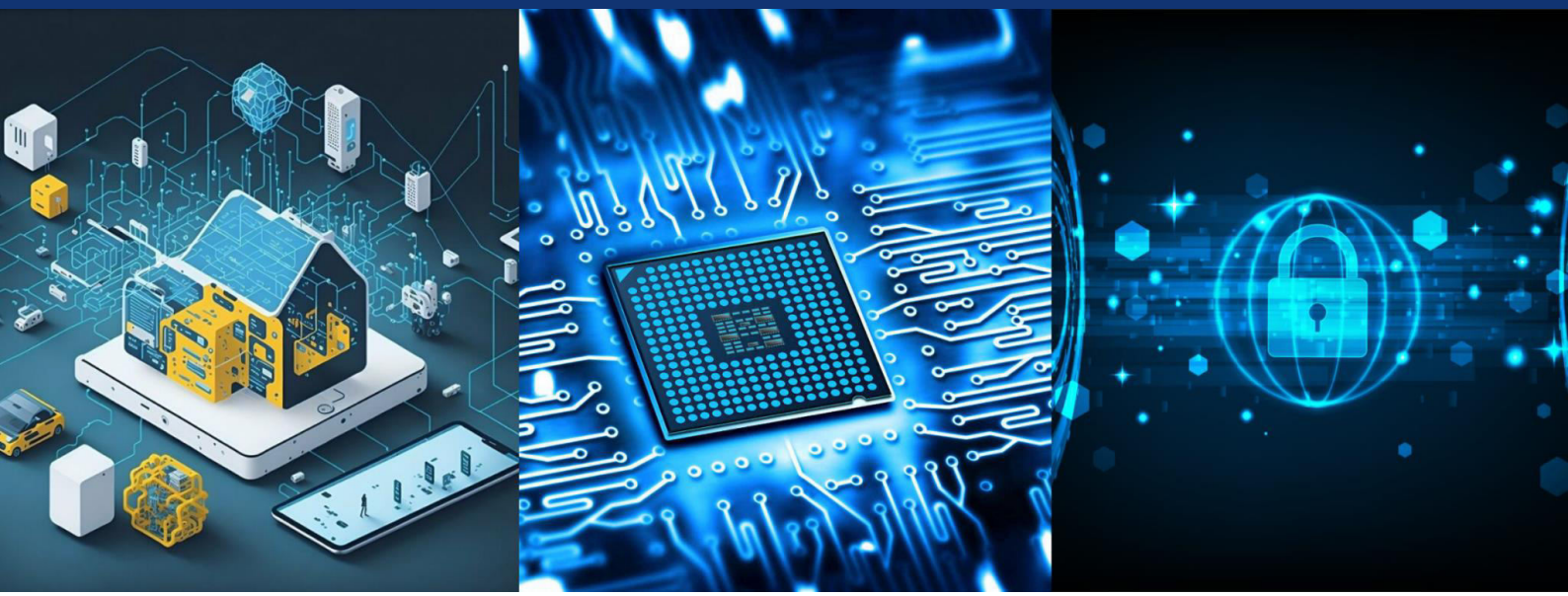
IJIRCCE

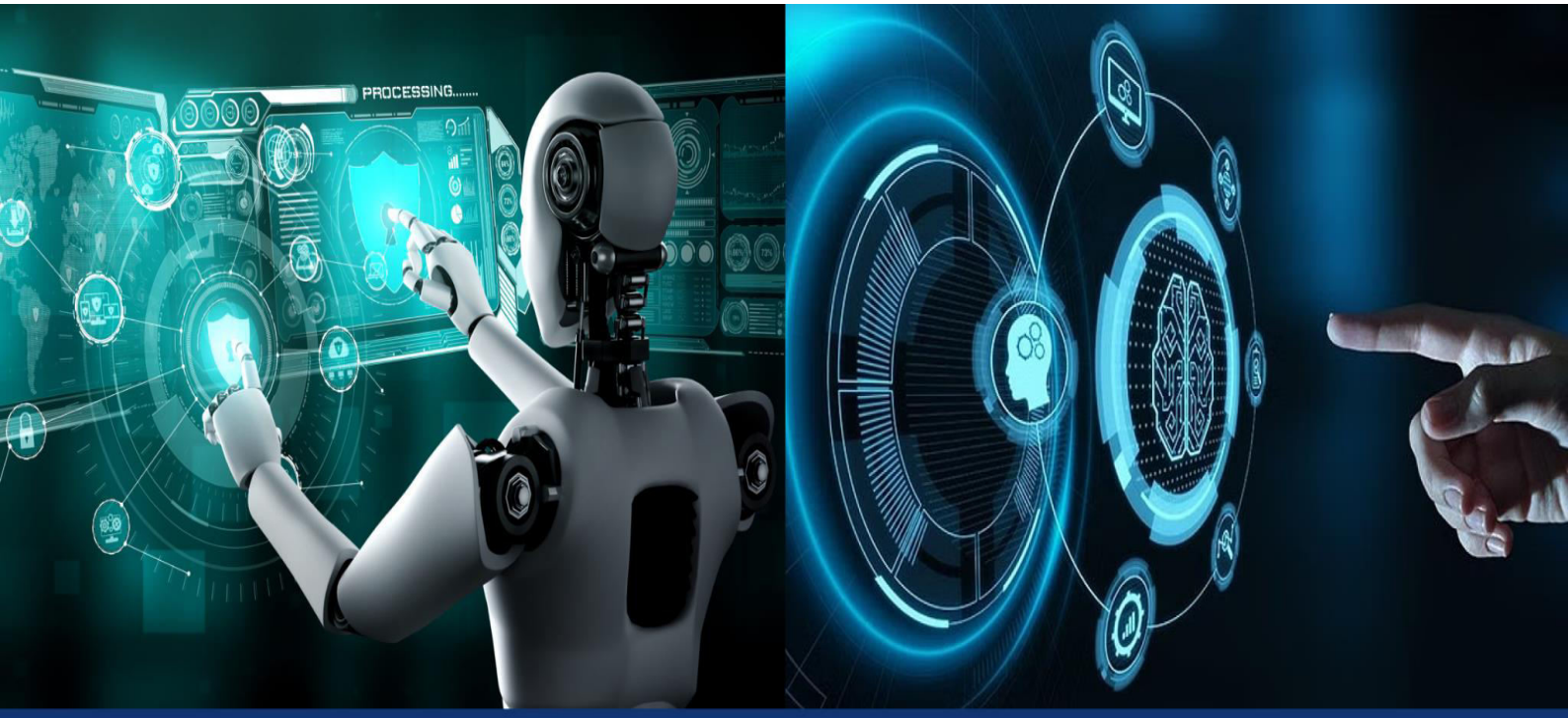
ISSN(O): 2320-9801

ISSN(P): 2320-9798



International Journal of Innovative Research in Computer and Communication Engineering

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)



Impact Factor: 8.771

Volume 13, Issue 5, May 2025

© 2025 IJIRCCE | Volume 13, Issue 5, May 2025| DOI:10.15680/IJIRCCE.2025.1305048

www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 8.771| ESTD Year: 2013|

International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

RC Underwater Waste Collecting Robots

L. Sujitha

Assistant Professor, Department of ECE, Paavai College of Technology, Paavai Institutions, Pachal, Namakkal Dist., Tamil Nadu, India

R. Divya, S. V. Hari Shree, K. Rimashri, P. Srikanthan

Department of ECE, Paavai College of Technology, Paavai Institutions, Pachal, Namakkal Dist., Tamil Nadu, India

ABSTRACT: This project presents the design and development of a Remote-Controlled (RC) Underwater Waste Collecting Robot aimed at cleaning aquatic environments such as lakes, ponds, and reservoirs. The system is built around an Arduino Uno microcontroller, which serves as the central control unit. The robot is equipped with an RF transmitter and receiver for wireless control, allowing operators to remotely navigate the robot in the water. An ultrasonic sensor is integrated to detect obstacles or measure water depth, ensuring safe operation. A LCD display is used to provide real-time feedback on system status or sensor data. The propulsion and steering mechanisms are powered by motors controlled through an L298 motor driver IC, with additional relays used for switching motor directions or activating specific functions such as the waste collection mechanism. The robot is designed to move underwater and collect floating or submerged waste material, contributing to environmental conservation and promoting cleaner water bodies. This system represents a cost-effective, user-friendly solution for tackling water pollution in small-scale and localized environments.

