# PROJECT REPORT

# SMART FLOOR CLEANER ROBOT USING IoT

**B.Tech** in Electronics and Communication Engineering **(ECE)**,
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**ECE3501 – IoT Fundamentals (Embedded Project)**

# SMART FLOOR CLEANER ROBOT USING IoT

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*Abstract*— **In the present day, individuals are turning out to be more profession oriented and due to their sporadic working timetable, it becomes testing to keep up with both home and office together particularly for ladies. The vast majority of the cases, they recruit the cleaners to clean the home, office and so forth, however no trust on cleaners. To defeat the issue, Smart Vacuum Cleaner has come up with the greater headway in innovation and is intended to robotize cleaning process. The Bluetooth application is used to initiate the robot. The navigation of the robot is according to the S - curve planning and with the help of sensors it detects and avoids obstacles. To save the hour of individuals the smart vacuum cleaner assists with cleaning the outer layer of the floor without any human intercession.**

*Keywords— IOT, Mobile, Bluetooth, Dust particle*

## I. INTRODUCTION

The Internet of things (IoT) describes physical objects with sensors, processing ability, software, and other technologies that connect and exchange data with other devices and systems over the Internet or other communications networks. The Internet of things (IoT) and Robotics have been hand holding each other contributing to individual growth and development. Robotics is a branch of engineering that involves the conception, design, manufacture and operation of robots. The objective of the robotics field is to create intelligent machines that can assist humans in a variety of ways.

In modern time robots are playing an important role in life of mankind with their advance technologies, making the human life easier and comfortable. The cleaning robot are effective in assisting humans in floor cleaning applications at homes, hotels, restaurants, offices, hospitals, workshops, warehouses and universities etc. so they have taken more recognition in robotics research. Fundamentally, the robot cleaners have been distinguished by their cleaning competence like dry vacuum cleaning, floor mopping etc. Existing products are built based on the obstacle avoidance using infrared sensors or ultra-sonic sensor. The obstacle avoidance-based cleaning robots are relatively time consuming and less energy efficient due to random cleaning but less costly. To give a significant critical thinking to assembling cleaning robot can be worked by using nearby assets and by keeping it low expenses. The Smart vacuum cleaning is built based on obstacle avoidance or Bluetooth controlled or voice command with low cost. This work gives the design and development of smart vacuum floor cleaning robot. The robot can be used in domestic and industrial purpose for cleaning the floor periodically with or without human intervention.

### A. SCOPE OF WORK:

The smart vacuum cleaner robot is built to collect the dry dust particles on the floor with or without human intervention.

### B. PROBLEM STATEMENT:

To design a vacuum cleaner that is programmed to clean the floor.

### C. OBJECTIVES:

The objectives of the project are as follows:
1. To automatically detect and avoid the obstacles. 2. To collect the dust particles into the vacuum.
3. To control the robot using voice commands.
4. To control the robot through application using Bluetooth module.

### D. COMPONENTS :

- Arduino UNO R3
- Ultrasonic Sensor
- Bluetooth Module
- L293D Motor Driver
- Servo Motor
- Vacuum pump
- Batteries
- 6V DC Motor
- Wheels

This paper is arranged into six sections. Section I discusses the brief introduction of Robotics and IoT, section II discusses the literature survey, section III deals with methodology use for robot implementation, section IV covers the implementation., Section V Results of the project and section VI conclusion.

