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## Design experimental of RF controlled beach cleaner robotic vehicle

**R Praveen<sup>1</sup>, L Prabhu<sup>2</sup>, P Premjith<sup>3</sup>, Adarsh. K. Mohan<sup>3</sup>, Ajayraj<sup>3</sup>**

<sup>1</sup>Assistant Professor, <sup>2</sup>Assistant Professor & <sup>3</sup>UG Students,  
Department of Mechanical Engineering, Aarupadai Veedu Institute of Technology,  
Vinayaka Mission's Research Foundation, Deemed to be University, India.

E-mail: praveen@avit.ac.in

**Abstract.** The research article on vortex tube, which deals with the operation of statistic parts. The project, tried it best to brief the RF control beach cleaner which is robotic vehicle that helps in cleaning the shores. It helps to collect the Garbage's, plastics etc near the shore. The concept of this project is to find solutions to help the marine life environment that garbage and litter is affecting the environment and everything surrounding it. This machine system is specifically focused to pick up litter from beaches and shores to serve the organizations and volunteers related to this issue. This project can be used in all different shores and beaches which will help organizations to achieve more and clean better with our project's prototype.

**Keywords:** Design, RF control, robotic, Cleaning

### 1. Introduction

The RF control beach cleaner project is designed so that; it will help the society and the environment to sustain a clean and a healthier life. The project name has been resulted from the main idea of the project's concept which is cleaning the beach along with a robotic/machine that does the work on its own. Beach sides in has been surveyed to understand the disposal of plastics and many other plastics debris that is harming the marine and coral life. The RF control beach Cleaner seemed the most practical and more of a promising project that will not only help a certain environment but many other places all around the world [1-3]. Hence, the project is reassuring and will help in saving time and effort; the team was more encouraged due to the fact that manufacturing out this concept will be quite useful and beneficial [4]. Therefore, this project is highly flexible and expandable. The RF control beach cleaner robot is the first eco-friendly, remote-controlled beach cleaning machine able to move both on wet and dry sandy terrain and to remove rubbish and other foreign matter [5]. Totally electrically driven, powered by full sealed lead acid batteries, voltage regulator. It is silent, accurate and robust, RF Beach Cleaner provides a comfortable and a low environmental solution for beach cleaning. This robotic trash collector was funded by PTT Company the Exploration and Production Public Company Limited. The company collaborated with Prince of Songkhla University faculty of Engineering [6-7]. The aim of this project is to love the sea and love the beach as their slogan. The robot has been developed to do the following such as having the ability to scoop up the trash from the sand. Also, the robotic trash collector uses a rechargeable battery. In addition, the trash collector can collect



bottles that are buried under the surface of the sand. Prometo is a project is developed by students studying Mechanical Engineering at the University of Catolica Del Peru, in Peru. The project focuses on beach cleaning. The rometeo is a mobile robotics to face the environmental pollution problems especially in sea and beach areas [8-9]. The robot can navigate and collect cans that are founded in the beach; after collecting the cans it will be transported to the deposit. The robot can do all the three main functions which are to locate, collect and dispose the garbage which can be controlled by a computer [10].

The main purpose of this project is developing a robot that would help and make the shoreline much cleaner in a faster way. Furthermore, the robot has the ability to move easier and to reach remote location simpler. Robot Missions is more efficient to collect the debris on daily basis in order to decrease and lowering the quantity of debris which has led to bio accumulation of the living organisms and animals. In addition, the robot is able to pick up and collect eight out of ten items of plastic bottles during the coastal cleanup

## 2. Problem statement

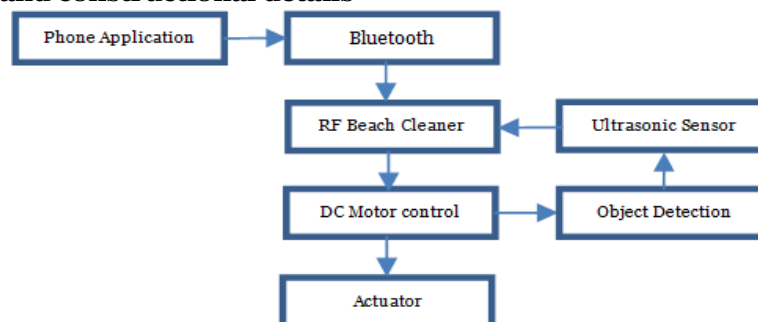
There are plenty of pollutants that are affecting the place we are living in. This problem is unpreventable because the environment needs protection and care. Maintaining a healthy and clean environment is essential to sustain the ecosystem. Every healthy environment including the beaches and shores should be limited and less exposed to the hazardous chemicals and pollution that may adversely affect human health. Thus, the concept of this project by definition is being able to help cleaning the beaches and shores which was filled with human's waste such as garbage and plastics. This project aims to decrease the amount of waste and help the organizations and volunteering communities to have more effective cleaning and saving time.