KEYWORDS: Water Cleaning, Remote Control Boat, Environmental Sustainability, Pollution Control, Waste Collection, Autonomous Navigation.

I. INTRODUCTION

Water pollution is a growing concern in today's world due to rapid urbanization, industrialization, and improper waste disposal. Floating waste, toxic chemicals, and untreated sewage severely impact aquatic ecosystems, affecting both marine life and human health. Traditional cleanup methods are mostly manual, inefficient, and lack real-time monitoring capabilities. There is an urgent need for a smart, automated solution that not only collects waste from water surfaces but also monitors the quality of the water continuously and accurately. This project proposes a remote-controlled aqua waste collector integrated with an IoT-based pollution monitoring and GPS tracking system. At its core, the system uses the ESP32 microcontroller, which enables wireless data communication and control. The boat is equipped with multiple water quality sensors such as pH, turbidity, and temperature sensors to detect pollution levels. A 16x2 I2C LCD provides real-time local display, while remote users can monitor data through the Blynk IoT application.

A GPS module is used for tracking the live location of the boat, and the GSM module sends SMS alerts if pollution levels exceed preset thresholds. In addition to monitoring, the system includes a motor-driven mechanism for boat movement, allowing remote navigation via a smartphone. This dual functionality—waste collection and pollution monitoring—makes the system an ideal solution for use in lakes, ponds, and urban water bodies. It offers a low-cost, scalable, and sustainable approach to tackling water pollution, aligning with smart environment and smart city goals. By automating data collection and waste management, the system reduces human effort and increases the efficiency of environmental monitoring.