## II. LITERATURE SURVEY

Mohd. Shahbaz Khan et al "Bluetooth control cleaning robot using Arduino". They have designed a robot and the robot is controlled using Bluetooth which is present at both transmitter and receiver end [1].Vijayalakshmi M et al proposed "Smart Vacuum Robot" with progressive technology. S-curve planning is used for efficient working along with sensors to avoid obstacles [2]. Gaurav Dhariwal et al have proposed "Development of Driverless RC Car" [3]. S Yatamono et al proposed a paper on "Development of Intelligent floor cleaning Robot". They have developed a smart floor cleaning Robot that can clean the spot by exploring, sucking the residue and cleaning the floor. The robot comprises of an omni wheel which is furnished with a vacuum cleaner and floor cleaning engine. It is coded in Arduino IDE by utilizing Arduino microcontroller and it is furnished with Bluetooth so that it can work from smart phone connected via Bluetooth [4]. Sabir Hossain et al proposed "Deep Reinforcement Learning-based ROS-Controlled RC Car for Autonomous Path Exploration in the Unknown Environment" [5]. R J Ong and K N F Ku Azir proposed "Low-Cost Autonomous Robot Cleaner using Mapping Algorithm based on Internet of Things (IoT)". Here, sensors are used to detect any obstacle and Arduino is used to control the robot. Mapping is applied so that the robot can clean without any huma intervention once it is switched on [6]. Anbumani V et al proposed a paper "Development of Ingenious Floor Cleaner using ARDUINO". Here, different modes of cleaning available such as mopping, sweeping or both mopping and sweeping is discussed. For controlling the robot, Bluetooth module is used and other functions are coded in Arduino. This can even clean corners of the floor [7]. Md. Farhanul Islam et al have proposed "Designing and Optimization of An Autonomous Vacuum Floor Cleaning Robot". Here, an economic prototype is designed using Arduino Mega and Raspberry Pi. GPS module is also present which helps the bot to move in the right direction [8]. Anshu Prakash Murdan et al proposed "A smart autonomous floor cleaner with an Android-based controller". Here, a bot is designed which can be controlled through Android. By using the application, the bot can be turned in the desired direction [9].

There are many existing paper and models that represent the additional features for cleaning robot [10 - 12].

## III. METHODOLOGY

*A. Design:*

i.   RC car:

The construction of RC is as car is as follows. In a form board hole are made in specific areas. To these places, using Glue gun the motor is fitted, motors are attached with wheels. Motors are soldered with wires - positive and negative. RC car is built by using 4 DC motors they run with the speed provided in Arduino IDE code, it uses motor shield to work in desired speed and direction. Ultrasonic sensor attached to RC car detects the distance at which obstacle is present in front of it. So, whenever it encounters any obstacles such as walls, tables, chair or any big things that cannot be considered as garbage or dust, RC car which carries vacuum cleaner changes its direction so that it won't crash and destroy itself. The code fed to the Arduino runs continuously and the cycle repeats in regular intervals whenever the obstacle is detected. The RC car is also controlled by voice command or joystick movement in android app using the Bluetooth module. The respective code we have to upload in the Arduino while using a particular mode for the motion. The batteries are placed on the form board.
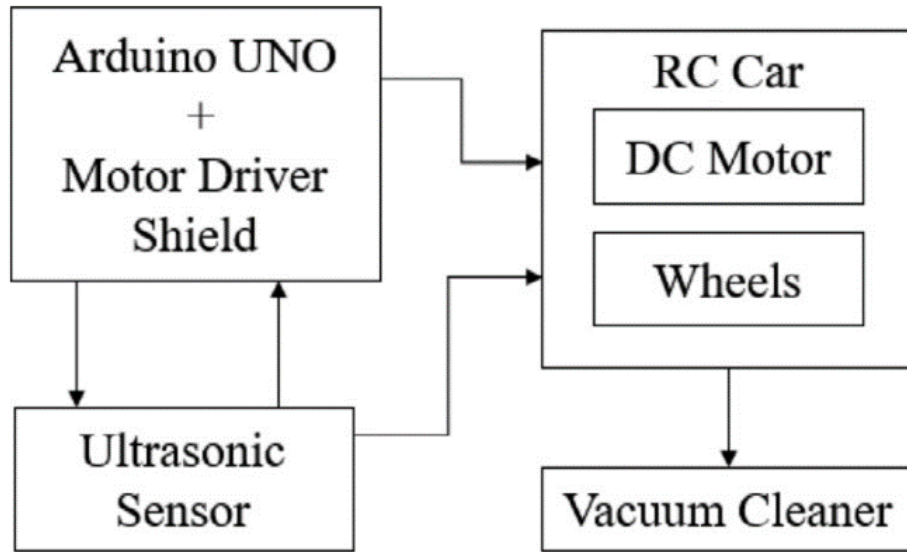
ii.   Vacuum cleaner:

Vacuum cleaner is made up of 750 mL water bottle, fan, pipe, tape, plastic net, batteries and switch. The steps to design the same is described below. Steps to create the vacuum cleaner:

- 750 mL water bottle is cut into half horizontally Top portion has conical and cylindrical structure;
- The conical structure is cut the bottle cap area is attached with a pipe as shown in the image.
- The other end of conical structure is covered with a plastic net to improve the vacuum.
- Now, the cylindrical part which was separated in step ii is taped with the conical part which has the plastic net.
- The other end of cylindrical structure is attached with a fan.
- It is given with a 3.7 V supply so as to develop the required vacuum.
- Switch is also attached to the side.

