

## **Cleaning Robot with Android Application Controller**

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**Abstract:** This research aims to discuss the development of cleaning robot using Arduino and Android application controller. Robot vacuum cleaners were developed to make cleaning easier, rather than using handheld vacuum cleaners including dry cleaning, wet cleaning and dust collection. Then send the output to the Arduino which controls the movement of the cleaning robot. In order to facilitate the execution of certain functions, interactivity plays an important role together with the binary signal sent to the robot via Bluetooth. In this research, a robot vacuum cleaner with an intelligent interface was developed. With the help of the HC05 Bluetooth module, users can use Android smartphones to control their sports remotely. There are two functions: dry cleaning mode and dry cleaning mode. Both wet cleaning modes work when the user turns on the robot to control its movements via the Android app on the smartphone. As a result, a prototype of the robot was manufactured and tested.

**Keywords:** Cleaning robot, Binary signal, Bluetooth, intelligent interface, Android application

### **1. Introduction**

An *automated robot cleaner* is a machine that uses incredibly stabilized and rapidly functionalized digital and mechanical manipulation machines to make the cleaning process more manageable. Cleaning the dirt is one of each day responsibilities that need to be finished. This is a not unusual place incidence now no longer most effective at domestic, however, in agencies and retail malls. Because cleaning the floor takes time, it is not unusual for different responsibilities to be disregarded. Floor cleansing sports in public regions need to be executed in any respect times; it is not always sufficient to agenda them within the morning or evening; the janitor must be too easy to ground in any respect times. Various forms of generation had been advanced to resource people of their each day responsibilities.

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One of them is the robots generation that has been advanced. Robots can take over human responsibilities that need to be finished on a normal or abnormal foundation at some stage in unscheduled times. In phrases of floor cleansing, robots need to be advanced instead of ground cleansing officers. A robotic named Roomba changed into advanced withinside the United States in 2002 [1]. iRobot manufactures Roomba's automated robotic vacuum cleaner. Roomba changed into added in September 2002 and consisted of several sensors that permit it to ease the ground. Roomba, for example, can regulate direction while it comes through obstruction and discovers unclean patches at the ground. However, there are different components of Roomba's robotic that are probably improved, including the truth that due to the fact the robotics' frame is round, a few regions at the ground nook cannot be reached. Furthermore, due to the fact this Roomba robotic can most effectively choose up dirt and does now no longer consist of additives to shine the ground, grimy spots at the ground remain.

H. Dogan, A. Eren has presented a low-cost and high-performance vacuum cleaner robot with autonomous algorithms such as random walk and snake algorithms controlled through smartphones. In this paper, the cleaning robot can operate autonomously and manually. The robot cleans the room by navigating around obstacles using an algorithm that has been chosen in autonomous mode. A cliff sensor is used to prevent the robot from falling from the stair area, and users can also operate it using a smartphone. The navigation techniques employed were the random walk and snake algorithm. With advanced sensors like the camera and lidar, the robot's position can be trace because the robot does not know its specific location and cannot schedule its navigation. It must clean the exact room multiples times, which lengthens the cleaning process [2].

R. Dalimunthe, M. Sena, W. Ramdhan has implemented the Floor Cleaning Robot Control System with Android-based voice command. The cleaning process can quickly be done since it can direct the robot's movement to clean the floor by tracing each side of the floor. The robot's movement can be controlled with the Arduino Uno microcontroller control connected with a Bluetooth connection. The robot will operate based on the voice command given with specific words on the Android voice control smartphone. It is required to utilize an additional control device in the form of the relay with a voltage of 24 volts to connect equipment with more power when putting this robot into action [3].

P. Khaushik, M. Jain, G. Patidar, et al. have described a cost-effective robot that might be utilized even by persons who cannot afford the luxury and branded cleaning robot. There are many different types of autonomous robots on the market, all of which perform precisely based on their specification, but none of them are cost-effective. This paper discussed the specifications of a vacuum cleaner in airspeed, airflow, suction power, output power, input power, weight, noise in decibels, and the power cord length. However, the project has its limitation which the aspiration is not that great, so it only collects dust efficiently [4].

