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Development of floating waste collector on river by using wireless connectivity

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Abstract: Plastic garbage in reservoirs causes significant harm to water quality, aquatic life, and the entire ecosystem. This project presents the design and development of a Lake Garbage Cleaning Boat. This study aims to develop a robot that can collect floating trash in place of humans and evaluate the performance of the proposed system. This automatic system is constructed of floatable material and will float on the water to gather waste materials. A simple smartphone application is used to control the robot's cage-like framework, resulting in an extremely user-friendly interface. The waste trapped inside will have to be manually taken out of the bot before a second launch. Successful experiments have been made to collect different types of plastic waste in a small water body. The boat efficiently collects floating waste using a conveyor-based mechanism. The system is powered by a 12V battery, ensuring adequate operational time. The project aims to provide a cost-effective and automated solution for cleaning lakes and improving aquatic environments.

I.INTRODUCTION

Water pollution is a growing concern worldwide, with lakes, rivers, and other water bodies becoming heavily polluted due to human activities. The accumulation of floating waste, including plastic bottles, polythene bags, and other non-biodegradable materials, poses a severe threat to marine and freshwater ecosystems.

Traditional methods of cleaning lakes involve manual labor, which is time-consuming, expensive, and inefficient for large-scale operations. To address these challenges, automated and semi-automated solutions are being developed to make the cleaning process more effective and less labor-intensive.This project focuses on the development of a Lake Garbage Cleaning Boat, which is designed to automate waste collection from the water surface. The boat is equipped with a DC geared motor and a conveyor mechanism to gather floating waste efficiently. The motor drives a collection mechanism that scoops up waste materials and deposits them into an onboard waste container, reducing the need for manual intervention. The boat is powered by a 12V 2200mAh battery, which provides sufficient operational time for cleaning small water bodies like lake, sand pond.

II.LITERATURE REVIEW

MD. SHAHNAUZE AHSAN et al. [2020] studied the design and fabrication of a cost-effective floating waste cleaning robot that will lift the waste surface garbage from the water surface. This robot is containing a propeller-driven conveyor mechanism, which collects & removes the wastage, garbage & plastic wastages from the water surface. The robot consists of a conveyor belt built-in with a fixed number of claws to pick up the waste material and a steel rod bound to a DC gear motor drives it. The claws transfer the collected waste into a deposit box and from there it will be displayed in the desired location utilizing a conveyor system.

ABIR A. AKIB et al. [2019] investigated the design of a cost-effective remote controlled floating waste removing robot which can be used in canals, ponds, rivers or in oceans. As the usage of plastic is growing in an unregulated way in many countries, toxins from these elements cause an imbalance in the ecosystem and are threatening to human health leading to cancers, birth defects and immune system problems.

NIRAMON RUANGPAYOONGSAK et.al [2017] Explored Collecting large amount of dry waste floating such as plastic bottles confronts with tension on water surface and small drag force causes waste floating away. The aim of this research is to design a robot that replaces human force for floating waste scooping and investigate performance of the designed waste scoopers installed on the Floating Waste Scooper Robot.

SAKSHI KANNAV et.al [2021] studied Water sources are contaminated by garbage, weeds and plastic wastes. Effective waste removal in water sources such as lakes, ponds and rivers is essential for waste management and control. In India, aquatic waste management and control is of main concern for implementing smart cities and achieving the mission of a cleaner India.

HIRDY OTHMAN et.al [2019] Explored this paper is to study, analyse and investigate the main contributor of plastic pollution which has become the world major infamous problem nowadays, and to explain our platform design which aim to help in reducing the issue of floating trash. Annually, more than 2 million tonnes of plastics have been tossed to water body and eventually washed away to the sea.

MIRZA TURESININ et al [2020] Studied Water pollution is a major problem worldwide. In order to tackle the pollution and keeping the water resources clean, this paper presents an affordable and advanced floating garbage removing robot called "Aquatic Iguana". The robot moves around the surface of the water and collects floating waste material such as plastic, packets, leaves, etc. Along with the waste-collecting system, the robot also includes water monitoring with pH, turbidity, temperature sensors, and a live streaming feature, increasing the capacity to a greater extent.

SHIHAN KONG et al [2021] Explored a robot system for intelligent water surface cleaner named IWSCR is developed to collect floating plastic garbage. It is able to accomplish three major tasks autonomously, i.e., cruise and detection, tracking and steering, and grasping and collection. The challenges behind these tasks involve how to realize the accurate and real-time garbage detection, how to resist the disturbances while IWSCR conducts vision-based steering, and how to grasp the floating garbage reliably despite the turbulent conditions on the surface of the water.

