# Design and Development of House Cleaning 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. This robot can remove debris from floor and clean floor by scrubbers. The robot also remove the dirty water and leave floor dry. The various size particles also sucked by vacuum cleaning method. In HCR, suction port, scrubber cleaner, transmitter AT 89C2051-24PI and receiver have been used. The two wheels which are driven by 200 rpm motors. Blower fan has been used to create suction & for power supply battery is used.**

***Keywords*— House Cleaning Robot, Automation, Programmable Robot.**

## I. INTRODUCTION

Robots have entered almost every field, now in cleaning as well. Since the day robots have entered the market household cleaning was changed forever. Robotic cleaners have been adopted in various fields of cleaning right from house hold to big laboratories and research centre. In the year 2010, a new automatic floor cleaner robot "Mint" was developed by Jen Steffen. Detachable clothes were attached for sweeping and mopping purposes.

Here, the HCR has been developed based on the AT89C2051-24PI which works on electric supply and used for house cleaning. This robot can perform operations like clean the floor by scrubber, suck the particles from floor with vacuum created by blower fan, remove the dirty water and try to keep floor as dry as possible. The Robot starts working in forward & backward direction. For automatic operation mode, obstacle detection is needed. So, for that transmitter and receiver circuit has been used. For mopping action water is applied on floor and then scrubber has been used followed by suction for removing dirty water from floor. Mostly the HCR are circular, square or semi-circular in shape 5 to 7 cm high and around 40 cm length with the width of 25 cm. On the top surface mostly the control panel is attached with 1 or 2 buttons or even with some complex pattern.

## II. DESIGN OF COMPONENTS FOR HOUSE CLEANING ROBOT

The main objectives of house cleaning robots are - to remove the debris and large particles from the floor, to clean the floor by scrubber, to remove the dirty water and leave the floor as dry as possible and to suck the dust particles by vacuum cleaning method. To fulfil all the objectives, various equipment like - wide suction port, scrubber cleaner, transmitter and receiver circuit, motors with gear box, wheels, battery set, blower fan, etc. have been designed or selected as per requirement.

Wide suction port has been located at the down side of the main surface, which will allow the dust to pass through it with the air suck by the blower fan and store that particles in the chamber. Scrubber cleaner has been provided to clean the floor and to remove the particles which are stick with the floor.

The AT89C2051 transmitter has been selected which is a low-voltage, high-performance CMOS 8-bit microcomputer with 2K bytes of flash programmable and erasable read-only memory (PEROM). This transmitter provides many standard features like - 2K bytes of Flash, 128 bytes of RAM, 15 I/O lines, two 16-bit timer/counters, a five vector two-level interrupt architecture, a full duplex serial port, a precision analog comparator, on-chip oscillator and clock circuitry. The AT89C2051 has been designed with static logic for operation down to zero frequency and supports two software selectable power saving modes as shown in Fig. 1. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port and interrupt system to continue functioning. The power-down mode saves the RAM contents but freezes the oscillator disabling all other chip functions until the next hardware reset.

Fig. 1 The AT89C2051 Transmitter

The receiver has been selected with embedded microcontroller and 16-Bit RISC architecture up to 16-MHz Clock. This receiver has code security and encryption, enhanced serial communication and ultra-low power Ferroelectric RAM (FRAM) as shown in Fig. 2.

Fig. 2 Receiver

The two motors with gear box are of 200 rpm have been connected with the wheels to provide the motion to the robot. The motor with wheel assembly as shown in Fig. 3. The blower fan also needs motor which runs at 5000 rpm to create enough suction.


Fig. 3 Motor and Wheel Assembly

The battery set has been used to charge the all motors whereas on-off switch has been used to operate the blower motor and scrubber motor both at the same time.

## III. WORKING PRINCIPLES OF HCR

The house cleaning robot can be working on various concepts. The suction has been provided at the foremost end through which dry and minute dust particles are sucked as shown in Fig. 4. The cold water has been sprayed over floor using pipe for wet cleaning which is wiped with the help of rotating scrubber. Using wet suction port, additional water has been sucked which is not required to keep floor dry and clean.

The rotating and pulsating scrubbers which are perpendicular to floor area as shown in Fig. 5 increase the efficiency of cleaning. The mop type cleaner can also be used as scrubbers for fast cleaning.

