

# Artificial Intelligence Enabled Robotic trash Boat to Drive and Harvest Floating Trash from Urban Drain

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**ABSTRACT:** This study is focused on development of water floating garbage cleaning machine or riverwastecleaning machine; a machine which is capable of removing waste debris from water efficiently and effectively. For the existence of life on earth water is a basic need and only about 3% of Earth's water is fresh for drinking. Of that, only about 1.2 percent is often used as drinking water; remaining is in the form of glaciers, ice caps, or deep inside the ground. The drinkable water which we drink comes from rivers and waterfalls. If we move our eyes toward existing situation of four rivers and water bodies which supply drinking water, they are reserving as dumping yard for waste debris, solid and liquid wastes, which includes plastic bags, bottles, plastic wrappings of food, beverage cans, so many toxic materials, pollutants, etc. Due to this pollution in water is increasing rapidly, which is dangerous for humans as well as

aquatic animals. The motive of this project is to clean this type of garbage from the water bodies like rivers and lake by, "water floating garbage cleaning machine." This machine will work on the chain drive mechanism which is operated by RF module remote control arrangement having components like conveyor belt attached with fins, motor, battery or solar panels, propellers, floating pipes, collecting tray, etc. assembled together. A motor runs conveyor belt which will collect the garbage floating on water and further transfer it to the collecting tray. With less human intervention reducing time and manpower for cleaning water bodies is our alternating aim.

**KEYWORDS:** Artificial intelligent, RF Module, Robotic trash boat, Conveyer Belt, Propeller, Solar panel, Urban drain cleaningsystem.



Water floating garbage (Source: Google)

## I. INTRODUCTION

Over 71% of Earth's surface is covered with water; water is the most precious resource for the humans as well for the animals. The population of earth continues to grow; the pressure over the planet's water resources is rapidly increasing [2]. In current scenario, our oceans, rivers, and other inland waters are being "squeezed" by human activities so their quality is reduced. The proof: tons of trash in our rivers and creeks, making it look and smell like a dumpsite by which quality of water is going too poor [1]; by the effect of which animals as well as humans are getting affected with the new types of fevers and diseases. Waste water garbage is defined as the flow of used water come from homes, business industries, commercial activities and institution, etc [2].

Our project can be used in that places where there is waste debris in the water body which are need to be removed. Our project is consisting of motor driven conveyer mechanism; which is efficient for collecting and removing the floating solid wastages from water bodies [3]. This will reduce the water pollution and also the uncertain death of aquatic animals. It consists of Belt driven mechanism which lifts the floating solid, plastics food wrappings and others solid wastages object from the water surface. The use of this project will be made in rivers, ponds, lakes and other water bodies for to clean the surface water debris from bodies. Some machines have been developed to clear and remove the waste on the surface of the water bodies but in our project/model we will use the different and more efficient garbage cleaning machine as compare to other developed garbage cleaning machine. Impurities in drainage water can be like empty bottles, polythene bags, food wrapping papers, etc [4]. It's an Industrial, commercial and residential working wastes. Our project can be used in that places where there is waste debris in the water body which are need to be removed. Our project is consisting of motor driven conveyer mechanism; which is efficient for collecting and removing the floating solid wastages from water bodies. This will reduce the water pollution and also the uncertain death of aquatic animals. It consists of Belt driven mechanism which lifts the floating solid, plastics food wrappings and others solid wastages objects from the water surface [6]. The use of this project will be made in rivers, ponds, lakes and other water bodies for to clean the surface water debris from bodies. Some machines have been developed to clear and remove the waste on the surface of the water bodies but in our project/model we will use the different a

nd more efficient garbage cleaning machine as compare to other developed garbage cleaning machine. Impurities in drainage water can be like empty bottles, polythene bags, food wrapping papers, etc [10]. It's an Industrial, commercial and residential working wastes battery used Water Cleaning Mechanism Which Can auto collect floating garbage and solid waste from the water surface and collect it into its floating plastic made collecting tray or dustbin. In which we can use here Solar panel for continuously charging of our battery and which will improve our machine performance and efficiency with reduced human efforts [10].

## II. LITERATURE REVIEW

The motive of their project "Design and fabrication of sewage cleaning machine" was to automate the sewage cleaning process in drainage, to reduce the spreading of diseases to human [3]. They proposed the system where they made machine which was operated by the remote control to clean the sewage from the water bodies. Hence their system reduces the impacts from the sewage waste and its harmful chemicals and gases [6]. They had used a wiper motor that starts working as soon as the setup is switched on. They attached two power window motors to the wheel and drive them with the help of remote control system. They used a remote control to lift the sewage and made a dustbin bucket arrangement for collecting the sewage [7]. They proposed that their machine is also capable of lifting the waste which floats on the water surface. Their system has limited human contacts and interference in the process of cleaning and this in turn reduces spreading of diseases to humans."