© 2025 IJIRCCE | Volume 13, Issue 5, May 2025| DOI:10.15680/IJIRCCE.2025.1305048

www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 8.771| ESTD Year: 2013|

International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

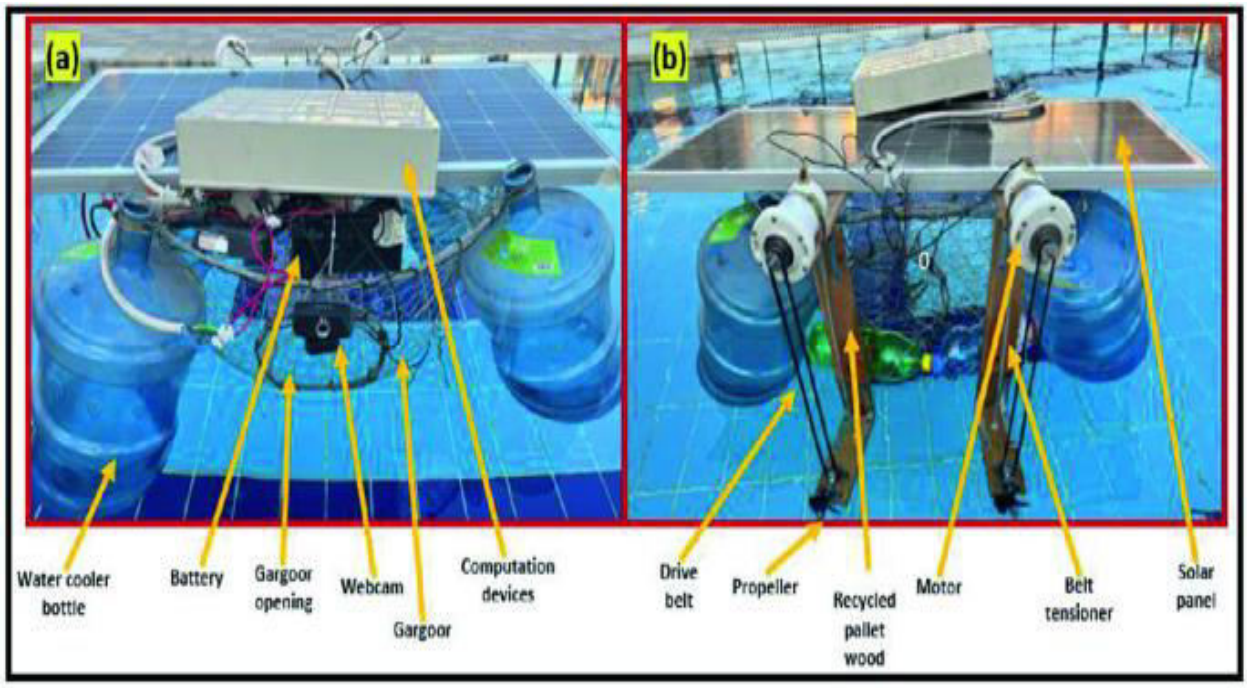


Fig 1: Detection and Collection of Waste Using a Partially Submerged Aquatic Robot

Water pollution has become one of the most critical environmental issues of the modern age. With increasing amounts of waste such as plastic, organic matter, and other debris polluting lakes, ponds, and rivers, there is an urgent need for effective waste management solutions. Manual cleaning of these water bodies is labor-intensive, time-consuming, and sometimes hazardous. Therefore, the development of automated or remotely controlled systems to assist in aquatic waste collection has gained significant attention. This project introduces an RC (Remote Controlled) Underwater Waste Collecting Robot designed to address this issue efficiently and affordably. The robot is powered by an Arduino Uno microcontroller, which controls the system based on input signals from a wireless RF remote. The robot is equipped with an ultrasonic sensor to detect obstacles in its path and avoid collisions. A LCD display is used to monitor system status or provide real-time data such as sensor readings. Movement and navigation are managed using DC motors, driven by an L298 motor driver IC and controlled via relays for direction control. The entire system is designed to function in shallow water environments, where it can navigate to collect floating or submerged debris using a mechanical collection mechanism. This robot offers a practical solution to aid in environmental cleanup efforts, particularly in small or medium-sized water bodies.

The proposed system combines real-time water quality monitoring, remote waste collection, and location tracking through a compact, IoT-enabled robotic boat. At the heart of the system is the ESP32 microcontroller, responsible for reading sensor data, controlling actuators, and enabling wireless communication via Wi-Fi. This central unit coordinates all system operations including sensor monitoring, boat movement, and remote communication. To assess the health of the water body, the system is equipped with several environmental sensors: a pH sensor to detect acidity or alkalinity, a turbidity sensor to measure water clarity, and a temperature sensor for detecting thermal pollution. These sensors help evaluate both chemical and physical parameters of the water in real time. A GPS module is used to continuously track the boat's position, allowing remote users to view its current location, while a GSM module sends SMS alerts if pollution thresholds are exceeded. A 16x2 I2C LCD display provides real-time sensor readings directly on the boat. Additionally, all data is pushed to the Blynk IoT platform, allowing users to remotely monitor pollution levels and track boat movement via smartphone. The boat's motors are controlled remotely through the Blynk app, enabling effective surface waste collection. This system provides a cost-effective and scalable solution for water pollution management in lakes, ponds, and reservoirs. By automating both the detection and collection processes, it reduces manual effort, supports environmental cleanup, and contributes to smarter water body maintenance.

© 2025 IJIRCCE | Volume 13, Issue 5, May 2025| DOI:10.15680/IJIRCCE.2025.1305048

www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 8.771| ESTD Year: 2013|

International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

II. LITERATURE SURVEY

Gholap Dipak Dattatraya1 , et.al. Robotic Vehicle for Seed Planting & Weeding Applications. This paper presents a system with high speed of operation for an advanced agriculture process which includes cultivation based on robotic platform. The robotic system is an electromechanical (conveys a sense that it has agency of its own) and artificial agent which is steered by DC motor which has four wheels. The farm is cultivated by the machine, depending on the crop considering particular rows & specific columns. The infrared sensor detects the obstacles in the path and it also senses turning position of vehicle at end of land. The seed block can be detected and solved using water pressure. The machine can be controlled remotely and solar panel is used to charge DC battery. Assembly language is used in programming the microcontrollers. The microcontroller is used to control and monitor the process of system motion of vehicle with the help of DC motor. The result of implemented unit is also presented.

