

Autonomous Ocean Garbage Collector

Sagar Gavade , Ghanashyam Phadke, Shrikant Somal, Praful Gaikwad, Mahesh Mane

Department of Electronics Engineering
K.J Somaiya Institute of Engineering and Information Technology
Mumbai 400031, India

Abstract - This paper describes an automatic ocean garbage collector robot for collecting garbage floating in the ocean. Debris and plastic built-up everywhere on the water surface can be cleaned using this robot. The Automatic Ocean Garbage Collector is designed by implementing the concepts of various fields such as Embedded, Electric and Mechanical system as well as IOT cloud. Apart from cleaning it also alerts the system about the polluted water area depending on temperature, humidity and conductivity of water. The core idea behind the project is to build a reliable and cost-efficient robot.

Keywords- Robot, ultrasonic sensors, motor, Arduino UNO, NodeMCU, AskSensors, pre-programmed path.

I. INTRODUCTION

1. Origin

Most of the plastic substances are long-lasting and degrade very slowly. This floating plastic fabric travels a great distance in the ocean. These floating plastics get amassed inside the centre of subtropical circulating currents, which leads to the formation of garbage patches. These sea currents converge at the centre and sink. But the floating plastic materials stay at the surface, allowing it to concentrate in these areas. These Plastic materials can purpose a whole eco-system to collapse if left uncollected. There are many ways to clean water surface which need human intervention. The time spend by a government person to clean the ocean can be saved to do some productive work. Hence it becomes necessary to come up with creative ideas to clean the debris on the ocean.

2. Need

Keeping the ocean clean every day is hard but also an important work. Debris and plastic built-up everywhere on the water surface which are cleaned by using huge boats, machines and manpower. Depending on the machines size it may use liters of fuel as well as thousands of watts of power. This may also risk a human life during the cleaning process.

3. Objectives

- The goal of the research is to design and develop low-cost Automated Ocean Garbage Collector
- Automatic Ocean Garbage Collector should collect garbage in a given amount of area.
- It should be monitored during the process.

II. LITERATURE SURVEY

In order to understand the need for a compact and cost-effective system, we need to first understand the existing

research and work done in the field. There have been many prototypes of Water garbage collection systems, autonomous robots, and waste segregating. The first “Water Surface Cleaning Robot” was controlled by remote Control through Arduino Uno and Xbee transmitter and receiver [1]. Second “Pond Cleaning Robot” was controlled through a Mobile phone using a Bluetooth module [2]. Third “Optimized and Innovative Remotely Operated Machine” was controlled remotely using a RF transmitter [8]. All of the above robot was controlled remotely, which means they involved manpower for controlling the robots and as well collecting it the garbage simultaneously.

III. INTERDISCIPLINARY RELEVANCE

The Automatic Ocean Garbage Collector is created by implementing the concepts of various fields such as Embedded, Electric and Mechanical system as well as IOT cloud. They are discussed below:

1. System Design

1.1 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 arm or paddle 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. The 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.

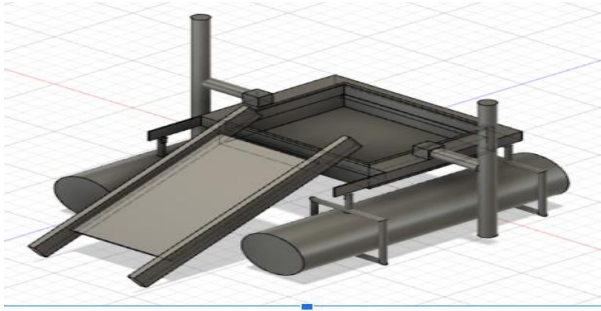


Fig 1 Schematic Diagram

2. Embedded System- The Arduino UNO is the brain of the complete system. This Arduino UNO is interfaced with sensors (Ultrasonic sensors) and actuators (DC motors) which together perform the whole operation of cleaning.

