

IOT Based Trash Collector Boat

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ABSTRACT

Water origins are polluted by debris waste. Adequate trash disposal in water origins such as lakes, ponds, and rivers is necessary for debris control. In India, marine trash administration and surveillance are of main concern for enforcing smart metropolia and fulfilling the task of a more hygienic India. Accordingly, this piece desires at developing a computerized approach to embark on the situation of water debris disposal. Lake cleaning IOT-based trash collector system for withdrawing the surface trash experimentations in this piece. In this project, we are going to use TinkerCAD and Proteus software to prototype and assemble Arduino Circuit for our IOT-based trash collector boat. It will accumulate the debris from the surface of the water and discard it into the container placed behind it. With the help of motors, the boat will have forward & reverse movement. We will emulate the working of our boat virtually in Proteus Software. Inspecting the outcomes indicates that the project can be used for sufficient debris reduction from the surface of the water.

KEYWORDS: Marine trash, Trash collector system, TinkerCAD, Proteus, Arduino Circuit

1. INTRODUCTION

Trash discarded in the water bodies close to human civilization is the root cause of water pollution. The consumption of toxic material creates a life-threatening situation for the creatures in the water bodies and eventually affects human life.

For narrowly structured water bodies it is difficult for a human to reach the point to clean the water body manually moreover this would hamper one's health.

To overcome this issue, this project obliges the creation of an IOT-based Trash collector boat, which is equipped with a conveyer belt and trash collecting container. This camera-equipped project would collect the trash on the surface of the water bodies, with the help of a conveyer belt attached to the front side of the body, which will collect the garbage that comes into its range of contact.

The purpose of this project is to sustain a clean environment, with minimum human intervention. The project is developed in such a way that it could advance the narrow portions of the water bodies to collect waste on the surface of water bodies.

2. BACKGROUND STUDY

A. RELATED HISTORY

Water pollution has significantly increased in the last decade as the urban civilization is booming at a fast rate it has become difficult to curb the increasing amount of waste dumped in to the water bodies around the metropolis and industrial region. Water pollution affects the groundwater purity, and the hazardous chemicals dissolved in the water bodies. This is harmful to both aquatic and terrestrial life.

Waste management administration done by the local authorities is not up to the mark when comes it to waste accumulation. This results in waste accumulation near residential or on road. This garbage goes into the river through canals and sewers in urban areas, and at the time of flood same garbage push back to the sewers and will chock them. This will lead to blocking of water and eventually, it causes flood situation more adverse and water will flow over the roads with all the garbage. Eventually, it will lead to various diseases caused by harmful toxic water and also the pitiful smell is bad for the health. Old people, also the kids with a low disease resistance suffer most when they contact with such water. There are effects on even the nature of this toxic water which makes land infertile.

The aquatic life get affected adversely as the floating filth minimizes the oxygen level in the water and in

addition to that wastage from the various industry when get added with this water the insoluble, harmful zinc, sodium, and other components makes this water very toxic. When such water is used by people living around it affects their health directly and it can be even fatal as industry's hazardous waste is also in that water. According to Geer's report, in the world, 10% of the total 100 million tons of plastic will be disposed of in the sea. Also, many of the mega cities around the world are near the sea, so all the waste water from the city and industrial waste ends up in the sea. Also, ocean waste is created by ships, crude oil plants, and ship containers. This garbage in oceans or seas will flow with the stream. Eventually, it ended on nearby beaches at the time of high tides. Often, oil gets leaked from ships, which is very harmful to marine life and even fatal for them.

Accumulation of the trash on the surface of the water is a tedious process when done fully manually moreover this is an expensive venture. It is also hard to discover the water surface which is covered with trash specifically when the toxic material is introduced into the water bodies, this situation is life hazardous for living begin. Nowadays, the amount of waste dumped in water bodies is making the situation hard to tackle.

This project is launched into the water bodies, on the surface of the water, it hovers in such a way that the conveyor belt is slightly submerged in the water to collect the trash. NodeMCU, Motor Drive, Motor, and Camera Module are the main components of this project. The establishment of the cloud server is created through the ESP8266 Wi-Fi module, this is the communication setup between the main components and controller. This technique of accumulation of waste from the water surface is more user-friendly due to the ease of access. This process of collection would eliminate the human effort to dive into the polluted water bodies.

Household products such as cans, bottles, plastics, and other industrial products when added to water bodies cause pollution as they contain harmful chemicals. This project would suppress such pollution but moreover, this problem could be addressed if human society decides to keep the environment clean as possible with the help of social awareness regarding water pollution.

