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# SEABIN FLOATING WASTE COLLECTOR USING ARDUINO

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## ABSTRACT

Floating waste, particularly plastics and debris, severely pollutes rivers, ponds, and lakes, posing environmental and health risks in developing regions. Manual cleaning is inefficient and hazardous. This paper presents a low-cost Seabin-inspired floating waste collector using Arduino Nano. The prototype integrates 433 MHz RF communication for remote control, L293D motor driver for propulsion, DC motors with water-wheel intake, and HC-SR04 ultrasonic sensor for automatic bin-level monitoring and shutdown at 70–75% capacity. The catamaran hull (PVC pontoons with styrofoam and waterproof coating) ensures stability for up to 5 kg payload. Controlled tests demonstrated reliable RF range (>20 m), stable flotation, effective collection (up to 5 kg capacity), and auto-cutoff safety. Total cost is approximately INR 4,500, making it suitable for small water bodies in resource-limited areas. This work extends our unpublished B.Tech major project (2023) with refined analysis and performance metrics.

**Keywords** — Water pollution, floating waste collection, Arduino Nano, RF communication, ultrasonic sensing, low-cost aquatic robot, environmental monitoring.

## I. INTRODUCTION

Water pollution caused by floating plastic waste and debris has become a serious environmental challenge in rivers, lakes, and urban water bodies. Automated cleaning systems are increasingly being explored as an effective solution to remove floating waste and improve water quality [1], [2].Traditional manual cleaning methods are labor-intensive, time-consuming, and inefficient for continuous monitoring of large water bodies. Therefore, the development of low-cost autonomous or semi-autonomous cleaning robots has gained attention in recent years [3], [4].

Commercial Seabins use suction but are expensive. This prototype provides an economical, RF-controlled solution using embedded systems, focusing on affordability, stability, and overflow prevention for small-scale deployment.

## II. RELATED WORK

Several researchers have proposed robotic systems for water surface cleaning. These systems typically use microcontrollers, sensors, and motorized propulsion mechanisms to collect floating waste materials. However, many existing designs face limitations such as high cost, complex control mechanisms, or limited waste collection capacity [5]–[7].Prior works include microcontroller-based aquatic cleaners , RF-controlled boats , and ultrasonic feedback systems. Many systems focus mainly on propulsion but lack integrated safety or cost-effective design **[10]**. This prototype combines these elements with emphasis on cost (< INR 5,000) and prototype validation.

## III. PROPOSED SYSTEM ARCHITECTURE

The proposed Aqua Clean Robot (ACR) is designed as a floating robotic platform capable of collecting floating waste using a conveyor or collection mechanism integrated with a motor-driven propulsion system.The system includes Arduino Nano as controller, 433 MHz RF module, L293D driver, DC motors, HC-SR04 ultrasonic sensor, battery, and floating hull.

