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Voice Controlled Smart Floor Cleaning Robot

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Abstract: ***Floor cleaning is a traditional system that is followed for many decades. In the olden days, people wish to clean the floor every day with water and cloth. Due to the advancement in the technology and lifestyle, there was a change in the cleaning process where the people started using Cloth / Thick threads tied to the Stick, dip in the water, and clean the surface. One needs to contribute more time to complete the cleaning floor work. If people do this work manually it takes more time and they couldn't do the work efficiently as their energy level will not be constant and they need to take care of their babies and other household activities too. When the same work is done by a machine, it takes less time and completes the task more efficiently with the same energy level. It is difficult to clean the large area properly when we have less time. The proposed robot is developed based on IoT technology using Arduino Uno, Bluetooth HC-05, DC motors, IR sensors, etc. In this robot, we are using a mobile App to control the cleaning process through voice commands which are transferred via Bluetooth module to Arduino in Manual mode. In the Automatic mode, the cleaning process is controlled by Arduino and IR sensor itself no human involvement is required.***
Keywords: Arduino Uno, IR Sensor, Bluetooth HC-05, DC motors, IoT.

I. INTRODUCTION

Cleaning the floor and house is very important to stay healthy and safe. Voice Controlled Smart Floor Cleaning Robot is the robotic system that provides floor cleaning service in room and big offices reducing human labour. Basically, like a robot, it eliminates human error and provides cleaning activity with much more efficiency. If we clean the floor manually then there is a possibility that the operator will leave some portion of the floor. Also due to manual labour involved this is time-consuming and irritating to clean the floor. Also in big offices, the floor area is very huge and the people involved there for cleaning purposes cannot clean it much more efficiently. This is where the robot comes as an advantage. Also, the robot is small and compact. So we can carry it and place it wherever we can in the house. Also in industries, the robot is very cost-effective as compared to manual labour involved. The flexibility, time-saving and efficiency make the robot a clean choice for cleaning the floor.

A. Literature Survey

In paper [1] the authors discussed an automatic floor cleaner robot. This robot operates only in automatic mode. The robot has 2 vacuum pumps connected in the backside as well as the front side of the robot. The robot can freely roam on the floor avoiding all the obstacles. It uses a microcontroller to control all components' operation and coordination which works as a brain of the robot. It has a proper power source and proper motor for regulating the sprinkling of the robot and motor driver for controlling the direction and speed of motor connected to the wheel. The navigation system of the robot is dependent on the sensors and microcontrollers and algorithm fed to it. The data acquisition system (here sensor) first collects the data from the environment and feeds it to the microcontroller. In paper [2] the authors discussed a smart floor cleaning robot that works on human instructions to clean the floor. By using a wireless robot cleaning system this robot ensures that the surface is properly cleaned. The wireless system has the transmitter application in it. This allows the robot to follow the commands which are given by the user through the android app. This robot is made up of the Arduino UNO controller consists of fourteen input/output pins, a robotic arm with a cleaning pad with a water sprayer to spray water on the surface on which the cleaning has to be carried out. The Arduino UNO decodes the given instructions and controls the movement of the motor to achieve the desired path, on receiving the commands from the android app.
In paper [3] the authors discussed the floor cleaning robot which can work in any of two modes i.e. "Automatic and Manual". This robot can perform both sweeping and mopping tasks. This robot is incorporated with an IR sensor for obstacle detection and an automatic water sprayer pump. Four motors are used, one for cleaning, one for the water pump and two for wheels. Dual relay circuit used to drive the motors one for the water pump and another for cleaner. In the automatic mode, the robot controls all the operations itself and changes the lane in case of hurdle detection and moves back. In the manual mode, the keypad is used to perform the expected task and to operate the robot. In manual mode, the RF module has been used to transmit and receive information between remote and robot. In paper [4] the authors discussed the floor cleaning robot that operates in two modes i.e., manual mode and autonomous mode. Here manual mode means mode selection switch is turned to High. Manual mode allows the users to give directions to the robot to move any place in the house; this gives them the freedom to the user to give instructions without any restrictions such as patterns on robot movements.

