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A Floor Cleaning Robot With Vacuuming, Broomimg, Mopping and Drying Feature

Ritik Bomle[1], Saurabh Patil[2], Rohit Mene[3] , Prof. Kirti Dhenge [4]

[1234]Department of Electrical Engineering, K.D.K. College of Engineering, Nagpur (Maharashtra), India

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Abstract - In this world leading towards automation the benefits of automation can be exploited to execute simple domestic duties when complex operations are automated to simplify jobs. Cleaning is one such task, despite its negative connotation due to nature of work, is extremely important. Cleanliness breeds a healthy lifestyle. However, in today`s fast paced world, cleanliness has been neglected. To compensate such problem this paper presents a floor cleaner based on Arduino Nano microcontroller with Bluetooth module to provide wireless controlling. The cleaner robot can be autonomous or can be controlled manually by android. All-around cleanliness is achieved through the use of its DRY and WET modes.

Key Words: Android; Vacuum; Broom; Mop; Drying; Bluetooth; Floor Cleaner

1.INTRODUCTION

Cleaning is necessary but frequently forgotten task. Cleaning has been considered as a time-consuming activity in today`s society where time is money. However, hygiene and, as a result, health must not be jeopardized. In today`s market, autonomous floor cleaning robots are common and these technical devices are designed to function without human intervention. Furthermore, these gadgets are designed to carry out their functions in at timely and precise manner. Over time, floor cleaners have improved. These devices include an application for navigating and controlling them, ranging from vacuum cleaners only to autonomous floor cleaners with cleaning and mopping capabilities. However, most of the time these robots are either dry or wet cleaning. Our project intends to close this gap by presenting a functioning prototype of a floor cleaning robot with android controlled (by Bluetooth) that might be turned into low cost robots in the future.

2.LITERATURE SURVEY

Roomba, Samsung Jetbot, Ecovacs OZMO, Eufy Robovac,[1] and a slew of other commercial devices have flooded the market. However, due to their expensive costs, many families, particularly those from the poorer classes cannot afford them. [2]For obstacle detection, it employs infrared sensors. Both manual and automatic procedure were available. Random motion is a part of autonomous motion.[3]Collisions are used to detect obstacles, and rectangular zigzagging is used to tidy an area.[4]At the same time, this robot sweeps and mops the floor. For cleaning, it uses spiral and random patterns. A remote control can be used to control this robot.[5]only vacuuming is done by the robot. The robot is equipped with WiFi control and uses vSLAM for mopping. Samsung released the first robotic vacuum cleaner that maps its surrounding and navigates through home in a methodical manner[6].

3.COMPONENTS REQUIRED

A. Arduino Nano Microcontroller

Based on the ATmega328P launched in 2008, the Arduino Nano is a compact, comprehensive, and breadboard-friendly board. It has same connectivity and specifications as the Arduino UNO board, but smaller.

The Arduino NANO has 30 male I/O headers in a DIP30-style arrangement that can be programmed using the Arduino IDE common to all Arduino boards and can be uses online or offline. The board is powered by 9V battery or a type B mini-USB connection. The operating voltage of this board is 5V DC. It has 8 analog pins and 14 digital I/O pins (6 optional PWM outputs).32 KB flash memory of which 0.5 KB used by bootloader.

B. Bluetooth Module HC 05

The Bluetooth Module HC 05 is used to communicate wirelessly. It can be configured as either master or a slave. Bluetooth serial modules allow all serial enabled devices to interact wirelessly.

There are six pins on it. Namely Key/EN, VCC, GND, TXD, RXD and State. It uses 3.3V to 5V as input voltage since the module has onboard regulator. To communicate with the smartphone must have a Bluetooth terminal application installled on it for data transmission programmes for android can be found in relevant appstore.

C. Motor driver L293D

The L293D IC is a most widely used common motor driver IC that allows a DC motor to rotate in any direction. This has 16 pins and used to operate a set of two DC motors in any direction at any time. It means that we can control two dc motors with an L293D. This IC is based on the H-bridge principle,which allows electricity to flow in any direction and in order to rotate the DC motor in both the directions voltage must be changed. As a results, an H-bridge circuit based on L293D IC is ideal for driving motors.

