy is centered around simplicity, flexibility, and accessibility. **Simplicity:** Blynk provides a user-friendly interface that allows users to create mobile apps for controlling and monitoring their IoT projects. The platform offers a drag-and-drop interface that allows users to easily add buttons, sliders, and other controls to their apps. This makes it easy for beginners to get started with IoT development. **Flexibility:** Blynk is a flexible platform that can be used with a wide range of devices, such as Arduino, Raspberry Pi, and ESP8266, among others. It also supports a wide range of communication protocols, including Bluetooth, Wi-Fi, Ethernet, and cellular. This makes it easy for developers to integrate Blynk into their existing projects. **Accessibility:** Blynk provides comprehensive documentation and code examples that make it easy for developers to get started with the platform. It also offers a cloud service that facilitates the communication between the app and the devices. This means that users can remotely monitor and control their devices from anywhere with an internet connection. Some of the key features of Blynk include:

Customizable mobile app interface: Blynk allows users to create custom mobile apps for controlling and monitoring their IoT projects. The platform offers a variety of widgets, such as buttons, sliders, and graphs, that can be easily added to the app interface. Cloud service: Blynk provides a cloud service that facilitates the communication between the app and the devices. This means that users can remotely monitor and control their devices from anywhere with an internet connection. Code libraries: Blynk offers a variety of libraries and code examples for popular hardware platforms, which makes it easier for developers to integrate Blynk into their projects. Data logging and analytics: Blynk provides data logging and analytics features that allow users to track and analyze data from their IoT projects. This can be useful for monitoring performance, identifying issues, and making improvements.

Overall, Blynk is a powerful and flexible platform that makes it easy for developers and hobbyists to build custom IoT applications. Its intuitive interface and comprehensive documentation make it accessible for beginners, while its advanced features and flexibility make it a popular choice for more experienced developers.

3.1.4 Syntax and Semantics

Blynk uses a simple syntax that is easy to learn and use, even for beginners. The platform provides a set of widgets that can be added to the mobile app interface, such as buttons, sliders, and graphs. These widgets are used to create the user interface for the app. To use Blynk, developers need to create a project in the Blynk app, and then download the code for their device from the Blynk website. The code for the device includes a library that contains the Blynk functions, which can be used to communicate with the Blynk cloud service.

For example, a button widget in the Blynk app can be linked to a virtual pin on the device. When the button is pressed in the app, it sends a signal to the virtual pin on the device, which can be used to trigger an action, such as turning on a LED. Overall, the syntax and semantics of Blynk are designed to be simple and intuitive, while still providing a powerful set of features for building custom IoT applications.

3.2 STATEMENTS AND CONTROL FLOW

In Blynk, the statements and control flow are based on the Arduino programming language, with additional functions specific to Blynk. Blynk programs typically consist of a `setup()` function and a `loop()` function. The `setup()` function is called once when the device starts up, and is used to initialize the device and establish a connection to the Blynk server. The `loop()` function is called repeatedly and is used to handle inputs from the Blynk app, process data from sensors, and control output to the device.

Blynk also supports a range of control flow statements, such as `if`, `else`, `while`, and `for`, which can be used to control the behavior of the program based on inputs from the Blynk app or data from sensors. Here's an example of an `if` statement in a Blynk program.

In this example, the `analog Read()` function reads the value of an analog sensor connected to pin A0, and the `if` statement checks if the value is greater than 500. If the value is greater than 500, the `digital Write()` function sets the LED pin to high, otherwise it sets it to low. Overall, the statements and control flow of Blynk are similar to the Arduino programming language, with additional functions and features specific to Blynk for communicating with the app and the cloud service.

3.2.1 Expressions

Expressions in Blynk are used to perform mathematical operations or manipulate data received from the Blynk app or sensors. Blynk supports a range of arithmetic operators, such as `+`, `-`, `*`, `/`, `%`, as well as comparison operators, such as `==`, `!=`, `<`, `>`, `<=`, and `>=`.

Expressions can also be used to manipulate data received from the Blynk app, such as button states, slider values, and text input. Here's an example of using expressions to control an LED.

Overall, expressions in Blynk are used to perform mathematical operations and manipulate data received from the Blynk app or sensors, allowing for a wide range of customizations and functionalities in Blynk projects.

3.2.2 Methods

Blynk provides a range of methods or functions that can be used to interact with the Blynk app and cloud service, and to control hardware devices. Some of the commonly used methods in Blynk are:

`Blynk.begin(auth, ssid, pass)`: This method is used to establish a Wi-Fi connection to the Blynk server using the authentication token, Wi-Fi SSID, and password.

`Blynk.run()`: This method is used to run the Blynk service, which communicates with the Blynk app and cloud service and receives data from sensors.

`Blynk.virtualWrite(pin, value)`: This method is used to send a value to a virtual pin in the Blynk app, which can be used to control widgets or display data.

`Blynk.virtualRead(pin)`: This method is used to read the value of a virtual pin in the Blynk app, which can be used to control hardware devices or display data.

`Blynk.syncVirtual(pin)`: This method is used to synchronize the value of a virtual pin between the Blynk app and the device, ensuring that the device always has the latest value.

`Blynk.notify(message)`: This method is used to send a notification message to the Blynk app, which can be used to alert the user of an event or condition.

`Blynk.email(to, subject, message)`: This method is used to send an email to a specified recipient with a subject and message.

`Blynk.setProperty(pin, property, value)`: This method is used to set a property of a widget in the Blynk app, such as color, label, or font.

`Blynk.virtualWrite(pin, value)` with `BLYNK_WRITE(pin)`: This pair of methods are used together to receive data from a widget in the Blynk app and perform an action based on the value. The `BLYNK_WRITE()` function is automatically called when data is received from the specified pin.

3.2.3 Working Process

Blynk is an Internet of Things (IoT) platform that allows you to build mobile applications to control and monitor hardware devices. The platform consists of three main components: the Blynk app, the Blynk server, and the Blynk library.

The working process of Blynk can be summarized in the following steps:

1. Download and install the Blynk app on your mobile device from the app store.

2. Create a new project in the Blynk app and choose the type of hardware device you want to control. Blynk supports a wide range of devices, including Arduino, Raspberry Pi, ESP8266, and many more.

3. Generate an authentication token for your project in the Blynk app. This token will be used to connect your hardware device to the Blynk server.

