# Ocean Surface Trash Collector

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**Abstract:** ***This paper describes the design of a robot for collecting waste floating on the water surface. Three important issues for designing the aquatic robots are a cost-effective solution along with robustness and durability. Due to the nature of the cleaning work, we designed the robot structure with car like mechanism that can provide high stability, good ability in maneuver and can easily collect all the waste flowing on the water. The plastic pipe container works best for this case and fulfils all structural stability criteria. For collection of waste, a motor-driven conveyor belt has been designed for collecting the wastes and deploy it into a plastic box connected to the platform. This design provides simple and effective waste removal and accommodates large amounts of waste within a little space. This light-weight and tough structure support the total weight of the collected waste, conveyor as well as the hardware components used. The rotating arms system based a differential drive mechanism has been designed, which allows the robots to require a 360 turn on the spot and provides high thrust. Electronic circuit and motors have been placed on the platform, in order to protect them from water. The robot is automatically controlled by Arduino, sensors, motor driver, GPS and GSM modules. The testing of the robot prototype proved to be effective in waste collecting and getting back to the way-point. The maximum trash loads that robot can bear is up 5 kg. The main aim of the project is to optimize time, energy and overall process speed.***

**Keywords:** Ocean; wastage; garbage; pollution; Bluetooth; GSM; GPS.


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## 1. Introduction

Waste is an environmental problem that always arises from year to year and still can't be resolved entirely. We frequently found garbage from various places dumped into rivers, water- ways, or reservoirs. The rubbish can clog the flow of water, causing water to become dirty and smelly in order that it often overflows and causes disasters, including flooding. the way to clean waste from water areas requires extensive resources, for instance, by cleaning staff and using excavators. This study aims to supply an alternate solution to the matter of waste in water areas by developing robotics technology capable of operating in water areas. Robotics technology developed within the sort of Eco-robot with the most task of collecting waste. The robot is meant to figure automatically. the event method of this research refers to ADDIE. This method including of analyzing of the robotic cleaning system, designing the robot, developing the robot, implementing robot to collect waste in limited water areas, evaluating the effectiveness of robot in cleaning up trash for the more extensive area. this text is that specialize in the planning and development of the robot. Previously some robots are built for cleaning water surface. a couple of results are available within the open references, which have discussed the event of such particular purpose robot. This work aims at developing a more versatile and efficient system by the usage of the aqua robot. For navigation and trash cleaning on the bottom, many well-designed algorithms are developed earlier for both single robotic systems also as for swarms. However, due to the difference within the dynamic environment, system, and therefore the difficulty to accurately determine the present position supported relative velocity and acceleration, these algorithms can't be directly used on aquatic surfaces. Also, the navigation algorithms developed. The robot is meant and developed for replacing labor, cleaning waste on ocean, rivers.

## 2. Literature Survey

In order to understand the need for a compact, cost effective and scalable system, and before diving in to provide our own solution, we need to first understand the existing research and work done in the field. There have been numerous prototypes of Water garbage collection systems, autonomous

robots, and waste segregating. In this section, we depict a concise review performed on these existing pieces of work, encompassing mobile robots, garbage collectors and IoT based systems for similar use cases. One paper proposed a Water Surface Robot using wireless communications. The primary objective of this research was Waste Hunter Surface Robot was a semi- automatic robot with three different main functions, which were surface cleaning, purification process and water quality monitoring. The robot was semiautomatic control robot where the robot will be turned on and off, makes a movement form the input gain from the user. Wireless based controller was used with WI-FI based communication protocol to communicate between the user and the robot. The remote control used was the smart phone apps called (Blink) virtual button keypad. The Node MCU micro-controller module was use to interface unit between the user and robot. The wireless based controller was used in WI-FI based communication protocol to communicate between the user and the robot. The remote control used was the smart phone apps called (Blink) virtual button keypad. The Node MCU micro-controller module is used to interface unit between the user and the robot. There will be several functions on the mobile apps, virtual keypad to control the robot, when the robot is connected to the WI-FI module, first button, the propeller control (virtual joystick) for the movement of the robot. One widget for monitoring the internet data connection (ping) between Blink cloud and user interface, digital switch to turn on or off the motor pump and one virtual gauge for data quality monitoring (PH value) Another paper demonstrates the use of a different algorithm. This paper emphasis on design and fabrication details of the river waste cleaning machine. This machine has designed to wash river water surface. The remote operated river cleaning machine has designed which helps in river surface cleaning effectively, efficiently and Eco-friendly. The "River waste cleaning ma-chine" is employed where there's waste debris within the water body which are to be removed. This machine consists of DC motors, RF transmitter and receiver, propeller, PVC pipes and chain drive with the conveyor attached thereto for collecting wastage, garbage plastic wastage from water bodies. Here they have used a Bluetooth module to control the robot via 2 DC motors at 300RPM approx. The robot is control by an android phone application Micro-controller used is AT89S51 from 8051 family to figure during a serial communication UART mode the communication is configured on 9800bps to communicate it with the Bluetooth module. The Bluetooth module used, HC-05 in SMD package which works on a 3.3 V and have a serial communication with any device connected thereto the communication speed can be configured on various speed via AT Command. The Bluetooth module may be a SPP supported profile so it are often connected easily to any module or phone. In this profile the info are often sent and receive to module. The Bluetooth module is connected to the RX pin of micro-controller. The L293D may be a motor driver IC to work the motors in any direction required hooked in to the logic applied to the logic pins. The controlling devices of the entire system are a micro-controller. Bluetooth module, DC motors are interfaced to the micro-controller. The data receive by the Bluetooth module from android smart phone is fed as input to the controller. The controller acts accordingly on the DC motor of the robot. The robot within the project are often made to maneuver altogether the four directions using the android phone. The direction of the robot is indicators using LED indicators of the Robot system.

