Bluetooth Controlled Aquatic Waste Collector

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Abstract - The Bluetooth Controlled Aquatic Waste Collector Project aims to design and develop an innovative solution for collecting aquatic waste using Bluetooth technology. The system enables remote monitoring and control of the waste collection process, improving efficiency and reducing labor costs. The design of the river garbage collecting system is the focus of this project. Currently, trillions of plastic particles contaminate rivers, lakes, the ocean, and seas, killing marine life, destroying ecosystems, and littering beaches. Therefore, removing plastic from the water is crucial, but no one is yet sure how to go about doing it. Nowadays, almost every step of the assembly process is automated to move the goods more quickly. Mass manufacturing relies heavily on automation. We have produced the remote-operated waterway cleaning machine as part of this endeavor. Our project's main goals are to reduce labor costs and gather any rubbish that is seen floating on water bodies. These are accomplished by utilizing a hardware prototype and a microcontroller to control every component of a machine via Bluetooth or Wi-Fi on a smartphone. We have made an effort to successfully fulfill each destination for this item with the ultimate objective of seeing our product gain traction in the market.

Keyworeds - Water Waste, Arduino Uno, Motor, Bluetooth, Plastic waste, Conveyor.

1. INTRODUCTION

Water is basic requirement of life on Earth, faces a critical challenge of pollution across many nations despite its abundance. A staggering 80% of water sources in India are contaminated. Pollution of water bodies in the country stems from various sources including floating garbage, weeds, plastics, sewage, industrial effluents, and toxic materials [1]. In response to this pressing issue, the Indian government has initiated projects such as ‘Swatch Bharat' and 'Smart City' as part of the Clean and Smart India mission. Central to these efforts is the goal of surface cleaning of rivers to remove solid waste, reflecting a significant investment by the government. However, the manual cleaning of water bodies poses numerous challenges including health hazards for laborers involved. This method is far from ideal and leads to various health issues such as musculoskeletal problems, intestinal diseases, and injuries. To address these challenges, there is a need for innovative solutions for the automate river cleaning Infrastructure which is cost-effective. The proposed solution is a water surface trash collector work designed to automate the collection of surface garbage from water bodies. This device aims to aid in cleaning small water areas by using a Bluetooth-enabled app to collect waste from the surface [2]. Development includes both software and hardware stages. Utilizing Solid works and an Arduino Circuit was developed to control the robot

functions. Testing has demonstrated the robot effectiveness in removing waste from water surfaces. This work aims to develop a prototype with a collector capable of efficiently cleaning water bodies by autonomously removing floating debris; thereby collecting the debris enhances the quality of water, which leads in quality of lives on the earth.

2. REVIEW OF LITERATURE

"Design and Development of a Portable Trash Collector Boat for Small Water Bodies" A literature review was carried out by S.H.Y.S. Abdullah, M.A.A Mohd Azizudin, A. Endut in (2019) , found that urbanization and industrial growth have led to increased pollution in these water bodies, primarily due to the accumulation of solid waste on their surfaces. This review examines the development of a trash collector boat to address the pollution problem in small water bodies like streams and drainage systems. "Smart Waste Controller Boat: A Solution for Cleaning Small Waterways" research done by Suhaimi, Rahman addresses the need for efficient waste management in small waterways in Malaysia. By leveraging technologies like the Interceptor and incorporating remote control functionality via Bluetooth, this project aims to provide a scalable solution for maintaining the cleanliness of small water bodies. "A Solution for Mitigating Water Pollution in Malacca River" survey done by M.F. Mukhtar, M.I.F. Rosley, A.M.H.S. Lubis, N. Tamaldin, M.S.F. Hussin, A.A.M. Damanhuri, K.A. Azlan, N.H. Hanizat thought that .The River Trash Collector System (RTCS) offers a promising solution to mitigate water pollution in the Malacca River and other water bodies. By adopting a watershed management approach and leveraging concepts like the Seabin, RTCS aims to reduce plastic pollution and improve water quality."the innovation of water trash collector by using arduino" The research that was M., Halim, A., & Din, M. N. B In this paper, the objectives of the project are to reducing the garbage as well as the manpower consumption and for handling the cleanliness process. The project focuses on designing a high stability of Water Trash Collector (WTC) model and fabricate this vehicle with the high stainless-steel material."A Review of Automated Surface Cleaning Systems for Water Bodies" Analysis done by Prof. Dr. Umesh Chavan and his students, present a promising solution to address water pollution challenges in India and other developing countries. The proposed water cleaning bot project demonstrates the feasibility and effectiveness of automated systems in removing floating garbage from water bodies. "Addressing River Pollution: A Literature Review on Causes, Impacts, and Cleanup Technologies" done survey by Kamarudin, N.A.S., Nordin, I.N.A.M., Misman, D., Khamis, N., Razif, M.R.M., Noh, F.H.M. in (2021)prosses that River pollution poses significant environmental and societal challenges, necessitating concerted efforts to mitigate its impacts. Government initiatives and cleanup technologies play crucial roles in addressing river pollution, with innovative approaches such as water surface cleaning robots and smartphone-controlled garbage collectors offering promising solutions."Advancements in Water Trash Collector (WTC) Technology" According to the findings of a comprehensive study that done Shamsuddin et al proposes Advancements in WTC technology have led to more efficient and reliable garbage collection systems for rivers and lakes. Innovations such as smartphone-based controls, deep neural network systems, and catamaran hull designs have improved operational capabilities and stability. Future research should focus on further enhancing automation features and optimizing energy efficiency to address water pollution effectively.