Akshay S. Hegade1 et.al - GSM Based Automation in Agriculture Many new concepts are being developed in few recent years. In some respects how we done these tasks in the past to how we could do them using GSM. That is we are interested to make the GSM based system to reduce the important factor to the farmer is wastage of time, money, manpower and also the errors which made by the humans. To do this a large amount of information is captured by using the sensors and transmitted to the controller for the further processing. In our system we get the information about percentage wetness of grapes bed, rainfall by GSM and accordingly this information we irrigate for the grapes and tunnel the grapes garden. Many new concepts are being developed to allow grapes automation to nourish and deliver its full potential. In some respects how we done these tasks in the past to how we could do them using GSM. That is we are interested to make the GSM based system to reduce the important factor to the farmer is wastage of time, money, manpower and also the errors which made by the humans. To do this a large amount of information is captured by using the sensors and transmitted to the controller for the further processing. In our system we get the information about percentage wetness of grapes bed, rain fall by GSM and accordingly this information we irrigate for the grapes and tunnel the plant or garden.

Martin Holm Pedersen Jens Lund Jensen Autonomous Agricultural Robot. The use of robots is a rather new development as most of the existing solutions for automatic supervision, is designed for standard farm equipment, such as tractors, combines and pesticide sprayers. One such solution is FIELDSTAR from AGCRO In most cases a small agricultural robot would be ineffective in performing farming jobs, as these often require a large quantity of materials, either to put into the ground, such as seeds or fertilizers, or to take from the field during harvest. But when dealing with monitoring and mapping of fields or precision spraying of pesticides, a smaller robot is ideal, as it is more gentle on the crops but also to the ground. This is due to the lower weight compared to a tractor, causing much lesser soil compaction (see Fig. 1.1). The degree of soil compaction is important to consider, especially when dealing with monitoring and mapping as this is often performed multiple times throughout the year, as soil compaction can cause a number of problems, such as reduced crop growth and gentrification

Luciano Cantelli, et.al. A Small Versatile Electrical Robot for Autonomous Spraying in Agriculture. Boosting innovation and research in the agricultural sector is crucial if farmers are asked to produce more with less. Precision agriculture offers different solutions to assist farmers in improving efficiency and reducing labor costs while respecting the legal requirements. Precision spraying enables the treatment of only the plants that require it, with the right amount of products. Our research group has developed a solution based on a reconfigurable vehicle with a high degree of automation for the distribution of plant protection products in vineyards and greenhouses. The synergy between the vehicle and the spraying management system we developed is an innovative solution with high technological content, and attempts to account for the current European and global directives in the field of agricultural techniques. The objectives of our system are the development of an autonomous vehicle and a spraying management system that allows safe and accurate autonomous spraying operations.

M.ARUN1, R et.al. SMART AGRICULTURE ROBOT. Agriculture is an essential thing for survival of the humans and the farmers who do agriculture spend so much of time in plugging the field and irrigating the field etc. The proposed system is a boon to farmers which combines the robotics with agriculture and capable of moving around the field like a farmer and plough the field and sow the seed in the pre determined row and irrigate the field along the rows autonomously. In addition to this, obstacle detection and clearance are also done. All these operations are controlled via Wi-Fi module.

© 2025 IJIRCCE | Volume 13, Issue 5, May 2025| DOI:10.15680/IJIRCCE.2025.1305048

www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 8.771| ESTD Year: 2013|

International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

III. METHODS

pH Sensor

The pH sensor measures the acidity or alkalinity of the water in real time, which is a key indicator of water pollution. It outputs analog values corresponding to the pH scale (0–14), where 7 is neutral. This sensor helps detect harmful chemical levels, making it essential for water quality monitoring. When interfaced with the ESP32, it enables automatic alerts and tracking of water contamination levels. Its simple structure, stability, and wide application in environmental monitoring make it perfect for aquatic waste management systems.

Temperature Sensor

(Water) The water temperature sensor is used to monitor the real-time temperature of the water surface. It provides crucial information about aquatic health, as temperature affects oxygen levels and chemical reactions. The sensor outputs digital or analog signals and is compatible with ESP32 for live readings. It operates reliably over a wide temperature range and is resistant to water damage, making it suitable for marine and riverine applications. These readings are essential for data logging and environmental research.