4. Download and install the Blynk library for your hardware device. The library provides a set of functions that allow your device to communicate with the Blynk server.

Write code for your hardware device using the Blynk library. This code will establish a connection to the Blynk server using the authentication token generated in step 3.

Create a user interface for your project in the Blynk app. You can add buttons, sliders, graphs, and other widgets to control and monitor your hardware device.

Connect your hardware device to the internet and run the code you wrote in step 5. Your device will now be able to communicate with the Blynk server and update the user interface in the Blynk app in real-time.

Use the user interface in the Blynk app to control and monitor your hardware device from anywhere in the world.

Overall, Blynk provides an easy-to-use platform for building IoT applications that can be controlled and monitored from a mobile device.

3.3 INTERNET OF THINGS

IoT stands for Internet of Things, which refers to the network of physical objects or "things" that are embedded with sensors, software, and other technologies to connect

and exchange data with other devices and systems over the internet. IoT devices can range from simple sensors and smart home appliances to more complex industrial machinery and transportation systems. The data generated by these devices can be used to optimize performance, increase efficiency, and improve decision-making. The widespread adoption of IoT technology has led to the creation of new industries, improved products and service offerings, and enhanced customer experiences. However, it has also raised concerns about privacy, security, and the potential misuse of personal data. One of the unique aspects of IoT technology is that it enables physical objects to be connected and communicate with each other over the internet, without requiring human intervention.

This connectivity allows for real-time data collection, analysis, and decision-making, which can lead to improved efficiency, productivity, and cost savings across a variety of industries. Another unique aspect of IoT is its ability to integrate with other emerging technologies such as artificial intelligence, machine learning, and blockchain, enabling even greater innovation and potential applications. IoT technology is also unique in that it has the potential to transform entire industries and disrupt traditional business models. For example, the rise of smart homes, smart cities, and connected cars are all examples of how IoT is changing the way we live, work, and interact with our environment. However, this technology also presents unique challenges in terms of security, privacy, and interoperability, which must be addressed to ensure its long-term success and adoption.

3.4 ARDUINO IDE

The Arduino Integrated Development Environment (IDE) is an open-source software application used to write and upload code to Arduino-compatible microcontroller boards. The IDE provides an intuitive interface for writing code in the Arduino programming language, which is based on C and C++. The Arduino IDE includes a text editor for writing code, a compiler for converting the code into a binary format that can be executed by the microcontroller, and an uploader for transferring the binary code to the board. The IDE also includes a variety of built-in functions and libraries, which make it easy to work with different components and sensors commonly used in

electronics projects. The IDE is compatible with a range of boards, including the popular Arduino Uno, Nano, and Mega boards, as well as other boards based on the ATmega and SAM microcontrollers. It is also available for Windows, Mac, and Linux operating systems.

Overall, the Arduino IDE is a powerful tool for beginners and advanced users alike, providing an easy-to-use interface for programming and uploading code to a variety of microcontroller boards. Its accessibility, affordability, and versatility make it a popular choice for DIY electronics projects and educational purposes. The Arduino is unique because of its versatility and accessibility. It is an open-source hardware and software platform that can be used for a wide range of applications, from simple DIY projects to complex robotics and automation systems. The Arduino is designed to be user-friendly and easy to use, even for beginners with little or no programming experience. Its programming language is based on C and C++, but it uses a simplified syntax and includes a variety of built-in functions and libraries that make it easy to work

with different components and sensors. Another unique feature of the Arduino is its affordability. The hardware components are relatively inexpensive and widely available, making it an accessible option for hobbyists, students, and professionals alike. The Arduino community is also a unique aspect of the platform. It is a large and active community of users and developers who share their projects, knowledge, and resources online. This community provides a wealth of information and support, making it easy to learn and troubleshoot Arduino projects. Overall, the Arduino's versatility, accessibility, affordability, and supportive community make it a unique and popular platform for electronics enthusiasts and professionals alike.

3.5 EXISTING SYSTEM

Aquatic garbage management systems are designed to address the problem of marine debris and pollution in bodies of water such as oceans, lakes, and rivers. Currently, there are several existing systems that aim to manage aquatic garbage. Skimmer boats: These are boats equipped with a net or a suction device that can collect floating garbage from the water's surface. The collected debris can be sorted, recycled or disposed of appropriately. Trash barriers: These are physical barriers

installed in rivers and waterways to capture floating debris. The barriers work by intercepting floating trash before it reaches downstream and collecting it in a designated area for later disposal. Trash skimmers These are specialized boats equipped with a conveyor belt that can scoop floating trash from the water and deposit it in a container on board. These boats can collect large quantities of garbage in a short amount of time.

Waste management barges: These are large boats equipped with sorting and processing equipment that can collect and sort trash from the water. The processed waste can then be recycled, composted, or disposed of in an environmentally friendly manner. Automated marine debris collection systems. These systems use artificial intelligence and robotics to detect, track and collect marine debris autonomously. These systems can identify and collect a wider range of debris, including microplastics, fishing nets, and other marine debris. These aquatic garbage management systems are being used in various parts of the world to manage marine debris and pollution. While these systems have proven to be effective, there is a need for more innovative and sustainable solutions to address the growing problem of marine debris. The unique features of these existing systems make them effective in managing aquatic garbage in different environments and situations. However, there is still a need for more innovation in this area to address the growing problem of marine debris and pollution.

3.5.1 Drawbacks

While existing garbage management systems for aquatic environments have proven effective, there are some drawbacks and limitations associated with them. Here are a few examples

Limited reach Most aquatic garbage management systems are designed for use in specific environments, such as rivers, harbors, or nearshore areas. This means that they may not be effective in other environments, such as open ocean or deep sea environments.

Cost: Many aquatic garbage management systems can be expensive to acquire and operate, particularly those that use advanced technologies such as artificial intelligence or robotics.

Maintenance Some aquatic garbage management systems require regular maintenance to ensure they are operating correctly and efficiently. This can be time-consuming and costly, particularly for systems that are used frequently.

Environmental impact Some aquatic garbage management systems, such as skimmer boats and trash barriers, can have a negative impact on the environment if they are not used correctly. For example, skimmer boats can cause water turbulence, which can disturb marine life, and trash barriers can obstruct the flow of water, which can affect the natural ecosystem.

