



DESIGN AND IMPLEMENTATION OF FLOOR CLEANING ROBOT USING IOT

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Abstract: In today's world, robots play an important role in every aspect of work. Robot made human's work very much easier and they save energy and time. This paper describes a floor cleaning robot which allows both dry and wet cleaning by providing commands to the robot through android device. This robot made cleaning process easy with great efficiency by using a wireless system. This system consists of two vacuum compressors which are placed in front of the robot, for the operation of dry cleaning and a cleaning pad is placed behind the robot with water storage on it, which is supported for wet cleaning. The proposed robot is operated through an android mobile app i.e. blynk app which acts as a transmitter gives commands to the receiver Node MCU which has 11 input output pins and 1 analog pin. The Node MCU receives the instructions from android app through Wi-Fi receiver, decodes the instructions and controls the robot in the right path and direction.

Keywords : Blynk app, Motor driver, Node MCU, Wi-Fi module.

I. INTRODUCTION

Evolution of robots brings advancement in the process of floor cleaning. Floor cleaning is a regular task carried out by number of people every day, it needs lot of human energy and time. Naturally, the high cost of this simple task has motivated alternative solutions and that is Automatic Floor Cleaner.

A smart floor cleaner using android app is a manual wet floor cleaner by human support. It cleans the wet floor by using a cleaning pad and water storage tank. After the process of cleaning, it drains the dirty water into another tank. The drawback of this model is it cannot go to the edges of the corners as it contains IR sensors, which stops the robot near the shortest distance of the wall. So, this may not help in cleaning the edges of the wall and it is used only for wet floor cleaning process. It has a range limit as it is using Bluetooth module, the user should be near to the model when operating [2].

An automatic smart mop for floor cleaning uses blynk app to give commands to the microcontroller, which includes self drive mode without human interference. This robot uses microcontroller AT mega 2560R3 for better performance and efficiency. It has a mopper which rotates to clean the floor by using stepper motor and submersible mini water pump. It can drain the dirty water into another tank, but the drawback of this robot is it cannot clean the dry dust. [3].

Roomba is an autonomous robotic vacuum cleaner, which was designed by I robot corporation. This robot uses two operating side wheels that can allow 360° turns in place, with a rotating 3-pronged spinner brush that can sweep debris from square corners to the cleaning head. Roomba's sensors can detect dirty spots on the floor and the presence of obstacles [4].

Dyson 360° eye robot is a floor cleaning robot which provides maximum floor coverage and edge to edge cleaning across hard floors and carpets with nylon & carbon fiber bristles. This robot has its own dyson link app available on iOS or android, gives you ability to control, schedule and analyze data from dyson robot [5].

II. COMPONENTS AND BLOCK DIAGRAM

The proposed model "Floor Cleaning robot based on IOT" shows in Fig.1. The following block diagram consists of two vacuum compressors, motor driver, 12V DC motor. In addition to this external wet floor cleaning mechanism is added to the model which consists cleaning pad which is placed behind the robot with water storage on it. To provide power supply we need to use external battery.

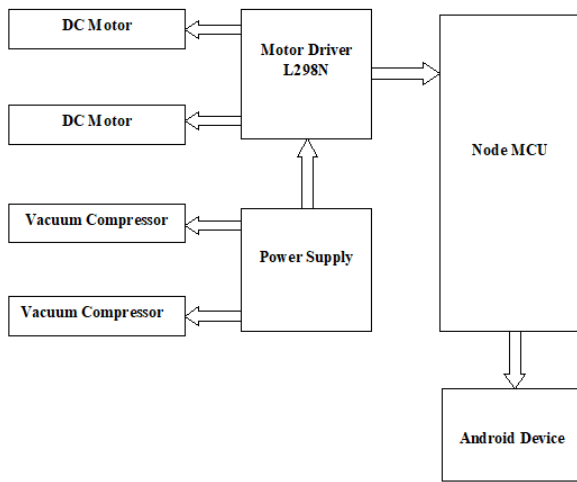


Fig.1: Block Diagram

A. Node MCU

The microcontroller used in proposed model is Node MCU. It is an open source platform for developing electronic projects. It uses ESP8266-12E as a main controller, which is a high integration wireless SOC (system on chip). It features ability to embed Wi-Fi capabilities to systems or to function as a standalone application. It has operating voltage of 3.3V and the recommended input voltage is 4.5-10V. It consists of 11 digital input/output pins and 1 analog pin. The Node MCU size is 49mm*26mm and clock speed is 80MHz with -45°C to -125°C temperature range. It has its own simplified programming language called “Lua Script” language, but we can also program by using Arduino IDE in C or C++ programming language. It is a low cost solution for developing IOT application because if we take another controller, we need separate Wi-Fi module.

B. Motor Driver L298N

The L298N motor driver is an integrated monolithic circuit, which is a high voltage high current dual full bridge driver. It has ability to drive 2 two phase stepper motor or four DC motors. The module can utilize the built in stabilivolt tube 78M05 to obtain 5V from the power supply. But to protect the chip of the 78M05 from damage, need to maintain the drive voltage is greater than 12V; external 5V logic should be used. It has high operating voltage up to 40V& peak current up to 3A and input voltage is 5-35V. The size of the PCB is 4.2*4.2cm with 15 input/output pins.

C. DC Motor

A dc motor is a motor whereby direct current electrical power is converted into mechanical power. Most often, this type of motor relies on forces that magnetic field produce. A 12v DC motor is small and inexpensive, yet powerful enough to used for many applications. Proposed robot is designed with four DC motors to operate in forward and backward directions.

