Industrial Engineering Journal
ISSN: 0970-2555
Volume : 54, Issue 4, No.2, April : 2025

LITERATURE REVIEW ON RIVER CLEANING BOAT

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ABSTRACT:
River cleaning boat focuses on designing and building an advanced, remotely operated, and ecologically sound water cleaning system. It incorporates wireless control, sophisticated environmental monitoring, and robotics to promote environmental sustainability. With rising concerns about water pollution, there's a growing need for easily deployable systems that efficiently remove waste and pollutants from water bodies. This system utilizes a substantial floating platform powered by a 12V battery and driven by four 500 RPM DC motors controlled by an L298N motor driver for navigating river surfaces. An ESP32-CAM module provides real-time video streaming, allowing operators to monitor the device and the waste collection process. This innovative system addresses the problem of debris accumulation in water bodies, facilitates water reclamation, and reduces the need for costly and labour- intensive manual cleaning. By offering a novel approach to environmental management, this technology has the potential to significantly improve environmental protection and advance sustainability efforts in preserving our water resources.
KEYWORDS: ESP32-CAM module, 500 RPM motors, L298N motor driver, 12V rechargeable battery, Servo Motors, SWCR.

INTRODUCTION:

Water pollution has emerged as one of the most critical environmental challenges facing our planet today, with plastic waste being a major contributor. Plastics, which often end up as floating debris in rivers, lakes, and oceans, constitute a significant portion of the pollution found in these water bodies. These plastics typically include everyday items such as bottles, packaging, bags, and other disposable materials. This accumulation of plastic waste poses severe threats to aquatic life, ecosystems, and human health.

One of the most concerning aspects of plastic waste in the water is that plastics are non-biodegradable. This means that they do not break down easily over time and can remain in the environment for decades. As they degrade, plastics break into smaller fragments, eventually turning into microplastics, which are even more difficult to remove and pose a further threat to both wildlife and the environment. These microplastics can easily be ingested by marine creatures, eventually entering the food chain and threatening human health when consumed through seafood.

LITERATURE :

The IWSCR robot addresses the pressing issue of aquatic plastic waste by autonomously collecting floating garbage. Previous efforts to clean water bodies, often involving large, manual vessels, are

limited in precision, scalability, and environmental friendliness. The IWSCR leverages advances in deep learning and robotics, utilizing the YOLOv3 detection model for fast, accurate recognition of waste, making it suitable for dynamic, open environments. This approach builds on recent success in deep learning frameworks like SSD and R-CNN, but YOLOv3's real-time capabilities better serve mobile, autonomous systems operating in unpredictable aquatic environments.

This study investigates the planning system for river cleaning boat [1]. This paper presents an advanced path planning system for autonomous water surface cleaning robots. Existing robotic cleaning systems face challenges in accurately planning and adapting to dynamic environments due to floating obstacles and shifting garbage.

This study investigates the design and fabrication of river waste cleaning machine [2], this paper focuses on developing a remote-controlled machine to address the increasing problem of waste in water bodies. Existing methods for cleaning floating waste, such as using boats or manual labour, are often time-consuming, expensive, and risky. Prior research has introduced various methods for surface waste collection, including pedal-powered boats and trash skimmers, yet these lack automation and efficiency in diverse environmental conditions.

This research presents a comprehensive overview of various water-cleaning robotics and autonomous systems developed by researchers worldwide [3], in this paper, the author introduced an autonomous garbage-collecting ship using ultrasonic distance measurement to control movement; however, this system lacked smooth navigation and precise control over garbage collection.

The proposed bot in this paper aims to overcome these limitations by integrating computer vision and sensor fusion in a mobile, solar-powered design that utilizes a conveyor belt mechanism to capture and remove waste from water bodies autonomously [4]. The paper explores previous efforts to develop automated solutions for water pollution control. Mukhtar et al. developed the River Trash Collector System (RTCS), which used a ballast tank for stability and trash collection in still waters.

