Floor cleaning robot with autonomous and manual control using blynk application

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Abstract— Nowadays people are looking forward towards autonomous and smart system that provides easier control and access to things. IOT has become one of the main aspects of autonomous system. Internet of things helps to connect applications to internet and helps to connect the user and the application from any location remotely .Manual labor is time consuming and not cot effective we are developing a low cost IOT based vacuum cleaner that can not only clean the surface but also provides a mopping on the floor hence it is easier and less time consuming. Control of this floor cleaner can be given both as manual mode and automatic mode and controlling part of the mops can be given by Blynk Application. The controlling can be done in automatic and manual mode according to user's wish.

Index Terms—Arduino Nano, Blynk, IR Sensor, IOT, LIDAR, L298n, PCB

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1 INTRODUCTION

The automatic floor cleaner is an intelligent device having its own way of working on both automatic and manual mode of operation working with Blynk so that it can do the work according to the User's demand. Autonomous movement of vehicle is guided by the IR and ultrasonic sensor. Floor cleaner is an important aspect in industries and in households. The homes are just becoming as intelligent and smart now a days. Sensors are used for sensing obstacles. Node MCU is the brain of Floor cleaner. The controlling of the floor cleaner is governed by various devices including gyroscope, IR, ultrasonic sensors. Blynk controls the floor cleaner in manual mode and controls individual segment of roller and mops.

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2 MODEL DESCRIPTION

Various components used were:

1. Ultrasonic sensor
2. IR sensor
3. Node MCU
4. Arduino Nano
5. Gyroscope
6. Acrylic Sheet
7. Jumper Wires
8. vaccum
9. Roller
10. Mops
11. Rechargable Batteries
12. PCB board
13. DC motor and Servo motor
14. L298n

1. Ultrasonic sensor: Ultrasonic transducers by action of crystal oscillator produce energy waves of ultrasound and ultrasonic sensors are devices that generate and sense ultrasound energy after hitting a obstacle of few meters. Ultrasonic sensors are used primarily as proximity sensors by measuring the distance between transmitted and received waves. They can be found in anti-collision safety systems and we use it for same purpose here.

2. IR sensor: An infrared (IR) sensor is an electronic device that measures and detects an obstacle using infrared radiation in its surrounding environment. It act as a proximity sensor , when an object comes close to the sensor, the infrared light from the LED reflects off of the object and is detected by the receiver.

3. Node MCU: NodeMCU is a low-cost open source IoT platform. It helps to attach a mutual relationship between the object and a receiver . NodeMCU is an open source firmware for which open source prototyping board designs in our floor cleaner.. The name "NodeMCU" combines "node" and "MCU" (micro-controller unit). It mainly used for connection between smartphone and the floor cleaner.

4. Arduino Nano: The Arduino Nano Every is an evolution of the traditional Arduino Nano board but features a lot more powerful processor. This will allo w you to make larger programs than with the Arduino, and with a lot more variables. It has many digital pins hence it helps to attach the ultrasonic , IR and gyroscope to audrino Nano.

5. Gyroscope: The MPU6050 IMU has both 3-Axis accelerometer and 3-Axis gyroscope integrated on a single module which helps to determine direction of floor cleaner.The gyroscope measures rotational velocity or rate of change of the angular position over time, along the X, Y and Z axis. It uses MEMS technology and the Coriolis Effect for measuring.

6. Acrylic sheet: Acrylic for Architectural Application as it is mainly due to its Acrylic's clarity, light weight, impact resistance, and weather resistance, make this material a popular

choice for architectural applications. Acrylic sheet is used in everything from windows and wall partitions to lighting fixtures and canopies.

7.Jumper wires: A jump wire (also known as jumper, jumper wire, jumper cable, DuPont wire or cable) is an electrical wire, or group of them in a cable, with a connector or pin at each end (or sometimes without them – simply "tinned"), which is normally used to interconnect the components of a breadboard or other prototype or test .

8. Vacuum: It is used for sucking up the dust particles and hair.

9. Roller mop: used for cleaning purpose as a wet mop.

10. Mops: used for cleaning purpose as a dry mop to take down the dust particles to the vacuum.

11.Rechargable batteries: to store charge and use for later purposes.

12. PCB board:. Printed circuit boards (PCBs) are used to connect electronic components using conductive pathways, tracks or signal traces etched from copper sheets laminated onto a non-conductive substrate by soldering, it is employed in the manufacturing of business machines and computers, as well as communication .