Dependence on human intervention Many aquatic garbage management systems require human intervention to operate effectively. This means that they may not be able to function autonomously and may require significant resources, such as personnel and time, to operate.

Overall, while existing aquatic garbage management systems have proven effective in managing marine debris, there is still a need for innovation and improvement to address these drawbacks and limitations.

3.6 PROPOSED SYSTEM

The Whole system works under two

modules

1. Data Acquisition

2. Data Analysis

3.6.1 Data Acquisition

Dumps of plastics collected from the aquatic river belt are fed through the conveyors and collected to the bins. The levels of the bins are monitored via a distance sensor and the data is published to the cloud through BLYNK WEB Server.

3.6.2 Data Analysis

The trash collected is per processed via metal sensors and bins are segregated. According to the filling rate users will be intimated with notifications. If there is some anomalous changes or peek dump. The emergency state is declared and notified to the health worker, through web applications.

There are several proposed systems for aquatic garbage management that aim to improve upon existing systems. Here are a few examples:

Drones: Unmanned aerial vehicles (UAVs) can be equipped with cameras and sensors to detect and track floating debris in open water. The drones can then guide boats to the debris for collection.

Underwater drones: Autonomous underwater vehicles (AUVs) can be used to detect and collect debris on the ocean floor, including microplastics and other small debris that are difficult to see with the naked eye.

Aquatic robots: Robots equipped with sensors and artificial intelligence can detect and collect debris autonomously. These robots can be deployed in areas that are difficult or dangerous for humans to access.

Biodegradable traps: Traps made of biodegradable materials can be deployed in waterways to collect debris. These traps can then be collected and disposed of in an environmentally friendly manner.

Ocean-cleaning vessels: Large, specialized vessels can be equipped with sorting and processing equipment to collect and dispose of marine debris. These vessels can also be used to deploy drones and other technologies to detect and collect debris more efficiently.

These proposed systems aim to improve upon existing aquatic garbage management systems by addressing some of the limitations and drawbacks associated with them. They leverage new technologies and approaches to detect and collect marine debris more efficiently and sustainably. However, like existing systems, they will require careful planning, implementation, and maintenance to ensure they are effective and do not harm the environment.

3.6.3 Advantages

In our proposed system we not only collect the plastic debris from the river bed we undergo a process of segregation of plastic waste

Since our system is connected to the cloud storage network, we can be able to predict the amount of plastic waste from the working site

Data are directed to the IoT system to get instant results in the segregation process

Due to the data analysis process, we can be able to recycle the plastic waste into a profitable resource

African companies owned by woman Entrepreneur working on with recycling of plastic to sandal footwear need a segregated bundle of plastic debris

The proposed systems for aquatic garbage management have several advantages over existing systems, including:

Improved efficiency the proposed systems leverage advanced technologies such as drones, underwater robots, and artificial intelligence to detect and collect debris more efficiently, which can lead to more effective cleanup efforts.

Reduced environmental impact Some of the proposed systems, such as biodegradable traps, aim to reduce the environmental impact of cleanup efforts by using materials that are safe for the environment.

Increased safety Autonomous systems, such as aquatic robots and drones, can be used in dangerous environments, such as in areas with strong currents or rough seas, reducing the risk to human workers.

Lower cost Some of the proposed systems, such as drones and aquatic robots, can be operated at a lower cost than traditional cleanup efforts, which can make them more accessible to organizations with limited budgets.

Greater reach Some of the proposed systems, such as drones and ocean-cleaning vessels, can cover larger areas of water, allowing for more comprehensive cleanup efforts.

Overall, the proposed systems offer several advantages over existing systems for aquatic garbage management and could help to address the growing problem of marine debris and pollution in a more efficient, sustainable, and cost-effective way.

CHAPTER –IV

HARDWAREANDSOFTWAREDESCRIPTION

4.1 NODEMCUESP8266WI-FIDEVELOPMENTBOARD

NodeMCU is an open-source firmware for which open-source prototypingboarddesigns are available. The name "NodeMCU" combines "node" and "MCU" (micro-controller unit). The term "NodeMCU" strictly speaking refers to the firmware ratherthan the associateddevelopmentkits. Boththe firmware and prototypingboarddesigns

areopensource.ThefirmwareusestheLuascriptinglanguage.Thefirmware is based on the Eula project and built on the Espressif Non-OS SDK forESP8266. It uses manyopen-source projects, such as a-JSON and SPIFFS. Due toresource constraints, users need to select the modules relevant to their project andbuild a firmware tailored to their needs. Support for the 32-bit ESP32 has also beenimplemented. The prototyping hardware typically used is a circuit board functioningas a dual in-line package (DIP) which integrates a USB controller with a smallersurface- mounted board containing the MCU and antenna. The choice of the DIPformat allows for easy prototyping on breadboards. The design was initially based ontheESP-12moduleoftheESP8266,whichisaWi-FiSoCintegratedwithaTensilicaXtensaLX106core, widelyusedinIoTapplications(seerelatedprojects).



Fig4.1NodeMCUESP8266Wi-FiDevelopmentBoard

As shown in Fig 4.1 NodeMCU is unique in that it combines the power and flexibility of the ESP8266 chip with an easy-to-use development platform. It provides a convenient way for developers to quickly prototype and develop IoT applications without having to worry about low-level details of programming and hardware interaction. Some of the unique features of NodeMCU include Lua Scripting Language: NodeMCU uses Lua, a lightweight scripting language that is easy to learn and use. This makes it accessible to a wide range of developers, regardless of their programming background. Integrated Development Environment (IDE) NodeMCU includes an integrated development environment (IDE) that provides a simple interface for uploading code and interacting with the ESP8266 chip. Wi-Fi Connectivity The ESP8266 chip has built-in Wi-Fi capabilities, which makes it easy to connect to the internet and other devices. Low Cost the NodeMCU board is very affordable, which makes it an attractive option for developers who want to experiment with IoT applications without spending a lot of money. Large Community NodeMCU has a large and active community of developers and enthusiasts who share code, tips, and advice on how to get the most out of the platform.

