



Autonomous Cleaning Robot for Highway Maintenance

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Abstract: - In this present era, highway roads are the ones that are most used mode of transportation. And cleaning a highway is not only time consuming, but also its very tiring. Especially for cleaning workers it becomes difficult to handle the highway lane work as it needs constantly the process getting repeated. More numbers of daily workers are involved to clean the highway road and it's not safe for them. For saving time we needed an automatic system that cleans on its own without human interventions. Also, we did think about how to aid people with physical disabilities. Since we had to do this, we were aware that we needed a cleaning system that could work in accordance to what we say, thus helping a physically disabled person.

Keyword: Ultrasonic Sensor, Pick and Place module, GSM Module, Driver unit, Microcontroller (AT328p), Suction pump and Driver unit.

I. INTRODUCTION

Robot is an electromechanical machine and used for various purposes in industrial and domestic applications. Robot appliances are entering in the consumer market, since the introduction of Robots. Many related appliances from various companies have been followed. Initially the main focus was on having a cleaning device. As the time pass on many improvements were made and more efficient appliances were developed. In this research work a highway cleaner robot working based on Street sweepers using PIC microcontroller. This cleaner robot is an electric Street sweeper's appliance, which works in two modes as per the user convenience "Automatic and manual". Unlike other floor cleaner robots this is not a vacuum cleaner robot; it performs sweeping operation and collect weed in highway. It works on +24V supply. Using battery and solar panel. In the automatic mode, robot performs all operations itself. Firstly robot starts it moves forward and perform cleaning action. For obstacle detection and to avoid hurdle IR sensors have been used. If any hurdle detected then robot change the lane automatically. The heart of the system is a microcontroller. It is programmed to accept inputs to sense obstacles around it and control the robot to avoid any collisions. There are 4 IR sensors used in this project-one at the front, and the remaining on the left, right and back of the robot to detect obstacles, if any. In case of an obstacle, or by a potential collision, the microcontroller controls the wheels

of the robot a motor driver to avoid collision. The vacuum cleaner mounted on the robot performs the cleaning process.

II. PROBLEM IDENTIFICATION

In this present era, people live a very busy life. People in cities have irregular and long working times. In such a Situation a person will always find ways of saving time. Highways roads are the ones that are most dread upon. And cleaning a highway lane tops the list. It is not only time consuming, but also its very tiring. Especially for working man and women it becomes difficult to handle both organisation and highway lane work together.



Figure 1: Floor Cleaning Robot Model



More numbers of wages workers are involved to clean the highway road it's not safe for them. For saving time we needed an automatic system that cleans on its own without human interventions. Also, we did think about how to aid people with physical disabilities. Since we had to do this, we knew that we needed a cleaning system that could work in accordance to what we say, thus helping a physically disabled person. Traditional machines used for high way cleaning makes a human carry themselves a vacuum unit and dispersive unit for cleaning and the other machines which are automated are finding fault in running through highways.

III. EXISTING DETAILS

- **iRobot**

The Bedford (Massachusetts) based company iRobot was founded in 1990 by a group of three robotics experts (Rodney Brooks, Colin Angle and Helen Greiner) from the Artificial Intelligence Lab of the MIT—the Massachusetts Institute of Technology. Their initial goal was it to bring robots into the everyday life and make them more accessible to the masses. But iRobot is not only specialized in Domestic Robots but also Military Robots with the Packbot being a very sophisticated model used in dangerous war conditions like to detect bombs and snipers. Prior to the development of the Packbot, which by the way was also an essential tool to gather data at the Fukushima nuclear disaster site, the company received a DARPA research contract in 1998.

- **Neato Robotics**

The Newark, California based Robotics Company is focusing solely on the development of robotic vacuum cleaners. Since the release of the **Neato XV** in 2010 it is aiming at dethroning iRobot and make that no secret in their promotional videos where they are referring to the competing Roomba series as “those round vacs” while not explicitly stating the name, of course. In 2014 they released a new product line called BotVac which incorporates a special side brush that was previously only available in certain vacuums manufactured by the German company “Vorwerk”. With only 65 employees Neato is still much smaller compared to iRobot but it does a phenomenal job at the development of their robotic vacuums. We are looking forward to the future of this company.