B. LITERATURE REVIEW

[1] The robot is built on caterpillar wheels, robot size 52x74x17 cm and power are supplied from a 12v 30Ah battery which is connected to 40 W solar cells. The user can control a robot via a program developed from a visual basic 2005 application based on Windows XP. The result of robot performance was found that the robot can move with an average speed of 0.5meter per sec. The robot is built on a metallic base of size 50*40 cm. [2] The robot is designed to collect garbage at the footpath, public places, mostly cemented paths and the beach. The robot cannot be used on a muddy surface. The robot is built in such a way that, when it is started it will move on the path defined in the program. [3] A transmitter converts an

electrical signal into sound and the receiver converts sound into an electrical signal. Two sensors are used, one is used for detecting the obstacles and garbage another is used for sensing the level of the garbage container. [4] The miniature size as compared to the trash collector boat available in the store and perfect for narrow area cleaning intents. [5] Upon receiving the signal the motor is turned ON and therefore the Infra-Red sensor is used to follow the trail to succeed in the specified destination of the bin for creating a turn and tracking the trail the IR sensors present on the edges are used as a detection unit supported the signal received from the sensor unit the Arduino makes the choice and adjusts the motor to form the turn.

C. PROBLEM STATEMENT

The investigation desires to ease waste existing in several water sites to the highest quantity feasible to waste deduction. The water waste reduction to the highest feasible level is the aim of this project so as to main the hygiene of the living beings and to prevent the water from being polluted. It provides answers to the following questions:

1. How to create a boat design that would hover on the water surface and weight proportion with respect to the design?
2. How to operate the boat from a distance so as to control it?
3. How to analyze a system that would alert the controller when the trash collector is full?
4. How would the boat communicate with the controller when the trash accumulation is in process?

3. SIGNIFICANCE OF STUDY

The project is focused on the reduction of the waste accumulated on several water bodies with the help of NodeMCU and ESP32 camera it is easy to control and set up the server to start its functioning without engaging humans to dive into the polluted water. This project could be used on a larger scale but this prototype suggests a way to tackle the issue.

This project has the following uses for each aspect of the human society:

To the local cleaning authorities:

The municipality worker has to jump into the polluted water and risk his/her life, such that the workers could use this project to compile the waste on the surface and send it to recycling plants. This would help the worker and also protect one from serious waterborne diseases.

To the community living nearby the water bodies:

Local individuals staying near the water surface would experience an unhealthy environment, which would eventually affect their lifestyle, and more importantly, the hygiene would be comprised. The use of such a project on a private basis would create awareness and reduce water pollution.

To the fauna inside the water bodies:

The waste dumped in to the water bodies would affect marine life on a huge scale, and the vitals of the clear clean water gets polluted. The utilization of such a project would help the aquatic to gain its natural stability.

To the Habitat:

To maintain the sustainability of the water is important to introduce such a project as the usable water is only 0.5% of the total water on the earth.

To the Regime:

This type of project can be installed on the shores of water bodies and curb the pollution, the camera installed on this device would help the authorities to keep a track record of the defaulters or the cause of water pollution of the particular location to identify the root cause of the water contamination.

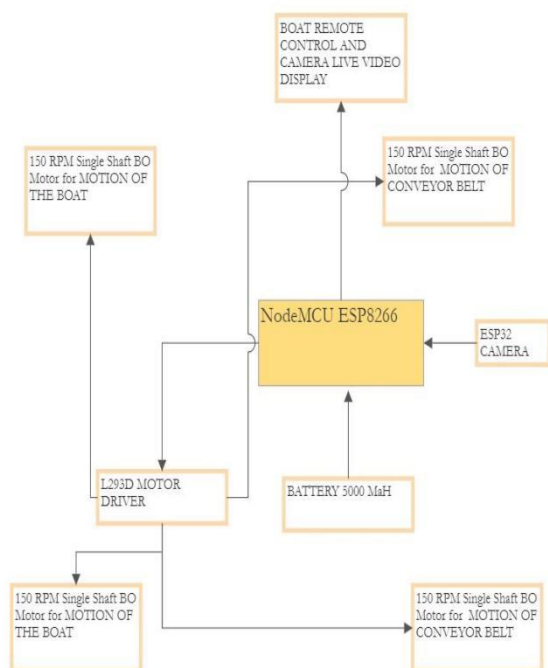
To the Nation:

The country could benefit from a device like this project, such that the clean and eye-catching locations such as seashores, lakes, and other water bodies make a most valued selling point for visitors and earn through tourists.

A. OBJECTIVE

The objective of this project is to reduce the human effort to clean the water waste on its surface and to sustain life such that to maintain the biological cycle of marine creatures.