*B. Block Diagram:*

Here, Motor Driver Shield is placed on top of Arduino Uno. In the front of the prototype, Ultrasonic sensor is attached which is used for object detection. Towards the front of the car, vacuum cleaner is placed. The vacuum cleaner holds the Fan.



Block diagram

IV. *IMPLEMENTATION*

7.4 V and 3.7 V supply will be given to RC car and vacuum cleaner respectively, once the car is started it measures the distance between obstacle and vehicle by using ultrasonic sensor, further it moves in the forward direction as per the code in Arduino IDE. If the distance is less than 30cm then RC car stops and reverses for a second and then moves towards left side and measures the distance, again it gets back to its original position. After that it turns right and stops for a second, after which it gets back to its original position. After measuring both the distances, whichever distance is greater car starts to move in that direction to avoid the collision with any objects. If there are no obstacle in its path it travels in straight direction without turning until it encounters any obstacle. The process repeats whenever there is an obstacle in the path.
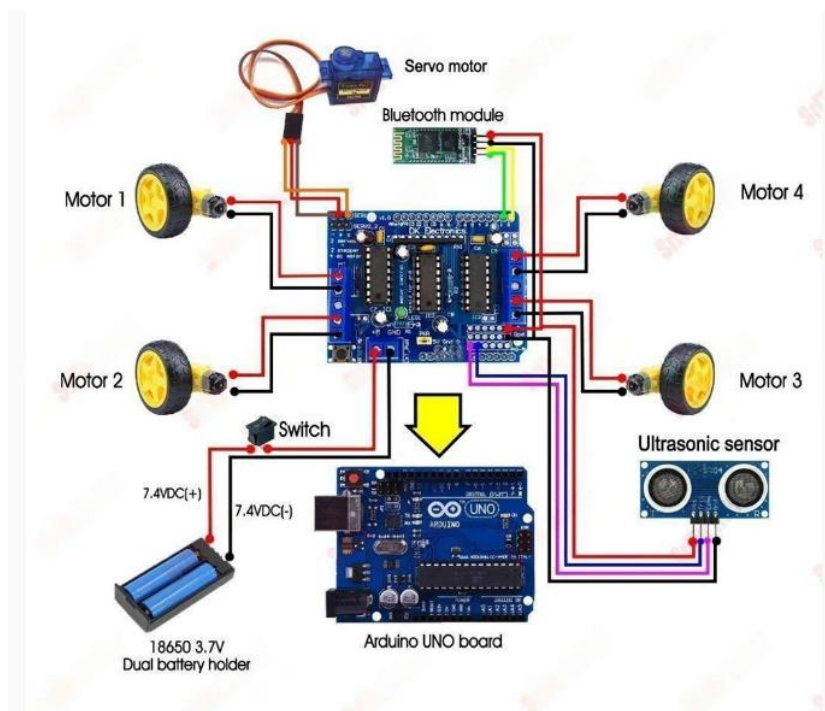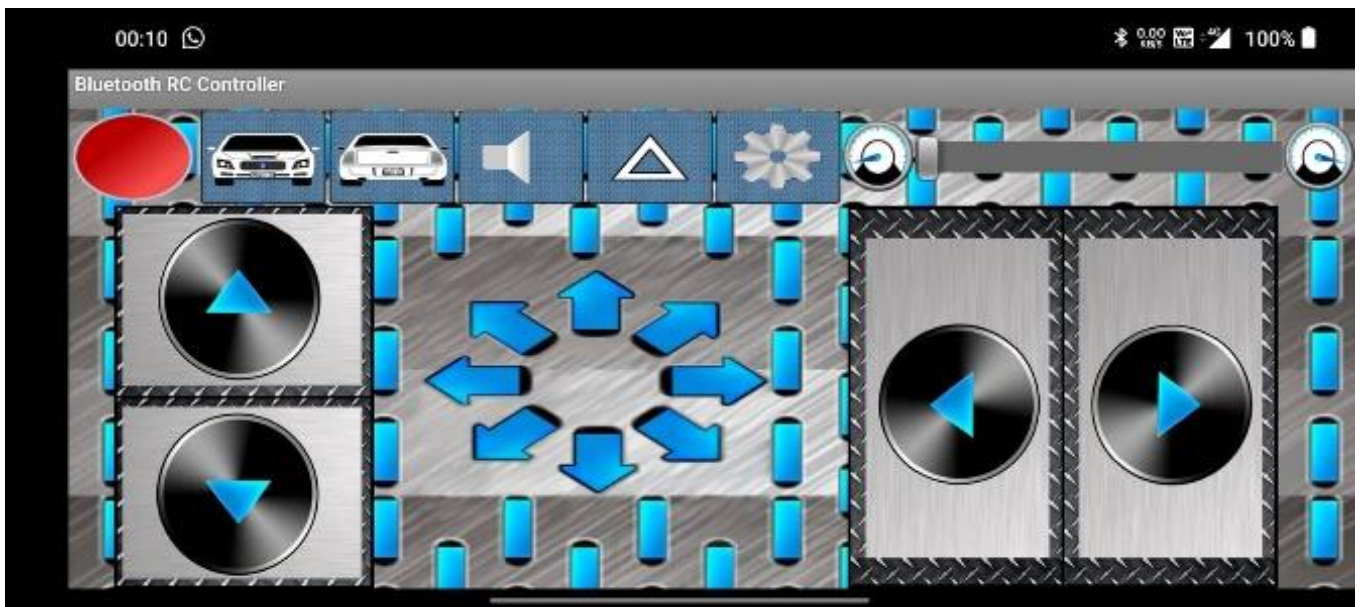


