Smart Beach Cleaner Robotic Vehicle

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Abstract— **Plastic has been a revolutionary paradigm shift for society. It has solved problems, But it has also created a new complication; or an abundance of garbage and debris. Much of this garbage finds its way to waterways and shorelines. When in water, plastic disintegrates into micro pieces that are consumed by marine life eventually traveling up the food chain. Additionally, this washed up trashed ruins intact shorelines while creating havoc for wildlife and their habitats. It is necessary to remove the trash from the ocean, but equally important to clean up the litter already washed up on shorelines. The purpose of this project is to present a new one innovation that assists individuals cleaning up litter from shorelines environments. Ultimately, it enhances the quality of human life and wellbeing.**

So, we come up with the equipment which detects the garbage on beaches using CNN and collects it using circular shovel forks. Collection process is carried out by motors which are driven by rechargeable batteries. It will help us to keep beaches clean and save marine life from garbage pollution.

This report contains detailed research, hands on understanding, interactive considerations and design thinking.

Keywords - **marine life, garbage detection, research, design, innovation**

I. INTRODUCTION

Beaches are main attraction of tourists, for attracting them the beach must be kept clean. For cleaning the beach, some cleaning machine must be used so we have come up with cleaning equipment which helps us to clean the beaches in less investing hours.

As today's era is moving towards being digitalized and automated, the youth want everything very easily and smart. Not only the youth but the people of all generation are getting attracted towards latest technology of "smart work". Anywhere you go, you heard this term - smart work. So we thought of it and adding more to it for our final year project. Nobody likes to wait for long waiting hours just to get good surrounding. To avoid this and to save time of our management of waste we are creating an application called "Smart beach cleaning robotic vehicle".

II. LITERATURE REVIEW

There are ways or methodologies for beach cleaning vehicles. We studied some of them. They are as follows-

1) SANDMAN 850 (CONNECTICUT- USA)

It is walk behind sand shifter machine which uses sifting technology to collect waste. It is powered by Gasoline engine.

2) Cavalluccio, Beach cleaning machine riding units (Italy)

It is also one walk behind machine used to clean sandy areas. It uses sifting technology. The depth of work is controlled by the operator acting on the steering wheel of which the machine is equipped.

3) Scorpion, Beach cleaning machine (Italy)

It is self-propelled beach cleaner which can be used to clean beaches and sandy areas. It also uses the vibrating screen (sifting) mechanism. Deeper cleaning, bigger screen, higher capacity and more powerful gasoline engine is used in this model.

By considering above three beach cleaning models, we observed that one mandatory skillful person is needed to operate those vehicles to clean beaches. To avoid this problem we come up with the idea of fully automatic beach cleaner vehicle where technically skilled person is not needed to operate it.

All the above machines mainly consist of an engine which runs through gasoline/fuel which contributes to air pollution. To overcome this problem we have designed machine which works on rechargeable batteries. We will try to overcome the above mentioned problems by successful implementation.

III. PROBLEM DEFINITION

The coastal area beaches are main attraction for tourism, so in attracting tourists the beach must be kept clean. Indian beaches might not be exotic because they are littered many of the times. This model is implemented to remove garbage, plastic bags, waste bottles and other debris from beaches and make them safe and visually pleasing for beach visitors.

IV. IMPLEMENTED SOLUTION
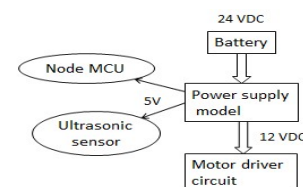
A. Block Diagram

Figure 1- Block Diagram of Power Supply

In power unit, we supply power to node MCU, ultrasonic sensor as well as motors .The battery in the vehicle is of 24V DC .The power requirement for node MCU and ultrasonic sensor is 5V and for motor it is 12V.

To convert 24V DC to 12V DC for motors, the voltage regulator LM 7812 is used. The LM7812 is three terminal positive regulator which takes an input voltage up to 35V and provide output of 12V. The second pin of IC is connected to ground.