B. BLOCK DIAGRAM



C. COMPONENT DETAILS

NodeMCU:

The NodeMCU (Node MicroController Unit) is an open-source software and hardware development environment assembled around an inexpensive System-on-a-Chip (SoC) called the ESP8266. The ESP8266, developed and fabricated by Espressif Systems, includes the essential components of a computer: CPU, RAM, networking (WiFi), and even a contemporary operating system and SDK. That produces it an exceptional option for Internet of Things (IoT) projects of all kinds.

This project is developed on an open-source hardware configuration and software SDK for their adaptable IoT controller. Similar to NodeMCU, the Arduino hardware is a microcontroller board with a USB connector, and definitive data pins. It also describes typical interfaces to interact with detectors or other boards.

Motor:

Bo motor (Battery Operated) weightless DC geared motor which gives exemplary torque and rpm at lower voltages. Here four bo motor with varying rated speeds. This motor can run at around 150 rpm when operated by a single Li-Ion cell. Excellent for battery-operated weightless robots.

Camera:

The ESP32-CAM is a small size, low-power consumption camera module based on ESP32. With an OV2640 camera and equips an onboard TF card slot. The ESP32-CAM is used in this project to monitor live video streaming.

L298N motor driver:

The L298N motor driver is based on the H-bridge configuration (an H-bridge is a straightforward circuit that allows us regulate a DC motor to go backward or forward.), which is useful in controlling the direction of rotation of a DC motor.

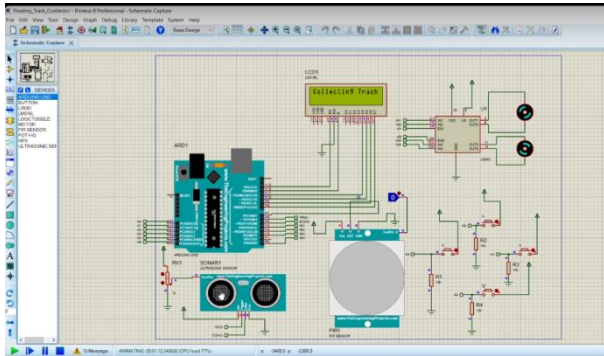
The motor driver module takes the low voltage input NodeMCU. This input logic controls the direction of DC motors connected to the driver. To control the direction of DC motors by giving suitable logic to the motor driver module.

The motor driver module consists of a motor driver IC, which is the main component of the module. The IC alone can control the DC motor but using the module makes the interfacing with NodeMCU manageable.

Battery:

5,000 mAh Lithium-Ion battery is used as input power to the NodeMCU, this is a rechargeable battery type, has a running time of 20 minutes.

D. PROTEUS SIMULATION



In this circuit, two motors are added to OUTPUT 1, 2 & OUTPUT 3, 4 correspondingly. The power given to circuit is 5V. When the switch 1 is pressed then both the motors will rotate in clockwise direction. Whereas, the switch 2 is pressed then both the motors will rotate in anticlockwise direction. If the switch 3 is pressed then the 1st motor will move in clockwise direction while the other will move in reverse direction. When the switch 3 is pressed the opposite of above condition will take place i.e. 1st motor will move in anticlockwise direction while the other will move in clockwise manner. So this circuit helps us in the movement of bot and collector.

E. METHODOLOGY

We have developed a project boat which will accumulate hovering trash from the different water resources. It will be a boat type model which will be having motors to move in forward, backward and in other directions. For the collection of trash there will be a conveyor belt at the front side. The boat will be completely IOT based that can be controlled by remote location.

In this section, our proposed system's working method is described.

It mainly consists of following phases:

- Controlling of boat & taking input from camera.
- Collection of trash.

Controlling of boat and taking input:

In this module we have a ESP-32 camera which is mounted on top of the boat and it will show the user all the footage. It's a 5 megapixel camera with many options like rotating incoming image and also its colour combination. So the user can watch the live stream on the webpage and can easily detect where the floating trash in water body is.

Node-MCU ESP8266 microcontroller is processing unit of the project. It will be connected to all the motors and camera also. The boat has three 150rpm DC motors. Two motors are mounted on both sides of boat and will help boat to move in forward and backward direction. The third one specifically used for direction controlling of the boat. The camera's live stream and prototype's control will be on same HTML webpage as in "Forward", "Backward", "Left",

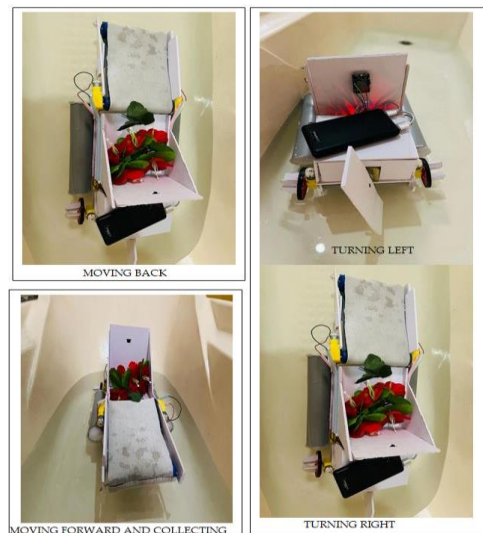
"Right" and "Stop" buttons. The live camera stream is source of information for the controlling person.