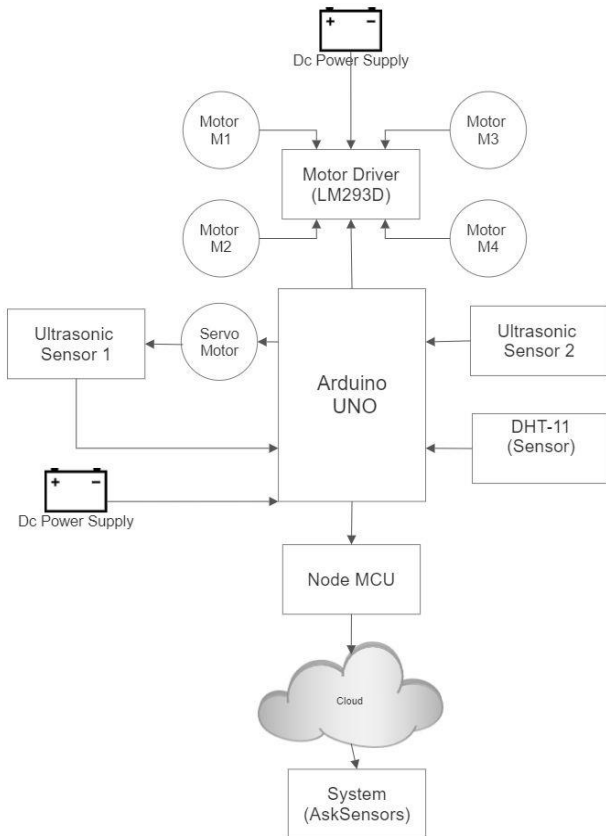


Fig 2: Block Diagram

3. Electrical and Mechanical System- The power subsystem is an integral part of the electrical system. Rechargeable SMF batteries are used to power up all the other components of the system. Most of the power is consumed by the conveyor belt because it requires a more power, due to high torque required to collect heavy plastics. A set of DC motors are used to drive the robot.

3.1 IoT Cloud- Node MCU is used to send data wireless through cloud. Using AskSensors Website or app the system gets alert message of the polluted area using DHT-11 and at the same time the robot process can be monitored.

4. Navigation Module- The robot will move in a pre-programmed trajectory, covering its locality or zone which it is responsible for cleaning. The trajectory program will be preloaded in the ECU on the. 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. If the garbage is detected, then the robot will stop and suck water toward itself, which will lead to collection of garbage.

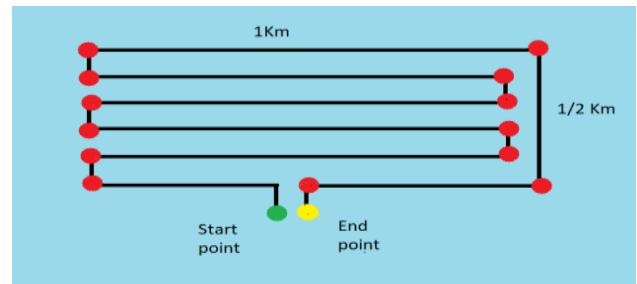


Fig. 3 Pre-Programmed Path

5. Description of the robot's components

Table 1 Components of AOGC

Components	Description
1. Arduino UNO	Flash Memory- 32 KB, SRAM-2 KB, EEPROM- 1 KB, clock -16 MHz
2. NodeMCU	Flash Memory: 4 MB, SRAM: 64 KB, Clock Speed: 80 MHz
3. Ultrasonic Sensor	Maximum Range 400cm
4. DC motors	12V, Torque- 2N.m
5. SMF Battery and HI Battery	I/P voltage: 12V and 9V and I/P current:2.28A
6. DHT -11	Outputs both Temperature and Humidity through serial Data

IV. METHODOLOGY

1. Algorithm Flow- When the robot is turn on, it will follow the pre-programmed path encoded in the arduino uno. during this process it will check for garbage floating on the surface. if garbage is detected the robot will stop and activate the conveyor belt, the motion of the conveyor will suck garbage will itself and collect the garbage in the container. the quantity of the collected garbage will be monitored using a ultrasonic sensor throughout the process.if the container gets full, the robot will stop detecting garbage and follow the pre-programmed path.

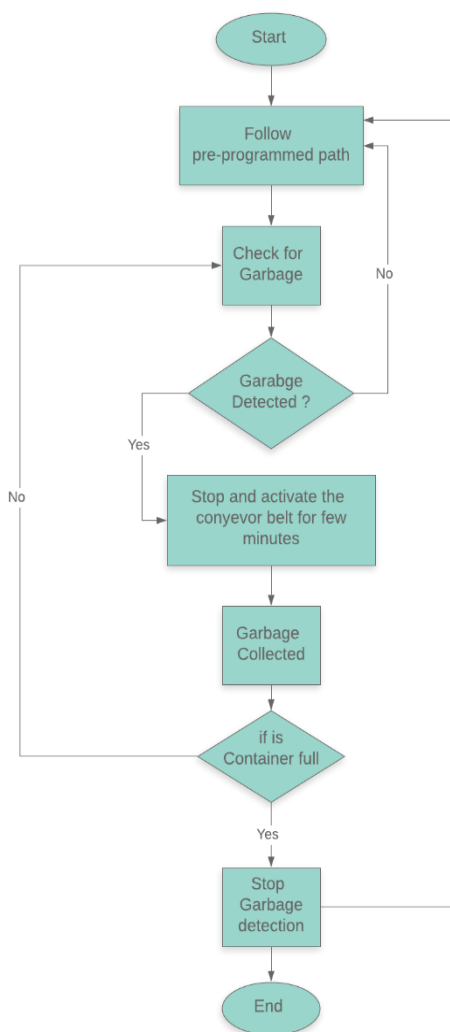


Fig. 5 Flow Chart

2. Software module- The data (temperature, humidity and amount of garbage collected) from the robot is sent to the cloud, using nodemcu. using asksensors we can check the data as well as it will also alert the system via emails.

