

VOICE OPERATED FLOOR CLEANING ROBOT

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Abstract

In today's world Robotics is a fast growing and interesting field. Robot has sufficient intelligence to cover the maximum area of provided space. The Robot is a machine which is doing its actions automatically, especially one programmable by a computer which means the robots are completely automated. Robots rarely make mistakes and are more precise than human workers. They can produce a greater quantity in a short amount of time. They can work at a constant speed with more repeatability than humans. Voice Operated Floor Cleaning Robot is a mobile robot whose motions can be controlled by the user by giving specific voice commands. The speech is received by a mobile Bluetooth device and processed by the voice module. When a command for the robot is recognized, then voice module sends a command message to the robot's microcontroller. Microcontroller analyzes the message and takes appropriate actions. The board has 14 Digital pins, 6 Analog pins, and programmable with the Arduino IDE via a Type B USB cable. It can be powered by a USB cable or by an External 9 volt battery. The software part is done in Arduino IDE using the software Embedded C. Hardware is implemented and software porting is done.

Keywords: *Arduino, Bluetooth, Ultrasonic, Voice control.*

Introduction

Speech Recognition is a technology where the system understands the words (not its meaning) given through speech. Speech is an ideal method for robotic control and communication. The speech recognition circuit which functions independently form the robot's main intelligence. This is a good thing because it doesn't take any of the robots main CPU processing power for word recognition. Voice system has one integrated module i.e. Bluetooth module. In voice system, user gives voice commands through an android phone using Bluetooth as a medium. Human voice of 50-110 dB can be easily accepted by system.

Voice system identifies, recognize the voice and then converts it from analog to digital command. Further that the command goes from serial port Bluetooth module to the Arduino UNO R3, which is another module. Arduino board is interfaced with the chip which is suitable to convert the digital command into machine understandable code.

If the given command matches with the saved command then robot will read command and perform the action. If wrong command is given or some error occurred then it will check in loop and go again to previous stage and try to retrieve command again. LED is used to identify whether the commands given to the device functions or not.

When any action is going to be performed by the robotic device the LED will glow green and when there is some error it will blink red.

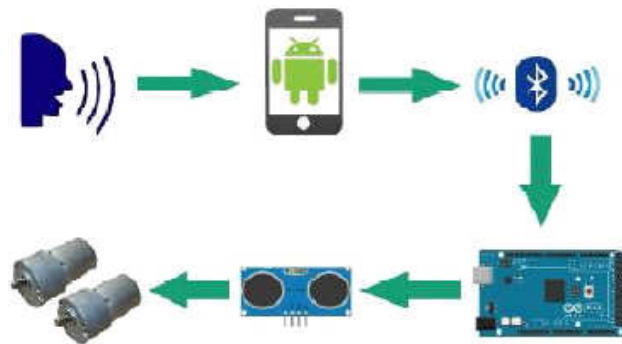


Fig 1: Block Diagram

System Description

Existing System

Before introducing the vacuum cleaner and floor cleaner it was manual and time consuming task. Now days in busy life human beings can't spend time on cleaning.

With the introduction of vacuum cleaner and floor cleaners this task is bit easy but still manual efforts are needed to perform it. So the robots for cleaning are proving as a solution to deal with cleaning

Proposed Work

Voice module

Speech recognition is the process of converting human voice to digital data, voice recognition is identifying the person who is speaking. Voice recognition works by an alysing the features of speech that differ between individuals.

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Hardware

i. Arduino Uno

The Arduino UNO is an open-source microcontroller board based on the Microship ATmega 328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits.

The board has 14 Digital pins, 6 Analog pins, and programmable with the Arduino IDE (Integrate Development Environment) via a type B USB cable. It can be powered by a USB cable or by an External 9 volt battery, though it accepts voltages between 7 and 20 volts.



Fig 2: Arduino UNO

ii. Hc-05 Serial Bluetooth Module

Hc-05 BLUETOOTH is an easy to use Bluetooth SPP (Serial Port Protocol module, designed for transparent wireless serial connection setup. Serial port Bluetooth module fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation with complete 2.4 GHz radio transceiver and baseband. It uses CSR Bluecore 04-External single chip Bluetooth system with CMOS technology and with AFH (Adaptive Frequency Hopping Feature). It has the footprint as small as 12.7mmx27mm. The pins present in the Bluetooth module are:

- *GND
- *5V
- *Tx (Transmitter)
- *Rx (Receiver)



Fig 3: Bluetooth Module

iii. Ultrasonic Sensor

As the name indicates, ultrasonic sensors measure distance by using ultrasonic waves. The sensor head emits an ultrasonic wave and receives the wave reflected back from the target.