In this paper, a machine for domestic cleansing is built making use of the HC-05 Bluetooth, Arduino, servo motor, and DC Gear Motor, where the cleansing robotic cleans the room in a moist or dry mode in keeping with a person's demand that has managed through an Android application. India is an unexpectedly growing us of a that embraces all new technological advancements. As a result, a product is designed, is price-powerful, taking into thought the monetary scenario of the people. The self-sufficient robots advanced for domestic cleansing, including iRobot, iScoba, and Dyson, price over a thousand dollars, which now no longer each person can afford, so making it a touch greater price powerful could be a terrific deal. Dyson, Neato, iRobot, hom-bot, Samsung, and greater agencies make smart floor cleaning robots. The robots being defined right here are smart cleaners for domestic use. Cleaning robots are available in a variety of shapes and sizes, relying on their production and function. The following are the categories:

I. **Handheld:** Handheld vacuums are incredible for cleansing the agonizingly difficult-to-attain regions that require instantaneous attention. It may be treated single-handedly because the names suggest.

II. Canister: Canister vacuum cleaners are a terrific compromise among upright and stick vacuum cleaners. They have the same abilities as upright cleaners, but they have a slimmer facet than stick cleaners. In this case, a separate canister is coupled to a protracted wand used to keep each included and uncovered floor surface. Given its routinely ahead and multi-realistic concept, this kind of vacuum cleaner tends to face the various maximum costly possibilities.

III. Upright: These fashions are the maximum ability to maintain the house while additionally offering the spontaneous gain of competencies and extras, which can be typically trustworthy because maximum people have used an upright vacuum cleaner as a minimum as soon as of their lives. Most fashions have settings that permit those vacuum cleaners for use on each included and exposed surface.

IV. Stick: These vacuums have a knack for moving into tight spots and installing many hardwood floors, territorial mats, and soft carpeting. This vacuum cleaner has a protracted stick-like deal with and a narrow design. This model's small profile makes it an incredible addition to any garage room because it tucks nicely into top corners as soon as its cause has been fulfilled.

V. Autonomous: These vacuums can freely wander around the house, vacuuming up any small messes that get in their way. They prevent time and can accomplish places in which large vacuums could be not able to. One of the enormous maximum risks of robotic vacuums is their excessive price.

### 1.1 Objectives Project

The main purpose of this project is to produce a smart cleaning robot using Android application. To ensure this goal is achieved, objective are listed as follows:

- (a) To design the cleaning robot with android apps controller by using Arduino Uno.
- (b) To design a suitable shapes and sizes for the smart cleaning robot.
- (c) Analyse the efficiency of smart cleaning robot.

## 2. Materials and Methods

The materials and methods section, otherwise known as methodology, describes all the necessary information that is required to obtain the results of the study.

## 2.1 Materials

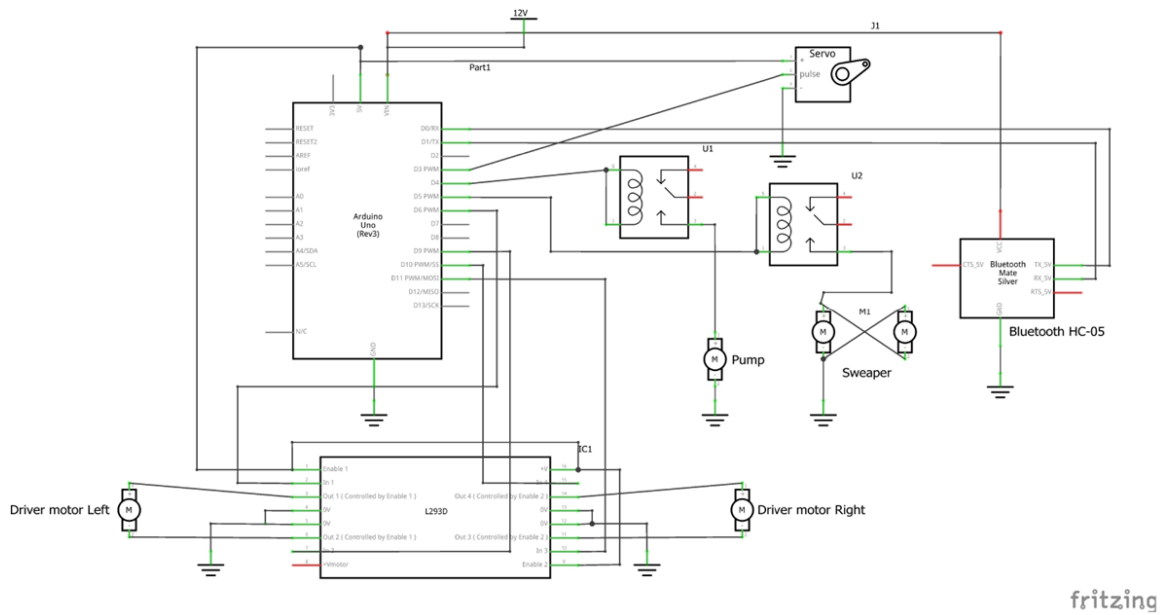
**Table 1: Details on Materials and Their Functions**