3. METHODOLOGY

3.1. DESIGN:

To make sure our prototype can float properly and stay balanced even when it's carrying a lot of waste, we've designed it to look like a boat. In order to float the trash collector, we have attached some water bottles at the bottom, such that the total weight due collected trash and heavy equipment like motors, batteries, motor driver will be compensated [5].The boat's base is made of ply-wood, the collector tray is made of lightweight sun board sheet. For movement, we have made a propeller by attaching sun board sheets pieces to the wheels of trash collector which is powered by a 300-rpm geared DC motor. These propellers help the robot move in the water [6]. We're also using the same DC motors to control the motion of the conveyer belt, which moves to dump garbage into the collector tray. All these motors are powered by a 12V battery weighing 0.55 kg. To control the robot's movement and the conveyer belt, we need a microcontroller and motor drivers. We've chosen the Arduino Uno as the brain of our robot [7], which will be programmed in Arduino IDE and the motor drivers will help us control the propellers and the conveyer belt effectively. The Arduino Uno is connected to a Bluetooth module (HC-05), which enables the mobile control of the robot. This works under masterslave arrangement [8] . The materials we have chosen for the robot's construction are durable and resistant to water damage. This ensures the longevity of the robot even when operating in challenging aquatic environments. As we are using energy-efficient components and optimizing the power management system to maximize the robot's operational time between battery recharges or replacements. This ensures sustained performance and minimizes downtime, resulting in more effective waste removal from water sources.

COMPONENTS:

3.2.Arduino Uno:

The Arduino Uno is a popular microcontroller board based on the ATmega328P chip. It features 14 digital input/output pins, with 6 of them capable of providing PWM (Pulse Width Modulation) output. Additionally, it includes 6 analog input pins. The Uno operates at a clock speed of 16 MHz and has 32 KB of flash memory for storing code (of which 0.5 KB isused by the boot loader). It has a USB connection for programming and power, making it easy to connect to a computer for uploading code. The Uno is widely used for prototyping and DIY electronics projects due to its versatility and ease of use.

Specifications	Arduino Uno
• Microcontroller: ATmega328P • Operating Voltage: 5V • Input Voltage (recommended):7- 12V • Input Voltage (limits): 6-20V • Digital I/O Pins: 14, Analog Input Pins: 6 • DC Current per I/O Pin: 20 mA • Flash Memory: 32 KB (ATmega328P) • SRAM: 2 KB (ATmega328P) • EEPROM: 1 KB(ATmega328P) • Clock Speed:16 MHz, USB Interface:ATmega16U2	 **Fig:1 Arduino Uno**

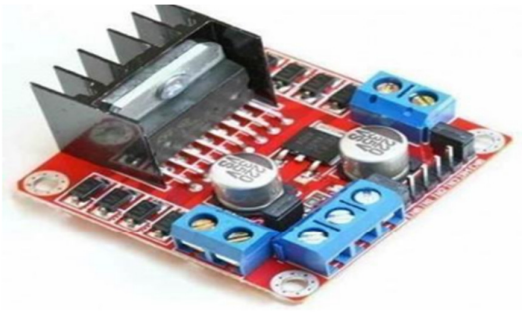
3.3. BLUETOOTH MODULE:

It facilitates communication between microcontrollers and mobile devices HC-05 has red LED which indicates connection status, whether the Bluetooth is connected or not. Before connecting to HC-05 module this red LED blinks continuously in a periodic manner. When it gets connected to any other Bluetooth device, its blinking slows down to two seconds.This module works on 3.3V. We can connect 5V supply voltage as well since the module has on board 5 to 3.3 V regulator. The data transfer rate of HC-05 module can vary up to 1Mbps is in the range of 10 meters.

