



# Automated Lake Cleaning Boat

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**Abstract:** Lakes are important ecosystems that benefit humans in many ways, including drinking water, tourism, and biodiversity. However, pollution can harm lakes, which can seriously harm human health. One strategy to lower pollution in lakes is to use automated lake cleaning boats. These boats have sensors that can locate and collect trash in the water.

The traditional method, which is primarily manual in nature, is used to gather trash, plastic, water debris, and other contaminants that float on water bodies. It can also be used to collect contaminants using a thrash skimmer, boat, or other means. and disposed of this impurity by removing it close to the riverbank. However, the conventional method is riskier, more expensive, and takes longer because it requires more labor. Considering all of this, the remote-operated floating river cleaning machine proves to be more effective and environmentally friendly than the traditional method.

Since this machine is remote-operated, no labor is needed. Consequently, this device is very helpful in lowering the Ganga River's water pollution, which is brought on by "Kumbh mela." Due to rising water pollution, the Indian government has also taken on the responsibility of cleaning rivers and ponds. As a result, they have invested a significant amount of money in numerous river cleaning projects, including Namami Ganga and Narmada Bachao. additionally developed several projects in different cities, including Varanasi and Ahmadabad.

This project works on developing a remote-operated river cleaning device has been designed with consideration to effectively clean the floating surface of rivers. This machine also has motors and an ultrasonic sensor. The user's Android phone can be used to access the data.

The automated lake cleaning boat is a technological innovation designed to address the issue of water pollution in lakes and other water bodies. This autonomous vessel utilizes advanced sensors, machine learning algorithms, and robotic mechanisms to navigate through water surfaces, identify and collect various types of pollutants, such as plastics, debris, and organic waste, thereby restoring the water quality and ecological balance of the lake environment. The boat's autonomy enables it to operate efficiently without human intervention, while its ability to adapt to changing environmental conditions ensures effective cleaning performance. This solution represents a promising approach to mitigate the detrimental effects of pollution on freshwater ecosystems, contributing to the preservation of water resources and biodiversity conservation efforts.

**Keywords-** Lakes, Pollution, Sensors, Traditional method, Remote-operated

## I. INTRODUCTION

Human society needs cleanliness. We should maintain a clean environment and surroundings, but we only care about those areas which are part of our society or surrounding. Most of the waste is dumped into water bodies like ponds, lakes, rivers and oceans. Thus, it contributes significantly to water pollution. The goal of our project is to clean the water surface and dispose of this waste. Floating garbage endangers the lives of river dwellers, which is a serious environmental problem. But traditional trash inspection uses very expensive, labor-intensive manual inspection by sending inspectors to the field. We intend to install a camera that can automatically detect waste from the water surface and send instructions to a boat to collect the waste.

To ensure effective and safe removal of floating waste and debris without endangering the lake's ecosystem, the project relies on the sensors and navigation systems of the automated lake cleaning boat to precisely locate and navigate around obstacles. Every living thing has a basic need for clean water. . It is impossible for human to live on earth without water. Only three percent of the water on Earth is pure water, even though seventy percent of the surface is covered by water. Waste from industries, sewage and garbage are some of the causes of polluted water. Therefore, it is important to keep the water clean and hygienic. Considering this water pollution as a serious problem, we started working on the project. To get the job done quickly and efficiently, we decided to use technology. We have designed our project so that it collects floating waste on water bodies. Almost everyone in the modern world is familiar with robots.



## II. POBLEM STATEMENT

To address the ongoing issue of environmental degradation in water bodies brought on by accumulated waste, pollutants, and debris, an automated lake cleaning boat must first define the problem. Creating a specialised boat with state-of-the-art equipment will enable it to traverse lakes on its own, gather different kinds of debris, and properly handle pollutants. This problem has several important components, such as knowing how pollutants and debris affect the aquatic ecosystem and how to design a boat with the right navigational systems, cleaning systems, environmentally friendly power sources, and real-time water quality monitoring sensors. It is imperative to strike a balance between autonomy, safety, cost-effectiveness, regulatory compliance, and maintenance requirements.

The key to coming up with a workable solution is working cooperatively with stakeholders and establishing quantifiable metrics to evaluate how well the boat cleans and restores the lake environment. To create an automated lake cleaning solution that works, this issue ultimately requires a multidisciplinary approach that incorporates environmental awareness, technological innovation, regulatory compliance, and community involvement.

For the cleaning boat to have a longer operational lifespan and less of an adverse environmental effect, it is also essential to develop sustainable power sources like solar or electric propulsion systems. There are a lot of obstacles in the way of completing the project when it comes to juggling the boat's degree of autonomy with safety, legal compliance, maintenance needs, and affordability.

