OCEAN PLASTIC WASTE COLLECTOR ROBOT USING ARDUINO

A PROJECT REPORT

Submitted by

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BONAFIDE CERTIFICATE

Certified that this project report **"OCEAN PLASTIC WASTE COLLECTOR ROBOT USING ARDUINO**" is the bonafide work of "**LINGESH N (2116210701133), MAKESHKUMAR S (2116210701144), MATHESHWARN K (2116210701155)**" who carried out the work under my supervision. Certified further that to the best of my knowledge the work reported herein does not form part of any other thesis or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

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ABSTRACT

This project emphasis on design of the river waste collection. Trillions of pieces of plastic currently pollute the seas, rivers, lakes, ocean harming sea life, contaminating ecosystems and making a mess on beaches. Thus, it's important to clean up the plastic in the water, but nobody knows how best to do so yet. These days practically all the assembling procedure is being automized so as to convey the items at a quicker rate. Automation plays an important role in mass production. In this venture we have manufactured the remote worked waterway cleaning machine. Prime objective of our project is to collect all the wastes which are found floating on water bodies and to minimize labor work. These are done by using a hardware prototype and by using a Microcontroller for controlling all parts of a machine by using an smart phone by using Wi-Fi or Bluetooth. We have attempted to meet every one of the destinations to this item fruitful with the end goal that our item gets propelled in the market. This project focuses on the design and implementation of an autonomous ocean plastic waste collector robot powered by Arduino microcontroller technology. The robot is engineered to navigate ocean environments, detect, and collect plastic waste, thereby contributing to the preservation of marine ecosystems. The electrical system is centered around the Arduino microcontroller, facilitating sensor data processing, decision-making, and control of the robot's actions. Actuators such as motors and servos execute tasks such as propulsion and waste collection. Benefits of this solution include efficient cleanup of plastic pollution, reduced reliance on manual methods, and increased awareness of plastic waste management.

ACKNOWLEDGMENT

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We also express our sincere gratitude to our college Principal, **Dr. S. N. Murugesan M.E., PhD.,** and **Dr. P. KUMAR M.E., PhD, Director computingand information science , and Head Of Department of Computer Science and Engineering** and our project coordinator **Mr. Gunasekar S M.Tech., (Ph.D),** for her encouragement and guiding us throughout the project towards successful completion of this project and to our parents, friends, all faculty members and supporting staffs for their direct and indirect involvement insuccessful completion of the project for their encouragement and support.

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CHAPTER 1

INTRODUCTION

1.1 GENERAL

The integration of Arduino technology into an ocean plastic waste collector robot enables real-time data processing, decision-making, and control of robotic actions. By leveraging sensors, actuators, and algorithms, the robot can autonomously navigate ocean environments, detect plastic waste, and execute collection tasks. Additionally, Arduino's open-source nature allows for customization and scalability, enabling the development of robust and adaptable robotic solutions tailored to specific environmental conditions and cleanup objectives. To develop autonomous systems capable of navigating ocean environments, detecting plastic waste, and collecting it with minimal human intervention.

The Arduino microcontroller platform provides a flexible and cost-effective foundation for developing such robotic systems, offering computational power, sensor integration capabilities, and ease of programming. This additionally lessen the challenges which we face when gathering of waste happen. A machine will lift the waste surface waste from the water bodies, this will eventually result in decrease of water contamination and in conclusion the sea-going creature's demise to these issues will be diminished. It comprises of Belt drive component which lifts the waste from the water. The use of this project will be made in rivers, ponds and other water bodies to clean the surface water debris
from bodies.

1.2 LITERATURE SURVEY

"Autonomous Underwater Robots for Marine Litter Collection: A Review" by Carreras et al.M (2018). This review provides an overview of autonomous underwater robots designed for marine litter collection. It discusses various robot designs, propulsion systems, sensing technologies, and control strategies employed in marine litter collection. While the review focuses on general underwater robots, it offers insights into the challenges and opportunities for developing ocean plastic waste collector robots. In this paper, we present a systematic review of autonomous underwater robots for marine litter collection, synthesizing the existing literature on AUV design, operation, and performance in litter detection and removaltasks. Through a critical analysis of the key technologies, challenges, and opportunities in this domain, we aim to provide a comprehensive overview of the state-of-the-art in AUV- based marine litter management and identify avenues for future research and development.

Design and Implementation of an Autonomous Surface Vehicle for Marine Litter Collection" by Fauzi et al.S (2021). This research presents the design and implementation of an autonomous surface vehicle (ASV) equipped with a robotic arm for marine litter collection. The ASV incorporates Arduino microcontrollers for sensor integration, data processing, and control, enabling autonomous navigation and litter collection. The study demonstrates the effectiveness of Arduino-based systems in addressing marine litter pollution in surface waters. Marine litter poses a significant threat to ocean ecosystems, biodiversity, and human health, necessitating innovative solutions for its mitigation and removal. In this paper, we present the design and implementation of an Autonomous Surface Vehicle (ASV) tailored for the efficient collection of marine litter. Our ASV integrates advanced robotics, sensing technologies, and autonomous navigation capabilities to autonomously traverse water surfaces, detect, and collect marine litter. The ASV's design encompasses a streamlinedhull equipped with propulsion systems for agile maneuverability and energy-efficient operation. Utilizing a combination of onboard sensors, including cameras, LiDAR, and sonar,the ASV autonomously navigates water bodies while simultaneously detecting and classifying marine litter with high precision.

"Design and Evaluation of an Autonomous Surface Vehicle for Marine Litter Collection" by Haarich et al.S (2020). This study describes the design and evaluation of an autonomous surface vehicle (ASV) specifically developed for marine litter collection. The ASV incorporates a robotic arm for collecting litter from the water surface and is equipped with sensors for navigation and object detection. The study evaluates the performance of the ASV in real-world conditions and discusses its potential for large-scale marine litter cleanup operations. The accumulation of marine litter in oceans, seas, and coastal areas poses multifaceted challenges, including ecological degradation, economic losses to fisheries and tourism industries, and potential risks to human well-being through the ingestion of contaminated seafood and the leaching of harmful chemicals. Addressing the complex issue of marine litter requires a multifaceted approach that encompasses prevention, mitigation, and clean-up strategies. While efforts to reduce plastic production and improve waste management practices are essential for long-term solutions, the removal of existing marine litter is equally critical to prevent further environmental harm and restore marine ecosystems.