Ultrasonic sensors measure the distance to the target by measuring the time between the emission and reception.

An optical sensor has a transmitter and receiver for both emission and reception. In a reflective model ultrasonic sensor, a single oscillator emits and receives ultrasonic waves alternatively. This enables miniaturization of the sensor head.

Ultrasonic sound vibrates at a frequency above the range of human hearing. Our ultrasonic sensors, like many others, use a single transducer to send a pulse and to receive the echo. The sensor determines the distance to a target by measuring time lapses between the sending and receiving of the ultrasonic pulse.



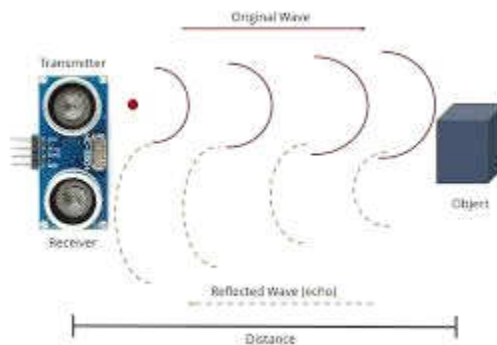
Fig 4: Ultrasonic Sensor

Distance Calculation

The distance can be calculated by the following formula:

$$\text{Distance } L = \frac{1}{2} \times T \times C$$

Where L is the distance, T is the time between the emission and reception and C is the sonic speed. (The value is multiplied by $\frac{1}{2}$ because T is the time for go-and-return distance)



L293D Motor Driver

Motor Driver is a module for motors that allows you to control the working speed and direction of two motors simultaneously. This Motor Driver is designed and developed based on L293D IC. L293D is a 16 Pin Motor Driver IC. This is designed to provide bidirectional drive currents at voltages from 5 V to 36 V.

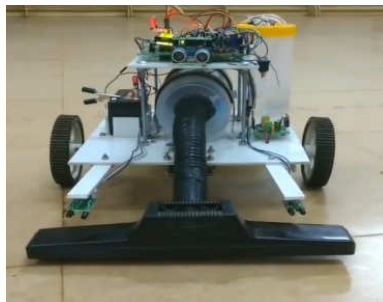
L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction.

It means that you can control two DC motor with a single L293D IC.



Fig 5: Motor Driver Circuit

Hardware Implementation



The Arduino is fitted on the wooden platform which has 2 wheels at the back and one chasis ball at the front. DC motor is used to control the wheel movements (right/left) acceleration. mechanism.

If robot is not accepting the commands or error occurs then it will go back to the Arduino for again receiving the commands once again.

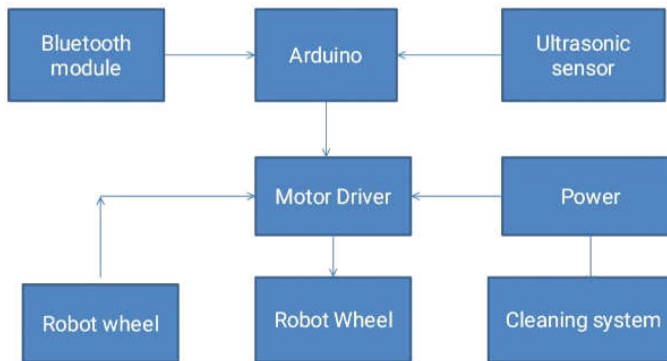
Operation

The purpose of this project is to build a robotic floor cleaning device which could be controlled using voice commands. Generally these kinds of systems are known as Speech Controlled Automation Systems (SCAS).

It is not aimed to control the robot using following voice commands. The robot can do these basic tasks:-

1. Move forward
2. Move back
3. Turn right
4. Turn left
5. Clean
6. Rotate
7. Stop (stops doing the current job)

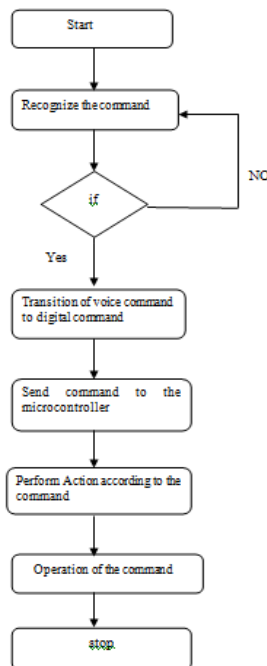
Block Diagram



Algorithm

1. The voice commands should be trained to the Easy VR module.
2. Then the stored voice commands are represented in the form of binary numbers such as move forward – 001, move backward – 010 etc.
3. These binary values are transmitted via Bluetooth module which is a transceiver.
4. The transmitted binary values are then received by another Bluetooth module which is present on the receiver side (Robot).
5. Microcontroller will take those binary values and performs action (servo motors) according to the binary values.