When the user will give input as forward all the motors will move clockwise and boat will move in forward direction. When user will push backward, the motors will rotate in anticlockwise direction and boat will move backward. When boat has to change in direction of right only the right sided motor will moved in clockwise direction and for left direction the left sided motor will move in clockwise direction only.

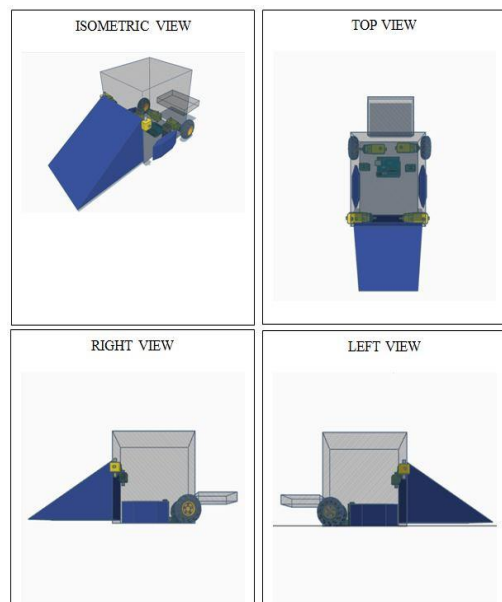
Accumulation of debris:

To collect the floating trash in the water bodies, the system is mounted with a conveyor belt at the front facing side. The conveyor belt is also power by two 150 rpm motors which will powered by 9V batteries. The belt will be rotating inside so the trash can collect inside the trash-cabin.

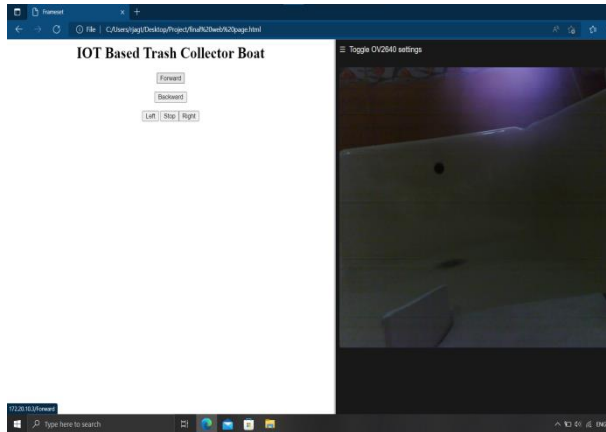
F. RESULTS



G. TINKERCAD



H. INTERFACING



A web page is created with the help of HTML and Java Script this connects with the IP address of the NodeMCU and ESP32 camera. This web page sends the command “left”, “right”, “Forward”, “Reverse”, to the NodeMCU with the help of IP addresses connected with the mobile hotspot. The NodeMCU trigger the motors with the help of motor driver.

4. LIMITATIONS

The model can take up the trash up to a load of 5 kg. Since the model is lowered in water up to a profundity of 100 mm, the bed of the water body to be lower than that for the model to be allowed to move in the water body. Another drawback is that the model can eliminate solid waste from the water yet isn't equipped for eliminating fluid waste like oils and so forth. Likewise, the model runs on battery, so when the battery is drained it is absolutely impossible for the model to fill its roles. These are a portion of the limitations of the model.

5. CONCLUSION

The prototype of the IoT-based Trash collector boat has shown a favorable outcome. This project is the miniature version of the regular garbage accumulator on the market, this appropriate size makes it more feasible to use in narrow areas of the water bodies which are manual out of reach by human efforts. The boat has a conveyor belt attached to its front part which collects the waste from the surface of the water. The features like live video streaming and control through a Wi-Fi server on a mobile device make it easy to utilize. The test done on this project prototype suggests promising result in terms of the amount of waste collected in the bin. This indicates adequate data from the camera to trace the source of the pollution. Water pollution reduces serious issues such as sewage clogging occurring during rainy seasons, especially in the landlocked areas of the earth.

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