RIVER SURFACE CLEANING WATER BOAT

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Abstract: Water bodies have a huge aquatic ecosystem within them. Any high concentration of suspended solids can cause numerous issues for aquatic life by blocking light from reaching submerged vegetation. Hence, there is a need for a solution to remove this trash from the water bodies. The Water cleaning boat Project is an endeavour to clean water bodies with an ambitious mission: to achieve cleaner water-bodies that are free from suspended solids; to reduce human intervention and human labour.

This project gives a solution of automated river cleaning with the help of a tread mill arrangement. The RF transmitter and receiver are used to control the cleaning machine. The battery energizes the conveyer belt to clean suspended solids in the river, then is stored in the boat itself to aside. A camera affixed to the boat helps in monitoring the movement of the boat in the necessary directions. The Water-boat Project not only concentrates on technology but also believes that using Science, Technology and Community it is possible to build a sustainable environment.

Keywords – Arduino UNO Board, Motor driver, DC Motors, PVC Pipes, ESP32 Camera, Online ESP32 Webserver, Bluetooth Module, Conveyor belt, Waste collector bin, Mobile Application (Arduino Controller).

I. INTRODUCTION

Water occupies about 71 percentage of the earth's surface and provides humans with a number of benefits. Water is indeed the backbone of human civilization. From the beginning of human history, rivers and lakes have been supportive of our livelihoods. Even today, we are still dependent on the water bodies for our growth in every aspect. But with the growing industrialization, we have ignored the fact that we are not only using but also causing harm to natural resources. The water drainage system consists of waste materials that might be non-biodegradable. The non – biodegradable wastes are a serious threat as they lead to climatic changes and floods. We must understand that saving and maintaining the resources for sustainable development becomes our responsibility. Decades of uncontrolled dumping have led to a lot of pollution already. It is time that we started cleaning up the mess we all have been making. Cleaning the waterbodies to improve the water quality of rivers and lakes is the endeavor. Generally, manual methods are used to pick up the water debris, trash, plastic, and all other types of impurities that lie on the surface of waterbodies. But this conventional method requires more human interference. Such a method of cleaning is risky, costly, and highly time-consuming as it may need more human labor. Thus, there comes the need for a sophisticated system that is eco-friendly and works efficiently. The river surface cleaning water boat is one such system. This systematic method can remove the waste debris from water bodies with comparatively less human interference. It is used to collect the waste present on the surface water of lakes,rivers, and ponds. The architecture of this machine consists of a cleaner mechanism for collection and removing waste from water bodies using a belt driver mechanism. The conveyor belt that is powered by a battery continuously rotates in a backward direction by taking water debris into the collector bin. The boat moves in the direction given by the person holding the control app. A camera affixed to the boat tells which directions are best for better water cleaning. This machine is controlled remotely.

Objectives
a. Reducing human intervention
b. Faster and easy cleaning
c. Remote Operation

II. SYSTEM MODEL AND COMPONENTS ANALYSIS

The proposed system can float on water and moves in all the possible directions for collecting the solids floating on the water. It is a working prototype of a water cleaning mechanism that collects floating debris and stores it in a collector's bin on its own. It can be programmed, scaled up to any size and can operate remotely. The movement of the cleaning boat is monitored using the camera installed in the boat. The power supply powers the boat to perform its operation. The motor driver handles motors with directional and speed controls. Motor 1 and Motor 2 are being controlled by the motor driver. These two motors are responsible for moving the propellers of the boat. The motors controlled using the Mobile app named Arduino Bluetooth Controller that is connected to the

boat through Bluetooth. The navigation keys on the terminal mode of the mobile app can be F for forward, B for backward, R for Right and L for left. Similarly, Start and Stop keys are for starting and stopping the motion.
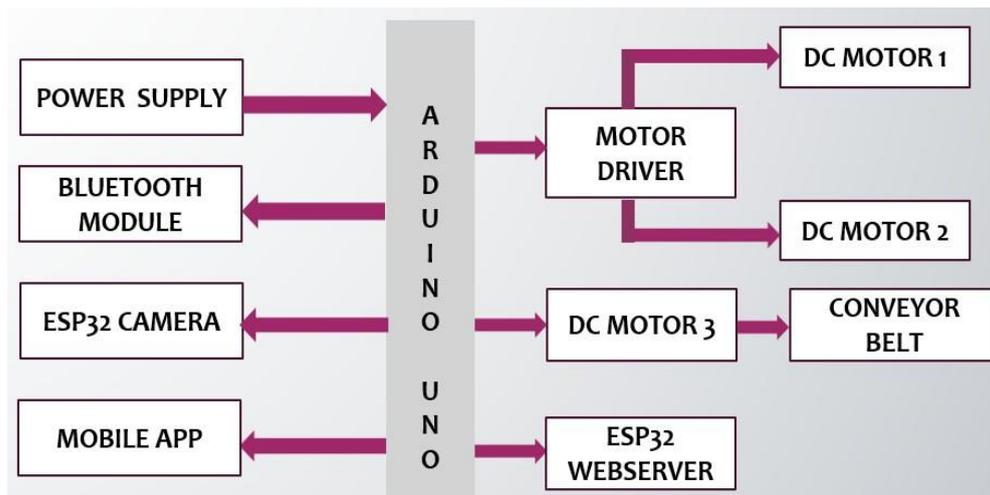

