



Drive Controlled Suction System

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Abstract: This research proposal is designed to automate the solid waste monitoring process and management of the overall collection process. It is designed in such a way that, it moves around without human involvement and collect the trash on its way using the vacuum unit. Added advantage of this system is GSM module. This GSM enables the authority to be aware of the fill level of the garbage box. The other functions will stop its work until the box is emptied. This proposed system is good enough to ensure the practical and perfect prototype for solid waste collection process, monitoring and management for green environment. This project can be implemented in industries for garbage collection and also it can be used in domestic home.

Keyword: Microcontroller, DC motor, sensor, GSM module, relay.

I. INTRODUCTION

In this modern era, everything around us is getting automated, but the trash level and its management is poor. If we consider India, due to its vast population, the trash or garbage accumulated in the surroundings, goes on increasing. As this is rapidly growing and fast moving century, most of us do not care about the proper disposal of dust. Still, in some societies of India, we depend on manual labours for purpose of cleaning the trash. This system is attempted to replace automation in place of manual work. The individuals working as a sanitary worker are more prone to health issues. This proposal has advantage of reducing the above health risk.

Methodology:

The system involves motors which is used to drive vehicle, is driven with help of relays.

Relays

In this proposed system relays are used for motor control purpose. The relay JQC-3FC/T73 is used here. Around six

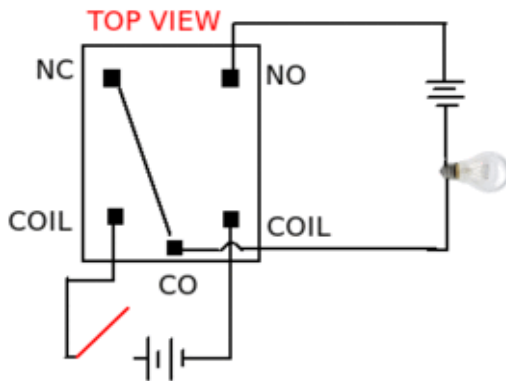
relays are used to control the forward and reverse motion of vehicle wheels.



Relays are the electromechanical switches which operates when the coil inside get energised by the flow of current. Single Pole Double Throw (SPDT) – Such relay has 5 terminal pins which consists of a pair of coil pins, a common pin, a normally open (NO) pin and a normally



closed(NC)pin.



These relays are also act as isolators which provide required current in the range, suitable for motors.

Motors

Here we use 12V, 30 rpm DC geared helical motor .Two wheels are driven with the help of this type of motors and third wheel which is mounted in the front will be a caster wheel. Motor draws about 2A current. The main cause for using geared helical motor type is,it reduces the speed of 180 rpm to 30 rpm. This is because the gear assembly or gear box present in the motor helps it to achieve high torque.



This gear box is placed in the motor shaft.Hence motor shaft produces higher rpm, when this output passes through the gearbox it reduces the rpm thereby resulting in increase in torque.In common dc motors produce high rpm and minimum torque,but the output of low rpm and high torque required for pull of the vehicle is obtained in this motor.

Microcontroller

Any working system which is expected to be automated involves the use of controllers and processors. Similarly this proposal is automated with help of Arduino UNO which has ATmega328 microcontroller.



Arduino UNO has digital 14 input/output pins, 6 are analog pins, 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button.The operating voltage for arduino is 5v and maximum of 7 to 12v can supplied. In this system, we use controller in two different units. One is used in the vehicle and the other is used in the GSM unit which is used for calling the respective authority. When a GSM modem is connected to a computer, this allows the computer to communicate over the mobile network. While these GSM modems are most frequently used to provide mobile internet connectivity, many of them can also be used for sending and receiving SMS and MMS message.

Sensor

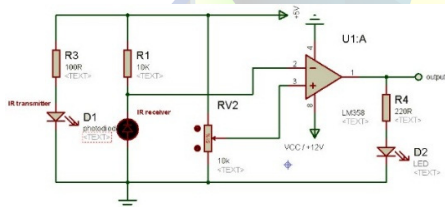
Sensors are used in this proposal for two different purpose. One sensor is used for obstacle detection and vehicle driving purpose. And the other is used for level detection. This level detection is meant for detecting solid garbage fill level in the garbage collecting box. With the output of this level detection unit[5], notification to the authority by means of a call is implemented using GSM unit. There are different sensors available, among which ultrasonic sensor is chosen for this system.