4.2 SINGLE CHANNEL RELAY MODULE WITH OPTO-COUPLER

A single channel relay module with an opto-coupler is a type of electronic module that is used to control the operation of an electrical circuit or device. The relay module consists of a single relay, which is an electrically operated switch, and an opto-coupler, which is an electronic component used to isolate and protect the control circuitry from high voltage or current signals. The opto-coupler in the relay module provides electrical isolation between the control circuitry and the load circuit, which helps to prevent any electrical noise or interference from affecting the control circuitry. This also protects the control circuitry from any high voltage or current spikes that may occur in the load circuit. The relay module can be controlled by a microcontroller or other electronic device, which sends a signal to the opto-coupler to activate the relay. When the relay is activated, it allows current to flow through the load circuit, which can be used to control the operation of a motor, light, or other electrical device. Single channel relay modules with opto-couplers are commonly used in industrial

automation, home automation, and other electronic applications where electrical isolation and protection is required. They are also often used in DIY electronics projects, as they are easy to use and can be controlled with a wide range of electronic devices.

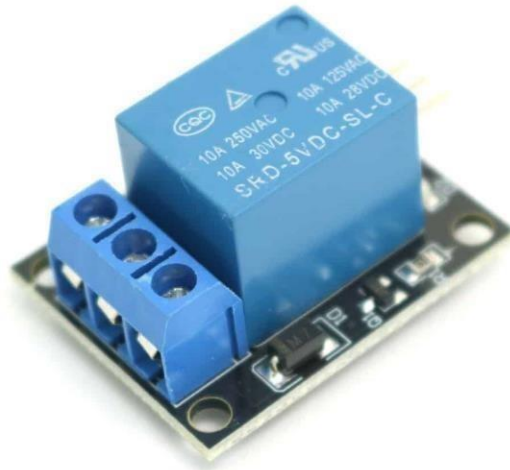


Fig 4.2 Single Channel Relay Module with Opto-Coupler

From Fig 4.2 a relay is an electrically operated switch. It consists of a set of input terminals for a single or multiple control signals, and a set of operating contact terminals. The switch may have any number of contacts in multiple contact forms, such as make contacts, break contacts, or combinations thereof. Relays are used where it is necessary to control a circuit by an independent low-power signal, or where several circuits must be controlled by one signal.

Relays were first used in long-distance telegraph circuits as signal repeaters: they refresh the signal coming in from one circuit by transmitting it to another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations. The traditional form of a relay uses an electromagnet to close or open the contacts, but other operating principles have been invented, such as in solid-state relays which use semiconductor properties for control without relying on moving parts. Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or multiple

operating coils are used to protect electrical circuits from overload or faults, in modern electric power.

4.3 ASIDE SHIFT DC MOTOR

From Fig 4.3 a Side shaft DC Motor is any of a class of rotary electrical motors that convert direct current (DC) electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current in a part of the motor.

DC motors were the first form of motor widely used, as they could be powered from existing direct-current lighting power distribution systems. A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of the current in its field windings. Small DC motors are used in tools, toys, and appliances.

The universal motor can operate on direct current but is a lightweight brushed motor used for portable power tools and appliances. Larger DC motors are currently used in the propulsion of electric vehicles, elevators, and hoists, and in drives for steel rolling mills. The advent of power electronics has made the replacement of DC motors with AC motors possible in many applications. A side-shaft DC motor is a type of electric motor that is designed to drive a load through a side-mounted shaft. Unlike other types of motors, which typically have a shaft that extends from the center of the motor, a side-shaft motor has a shaft that is mounted on the side of the motor body.

This type of motor is often used in applications where a compact motor design is required, such as in robotics, automation, and other industrial applications. The side-shaft design allows the motor to be mounted in tight spaces, and the shaft can be used to directly drive a load without the need for additional gearing or transmission components. To control the speed and direction of a side-shaft DC motor, a motor controller is typically used. The controller regulates the voltage and current supplied

to the motor, which in turn controls the speed and torque of the motor. The motor controller can also reverse the polarity of the motor to change its direction of rotation.



Fig4.3 A Sideshaft DC Motor

4.4 PROXIMITY METAL DETECTOR

A proximity sensor is a non-contact sensor that detects the presence of an object (often referred to as the “target”) when the target enters the sensor’s field. Depending on the type of proximity sensor, sound, light, infrared radiation (IR), or electromagnetic fields may be utilized by the sensor to detect a target. Proximity sensors are used in phones, recycling plants, self-driving cars, anti-aircraft systems, and assembly lines. There are many types of proximity sensors, and they each sense targets in distinct ways. The two most used proximity sensors are the inductive proximity sensor and the capacitive proximity sensor. An inductive proximity sensor can only detect metal targets. This is because the sensor utilizes an electromagnetic field. When a metal target enters the electromagnetic field, the inductive characteristics of the metal change the field’s properties, thereby alerting the proximity sensor of the presence of a metallic target. Depending on how inductive the metal is, the target can be detected at either a greater or shorter distance. Capacitive proximity sensors, on the other hand, are not limited to metallic targets. These proximity sensors can detect anything that can carry an electrical charge. Capacitive

sensors are commonly used in liquid-level detection. Possible targets for capacitive sensors include but are not limited to glass, plastic, water, wood, metals, and a myriad of other materials



Fig4.4 Proximity Sensor NPN type

A proximity metal detector is a unique type of metal detector that is designed to detect metal objects within a certain distance from the detector. These detectors work by emitting a high-frequency electromagnetic field and detecting changes in the field caused by the presence of a metal object. One of the unique features of proximity metal detectors is their ability to detect metal objects without the need for physical contact. This makes them ideal for use in applications where contact with the metal object is not desirable or practical, such as in industrial settings where the metal object may be moving or where contact could cause damage to the detector, or the object being detected. Proximity metal detectors are also known for their high sensitivity and accuracy. They are often used in applications where the size and shape of the metal object being detected can vary, as they can detect small or irregularly shaped objects with ease.

Some of the common applications for proximity metal detectors include security screening at airports and other high-security facilities, quality control in manufacturing, and detection of metal objects in food processing and packaging industries. They are also used in archaeological surveys and other scientific applications where the detection of metal objects is important.

4.5 SR04ULTRASONICMODULE

An ultrasonic sensor is a device that uses high frequency sound waves to detect objects and measure distances. These sensors typically emit a sound wave at a frequency above the range of human hearing (typically between 20kHz and 200kHz), and then measure the time it takes for the sound wave to bounce back from an object and return to the sensor. By measuring the time, it takes for the sound wave to travel to and from an object, the distance between the sensor and the object can be calculated.