SURESH MUTHUSAMY et al [2024] Explored Environmental pollution, especially in aquatic ecosystems, poses an important risk to the planet. The proliferation of plastic discarded in water bodies has prompted the development of innovative technologies to address this crisis. This abstract introduces a novel solution in the form of a Hybrid Land and Water Buoyancy Trash Collecting Robot. It is designed to operate both on land and in aquatic environments, providing a versatile and efficient solution for collecting and removing debris from water bodies

III.SCOPE OF THE PROJECT

1.Integration with Solar Power:
Adding solar panels to the boat can make it energy-independent, reducing reliance on batteries and extending operational time.
2.Enhanced Automation with Sensors:
Incorporating sensors such as ultrasonic sensors, water quality sensors, or cameras can enable real-time monitoring of garbage levels, water quality, and obstacles.
3. Autonomous Navigation:
By integrating GPS modules and AI-based navigation systems, the boat can be upgraded to operate autonomously without human intervention.
4. Modular Design for Larger Water Bodies:
The boat can be redesigned to include modular components, making it suitable for larger lakes and rivers by increasing its garbage collection capacity.
5. Improved Conveyor System:
Enhancements to the conveyor belt mechanism, such as using higher-quality materials and improving its speed and efficiency, can allow for quicker garbage collection.
6. Advanced Control Systems:
Replacing Bluetooth with Wi-Fi or cellular connectivity can increase the operational range, enabling control from greater distances or even via the internet.

IV.METHODOLOGY

1.Problem Identification and Definition
- Identify the specific problem: Clearly define the target waste (e.g., plastic, organic, etc.) and the aquatic environment (e.g., rivers, lakes, oceans).
- Analyses existing solutions: Research and evaluate current methods for waste collection in aquatic environments.

2.Concept Development and Design
- Brainstorm ideas: Generate various concepts for a floating waste collector robot. Consider factors like size, manoeuvrability, waste collection mechanism, and power source.
- Select the optimal design: Evaluate the proposed concepts based on feasibility, efficiency, and environmental impact.

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• Develop detailed design specifications: Create blueprints, schematics, and technical drawings to guide the construction process.

3.Component Selection and Procurement

• Identify components: Determine the necessary components, such as motors, sensors, batteries, and flotation devices.
• Select suppliers: Research and choose reliable suppliers for the required components.
• Procurement: Purchase the components based on the design specifications and budget.

4.Robot Construction and Assembly

• Assemble the robot: Follow the design specifications to construct the robot's mechanical structure.
• Integrate components: Install motors, sensors, batteries, and other components as per the design.
• Test the assembly: Verify the mechanical integrity and functionality of the assembled robot.

5.Software Development and Programming

• Develop control algorithms: Create software to control the robot's movement, waste collection, and obstacle avoidance.
• Implement sensors: Integrate sensors (e.g., GPS, sonar, cameras) to enable the robot to navigate and detect waste.
• Program the robot: Write code to implement the control algorithms and sensor data processing.

6.Testing and Optimization

• Conduct lab tests: Test the robot's functionality in a controlled environment.
• Refine the design: Identify and address any issues or inefficiencies.
• Optimize performance: Make adjustments to improve the robot's efficiency and effectiveness.

7.Field Testing and Deployment

• Conduct field trials: Test the robot in real-world aquatic environments.
• Gather data: Collect data on the robot's performance, waste collection efficiency, and environmental impact.
• Make necessary adjustments: Modify the design or software based on field test results.
• Deploy the robot: Implement the robot in the target aquatic environment.

8.Maintenance and Monitoring

• Develop a maintenance plan: Establish a routine for inspecting, cleaning, and repairing the robot.
• Monitor performance: Track the robot's operations and collect data on its effectiveness.
• Make updates: Implement improvements or modifications as needed

V.BLOCK DIAGRAM

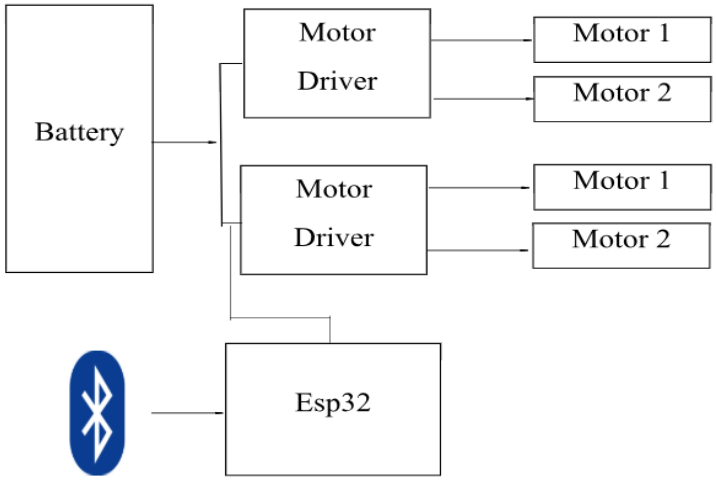

Figure No.1(Block diagram of project)