No.	Materials	Functions
1.	Plywood	Base for all components
2.	12 V Rechargeable Battery	To supply power for the whole robot
3.	Arduino UNO R3	An open source microcontroller board meant to make the application more accessible
4.	DC motor	Converts direct current electrical energy into mechanical energy
5.	Relay	To work as electrical switch
6.	L293N Motor driver	To supply power to dc motor for movement of robot
7.	Water pump	To pump water for wet cleaning
8.	Servo motor	To move paint roller 90
9.	HC-05 Bluetooth	To receive binary inputs from phone and send to Arduino

**Table 1**, refers to the materials and components used to construct the project after the material selection process has been completed. Each component and material are categorized and chosen according to their functionality for the project, as Michael [5] said.

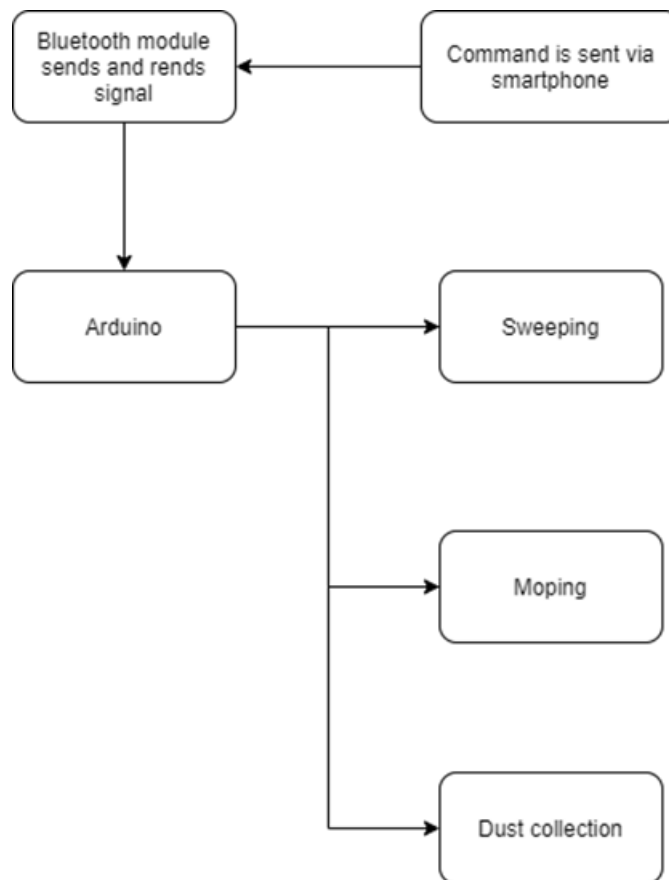
## 2.2 Methods

First, a schematic diagram has been drawn to see connections and arrangement of each component. The schematic diagram in **Figure 1** illustrates the arrangement and connections of the components. The application used to draw the schematic was Fritzing [6].



**Figure 1: Arrangement and connections of the components**

After that, a programming code is uploaded to the Arduino to carry out various tasks. The Bluetooth module is connected to the Arduino, and the Arduino handles the signal sent by the Bluetooth module. The Bluetooth module receives command signals from the normal smartphone. **Figure 2** is a block diagram that explains the process of the robot.



**Figure 2: Block diagram the process of the robot**

### 3. Results and Discussion

The results and discussion section presents data and analysis of the study. This section can be organized based on the stated objectives, the chronological timeline, different case groupings, different experimental configurations, or any logical order as deemed appropriate.

