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Smart Floor Cleaning Robot Using Android

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Abstract: This paper presents a cost-efficient robot that could be used even by people who won't be able to enjoy luxury to use roomba, scooba etc. There is variety of autonomous robots available in the market and they all do their work perfectly according to their specifications but none of them are cost-efficient. For a developing country like India, where the majority of the population is economic, keeping this in mind the robot is designed.
Keywords: Autonomous Robot, geolocation, cost efficient, android.

Introduction

Automatic floor cleaner is a system that enables cleaning of the floor with the help of highly stabilized and rapidly functionalized electronic and mechanical control system. While designing the robot we must broadly understand that how the domestic service robots can be used for cleaning purpose and secondly, we must consider that how the robot fits into our home [1]. In this paper our targets to design an automatic floor cleaner for household purposes. The cleaning purpose is specifically carried out by continuous relative motion between a mopping and the floor vacuum. During the cleaning and moving operation of vehicle a propulsion mechanism such as driven wheels and guide wheels for the dry tracking on the floor surface to be cleaned, suction of water is carried out by water motor pump, mopping action is done by the roller directing water towards rear end. The new automatic floor cleaner will save huge cost of labor in future. DRE (Domestic Robot Ecology) has become a useful tool which helps in designing robot. DRE is a framework that shows holistic view in the relationship that robots shape in the home [3]. The basic advantage of this product is that it will be cost effective and no human control is needed. Once put in on mode it will clean the whole room without any omission of surface. Nowadays, people are moving fast with their life and are more career-oriented people. So, to save their time and to make their life little more convenient a robot is designed which doesn't require human interface once ON.

In this paper a system is implemented for home cleaning using Sensors, Microcontroller, vacuum motor and DC Gear Motor in which, the smart floor cleaning robot clean the room in automatic or manual mode according to the command given by a person. India is a rapidly developing country that accepts all the new technologies that surround it. So, keeping in mind the economic condition of people a product is designed which would be cost efficient. The autonomous robot like iRobot, iSccoba, dyson designed for home cleaning cost almost 1000 dollar which could not be afford by everyone so making it a little cost efficient would be a great deal. Companies manufacturing the smart floor cleaning robots are Dyson, Neato, iRobots, hom-bot, Samsung etc. The robots discussed here is about smart floor cleaners for house hold purposes. There is wide variety of robots available for cleaning based on their structure and functioning. These are categorized as follows:

I. Hand-Held: Handheld vacuums are ideal for getting those agonizingly difficult to-achieve territories that urgently require a cleaning. As its name suggest it can be handled single handed.

II. Canister: Canister vacuum cleaners are a glad medium between the upright model and the stick display. They are capable like the upright cleaners, however highlight a slim edge, like the stick cleaners. For this situation, a different canister is connected to a long wand which can be utilized to keep up covered regions as well as uncovered ground surface too. This style of vacuum cleaner tends to stand out among the most expensive options, given its mechanically forward and multi-practical plan.

III. Upright: These models give the most capable of putting your house in order and offering the impromptu advantage of skills and extras usually simple because many people have utilized an upright vacuum cleaner in any event once in their lifetime. Most models give settings that enable these vacuum cleaners to be utilized on covered surfaces as well as uncovered floors.

IV. Stick: These vacuums have a talent for getting into limit puts and completing a huge activity on hardwood floors, territory mats and light covering. This kind of vacuum includes a long stick-like handle and a slim development. The slimness of this model makes it an ideal expansion to any storage room space, as it tucks perfectly into most corners after its motivation has been served.

V. Autonomous: These vacuums can move uninhibitedly around your home, sucking up any little chaos in its way. They spare your time, as well as ready to achieve places that bigger vacuums wouldn't have the capacity to. One principle downside of robot vacuums is that they commonly come at a lofty cost.

LITERATURE SURVEY

Generally, floor is cleaned with the assistance of dry wipe or wet wipe utilizing the hand as a potential instrument. They need to clean hard at first glance. The cleaning incorporates cleaning of different surfaces fundamentally bond floors, exceptionally finished wooden or marble floors. Among these floors the harsh surface floor, for example, concrete floor, for the most part exhibit in semi urban regions are secured with to such an extent clean.

The body of the robot has numerous little parts. Like all robots it has sensors, microcontrollers and actuators and different parts. A servo-motor associated amidst the robot with the roller. A DC brushless fan motor for suction purpose. 2 DC motors of 100 rpm are associated with the wheels. One microcontroller with 3 ultrasonic sensors is joined to it. This has 2 bread sheets for circuit association which eventually can be supplanted in the wake of welding. For moping we are utilizing the roller. The roller turns at fast which performs great wiping activity. So, for smart floor cleaning, Robot need mechanical arrangement of chassis[4]. Arrange the chassis and connect the two wheels of the robotic vehicle to the motors which are in turn connected to the microcontroller. For mechanical arrangement we used Motor driver Module (L298N), dc Motors, wheels because the output of the microcontroller is maximum 5V only which cannot drive dc motor so in the place of it we used motor driver module which amplify voltage up to 36V.

