

# Solar Powered Robotics Trash Board

Mrunmayee Rokade<sup>1</sup> Krutika Pawar<sup>2</sup> Priti Kamble<sup>3</sup> Gauri Kokare<sup>4</sup>

<sup>1,2,3,4</sup>Department of Electronics and Telecommunication Engineering  
<sup>1,2,3,4</sup>Jayawantrao Sawant Polytechnic, Pune, India

**Abstract** — The solar powered robotics trash board Is an innovative and eco-friendly solution designed to Addressed the growing problem of water pollution caused by floating solid waste. Rivers, lakes, and ponds are increasingly contaminated with plastics bottles, wrappers and other debris, which harm aquatic life and disturb the Natural ecosystem. Traditional cleaning methods are labor-Intensive, time-consuming, and often inefficient. To overcome this limitation, this system that uses renewable Solar energy to collect floating waste effectively.

**Keywords:** Solar Energy, Robotics, Water Pollution Autonomous Robotics System, Renewable Energy

## I. INTRODUCTION

Water pollution has become one of the most pressing Environmental changes worldwide rivers, lakes, and other Water bodies are increasingly contaminated with plastic waste, bottles, wrapper and other floating debris due to rapid urbanization, industrial growth and improper waste disposal. This accumulation of solid waste not only harms aquatic life but also affect human health, water quality, and the overall ecosystem. Traditional cleaning methods rely Heavily on manual labor, which is time-consuming, costly and sometimes unsafe to address these challenges, the development of a solar Powered robotics trash boat presents an innovative and Sustainable solution. A solar powered robotics trash boat Is an autonomous or semi-autonomous surface vehicle Design to detect, collect, and store floating debris from water.

### A. Objectives

- To design and develop a solar powered robotics Trash board for collecting floating waste from water Bodies.
- To reduce water pollution by removing plastics, Bottles, and other solid debris from the water surface.
- To utilize solar energy as a renewable and sustainable power source for system operation.
- To minimize human effort, improve safety by automating the waste collection process
- To develop a cost -effective and energy-efficient cleaning solution.

### B. Concept Overview

The solar powered robotics trash board operates on the principle of solar energy conversion and mechanical waste collection. Solar panels mounted on the board capture sunlight and convert it into electrical energy which is stored In a rechargeable battery. This stored energy powers DC motor for movement and operates a conveyor belt mechanism installed at the front of the board as surface the conveyor collect floating debris and transfer It into an onboard storage container for proper disposal.

The project focuses on reducing manual labor, operational cost, and environmental impact by utilizing clean energy.

It designed to work efficiently during daylight hours and can be further enhanced with sensors and microcontroller for autonomous navigation and obstacle detection.

The primary idea is to deploy a lightweight, floating robotics Platform equipped with photovoltaic panel mounted on its upper surface. These panel convert solar radiation into electrical energy, which is stored in onboard rechargeable batteries The stored energy powers the propulsion motor, control System, sensor and waste collection mechanism, enabling the system to operate without reliance on conventional Fuel sources.

