Surface Dweller (The Cleaning Robot)

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Abstract- *The COVID -19 Virus has become a huge issue recently, in these desperate times cleaning and sanitizing the place where we live has become mandatory and essential. For such tasks we obtain the help of modern technologies such as robots.*

There are various types of cleaning robots available in the market, but it is not pocket friendly and many of them only work under a single function such as vacuum or mopping. Unlike those, this project serves as a multipurpose cleaning robot which is manufactured with the help of simple and easily available components. It can be used for cleaning, mopping with disinfectant, vacuum cleaning and it also functions as an RC controlled car. It identifies the obstacles in its path using ultrasonic sensors and so the user can map its pathway accordingly. The RC transmitter can be operated by the user to cover larger areas for maximum cleaning efficiency. The IR remote used to control the robot, can cover a radius of 30 feet between the robot and the controller. This robot specializes in such a way that when it runs in automatic mode it detects the obstacle and plans its movement accordingly. If the user wants it to move closer to the obstacle he can use the RC to control its movement manually. Since this used to be a major issue among many other similar cleaning robots we thought of such mechanisms.

Keywords- Arduino, Remote Control, Autonomous, RC car, Ultrasonic sensor, Vacuum.

I. INTRODUCTION

The world is moving towards the next era which is implementation of robotics in the modern society. A very notable household chore is floor cleaning which is often considered as unpleasant, difficult, awkward and boring. In most cases, cleaners are hired to do the task rather than the household residents do it. The discomfort posed by this recurrent chore necessitated development of a multifunctional cleaning robot that could assist humans with such a task. The current cleaning robots in the market are limited to a single cleaning function, when compared to the multifunctional cleaning robot hence making our robot seems rather beneficial in the view of a consumer. The frontal region consists of the fan which directs the dry dust particles to the vacuum attached to it and then stores it in a separate container fitted within. When the container is filled to the brim the user can remove the vacuum part separately and they proceed to take off the top closing lid to dispose the dust. The cleaning robot also uses 3 ultrasonic sensors fitted at the front, left and right side of the robot to detect obstacles during its movement and sends the data to the user so that, it can be moved to the desired direction using the RC transmitter. The rear end of the robot is fitted with the mopping part and a container which is used to store the disinfectant cleaning solution. The solution is squirted on the floor through a pipeline which is used to regulate the flow. It also has a pair of sponges to absorb the dirty water which is removable when it is completely soaked with dirty water so that it can be cleaned and used again later. The DC motor and the sponges are attached with a conveyer belt which helps in rotation of the sponges thereby cleaning the floor. The robot completely functions with the help of the RC transmitter controlled by the user. Both the vacuum and mopping compartments are mounted on a flat surface consisting 4 wheels which are powered by a servo motor which helps the robot in locomotion. There are specific robots that are assigned to do specific function unlike our robot which is multifunctional.

This robot is fabricated using ultrasonic sensors, an arduino microcontroller, IR transmitter, receiver and simple motors making it relatively cheaper.

II. COMPONENTS

Microcontroller**:**

Arduino Uno uses ATmega328p – 8 bit AVR microcontroller. It consists of 14 digital input, output pins and 6 analog pins. It uses clock speed of 16MHz, contains 2kb of

SRAM and EEPROM of 1 kb and has the flash memory of 32kb. The microcontroller is used to control and coordinate the sensors and other component, Therefore it acts as the brain of this system.

Servo Motor:

Servo motors are used to make rotation in a controlled and precise manner. In this motor we can specify the angle of rotation in means of the degree. It is a pulse controlled motor. The input signals are given in the form of PWM signals. It has the Torque of 1.6 kg/cm, angle of rotation is 180° and the operating voltage is 3.5 – 6v.

Ultrasonic Sensor:

It is used to measure the distance between the object and the sensor, for that it uses the ultrasonic sound waves which has a frequency of 40KHz. The echo mechanism is used to measure the distance between the object and itself (sensor).

Initially, it transmits the sound waves through the transmitter and it senses the output through the receiver. The distance is calculated by the simple formulae of Distance= Speed*Time. Here the time is considered as the duration of the wave to hit the object and return.