To convert 24V DC to 5V DC for node MCU and ultrasonic sensor, the voltage regulator LM7805 is used. It is also a three terminal positive regulator first pin is input which is from 7V to 35V, the second pin is connected to ground and third pin is output which is 5V
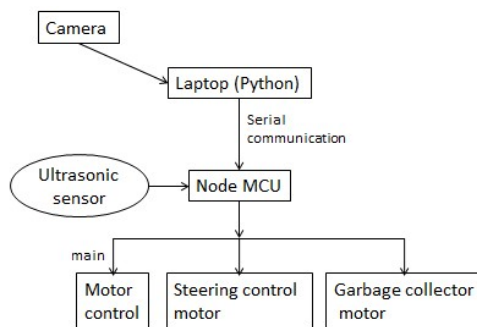

Figure 2- Block diagram of Control unit

Figure illustrated in above figure is control unit of model. 5 megapixel Logitech camera is connected at the front side of the vehicle so that it can detect the garbage using CNN. Detected signals are sent to the laptop and it is serially communicating with node MCU using Python programming.

Here node MCU is the brain of the circuit which controls the motors and sensor according to the direction and detection of garbage.

- Main motor control is used for forwarding and backwards direction movement.
- Steering motor is used for the left or right turn.
- Garbage motor is used to rotate circular shovels for collection of garbage.

If any Obstacle is observed by the ultrasonic sensor, node MCU immediately changes the direction of vehicle or motors are switched off & buzzer is on.

B. Types of modes

The device is placed across the beach and sea so that only beach sand can get through the lower basement. Once the machine is kept at its place the machine is turned ON using the main switch. This initialize motor sensor, buzzer and wifi connection and the machine gets connected to mobile phone through the application using node MCU. The application is an open-end application which allows us to select the mode i.e. automatic mode and manual mode.

1) Automatic mode

If auto mode is selected then we have to input the measurement of the area which has to be cleaned. At the start the machine checks if there is an obstacle present in 2-meter distance using an ultrasonic sensor. If an obstacle is present then buzzer starts and machine remains stopped. If obstacles are not present then the car start. Car is moved using a steering motor which is driven using 12 v DC motors. The ultrasonic sensor is kept ON throughout from the start of the machine until it is switched off to avoid an obstacle in the path. If an obstacle is present directly machine is triggered to stop at that place. In automatic mode the node MCU is programmed in such a way that only the distance (length * breadth) has to be given as an input, so the car moves in a particular manner, covering specific area automatically collecting garbage. Motion of vehicle is illustrated in figure 3. The machine has a camera installed which scans the path simultaneously while moving and detects garbage. The camera is interfaced with node MCU. Once the garbage is detected camera sends a message to node MCU and then node MCU starts circular shovel fork which collects the garbage in the path. Circular shovel fork is circulated using stepper DC motor powered by batteries. The energy provided to the motor is electrical energy. When the motor runs the circular shovel starts to circulate making the fork to lift up. The wastage material is lifted by fork teeth and stored in collecting box. Once the collecting box is full, the waste materials are removed from the box. Circular shovel fork is kept ON for specific programmable time. After covering the distance given as an input machine stops automatically cleaning the beach area.
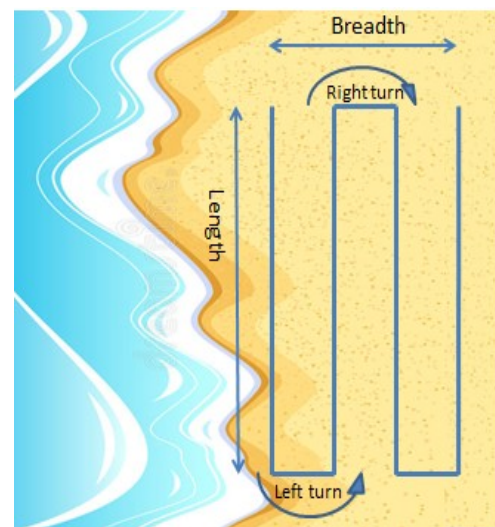