Turbidity Sensor

The turbidity sensor measures the cloudiness or impurity level in water caused by suspended particles. It works on the principle of light scattering, and its analog output varies with particle density. This sensor is critical in detecting the presence of waste or pollutants in water. When connected to the ESP32, it helps in realtime analysis of water cleanliness and triggers alerts if pollution exceeds thresholds. It is durable, waterproof, and ideal for field deployments in rivers, lakes, and coastal areas.

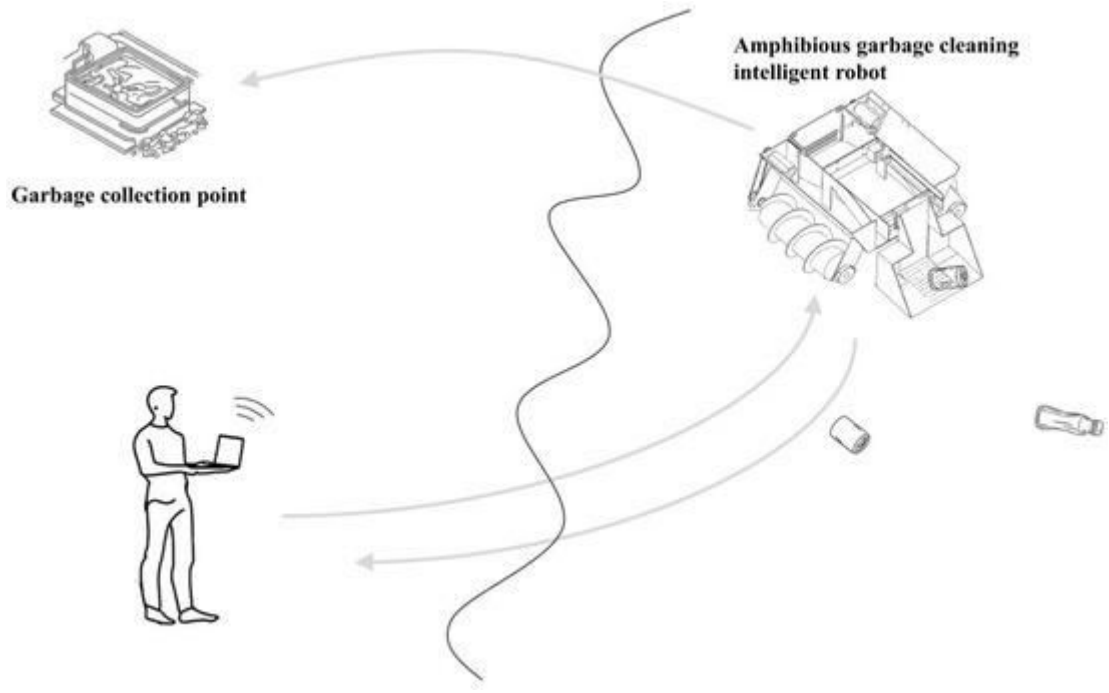


Fig 2: Intelligent Robot for Land Water Cleaning

GPS Module

The GPS module is used to track the real-time location of the aqua waste collector boat. It communicates with satellites to determine coordinates and sends data to the ESP32. This enables route tracking, geo-fencing, and logging of pollution hotspots. GPS data can be uploaded to cloud platforms or displayed on mobile apps for monitoring. It plays a vital role in location-based environmental data analysis and enhances the smart tracking capability of the system.

© 2025 IJIRCCE | Volume 13, Issue 5, May 2025| DOI:10.15680/IJIRCCE.2025.1305048

www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 8.771| ESTD Year: 2013|

International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

IV. RESULT ANALYSIS

The RC Underwater Waste Collecting Robot operates using a combination of electronic components and mechanical systems, controlled by an Arduino Uno. The user sends commands to the robot wirelessly through an RF transmitter, which are received by the RF receiver module connected to the Arduino. Based on these commands, the Arduino controls the movement of the robot by sending signals to the L298 motor driver IC, which drives the DC motors for forward, backward, left, and right movement. An ultrasonic sensor is mounted on the robot to detect obstacles underwater. If an obstacle is detected within a set distance, the robot can be programmed to stop or change direction automatically to avoid collisions.