Motor driver:

Motor driver is used to produce the sufficient current and voltage required for the motor. It amplifies the input current signals and gives it to the motor which is required for the microcontroller. Here we are using the l293d it contains 16 pins. It has 4 input and 4 output pins respectively. The motor voltage can be given from 4.5v to 36v.It can run 2 motors in the same IC.

Battery:

The battery is used to produce the power for the circuit. e use 2 types of the batteries 12v lead acid battery and 9v battery. The 12v lead acid battery is used to power up the motors that are used by the vacuum cleaner and mopping device. Lead acid battery is rechargeable battery. 9v battery is used to power up the Arduino controller.

LED:

The LED is also known as light emitting diode.it act as the light source in our circuit. It is used to indicate operations that are carried out by the machine.

RGB LED:

Like ordinary led it acts as output light source. Uniqueness of this RGB led is this givers different combinational color according to the input used so it is used to indicate the modes of operation.

Resistors:

The resistors are used to control the current low through the circuit. It helps to precise the flow of the current. It is a non -polar device which means it does not have polarity.

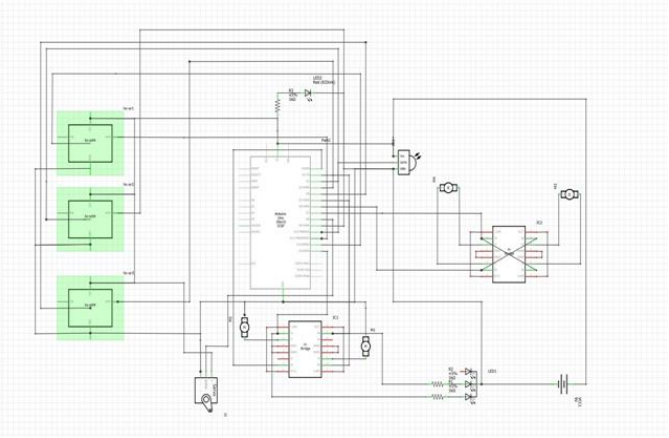
Motors:

Motors are electromagnetic actuator converts electrical energy into mechanical energy. Here we used motors to move the wheels and used in working of vacuum and mopping part. In wheels using help of motor driver it can move both forward and reverse.

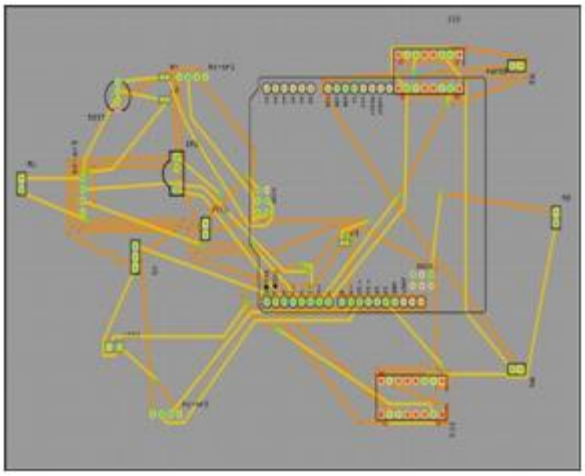
IR receiver and IR remote:

IR remote use the infrared frequency range of 300MHz-400GHz.IR remote can control the devices within 30feet. Each button in the IR remote is used to store different functions.IR receiver receives the signal send from the IR remote and used to controls the device with different functions.

III. DESIGN AND IMPLEMENTATION



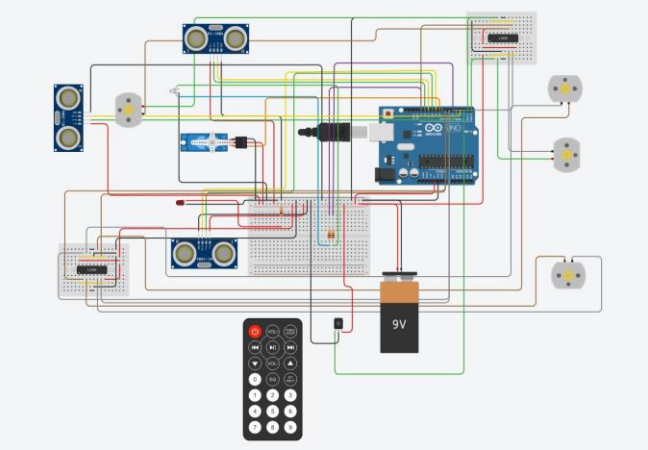
Schematic design



PCB layout

The schematic design serves as a blueprint for laying the components on the PCB and the circuit design is used to verify the working of the whole equipment. So, this schematic and circuit design explains the physical arrangement of wires