Madhavi N. Wagh ,2Kashinath Munde, "Design and Analysis of River Water Cleaning Machine" IJSDR Volume 3, Issue 7, ISSN: 2455-2631. [JULY 2018]. Design and Analysis of River Water Cleaning Machine: This project emphasis on Design and Analysis of the River Water Cleaning Machine.The work has done looking at the current situation of our national rivers which are dump with crore litters of sewage and loaded with pollutants, toxicmaterials, debris etc. The government of India has taken charge to clean rivers and invest huge capital in many river cleaning projects like "Namami Gange", ''Narmada Bachao'' andmany major and medium projects in various cities like Ahmadabad, Varanasi etc. By takingthis into consideration, this machine has designed to clean river water surface. Nowadays almost all the manufacturing process is being atomized in order to deliver the products at a faster rate. Automation plays an important role in mass production. In this project we have fabricated the remote operated river cleaning machine. The main aim of the project is to reduce the man power, time consumption for cleaning the river. In this project we have automated the operation of river cleaning with help of a motor and chain drive arrangement.Some needs of automation are described below. Here using RF transmitter and receiver are to control the cleaning machine. Automation can be achieved through computers, hydraulics,pneumatics, robotics, etc., of these sources, pneumatics form an attractive medium for low- cost automation.

Osiany Nurlansa, Dewi Anisa Istiqomah, and Mahendra Astu Sanggha Pawitra, Member, IACSIT.AGATOR (Automatic Garbage Collector) as Automatic Garbage Collector Robot Model.AGATOR (Automatic Garbage Collector) as Automatic Garbage Collector Robot Model. This research aims to design and make AGATOR (Automatic Garbage Collector), a rotor robot model as automatic garbage collector to counter accumulation of garbage in the river which has no flow effectively and efficiently. The method of implementation is design and construction. This method includes the identification of needs, analysis of the components required specifically, hardware and software engineering, developing, and testing. The test results obtain data by specification of AGATOR includes IC ATMega16 with 5 Volt voltage and 1,1 ampere current, IC Driver with 12 Volt voltage and 1,2 Ampere current, and Limit switch as the controller. Support devices of the robot are mechanical robot, robot control system, sensor system, and actuator robot. The maximum load drives the garbagereceptacle until 5 kg. The average speed of robot when take out the garbage is 0,26 m/s.

River cleaning machine,this paper present theory on “river cleaning Mechanism” The system is successfully able to clean the floating solid waste over the river surface more efficiently. This system works towards its social aim of cleaning the rivers & other water bodies. It simulates the conventionally used mechanisms of using conveyors in its working principles but have an intimidating modification of Air Tube Piping Guider mechanism for improving its efficiency. The conventional & generally used method of cleaning or more precisely collecting the floating waste are manual or by means of boat etc. and are deposited near the shore of river. But these methods are risky, costly, time consuming and required major workforce. By considering all the parameters of river surface cleaning systems and eliminating the drawback of all the methods mention earlier, the remote operated river cleaning machine has been designed and constructed which helps in river surface cleaning effectively, efficiently and ecofriendly. The main aim of the project is to reduce the manpower, time consumption and thereby increasing the efficiency of the machine for cleaning the river. In this project, we have remotely controlled the operation of river cleaning with the help of motor, coupling & R/C arrangement.

1.3 SUMMARY OF LITERATURE SURVEY

Nowadays human population became a greatest challenge for recycling and managing the available resources in our motherland. Since humans are major polluting agents of fresh water resources available on the Earth. Humans pollute water resources by means of throwing waste like plastic and garbage into water bodies, wastes from factories and other industries are allowed to mix with the fresh water sources. In addition to that natural barriers such as shrubs grown in the water surface causes the water current to stay stagnant in some crowded areas of garbage and plants. These challenges will be resolved by our project. A new type of chemical salted corrosion free blades was used in our rotating blade system. This helps in aiding our module to work much longer than anticipated lifetime. Cutting is done over variety of plants which may vary in their biological composition and can cause chemical damage to the blades. To overcome that, we used special blades and this adds extra advantage to our module.

1.4 METHODOLOGY

Identify the scope of your project, including the type and size of plastic waste to be collected, the depth at which the collector will operate, and any environmental constraints. Choose sensors and actuators suitable for marine environments, such as waterproof ultrasonic sensors for obstacle detection and waterproof motors for propulsion. Construct the physical structure of the plastic waste collector using the selected materials and manufacturing techniques. Conduct initial bench tests to verify the functionality of individual components, such as sensors, motors, and communication interfaces. Once the plastic waste collector has been successfully tested, deploy it in the target ocean environment for long-term monitoring and operation.

1.5 OBJECTIVE

Contributing to the preservation of marine ecosystems and biodiversity by effectively removing plastic waste from oceans. Integrating propulsion mechanisms such as thrusters or propellers to enable efficient movement through water.

Designing a streamlined mechanical structure optimized for maneuverability and durability in marine conditions. Designing a robust and scalable solution capable of adapting to different environmental conditions and cleanup scenarios.

1.6 ORGANIZATION OF THESIS

This thesis is organized into four chapters. The description about each chapter is a follow.

Chapter 1: deals with introduction, literature survey, objectives, methodology and the chapter wise organization.

Chapter 2: explains the functional block diagram and gives each block explanation.

Chapter 3: explains about the operation and analysis of the system.

Chapter 4: presents the conclusion, results and the scope for the future work.

CHAPTER -2

OVERVIEW OF THE PROJECT

2.1 INTRODUCTION

The increasing accumulation of plastic waste in our oceans has become a critical environmental concern, posing significant threats to marine life, ecosystems, and human health. Addressing this issue requires innovative solutions that can efficiently remove plastic debris from marine environments while minimizing the impact on aquatic ecosystems. In response to this challenge, we propose the development of an Ocean Plastic Waste Collector using Arduino, an autonomous robotic system designed to detect, collect, and remove plastic waste from ocean surfaces. Leveraging the versatility and accessibility of Arduino microcontroller technology, our project aims to contribute to the global efforts to combat marine plastic pollution by providing an affordable and scalable solution for plastic waste removal.