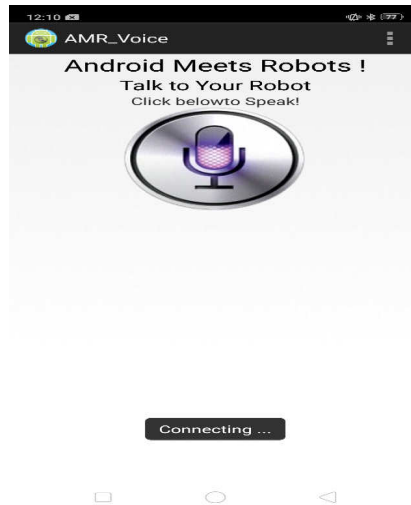
Flowchart



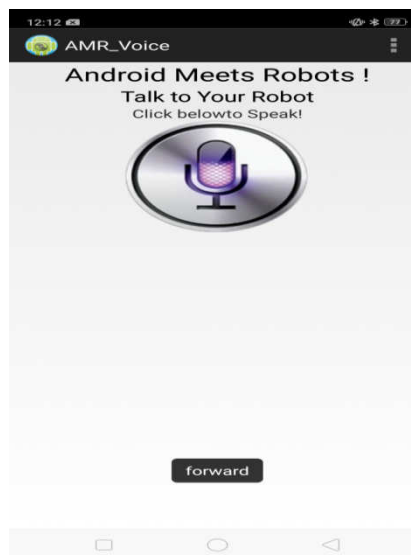
Results

The user can give commands through the mobile applications.

The mobile application is receiving the voice command through Bluetooth and sending to Arduino so that robot can perform the actions as user needs.



The forward command is given to the application from the user and Arduino will accept this command and will start then robot will move forward.



Applications

At Railway stations on platform for Robots can be used with manual mode at railway station, bus station at harsh situation.

Robots can clear any corners or edges as it is program to run at six different scenarios. To clean the carpet and sofa in home.

Disadvantages of Existing System

1. Even the best speech recognition systems sometimes make errors. If there is noise or some other sound in the room (e.g. the television or a kettle boiling), the number of errors will increase.
2. Speech Recognition works best if the microphone is close to the user (e.g. in a phone, or if the user is wearing a microphone). More distant microphones (e.g. on a table or wall) will tend to increase the number of errors.

Scope for Future Work

This research work has been narrowed down to short range Bluetooth module. Using a long range modules will result in connectivity with the robot for long distances.

1. Power Optimization such sleep and wakeup schedules can be incorporated.
2. Image processing can be implemented in the robot to detect the colour and the objects.
3. Automatic Targeting System can be implemented in the robot for tracking the target

Conclusion

The voice operated floor cleaning robot has been successfully designed and implemented which is capable of cleaning the room and table also. At the same time the robot will automatically change its direction if any obstacle is present in its path. There are still new ideas to improve the developed system and to add new functionality to it. The robot can be made to move randomly in any direction and its speed can be controlled.

References

1. IEEE Standard for User Interface Elements in Power Control of Electronic Devices employed in Office/Consumer Environments, IEEE Standard 1621, 2017(R2018).
2. Irobot.com, 'iRobot Corporation: We Are The Robot Company', 2018. [Online]. Available: <http://www.irobot.com/>.
3. Neato, 'Neato Robotics | Smartest, Most Powerful, Best Robot Vacuum', 2018. [Online]. Available: <http://www.neatorobotics.com/>.
4. Dyson.com, 'Latest Dyson Vacuum Cleaner Technology | Dyson.com', 2018. [Online]. Available: <http://www.dyson.com/vacuum-cleaners.aspx>.
5. Dyson 360 Eye robot, 'Dyson 360 Eye robot', 2018. [Online]. Available: <https://www.dyson360eye.com/>.