Specifications	**Bluetooth Module**
• Operating Voltage: 3.3V • Frequency: 2.4GHz ISM band • Baud Rate: Default baud rate of 9600 bps • Default PIN: 1234 or 0000	 **Fig:2 Bluetooth Module**

3.4.MOTOR DRIVER:

To connect motors to the Arduino, we are using a motor driver shield called the L298N. This shield can handle both high current and high voltage. It can take signals from the Arduino and control various devices like motors, solenoids, and relays. The L298N has pins that can turn devices on or off. The L298N is like a controller for two motors at once. It controls the speed and direction of both motors together. It's designed to work with DC motors that run on voltages between 5 and 35 volts and can handle a peak current of up to 2 amps.

Specifications:	**Motor Driver**
• Driver Model: L298N 2A • Driver Chip: Double H Bridge L298N • Motor Supply Voltage (Maximum): 46V • Motor Supply Current (Maximum): 2A • Logic Voltage: 5V • Driver Voltage: 5-35V • Driver Current:2A • Logical Current:0-36mA • Maximum Power (W): 25W	 **Fig:3 Motor Driver**

• Current Sense for each motor • Heatsink for better performance • Power-On LED indicator	

3.5.DC MOTORS:

We have made the use of DC motors at two locations. The first application is for rotating the propellers. The rpm considered for those motors is about 300 rpm. Secondly we have also made the use of motors in the collecting arms of the tray, to simulate to and fro movement. The designated rpm for these motors is 150 rpm.

Specifications:	**Fig: DC Motors**
• Motor Type: DC • Operating Voltage: 3 ~ 12 VDC • No Load Current: 40-180mA • Shaft Type: Dual Shaft • Shaft Length: 8.5 mm • Shaft Diameter: 5.5 mm • Speed: 150-300 RPM • Rated Torque: 1Kg-Cm • Application: Robotics, Automation • Dimensions (L x W x H): 64 x 22 x 18 mm • Weight: 30 g	 **Fig:4 DC Motors**

3.6. ALGORITHM:

1. The robot starts and the propellers will get activated.
2. Its motion will be controlled remotely by mobile phone.
3. The robot will collect all the garbage and dump it in the collector tray.
4. The robot will move towards the polluted area with the help of propellers.
5. Now the robot returns back to its initial point and empty the collector tray.

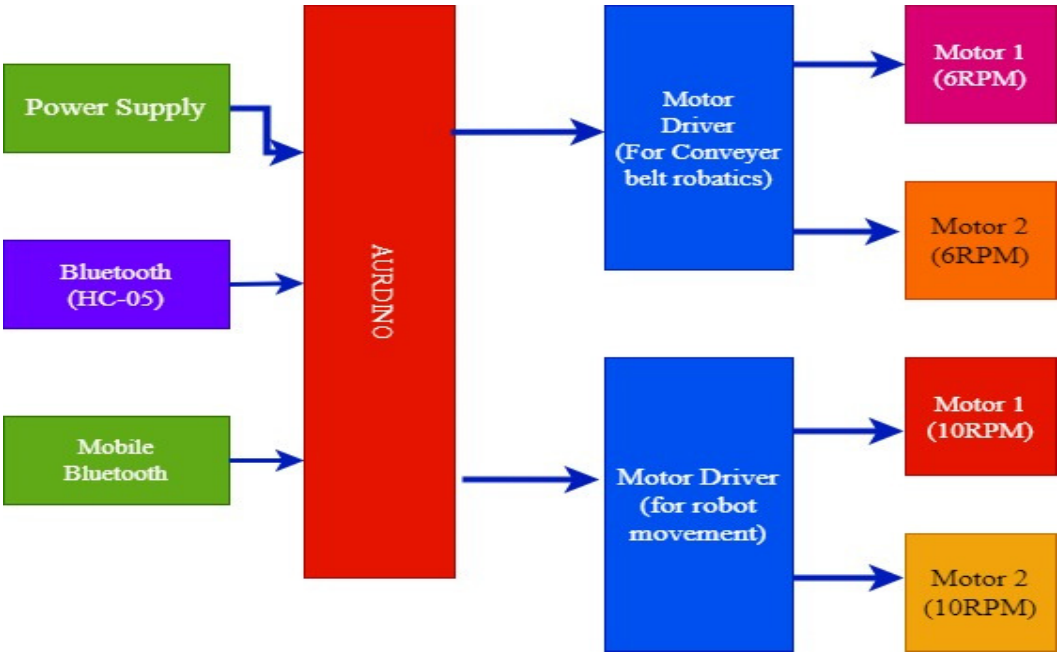


Fig:5 Proposed Block Diagram

4. Experimental setup

Experimental trials showed the water surface trash collector effectively gathers floating debris, including plastics and foam. Compared to manual methods, it significantly improved cleanup efficiency, indicating its scalability. Environmental impact assessments found minimal disruption to aquatic ecosystems, confirming its sustainability. The device's successful development marks a significant advancement in sustainable water pollution solutions. By targeting surface litter, it prevents debris from harming wildlife and the marine food chain. Its adaptability suits deployment in various water bodies, from rivers to urban waterways.