13. DC and Servomotor: DC motors are fast and continuous rotation motors mainly used for anything that needs to rotate at a high rotation per minute (RPM). For instance; car wheels, fans etc. Servo motors are high torque, fast, accurate rotation in a limited angle. It is used in the roller.

14. L298n motor driver : This L298N Motor Driver Module is a high power motor driver module for driving DC and Stepper Motors. This module consists of an L298 motor driver IC and a 78M05 5V regulator. L298N Module can control up to 4 DC motors, or 2 DC motors with directional and speed control.

3 PROCESS DESCRIPTION

.The Ultrasonic sensor which is mainly Ultrasonic module HC - SR04 which provides us with a distance of 2cm - 400cm non-contact measurement function.
The modules mainly includes with ultrasonic transmitters, receiver and control circuit and the basic principle of work include with :

It mainly uses an IO trigger for at least 10us high level

signal and by this method the ultrasonic sensor of 40 kHz frequency specification is required by the floor cleaner. It requires power supply of 5 volt with working current specification as 15 mA and It detects obstacle around 13ft of distance and it triggers the pulses in the interval of 10 us. It has 4 terminals namely Vcc,trig,echo and GND pin . Vcc = 5v Trig pin =connected to Arduino board PWM pin Echo pin = connected to Arduino GND = negative terminal.

Therefore an ultrasonic sensor helps to determine an obstacle from a certain distance. It avoids the obstacle and comes in action with algorithm for movement.

IR Sensor :- The IR sensors are used for the obstacle detection. These are sent as the input values for the Arduino Nano and then goes over to the Node MCU . The IR sensors works according to the following factors:The IR sensors emit IR rays continuously in a line. The rays transmitter and detector are present in the same board. Once any object comes as an obstacle, the IR rays are reflected back to the source. These rays are detected and an output signal Is sent. This signal is sent to the arduino board for further processing Infrared radiation is the portion of electromagnetic spectrum having wavelengths longer than visible light wavelengths, but smaller than microwaves,it helps to determine the ground obstacles and also works as a ground support for the floor cleaner.

Hence both the ultrasonic and the IR sensor help in the detection of obstacles.

DC Motors has different specifications we mainly uses the 12V DC motors with 60 RPM and with a weight of 180gm and these help in movement of the floor cleaner and the 30 RPM motor is used in the dry mops on the sides of the front of the floor cleaner which rotates in anticlockwise and clockwise direction.

L298n helps For rotating the motor in clockwise direction simultaneously..
The mop, vacuum and roller are controlled by the action of blynk app in manual mode .

Movement can be controlled and notifications can be received using the blynk server. The only requirement is that the floor cleaner and the users mobile should be connected to a Wi-Fi so that the cleaner and the mobile are connected to Blynk Server.

4 IMPLEMENTATION OF THE WHOLE PROJECT

The whole project depends on the working of the sensors and the Blynk application that determines the mode of operation.
The robot starts working when the switch is turned on. It simultaneously starts cleaning and mopping the floor as the function provided by the automatic cleaning facility of the robot in the Blynk. It follows the code input on the audrino to the Node MCU via audrino IDE and helps to follow the path with obstacle detection. After it senses an obstacle in front of the floor cleaner or the ground it changes it's direction. . Floor cleaner changes the path when it encounters an obstacle. It can also be controlled by mobile phone using A wi –fi which helps to control the floor cleaner manually.