Obstacle detection unit is performed using ultrasonic sensor[4]. Ultrasonic sensor has two circular ports in its front portion. One port is transmitter and other one is receiver. Transmitter port works as a speaker, which sends sound pulse signals at high frequency in the range of 40kHz. Receiver port behaves like a microphone, which receives the echoed signal that reflects back whenever obstacle is detected. Range of working of ultrasonic sensor is about 10cm to 30cm. Power consumption of ultrasonic sensor is about 20mA.

Level detection unit is executed with help of IR (infrared) sensor. Similar to ultrasonic sensor, IR sensor also has transmitter (LED) and receiver(photo diode)[2].

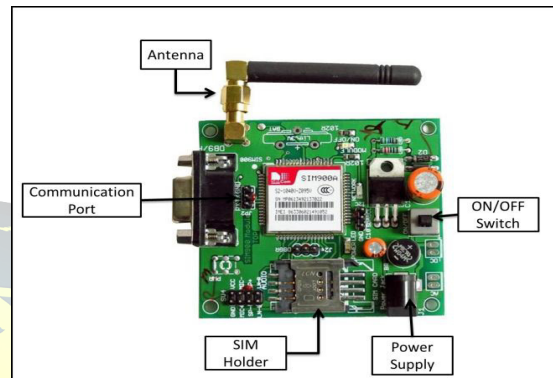
- Near infrared region — 700 nm to 1400 nm
- Mid infrared region — 1400 nm to 3000 nm
- Far infrared region — 3000 nm to 1 mm



IR sensor contains lm358 comparator. Output from IR receiver is given to the voltage comparator. Output from voltage comparator is given to arduino and finally this helps in execution of GSM unit. In lm358 set voltage is assumed as some fixed value. This set value is compared with the voltage that is obtained when fill level is detected[3]. If this set voltage is less than the input voltage, then the output of the comparator lm358 is 5V and call is made with GSM unit. If the set voltage is greater than input voltage then output is 0.

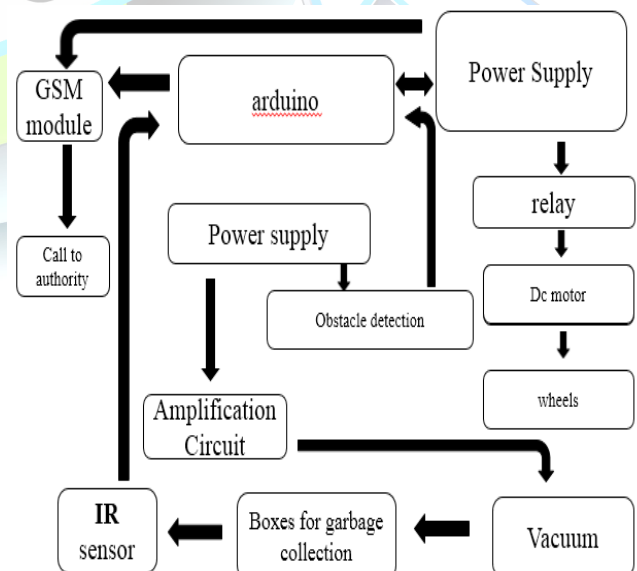
GSM

Communication from one place to another is performed using GSM(Global system for mobile communication) technology in this system. Here SIM900 module is used for GSM purpose.



It is a quad-band GPM/GPRS of 850/900/1800/1900 MHz performance for voice, data, SMS etc[10]. It has 12 GPIOs, 2 PWMs and built in ADC. It is controlled through AT commands [1]. Operating voltage is 5V,500mA. It consists of antenna, SIM jacket and some ports. SIM jacket is used for holding SIM. SIM is used for communication purpose to make a call.

II. BLOCK DIAGRAM





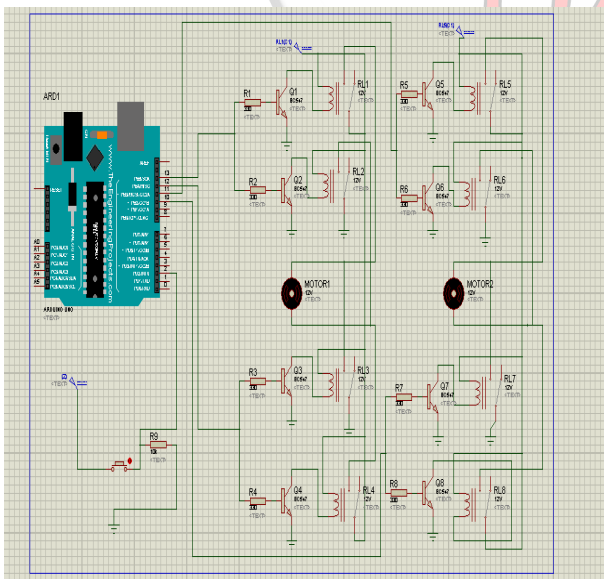
This block diagram shows different units in this vehicle. Power supply unit is given to the relays, obstacle detecting unit and vacuum unit. Motor driving unit consist of relays which is used for motor control. It also has dc motors, wheels etc. Cleaning unit consist of vacuum [9], boxes for garbage collection unit, level detection unit etc.[2]. Each unit is operated with the help of dc battery of 12V. GSM unit consist of SIM900 module. This unit is used for the purpose of making call.

