Automatic Remote Control based Surface Level Marine Debris Cleaning and Signaling

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Abstract - Marine debris in the water bodies is one of the major issues prevailing in our world, where 8.8 million metric tons of plastic waste are being dumped each year. The main objective of our system is to make an autonomous system which can clean the surface level solid waste (plastic, wood and metal) in the ocean, in addition it aims at collecting more waste at a time. Our idea proposes to allow the ocean water to flow through the water inlet. The water inlet has been designed with an escalator mechanism such that it dumps the waste in the container which is also fitted with a crusher at it sides to crush the waste almost in order to collect more waste. Since the ship is guided through the remote control, this technique involves no manual contrivance to clean the plastics that float on the apparent level of the ocean.

Keywords - escalator, IoT, IR sensor, 3-D modeling, remote control, crusher

1. Introduction

The pollution of ocean water is rising exponentially every year. These wastes are either naturally or artificially let into the ocean. That is, it could be created to let in directly, deliberately or unintentionally. The ecological equilibrium of aquatic life is being destroyed due to these water contaminants. The United Nations Joint Group of Experts on the Scientific Dimensions of Marine Pollution (GESAMP) has reported that 60-90 percent of plastic waste accounts for marine pollution in the world. Since more than 700 species are endangered by plastic traces, plastic debris has a greater effect on the lives of marine creatures. 52 percent of the wildlife disappears around the world due to plastic ingestion. When looking for their prey, the marine animals get lapsed and 'unfortunately they eat the plastic.' This leads to certain creatures being suffocated and entangled.

As a consequence, the plastic discarded in the ocean is often dumped in the stomach of the marine animals, contributing primarily to death. Marine debris comes from sources both land-based and sea-based and can fly vast distances. Inside Figure 1. It reveals the debris that human beings add to the sea. It can pose a danger to navigation, smother coral reefs, transport invasive species and impact tourism negatively.

Wildlife is also harmed and killed, has the potential to transport chemical pollutants, and can pose a threat to human health. So, there is a desire here to clean up the garbage dumped into the ocean. Even though some of the crew of the NGO and other self-interested individuals try hard to clean up the marine debris, the job is done manually. More human interaction requires this form of cleaning. This is also a cleaning technique that is time consuming. It is also predicted that engineers would create a technical device that will work for better livelihood survival.

Fig. 1: Statistical approach to the debris in marine

With RFID-based marine debris cleaning and GSM-based marine debris cleaning, the current ocean cleaning system has been developed. But it's usually more costly to set up RFID-based programmes. RFID often poses some security concerns as unauthorized computers, without the knowledge of the authority involved, are able to interpret and modify tag data. The RFID tags covering metal items are also quickly influenced. The remote RFID reading can be restricted by external electromagnetic interference and its coverage range is often limited to 3 meters. The alerts are sent late in the other view of the GSM-based cleaning, since the GSM technology is a 2 G module. GSM uses pulse transmission technology that has the biggest drawback that it undergoes interruption during transmission.
as multiple users share the same bandwidth. While the use of repeaters does not confine the GSM module to a shorter range, it also results in a higher cost.

2. Survey

The River Water Cleaning Machine unit was designed to clean the remote-controlled surface of river water. This lowers the strength of man and takes less effort to drain the rivers. With the assistance of a generator and a chain drive mechanism, it automatically cleans the river. To show the amount of the waste in the jar, the system uses several memory chips [1]. Automatic River Cleaning System [2] focuses on cleaning of floating garbage, normally plastic waste, on the surface of water bodies. The boat is made up of pipes made from U-PVC. To contain the waste, a tank is used, and the size will vary according to the need. A wired remote control is used to navigate the ship. The remote control is cabled, which in rivers would be boring.

In design and Fabrication of River Cleaning Machine [3], the contamination caused by rivers hampers the life of marine creatures and endangers their lives. The system uses an engine, chain drive, propeller, conveyor, gear, chain and sprocket, and ball bearings. This system will be used in the future with sophisticated conveyor systems and conveyor materials to improve waste management efficiency. But the amount of the waste in the collection tray is not demonstrated by the computer.