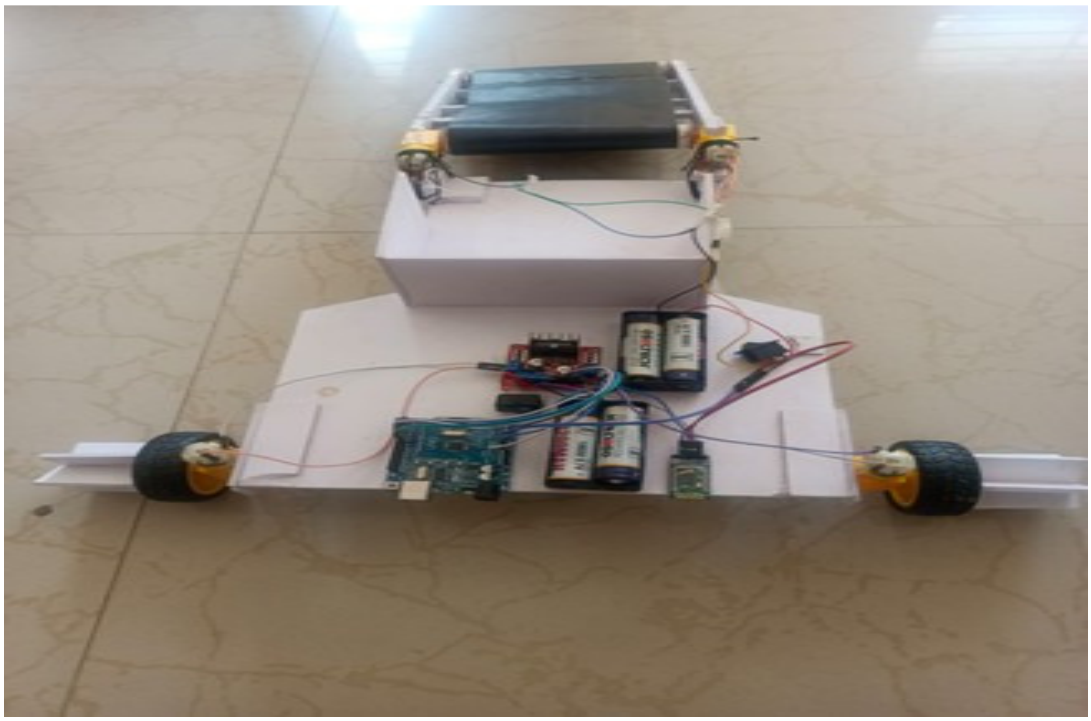


Fig:6 Project Prototype

An inventive environmental project created to address water pollution in bodies of water such as lakes and rivers is the Bluetooth-controlled Waste Segregator Boat. With the help of sophisticated sensors and sorting systems, this self-sufficient vessel can identify and gather floating trash and separate it into several categories for appropriate disposal. Operators may remotely manage the boat's motions, track its progress, and start garbage collection and segregation procedures using an easy-to-use Bluetooth interface, all of which help to create cleaner and healthier aquatic environments. An Arduino block diagram project for a Bluetooth-controlled waste segregator boat, a waste management sea boat project, a smart waste collection boat project, a remote-controlled trash boat project, an eco-friendly garbage collection boat project, a project report, Smart garbage collection on the sea, river projects, marine pollution cleanup technology projects, Bluetooth-enabled waste management at sea projects, wireless waste segregation boat projects, and environmentally friendly trash collection boats utilizing Arduino projects

5. CONCLUSION:

Through repeated experimentation and testing the prototype has demonstrated its effectiveness in collecting garbage from water surfaces and the utilization of a spinning wheel and conveyor belt allows the device to efficiently scoop up floating debris leading to cleaner and safer water environments moreover the integration of remote navigation control using smart phone applications underscores the feasibility and potential of this innovative technology moving forward the trash collector holds immense promise for widespread adoption and implementation in various water bodies including rivers lakes ponds canals and even the ocean by harnessing this technology we can significantly reduce the presence of trash and plastic waste in water leading to cleaner water sources and healthier ecosystems for both humans and aquatic life in addition to its practical benefits the trash collector offers a cost-effective and sustainable solution to water pollution its design and estimated cost make it accessible and beneficial for society presenting an innovative method to minimize manual labour while effectively cleaning water bodies.

6.Future Developments:

1. Integration with Other Technologies: Explore integration with drones, satellite imaging, and artificial intelligence to enhance waste collection efficiency and environmental protection.

2. Expanded Sensor Suite: Incorporate additional sensors to monitor water quality parameters, such as dissolved oxygen, conductivity, and nutrient levels.

3. Autonomous Operation: Develop autonomous operation capabilities, enabling the waste collector to navigate and collect waste independently.

7. REFERENCES:

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