D. Ultrasonic Sensors

The robot is guided by an ultrasonic sensor, which also prevents collisions with walls or obstructions. The sensor head sends out an ultrasonic pulse, which is reflected back to the sensor head, which measures the distance to the obstruction. The time between emission and reception is used to calculate the distance.

E. Water Pump

The 12V DC operated water pump is used for pumping of water in the container to in front of moper to achieve wet cleaning.

F. DC Motors

Two dc gear motors of 12V are used for the wheels of the robot due to their high torque and high efficiency.five 6V gear dc motors are used for the 2 brushes, 2 moppers and one in vacuum.

G. BATTERY

A 12v of lead acid battery is used to power the circuit.

4.METHODOLOGY

The floor cleaner is designed to operate on autonomous as well as manually. It has the feature with vacuuming, brooming, mopping, and drying. During the autonomous mode of operation the cleaner robot works without any human intervention. Three Ultrasonic sensors are equipped on front, left and right side of the robot and interfaced with Arduino Nano for obstacle detection and prevent it from collision. Wet cleaning is achieved by water pump and two DC motors having action takes place at a time in this mode. The mode from autonomous to manual or viceversa can be change by a switched button connected to the circuit of the robot.

When it is switched to manual control the robotic movements are controlled via Bluetooth and android control interface in Bluetooth terminal app. On the android screen there are the options to control the motion of the robot as well as wet clean and dry clean on/off. In this mode also user can achieve wet and dry cleaning simultaneously.

The water tank can be refilled if it gets empty and the debris bin is removable to take out the accumulated dust and clean it thoroughly.