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VI.CIRCUIT DIAGRAM

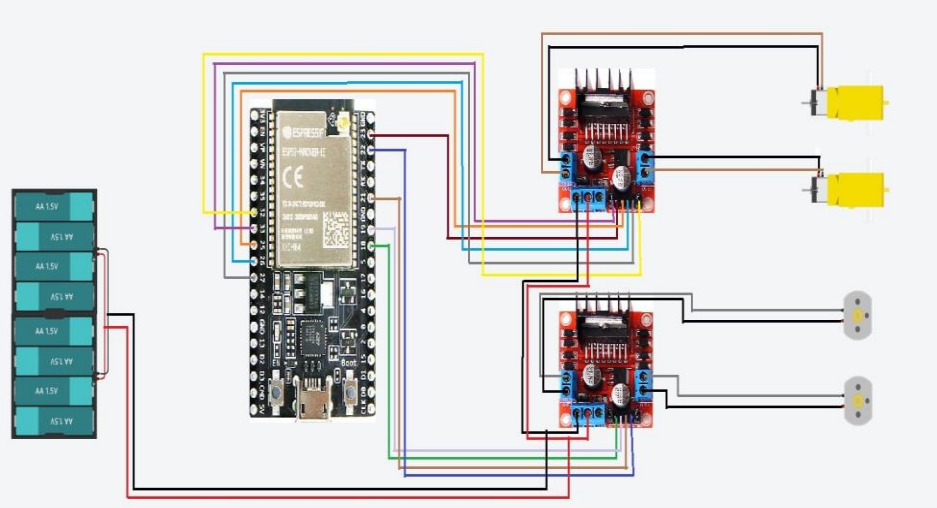

Figure No.2 (Circuit diagram of project)

VII.CAD DRAWING

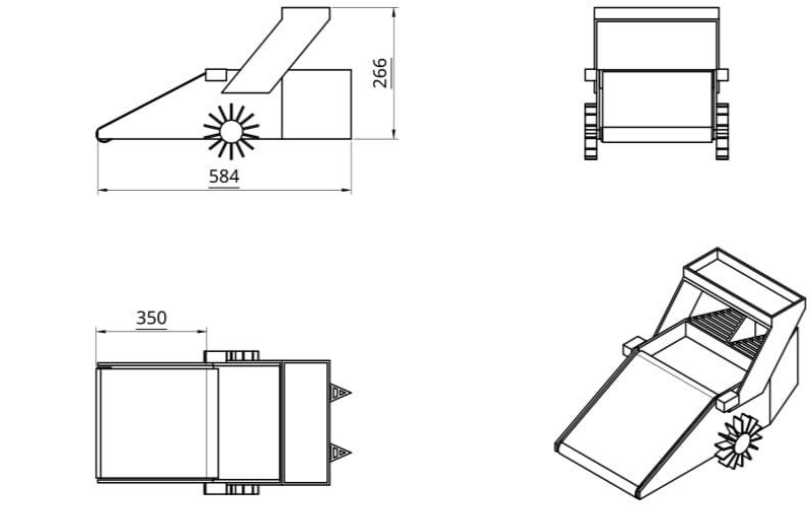

Figure No.3 (CAD drawing of project)

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VIII.EXPERIMENTAL SETUP

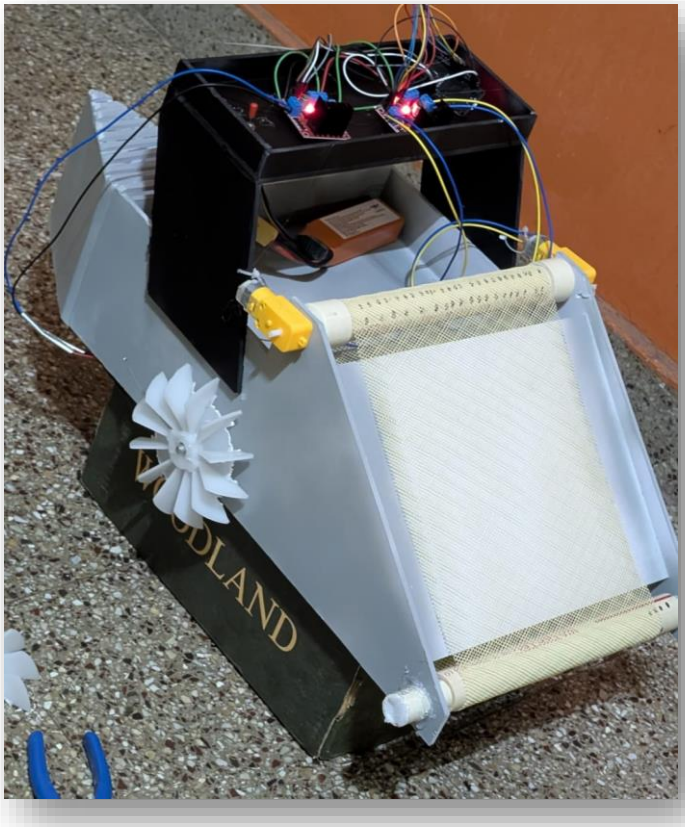

Figure No.3 (Experimental setup of project)

IX.CONCLUSION

The Lake Garbage Cleaning Boat project provides an efficient, cost-effective solution for cleaning floating waste from water bodies. Its lightweight design, remote-controlled operation, and eco-friendly approach demonstrate practical engineering applications while promoting environmental sustainability.

This prototype paves the way for future advancements, such as autonomous navigation and solar power integration, to enhance its efficiency and scalability. Overall, the project highlights the importance of innovation in addressing water pollution and contributes to preserving natural resources for a sustainable future

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