#### 3.1 Results

**Table 2: Operation of Cleaning Techniques**

Cleaning Techniques		Description
Dry Method	Sweeping	Sweep the rubbish to the edges. The most commonly used method.
Dry Method	Dust Collector	Collecting the dust to the centre.
Wet Method	Mopping	Liquid solutions are sprayed to the floor and the mop will start mopping the floor.

**Table 3: Bluetooth Connectivity**

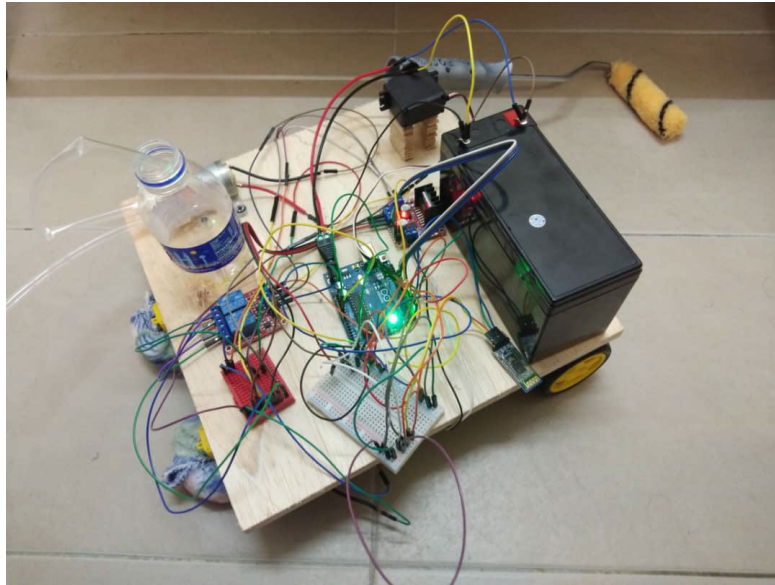
Range (meter)	Bluetooth Connectivity
0 - 4	Strong
5 - 8	Medium
9 - 10	Weak

**Table 4: Battery Usage**

Usage	Battery Life
Motor with high speed	Medium
Motor with low speed	Low
Motor + Sweeper	High
Motor + Sweeper + Water pump	Very high
Motor + Sweeper + Water pump + Dust collector	Very high
Dust collector	Low

**Table 2** refers to the cleaning robot's cleaning techniques, which will operate when the project is complete. The robot is being operated in dual modes. In one of the modes, the robot in dry mode can sweep the rubbish and collect the dust while in wet modes, the robot can spray the liquid cleaner to the floor and mops the floor. **Table 3** refers to the Bluetooth connection for the robot using smart phones. **Table 4** refers to the battery life of the robot. The more components apply at one time, the more power

is used during the cleaning process. The rate of battery power used is based on its usage [7]. **Figure 3** shows the final prototype of Cleaning Robot with Android Application Controller that has been implemented in this project.



**Figure 3: The final prototype of Cleaning Robot with Android Application Controller**

### 3.2 Discussions

The collected data shows that the effectiveness of the cleaning robot in terms of battery life, Bluetooth connection and dual robot mode has been verified. Dual mode allows users to switch from one mode to another simultaneously by simply sending a command from their mobile phone via Bluetooth. Since Bluetooth is a standard feature of smartphones, the connection with the smart cleaning robot is effortless and reliable. Therefore, no special software is required to control this Bluetooth control robot.

## 4. Conclusion

Many cleaning and mopping robots are on the market, but only a few are acceptable and inexpensive. There are not many robots that can do cleaning and mopping at the same time. We want to reduce the cost of robots and make them more convenient for the industry. They are widely used in industry for mass production of consumer and industrial products. To be widely used in homes and industries, robots must do their jobs correctly, be easy to use, and most importantly, be inexpensive. A vacuum robot makes cleaning and mopping the floor easier. It can be done by pressing a button, and the robot will complete the task. It also reduces the time required for wiping and will prompt us to design and build an autonomous cleaning and mopping robot, which can complete all cleaning and mopping tasks at the push of a button. With the aid of a mobile Bluetooth device, this robot may be operated manually. Floor cleaning is manually controlled by a smartphone so that the robot can clean the relevant area.

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