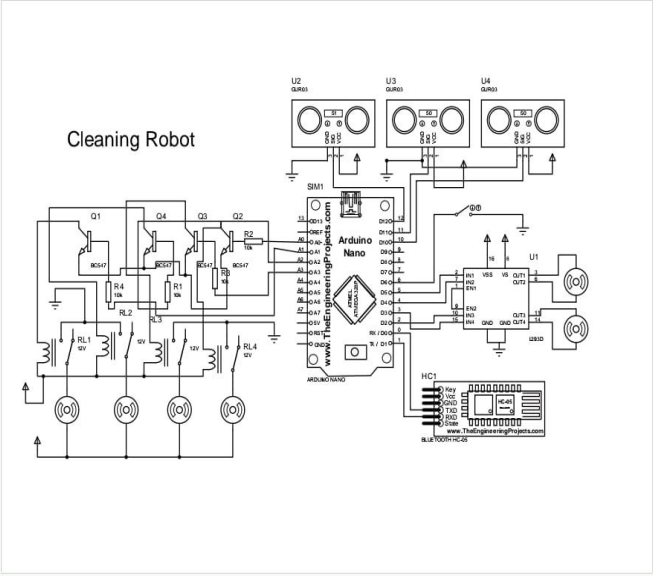

Figure 1 Schematic diagram of prototype

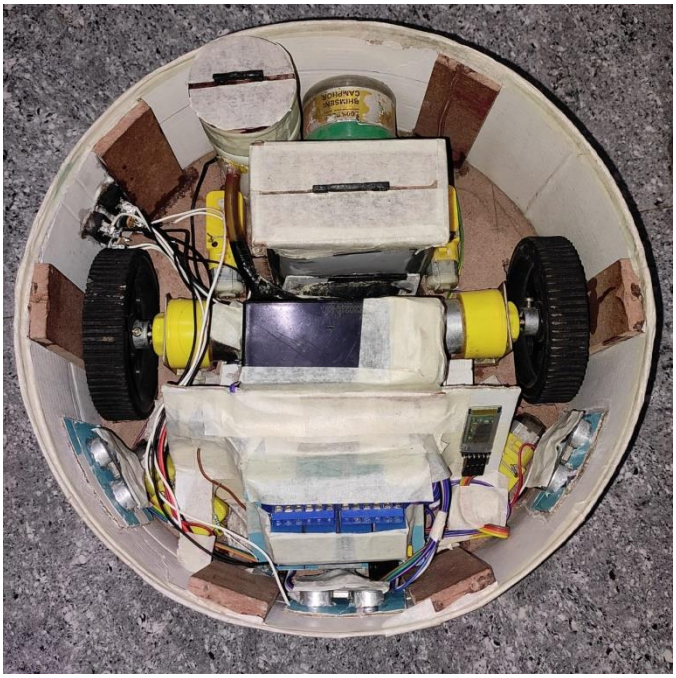

Figure 2 Inner region of prototype

5.MECHANICAL DESIGN

The wooden plank made circular is used for the chassis of the robot. Plywood is robust enough to support the two motors of the wheels, four 6V motors of moppers and brushes, pump water tank and the vacuum system. A second wooden chassis of same shape and size is placed on the top to cover the robot. It is also covered by side covering attached to wooden columns sticked to the horizontal chassis by glue. The brushes and mopper are located on both sides of wooden chassis at the bottom. The user can adjust the pace and the direction of the bush rotation with the geared DC motor. The vacuum cleaner system has been built to fit inside the robot. The vacuum box and the port that pulls air into the container and uses the dc fan to suck up dirt and dust. A filter is placed between the container`s air input and the dc vacuum fan to prevent dust from passing through and we use the same air flow for drying the floor.

So, when the floor is wet due to mopping these air flow is used to dry the floor which act as a dryer. The debris bin is made removable and water tank can be refilled. For the free displacement of cleaning robot a smack wheel infront and two larger wheels at backside attached to 12V dc geared motor.

6.ANDROID CONNECT

To operate the robot in manual mode the Bluetooth Terminal app is used in android to connect it to bluetooth module HC 05 interfaced with Arduino Nano.

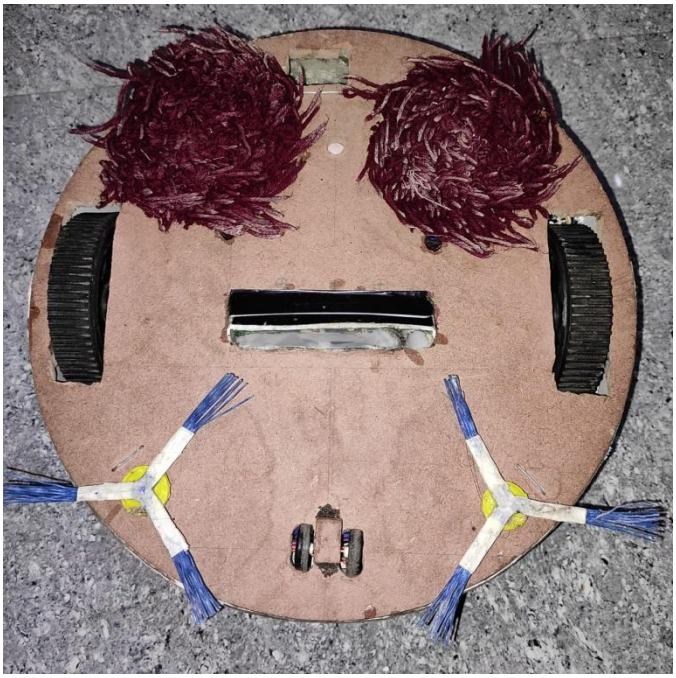

Figure 3 lower region of prototype

7.TABLE: BUTTONS ON ANDROID INTERFACE[7]

Button	Action
I. Forward	Moves Forward
II. Reverse	Moves Reverse
III. Left	Moves Left
IV. Right	Moves Right
V. All one	VI & VII on/off
Wet Clean	Vacuum & Brushes on/off
VI. Dry Clean	Pump & Mopper on/off
VII. Stop	Halts

8.TESTING

Testing of component is performed first, like all the DC motors are tested before attached to the wheels. The system`s functionality is independently tested.

Finally, the integrated system (vacuum, broom, mop and dryer) is put to the test. The system responds as expected.

9.CONCLUSION

In this paper, the design and implementation of an automatic floor cleaner with wet and dry cleaning is presented. The Arduino Nano board and Bluetooth module is used in this project to achieve wireless android controlling with the help of Bluetooth Terminal app. It is powered by 12V DC lead acid battery. The wireless control range is about 10 meters, sufficient to control the device throughout the house. Each Individual system is thoroughly tested before the entire cleaning system is implemented and tested. It is observed that the system successfully completes the desired task and operates in both autonomous and manual controlled modes.

The whole system is designed and programmed on Arduino IDE. The aims and main objectives of the project are achieved.

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