Fig4.5 UltrasonicModule

From Fig 4.5 ultrasonic sensors are commonly used in a variety of applications, such as object detection, distance measurement, and level measurement. They are often used in industrial automation and robotics, as well as in automotive applications such as parking sensors and collision avoidance systems. The HC-SR04 Ultrasonic Distance Sensor is a sensor used for detecting the distance to an object using sonar. It's ideal for any robotics projects you have which require you to avoid objects, by detecting how close they are you can steer away from them! The HC-SR04 uses non-contact ultrasound sonar to measure the distance to an object and consists of two ultrasonic transmitters (basically speakers), a receiver, and a control circuit. The

transmitters emit a high-frequency ultrasonic sound, which bounces off any nearby solid objects, and the receiver listens for any return echo. That echo is then processed by the control circuit to calculate the time difference between the signal being transmitted and received. This time can subsequently be used, along with some clever math, to calculate the distance between the sensor and the reflecting object! We have this sensor, and along with our Ultrasonic mounting kit, you can easily attach this sensor to your project and get measuring distances! Using an Ultrasonic we can connect up to 4 of these HC-SR04 sensors to obtain precise distance measurements without affecting CPU load, or alternatively you can connect one directly to your Raspberry Pi using a few resistors; see this tutorial for details.

4.6 SOFTWARE LIST

4.6.1 *Arduino IDE*

The Arduino Integrated Development Environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in functions from C and C++. It is used to write and upload programs to Arduino compatible boards, but also, with the help of third-party cores, other vendor development boards. The source code for the IDE is released under the GNU General Public License, version 3. The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub `main()` into an executable cyclic executive program with the GNU toolchain, also included with the IDE distribution. The Arduino IDE employs the program `avrdude` to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware. By default, `avrdude` is used as the uploading tool to flash the user code onto official Arduino boards. Arduino IDE is a derivative of the Processing IDE, however as of version 2.0, the Processing IDE will be replaced with the Visual Studio Code-based Eclipse Theia IDE framework.

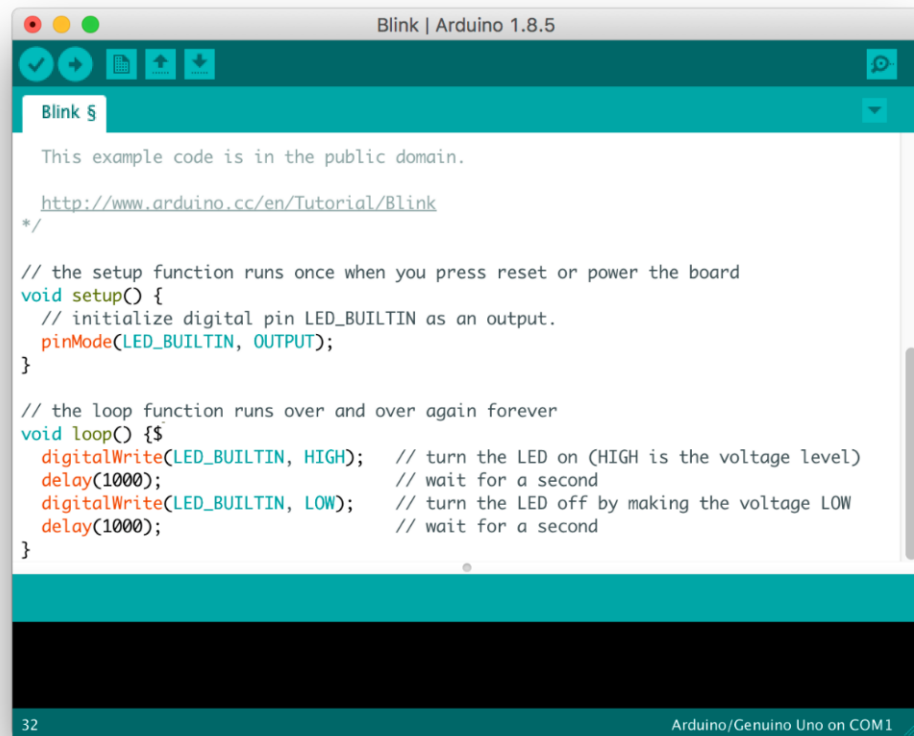


Fig4.6.1 Arduino IDE

With the rising popularity of Arduino as a software platform, other vendors started to implement custom open-source compilers and tools (cores) that can build and upload sketches to other microcontrollers that are not supported by Arduino's official line of microcontrollers.

As shown in Fig 4.6.1 the Arduino IDE (Integrated Development Environment) is an open-source software program used to write, compile and upload code to Arduino boards. Arduino is an open-source electronics platform based on easy-to-use hardware and software that allows you to create a wide range of projects, from simple LED displays to complex robotics and automation systems. The Arduino IDE provides an intuitive graphical interface for creating and uploading code to the Arduino board. It includes a code editor with syntax highlighting, code completion, and error checking features, as well as a serial monitor for debugging and testing your code. The IDE comes with a large library of pre-written code, known as sketches, that can be used

as building blocks for your own projects. It also supports third-party libraries, which can be downloaded and added to the IDE to extend its functionality. One of the main advantages of the Arduino IDE is its simplicity and ease of use, making it accessible to beginners and experts alike. The IDE abstracts away much of the complexity of embedded programming, allowing users to focus on the functionality of their projects rather than the intricacies of programming. Overall, the Arduino IDE is an essential tool for anyone interested in developing projects using Arduino boards, and its popularity has led to a large community of users who share their projects, code, and expertise online. The Arduino is unique because of its versatility and accessibility. It is an open-source hardware and software platform that can be used for a wide range of applications, from simple DIY projects to complex robotics and automation systems.

The Arduino is designed to be user-friendly and easy to use, even for beginners with little or no programming experience. Its programming language is based on C and C++, but it uses a simplified syntax and includes a variety of built-in functions and libraries that make it easy to work with different components and sensors. Another unique feature of the Arduino is its affordability. The hardware components are relatively inexpensive and widely available, making it an accessible option for hobbyists, students, and professionals alike. The Arduino community is also a unique aspect of the platform. It is a large and active community of users and developers who share their projects, knowledge, and resources online. This community provides a wealth of information and support, making it easy to learn and troubleshoot Arduino projects. Overall, the Arduino's versatility, accessibility, affordability, and supportive community make it a unique and popular platform for electronics enthusiasts and professionals alike.