This paper emphasizes on design and fabrication details of the river waste cleaning machine. The work has done looking at the current situation of our national rivers which are dump with crore liters of sewage and loaded with pollutants, toxic materials, debris etc [8]. The government of India has taken charge to clean rivers and invest huge capital in many river cleaning projects like "Namami Gange", "Narmada Bachao" and many major and medium projects in various cities like Ahmadabad, Varanasi etc [2]. By taking this into consideration, this machine has designed to clean river water surface.

Conventional methods used for collection of floating waste are manual basis or by means of boat, trash skimmers etc. and deposited near the shore of rivers. These methods are risky, costly and time consuming. By considering all the parameters of river surface cleaning systems and eliminating the drawback of the methods used earlier, the remote operated river

cleaning machine has designed which helps in river surface cleaning effectively, efficiently and eco-friendly [9]. The “River waste cleaning machine” is used where there is waste debris in the water body which are to be removed. This machine consists of DC motors, RF transmitter and receiver, propeller, PVC pipe and chain drive with the conveyor attached to it for collecting wastage, garbage & plastic wastages from water bodies.

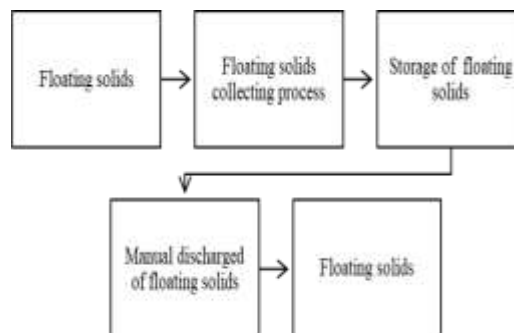
### DESIGN METHODOLOGY

The methodology for designing trash collector boat is based on the engineering design and system analysis. Particular attention is given to the available design of trash collector boat since

they are the basic reference to the development of the concurrent design.

### FUNCTION ANALYSIS METHOD

The aim of function analysis method is to establish the functions required by the trash collector boat to perform the desired task which is to collect floating solids from surface water. Fig. 1 shows how a trash collector boat should perform in the desired manner. It begins with the collecting process where floating solids were collected of the water surface. Next, the collected floating solids will be stored temporarily in the storage container and lastly, the trash will be manually collected at the end of the process.



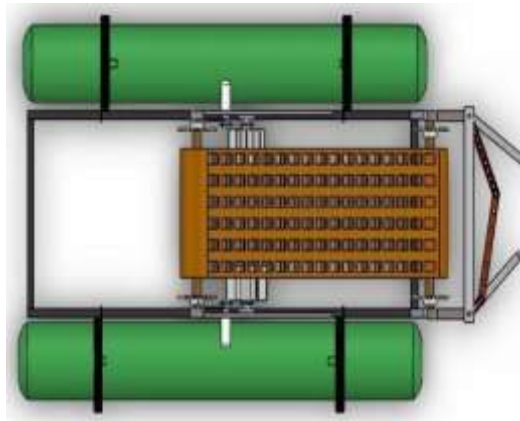
### Analysis of principal function for the collection of floating solids

#### A. 3D MODEL

The design for trash collector boat for small area application was completed using Autodesk Inventor 2019 software, and a 3D model had been generated for the purpose of visualizing the requirements and specification that had been determined throughout the analysis. Four drawings are previewed with different angles of view; isometric view, front view, top view and side view as illustrated in figure below.

The basic design of the trash collector boat is based on the catamaran boat with two hulls positioned at both sides of the trash collector boat. The unique feature of Catamaran hull was selected to reduce the water resistance and improve the stability of the trash collector boat. Several modifications have been made to equip the boat with an additional

system for the collection of floating solids off the surface water including conveyor system and temporary storage. In this design, a rotating conveyor belt is positioned in between of the catamaran hulls along the centre line. The rotating conveyor is mounted at the front of the boat and tilted at a certain angle for an efficient trash collection system. A few of wire mesh are attached to the conveyor system to act as the main trap to collect and capture the floating solids and carried them to the storage container or dustbin that is located at the back of the trash collector boat. The dustbin is made of wire mesh web to remove any trapped water within the trash. When the dustbin is fully loaded, the boat is taken to a discharge position where the trash is manually removed into a truck or other facilities.



