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Design and Manufacturing of Arduino Smart Vacuum Cleaner

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ABSTRACT: This Project is to Automatic Cleaning of floor without human interference. The aim of this project is to reduce human effort for cleaning purpose. This system is mainly works in indoor applications. A automatic cleaning algorithm is to be designed to clean the floor by detecting the garbage on the floor. Ultrasonic sensor is used to perform the task of obstacles avoidance. In the current hectic schedule, cleaning houses and surrounding environment is more difficult. There are vacuum cleaners which require humans to handle it. Thus, there is a need to implement vacuum cleaner which works without human interference. The method to clean the desired area has been implemented through this project. By using this vacuum cleaner, hazardous places can be cleaned which thereby reduce risks to mankind. This is achieved by implementing an autonomous system. The main objective of this project is to design and implement a vacuum robot prototype by using Aurdino uno, Motor shield, Ultrasonic sensor and motor with wheels to achieve the goal of this project. The ultrasonic sensor is used to measure the distance between robot and obstacle. The whole circuit is connected with battery. Vacuum robot has several criteria that are user-friendly.

KEYWORDS: Cleaning, algorithm, Ultrasonic sensor, obstacles, environment, vacuum cleaners, Aurdino uno.

I. INTRODUCTION

As robotic field is growing rapidly and robot is very useful to reduce human work, Arduino smart vacuum cleaner is one of the robots that many people can use it in day to day life. It can be used in many places such as medical field like hospitals and household. Arduino smart vacuum cleaner has capability to avoid obstacles coming in its way.

Arduino micro-controller is used to control the motion of the Arduino vacuum cleaner as per the program fed in it. The Arduino micro-controller runs all the components such as motor shield, ultrasonic sensor, servo motor, Gear motors etc as per the program fed in it. It can detect all the obstacles in its way and due to its suction power it can clean specific areas and program allows it to control its motion. In future some parts like Bluetooth module can be added to connect it with mobile phone and remote to make it more perfect in its direction and in controlling also. This makes the vacuum cleaner more advance and more efficient.

II. RELATED WORK

An obstacle avoiding car is a robot which can avoid all the obstacles coming in its way and it can move freely without any operator or human interference. It consist of sensor that identify obstacles in its path and as per program fed in it it will avoid the obstacles .The robot can move in any directions left, right, forward and backward. It has high working range to face outdoor terrains. It can travel through any direction and unfamiliar environments and it can avoid dangers in its route. These types of robots have so many applications like surveillance, exploration, and Transportation. Obstacle avoiding robots has very large use as a base in Automatic cars for manufacturing industries and service robots for air crafts.

Robot is controlled using Bluetooth which is present at both transmitter and receiver end. Smart Vacuum Robot with progressive technology. S-curve planning is used for efficient working along with sensors to avoid obstacles.

III. METHODOLOGY

The methodology for creating an Arduino-based smart Vacuum cleaner entails defining the cleaning requirements, selecting the necessary hardware components, such as motors, sensors, and batteries, writing the software code using the Arduino IDE, assembling the components in accordance with the design, testing and debugging the system to ensure it satisfies the requirements, improving the design to add features, and documenting the design and code for later



use. To produce a practical and effective tool that can carry out particular cleaning activities automatically or manually, this requires a mix of hardware and software design and testing.

It takes a combination of hardware and software design and testing to create a useful and effective gadget that can do specific cleaning tasks automatically or manually.

Components used in the prototype

1. Arduino UNO

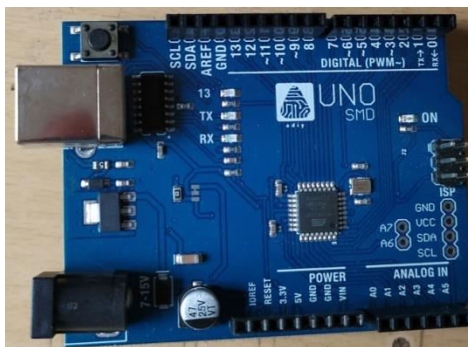


Fig. 1 Arduino UNO

2. Servo motor: Specifications

- Operating Speed: 0.12second/ 60degree (4.8v No Load)
- Stall Torque (4.8v): 17.5oz /in (1kg/cm)
- Operating Voltage: 3.0v~7.2v
- Temperature Range: -30 to +60
- Dead Band Width: 7usec; Colour: Multicolour; Package Contents: RC Robot Helicopter Airplane Boat Controls.