The Remote Operated Floating River Cleaning Machine uses renewable energy options such as lead-acid batteries and solar panels. Also incorporated in this system is a monitoring device that helps to change the orientation of the solar panel with respect to sunrays. That way, we get more solar production. The Bluetooth module is ideal for a translucent serial wireless link. The Bluetooth remote control is not powerful because after a certain distance the control of the computer is lost, the Bluetooth module functions for only a limited range [4].

3. Proposed System

The key goal of this initiative is the use of IoT technologies to clear up underwater garbage. The suggested scheme is applied with the ship's interface to the system's designed hardware and software module. The block diagram is planned as in Figure 2. The ship's front-face is fitted with a conveyor. The conveyor collects the waste and continues to deposit it in a bucket that is held within the tank.

Our work allows for continuous tracking using IR sensors of the state of the container. Two IR sensors are working here. The first IR sensor forecasts 50 percent of the filled bin status, and the second IR sensor forecasts 100 percent of the filled bin status.

In order to crush the waste obtained in the container, a crusher is mounted at the edges of the container. The sensor data is constantly tracked using microcontroller and these data are sent to the server.

By using the Arduino microcontroller, the proposed scheme may also be applied, but it also has some disadvantages. The Arduino is more expensive than the Node MCU and the Node MCU's memory space is higher than the Arduino.

![Fig. 2: Model for surface level marine cleaning](image)

4. System Setup

We have used hardware like Power supply, IoT module, IR sensors, motor, transmitter, receiver, crusher and software like Arduino IDE, Proteus 8 professional in this setup.

*Power supply*

A step-down transformer is supplied with a supply of 220V, 50Hz ac signal from the main supply board. It is used to move down the 220V AC to 12V AC supply in this system which provides insulation between power grids and circuits. A rectifier is one of the electrical instruments that transform the alternating current source (AC) to the direct current source (DC), which regularly reverses direction. A DC will flow in just one direction. Pulsating D.C. is the output from the rectifier. Such pulsations are because of the presence of A.C. The filter circuit separates the A.C. portion from the output of the rectifier. Ingredient so the steady D.C. Across the load, voltage is received. A controlled power supply consists of a typical unit controlling the power supply and voltage. The power supply output is fed to the voltage regulator, resulting in the final output.

*IoT Module*

The Node MCU module is an IoT application that is open source. It has firmware operating on Espressif Systems' ESP8266 Wi-Fi SOC and hardware based on the ESP-12 board.

"The Node MCU pin configuration is seen in Figure 3. By default, the word" Node MCU "signifies the firmware rather than the development kits. For Firmware, the Lua scripting language is preferred."
As seen in Figure 4, an infrared sensor circuit is one of the simple and prevalent sensor modules in an electronic system. This sensor is similar to the visionary senses of humans that can be used to identify obstacles and is one of the real-time corporate applications. This sensor is used here to show the amount in the jar of the dumped waste.

As seen in Figure 5, the direct current motor is represented by the circle in the middle where the brushes are placed, where the external terminals are attached, from where the supply voltage is supplied. The created electro motive force (Eo) known as emf is guided opposite the supply voltage and is referred to as the back-electro motive force, as it hosts the forward voltage. The electrical current that flows through brushes over the rotor armature in the presence of the magnetic field, produces torque.

The transmitter and receiver characteristics are
- Radio frequency signals can travel longer distances than infrared signals
- Infrared beams can only be emitted on the site contact line as transmission and reception loss happens where deviated from the site line (LOS), whereas radio frequency signals can be transmitted even where obstacles are present.
- The infrared signals interact with IR rays from other sources and make contact poor. Yet radio frequency signals on a single frequency band would not interfere with other RF frequency signals.

Arduino IDE
The Arduino IDE is a Java-coded cross-platform framework. It is adapted from the IDE for programming language processing and system wiring. It is intended to bring artists and other tenderfoots unfamiliar with software production to programming. The Arduino IDE comes with a "Wiring" (from the system of the same name) C / C++
library, which makes certain basic input/output operations much simpler.

Arduino programmes are written in C/C++ at most as shown in Figure 8. It provides a code editor with characteristics such as highlighting, matching, and automated indentantion of syntax. With a single press, it is also able to compile and upload programmes to the monitor. It usually provides a non-requisite for the command-line interface to edit and build files or execute programs.