This study highlights various approaches for managing water pollution through robotics and automation [5]. In this paper, traditional methods, such as manual trash skimmers, are labour-intensive and costly, motivating the shift toward automated solutions. For example, the author proposed an unmanned surface vehicle equipped with sensors for coastal monitoring, while Jogi developed a pedal-operated lake garbage collector.

The study addresses recent technological advancements in water cleaning robots designed to manage pollution [6]. In this paper, Traditional manual methods for collecting floating waste are inefficient, time-consuming, and labour intensive. The robot is equipped with intelligent features, enabling it to navigate autonomously and collect floating debris, providing an accessible and scalable solution for maintaining cleaner water bodies.

To address various challenges, the authors propose a lake surface cleaning robot (LSCR) with hydrodynamic modelling based on the Manoeuvring Model Group (MMG) approach [7]. This paper emphasizes the development of autonomous robots for maintaining lake surfaces. Traditional methods such as manual clean up by workers on boats are labour-intensive and inadequate for small lakes or reservoirs that accumulate floating waste after storms or strong winds.

This study addresses these limitations by developing SMURF, a fully autonomous robot that integrates an improved Nonlinear Model Predictive Controller (NMPC) for path tracking and a novel Coverage Path Planning (CPP) algorithm [8]. This paper outlines recent advancements in water surface cleaning technologies. Traditional manual cleaning approaches, while still used, pose challenges due to low efficiency, high labour requirements, and health risks from polluted water. Early autonomous systems have introduced unmanned surface vehicles (USVs) equipped with GPS and wireless communication, yet these typically rely on remote control or are restricted to small, controlled environments.

Previous studies reveal the adverse effects of plastic debris on marine habitats, with only a small percentage of waste being recycled globally [9]. This paper proposes a solution for water pollution

by removing suspended solids and floating debris from water bodies. High concentrations of pollutants like plastic waste, industrial waste, and decaying organic matter severely affect aquatic ecosystems, blocking sunlight and reducing photosynthesis, which in turn diminishes dissolved oxygen levels essential for aquatic life

Recent research emphasizes autonomous, sensor-equipped robots capable of identifying and collecting floating debris efficiently [10]. The paper explores advancements in sensor-based water surface cleaning robots designed to address pollution in aquatic environments. Traditionally, water cleaning methods relied on manual labour or large machines that are not only costly but also environmentally invasive.

EVOLUTION OF RIVER CLEANING BOAT:

The evolution of river cleaning boats has progressed from manual methods to sophisticated, mechanized systems. Early efforts involved simple rafts and nets, while the mid-1900s introduced mechanized boats with engines and mechanical scoops. Modern boats now feature advanced waste collection systems, hybrid or electric engines for eco-friendliness, and even autonomous vessels that use AI and sensors. Recent innovations include drones, robots, and waste-to-energy technology. The focus is on improving efficiency, minimizing environmental impact, and utilizing new technologies to maintain cleaner rivers.

EFFICIENCY IN OPERATIONS:

Traditional river cleaning practices relied on manual labour using small boats, nets, and dredging, focusing on shoreline cleanup and basic waste collection. Modern technology has advanced to include mechanized boats with automated systems, autonomous vessels, eco-friendly engines, and waste sorting/processing technologies. Additionally, drones and robots are used for more efficient and thorough cleaning. These modern methods make river cleaning more effective, sustainable, and less reliant on human labour.

PREDICTIVE ANALYSIS:

Increased Efficiency and Coverage with Modern technology will clean more area faster. Enhanced Accuracy and Thoroughness of Modern methods will remove more pollutants. Reduced Labor and Costs of Automation will lower long-term expenses. Improved Data Collection in Modern systems will provide better pollution data. Greater Environmental Impact in Modern tech will improve river health. Scalability and Adoption for Modern solutions will become more widespread. Integration with Monitoring of Modern boats will connect with environmental network.

CONCLUSION:

Cleaning of water bodies is always been a huge problem. Due to which the aquatic life of animals is destroying. So, to maintain a good balance between the aquatic life, this automatic water cleaning machine is introduced. This machine is easy in operations and its manufacturing cost is also low. Hence this water cleaning machine is very useful.

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