For obstacle avoidance ultrasonic sensor is used. We placed 3 ultrasonic sensors on each front-end and if any object is detected by the robot it changes its path according to the condition of the algorithm. Algorithms like shortest path routing can be used here. And Fourth ultrasonic sensor is used at bottom of front part which is used for stair detection and then moves backward. For manual control of robot, we are using Bluetooth module and Wi-Fi module and built Android APP using MIT app inventor. Other reason of using wi-fi module is location tracing of robot .we can get our location by just using our ESP8266 module (WI-FI MODULE) and no other external GPS module or GPS hardware required.

SPECIFICATIONS OF A VACUUM CLEANER

- **Air speed :** The faster the air speed, generally stronger 'cleaning' power of the vacuum cleaner, but faster air speed also requires stronger motors, requiring more power, thicker cables etc. To avoid that, many manufacturers keep the air flow speed within certain limits but use various power tools like spinning brush and how to increase the cleaning effects of vacuum cleaners, without increasing motor power.
- **Airflow** is amount of air that flows through the vacuum at any given moment. It can be obtained by multiplying the cross-section area of cleaning head and air speed at given point. Larger the airflow, generally stronger 'cleaning' power, but also larger volume of air that needs to be filtered before it is released into the cleaning area. Larger airflow hence requires larger filters, larger and stronger motors, thicker cables.
- **Suction power** is maximum difference in pressure that vacuum cleaner can create. Typical domestic vacuum cleaner can create suction of 20 kPa. More powerful vacuum cleaners generally have more powerful suction.
- **Output power** is ratio of output and input power gives effectiveness of vacuum cleaner in percentages. Usually measured in air watts.
- **Input power** is consumption of energy of the vacuum cleaner. This is not the actual power of vacuum cleaner due to losses in the system and level of effectiveness in general.
- **Weight:** Lighter vacuum cleaners are easy to maneuver with and often, due to their smaller sizes, can reach tight spaces. On the other hand, they often lack power and filtering capabilities of the larger, but heavier models.
- **Noise in decibels (dB):** determines noise of vacuum cleaner. Vacuum cleaners with noise levels below 60dB are great, but most of them are between 65 and 75dB.
- **Power cord length:** longer power cord means more freedom when vacuuming and changing outlets less. Most of the models have some sort of automatic winding mechanism, so after vacuuming, power cord is stored in seconds, literally.

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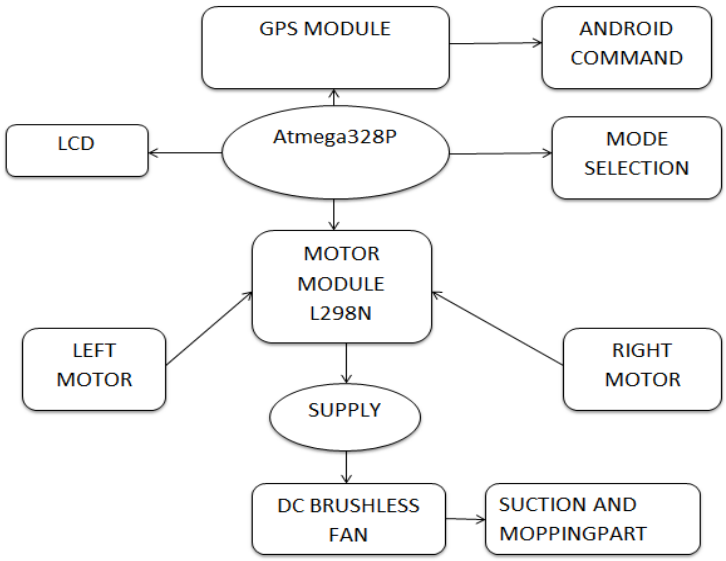
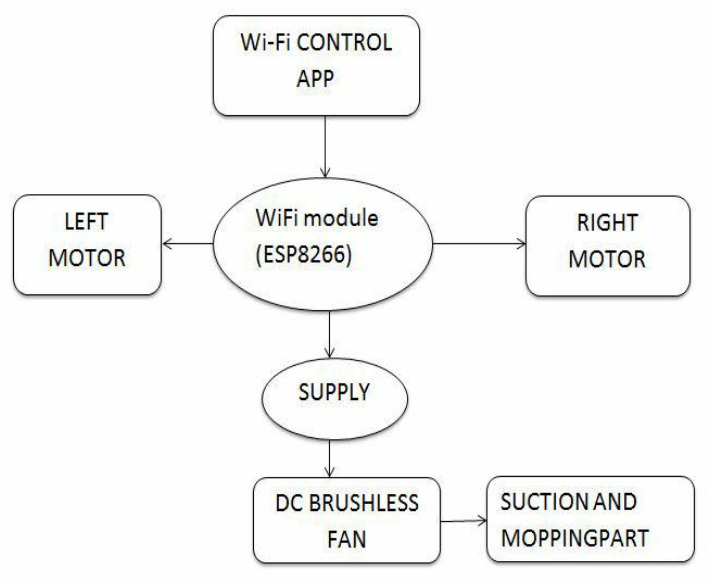
PROPOSED METHODOLOGY