![Arduino Programming](image)

**Fig. 8: Arduino Programming**

### 5. Methodology

The technique utilized in our system is to drag the surface waste floating on the ocean to the planned conveyor belt. The conveyor belt is located on the ship's front face. The architecture of the conveyor belt has been stalked by an escalator mechanism. With two control switches, the conveyor belt is built in such a manner that one switch controls the conveyor belts clockwise rotation and the other switch controls the conveyor belts anti-clockwise rotation. This conveyor belt is also connected to the top surface body with a mesh. This relates to the filtering of waste and water. It would drive the recycled water out to the ocean. And the waste collected would travel around the body of the conveyor.

When the conveyor with the gathered waste hits the endpoint of the conveyor due to its gyration, the waste will be lowered to the container such that the conveyor has been lifted to a measured aggregate so that the waste is expected to fall off [4]. At the bottom of the ship, the container is located. A remote-control system using a transmitter and receiver controls the motion of the ship.

The transmitter is designed with an integrated chip from HT12D and the receiver is designed with an integrated chip from HT12E. This remote-control module. Thus, makes a helmsman-less sail [5]. This is a better way to help the ship's kinensis, which encourages less isolation from physical labor. All the other components are assembled in a PCB fabricated board except the conveyor set-up. The microcontroller we are using is a Node-MCU. Node MCU based Wi-Fi kit, which is an open source IoT framework.

It is a microcontroller with 30 pins. The justification for selecting this micro-controller is that, from a number of various parameters, the data to be transmitted should be uninterrupted. This Node MCU is programmed using the language of Embedded C. The data from the cloud is designed to be read.

The level of the container (the waste material that was poured into the container) that was filled is documented in the results [6]. It is configured in such a way that 3 levels represent the level of the container. The first level, which is responsible for the vacant container level. The second level is the 50 percent bay (a half-filled) container holding waste. The third reveals the jar occupied by 100 percent garbage.

In the latter two levels of the jar, there are two IR sensors mounted. The first (bottom) IR sensor mounted in the container is used to sensitize the amount of waste and to inform the consumer about 50 percent through the cloud. Via a smart phone application called Ubidots, such data is displayed and read. The second IR sensor mounted is used to relay the 100 percent filled container indication.

The ship can be traced back via the remote control until the container hits its third floor as smart vehicle [7]. Since the receiver portion of the remote has 4 switches that are used to control the action, depending on the specifications, such as left, right, up or down. Depending on the requirement, the waste thus collected may be relocated to different sectioning layers that may have a segregating section or a recycling section. The sensor nodes operate same as like WBAN network.

### 6. Result and Discussion

The key factors for contributing to marine debris are development and industrialization and it also causes water volatility. The scheme shown in Figure 9, will efficiently seeks to eliminate waste at the surface level of the water, thus promoting water quality. It is effective in dealing with aquatic litter and the non-conventional method of ocean cleaning. The waste is stored in a jar in this system where it has a sensor to sense the volume of waste filled so far. The swarm optimization algorithm can be involved in future to segregate and identify the waste.

The primary benefit of our system is that we use a crusher mounted inside the jar. As this crusher requires the waste to be crushed, it eliminates the waste and thereby provides more space within the bag. A warning will be transmitted to the edge of the transmitter once the container is filled, so that it allows the ship to track it back to the shore in order to dump the waste and the system is carried out repetitively. The amount of pollution associated with knowledge stored in the cloud. The transmitter and receiver allow the ship to be properly controlled and guided. Here in the ship, a DC motor is used to drive it in the ocean. A conveyor belt, which is mounted in the front part of the boat with two switches to control its rotation directions, gathers the waste.

As a result, it removes the inhibition of manual power and helps one to regulate the paths and track the waste volume. It expands its approach in a foresight manner by crushing the waste to be performed at the next stage. All the above stages can be monitored using wireless sensor network.
7. Conclusion

The remote control-based ocean cleaning boat was built to minimize human cleaning capacity and to gather more garbage at a time, so that there is no risk to humans. Because much of the plastic waste floats on the water floor, the installation of the boat is very successful. Another value of surface level ocean cleaning is versatile usage and fast recognition of fault detection. For surface level sanitation, an autonomous robot system is used and it compromises the aquatic organisms without hindrance.

In the future, a geo-tracker may be substituted for the remote-control device so that the coordinates can be viewed and monitored over a longer distance. And at the front end of the ship, a water mill can be mounted such that even micro plastics can be collected.

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Fig. 9: Top 3D view