D. Vacuum Compressors

Vacuum compressor is a device used to remove gas molecules from the sealed volume in order to leave behind a partial vacuum.

E. Video Streaming

In order to meet our target in proposed model, here we require one device to identify obstacles i.e., IP camera, to connect ip camera here we require another camera mobile to

see obstacles in front of the robot which can be seen from blynk app.

III. CONNECTION DIAGRAM

The fig.2 shows the connection diagram of the proposed model.

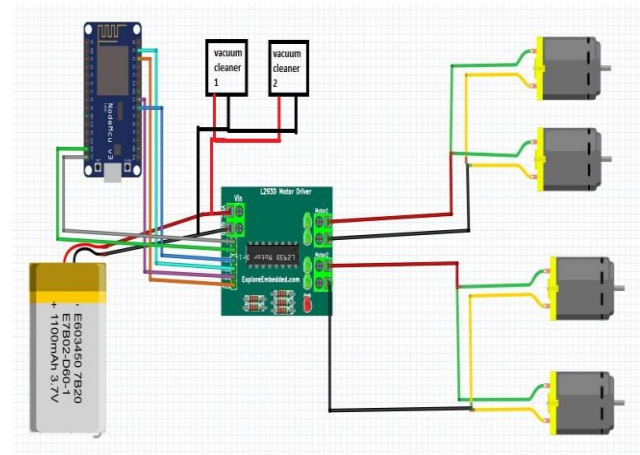


Fig.2: Connection Diagram

The power supply is given to vacuum compressors as well as motor driver. Here power supply to the Node MCU and DC motor can be given from motor driver. A switch is connected between power supply and vacuum compressors for better usage; it helps in using of vacuum compressors when there is a need of dry floor cleaning. Here, we are connected four 12v DC motors for forward and backward operations of robot. The motor driver has it's inbuilt controller which controls the voltage to 5V and given it to the Node MCU. This robot consists of two vacuum compressors, which are supposed to clean dry floor. A cleaning pad with water storage is attached behind the robot to clean the wet floor. The entire operation depends on the android device, which gives commands to the Wi-Fi receiver. An android app called “BLYNK” is used to synchronize with Node MCU for the operation of robot in right path. The entire model is based on IOT technology, so there is no range of usage, we can use from anywhere with the help of internet connection to Wi-Fi chip and android device.

A camera has been placed in front of the robot to avoid the collision with obstacles by viewing the path of robot in android device. The proposed model is more focused towards the financial side and enhanced technology for avoiding accident with obstacles, navigating its own path and making the vacuum cleaner functionally more competent i.e., doing various functions of floor cleaning like mopping.

IV. SOFTWARE IMPLEMENTATION

Here, we use Arduino IDE to program Node MCU by selecting ESP8266 support and 80MHz as CPU frequency.

An android app called “Blynk” is used to synchronize with the Node MCU. The process of synchronization is by opening blynk app, an authentication code will be sent to provided email, and we have to paste that code in developed program.

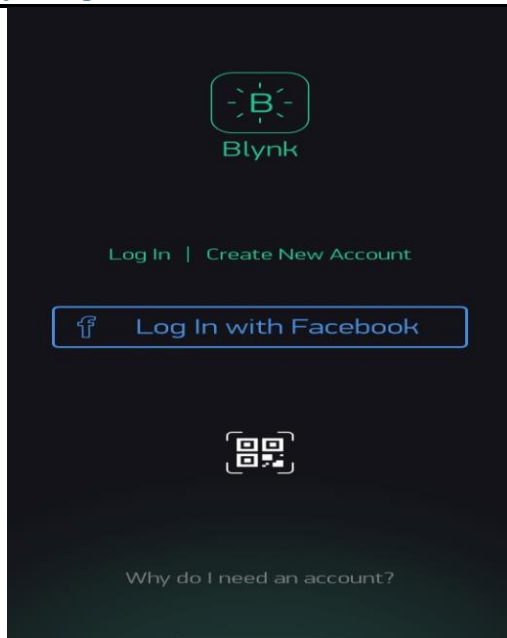


Fig.3: Opening tab of Blynk app

V. RESULT

A smart floor cleaning robot using IOT has been developed for both dry and wet floor cleaning process. It has ability to clean the floor in an efficient way with less cost and also control it from anywhere as it has video streaming ability.



Fig.6: Hardware output at different angles

Table 1: Comparison of robot floor cleaners

Types of robots	Roomba	Dyson	Proposed Robot
Type of cleaning	Wet cleaning	Dry vacuum	Dry vacuum and wet cleaning
Technology	Bluetooth and auto charging mechanism	Bluetooth	Wi-Fi module and android device
Type of control	Automation	Automation	Manual control
Cost of robot in Rupees	Rs.21000/-	Rs.30000/-	Rs.6000/-

VI. CONCLUSION

Proposed automatic floor cleaner is a model that enables cleaning of the floor by the help of highly stabilized electronic system. The designed system uses for both office and home environments, which is to clean both dry and wet dust. There exist many floor cleaning robots in the market which are not capable of cleaning the remote areas which are not in range. This proposed robot is purely based on IOT, so we can operate from any place with the connection of internet this also makes surroundings are maintained by hygiene. In industrial and domestic applications a robot is very cost effective as compared to cost of labor, the cost& flexibility makes this robot as a better choice for floor cleaning.

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