## 3. Methodology

### 3.1 Algorithm Flow

In the first step Mobile phone is used to set the way-point for the robot using the Bluetooth module. Once the start button is pressed the robot travels according to the path loaded in the Arduino. We have combined the usage of proximity sensors with motor driver to accomplish our purpose. The ultrasonic sensor mounted on the servo rotates and remains ON during the whole process. Once the sensor detects any object on the water surface, the motor driver moves the robot in that direction and starts the conveyor belt and collect the waste. This helps us to save battery power required for the process. The weight sensor attached in the waste collector or plastic box will keep the reading of the weight. Once the weight reaches to 5kg or above, the robot will come back to the way-point set using the GPS module or either keep flowing the path. Once the robot reaches the way-point, the location co- ordinates of the robot will be sent to the mobile using GSM.

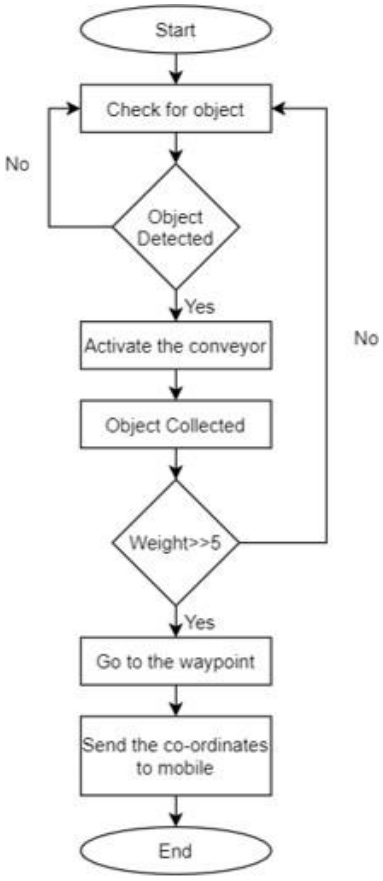


**Fig. 1**: Flow chart

### 3.2 System Design

***1) Robot Body Architecture*:** The robot is made on a flat wooden sheet on the top, with two-wheel drive. At the front, a conveyor belt is mounted, responsible for collecting up the garbage, when detected. The flat chassis is made of a wooden sheet of measured dimensions, attached to a floating circular pipe and supports made up of small pipes. Two rotating arms or paddles are attached to it via two different DC motors. The conveyor belt is mounted with the help of 2 DC motors, on either extreme of the width of the robot. On top of the wooden sheet, contains the main ECU of the robot, with all circuitry and connections. The sheet contains a small slot, making space for the presence of an ultrasonic sensor and servo.