1) Switch on the power button of the vaccum .
2) Switch on the hotspot option of the phone.
3) The Node MCU connects to the hotspot of the phone.
4) In the blynk app, user give can the option for movement either in manual or automatic mode.
5) In automatic mode , the floor cleaner movement is controlled by the ultrasonic and IR sensor.
6) In manual mode, the floor cleaner movement is controlled by the buttons in the app.
7) Every part can be controlled separately in the app.
8) Hence it is a flexible controlling unit for the floor cleaning robot.
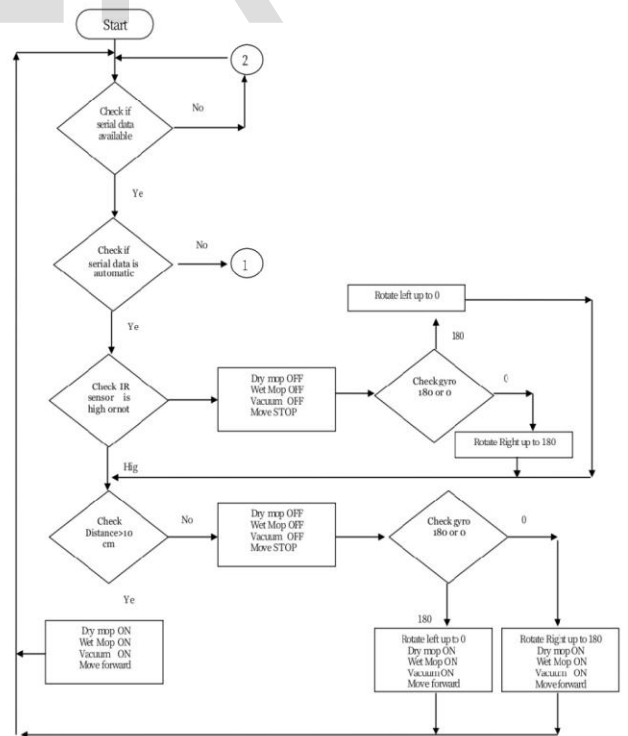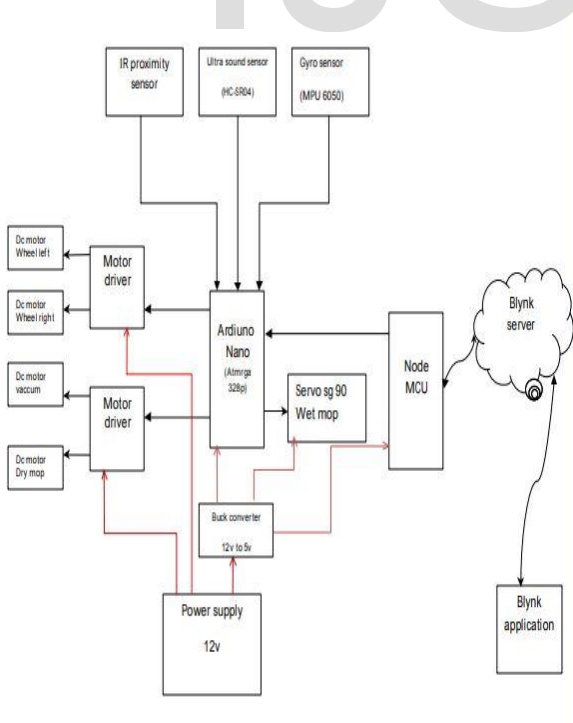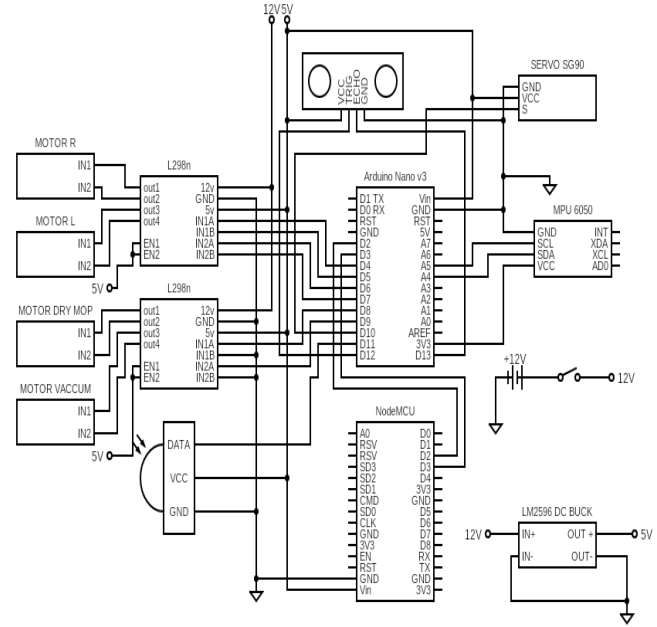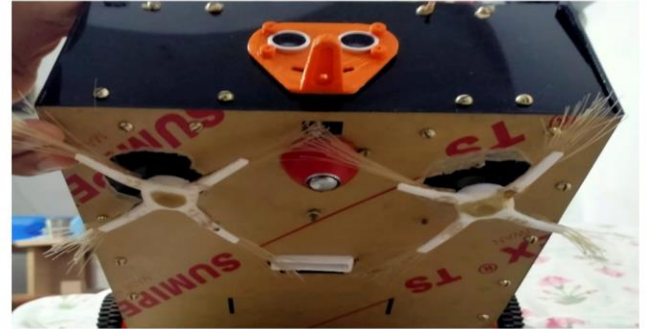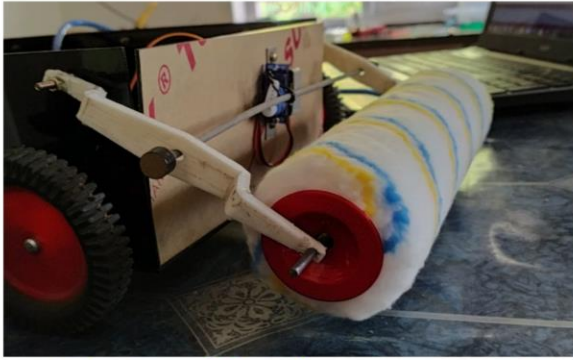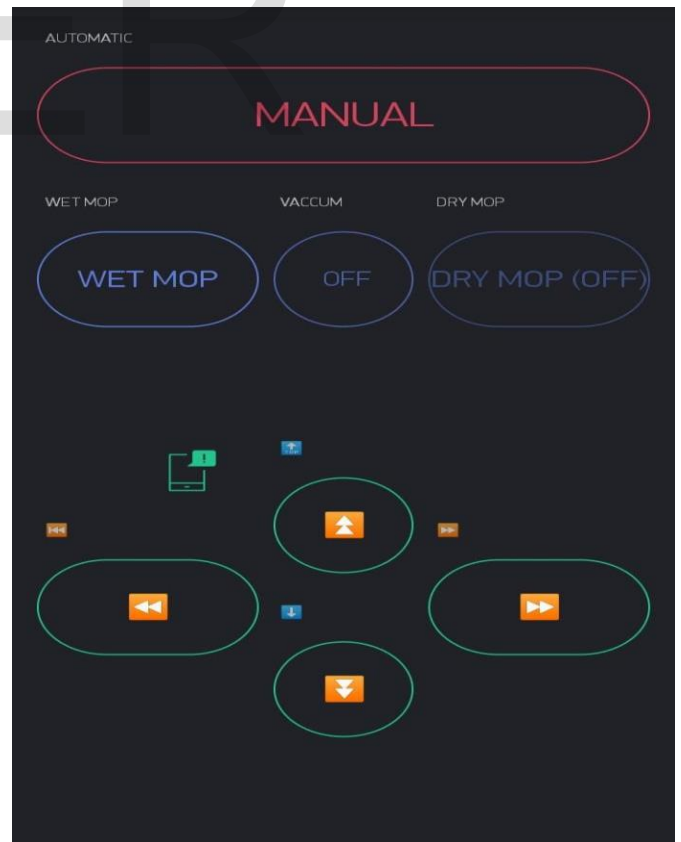
5 ADVANTAGES