figure1. Block diagram of proposed system

The Motor3 holds the responsibility of conveyor belt, that collects dust and drop them into the collector bin in the boat. Arduino acts as central unit. The ESP32 camera on the boat provides the visibility of path through the webserver, which can be accessed using the port address 192.168.4.1. This camera displays the view from boat with utmost resolution. Thus, the boat is an automated cleaning machine.

2.1. Arduino Uno Board

Arduino Uno ATMega microcontroller. It is the most flexible hardware platform as it adapts and works for every program with different functionalities. Six analog inputs, fourteen digital input/output pins, a USB connection, a 16 MHz quartz crystal, SPI, ICSP header, a reset button, serial interface and a power jack. It operates at a voltage of 5V and an input voltage of 7-12V. Any four digital pins (2 – 13) can be used to connect to motor driver. And the Bluetooth is connected to Tx and Rx of Arduino.

2.3. Motor Driver and DC Motors

L298N Motor Driver Module is driver module for driving DC and Stepper Motors. It consists of an L298N motor driver IC and 5V regulator that requires 5v power. L298N Module can control up to 4 DC motors, or 2 DC motors with directional and speed control. Three geared DC motors of 60 RPM at 12v whose maximum load current is 350mA are used to rotate the propellers of the boat and for the rotation of conveyor belt. The Motors are connected to the out 1,2,3,4 pins of the motor driver to drive their motion.

2.3. Bluetooth Module and Mobile App

Arduino Bluetooth Controller is the mobile app through which the motion of the boat is controlled. Bluetooth HC-05 when connected with mobile app, the commands given in the terminal mode of app will result the direction of boat's motion. Default Bluetooth name of the device is "HC-05" and default PIN (password) for connection is either "0000" or "1234". 'Paired and connected' message displays on the screen after it gets connected to boat. With the mobile App connected to boat, the boat is under control. Moving the boat away from obstacles in the right directions increases lifespan of boat. Remotely controlled rotation is an asset to the cleaning mechanism.
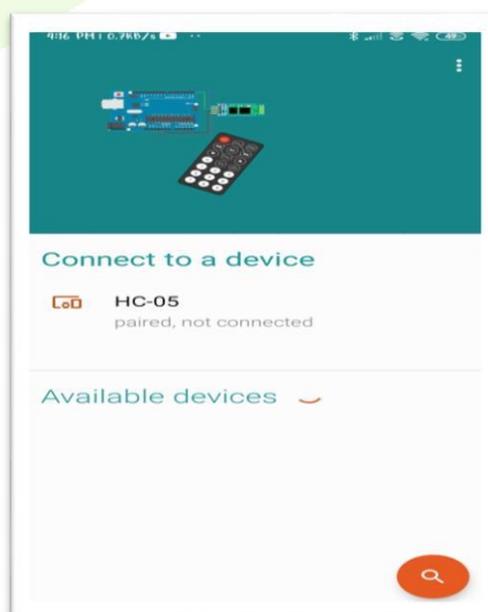

figure 2. Mobile App

2.4. Conveyor Belt and Collector bin

Conveyor belt uses torque from the motor to chain drive that pulls up the waste on the water surface that is put into a bin called garbage collector with capacity of storing 150gm. We have used the polyvinyl Conveyor Belt. The conveyor belt is controlled by the Arduino system with using motor driver circuit. It has PVC pipes under the boat that drives the air tube piping guider mechanism. This mechanism draws all floating garbage from water towards boat and are collected through conveyor belt. Specifications are:

1. Belt Capacity: 4 kg
2. Belt Speed: 5-10 ft/min
3. Belt Width: 10*30 mm
4. Belt Length: 282 mm
5. PVC pipe Diameter: 6 mm

2.5. Camera Module

ESP32 CAM WIFI Module with 2MP camera which has a range of 1km is being used in the boat for monitoring the path and obstacles in the cleaning process. The online webserver can be accessed with the IP address 192.168.4.1 and different modes can be adjusted to view the path like quality, contrast, brightness, resolution, saturation.

