

# Wireless Automatic Floor Cleaning and Safety Indicator Robot

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**Abstract** - An amalgamate of a robot which will enable cleaning the floor with the help of a very stable, quick and highly functionalized electronic and mechanical control system and is completely wireless. Cleaning has always been one of the essential needs of the current generation. Especially in household floors, the floor has to be cleaned regularly. There are many different techniques which are used to clean the different types of surfaces depending on the application. The strut has been made using a Foam Board but can be easily upgraded. During the cleaning and moving operation of the robot a temperature sensor is connected to detect the room temperature if the temperature is anomalous then it will be indicated by a led signal this will be useful in case any catastrophe like a fire outbreak strikes or a sudden change in weather. A gas sensor is used to continuously detect the presence of gas particles in the surrounding atmosphere which will be very useful in case there is a gas leakage in the surrounding environment, the presence of gas particles can be wary and is thus indicated by a LED signal. A vacuum pump is used to precipitate the water on the floor and a scrubber is used for scrubbing the floor. Emphasis has been put into rarefying the model. The model also has been made prudent so future modifications are possible.

**Key Words:** Automatic Floor Cleaning, Mopping Wireless Robot, Gas Detection, Temperature Sensing, Humidity Sensing, Safety Indicator, Bluetooth Enabled Cleaning Robot, Gas Leakage Indicator.

## 1. INTRODUCTION

Cleaning has quickly become one of the most important basic needs of the society in the current generation. In household floors, the floor has to be cleaned regularly. Techniques used to clean the various types of surfaces. Floor cleaning is important because of the following reasons-

- Bad practice and mistakes in floor cleaning are the cause of accidental injuries and death in severe cases.
- Clean and beautify the floor.
- Removing Debris and obstructions.
- We have to remove the Dust and Allergens.
- Wearing of Surface is to be avoided.
- Make the environment more sanitary and safe especially the kitchen.
- Provide a means of alerting the consumer that something is wrong with the house.
- Traction to be maintained at an optimum level so that there is no slipping on the floor.

Floor cleaning is achieved by a different technique which might be of different kinds this is because various distinct

types of floor need their own unique type of treatment. The floor should be properly dried once the cleaning is completed or else it might result in a hazard. On some floors, wood dust is used to absorb all kinds of liquids. This will ensure there is no need for preventing the water from precipitating. The wood dust had to be swept and replaced every day. This process is still used with butchers but was way more common in bars in the past. Sometimes, tea leaves are used to collect dirt and odor from carpets for removing them. Numerous floor cleaning machines are available nowadays like floor buffers, extractors and automatic floor scrubbers which can clean almost all types of hard or carpeted flooring surfaces efficiently and in very less time compared to the more traditional cleaning methods. Here again, the cleaning would be different for different floorings.

## 2. AUTOMATION

Floors are basically cleaned by using a hard cloth or plastic-like material called scrubber or mop and rubbing the floor with it. Therefore, the design of the scrubber is one of the most important tasks while cleaning floors. The scrubbers motion may be rotatory or harmonic depending on the type of material used or the surface being cleaned. Normally we use a hard material like a heavy cloth to make the scrubber. The purpose of a scrubber is to clean the surface completely and also to soak the water or liquid which is used for cleaning. We are using a scrubber which is made up of an absorbing cloth wound over a metallic/cylindrical rod. The scrubber has an additional purpose of directing the flow of dirty water towards the direction needed we need. Sometimes we need to clean a particular single spot more than once. For this purpose, usually, a harmonic motion is used which enable better removal of debris. However, in our case, our purpose is to clean household flooring so a relative rotation of scrubber has been made to achieve the required purpose. The process of using different components to make the whole machinery process operate automatically and using any Bluetooth device. We have used a microcontroller and a Bluetooth controller to control the various sensors and robot. We use different power sources and they have to be operated at a different time so we use a microcontroller for the purpose. For our purpose, the microcontroller is to make all the systems work in proper sequence and to move according to the image sensed. Image sensing is basically achieved by the ultrasonic sensors. These sensors work according to the passive type of sensory circuit. This system of ultrasonic sensor sends ultrasonic range wave and the wave reflects after encountering any obstacle. This retraced wave is then sensed by the sensor circuit which is then calculated as the distance of the obstacle.