2.2 BLOCK DIAGRAM

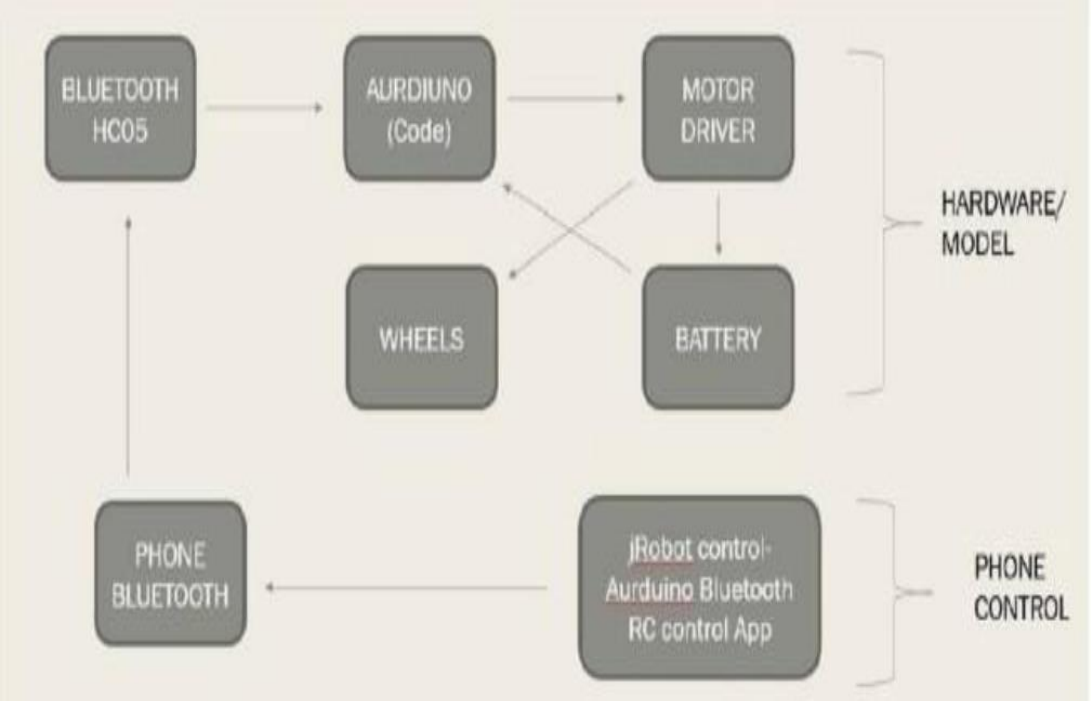

Fig 2.1 BLOCK DIAGRAM

Fig 2.1 shows the block diagram of ocean plastic waste collector robot using arduino.

2.3 EXPLANATION FOR BLOCK DIAGRAM

Arduino Microcontroller: At the heart of the robot is an Arduino microcontroller board, which serves as the central processing unit. It receives inputs from sensors, processes them according to the programmed instructions, and controls the output devices accordingly**.**

Bluetooth HC05: the Bluetooth HC-05 module is a versatile and affordable solution for adding Bluetooth connectivity to a wide range of electronic projects.

Motor Drivers**:** These components interface between the Arduino and the motors, controlling their speed and direction. H-bridge motor driver modules are commonly used for this purpose.

Motors**:** The robot employs DC motors to drive its wheels or cleaning mechanisms. These motors are responsible for the robot's movement across surfaces and can be controlled to maneuver in different directions.

Lithium-ion Battery**:** Lithium-ion (Li-ion) batteries have become ubiquitous in our modern world, powering everything from smartphones and laptops to electric vehicles and energy storage systems.

Wheels**:** Wheels are circular objects that rotate around an axle, allowing vehicles and other objects to move more efficiently by reducing friction between the moving object and the surface it travels on.

2.3.1 Arduino Microcontroller

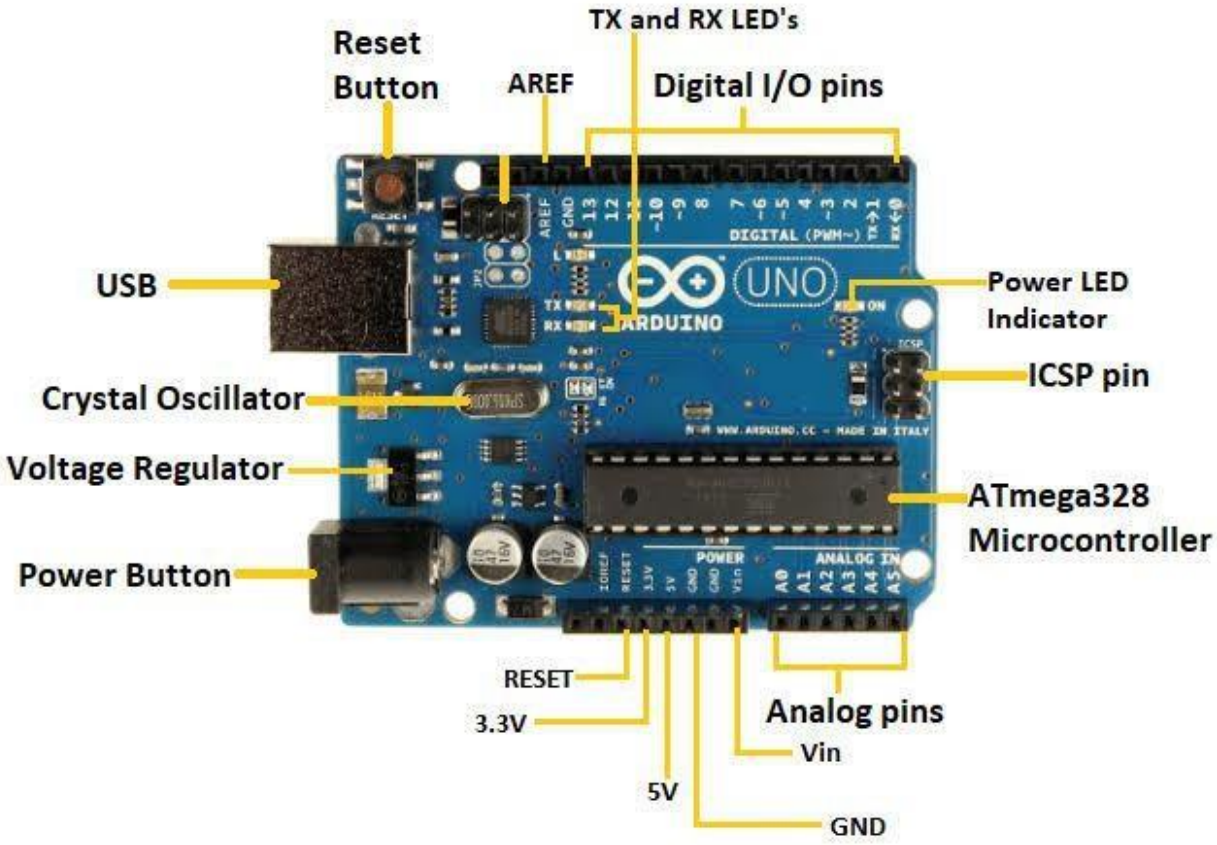

Fig 2.2 ARDUINO MICROCONTROLLER

Fig 2.2 shows the pin diagram of Arduino Microcontroller.

ARDUINO UNO DESCRIPTION

Uno is a microcontroller board based on 8-bit ATmega328P microcontroller. Along with ATmega328P, it consists other components such as crystal oscillator, serial communication, voltage regulator, etc. to support the microcontroller. The Arduino Uno comes with USB interface, 6 analog input pins, 14 I/O digital ports that are used to connect with external electronic circuits. Out of 14 I/O ports, 6 pins can be used for PWM output. It allows the designers to control and sense the external electronic devices in the real world.