Fig. 2 Servo motor

3. Motor Shield:

Motor Driver Shield is a board which gives possibility to control 4DC motors or 2 step motors [unipolar or bipolar] and 2 servo motors additionally by stacking on Arduino. There are 2 L293D motor driver IC on board which means it can drive 0.6A 4 separate DC motors or 0.6A 2 separate step motors.

Specifications:

- 2 connections for 5v 'hobby' servos connected to the arduino's high-resolution dedicated timer
- 4 h-bridges: L293d chipset provides 0.6a per bridge with thermal shutdown protection
- Up to 2 stepper motors with single coil, double coil or interleaved stepping
- Has internal kickback protection diodes
- weight: 0.2 gms



Fig 3 Motor Shield

4. Arduino IDE software

Arduino IDE software has been used for coding and fed the program to runs the robot as per applications. C programming code is fed in the Arduino.

IV. EXPERIMENTAL RESULTS

The block diagram shows all the components to control the robot represents block diagram of our prototype which includes components:

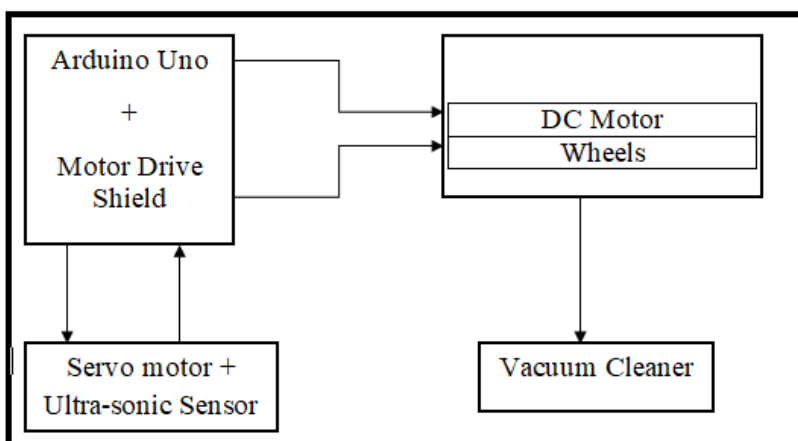


Fig. No. 1 Block diagram.

Arduino Uno microcontroller, Ultrasonic sensor, Motor drive shield, servo motor and vacuum cleaner. These all components are connected to Lithium-ion batteries which gives power to all components. The Lithium-ion batteries give power to Arduino Uno and motor shield. Then Arduino Uno operates the Servo motor and ultrasonic sensor which detects the obstacles and changes its direction as per coding. The Motor shield runs all the gear motors simultaneously and moves the robot from one place to another place. Vacuum cleaner is mounted on the base which sucks the dirt particles and bits of paper to clean the floor.

The principle of normal vacuum cleaner has been used in this robot. In vacuum cleaner motor assembly and storage tank both are separated but in this robot the combination of both rectangular structure to make it compact. Motor and fan assembly has been fitted at the Inlet of pipe and pipe is L-bow pipe which sucks dirt particles and bits of paper due to power of motor. Motor rotates inside the Tank and due to this high rotation it sucks the air through inlet of pipe and suction is created at the inlet and dirt particles and bits of paper get sucked.



Fig. No. 2 Actual working model view

V. CONCLUSION

The use of a smart vacuum cleaner has been implemented in this project. It operated using pre-written code that is placed into an Arduino UNO. When an impediment is encountered, a Vehicle is turn to the side. When there is more space between the car and the obstruction. This invention uses a battery-powered vacuum cleaner and axial fan connected to the 6V motor to collect dust without the need for human interaction, lowering the risks to human health. This cleaner is easy to use and reasonably priced.

VI. ADVANTAGES AND DISADVANTAGES

Advantages:-

- i. Manual Cleaning is reduced.
- ii. Easy to operate and clean in any Areas where is the chances of Human risk life.
- iii. Easy to Customize as per requirement.
- iv. Cheap Cost as compare to other Vacuum Cleaner.
- v. Time and Human Efforts get saved.
- vi. More Efficient and Convenient in Cleaning.

Disadvantages:-

- i. Chances of certain Areas get avoided to clean or not possible to reach there.
- ii. Small Obstacles may be able to block the Robot.
- iii. Storage Capacity is limited as per Design.

VII. FURURE SCOPE

Arduino based Smart Vacuum Cleaner Robot will be helpful to reduce the Human Effort as well as completing the Tasks, this Robot can be modified in many other such types of Operations like:

- a) Wall Cleaning
- b) Floor Cleaning using Water and Cloth
- c) Ceiling / Roof Cleaning
- d) Stair Cleaning

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