The floor cleaning robot mainly reduces human effort and human intervention and people in cities have irregular and long working times. In such a situation a person will always find ways of saving time.

It can be helpful in the covid pandemic situation and helping physically disable person is also advantage of this project by the action of blynk application and we can use this robot in Automatic and Manual mode for overall control.

6 COMMERCIALIZATION POSSIBILITY

In the current scenario ,the current market trends in floor cleaner market is ruled by iRobot and Scooba all around the world . They hold around 60% of the market. The covid-19 pandemic caused an increase in cleaners. Their costs are around 35000 to 45000.Most of these are not effective even though they put a reduction in the costs. Effectiveness is less with the costs. They are using controllers which are accurate .Some of them are not using any image processing LIDAR concepts to run the floor cleaner. But the floor cleaner designed by us is cost efficient which will cost around 15000 and can be upgraded to LIDAR , image processing techniques and upgrade it with raspberry pie modules which further increase the cost to 20,000 which is still less than the current floor cleaners in the market and also this increase the effiency and accuracy by 80% .Also we use a roller mop for cleaning controlled automatically and manually. Adding a real time clock helps to reduce time reductancy and helps to increase efficiency. Hence the product would be useful in the market.

7. CONCLUSION

A Combination of hardware with wheels and fixed ball movement wheel in the front and software application of Blynk gives better accuracy and reduces the work load. Man power is minimized as it can be controlled by automatic and manual modes. And it have Low cost compared to roomba which cost almost 60,000 in Indian market and also comes with the mopping facility. This projects presents the design that is economical for development and fabrication of prototype automatic floor cleaner. This robot operates autonomous mode with additional features like mopping. This work is very useful as automation helps the mankind to reduce time in functioning. To further enhance the performance of the robot for cleaning purposes, raspberry pie and LIDAR function can be added. LIDAR function helps for mapping up the rooms its algorithm and can help the user for faster cleaning in less time.

ACKNOWLEDGMENT

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