### 3. LITERATURE SURVEY

Traditionally the floors are cleaned by hand using usually a broom or a mop. Sometimes floor is washed by different reed brushes. In ancient times, Egyptian houses were built of sun-dried mud bricks usually whitewashed and the floors were stamped earth. The outdoor kitchen floor was always simply the ground baked stone hard by the sun. It rarely rained so the floors were easy to keep clean by sweeping. Like other common ancient Egyptian tools, the brushes did not have long handles which would have rendered their use less difficult, and they required bending low when using them. For ease of human beings, the different designs of brushes have now evolved for our ease of use. During the monarch's age, the carpets of different designs were utilized to cover the floor and to keep it clean. As the time passed we entered a new scientific era which brought a lot of new methods are now developed to clean the floor. The first among them is the reciprocating action of brush which is accomplished by muscular force. The brush design has also changed a lot with time depending upon the ease of washing personnel and floor structure. After the discovery of electricity, it too had a unique role to play, vacuum cleaners were invented to clean dry surfaces. In modern days different floor cleaning machines are being invented which can easily clean the floor with less application of muscular power. Then comes the concept of a wireless mobile robot. Wireless mobile robots have the capability to move around in their environment while not being fixed to any one physical location. In contrast, the industrial robots are usually much more always stationary, they also always consist of a jointed arm and the gripper assembly, attached to a fixed surface.

For the help in the households, the first-floor cleaner was manufactured around the 80s. In that early equipment, the aim was to wash the floor with least power utilization. There sweeping mechanism of mop was always actuated by a timing motor which was controlled by a dc circuit. Here the water is sprinkled on the mop and hence a wet mop is used to clean the debris from the floor. But the problem here is that it can't use any chemical solvent or any other disinfectant. Again, for soaking purpose only hot air is used. Again, for moving the machine a worker had to be engaged. To overcome all of these conflicts current study was done to enable the cleaner to move automatically throughout any sort of room. The moping mechanism has also been readily modified to lower the overall cost of the product. In our current study the mop is continuously revolving about an axis which is perpendicular to the motion of the cleaner this will also help in directing water precipitated on the floor backward. A sprinkle mechanism is preempted against wet mop to make the floor wet which is when scrubbed by the mop. A vacuum cleaner was then used to soak dirty water from the floor surface and also continuously clean the surface. For the automatic movement, a cleaner wireless mobile robotics is used.

Wireless mobile robots are a major focus of current research and almost every major university has one or more labs that focus on mobile robot research. Mobile robots are also found in industrial, military and security settings. Domestic robots are consumer products, including entertainment robots and for those that perform certain household tasks such as vacuuming or gardening. From then on to a more sophisticated robot is designed for household equipment for automating the tasks including washing machine, micro woven. After that, only the revolution of mobile robotics came to household usages.

The problem with them is that the current automatic wireless floor cleaning machines are they are only used in households for only dry and wet cleaning but not as infection remover. So, it is only used in households and not in hospitals or small areas in public. The automatic floor mops are bulky and they also require large power and are used for commercial purpose. But we think this (Our cleaner) will solve almost all in one go... We will basically focus on a smart and smaller and good designed robot which can be used in many sectors like healthcare and educational areas (which are of course small areas) and also for household use. So, it would be both for terminal cleanings like medicals and indoor floor cleaning. In future we will focus on indoor air cleaning service as an additional feature to this machine.

### 4. CONSTRUCTION

**Vacuum Cleaner:** It is a mechanical machinery that creates negative pressure which helps in sucking air. Vacuum pump exchanges the mechanical input power rotating shaft into pneumatic or hydraulic power by evacuating the air or liquid contained in a system.

**DC motor:** It is an electrical machine that utilizes electric power resulting in mechanical power output. Normally the motor output is a rotational motion of the shaft.

**Ultrasonic Sensor:** It is a type of electronics component that uses ultrasonic transmitter and receiver pair to send and collect signals resulting in the proper sense of obstacles. The more the resonant frequency the lesser will be the wavelength of transmitted radiation and it will provide a good surrounding condition. The more directional the sonic wave the more resolution in the measurement.

**Bluetooth Module:** It is a Wireless transceiver. We are using HC-06. It's at the Bluetooth class 2 power level. It's at the Bluetooth class 2 power level. Has a built-in 2.4GHz antenna; the user needn't test antenna.

**Arduino Mega:** It plays a major role in automation. It acts as the brain of the robot. It uses atmega16 on its core which uses ARM processor. It has 2 USB ports.

**Motor Driver:** We are using here L293D motor driver which has 16 pins 8 on each side. We can control maximum 2 motors connecting on each side.

**Servo Motor** is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity, and acceleration. It consists of a suitable motor coupled to a sensor for position feedback.

**Temperature and Humidity Sensor:** It is a composite Sensor contains a calibrated digital signal output of the temperature and humidity. Application of a dedicated digital modules collection technology and the temperature and humidity sensing technology, it ensures high reliability and excellent long-term stability.