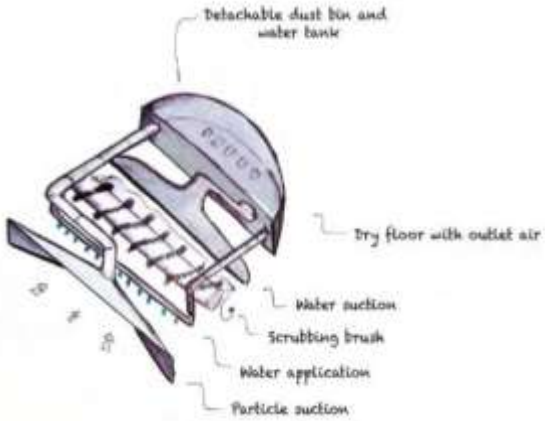


Fig. 4 Components of HCR

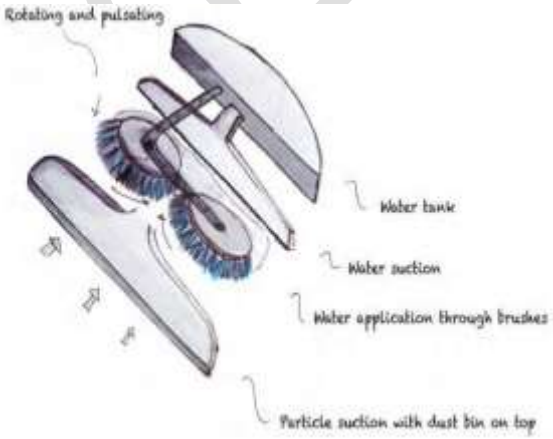


Fig. 5 Working Principle of HCR

The developed concept utilises a one-stroke strategy and implements both the dry and wet cleaning procedures simultaneously. The robot acquires two different cleaning modes - one dry cleaning mode, in which it vacuum cleans the floor and one wet and dry cleaning mode, in which it vacuum cleans and mops the floor. The cleaning robot first suctions larger particles and debris from the floor. Afterwards, fresh water is applied to a rotating cylindrical brush that scrubs the floor. The dirty water is then suctioned off the floor. This means that only fresh water will be utilised to clean the floors, which provides an enhanced cleaning result. The wheels of the robot are placed in front of the wet cleaning mechanism so that the robot does not disrupt the scrubbing of the floor. Hence, in this manner the whole cleaning process is carried out in well sequential manner process by process in an automated way.

The block diagram for electronics circuit as shown in Fig. 6. Here, 12 V rechargeable battery has been used to fulfil power requirements. The micro-controller has been used to make system automatic. This reads the signals from the sensors and according to that gives instructions to the motor drive unit.

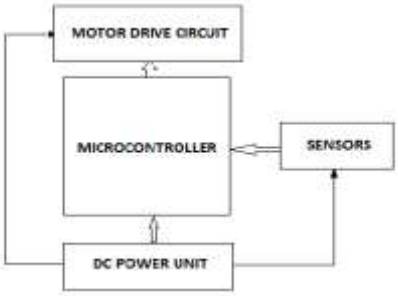


Fig. 6 Block Diagram for Electronic Circuit

## III. FABRICATION OF HCR

The 3D CAD model for assembly of house cleaning robot has been developed using solid modelling software as shown in Fig. 7.

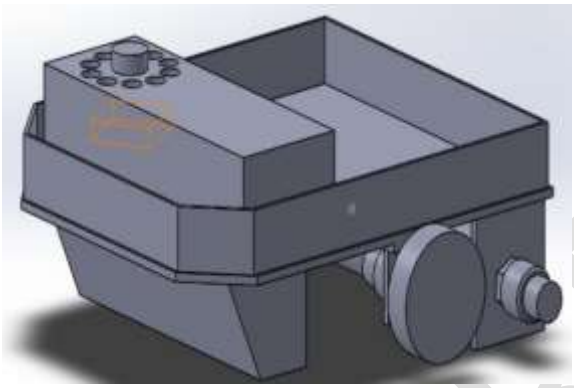

Fig. 7 3D CAD Model of HCR

The outer body of HCR has been made using plywood to reduce the weight as shown in Fig. 8. The wheels have been connected with the two motors which are of k200 rpm and provide enough torque to move the robot with full load condition. At the front side of the robot suction port and at the top side box with blower fan and storage have been provided. At the back side scrubber has been provided and that scrubber is attached with the motor. The transmitter and receiver circuit has been provided which is connected with all motors and 12 volts battery.

Fig. 8 Fabricated Model of HCR

The power is supplied from the battery to operate circuit. So at that time the motion is provided by providing the signal from the transmitter and motor starts to move. The blower fan is connected with the battery so when the switch is on, the fan starts to rotates and produce the suction operation to suck the dust particles from the floor. Those particles are stored into the wooded box provided at the above. When the switch is on at that time scrubber is also stars to rotate which will clean the floor from the dust and also to keep it dry.

### *A. Operating Condition*

Basic use of this robot is to do household work, and as the size of this robot is small so it can go in each corner and clean the floor efficiently. In the places such as hospitals, restaurants, cafes and the homes where kids are not present where so much dirt is not available, there we can use this device.

HCR will provide highly efficient work. This robots are semi or fully automated hence can be easily used by anyone. They come in very small size and compact design which makes its working simple and convenient. This robots are highly intelligent so accurate and precise result can be achieved. Lots of time can be saved. They cannot be used in all places like highly occupied, slope beyond 30 to 35. They are not capable of climbing or descending stairs. Repairing is tedious and costly.

## IV. CONCLUSIONS

The design and development of automatic house cleaning robot has been carried out. The debris and large particles from the floor have been removed and the floor has been cleaned by scrubber using this robot. Various components like transmitter, receiver, battery, motor, wheels, body etc. have been used for different activities. The 3D CAD model has been developed. The actual testing has also been performed after fabrication of HCR. This robots are highly efficient, intelligent, and accurate as well as compact in size.

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