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# ARM based obstacle avoiding vacuum cleaner robot

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*Abstract*- **In the present era, cleaning of house is least priority work due to busy schedule of persons. Many instruments have been developed so far to reduce the human effort as well as time for house cleaning. But, most of them are operated manually or may be semi-automatic and also some remote places cannot be cleaned. The programmable robot which is fully automatic solves all the problems related to cleaning of house in large extent**

**In this paper, design and fabrication of automatic house cleaning robot (HCR) is described. The cleaning robot uses a microcontroller to detect obstacles and manipulates its direction as per the inputs . It is programmed to accept inputs to sense obstacles around it and control the robot to avoid any collisions. In case of an obstacle, or a potential collision, the microcontroller controls the wheels of the robot by a motor driver to avoid collision. The vacuum cleaner at the top of the robot performs the cleaning process.**

**Key words : Sensors, computer application, ATmega8 microcontroller, obstacle.**

## I. INTRODUCTION

Robots are utilized for many applications to assist Human Beings. The conventional vacuum cleaner system consists of large mechanical and electrical parts which are more costly and incur more losses. It works only on AC which consumes more power around 1000W and we cannot use it during power outage period. The autonomous cleaner robot consist of low power consuming electronic and mechanical parts and it can operate during power outage period and does not need any human guidance. By using this proposed autonomous cleaner robot operating cost and initial cost of the machine will be reduced and the human effort and time will be saved. Robots have electrical components which power and control the machinery. That power comes in the form of electricity, which will originate from a battery, a basic electrical circuit plays a vital role here

## II. BLOCKDIAGRAM

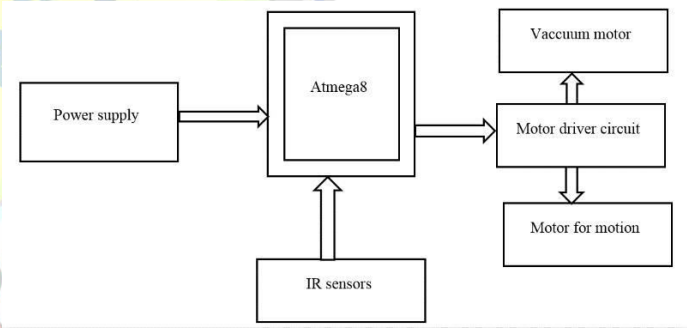


Figure.1: Overall block diagram

### A. Power supply

Power supply to the robot is given through a lead acid battery, which acts as a heart of the proposed system. Entire power supply to the robot including motor, ultrasonic sensors and controller board is given through the 12V 4.5 AH battery. Power source can also be varied based on the usage time.

### B. Controller board

A controller is a chip or a standalone device that that interfaces with a peripheral device. Controller board acts as the brain of the robot. In this system ATmega8 controller board is used.

### C. IR sensor

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IR sensors are used to detect the obstacle. IR sensor consists of IR LED and photo diode.

**D. Motor Driver**

Motor driver is an intermediate circuit that interface Arduino controller with the motor. Arduino cannot run the motor directly since motor requires higher current rating, which can be maintained by the motor driver. Here L293D IC is used as driver circuit There are 4 input pins for this l293d, pin 2,7 on the left and pin 15 ,10 on the right. Left input pins will regulate the rotation of motor connected across left side and right input for motor on the right hand side. The motors are rotated on the basis of the inputs provided across the input pins as LOGIC LOW or LOGIC HIGH

**E. Motor for movement**

Motors are the essential part in locomotion of the robot. Rotation of the motor will assists the wheel to rotate. DC-motors are very easy to use. Their usefulness for robotics is very dependent on the gearing available. DC-motors are made much more effective if they have an efficient gear ratio for a particular task.

**F. Motor for vacuum system**

Since main purpose of this robot is used to clean the dirt's it should possess the maximum speed motor to get high speed so that the dirt's will be sucked in, Hence a high Speed DC motor of nearly 20000Rpm is being used, this motor is widely used for high speed applications like cooling fans, suction, RC planes etc. Since it has a high speed at no load this motor has been chosen for the vacuum motor. This motor is very light in weight and has a balanced torque to weight ratio at high speed

## III. OBSTACLE DETECTION

IR sensors are used to detect the obstacle. If obstacle is detected by robot, the robot will stop and change its direction either left or right.