**Gas Sensor:** The Gas Sensor (MQ2) module is useful for gas leakage detection (home and industry). It is suitable for detecting H<sub>2</sub>, LPG, CH<sub>4</sub>, CO, Alcohol, Smoke or Propane. Because of its high sensitivity and fast response time, measurement can be taken as soon as possible. The sensitivity of the sensor can be adjusted.

The HC-05 module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. An HC-05 Bluetooth Module can be used in a Master or Slave configuration, making it a great solution for wireless communication.

## 5. IMPLEMENTATION

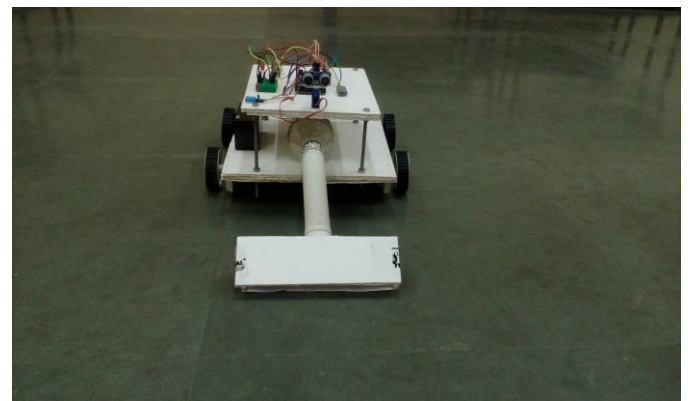
A Foam board is used to bolster the entire structure. The robot is programmed to move continuously in the forward direction in the automatic cleaning mode. This was done intentionally and deliberately so as to have a more flexible way of controlling the robot. There are 2 motors on the robot that perform various combinations of start and stop depending on the ultrasonic sensor value received by the microcontroller. The ultrasonic sensor will be the input that will be triggered by the microcontroller to control the motor by certain condition or programming and simultaneously be equivalent to the eyes of the robot. The sensor will continuously be ON and when obstructed by an obstacle it will be used to send a signal to stop the robot. The microcontroller is set to decide how the output will be produced from the motor and interfaces ultrasonic sensor and servo motor to perform the desired output. After the robot stops the ultrasonic sensor is used to compare the distance to the left and right direction. If there is an obstacle in the left then the robot turns to the right and similarly if there is an obstacle in right the robot turns to left. If there is an obstacle at both left and right of the robot then the robot goes back in the reverse direction. The Bluetooth module has been integrated and a robot to control it remotely we can use any app that supports Bluetooth and can calibrate buttons for various directions we want the robot to move. We then interface the gas sensor and temperature and humidity sensor these are calibrated to show values whenever they differ from their normal values. When there is the presence of gas particles in the atmosphere then we have calibrated the gas sensor to show an output by turning on the LED connected to the gas sensor. When the temperature is too hot or too cold then it will be indicated by a LED connected to the temperature sensor. Next, we will have to interface the vacuum and water pump on the robot so that it is continuously high and the robot cleans continuously as long as the robot is being used. As the system requires the use of a microcontroller, the design consists of two parts, hardware, and software. Hardware has been constructed and an

integrated module for hardware to software easy troubleshooting and testing. To make our lives easier and to make maximum use of the time available to us, we plan to use the modular design concept to implement our system. The entire system is to be divided into different modules, which not only makes troubleshooting easier but is also an effective approach for system modification. It is necessary to hermetically isolate the electronics and the water system to prevent any damages to the electronics used.

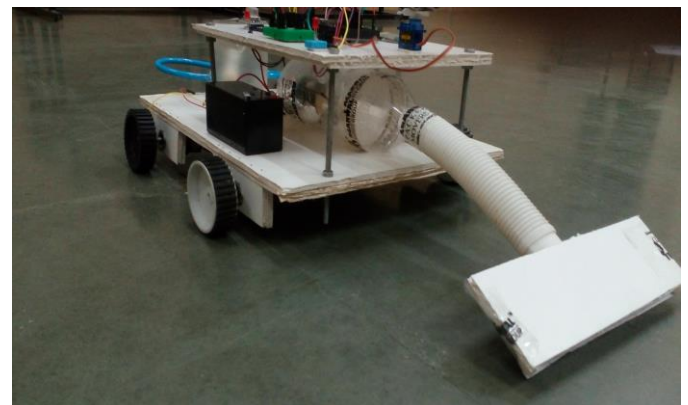
The system consists of an amalgamation of the following modules:

- Obstacle Detection Robot
- Interfacing Ultrasonic sensor, Servo, Gas sensor, Temperature and Humidity sensor with Arduino
- Setting up the vacuum cleaner and water pump
- Assembling all the components on the robot
- Embedding the software on the robot

The plan is to implement each of our sensors individually on the robot. In the next step, all the components will be then linked together via a microcontroller. The software will then be embedded on the microcontroller to perform the control operations.