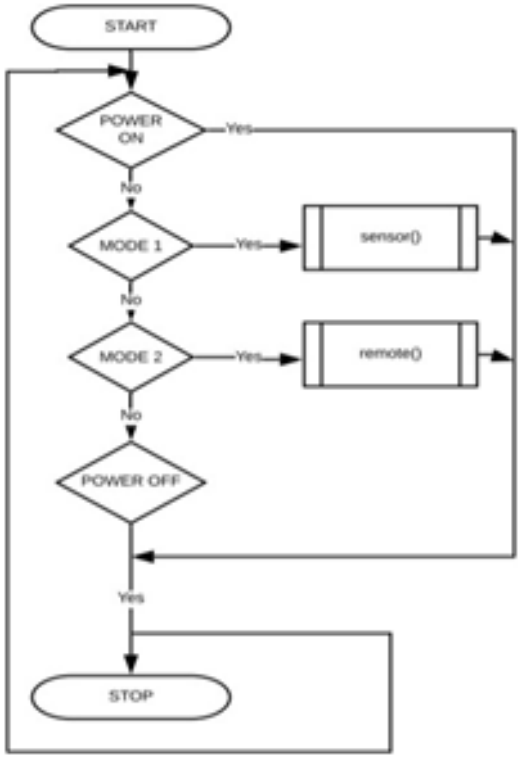
and the components used in this equipment. With help of these designs we can construct a PCB layout. The PCB layout combines routing and component placement on a circuit. This PCB design gives life for electric circuits in physical form.