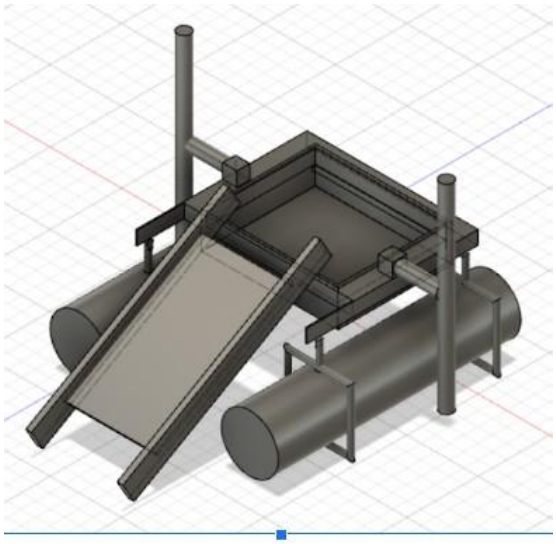

**Fig. 2**: Schematic Diagram

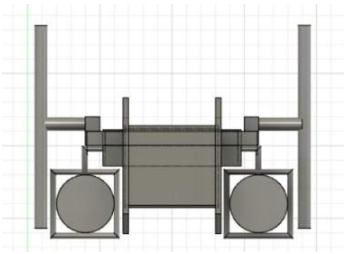

**Fig. 3:** Front View

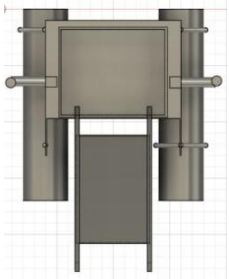

**Fig. 4:** Top View

***2) Robot circuitry architecture*:** The ECU of the Robot is controlled mainly by a Arduino UNO or MEGA. The Arduino UNO is connected to the ultrasonic sensor, L293D motor driver modules (2 in Number), GPS and GSM. The motor driver modules are each connected to 2 DC motors, which drive the wheels and also to conveyor belt for collecting waste.

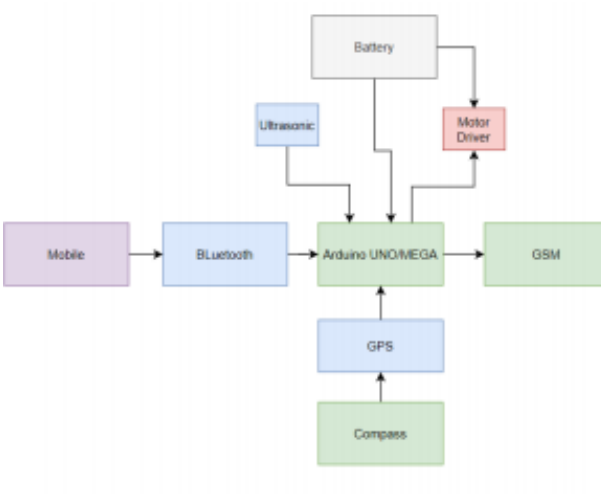


**Fig. 5:** Block Diagram

### 3.3 Modular Analysis

The system is divided into a number of Modules. We shall analyze each of these modules in detail, as follows:

***1) Trajectory and motion module*:** The robot moves in a pre-programmed trajectory, covering its locality or zone which it is responsible for cleaning. The trajectory program is present on the Arduino UNO. The Arduino UNO sends commands to the motor drivers, which in turn controls the motors for various functionalities, such as forward, reverse, left turn, right turn and stop. In an obstacle free path, the robot continues to move forward. The trajectory may further be optimized by taking into account a number of factors so as to cover minimum distance while accomplishing its purpose. After the obstacle is detected, depending on whether it is garbage it will take action. If the garbage is detected, then the robot will move in that direction. After collecting up the pieces of garbage, it must travel to the way-point of the assigned zone and deposit the garbage.

***2) Object Detection module:*** The motion, object detection, data communication and actuation were all performed success- fully. The given code is just for communication between a Robot and Arduino. The demonstration of garbage classification is also shown. We attached an LED to the front of the robot to indicate the detection of garbage. It was found that, whenever garbage was detected, the LED began to glow, and the conveyor w smoothly lifted up the waste using DC motors.

## 4. Results and Discussion

The motion, object detection, data communication and actuation were all performed successfully. The given code is just for communication between a Robot and Arduino. The demonstration of garbage classification is also shown. We attached an LED to the front of the robot to indicate the detection of garbage. It was found that, whenever garbage was detected, the LED began to glow, and the conveyor w smoothly lifted up the waste using DC motors.

## 5. Relevance to Social Benefit

The waste collecting robots are a great step forward in combat-ting pollution, the major cause of water scarcity. However, it could also be a method of improving the lives of individuals in developing countries. The most direct effect of decreased pollution is improved health as a result of increased availability of clean water, but the proliferation of trash robots could lead to economic opportunities as well. In order to deploy waste collecting robots across the planet, people are going to be needed to take care of them and take away the waste they collect. This illustrates the multi-faced benefits waste collecting robots can have in helping to lift people out of poverty.

## 6. Conclusion and Future Scope

The structure of the Ocean surface Trash collector Robot is presented in details. Both arms are made of plastic pipes and cause small surface wave amplitude when compared with fan or rotatory mechanism. Difference in term of mechanism has much influence on collecting system. Capability of the designed conveyor was successfully evaluated. It is also shown that both the robot driving speed and the conveyor belt speed has influence on waste scooping and the best capability of the robot is achieved at 0.38 m/s driving speed and 0.5 m/s belt speed. The maximum amount of collected bottles is 1.71 kg/minute, which is 75 percent over that of human force using a scoop net. Therefore, the Ocean Surface Trash Collector is proven capable of replacing human labor for water surface cleaning.

The robot can be controlled ad monitored by building a central server. The image processing algorithm can be used upon without any constraint in processing hardware. The system may also encompass a broad domain of use-cases. It can particularly be used for nuclear-waste collection, where human presence is unsafe. It is primarily proposed for a “smart ocean”.

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