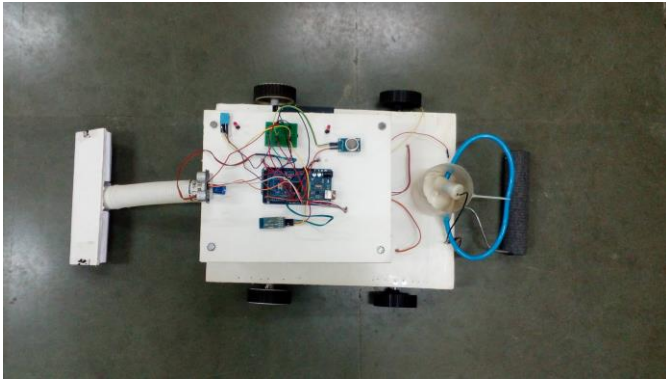


**Fig -1:** Front View of the Robot and the Vacuum Suction Pump

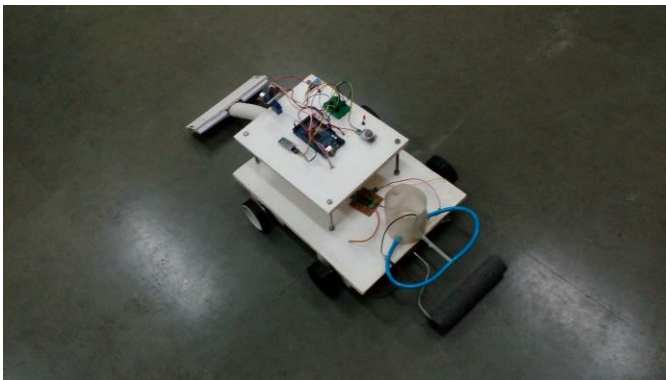


**Fig -2:** Layered View of the Robot





**Fig -3:** Top View of the Robot and the Safety Indicator



**Fig -4:** Back View of the Robot and the water precipitation mechanism

## 6. CONCLUSIONS

After the whole design was completed, it was put to test to see if it performs the designed specifics such as cleaning, mopping, and safety indication. In the model, a vacuum cleaner, water pump, gas sensor, temperature and humidity sensor, Wireless Bluetooth module and scrubber are attached to the robot which will always be moving continuously and will stop only when there is an obstacle, this robot will then choose the most suitable path to move forward. The Product thus developed is fully operational and gives the deliberate motion. It's tested on the floor and the result is euphonic. Further modifications are being done so as to mollify the model. The security model is very precarious and needs to be modified further. The scrubber design should be modified in future because the current design has a few problems. Few of them are that the motor is not detachable and the high rpm leads to vibration of the whole system so it is a bit difficult to calibrate. If these features will be modified, this will work well. We also need to change the foam board body with a more permanent body for a commercial use which will provide a more bolster body to the mechanism. In our case a single vacuum pump is used which saves power but makes the robot less efficient, to tackle this we can use Two vacuum pumps or by using a single pump having Two pathways. This will lead to next development stages. This will increase the reliability of the

instrument. The robot can be successfully controlled by any mobile device using Bluetooth. The sensors work properly as desired and give the expected output which is very necessary as it is a feature which can save lives. A Buzzer can be used along with the LED to indicate a hazard. Overall the concept is very much helpful to households and there is the scope of a lot of development in the mechanical parts and security system. The optimization will continue until we achieve the best one. Overall the project is completely successful in its intent and will define the next era of robotics and wireless floor cleaning. In the automation part, the algorithm is designed to give the most effective path which the robot should take. The development can be made in the field of sensing and security. The product has the capability to detect as well as move in the direction previously uncleaned and we can improve the algorithm to better move on the path of dust and thus be resulting in better cleaning of floors. As a whole, this is a successful product developed that can be used in the current households.

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## REFERENCES

- [1] T. Palleja, M. Tresanchez, M. Teixido, J. Palacin "Modeling floor-cleaning coverage performances of some domestic mobile robots in a reduced scenario", Robotics and Autonomous Systems(2010) 58 37-45.
- [2] Manreet Kaur, Preeti Abrol "Design and Development of Floor Cleaner Robot (Automatic and Manual)" "International Journal of Computer Applications (0975 – 8887) Volume 97– No.19, July 2014.
- [3] J Frolizzi C. Disalvo. Service robots in the domestic environment: A study of Roomba vacuum in the home". In int. conference on human robot interaction HRI, PAGE 258-265 March 2006.