## 3. Strategy of the Project

Different types of bottles that are used and mostly seen by the shores or beaches. In order for the future reference of designing and implementing the robot; there should be knowledge regarding the approximation of the litter's dimensions such as bottles. According to the project's strategy there should be fixed ones.

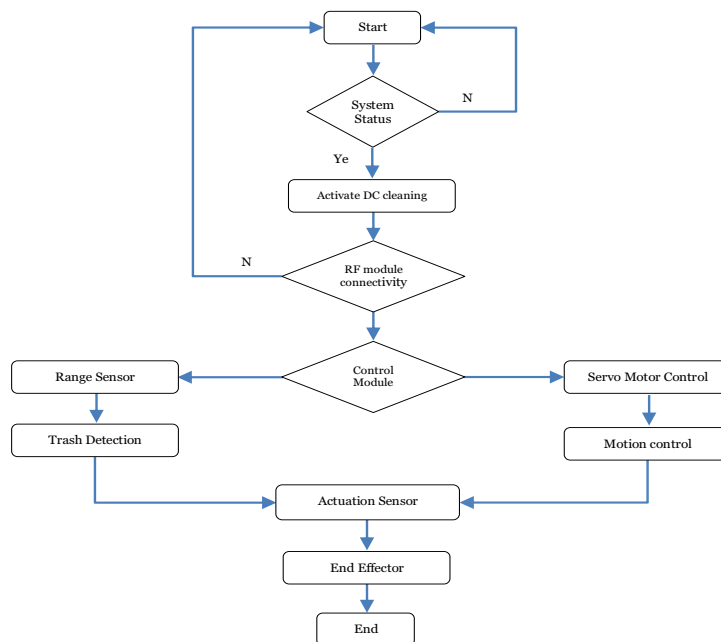
The first strategy is to be able to collect bottles and collect them into the deposit section of the robot. Afterwards, the excess that comes with the litter such as the sand should be filtered and dropped back into the shore. In order to successfully completing this project in a short period of time is already a challenge. However, there are certain tasks that are expected from the robot such as fast movement due to its light weight. As a result, the robot will be able to have extra time to maximize the amount of the litter collected and filtering the sand.

## 4. Design and constructional details



**Figure 1:** System Architecture of RF Control Beach cleaning robot

Figure 1 shows the system Architecture the relation of the various systems and sub systems in the project. It is fundamental to comprehend and understand the system architecture of this project because it shows the representation of the overall system connecting with the components. Since the project is basically the combination of hardware specifically in mechanical and electrical engineering and software that includes coding the Arduino. The Rf controlled Beach Cleaner system includes the chassis of the cleaning robot, the motors used, and the remote controller to make it able to move into remote areas and places. Figure 2 shows the algorithm for RF control beach cleaning robot.



**Figure 2:** Algorithm for RF Control Beach cleaning robot

## 5. Programming Software:

### 5.1 Arduino IDE

The open-source Arduino Software IDE makes it easy to write code and upload it to the board. It runs on Windows, Mac OS X, and Linux. This software can be used with any Arduino board. Arduino IDE software is compatible with the Arduino Board and programmed using Java platform.

### 5.2 Fusion 360

Fusion 360 is the first 3D CAD, CAM, and CAE tool of its kind. It connects your entire product development process in a single cloud-based platform that works on both Mac and PC. Design, test, and fabricate in a single tool. This software was used for designing because the software is commonly used for beginners to design in 3D.

## 6. Hardware Requirements:

### 6.1 Arduino Uno

Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz

quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.

#### *6.2 DC Motor*

A brushless DC motor is a synchronous electric motor which is powered by direct-current electricity (DC) and which has an electronically controlled commutation system, instead of a mechanical commutation system based on brushes. In such motors, current and torque, voltage and RPM (Revolution per Minutes) are linearly related.

#### *6.3 Servo Motor*

Professional range of G series servo motors from Omron. This wide range of compact servo motors is designed to meet all application needs. When used with a Smart Step drive, the G-series servo motors offer the simplicity and cost-effectiveness of a stepper. These servo motors have the added advantages of a servo system.

#### *6.4 Gear Motor 12V 600RPM*

these tiny brushed DC gearmotors are available in a wide range of gear ratios—from 5:1 up to 1000:1—and with five different motors: high-power 6 V and 12 V motors with long-life carbon brushes (HPCB), and high power (HP), medium power (MP), and low power (LP) 6 V motors with shorter-life precious metal brushes. The 6 V and 12 V HPCB motors offer the same performance at their respective nominal voltages, just with the 12 V motor drawing half the current of the 6 V motor. The 6 V HPCB and 6 V HP motors are identical except for their brushes, which only affect the lifetime of the motor.

