Automatic Surf Rake Beach Cleaner: Design and Development of an Autonomous Coastal Waste Removal System for Environmental Protection and Public Health Improvement

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ABSTRACT

The paper presents a solution for major garbage problem in our society. Most of the waste materials including plastic waste are settled in the sea shore. So in this paper we are presenting a new method for collecting plastic waste from the sea shore especially from the sea sand. This include a vehicle like structure whose motion is controlled by a motor and a claw like structure for collecting waste. The entire system is controlled by Arduino. With the help of GSM module and ultrasonic sensors the control of the system is achieved. The claw is made in aluminum material with small pores placed in it. The necessary power requirement is provided by solar panels placed in an inclined direction on the vehicle. Small bin is placed inside the vehicle and the waste is collected into it.

KEYWORDS: Surf Rake, Arduino, GSM Module

1. INTRODUCTION

Garbage is a major problem worldwide. It can be seen that many organization come forward for cleaning garbage, but we can see that nobody has an eye on beaches which gets polluted day by day. Here we come with an idea of an autonomous surf rake robot which can be used wireless for collecting and depositing the garbage on the beach. The robot uses mechanical arm to collect the waste from the sand and filter them.

The collected garbage of medium sizes are deposited automatically on to the bin. We use Arduino microcontroller for the movement and controlling the claw. We also included GSM module for wireless communication. The average range of the Bluetooth is 10-15m.

2. EXISTING SYSTEM

Garbage Collection Robot on the Beach using Wireless Communications [1]

This paper is aimed at collecting garbage from the beach by making usage of wireless communication such as Bluetooth. The system is movable and the entire control is accomplished by visual basic application program based on windows XP.

Advantage of our system with respect to the above system is that separation of material is possible. Metals and plastics are separated effectively in our system.

Windows XP is outdated and cannot support in latest firmware. We use android platform so that entire robot is controlled by mobile phones.