**Top view of proposed model**



**Side view of proposed model**

## B. BODY FABRICATION

The body of the trash collector boat is divided into five main parts including frame, dustbin, electronic board, hull, and motor cover. Each part is built using different methods and types of materials. Every part of the trash collector boat can be easily assembled and disassembled, except for the frame and the electronic board. Table 4 summarizes the function of each part of the trash collector boat. Several criteria were considered in the selection of materials to fulfil the objectives of the construction of a lighter collector boat. Proper selection of materials is very important to determine the right method of construction. In addition, the durability and strength of the boat are also influenced by the type of material used in the fabrication of the trash collector boat. The main body of the trash collector boat which is the frame, dustbin, and conveyor system were constructed

using square hollow mild steel and stainless steel net. Stainless steel was chosen since it is durable and lightweight material. On top of that, it does not corrode when in contact with water allowing their usage in the surface water. The Catamaran hull was fabricated using fiberglass material. Fiberglass is a lightweight material that is mostly used in boat fabrication [16]. It is durable and high in strength which makes it a suitable material for the hull. An electro-galvanized sheet was used in the fabrication of the electronic box to store all the electronic components of the trash collector boat due to the high level of thickness which will prevent from water intrusion to the electric and electronic components of the trash collector boat. The motor cover was made using PVC material since it is durable and lightweight.

**Table 4. Main components of trash collector boat**

Component	Function	Material	Characteristic
• Frame	• As a support to the prototype	• Square hollow mild stainless steel	• Durable • Lightweight • High strength
• Dustbin	• As a temporary floating solids storage	• Stainless steel net	• Durable • Simple design • Lightweight • Easy handling
• Conveyor system	• As a trash collector	• Square hollow mild stainless steel and rubber gasket	• Durable • Lightweight • High strength • Eco-friendly • Flexibility
• Hull	• As a buoy to float the prototype in surface water	• Fiberglass	• Durable • Water resistance • Anti-corrosive
• Electronic box	• As a storage for electronic components and power supplies	• Electro-Galvanized (E.G) sheet	• Used to keep electrical part • Higher level of thickness control • High strength • Durable
• Motor Cover	• Install brushless motor	• PVC	• Durable • Lightweight • Water resistance

### C. SYSTEM FABRICATION BOAT SYSTEM

Boat system composes of three main components including boat, remote control and adjustable step-down power supply module. It uses two motors to drive and operate the boat within 30 m distance control with 27MHz frequency. An adjustable step-down module was used to reduce the power supply from 12V to 7.2V to suit the requirement of the boat system. A rechargeable sealed lead battery is used to supply power to the system.

### CONVEYOR SYSTEM

The conveyor system is the main feature for the trash collector boat to collect floating solids and debris from surface water. The conveyor system has been featured in most trash collector boat design since it can effectively collect trash and floating solid off the water surface [7,17]. The conveyor was fabricated using aluminium, gasket rubber and PVC pipe. Wire mesh was attached to the conveyor for

trash collecting purpose. The system is equipped with a DC motor speed that enables the user to control the speed of the conveyor according to the collection area. In addition, a relay wireless remote control was installed into the conveyor system to allow the control of the forward and backward movement of the conveyor. The relay wireless controller can be operated within a distance of 300m.

### MONITORING SYSTEM

Monitoring system consists of a camera with android application **ARDUINO BLUETOOTH CONTROL** and battery indicator. This system was incorporated to facilitate the operation of the prototype in terms of movement control. An FPV Wi-fi Camera Cam was used that supports real-time image transmission within 100m range. It allows the user to monitor the condition of the river or the direction of the boat.

#### D. TESTING AND ANALYSIS

The trash collector boat prototype was tested to ensure that any system and parts installed are effectively working. The monitoring system of the trash collector boat such as the camera, lamp and battery indicator was also evaluated. The product testing was completed

at the university lake.

#### PROTOTYPE EVALUATION

The finished product of the prototype is shown in Fig. .



Prototype of portable trash collector boat (Side View)



Fig. Prototype of portable trash collector boat (Top View)

#### III. CONCLUSIONS

After studying and understanding above all research journal papers and the projects on river cleaning machine or water floating garbage cleaning machine, we can conclude that from the manual to semi-automatic operated machines, so much efficient and effective work and research has been done by different authors from different regions of different country.

Many researchers have accomplished their project objectives like minimizing manual stress, less human intervention, environmental friendly, reliable stability, cost efficient and economical.

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