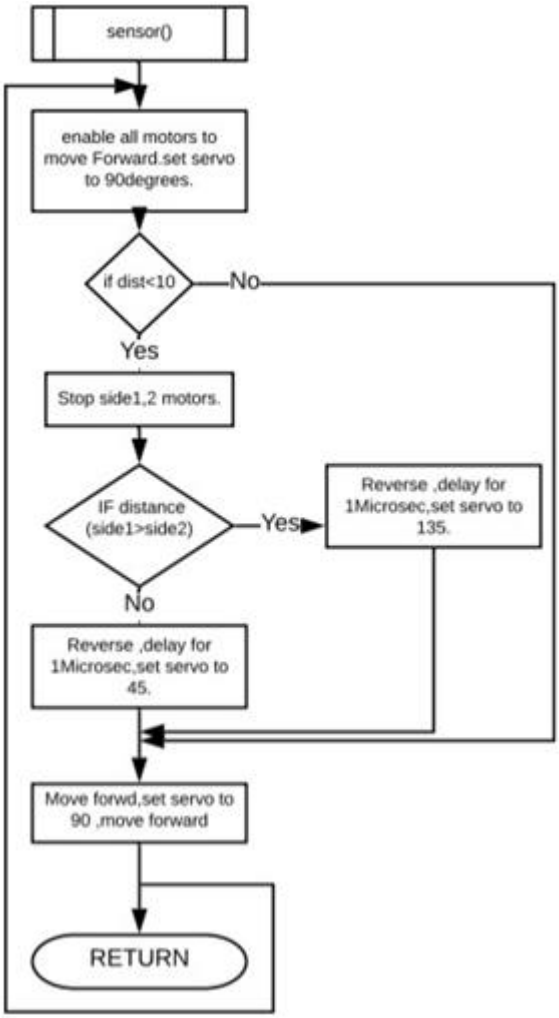
Circuit design

IV. WORKING METHODOLOGY

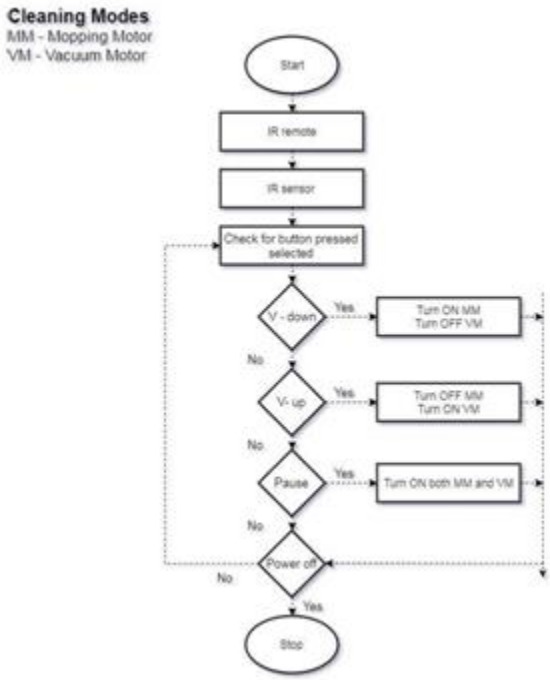
The overall flow of working and operating modes of this product is shown below in the following flowcharts.