Vacuum suction unit in this proposal is controlled for variable speed control. This variable speed control is meant for giving various pressure for varying dust weight. Consider if a dust with low weight is present, then the pressure needed for collecting it can be low. Also if dust with weight higher, then the pressure needed for collecting it should be high.

III. EXPERIMENTATION

Simulation of motor control in Proteus professional 7

The below picture represents the simulation of motor control. This vehicle has two motors for which simulation is done to control it. Proteus professional 7.0 software is used.



In this simulation, one port of the arduino is used for controlling two relays, which controls the motor rotation. Similarly, four ports are used for control of eight relays. Two relays are used for forward motion of the motor and another two relays are used for reverse motion of the same motor. This is same for motor 2 also. This simulation shows the output initially as forward motion of the motor when the input is low (sensor output). Motor 1 stops and motor 2 moves in reverse direction when input is high (sensor output).

IV. RESULTS AND DISCUSSION

The above simulation image (controlling motor for self-driving purpose of the system) is programmed in Proteus professional 7. In this simulation, arduino UNO is used for control purpose. The arduino UNO is programmed for its control, in arduino software. The output achieved through this simulation is for direction and obstacle detection purpose.

Initially the system moves straight, this is achieved by forward motion of the motors. Whenever obstacle (example: wall, table, human etc.) is detected by the sensor, motor 1 stops rotating and motor 2 rotates in the reverse direction. This reverse side rotation of motor 2 continues until the obstacle detection is not obtained. By this movement the vehicle aligns itself in the path away from the obstacle. If obstacle is once again detected the above process is repeated again.

V. CONCLUSIONS

This paper brings the cleaning output in very efficient manner. The vehicle developed in this paper is designed in such a way that it sweeps even a large span of area effectively. As it possesses components such as controller, sensors the output is tend to be time consuming. The final vehicle or the system is a three tyre system with two wheels operating with dc supply from the motor and one is free

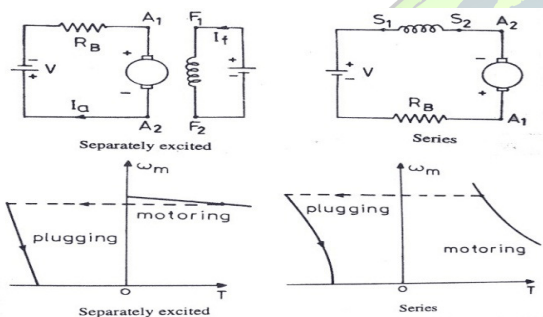


rotating caster wheel. As two motors are used in this system, range of upto 2kg (garbage and overall system weight) can be moved with the help of this vehicle.

Appendices

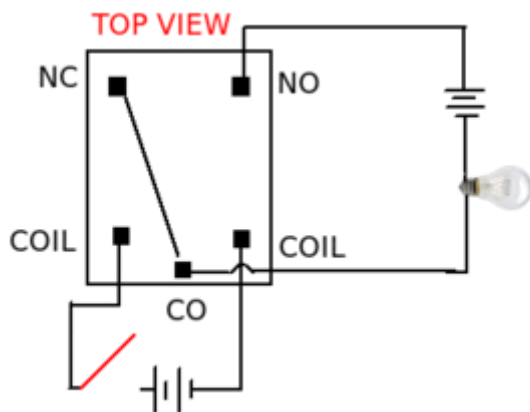
Braking

Plugging is a type of braking. It is used for motor control in this vehicle. The motor will initially move in forward direction. To change the direction of rotation of motor this plugging technique is used. In this method the terminals of the supply to the motor is interchanged for reversing the direction of rotation of motor.



Relay

JQC-3FC/T73 model 12VDC PCB MOUNTED SUGAR CUBE RELAY



JQC-3FC/T73 12VDC Here's the Back view of the relay

Max.switching current:7A,10A;

Max .switching voltage:28v dc250v Ac;

Between coil and contacts: 1000VAC;

Between contacts form: 1000VAC;

Ambient temperature: -40-+85oC;

Operation /release time: 10/8MS;

Contact capacity :10A,125V

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