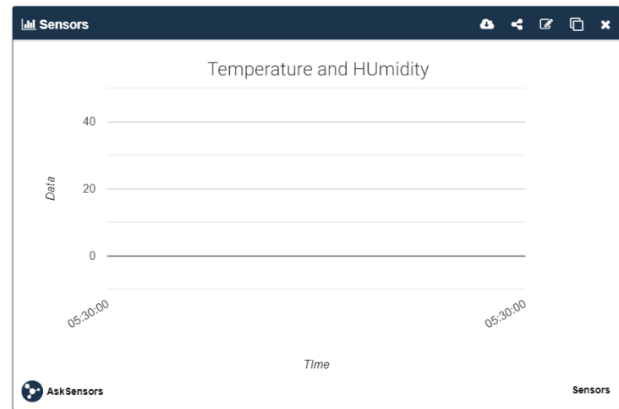


Fig. 6 Temperature and humidity analysis.

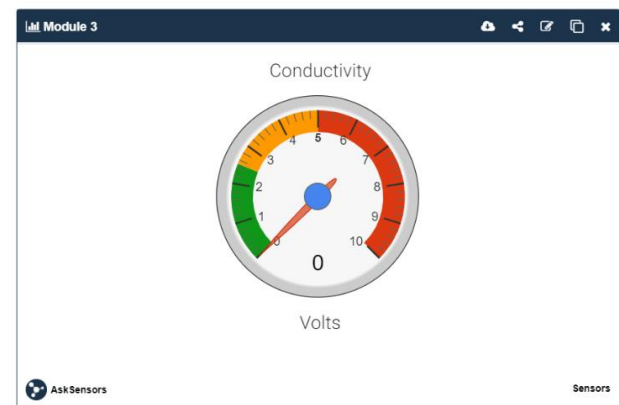


Fig. 7 Water conductivity meter.

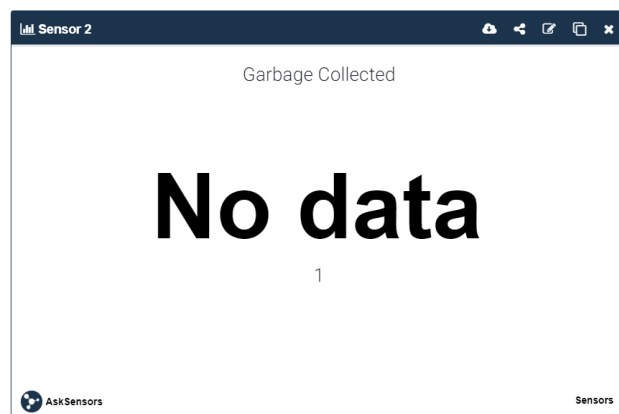


Fig. 8 percentage of garbage collected

V. CONCLUSION

Keeping the ocean clean from one end to another is a difficult task, so for cleaning the ocean at the push of a button we designed the autonomous ocean garbage collector. the design is reliable and cost-efficient. the robot can clean up 1km of area in one process cycle. the robot is monitoring and data is sent to the cloud in every

15 minutes. the robot is expected to overcome the garbage patches especially in the ocean.

Acknowledgment

- We extend our sincere thanks to prof dr. milind uttam nemade.
- We also would like to thank our project guide prof ghanashyam phadke

REFERENCES

- [1] Erahmawati*1 , I Suchayo1 , A Asnawi1 , M Faris1 , M A Taqwim1, D Mahendral “A Water Surface Cleaning Robot” Journal Of Physics: Conference Series J. Clerk Maxwell, A Treatise On Electricity And Magnetism, 3rd Ed., Vol. 2. Oxford: Clarendon, 1892, Pp.68–73
- [2] Soumya1, H.M. Preeti2, Baswaraj Gadgay3 “Pond Cleaning Robot” International Research Journal Of Engineering And Technology (Irjet)
- [3] “Trash Robots Saving The World’s Water”Borgen Magazine K. Elissa,
- [4] “Agator (Automatic Garbage Collector) As Automatic Garbage Collector Robot” Model Osiany Nurlansa, Dewi Anisa Istiqomah, And Mahendra Astu Sanggha Pawitra, Member, Iacsit.
- [5] B.H. Yuan, X.H. Gao, B. Zhang, Et Al. “The Design And Realization Of Small-Sized Water- Surface Garbage Cleaning Boat ” , Journal Of Long Dong University,2017,28(1): 24-29.
- [6] M. Leanglum, N. Ruangpayoongsak, A. Phunopas, “Design And Development Of The Waste Collector For A Surface Robot Cleaner,” Proc. Of Industrial Engineering Network Conference (Ie Network), Pp. 900-905, 2015.
- [7] Technoment is,“Automated garbage collector”, Instructables.Com. [Online]. Available: <https://www.instructables.com/Id/Automatedgarbage-Collector/> . [Accessed April 10, 2019].
- [8] “Design Of Optimized And Innovative Remotely Operated Machine For Water Surface Garbage Assortment” Ganesh S. Khekar, Urvashi T. Dhanre, Gaurav T. Dhanre, Sarika S. Yede , 2019, Ijese