4.6.2 Blynk

Blynk is a popular Internet of Things (IoT) platform that allows developers to create and deploy IoT applications quickly and easily. While Blynk is primarily focused on providing a platform for remote control and monitoring of IoT devices, it can also be used to generate reports. Blynk provides a range of widgets that can be used to collect data from sensors and other IoT devices, such as graphs, gauges, and data

tables. This data can then be visualized and displayed in real-time within the Blynk app or exported to a CSV file for further analysis. To generate reports using Blynk, you can use the Blynk API to retrieve data from your Blynk app and integrate it with third-party reporting tools or services.

For example, you could use a data visualization tool like Tableau or PowerBI to create custom reports based on the data collected from your Blynk app. Another option is to use Blynk's built-in email functionality to automatically send reports to stakeholders on a regular basis. This can be set up using Blynk's Eventor widget, which allows you to trigger actions based on various conditions, such as sending an email when a certain threshold is reached. Overall, Blynk can be a useful tool for generating IoT reports, as it provides an easy-to-use platform for collecting and visualizing data, as well as a range of integration options for exporting and automating report generation.

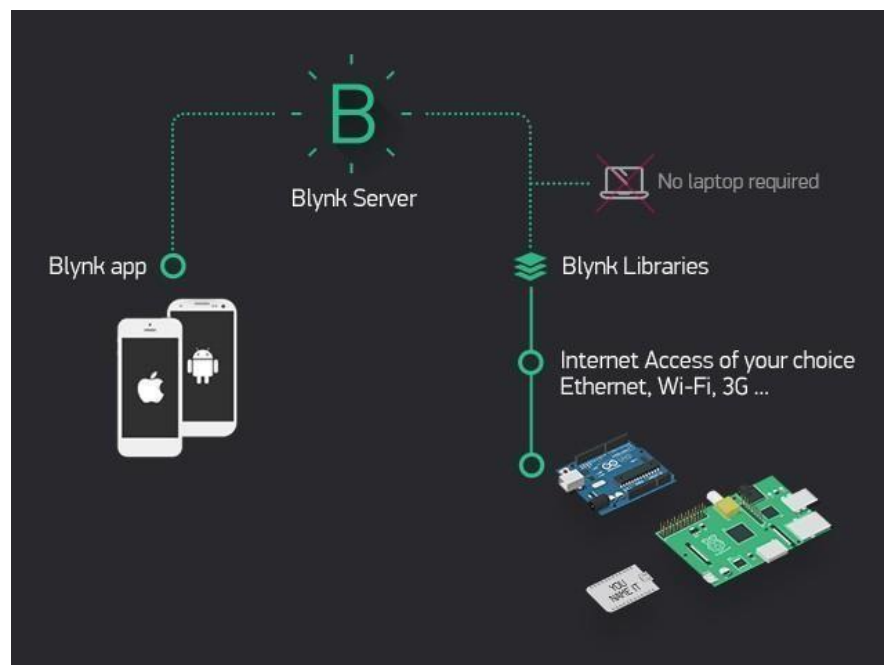


Fig4.6.2 Blynk Application Support and Interface

From Fig 4.6.2 Blynk was designed for the Internet of Things. It can control hardware remotely, it can display sensor data, and it can store data, visualize it and do many other cool things.

There are three major components in the platform:

1. Blynk App - allows you to create amazing interfaces for your projects using various widgets we provide.
2. Blynk Server - responsible for all the communications between the smartphone and hardware. You can use our Blynk Cloud or run your private Blynk server locally. Its open source could easily handle thousands of devices and can even be launched on a Raspberry Pi.
3. Blynk Libraries - for all the popular hardware platforms - enable communication with the server and process all the incoming and outgoing commands.

Now imagine: every time you press a Button in the Blynk app, the message travels to the Blynk Cloud, where it magically finds its way to your hardware. It works the same in the opposite direction and everything happens in a blink of an eye. Blynk is a unique platform for developing Internet of Things (IoT) applications. It provides a user-friendly interface for creating custom mobile apps that can be used to control and monitor a wide range of IoT devices. One of the unique features of Blynk is its drag-and-

drop interface, which allows users to easily create custom dashboards for controlling their IoT devices. Users can add buttons, sliders, gauges, and other widgets to their dashboard, and then link them to their IoT devices using Blynk's cloud-based service. Another unique feature of Blynk is its support for a wide range of hardware platforms, including popular microcontroller boards like Arduino, Raspberry Pi, and ESP8266. Blynk provides libraries and code examples for each of these platforms, making it easy to get started with IoT development even if you have no prior experience with embedded systems. Blynk also offers a range of features for advanced users, including support for custom APIs, integration with popular IoT platforms like IFTTT and Zapier, and the ability to create custom widgets using HTML, CSS, and JavaScript. Overall, Blynk is a unique platform that makes it easy for anyone to create custom mobile apps for controlling and monitoring their IoT devices. Its drag-and-drop interface, support for a wide range of hardware platforms, and advanced features make it a popular choice among developers and hobbyists alike.

Blynk is a unique platform that allows users to easily build and control Internet of Things (IoT) projects from their smartphones or tablets. It offers a user-friendly mobile app that enables users to create custom interfaces, connect to various sensors and devices, and remotely control and monitor their projects. One unique feature of Blynk is its drag-and-drop interface builder. Users can easily create custom dashboards and control panels for their projects without the need for any coding knowledge. The platform also offers a wide range of widgets and controls, including buttons, sliders, gauges, and graphs, making it easy to create interactive interfaces. Another unique feature of Blynk is its cloud-based infrastructure. The platform provides a secure and reliable cloud server that enables users to remotely control and monitor their projects from anywhere in the world. This makes it easy to build IoT projects that can be accessed and controlled from anywhere with an internet connection. Blynk is also unique in its support for a wide range of hardware platforms, including Arduino, Raspberry Pi, ESP32, and more. This means that users can build projects with their preferred hardware and easily integrate it with the Blynk platform. Overall, Blynk's unique features and user-friendly platform make it a popular choice for IoT enthusiasts and professionals looking to build and control their projects from their mobile devices.