- **LG Corporation**

Formerly known as Lucky Goldstar, the LG Corporation has become a technology giant that manufactures all kinds of devices. It is therefore no

wonder that LG has also invested into the robot vacuum niche. The first line of vacuums was called **HomBot** and was recently succeeded by a new model called Roboking.

- **Infinuvo**

Infinuvo is a robotic vacuum manufacturer currently based in Saragota, California. The company is famed for making some of the best products under this category, their machines deliver excellent cleaning power and are also affordable compared to those of competitors. They are also versatile and can be used to vacuum all types of surfaces without encountering any problems, these appliances can clean normal household floors as well as beneath the furniture sets.

IV. METHODOLOGY USED

Our project aims at designing an autonomous robotic system that helps people to maintain their highway cleaned during their rush times and also help the highways neat and clean. This can be achieved with a combination of a micro-controller based system, a hardware cleaning module and a wireless system.

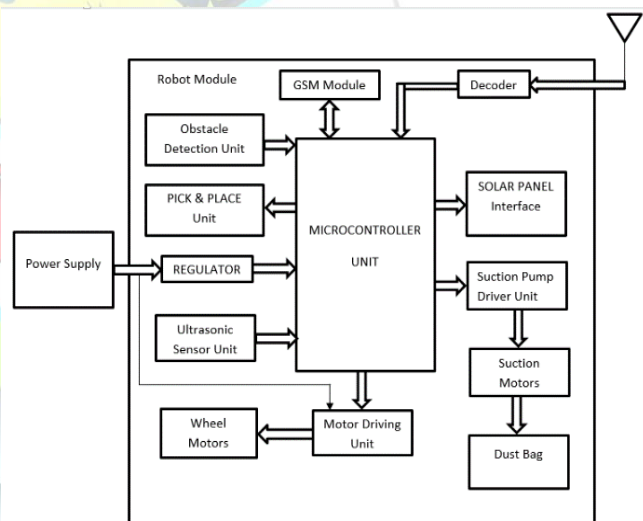


Fig. 2 Block diagram of an Autonomous cleaning robot

A. Motor driver

The L293D is a monolithic, integrated, high voltage, high current and has 4 channel drivers. Basically this means using this chip one could use at most four DC motors and provide power supplies of up to 36V. Figure 5.3 is the Motor Driver L293D. The L293D chip uses H-Bridge. Motor drivers act as current amplifiers since they take a low-current control signal and provide a higher-current signal. This higher current signal is used to drive the motors.

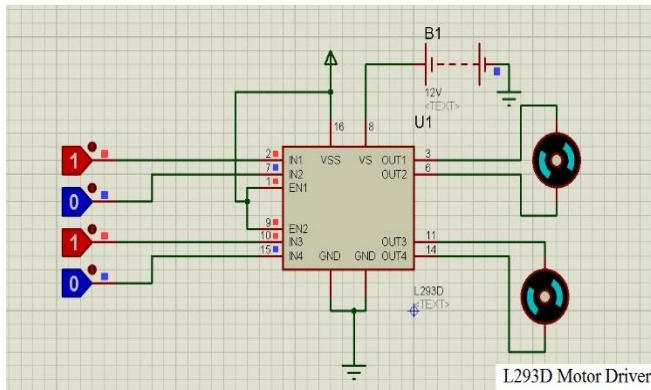


Fig. 3 General working diagram of L293D motor driver

In its common mode of operation, two DC motors can be driven simultaneously, both in forward and reverse direction. The H-Bridge is typically an electrical circuit that enables a voltage to be applied across a load in either direction to an output e.g. motor. This means that just reversing the direction of current leads to reversing of the direction of motor. The motor operations of two motors can be controlled by input logic at pins 2 & 7 and 10 & 15. Input logic 00 or 11 will stop the corresponding motor. Logic 01 and 10 will rotate it in clockwise and anticlockwise directions, respectively. Enable pins 1 and 9 (corresponding to the two motors) must be high for motors to start operating. When an enable input is high, the associated driver gets enabled. As a result, the outputs become active and work in phase with their inputs. Similarly, when the enable input is low, that driver is disabled, and their outputs are off and in the high-impedance state.