This enhances the robot's ability to operate in tight or debris-filled spaces. A relay module is used to switch the motors or other components like a waste collection mechanism (e.g., a scoop or net) on or off. The robot moves through the water and collects waste using this mechanism. A LCD display shows useful information like obstacle distance or motor status to the user, either on the robot itself or on a base station, depending on setup. All components are powered by a suitable battery pack enclosed in a waterproof housing. The entire system is designed to be lightweight, portable, and efficient for use in cleaning small water bodies.

Fig 3: Water surface cleaning robot

This water-cleaning RC boat operates through an Arduino Uno, an HC-05 Bluetooth module, a L298N motor driver, DC motors, and a conveyor belt mechanism to collect floating debris from water bodies. All the components of the boat are powered by a rechargeable battery and work in coordination under the control of the Arduino Uno. It is established through the HC-05 Bluetooth module, enabling a user to send commands from a smartphone. The L298N motor driver controls the navigation propulsion DC motors, meaning the boat can move forward, backward, left, or right. Another DC motor is used to operate the conveyor belt, rotating to scoop up floating debris and deposit it into a storage compartment onboard. It is the user who has to navigate the boat to the cleaning area. The Arduino interprets these commands and runs the motors as required. Optional features can include ultrasonic sensors for obstacle detection or water quality monitoring. This setup is efficient in cleaning small water bodies with ease and effective debris collection.

© 2025 IJIRCCE | Volume 13, Issue 5, May 2025| DOI:10.15680/IJIRCCE.2025.1305048

www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 8.771| ESTD Year: 2013|

International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

V. CONCLUSION

The RC Underwater Waste Collecting Robot is an innovative and efficient solution for addressing the growing problem of water pollution in small to medium-sized water bodies. By integrating components such as the Arduino Uno, RF communication, ultrasonic sensor, motor driver IC, and relay modules, the robot effectively navigates underwater environments and collects floating or submerged waste with minimal human intervention. This system demonstrates how low-cost, easily accessible components can be used to build a practical tool for environmental conservation. Its remote-controlled functionality ensures operator safety, while the obstacle detection system increases reliability and ease of use. Overall, the project promotes cleaner water ecosystems and can serve as a prototype for larger or more advanced aquatic cleaning robots in the future.

REFERENCES

[1] Raghavi R. and Varshini L. Kemba Devi, "Water Surface Cleaning Robot," International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, vol. 8, pp. 831–837, March 2019.

[2] Muben Suraya, Kumar Yadav M., Sirisha Reddy B., Sowmya Reddy T., and Praneetha B., "Wireless Electrical Apparatus Controlling System with Speed Control of AC Motor Using RF Communication," Global Journal for Research Analysis, vol. 6, April 2017.

[3] Mohan Devika and Vivek A., "Navigation of Two-Wheeled Mobile Robots Cooperatively Carrying Objects," International Conference on Circuits, Power and Computing Technologies, pp. 1–6, 2017.

[4] Ganesh U. L. and Rampur Vinod V., "Semi-Automatic Drain for Sewage Water Treatment of Floating Materials," International Journal of Research in Engineering and Technology, vol. 5, pp. 1–4, 2016.

[5] Albitar Houssam, Ananiev Anani, and Kalaykov Ivan, "In-Water Surface Cleaning Robot: Concept, Locomotion and Stability," International Journal of Mechatronics and Automation, vol. 4, pp. 104–114, 2014.

[6] Albitar H., Ananiev A., and Kalaykov I., "New Concept in Water Surface Cleaning Robot," International Conference on Mechatronics and Automation, pp. 1582–1587.

[7] Gopinath Harsha, Indu V., and Dharmana Meher Madhu, "Autonomous Underwater Inspection Robot under Disturbances," International Conference on Circuits, Power and Computing Technologies, 2017.

[8] Jayasree P. R., Jayasree K. R., and Vivek A., "Dynamic Target Tracking using a 4-Wheeled Mobile Robot with Optimal Path Planning Technique," International Conference on Circuits, Power and Computing Technologies, 2017.

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

INNO SPACE SJIF Scientific Journal Impact Factor

doi crossref

निस्केयर NISCAIR

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

9940 572 462 6381 907 438 ijircce@gmail.com

www.ijircce.com

Scan to save the contact details