This project is to remove the floating trash in the lake or water bodies, to reduce the waste. By cleaning down this lake or water bodies without the manual help will save times and manpower. In this proposed system, an automated vehicle is used to clean down the floating trash. Hence the contact with the dirt and the mosquitoes will be reduced. The system has a Raspberry camera which detects down the waste by image processing and the automated vehicle will collect the floating trash and this will have a bin in the boat where the trash will be stored. This system will be more advanced as this would collect down the floating non degradable wastes with the help of the image processing. The system can also able to detect any drowning person in the waterbodies by using AI based image processing. That information will be relayed to the nearest emergency services so that the drowning person life can be saved in time

## III. DESIGN AND IMPLEMENTATION OVERVIEW

The rationale behind the plan is to set a course of action for the issue identified by the requirements report. This phase is the underlying phase of moving from issue to game plan space. All things considered, start with what is mandatory; The diagram leads us to work out how to satisfy those needs. System design is perhaps the most essential segment that affects the way things are going and of note rightly affects the later stages, especially testing and maintenance. A system diagram describes all the huge data structures, report game plans, yield and genuine modules in the system and their specifications are selected.

In this system the boat is designed to pass through the water current. The boat will have cameras to detect debris and clear it. Most water bodies will have large floating waste like bottles and plastic waste that will only pollute water bodies like lakes or rivers. So, when it sees floating garbage, the robotic system will be started to move the conveyor belt and collect this garbage. This process continues until the bin is full

The architectural configuration procedure is concerned with building up a fundamental basic system for a framework. It includes recognizing the real parts of the framework and interchanges between these segments. The beginning configuration procedure of recognizing these subsystems and building up a structure for subsystem control and correspondence is called construction modeling outline and the yield of this outline procedure is a portrayal of the product structural planning. The proposed architecture for this system is given below. It shows the way this system is designed and brief working of the system.