Circuit Diagram
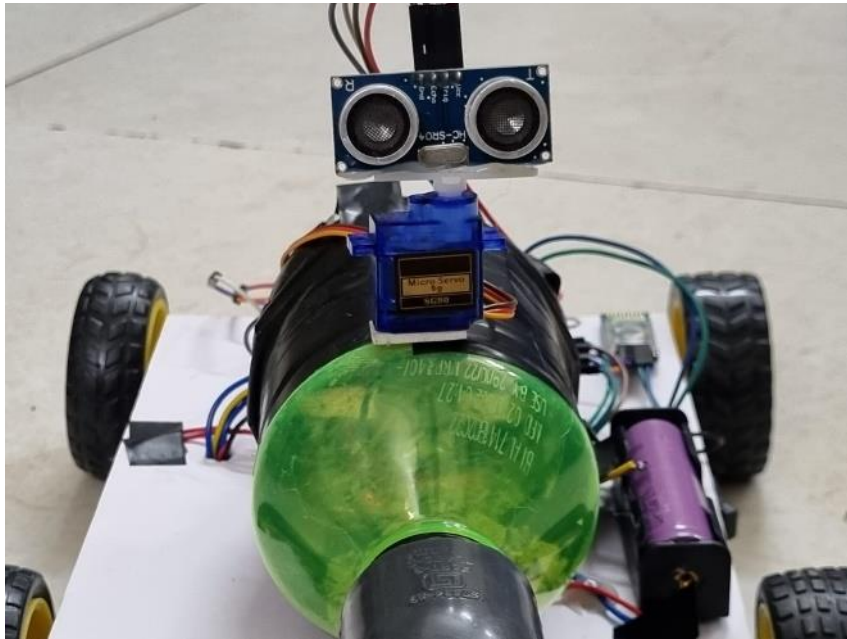
Obstacle Avoidance

By the Bluetooth module we can connect it with our android app and we can control the motion of the RC car using the joysticks present in the app. For that first we need to upload the Remote-Controlled module code in the Arduino UNO. By this we can manually control the RC car and make it to collect the dust particles.