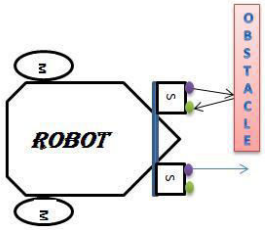


Fig.2: Obstacle detection and avoidance

Initially the robot will move in forward direction. If any obstacle is detected by the sensors, the robot will stop for 500ms and turns either left or right direction. Then it will move to the forward direction.

| A | B | C | D | M1 | M2 | Direction |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | Stop | Stop | Stop |
| 0 | 1 | 0 | 0 | CW | Stop | Soft Right |
| 0 | 1 | 1 | 0 | CW | ACW | Right |
| 0 | 0 | 0 | 1 | Stop | CW | Soft Left |
| 1 | 0 | 0 | 1 | ACW | CW | Left |
| 0 | 1 | 0 | 1 | CW | CW | Forward |
| 1 | 0 | 1 | 0 | ACW | ACW | Backward |

Table.1 : Control process of motor

## IV. INTERFACING METHOD

The output of the both IR sensors will given to the microcontroller. The microcontroller will give the control signal to the motor driver circuit. The motor will run according to the control signal. All the operations are controller my microcontroller.

a) Software used :
CodeVision AVR
Evaluation HID Bootloader

b) Microcontroller :
ATMEGA8

The ATmega8 is a low-power CMOS 8-bit microcontroller based on the AVR RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega8 achieves throughputs approaching 1 MIPS per MHz, allowing the system

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designer to optimize power consumption versus processing speed.

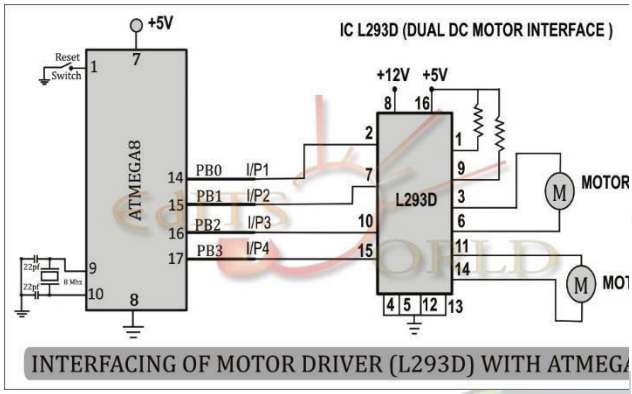



Fig.3: Interfacing of motor driver (L293D) with ATMEGA8

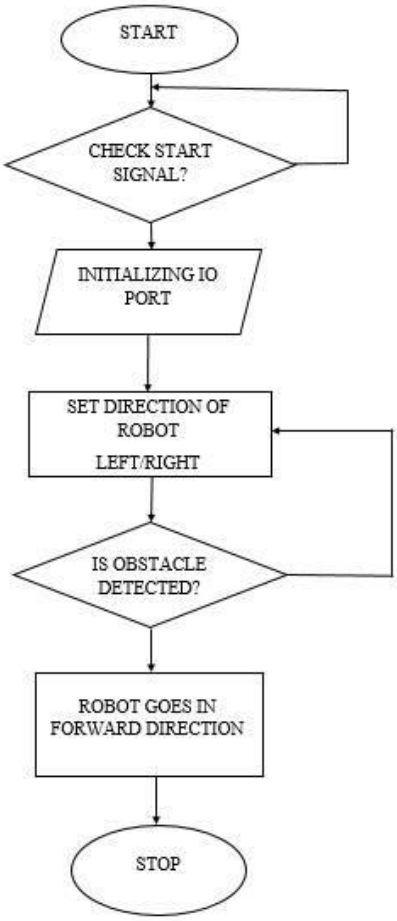
i. Pin 1 or Vss is for supply voltage.
ii. Pin 2, pin 7, pin 10 and pin15 are to input.
iii. Pin 3, pin 6, pin 11 and pin 14 are to output.
iv. Pin 4, pin 5, pin 12 and pin 13 are to ground.

## V. ARCHITECTURE

The flowchart of ARM based obstacle avoiding vacuum cleaner robot is shown in figure. Initially the robot is moving in the forward direction. The vacuum cleaner is connected on the robot. It will clean the floor while the robot is moving. The direction of the robot is controlled by microcontroller. The IR LED continually emits the infrared light. If any obstacle is present infront of the robot, the IR light will break. After detecting the obstacle the robot will get stop for some period. And then it will turn either right or left direction according to the commands from the microcontroller. All the operations will be controlled by microcontroller.

The flowchart gives a clear idea right from the time when IR sensor detects an any obstacle. Once the flowchart is drawn, it becomes easy to write the program in any high level language, first we have to do all start peripherals. For Example – All the circuit will be properly given.

After all the connections get completed then, the robot will work according to the commands.




## VI. FUTURE DEVELOPMENT

Now we are working to make the robot smart enough to detect all objects in any position of room.

In the future we hope to make the robot smarter such that when the robot cleans any room it will save the information about obstacle and its location and if the user want to clean a room it just will restore information and will clean faster.

We hope to make the robot to clean tables such that it can detect edges and it will clean the tables without falling down.

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In the future we are using ultrasonic sensors to increase the distance between the obstacle and the robot.

## VII. CONCLUSION

The designed Vacuum cleaner robot works well for the distance of 80 cm in detecting obstacle and it is cost efficient. The major purpose of this project is to make cleaning process easier especially for working people. The robotic vacuum cleaner is designed for specific area such as under beds.

## VIII. REFERNCE

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