B. Radio Frequency

RF transmission system composed of Amplitude Shift Keying (ASK) with the transmitter/receiver (TX/RX) pair, operating at frequency of 434 MHz. Transmitter modules take serial input and transmit it through RF. Receiver module receives signals which are transmitted by transmitter module placed away from it. The RF module has been used with a set of four channels Encoder/Decoder ICs. HT12E & HT12D have been used as encoder and decoder ICs respectively. The encoder converts the parallel inputs into serial signals. These signals are serially transferred through RF. The decoders are used after the receiver to decode the signal and obtain the original signals as an output. These outputs can be easily observed on the corresponding LEDs. The block diagram of RF transmission is shown in fig.4.

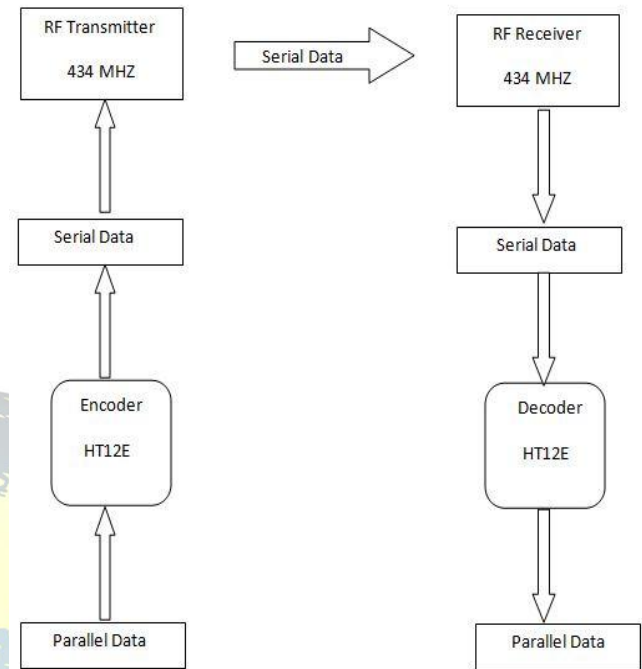


Fig. 4 Block diagram of RF transmission system

C. GSM

GSM stands for global system for mobile communication. It is a standard set developed by the European telecommunication standards institution (ETSI) to describe protocols for second generation digital cellular networks used by mobile phones. A Modem is a device which modulates and demodulates signals as required to meet the communication requirements. It modulates an analog carrier signal to encode digital information, and also demodulates such a carrier signal to decode the transmitted information. A GSM Modem is a device that modulates and demodulates GSM signals and in this particular case 2G signals. The modem we are using is SIMCOM SIM 300. It is a tri band GSM/ GPRS modem as it can detect and operate at 3 frequencies (EGSM 900MHZ, DCS 1800MHZ and PCS1900MHZ).