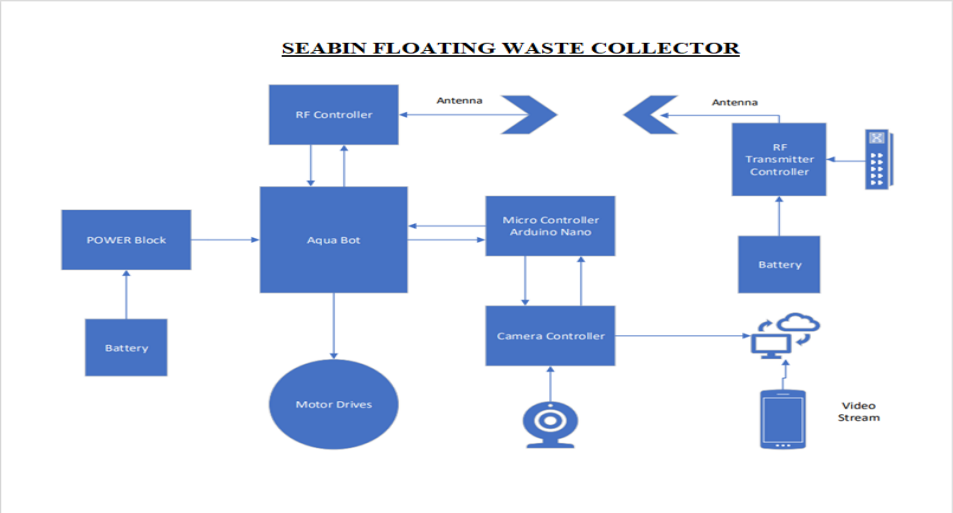



Figure 1. Block Diagram of Seabin Floating Waste Collector

## IV. HARDWARE DESIGN

The hardware system consists of an Arduino Nano microcontroller, RF transmitter and receiver modules for wireless control, an L293D motor driver for motor actuation, and DC motors for propulsion. An HC-SR04 ultrasonic sensor is used to monitor the waste bin level and automatically stop the system when the threshold level (70–75%) is reached to prevent overflow.

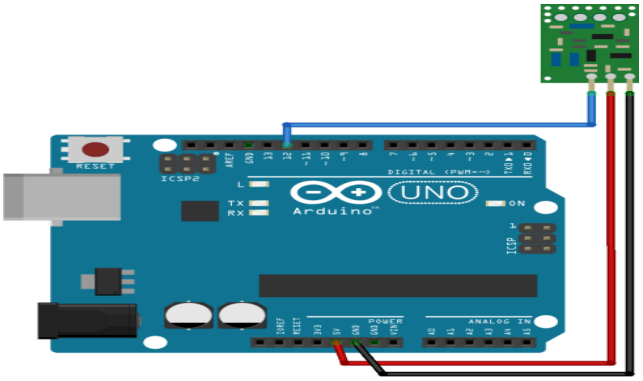


Figure. 2(a). RF Transmitter Circuit.

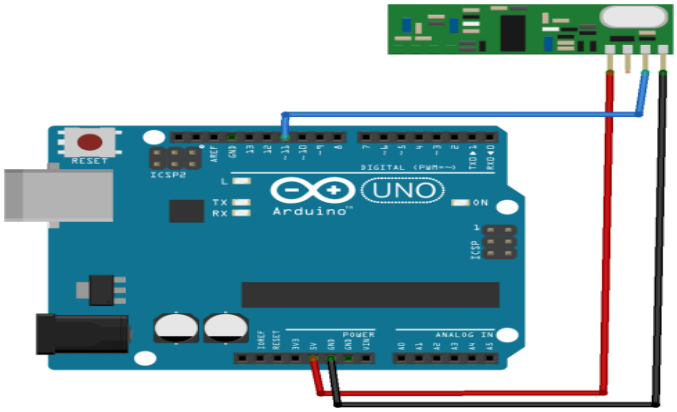


Figure. 2(b). RF Receiver Circuit.

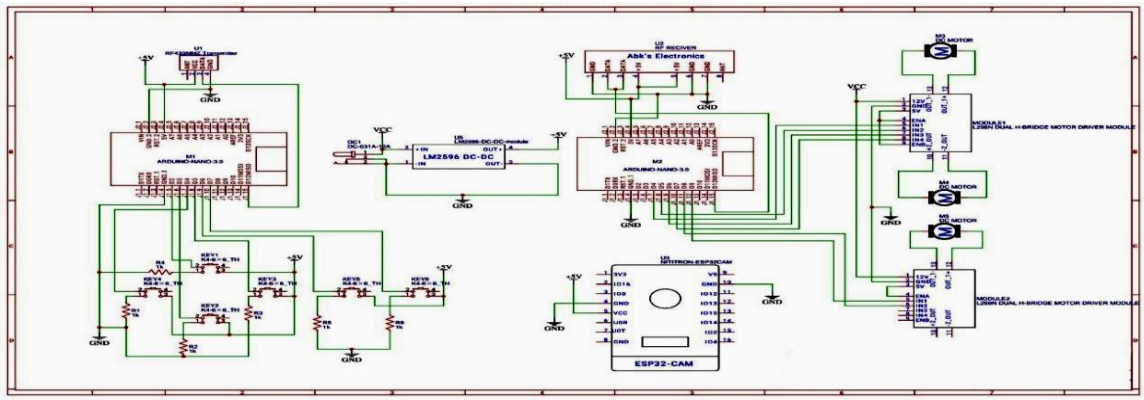


Figure. 3. Complete Circuit Schematic of Seabin Floating Waste Collector.