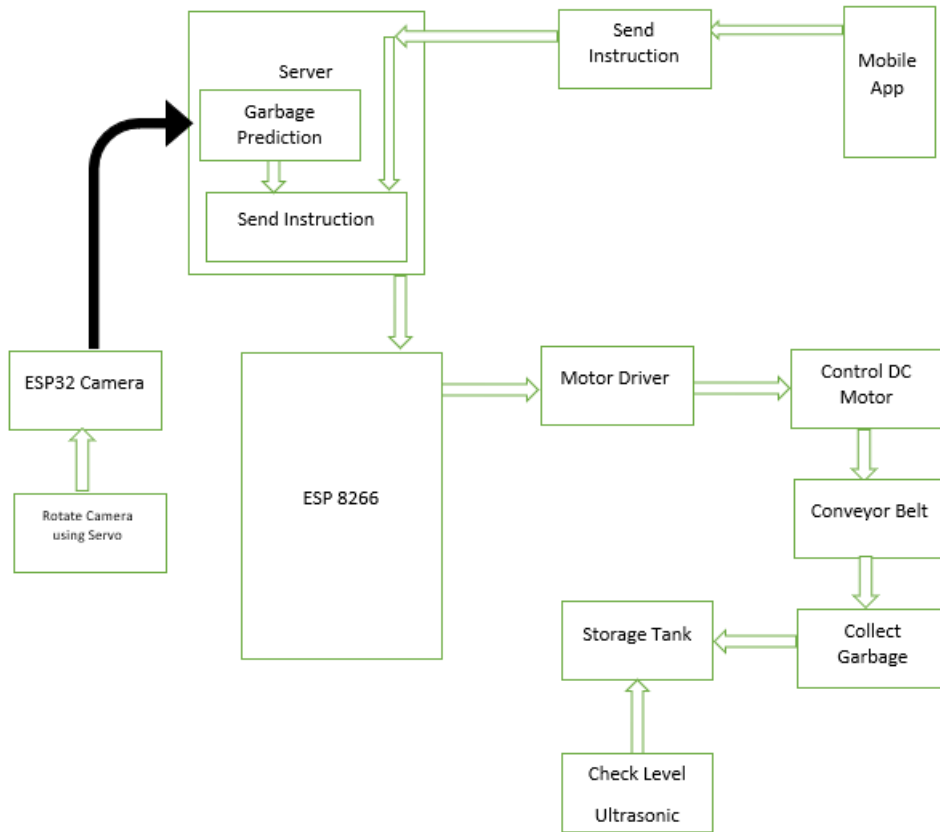


Figure 1 System Architecture

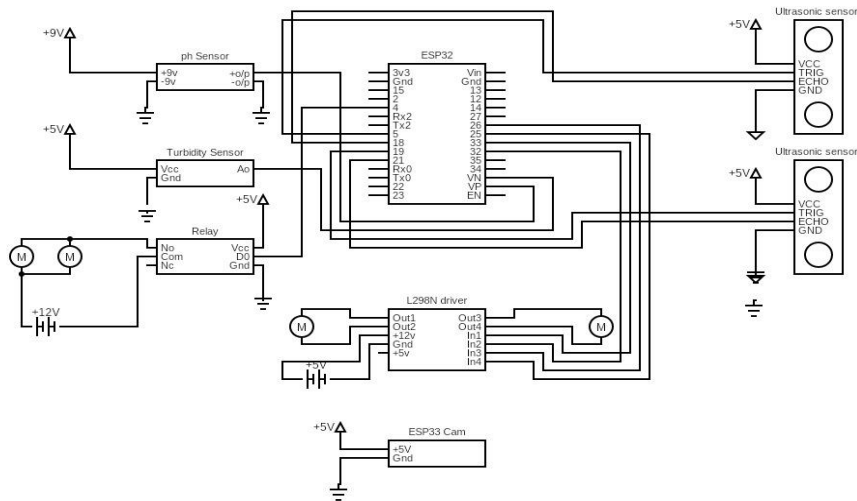


Figure 2 Pin Diagram



#### IV. METHODOLOGY

##### Initial setup:

The vehicle will be fitted with six DC motors. Two DC motors will be used for vehicle movement and two DC motors for pond cleaning. The vehicle will have a Node MCU microcontroller that will act as the brain of the vehicle. The node MCU will be connected to the vehicle to communicate wirelessly.

##### Set Instructions:

Various instructions will be sent to the boat using the smart mcu. We will use an android app to send directions in the car. The server processes the captured images and if any debris is found, sends a command to the boat and controls the boat's motor to turn in that direction.

##### Execution:

In the execution phase when the vehicle starts it will initiate communication with the user's Android device. It will respond to user notifications. When the user presses the start button, it will start the automatic cleaning of the pond. The user can also manually control the vehicle by pressing various buttons to move forward as well as backward, left and right. If the vehicle detects an obstacle, it will stop the vehicle

Automated lake cleaning boats are engineered with intelligent assistance systems to increase operational safety and efficiency, thereby improving the overall effectiveness of the cleaning process. These systems leverage sophisticated technology such as sensors, cameras and potentially machine learning algorithms to provide real-time guidance and alerts.

The importance of smart assistance in pond cleaning operations lies in its ability to minimize risks and ensure easy maneuvering, especially in challenging environments. As the boat navigates the water, integrated sensors and cameras continuously scan the surroundings, looking for debris, obstacles and potential hazards. Onboard intelligent software then analyzes this data to assess the feasibility of cleaning maneuvers.

One of the primary features of these systems is obstacle detection, alerting operators to the presence of large debris or obstacles in the water, facilitating timely avoidance maneuvers. In addition, advanced functionality such as predictive analytics can anticipate the movement of floating debris or changes in water flow, aiding in proactive navigation and cleaning strategy adjustments.

Additionally, the integration of machine learning algorithms enables the system to learn from historical data and predict potential obstacles or challenges in the cleaning route. For example, the system can anticipate debris accumulation in certain areas of the pond based on past patterns, optimizing cleaning efforts.

The paramount importance of these smart assistance systems in automated lake cleaning boats is evident in their ability to increase safety for both operators and the surrounding environment. By providing real-time information and alerts, they serve as critical tools in reducing the risk of collisions, optimizing cleaning operations and maintaining the ecological balance of lake ecosystems.

#### V. FUNCTIONAL REQUIREMENTS

##### HARDWARE REQUIREMENTS

1. Processor: i5
2. RAM: 8 GB
3. Hard Disk: 400GB
4. Processor Speed: 2.4GHZ
5. System Type: 64-bit
6. Node MCU
7. DC Motor



H-Bridge L298 Driver

8. Ultrasonic Sensor

9. Battery

#### FUNCTIONAL REQUIREMENTS

- User give instruction to start the boat.
- The vehicle will start its conveyor belt mechanism to start cleaning the detected debris or garbage's.
- The garbage's will be collected in the collection bin for disposal.
- Movement of the boat can be controlled by the android app

#### NON FUNCTIONAL REQUIREMENTS

##### Usability

The client almost accepts to be characteristic of the buyer interface and is committed to ask for surprise pressure in transferring to a unique framework with another condition

##### Reliability

The progress made by the programmer should be clear both to the project leader and additionally to the test design.