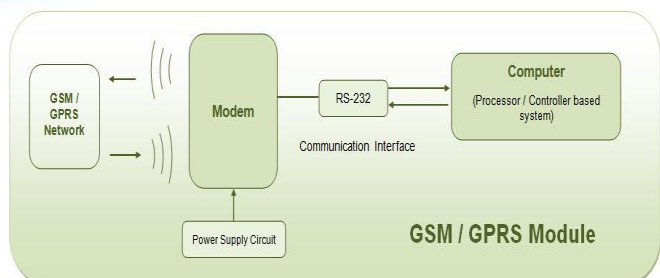


Fig. 5 Block Diagram of SIM300



Fig. 6 Module of SIM300

SIM 300 consists of a buzzer, antenna and SIM slot. SIM300 in this application is used as a DCE (Data Circuit Terminating Equipment) and PC as a DTE (Data Terminal Equipment). SIM300 GSM Module can be used to send and receive SMS connecting it to a PC when a SIM is inserted. The GSM Modem can be sent commands to send or receive SMS from the PC through a COM Port (Serial port or a USB). These commands are called as AT commands. Through AT commands we can perform several actions like sending and receiving SMS, MMS, etc. Sim300 has an RS232 interface and this can be used to communicate with the pc. Sim300 usually operates at a baud rate of 9600, with 1 stop bits. No parity bits, No hardware control and 8 data bits we shall see at some of the AT Commands necessary for sending and receiving SMS.

V. RESULT

A Prototype on Self Directed Highway cleaner robot has been designed that can prove our implementation is capable of cleaning and removing real-time obstacles that are found on roads. Our Proposed system has several advantages in terms of its size, cost, efficiency and uniqueness. Thus our proposed system could meet the goal of providing proper safety for road passengers, whenever necessary conditions avail at all environmental circumstances.

VI. CONCLUSION

Thus the proposed Autonomous cleaner robot consists of DC battery which can be charged with in an hour with the help of solar panel and can be used during power outage period. It has a vacuum cleaning system which consumes very less power on comparing with existing

system. The existing system consumes very high power of around 500W for suction whereas autonomous cleaning system only requires 10W for suction. So power consumption will reduced greatly and hence the operating cost is also very low.

REFERENCE

- [1]. Hasan, K.M.etal. (2014).Path planning algorithm development for autonomous vacuum cleaner robots. Electron. & Commun. Eng. Discipline, Khulna Univ., Khulna, Bangladesh. 9781-4799-5179-6. Date of Conference: 23-24 May 2014Page(s):1 – 6. Publisher: IEEE
- [2]. Han-Gyeol Kim; Jeong-Yean Yang (2014) Experience based domestic environment and user adaptive cleaning algorithm of a robot cleaner; Pages: 176 - 178, 10.1109/URAI.2014.7057525. . Publisher: IEEE
- [3]. Rincon-Suarez, A.etl. (2007) Design and Construction of an Autonomous Cleaner Robot, for an aquatic environment. Electronics, Robotics and Automotive Mechanics Conference, 2007. CERMA 2007. Page no.482 – 487. ISBN: 978-0-7695-2974-5. Publisher: IEEE
- [4]. Yueguang Li,etl. (2015).Design and control research of vacuuming robot cleaning Mechanism. Page 258-262. . Publisher: in computer science and mechanical automation CSMA-2015 IEEE.
- [5]. M. Ranjith Kumar and N. Kapilan (2015) Design and Analysis of Manually Operated Floor Cleaning Machine International Journal of Engineering Research & Technology (IJERT) ISSN: 2278-0181 Vol. 4 Issue 04, April-2015
- [6]. Liu, Kuotsan, Wang Chulun, (2013).A Technical Analysis of Autonomous Floor Cleaning Robots Based on US Granted Patents, European International Journal of Science and Technology Vol. 2 No. 7 September 2013, 199-216.
- [7]. Abhishek Pandey, Anirudh Kaushik.(2014)A Technological Survey on Autonomous Highway Cleaning International Journal of Scientific and Research Publications, Volume 4, Issue 4, April 2014 1 ISSN 2250-3153.
- [8]. Manreet Kaur etl. (2014)Design and Development of Floor Cleaner Robot. International Journal of Computer Applications (0975 – 8887) Volume 97– No.19, July 2014.
- [9]. Dr.Tamas Szecsi. (2009)An Automated Cleaning System for Hospitals School of Mechanical and Manufacturing Engineering. September 2009 thesis.
- [10]. Karthick.T, etal, (2015) Simple Autonomous cleaner Robot International Journal of Science, Engineering and Technology Research (IJSETR), Volume 4, Issue 5, May 2015.

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