For smart floor cleaning, Robot needs mechanical arrangement of chassis. Arrange the chassis and connect the two wheels of the robotic vehicle to the motors which are in turn connected to the microcontroller. For mechanical arrangement we used Motor driver IC (L293N), dc Motors, wheels because the output of the microcontroller is maximum 5V only which cannot drive dc motor hence we used motor driver module which amplify voltage up to 36V. Then, we had used four Ultrasonic sensors for object detection. In our robot we are using four ultrasonic sensors in which three ultrasonic sensors are placed on left, Right and front part of the Robot and if an object detects by the robot, it changes its route according to the condition of the algorithm. The fourth ultrasonic sensor is used at bottom of front part which is used for stairs detection and then move backward. It is controlled by Bluetooth module and Wi-Fi module. It works in both manual and automatic modes. Utilizing esp8266 module we can control robot and furthermore track the area of robot with no GPS module. There is an arrangement of progression conditions that can be used to program the ESP8266. The social order ESP8266 is added to the Adriano IDE that empowers you to program the ESP8266 using the Adriano IDE and its programming vernacular.

a) Manual Mode



b) Automatic Mode



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c) Flow Chart of Motion Robot

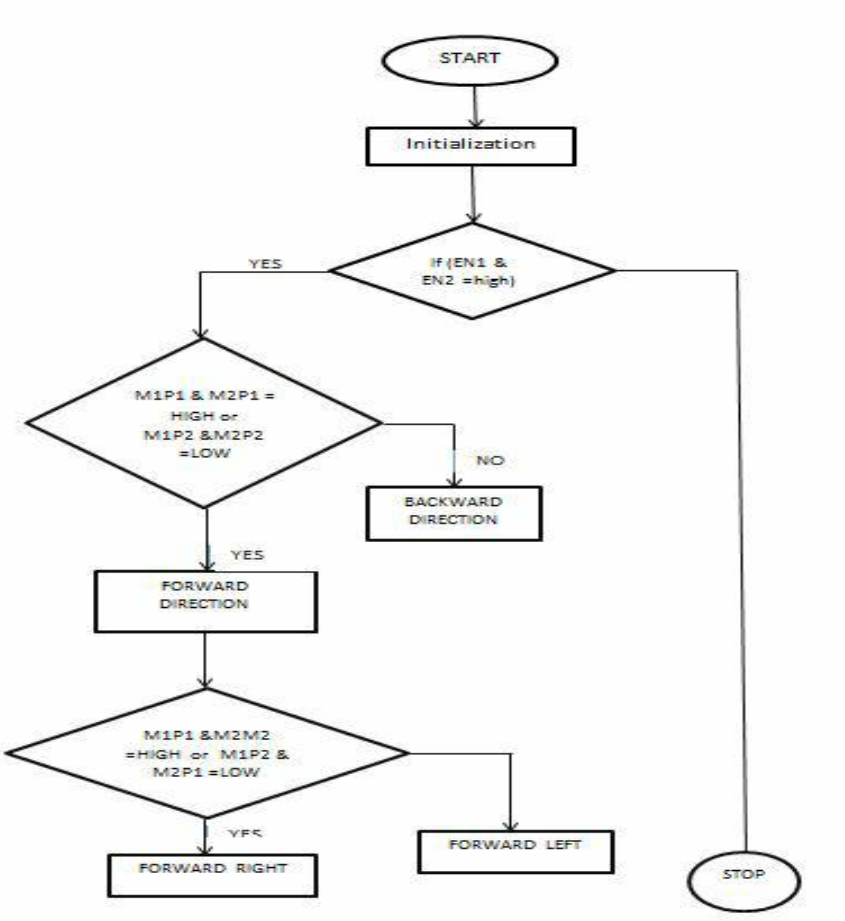

Figure 1 : Proposed Robot Design

Future Scope

From ventures to homes programmed floor cleaner is utilized and is turning into an essential piece of life as it spares time, cash and diminishes human endeavors as it were. Its rough cost is 5000 INR. It is the fate of cleaning in our quick moving life. It is nothing unexpected that they would presumably be more solid than manual cleaning to improve detection using a laser camera and improve the suction so that the cleaning is better, to improve the life of the battery. Another future scope of this robot is to add web server control using that we have to control our robot from any place. For example, suppose if we must control from our office place to our home. For better designing we can use 3d printed cover for the robot. The overall cost estimate would had been Rs.3000 but if we make improvising by adding 3D printing and other specs price may increase which is not our aim.

Limitation

The aspiration is not powerful, so it collects light dust. Battery supply drains quickly. The circuit if kept small and compact suction motor with high suction power can't be used making robot not that much efficient.

Conclusion

We were able to make a robot which not only vacuums the house but also mops the floor. Many more advancements could have been brought like laser cameras etc. But that would not serve our purpose of making a cost-efficient robot. So here we designed a cost-efficient robot which not only vacuums but also mops the floor controlled automatic. It could be improved if produced in bulk amount, so cost relatively would have gone down.

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