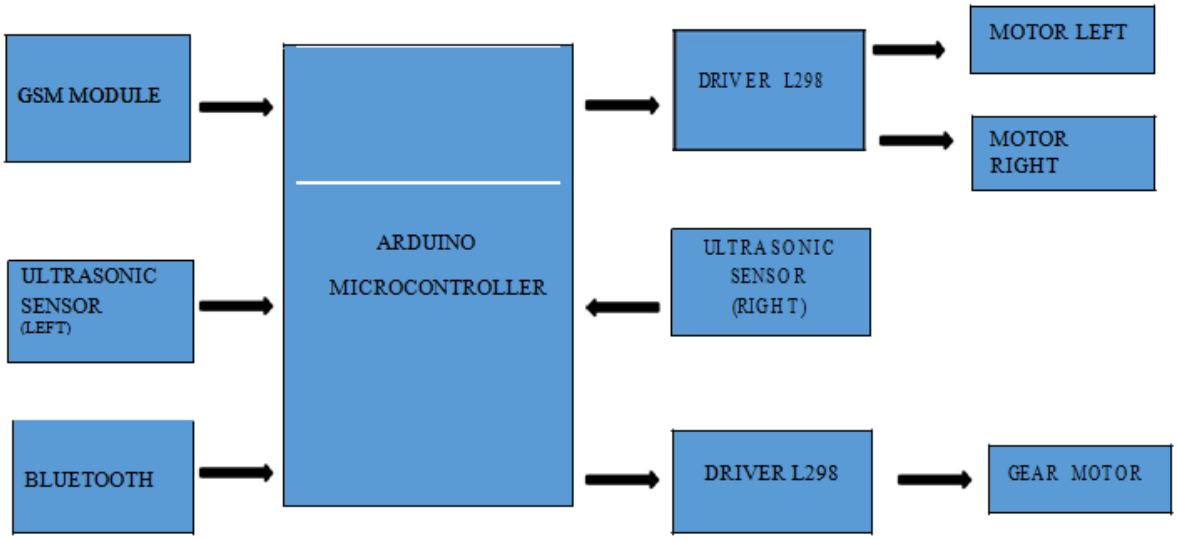


Fig.1 block diagram representation of proposed system

A. Hardware required

1. Bluetooth

Bluetooth is a wireless technology used for exchanging information over short distances (using short-wavelength ultrahigh frequency, radio waves within the philosophical system band from 2.4 to 2.485 GHz) from fastened and mobile devices, and building personal space networks (PANs).Here we are using Bluetooth to control the entire system in mobile devices. Bluetooth uses a radio technology referred to as frequency-hopping unfold spectrum. Bluetooth divides transmitted information into packets, and transmits every packet on one among seventy nine selected Bluetooth channels. Every channel includes information measure of one megacycle. It always performs 800 hops per second, with accommodative Frequency-Hopping (AFH) enabled. Bluetooth Low Energy uses 2 MHz spacing, which accommodates forty channels.

2. Ultrasonic sensor

Ultrasonic sensors measure the distance using the properties of sound waves. Ultrasound is not any totally different from 'normal' (audible) sound in its physical properties, except in this humans cannot hear it. This limit varies from person to person and is more or less 20 kHz (20,000 Hz) in healthy, young adults. Ultrasound devices operate with frequencies from 20 kHz up to many GHz. The main aim of using ultrasonic sensor is to detect objects and avoid collision between our vehicle and other heavy objects in the seashore.

3. GSM

GSM is a mobile communication modem; it's stands for international system for mobile communication. It's wide used mobile communication system within the world. GSM is associate degree open and digital cellular technology used for transmittal mobile voice and knowledge services operates at the 850MHz, 900MHz, 1800MHz and 1900MHz frequency bands.

GSM system was developed as a digital system victimisation time division multiple access (TDMA) technique for communication purpose. A GSM digitizes and reduces the info, then sends it down through a channel with 2 completely different streams of consumer knowledge, every in its own specific time interval. The digital system has a capability to hold 64 kbps to 120 Mbps of information rates. Here we interacts gsm module with arduino to provide a secure and continuous messaging platform. The GSM sends message signals to the admin for every half , ¾ and full occupation of waste in the bin**4.**

4. L293D MOTOR DRIVER

L293D is a Motor driver or Motor Driver IC that permits DC motor to drive on either direction. L293D is a 16-pin IC which can manage a group of 2 DC motors at the same time in any direction. It implies that you'll be able to manage 2 DC motor with one L293D IC. It works on the concept of H-bridge. H-bridge is a circuit that permits the voltage to be flow in either direction. As you recognize voltage ought to amendment its direction for having the ability to rotate the motor in clockwise or anticlockwise direction, therefore H-bridge IC are ideal for driving a DC motor.

In a very single L293D chip there are 2 h-Bridge circuit within the IC which can rotate 2 dc motor severally. Due its size it's pretty much utilized in robotic application for dominant DC motors. There are 2 Enable pins on L293D motor. Pin 1 and pin 9, for having the ability to drive the motor, the pin 1 and 9 ought to be high. For driving the motor with left H-bridge you wish to change pin one to high. In our system the entire control of the two motor is achieved through L293D

5. ARDUINO UNO

The Arduino UNO is a microcontroller board, used for performing various programs uploaded into it. The board is provided with sets of digital and analog input/output (I/O) pins that will be interfaced to numerous enlargement boards (shields) and different circuits. The board has fourteen Digital pins, six Analog pins, and programmable with the Arduino IDE (Integrated Development Environment) via a type B USB cable. Our entire system is controlled by Arduino Uno.

6. Gear motor

A DC motor is any of a category of rotary electrical machines that converts electrical energy into mechanical energy. Most common motors are based on the forces created by magnetic fields. Every type of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current flow in the motor.