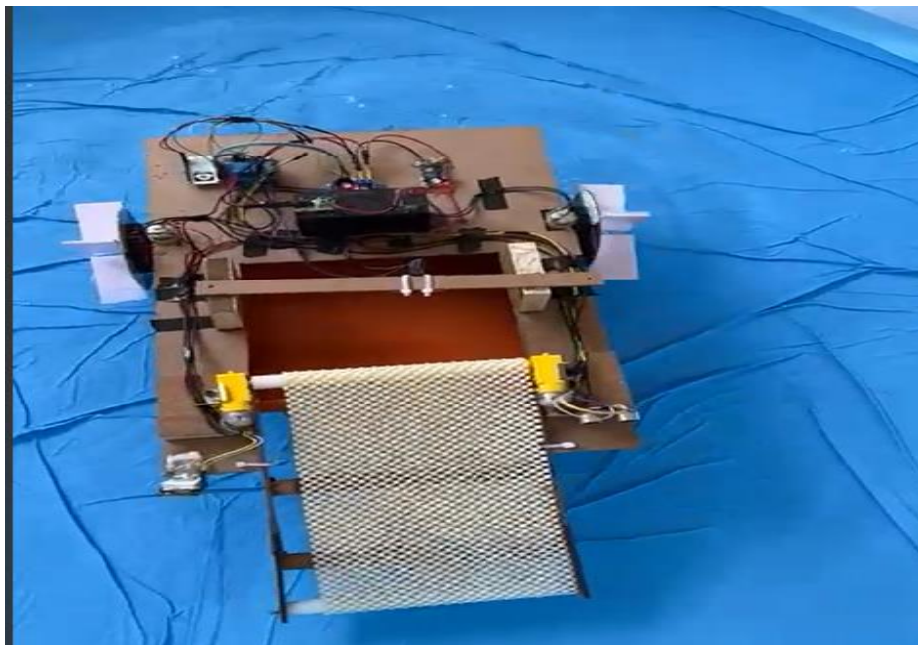
##### Performance

The framework will be facilitated on a solitary web server with a solitary database server, consequently execution turns into a significant concern.

##### Reusability

A framework should be divided into such modules that it can be used as part of another framework without requiring much work.

## VI. TESTING AND RESULT







## VII. CONCLUSION

The "lake cleaning boat" project has been developed to be highly affordable, simple to use, and useful for cleaning water. It can also be modified to increase its cleaning capacity and efficiency. The goal of this project is to operate with flexibility. This requires little maintenance costs and is simple to operate. Therefore, the "lake cleaning boat" project is primarily intended to make the system very helpful and economical to remove water impurities such as plastics, trash, and water debris that float on the surface of ponds and rivers. The main benefits of this are for human health maintenance and aquatic animal longevity..

In conclusion, the implementation of automated lake cleaning boats shows significant progress in reducing water pollution and maintaining the health and ecological balance of lakes. Using advanced sensors and robotic mechanisms, these autonomous vessels can effectively detect and remove various pollutants from the water surface, contributing to the enhancement of water quality and the sustainability of freshwater ecosystems. Compared to traditional manual methods, automated pond cleaning boats offer greater effectiveness, cost-efficiency and environmental friendliness, making them a promising solution to meet the challenges posed by pond pollution. Moving forward, continued research, development and deployment of these technologies is essential to ensure long-term health and viability.

Scope for future work of the automated lake cleaning boat project presents numerous avenues for enhancement and expansion. Firstly, integrating advanced sensor technologies such as LiDAR and sonar could improve the boat's ability to detect and navigate around obstacles underwater, thereby enhancing its efficiency and safety. Additionally, incorporating machine learning algorithms could enable the boat to autonomously identify and prioritize the removal of different types of pollutants or debris based on real-time data analysis.

Moreover, implementing remote monitoring and control capabilities through a mobile application or web interface would facilitate easier operation and management of the boat from a distance. Furthermore, exploring the feasibility of incorporating renewable energy sources such as solar or wind power could enhance the sustainability of the boat's operation, reducing its environmental footprint. Finally, conducting extensive field testing and validation in various lake environments would be crucial to refining the boat's design and functionality for optimal performance under different conditions. Overall, the future work for the automated lake cleaning boat project holds immense potential for advancing environmental conservation efforts and ensuring the cleanliness and health of water bodies worldwide.

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Everyone's belief in the potential of "Automated Lake Cleaning Boat" has been a source of motivation and has enabled us to pursue this ambitious project.

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