Since it was first debuted the Arduino Uno has been a huge hit with electronics enthusiasts from beginner hobbyists to professional programmers. It is an open-source platform, means the boards and software are readily available and anyone can modify and optimize the boards for better functionality. The software used for Arduino devices is called IDE (Integrated Development Environment) which is free to use and required some basic skills to learn it. It can be programmed using C and C++ language.

ARDUINO UNO PINOUT

Vin: This is the input voltage pin of the Arduino board used to provide input supply from an external power source.
5V: This pin of the Arduino board is used as a regulated power supply voltage and it is used to give supply to the board as well as onboard components.
3.3V: This pin of the board is used to provide a supply of 3.3V which is generated from a voltage regulator on the board
GND: This pin of the board is used to ground the Arduino board.
Reset: This pin of the board is used to reset the microcontroller. It is used to Resets the microcontroller.
Analog Pins: The pins A0 to A5 are used as an analog input and it is in the range of 0-5V.
Digital Pins: The pins 0 to 13 are used as a digital input or output for the Arduino board.
Serial Pins: These pins are also known as a UART pin. It is used for communication between the Arduino board and a computer or other devices. The transmitter pin number 1 and receiver pin number 0 are used to transmit and receive the data resp.

External Interrupt Pins: This pin of the Arduino board is used to produce the External interrupt and it is done by pin numbers 2 and 3.
PWM Pins: This pin of the board is used to convert the digital signal into an analog by varying the width of the Pulse. The pin numbers 3,5,6,9,10 and 11 are used as a PWM pin.
SPI Pins: This is the Serial Peripheral Interface pin; it is used to maintain SPI communication with the help of the SPI library. SPI pins include:
SS: Pin number 10 is used as a Slave Select
MOSI: Pin number 11 is used as a Master Out Slave In
MISO: Pin number 12 is used as a Master In Slave Out
SCK: Pin number 13 is used as a Serial Clock
LED Pin: The board has an inbuilt LED using digital pin-13. The LED glows only when the digital pin becomes high.
AREF Pin: This is an analog reference pin of the Arduino board. It is used to provide a reference voltage from an external power supply.

The arduino can be programmed using the arduino open-source software. Once the program is developed, the program can be dumped on the board by connecting it either with a laptop or computer. Once the program is dumped, we can remove its connection from laptop or computer and can be powered using external supplies. Once a program is dumped to the board, the program remains in the board until a new programmed is dumped. The programs can be changed or updated and can be dumped multiple times. The function of the controller is to receive the speed of rotation of rotor shaft from the speed sensor and check whether the speed is within the desired range and if it exceeds the range increase the gear and if it is below the range the gear is decrease until the speed comes back to optimum value.

2.3.2 Motor Driver L298N 2A

Two enable inputs are given to enable or disable the gadget freely of the info signals. The producers of the lower transistors of each extension are associated together and the relating outside terminal can be utilized for the association of an outer detecting resistor. An extra Supply input is provided so that the logic works at the lower voltages used as triggering.