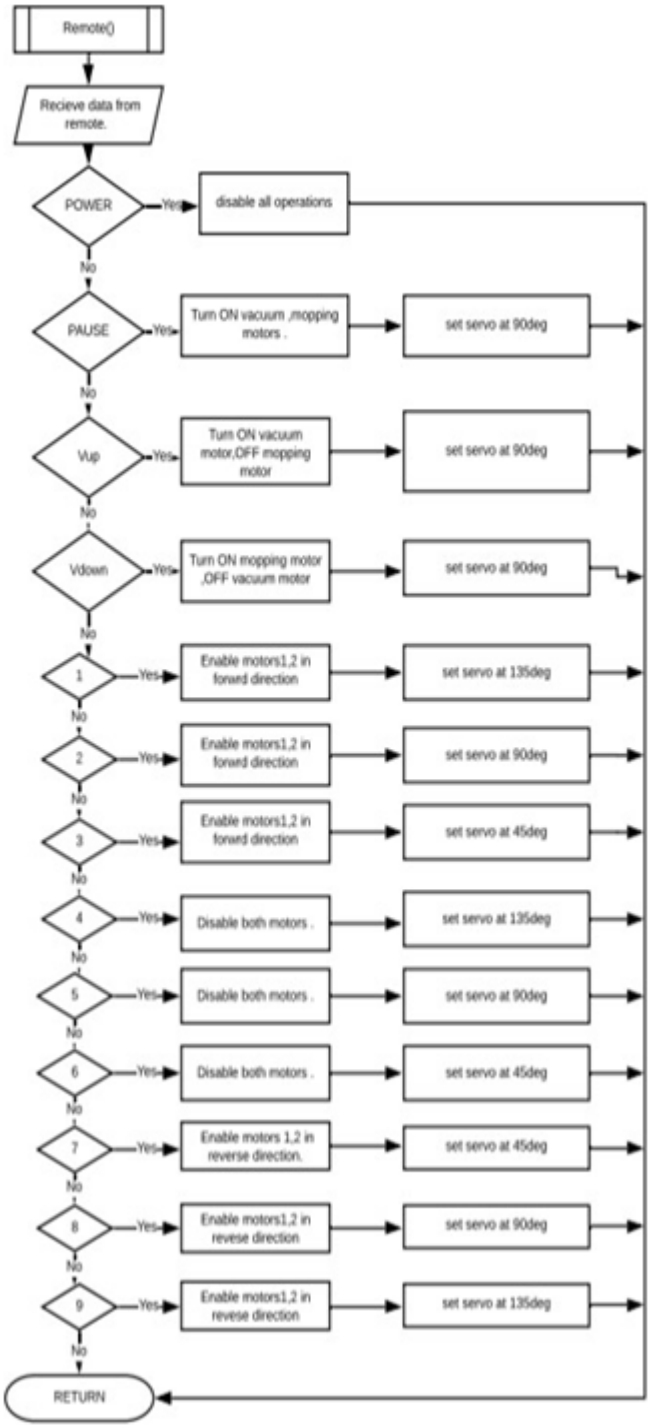
Mode 1 flowchart



Obstacle avoider mode

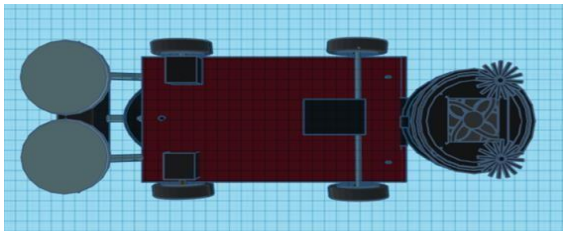


Mode 2 flowchart



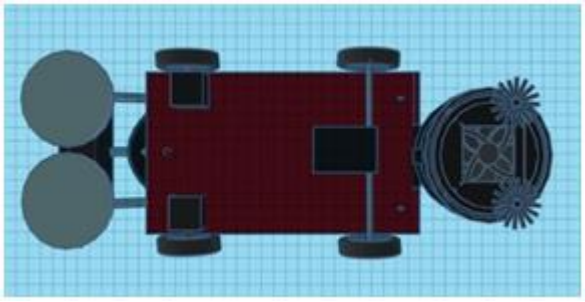
RC mode

V. 3D DESIGN

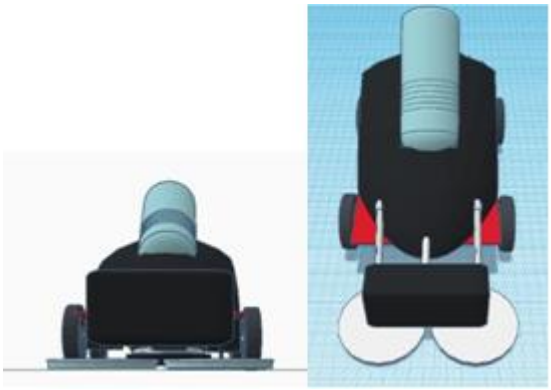


Top View

Front View

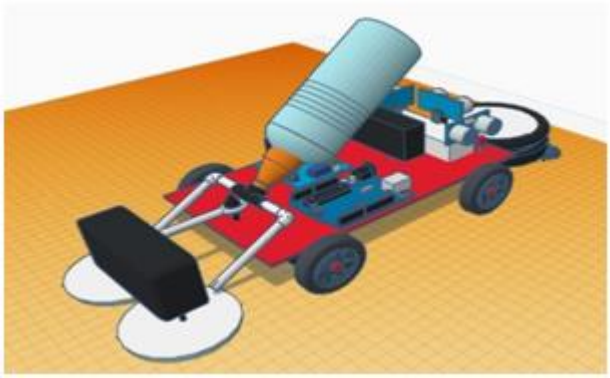


Bottom View

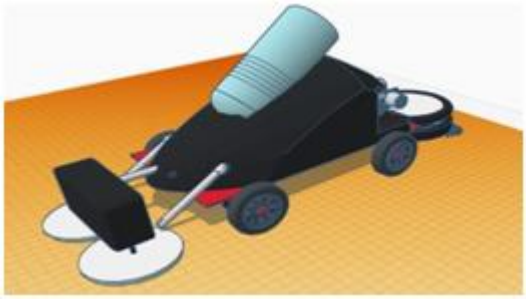


Rear View

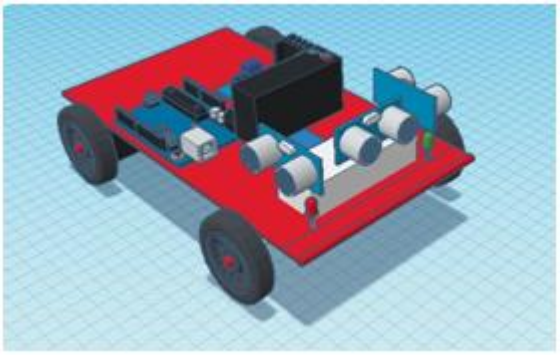
Side view



View without outer cover

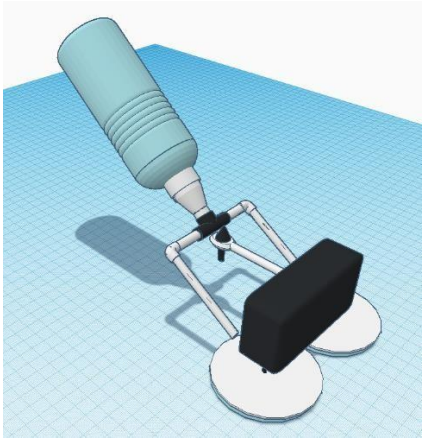


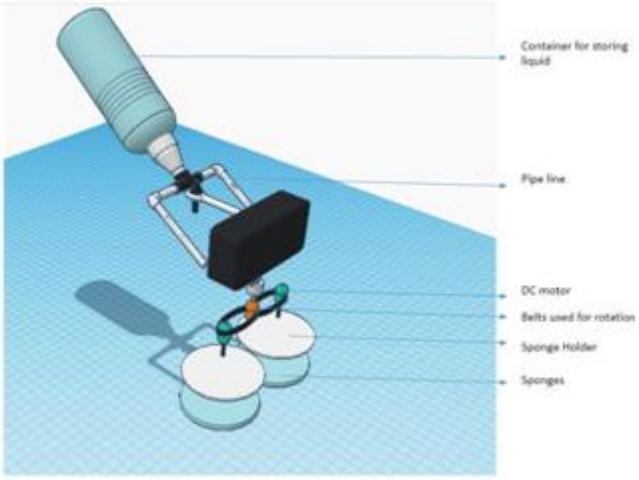
Side view



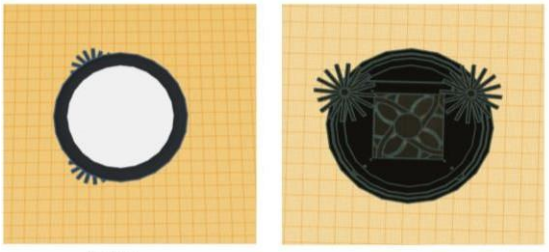
Interior design view

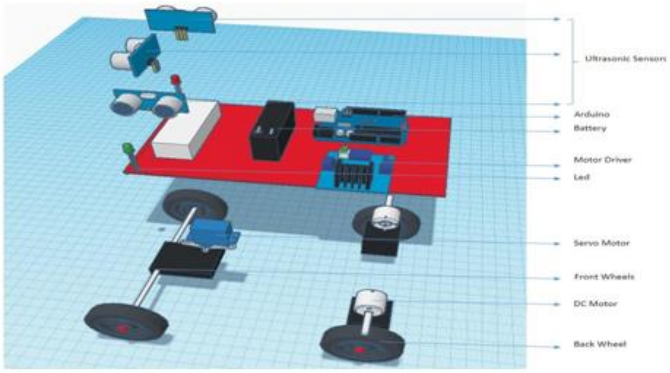
MOPPINGPART





VACUUMPART





VI. DESIGN DIMENSIONS

(Length * Width * Height) in mm

- Base: 230*148*4
- Vacuum part: 150*150*80
- Mopping part: 80*164*100

- Outerbody: 204*140*120
- PCB: 167.25*105.81
- RC car part: 240*160*130
- Obstacle sensing car part: 240*160*130
- Mopping Robot: 335*160*130
- Vacuum Robot:380*160*130
- Vacuum + Mopping Robot: 460*160*130

VII. COMPONENTS LIST

Component	Quantity
Arduino Uno R3	1
DC Motor	4
Ultrasonic Distance Sensor	3
Micro Servo	1
Battery	As required
Red LED	1
LED RGB	1
1 kΩ Resistor	3
H-bridge Motor Driver	2
IR sensor	1
IR remote	1
Jumper Wires	As required
Wheels	4

VIII. CONCLUSION AND FUTURE SCOPE

Poor sanitation and hygiene cause 100,000 child deaths per year in India. The greatest vaccine against this is sanitation. As conclusion, an automated robot was designed with low cost material and a user friendly interface. This robot facilitates efficient floor cleaning with sweeping and mopping functions. The robot works in both manual and automatic modes. It can be operated either as a cleaning robot or can be used as a remote controlled car. Another potential improvement that is made in this design is the crash detection. The robot completely stops if it's too close to any object. The modish design of the robot helps to overcome the basic limitations of the existing robots interms of appearance, capability and payload as well. The robot is also separable and can be operated according to the needs of the user.

Consequently, the next step with this current system will be the optimization it with a WIFI module, so that we can operate the robot with the help of an android device in a larger area.

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