#### *6.5 IP Camera*

CCTV mini IP camera WIFI surveillance system wireless home security 720P support audio indoor P2P small cam video webcam. Installing the IP Camera is to have a better surveillance while controlling the robot with the phone application.

#### *6.6 Linear Actuator*

Actuonix Motion Devices' unique line of Miniature Linear Actuators enables a new generation of motion-enabled product designs, with capabilities that have never before been combined in a device of this size. These linear actuators are a superior alternative to designing your own push/pull mechanisms. The L16 actuators are complete, self-contained linear motion devices with position feedback for sophisticated position control capabilities, end of stroke limit switches for simple two position automation, or RC servo. Several gear ratios are available to give you varied speed/force configurations.

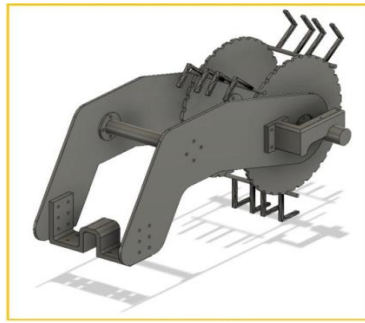
#### *6.7 Ultrasonic Sensor*

This is ultrasonic sensor distance measuring module which a non-contact distance measurement module. It has high measurement accuracy and its blind area is close (up to 2cm). The module automatically sends eight 40khz square wave and automatically detect whether receive the returning pulse signal. If there are signals returning, through outputting high level and the time of high-level continuing is the time of that from the ultrasonic transmitting to receiving. Ultrasonic Sensor is a must in this project because this sensor is responsible for measuring distance of targeted objects. This sensor can be used indoors and outdoors.

#### *6.8 LiPo RC Battery Pack*

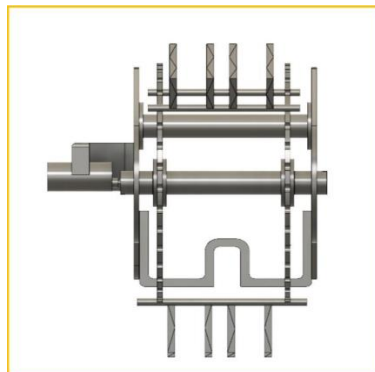
This is a Li-Poly 2300mAh receiver battery pack from Protek R/C, made with super thick 20awg silicone wire! This super lightweight Li-Poly battery is designed to power the

electronics of 1/10th & 1/8th scale nitro powered race cars. There are many advantages to using a Li-Poly receiver battery, but the biggest advantage is that the battery voltage to your receiver and servos will remain constant throughout the race with the use of a voltage regulator (required).



**Figure 3:** 3D Design of Extended arm

The figure 3 & 4 shows the overview of the extended shovel as a whole by using Fusion 360. The extended shovel is implemented first using the 3D design tool with approximated dimension and design.



**Figure 4:** Top view of RF Control Beach cleaning robot

The figure shows the side view of the shovel movement that has been designed using Fusion 360. The shovel is used to pick up the litter and garbage from the beach easily.

## 7. Electrical Requirements:

### Power Consumption (DC motor for harvesting)

For the power consumption of the system in terms of the DC motor for harvesting, it follows the following equation:

$$P = V * I$$

$$= 5W * 1.5m = 75Watt$$

### Power Consumption (Servo Motor)

For the power consumption of the system in terms of the Servo Motor it follows the following equation:

$$P = V * I$$

$$= 5V * 500m = 2.5\text{watt}$$

### Measurement of the System

- Angle Measurement: For the RC body chassis, the angle movement of it is from 0 Degrees – 180 Degrees
- Weight: For the RC body chassis, the weight of the system with the extended shovel is 2 kg.
- Length: For the RC body chassis, the length of the system is 95 cm. 4.5

### 8. Conclusion

The RF Controlled Beach Cleaner Robotic Vehicle is a vital project which was developed. The project's tenacity is that public places such as the beach and the sea always had a huge number of people visiting and coming all year round. People including children and senior citizens including their pets are exposed to a risk of the spreading of the diseases due to the dirty environment and rotten garbage at the shoreline. The development of this project includes a four-wheel drive vehicle and a chassis that is equipped and prepared with a cleaning mechanism and a dirt bag to collect the garbage. In addition, the robot vehicle also includes a high-performance electrical motor to drive the robot. The system is controlled by a Microcontroller and powered by the circuitry PCB that has push buttons used to transmit the directional commands.

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