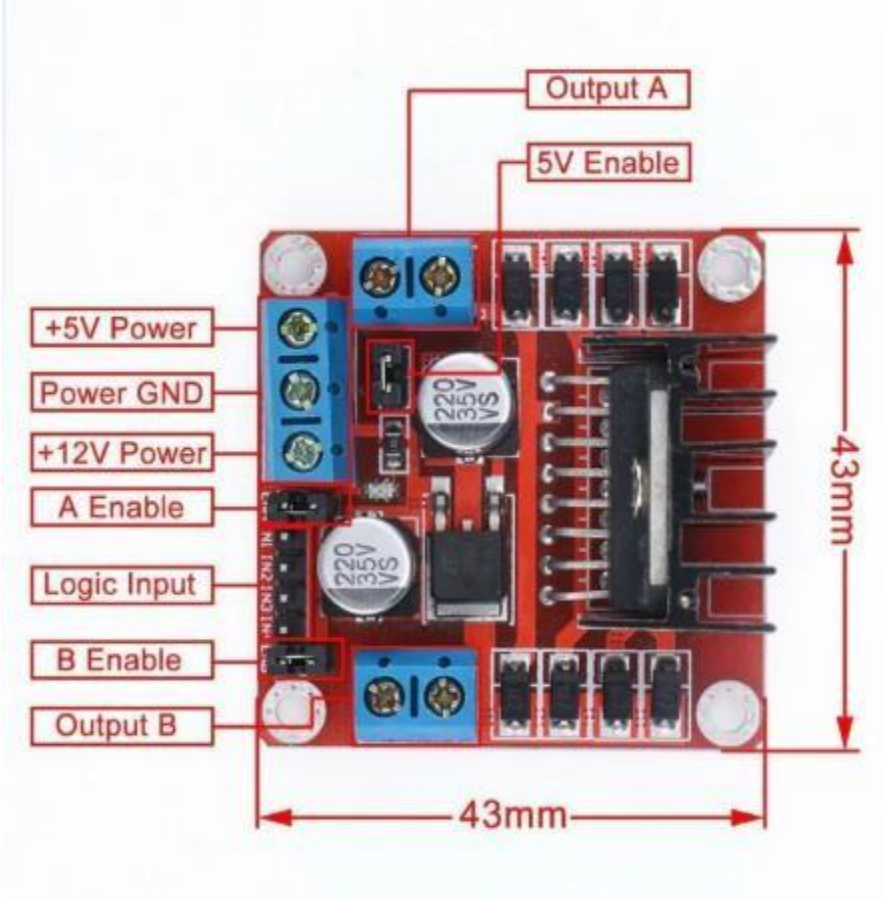

Fig 2.3 MOTOR DRIVER L298N 2A

Fig 2.3 shows the diagram of Motor Driver L298N 2A

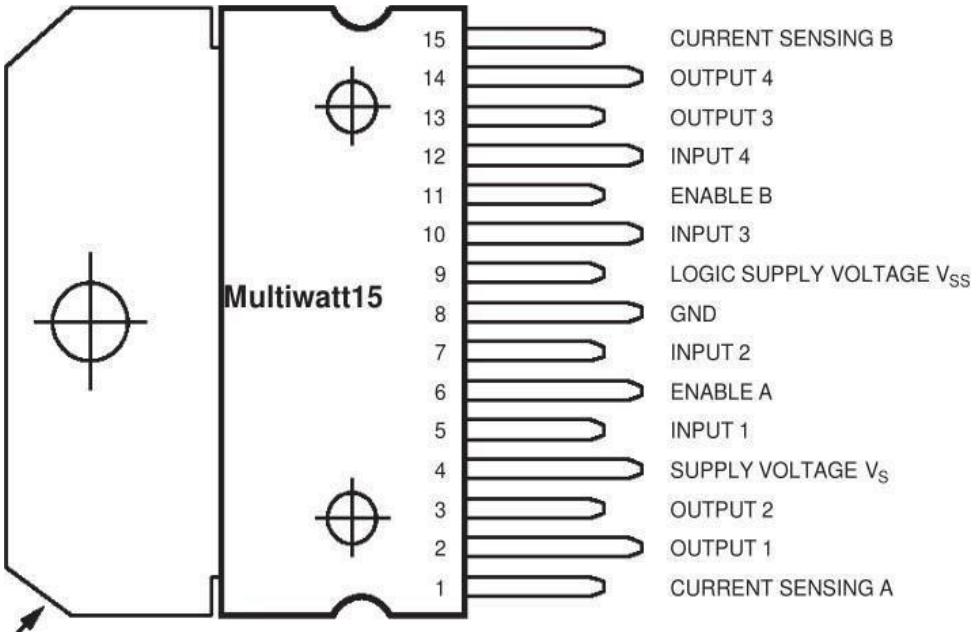

Fig 2.4 PIN DIAGRAM OF MOTOR DRIVER L298N 2A

Fig 2.4 shows the pin diagram of Motor Driver L298N 2A

The L298N is a popular dual H-bridge motor driver integrated circuit (IC) commonly used in robotics and other applications where controlling the direction and speed of DC motors is required. Here's an overview of the L298N motor driver: The L298N is designed to control two DC motors bidirectionally, allowing them to rotate forward, reverse, or stop. It can drive motors with voltages ranging from 5V to 35V and currents up to 2A per channel (with proper heat sinking).The L298N uses an H-bridge configuration, which consists of four transistors arranged in a bridge formation. This configuration enables the motor driver to control the polarity of the voltage applied to the motor terminals, thereby controlling its direction of rotation. Built-in Diodes: The L298N has built-in flyback diodes (also known as freewheeling diodes) to protect the circuit from voltage spikes generated by the motor when it is turned off. These diodes provide a path for the current to circulate safely, preventing damage to the driver. Control Interface: The L298N can be controlled using simple digital signals from a microcontroller or other control circuitry. It has input pins for controlling the direction (e.g., IN1 and IN2 for Motor 1) and speed (e.g., ENA for Motor 1) of each motor.

2.3.3 Bluetooth Module

HC-05 module is a simple to utilize Bluetooth SPP (Serial Port Protocol) module, intended for straightforward remote sequential association setup. The HC-05 Bluetooth Module can be utilized in a Master or Slave arrangement, making it an incredible answer for remote correspondence. This sequential port Bluetooth module is completely qualified Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation with complete 2.4GHz radio handset and baseband. It utilizes CSR Blue center 04-External single chip Bluetooth framework with CMOS innovation and with AFH (Adaptive Frequency Hopping Feature).

All-inclusive offbeat recipient/transmitter is typically an individual incorporated circuit utilized for sequential interchanges for PC or fringe gadget sequential port. UART are currently generally utilized in micro- controllers. A double UART joins two UARTS into a solitary chip. Numerous cutting-edge ICs accompany a UART that can likewise convey synchronously; these gadgets are called UART. UARTs are generally utilized related to correspondence principles, for example, TIA (once in the past EIA) RS-232, RS-422 or RS-485. The all-inclusive assignment demonstrates that the information configuration and transmission speeds are configurable. The electric flagging dimensions and strategies, (for example, differential flagging and so on.) are dealt with by a driver circuit outer to the UART. The UART takes bytes of information and transmits the individual bits in a grouping. At the goal, a second UART re-collects the bits into complete bytes. Each UART contains a move register, which is the crucial strategy for transformation among sequential and parallel structures. Sequential transmission of computerized data (bits) through a solitary wire or other medium is less expensive than parallel transmission through numerous wires.

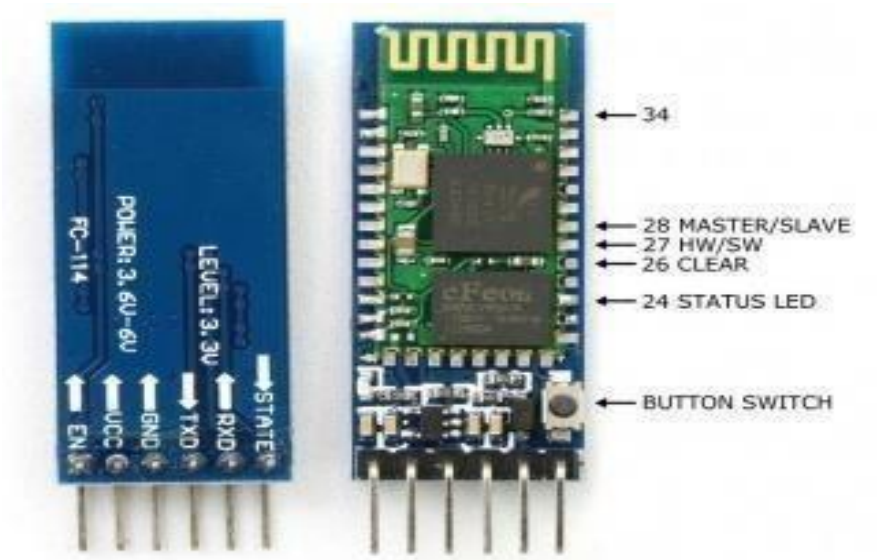

Fig 2.5 HC-05 BLUETOOTH MODULE

Fig 2.5 shows the diagram of HC-05 Bluetooth Module

2.3.4 Conveyor Belt

Fig 2.6 CONVEYOR BELT

A transport line is the conveying mechanism of a belt transport framework. A belt transport framework is one of numerous kinds of transport frameworks. A belt transport framework comprises of at least two pulleys, with a perpetual circle of conveying medium—the transport line—that turns about them. Either of the pulleys are fueled, moving the belt and the material on the belt forward. The fueled pulley is known as the drive pulley while the unpowered pulley is known as the idler pulley. Fig 2.6 shows the diagram of Conveyor belt.

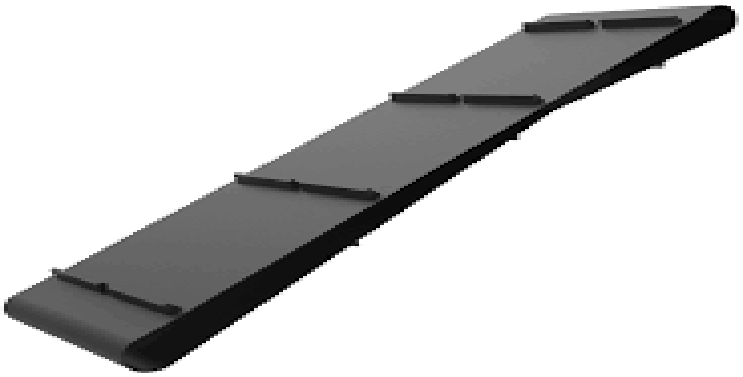

Fig 2.7 CONVEYOR BELT

There are two principle mechanical classes of belt transports; Those when all is said in done material taking care of, for example, those moving boxes along inside a processing plant and mass material dealing with, for example, those used to transport extensive volumes of assets and horticultural materials, for example, grain. Fig 2.7 shows the diagram of Conveyor belt.