## V. WORKING PRINCIPLE

Upon receiving the RF command, the motors are activated, and the intake mechanism collects the floating waste. The ultrasonic sensor monitors the waste level and automatically halts the operation at the preset capacity.

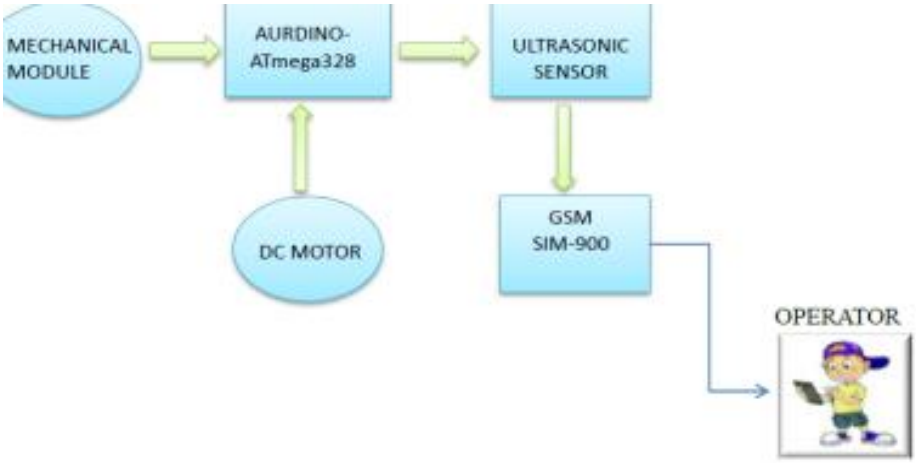



Figure. 4. System Methodology Flow Diagram.

## VI. EXPERIMENTAL RESULTS

The developed prototype was tested under controlled water conditions to evaluate its performance. The robot demonstrated stable floating behavior due to the catamaran hull structure and successfully collected floating waste materials from the water surface. The RF communication module provided reliable remote control with an effective operating range of approximately 20 meters.

The ultrasonic sensor accurately monitored the waste collection bin level and automatically stopped the system when the bin reached nearly 70–75% capacity, preventing overflow. The system was able to collect small plastic debris and floating waste effectively with a load capacity of approximately 5 kg. These results confirm that the proposed system is suitable for small water bodies such as ponds, canals, and lakes.

| Parameter | Value | Notes |
|---|---|---|
| Max capacity | 5 kg | Tested limit |
| Auto-cutoff threshold | 70–75% fill | Ultrasonic-based safety |
| RF range | >20 m | Line-of-sight |
| Total cost | INR 4,500 | Off-the-shelf components |

Table I. Key Performance Metrics




Figure. 5. Prototype Implementation of Seabin Floating Waste Collector.

## VIII. CONCLUSION

The proposed Aqua Clean Robot provides a low-cost and efficient solution for removing floating waste from water bodies. The system can help reduce environmental pollution and support sustainable water management. Future improvements may include autonomous navigation, solar power integration, and IoT-based monitoring systems.The proposed Aqua Clean Robot demonstrates an effective prototype for collecting floating waste from water bodies. Future improvements can focus on developing a fully autonomous navigation system using GPS and advanced sensors for obstacle detection. Integration of IoT technology can enable real-time monitoring and remote control through mobile or web-based applications. The robot can also be enhanced with solar power systems to increase operational time and reduce dependency on external charging sources. Additionally, machine learning algorithms may be incorporated to identify and classify different types of waste materials for more efficient collection. With further development, the system can be scaled for large rivers, lakes, and coastal areas, contributing significantly to environmental protection and sustainable water resource management.

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