CHAPTER –

V RESULTS AND ANALYSIS

S

5.1 RESULT

The results and discussion of Aquatic garbage management efforts can vary depending on the specific strategies and methods used. However, some general trends and observations can be made based on research and case studies in this area.

One of the main challenges of aquatic garbage management is the sheer volume of waste that enters water bodies every day. According to the United Nations, over 8 million tons of plastic end up in the oceans each year, causing significant harm to marine life and ecosystems. Therefore, preventing waste from entering the water in the first place is a crucial aspect of any garbage management strategy.

Several countries and organizations have implemented successful prevention measures, such as banning single-use plastics, implementing recycling programs, and promoting public education and awareness campaigns. For example, countries like Rwanda and Bangladesh have banned plastic bags and seen a significant reduction in plastic waste in their waterways.

However, even with prevention efforts in place, some waste will still inevitably end up in the water. Therefore, cleanup efforts are also necessary to remove waste from the water and prevent it from causing further harm. Manual cleanup efforts, such as beach cleanups and volunteer efforts, can be effective in removing large pieces of debris. However, more advanced technologies, such as drones and autonomous vehicles, are also being developed to make cleanup efforts more efficient and cost-effective.

Another aspect of aquatic garbage management is recycling. Recycling can help reduce the amount of waste that enters the water by turning waste materials into new products. However, recycling can be challenging in some cases, especially for certain

types of plastics and other materials that are difficult to recycle. Therefore, research and innovation in this area are essential to developing more efficient and effective recycling processes.

Overall, aquatic garbage management efforts have shown some success in reducing the amount of waste that enters water bodies and causing harm to marine ecosystems. However, more work is needed to develop and implement effective strategies for preventing waste and cleaning up the waste that is already in the water. Collaboration between governments, organizations, and individuals will be crucial in addressing this global issue.

There have been several initiatives aimed at improving aquatic garbage management, and many of these efforts have shown promising results. For example:

The Ocean Cleanup project: This project is a large-scale effort to remove plastic waste from the Great Pacific Garbage Patch, a vast area of floating trash in the Pacific Ocean. The project uses a system of floating barriers to capture and collect plastic waste, which is then transported to shore for recycling.

Trash Free Seas Alliance: This is a partnership between businesses, NGOs, and governments aimed at reducing marine litter. The alliance has launched several initiatives, including a program to promote recycling and reduce waste in coastal communities.

Waste collection and segregation in coastal communities: Many coastal communities around the world have implemented waste collection and segregation programs to prevent waste from entering the water. These programs involve educating residents about proper waste disposal and providing waste collection facilities in areas close to the water.

Despite these efforts, there is still a long way to go in terms of effective aquatic garbage management. Challenges such as lack of funding, insufficient waste management infrastructure, and inadequate public awareness and education continue to hamper progress.

Moreover, while efforts to remove waste from the water are important, prevention remains the most effective strategy for reducing marine litter. This involves addressing the root causes of marine litter, such as overconsumption and improper waste disposal, and promoting sustainable practices at all levels of society.

In conclusion, while there have been some positive results in aquatic garbage management, much more needs to be done to address the issue of marine litter. This will require a combination of efforts, including prevention, cleanup, and recycling, as well as greater public awareness and support from governments, NGOs, and the private sector.

5.2 LIMITATIONS OF THE PROJECT

Aquatic garbage management systems are designed to help remove and manage waste in bodies of water such as oceans, lakes, and rivers. While these systems can be effective in reducing the amount of garbage in aquatic environments, there are some limitations to their effectiveness and implementation. Some of the limitations of aquatic garbage management systems include Limited coverage Aquatic garbage management systems are typically designed to cover a specific area, such as a river or a section of coastline. This means that they may not be able to effectively address the issue of garbage in larger bodies of water or in areas that are difficult to access. Maintenance Aquatic garbage management systems require regular maintenance to ensure that they are functioning properly. This can be a costly and time-consuming process, especially if the system is in a remote or hard-to-reach area.

Cost The cost of designing, building, and implementing an aquatic garbage management system can be high. This can make it difficult for organizations with limited funding to implement such systems on a large scale. Environmental impact While aquatic garbage management systems can help remove waste from bodies of water, the systems themselves can have an environmental impact. For example, the use of boats or other machinery to collect garbage can create noise pollution and disturb marine life. Limited effectiveness While aquatic garbage management systems can help reduce the amount of garbage in aquatic environments, they are not a complete solution to the problem. It is important to address the root causes of

garbage in bodies of water, such as reducing the use of single-use plastics and improving waste management practices on land.

Aquatic garbage management systems, also known as marine litter management systems, are designed to collect, process, and dispose of waste materials in marine environments. While these systems have the potential to reduce the amount of trash in oceans and waterways, there are several limitations that need to be considered, including Limited collection range Aquatic garbage management systems are limited by their range, which can be affected by factors such as water currents, wind, and weather conditions. This means that even if a system is deployed in a certain area, it may not be able to collect all the garbage present in the surrounding waters. Maintenance requirements These systems require regular maintenance and upkeep to ensure that they are functioning properly. This can be challenging in remote locations or harsh marine environments where maintenance crews may not be readily available.

Cost The cost of designing, building, and operating aquatic garbage management systems can be significant, especially if the system needs to be customized for a particular location or application. Funding for these systems may be limited, particularly in areas where there are competing priorities for resources. Impact on marine life: The use of aquatic garbage management systems can have unintended consequences on marine life. For example, some systems may trap or harm marine animals, or disrupt natural currents and water flow. Limited effectiveness Even with the best intentions and efforts, aquatic garbage management systems may not be able to remove all the trash in marine environments. There may be areas that are difficult to access or clean, or types of waste that are not easily captured or processed by the system. Overall, while aquatic garbage management systems can be effective in reducing the amount of garbage in marine environments, they are not without limitations and must be carefully designed and implemented to minimize negative impacts on the environment and marine life.

CHAPTEVI

CONCLUSIONANDFUTUREWORK

6.1 CONCLUSION

In conclusion, the issue of marine litter poses a significant threat to our oceans and waterways, and effective aquatic garbage management is crucial for protecting marine ecosystems and human populations that rely on water sources. While there have been some promising results in aquatic garbage management efforts, such as prevention, cleanup, and recycling, there is still a long way to go to address the root causes of marine litter. This requires a sustained effort from all stakeholders, including governments, NGOs, businesses, and individuals.