## II. BLOCK DIAGRAM AND MAIN COMPONENT

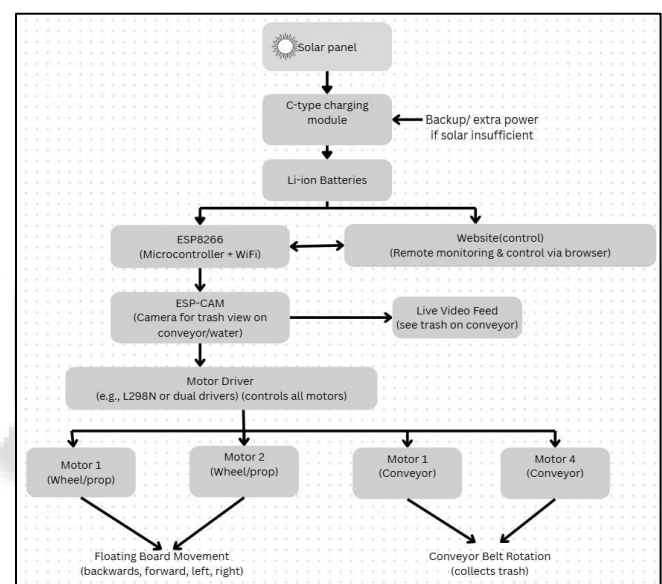


Fig. 1: Name of the chart

### A. Components

- 1) Solar panel: Convert sunlight into electrical energy it is the primary power source of the system, making it Energy-efficient and sustainable for outdoor/water Environments.
- 2) C-Type charging module: Acts as a power management Unit. It regulates charging from the solar panel and also Allows backup or extra power input is solar energy is Insufficient.
- 3) Li-ion batteries: Stores the generated electrical energy Supplies stable power to the microcontroller, camera Motors and other electronics.
- 4) ESP8266: The main controller of the system Control motors and system logic and connect to Wi-Fi For remote operation.
- 5) ESP-CAM: It provide live video feed and helps monitor Trash collection on conveyor or water surface.
- 6) Website: Enables remote monitoring via browser.
- 7) Motor Driver: Control direction and speed of motor
- 8) Wheels: Enables forward, backward, left and right Movement.

- 9) Conveyor motor: Rotates belt mechanism to collect Floating trash.
- 10) Conveyor belt: Mechanical belt system that lift and collect trash from water surface into storage.

### III. WORKING PRINCIPLE

- 1) Power Generation: The solar panel converts sunlight into electrical energy.
- 2) Power regulation & backup: The C-type charging module Regulates the voltage and allow backup.
- 3) Energy storage: The Li-ion batteries store the generated Energy and supply stable power to all components.
- 4) System initialization: The ESP8266 microcontroller power on and connects to wi-fi.
- 5) Remote monitoring setup: The website interface become accessible through a browser for monitoring and control.
- 6) Live video streaming: The ESP-CAM captures real-time video of the water/conveyor area and streams it to the user.
- 7) User control commands: The user sends movement or conveyor commands via the website.
- 8) Signal Processing: The ESP8266 processes received command and sends control signal to the motor drives.
- 9) Movement control: The motor driver activates the wheel Propulsion motors to move the floating board.
- 10) Trash collection mechanism: When activated, the motor driver runs the conveyor motors
- 11) Conveyor operation: The conveyor belt rotates and lifts floating trash from the water surface.

### IV. ADVANTAGES

- 1) Uses renewable solar energy, reducing electricity costs and dependency on external power sources.
- 2) Helps in cleaning water bodies by collecting floating trash, reducing water pollution.
- 3) Can be operated from anywhere using a web browser through WiFi.
- 4) Real time camera monitoring improves accuracy and control during trash collection.
- 5) After installation, maintenance and running costs are minimal due to a solar charging.
- 6) Floating design allows movement in different direction.
- 7) Conveyor belt mechanism simplifies the collection process.

### V. APPLICATION

- 1) Cleaning lake
- 2) River surface cleaning
- 3) Ponds and water tanks
- 4) Smart city projects
- 5) Industrial water bodies

### VI. CONCLUSION

The Solar Powered Robotics Trash Board is an innovative and eco-friendly solution for cleaning floating waste from water bodies. The use of renewable energy reduces operating costs and environmental impact, while the Wi-Fi based remote control system allows easy monitoring and operation

The floating and mobile design ensures flexibility in movement, making it suitable for lakes, ponds, canals, and small rivers.

The solar powered robotics trash board demonstrate significant potential as a cost-effective, scalable, and environmentally responsible solution for water pollution control. Future enhancement may include AI-based waste detection, real time data transmission and improve energy optimizing to further increase efficiently and adaptability.

### REFERENCE

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