Figure 3- Vehicle movement

2) Manual Mode

In manual mode, each and every moment of the machine is controlled by a software-based application which communicates wirelessly with node MCU mounted on vehicle and controls movement of the machine. Applications consist of control which controls left, right, forward, back motion also there is a separate button for circular shovel fork. Visually we have to check the garbage and then using movement buttons we have to collect the garbage. For example, if we visually spot garbage at point A then we have to take the machine there using direction button manually then we have to press the circular shovel fork button so that it starts rotating and collects garbage.

C. Hardware Description

The machine looks similar to four-wheeled vehicle known as Go-kart. We have done some changes in physical model of kart basic frame measures 4 feet by 3 feet. Having two standing triangle shape frames of 4 feet height to support circular shovel which is placed in the middle of two triangular frames. We have installed node MCU, 4 batteries, 4 motors, circular shovel fork, temporary laptop placing stand, Rack and pinion, steering and garbage collecting tray all on our go-kart.

Machine is placed across the beach. Machine can be used on dry or wet sand. When using this method, a rotating circular shovel containing hundreds of fine forks through the sand and removes surface and buried debris while leaving the sand on the beach. Beach cleaner machine can remove materials ranging in size from small pebbles, shards of glass to larger debris, like seaweed and driftwood, floating waste like bottles and plastic cans. By keeping the sand on the beach and only lifting the debris, the machine can travel at high speeds. The sand and waste are collected via the pick-up fork of the vehicle, which leaves the sand behind. The waste is gathered in a collecting tray which is often situated at the top of the vehicle. Because sand and waste are lifted onto the forks, it allows time for the sand to sift through the forks and back onto the beach. The size of the materials removed is governed by spacing between two forks. Debris are collected into a window or garbage tray. The sand on the ground will be leveled up with the help of a 65-degree angled fork as the cleaning process continues and the lifted debris will be dumped into a separate can. Once the garbage CAN have been filled it could be emptied manually and that's all our project is going to be about.

V. FUTURE SCOPE

- We can use drone for further modification. Drone can be connected to the vehicle by means of wireless medium. Drone will capture the image and send garbage location to vehicle. So vehicle will directly go to that location where garbage is present. This implementation will overcome limitation of our present model as power consumption in this model will be comparatively less.

- We can put solar panels at the top of the vehicle which will charge the vehicle. This will help the batteries to charge faster and an efficient way where a person does not have to wait near a pump to charge the batteries.
- We can use night vision camera instead of normal mode for detection process, so if crowd is present at the beach, the vehicle will complete its task at night.
- In future, if we change the height and shape of forks, we can use this model for grass cleaning in the garden.

VI. ADVANTAGES

1. In today's World of era we require skilled workers to operate machines. But this Beach cleaner robot machine is easy to operate. As skilled Worker is not necessary to operate the machine and our machine contain both manually and automatic operating modes.
2. The machine is environment friendly, because it is totally electrically driven, powered by rechargeable full isolated GEL batteries.
3. It reduces human efforts also More comfortable to use, moreover it is silent, robust and accurate.
4. By removing litter, unwanted seaweed, Floating waste like bottles, plastic cans, covers any kind of waste unwanted seaweed and other debris from the beach, municipalities and resorts are able to maintain their beaches with fewer invested hours.

VII. CONCLUSION

Hence Smart Beach Cleaner Robotic Vehicle is implemented successfully. It will help us to keep the beaches clean and save the ocean life from garbage pollution. This system does not need more human labor. Also this can reduce the direct contact of the human labor with the waste so there is no hazard for human labor. We concluded that the cleaning process of beaches needs to be upgraded with the latest engineering subsystem and most important to make beaches safe, comfortable and visually pleasing for beach visitors using the technology.

ACKNOWLEDGMENT

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