Effective aquatic garbage management will require a combination of prevention, cleanup, and recycling efforts, along with greater public awareness and support. It will also require the development of new technologies, policies, and collaborations to address the challenges associated with marine litter. By working together to address this global problem, we can help protect our oceans and waterways, reduce the impact of pollution on wildlife, and promote sustainable practices for the benefit of current and future generations. Aquatic garbage management is a critical issue that requires immediate attention and action. Marine litter poses a significant threat to marine ecosystems, wildlife, and human health. However, there have been some positive results in aquatic garbage management efforts, including prevention, cleanup, and recycling initiatives.

6.2 FUTUREWORK

Future work in aquatic garbage management should focus on several key areas, including Prevention Addressing the root causes of marine litter by promoting sustainable practices and reducing waste at the source. This includes reducing the production and use of single-use plastics, promoting circular economy practices, and

encouraging sustainable consumption and production. Technology: Developing new technologies for waste removal and recycling that are efficient and cost-effective. This includes developing new materials that are biodegradable, designing new waste collection and recycling technologies, and exploring innovative approaches such as using drones to collect marine litter. Education and Awareness: Increasing public awareness about the dangers of marine litter and the importance of proper waste disposal. This includes educating the public about the impacts of marine litter on ecosystems and human health, as well as promoting sustainable waste management practices. Collaboration: Encouraging collaboration between governments, NGOs, and the private sector to share knowledge, resources, and expertise. This includes promoting public-private partnerships and encouraging the sharing of best practices across different sectors and regions. Policy: Developing and implementing policies that promote sustainable waste management practices and hold polluters accountable. This includes promoting extended producer responsibility, implementing waste reduction targets and policies, and enforcing regulations to prevent illegal dumping and littering.

Overall, addressing the issue of marine litter requires a sustained and coordinated effort from all stakeholders. By working together to address this global problem, we can help protect our oceans, waterways, and the millions of species that call them home.

REFERENCES

- [1] Derraik, J.G.B. The pollution of the marine environment by plastic debris: A review. *Mar. Pollut. Bull.*, 44(9), 842-852, 2002.
- [2] Thompson, R.C, The environment and human health: Current consensus and future trends. *Philos. Trans. R. Soc. Lond. B Biol. Sci.* 364(1526), 2153-2166, 2009.
- [3] Wright, S.L.; Thompson, R.C; Galloway, T.S. The physical impacts of microplastics on marine organisms: A review. *Environ. Pollut.* 178:483-492, 2013.
- [4] Hammer, J.; Kraak M.H; Parsons, J.R. Plastics in the marine environment: The dark side of a modern gift. *Rev. Environ. Contam. Toxicol.* 220, 1-44, 2012.
- [5] Science for Environment Policy (SEP). Plastic waste: Ecological and human health impacts, 2017.
- [6] Kaushal, V.; Sharma, R.; Sharma, M., Sharma, R.; Sharma, V. Plastics: Issues, challenges, and remediation. *Int. J. Waste Resour.* 4(1), 134-139, 2014.
- [7] Moore, C.J.; VomSaal, F.S.; Swan, Plastic Ocean Foundation. A plastic ocean 2017.
- [8] United Nations Environmental Program UNEP. Marine litter - trash that kills. Available online: <http://wedocs.unep.org/rest/bitstreams/17739/retrieve> (accessed 02 January), 2018.
- [9] United States Environmental Protection Agency (USEPA). Municipal solid waste generation, recycling, and disposal in the United States: Facts and figures, 2008.
- [10] Ryan, P.G.; Moore, C.J.; van Franeker, J.A.; Moloney, C.L. Monitoring the abundance of plastic debris in the marine environment. *Philos. Trans. R. Soc. Lond. B Biol. Sci.* 2009, 364, 1999.
- [11] Anonymous. Garbage. Center for Marine Conservation: Washington DC, USA. 1990.
- [12] Corbin, C.J.; Singh, J.G. Marine debris contamination of beaches in St. Lucia and Dominica. *Mar. Pollut. Bull.* 26, 325-328, 1993.

- [13] Debrot, A.O.; Tiel, A.B.; Bradshaw, J.E. Beach debris in Curacao. *Mar. Pollut. Bull.* 38, 795–801, 1999.
- [14] Galgani, F.; Burgeot, T.; Bocquene, G.; Vincent, F.; Leaute, J.P.; Labastie, J.; Forest, A.; Guichet, R. Distribution, and abundance of debris on the continental shelf of the Bay of Biscay and in Seine Bay. *Mar. Pollut. Bull.* 30, 58–62, 1995.
- [15] Galgani, F.; Jaunet, S.; Campillo, A.; Guenegen, X.; His, E. Distribution and abundance of debris on the continental shelf of the north-western Mediterranean Sea. *Mar. Pollut. Bull.* 1995b 30, 713–717, 2001.
- [16] Galgani, F.; Souplet, A.; Cadiou, Y.; Accumulation of debris on the deep seafloor of the French Mediterranean Coast. *Mar. Eco. Prog. Ser.* 142, 225–234, 1996.
- [17] Galgani, F.; Leaute, J.P.; Moguedet, P.; Souplets, A.; Verin, Y.; Carpenter, A.; Goraguer, H.; Latrouite, D.; Andral, B.; Cadiou, Y.; Mahe, J.C.; Poulard, J.C.; Nerisson, P. Litter on the sea floor along European coasts. *Mar. Pollut. Bull.* 40, 516–527, 2000.
- [18] Garrity, S.D.; Levings, S.C. Marine debris along the Caribbean coast of Panama. *Mar. Pollut. Bull.* 26, 317–324, 1993.
- [19] Gilligan, M.R.; Randal, S.P.; Richardson, J.P.; Kozel, T.R. Rates of accumulation of marine debris in Chatham County, Georgia. *Mar. Pollut. Bull.* 24, 436–441, 1992.
- [20] Golik, A. Debris in the Mediterranean Sea: types, quantities, and behavior. In *Marine Debris—Sources, Impacts and Solutions*, Coe, J.M.; Roger, D.B., Eds.; Springer-Verlag: New York, USA, pp. 7–14, 1997.