Android app with Joystick option

By the Bluetooth module we can connect it with our android app and we can control the motion of the RC car using the Voice command present in the app. For that first we need to upload the voice command module code in the Arduino UNO. By this we can manually control the RC car and make it to collect the dust particles.
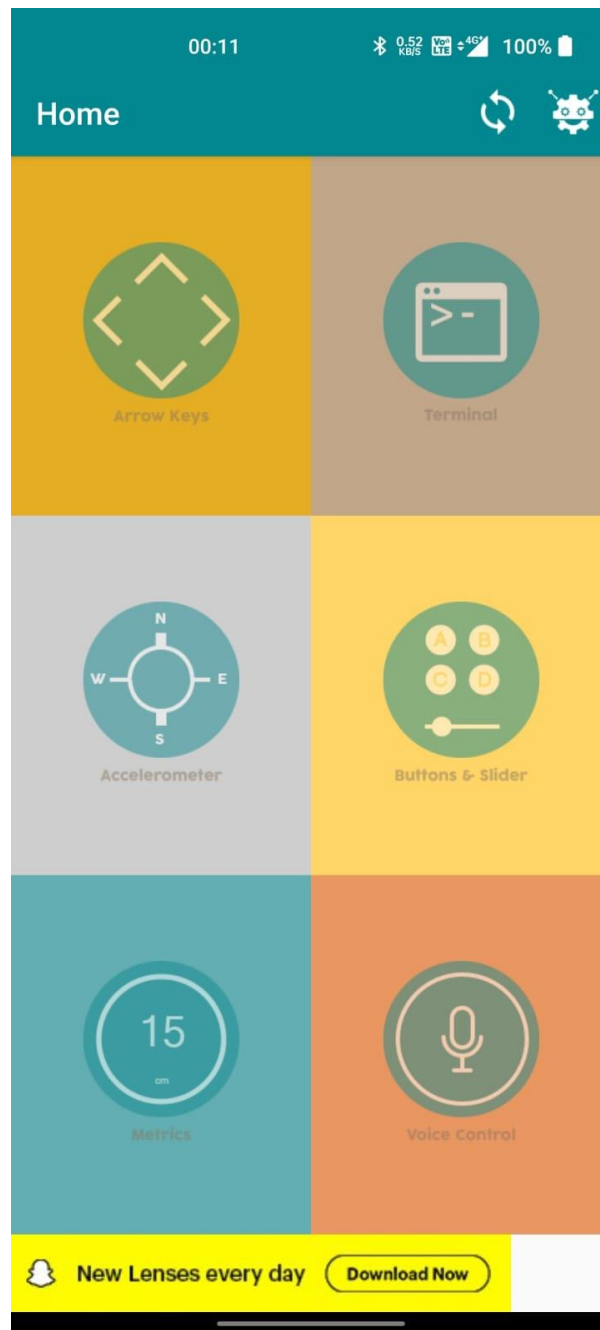
Voice control using app

Table 1 shows the modules of the proposed solution and their specifications.

*Table 1. MODULES AND SPECIFICATIONS*

| SL.No | Modules | Specifications |
|---|---|---|
| 1. | *Battery* | 1800 mAh |
| 2. | *Vacuum Size* | *250 cm³* |
| 3. | *Bluetooth Range* | 20 m |
| 4. | *Robot Weight* | 1 kg |

## V.  RESULT

The Smart vacuum cleaner is constructed and it can able to run automatically or manually using Obstacle avoidance module and Voice Command module respectively. Which can be uploaded in the Arduino UNO using Arduino IDE.
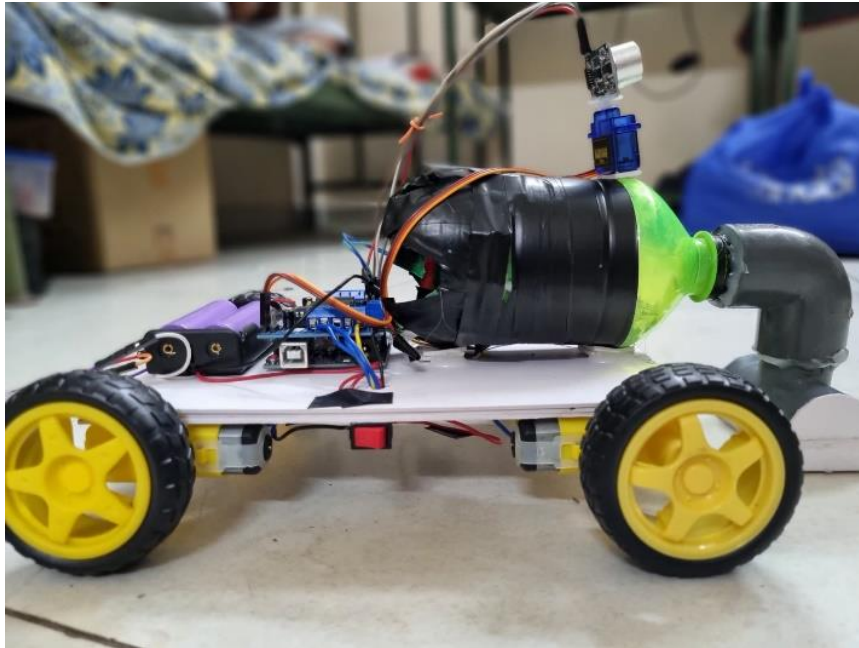


Side view of the smart vacuum cleaner



Smart vacuum cleaner collecting Dust Particles

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