2.3.5 Battery

An electric battery is a gadget comprising of at least one electrochemical cell with outside associations gave to control electrical gadgets, for example, spotlights, advanced mobile phones, and electric cars. At the point when a battery is providing electric power, its positive terminal is the cathode and its negative terminal is the anode. The terminal stamped negative is the wellspring of electrons that will move through an outside electric circuit to the positive terminal. At the point when a battery is associated with an outside electric burden, a redox response changes over high vitality reactants to bring down vitality items. Fig 2.8 shows the diagram of Battery.

Fig 2.8 BATTERY

2.3.6 Wheels

A water wheel is a machine for changing over the vitality of streaming or falling water into valuable types of intensity, frequently in a watermill. A water wheel comprises of a wheel, with various edges or basins organized outwardly edge framing the driving surface.

The blades which are present around the wheels will push the water and then the machine will move the direction that we required. This wheel is connecter to a motor and motor is fixed to a device. Whenever we want to move a vehicle on a river or water, then we are rotating specified motors due to that rotating wheels the vehicle will move forward, backward, left or right. Fig 2.9 shows the block diagram of wheels.

Fig 2.9 WHEELS

2.4 CONCLUSION

The components which are exposed for the project are studied and properties are analysed.

CHAPTER 3

HARDWARE ANALYSIS

3.1 INTRODUCTION

The Arduino controller has a specialized software for itself called the Arduino IDE. The latest version Arduino 2.3.2 is used here. Generally, the Arduino program consists of two main parts the setup part and the loop part.

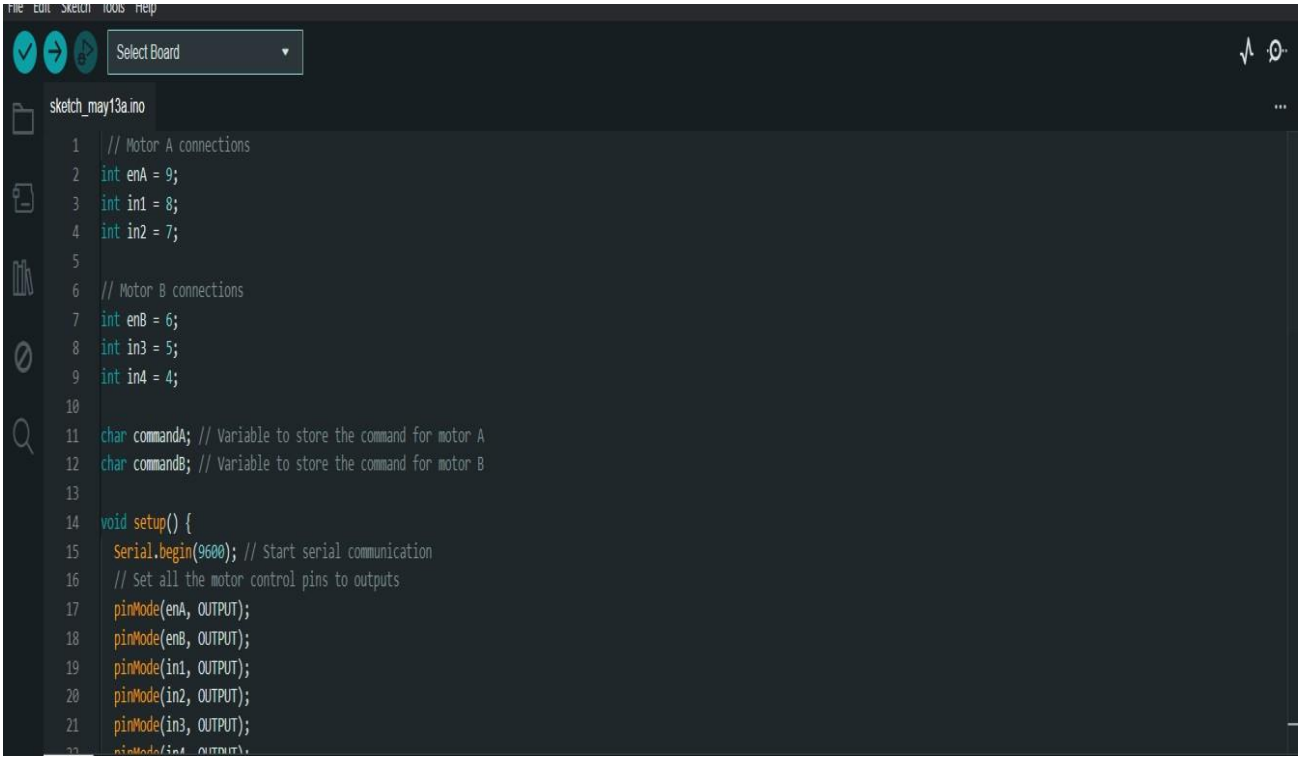

Fig 3.1 ARDUINO SOFTWARE

Fig 3.1 shows the diagram of the code in Arduino software.