2.6. Software Required

Arduino IDE is a software which is open-source and can be used to write and upload code to the Arduino boards. IDE means Integrated Development Environment. This Arduino IDE is suitable for different operating systems like Windows, Mac OS, and Linux. It supports C and C++ programming languages.

III. DESIGN IMPLEMENTATION

River Surface Cleaning Water Boat covers an area of 35*45 cms on the water surface. The device is placed on a foam board with a free rotation slot for the propellers. And the PVC pipes under the boat help the which facilitates bringing the waste to the machine rather than moving the machine towards the waste. Arduino board, Bluetooth and ESP32 cam are powered with the battery or power supply of 12V.
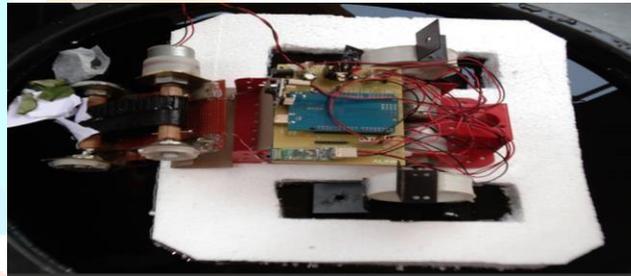

figure 3. Water cleaning boat setup

As it switches on, the device can found on the active devices. Then, Bluetooth module and smart phone are to be paired for navigation. Moving on to the Terminal mode of the Arduino Bluetooth Controller Mobile App makes it possible to control the boat using the smart phone. Similarly, the Camera module can be connected onto the controlling device through esp32 port address. The port address 192.168.4.1 on the online webserver connects the device to the nearest esp32 camera. Once the view of camera is clear on the device, the boat is set to go. Navigation Keys are Start for starting the boat, F or Front that rotates the propellers in clock wise direction for forward movement, B or Back rotates the propellers in anti-clockwise direction for Backward movement, R or Right that rotates right propeller in anti-clockwise and the other in clockwise directions for right turn, L or Left that rotates left propeller in anti-clockwise and the other in clockwise directions for left turn and finally Stop for stopping the boat. As the boat moves on water, debris on its way taken into the collector bin through the conveyor belt. The storage capacity of the collector is 150 gm, which if filled can be observed on camera. Then the bin is emptied properly.
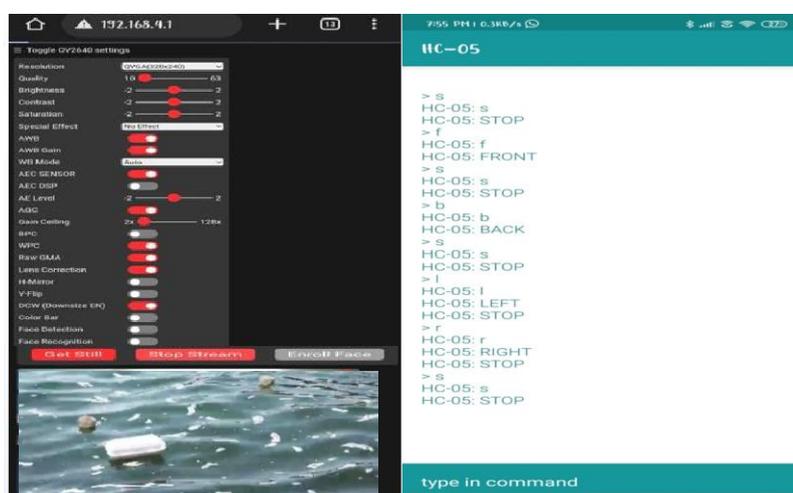
IV. RESULTS

figure 4. Camera View   figure 5. Mobile app terminal mode

River Cleaning Water Boat when used in cleaning of a waste dumped river has shown markable results. View infront of the boat for organised waste picking from the surface of water can be observed as in following figure. Camera View in mobile web browser is seen with a decent 2MP resolution and can be adjusted to night vision if boat is in dark weather condition. Navigation commands for boat are given in the terminal window of Arduino Bluetooth Controller APP as shown in the figure. The boat gives out the efficient cleaning mechanism with the help of camera and mobile app.

V. CONCLUSIONS

During the course of the project, certain conclusions have been made. The efficiency of the conventional water cleaning mechanism is too low thus, we observed that by replacing the existing method with this automated cleaning mechanism could increase the efficiency with minimal expenses. Since the boat has PVC pipes under it, the air tube piping guider mechanism draws all floating garbage from water towards boat. Cleaning of certain amount of waste with the conventional method that took 20 min is performed using the river boat in 11min. Thus, there is an increase in the efficiency by 88.81 percent. The growing problem of waste disposal in fresh water sources can be stopped not only by putting a stop to the mentality of polluting the environment but also cleaning the already polluted fresh water resources in a more sophisticated way.

VI. ACKNOWLEDGMENT

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