B. Software required

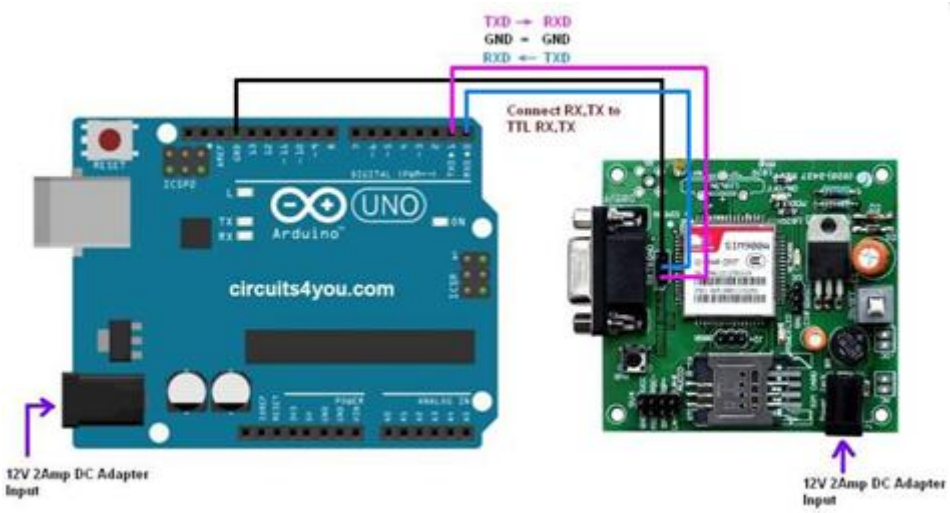
ARDUINO Software (IDE)
Aurdino software IDE is an open source software for coding, executing programs and employing into Arduino processor. IDE is written in Java. IDE makes easy uploading of codes in to the board. The Arduino IDE software can be used with any Arduino board. The Arduino software is licensed under general public license.

3. WORKING

The working involves the method and collecting garbage. The system consists of three bin which collects metallic, plastic and other garbage. The structural part consist of a claw like structure which is entirely made of aluminum Small pores are introduced in to the aluminum plate. The aluminum claw enter into seashore sand in some depth and after, the wheel moves forward so that sand enters in to the claw. [2]

The movement of the wheel is provided by a 30rpm motor, which also provides a vibration. Due to the vibration the sand leaves the claw through small pores and thereby leaving the waste only in the claw. Different types of sensors are employed in the separation of garbage.

A capacitive sensor sense plastic waste and put the waste in specific bin. Three bin are provided for collecting plastic metals and other waste. Metal detector detects the metallic waste and put the waste in another bin, which is specified for the collection of metals. Other waste are collected in to another bin. The movement of garbage in to different bin are achieved by another motor which provide 90 degree rotation. Power requirement for the entire system is provided by batteries recharged by solar power. Lead acid batteries are used as energy storage medium for solar battery banks. The energy is the result of chemical reaction occurring within the battery between electrolyte and lead acid plates within the battery. Off grid solar power systems require battery banks to reserve electricity for times of frequent power cuts [3]. The amount of solar energy that can be stored in battery depend upon ‘Capacity Rating’



The entire system is controlled by Arduino Uno. GSM module is also incorporated for delivery of message to the administrator. Messages will be delivered for half filled, ¾ filled and full .This works for all the three bins

4. RESULTS AND DISCUSSION

The robot with garbage collection and storage system was successfully designed and assembled. The system is manufactured with built-in microcontrollers. To build an automatic garbage robot using Arduino microcontroller which detects and collects the paper and plastic items automatically. The aim of the project was achieved. The robot moves in constant acceleration. Acceleration is provided by batteries which are recharged by solar panels.

5. CONCLUSION

This project developed the robot for collecting the garbage at beaches. The rise in the rate of waste production is no longer acceptable. In many beaches no one are cautious of the waste dumping. It is essential that governments bodies and corporations face up to the waste, using what we know about reduction, recycling and reuse we are trying to develop a robot which can move and collect garbage on beach. The robot can move with a speed of 0.5 m/s on the sand with the help of Bluetooth and collect the large garbage. The robot is expected to have a range of 10 meters. This robot is expected to reduce the garbage problem.

6. ACKNOWLEDGEMENTS

The authors would like to thank department of electronics and communication, college of engineering, perumon that support to complete the project and thank Mrs Archa A B, Mr Santhosh B S and Mrs Jesna KA for their help on the project. We thank all other faculties who tried their best to help for this project in different scenarios.

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