3.2 HARDWARE SETUP

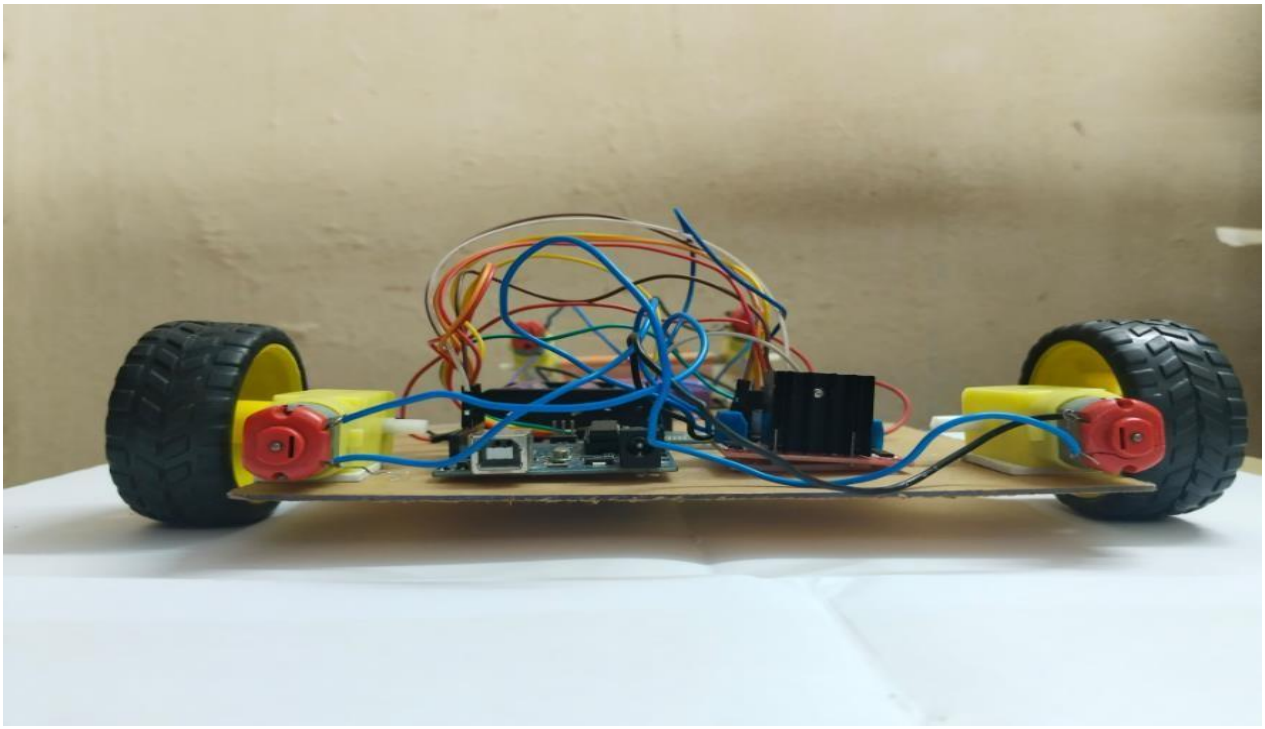

Fig 3.2 HARDWARE SETUP

The collector is deployed into the ocean, either manually or using an automated launching system, from a stationary platform or a vessel. As the collector moves through the water, the conveyor belt system continuously rotates, scooping up plastic waste floating on the surface. Side guards on the conveyor belt prevent collected waste from falling off, ensuring efficient collection. Throughout the operation, the Arduino microcontroller continuously monitors the status of the conveyor belt system, sensor readings, and power levels. It adjusts the collector's speed, direction, and other parameters as necessary to optimize performance and ensure safe operation. Periodically, the collector is retrieved from the ocean for maintenance and inspection. Maintenance tasks may include cleaning the conveyor belt, inspecting mechanical components for wear or damage, and replacing any faulty sensors or electronics.

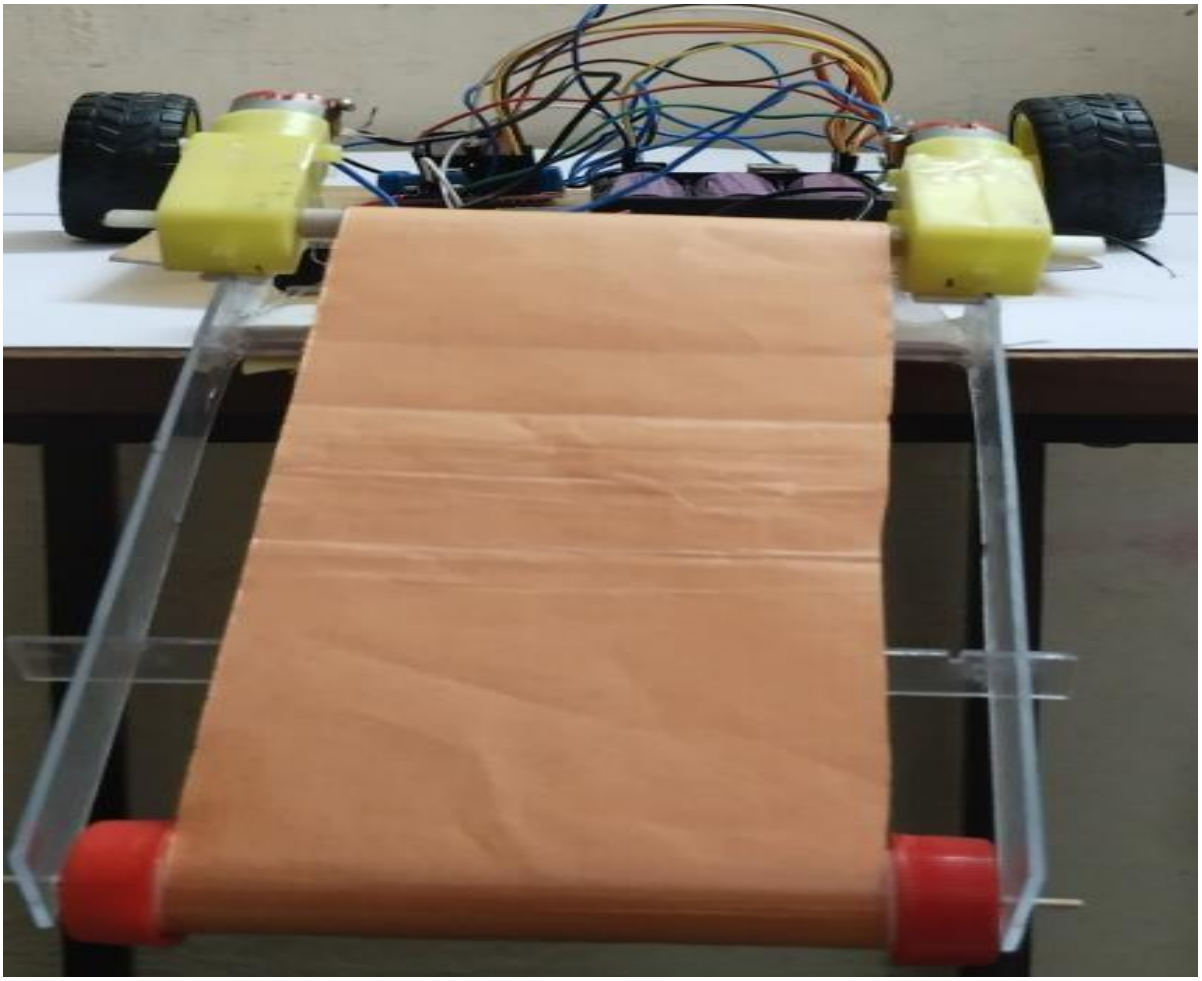

Fig 3.3 HARDWARE SETUP

Fig 3.2 and Fig 3.3 shows the front and back of the hardware setup.

3.3 CIRCUIT DIAGRAM

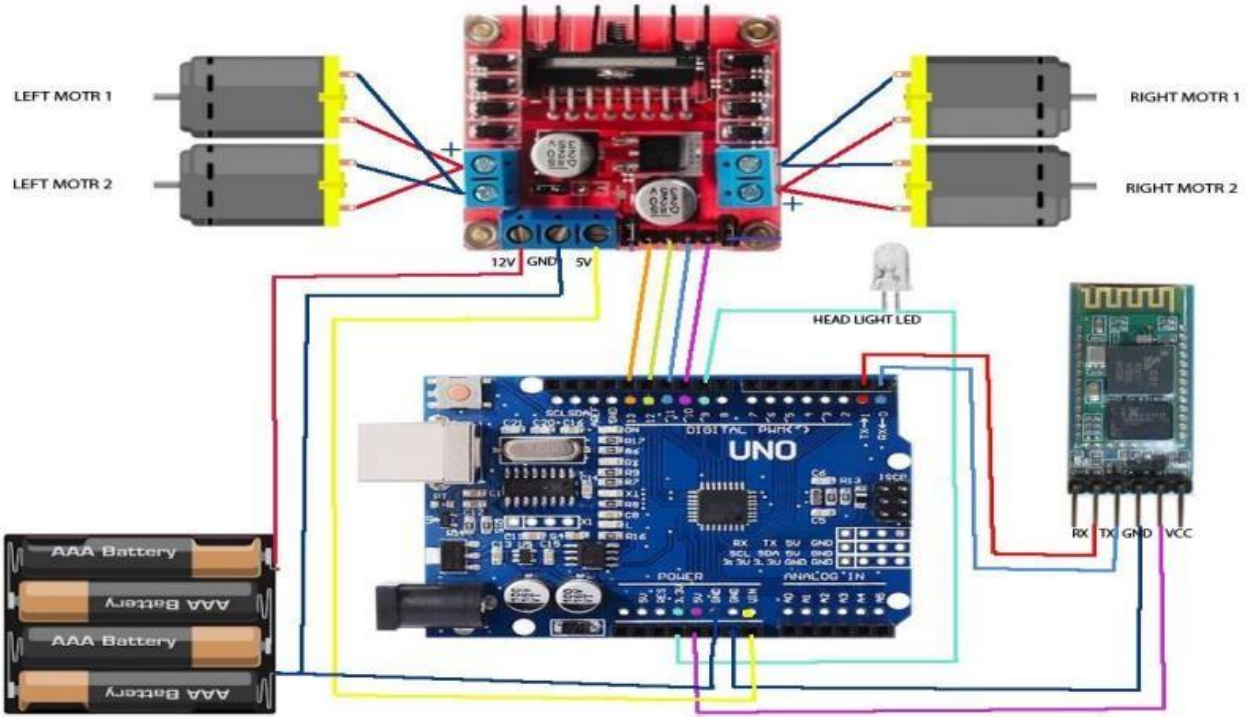

Fig 3.4 CIRCUIT DIAGRAM

Fig 3.4 shows the diagram of circuit diagram.

CHAPTER-4

CONCLUSIONS AND FUTURE SCOPE

This chapter summarizes the conclusions drawn from the project carried out to ocean plastic waste collector robot using arduino is a budget-friendly solution for automating waste collecting tasks. By leveraging Arduino's open-source platform, users can build a robot equipped with sensors and actuators to navigate and clean water surfaces effectively while keeping costs low.

4.1 CONCLUSION

In conclusion, the development of an ocean plastic waste collector utilizing Arduino technology represents a significant stride towards mitigating the escalating crisis of marine plastic pollution. Through the integration of Arduino-based sensors and control mechanisms, the prototype demonstrates an efficient and scalable solution for addressing this global environmental challenge. Further research and development efforts are warranted to optimize the performance and scalability of the technology, ultimately contributing to the preservation of marine ecosystems for future generations.

4.2 FUTURE SCOPE

Ocean plastic waste collector using Arduino is a fantastic initiative that combines technology with environmental sustainability. Continuously work on improving the efficiency of the waste collector. This could involve optimizing the design for better maneuverability in water, increasing the collection capacity, or refining the sensing mechanisms to detect and collect waste more effectively. Foster collaboration with other organizations, governments, and communities to scale the deployment of ocean plastic waste collectors. This could involve sharing resources, best practices, and lessons learned to maximize impact.

5.REFERENCES

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[4] Madhavi N. Wagh,2Kashinath Munde, “Design and Analysis of River Water Cleaning Machine” IJSDR Volume 3, Issue 7, ISSN: 2455-2631. [JULY 2018].

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6.APPENDIX

```
// Motor A connections
int enA = 9;
int in1 = 8;
int in2 = 7;
// Motor B connections
int enB = 6;
int in3 = 5;
int in4 = 4;
char commandA; // Variable to store the command for motor A
char commandB; // Variable to store the command for motor B
void setup() {
  Serial.begin(9600); // Start serial communication
  // Set all the motor control pins to outputs
  pinMode(enA,  OUTPUT);
  pinMode(enB, OUTPUT);
  pinMode(in1, OUTPUT);
  pinMode(in2, OUTPUT);
```

```
pinMode(in3, OUTPUT);
pinMode(in4, OUTPUT);
}

void loop() {
  if(Serial.available() > 1){ // Check if at least two characters are available to read
    commandA = Serial.read(); // Read the command for motor A
    commandB = Serial.read(); // Read the command for motor B

    // Move motors according to received commands
    moveMotors(commandA, commandB);
  }
}
void moveMotors(char cmdA, char cmdB){
  // Move motor A
  if(cmdA == 'F'){ // Move motor A forward
    digitalWrite(in1, HIGH);
    digitalWrite(in2, LOW);
```

```
analogWrite(enA, 255); // Adjust speed by changing PWM value (0 to 255)
  } else if(cmdA == 'B'){ // Move motor A backward
    digitalWrite(in1, LOW);
    digitalWrite(in2, HIGH);
    analogWrite(enA, 255); // Adjust speed by changing PWM value (0 to 255)
  } else { // Stop motor A
    digitalWrite(in1, LOW);
    digitalWrite(in2, LOW);
  }
// Move motor B
  if(cmdB == 'F'){ // Move motor B forward
    digitalWrite(in3, HIGH);
    digitalWrite(in4, LOW);
    analogWrite(enB, 255); // Adjust speed by changing PWM value (0 to 255)
  } else if(cmdB == 'B'){ // Move motor B backward
    digitalWrite(in3, LOW);
```

```
digitalWrite(in4, HIGH);
    analogWrite(enB, 255); // Adjust speed by changing PWM value (0 to 255)
  } else { // Stop motor B
    digitalWrite(in3, LOW);
    digitalWrite(in4, LOW);
  }
}
```