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In manual mode, the robot may bump an obstacle badly or fall from stairs it has to be taken care of by the user which may bring huge damage to the robot. This can be overcome by using android application and programming accordingly. The android application consists of the Forwarding symbol which moves the robot forward, the Backward symbol which moves the robot back, The Right and Left symbol which moves the robot right and left respectively when pressed else the robot will be in a static position. Autonomous mode means mode selection switch is turned to LOW. Here autonomous mode is guided by algorithms for path planning of the robot. The route map algorithm used here is like the letter 'S' pattern. In the collision with an obstacle, the robot changes its direction continuously using the route map algorithm. In paper [5] the authors discussed a Voice operated floor cleaning robot that works on voice instructions by a human. This mobile robot is controlled by servo motors. Then a voice is sent to the microcontroller. The Voice received by the microcontroller analyses the command and takes suitable actions. When any voice commands are given on the android application, the voice module will take the voice commands and convert the voice commands into digital signals. Then these digital signals are transmitted via the Bluetooth module to the robot. On the receiver end, the other Bluetooth module receives the command from the transmitter end and then performs the respective operations. In paper [6] the authors discussed a robot that operates on semi- or fully autonomous to perform services. To keep our robot as simple as possible, while able to perform the initial goals, i.e. an autonomous vacuum cleaner robot able to randomly navigate in a room. The Android app is generally developed using C, C++, and JAVA. The app consists of buttons for controlling robot movement i.e., left, right, up, down. Based on the instruction provided which are the directions given by the user in that particular direction only the robot has to move. In paper [7] the authors discussed Controlling Smart Devices with Voice Control Touch-based user input is not the only form that users can use to communicate with smart objects. Voice control is used by many consumers and smart devices. Applications such as Siri and Okay Google are exploring the limits of voice control. Even though the software's efficiency can invite fears of artificial intelligence taking over the human race, it can also prove a great asset to future IoT and non-IoT devices.

B. Terminology

1) *Arduino Uno:* The Arduino Uno is an open-source microcontroller board has 14 digital I/O pins 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable.
2) *Bluetooth HC-05:* To communicate with robots through mobile. This device is attached to the robot which receives the data from the mobile and it transmits the data.
3) *IR Sensor*: An infrared sensor is an electronic device, which emits infrared rays to sense some aspects of the surroundings.
4) *Motor Drivers:* Motor driver acts as an interface between Arduino and the motors. The movement of robot wheels is controlled by DC motors that work on batteries. The speed of the robot depends on the speed of the DC motor.
5) *Internet of Things:* The internet of things is the interconnection of many physical devices that are used to send and receive data.

II. PROPOSED METHODOLOGY

In this paper, we are proposing a hardware and software controlled tool called Voice Controlled Smart Floor Cleaning Robot which is based on the Internet of things uses Arduino Uno board, Bluetooth HC-05 that transmits commands from mobile app to Arduino. In this robot, we used an IR sensor to detect an obstacle and thus avoid the occurring collision. This robot has two operating modes i .e.., Automatic mode and Manual mode. In Manual mode, the user provides voice commands through the app, and then commands are transmitted via the Bluetooth module to Arduino, and the cleaning process is performed. In Automatic, no user interaction is required just Switch needs to be ON. This robot will have water storage with an anti-infection solution which is pumped with the water pump motor. This robot on receiving the voice commands from the user cleans the area by spraying water on the floor and wipes it using a mop fixed to its base.

A. Working of Proposed Methodology

The block diagram of the voice-controlled smart floor cleaning robot is shown in the fig 1.1. This paper presents a Voice Controlled Smart Floor Cleaning Robot which is based on the Internet of things that uses different hardware components such as Arduino Uno board, Bluetooth HC-05 that transmits commands from mobile app to Arduino. In this robot, we used an IR sensor to detect an obstacle and thus avoid an occurring collision. This robot has two operating modes i.e.., Automatic mode and Manual mode.

1) *Automated Mode:* When the robot is in the automated mode it will consider the sensor values to decide the movement of the robot. If the right sensor detects an obstacle the robot moves in the left direction if the left sensor detects the obstacle the robot moves in the right direction, whereas if both the sensors detect the obstacles the robot stops moving thinking it as a dead end. As long as the robot is in the automated mode it doesn't require any user commands to work.

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2) *Manual Mode:* When the robot is in manual mode it works according to the user instructions. Here the user needs to give the voice commands for the system to act. When the user gives a command to move forward, the robot moves forward with moping and the same way in all the directions. This manual mode is mainly useful when the user wants to clean only a particular area. The user can easily switch from manual mode to automated mode and vice-versa at any time.

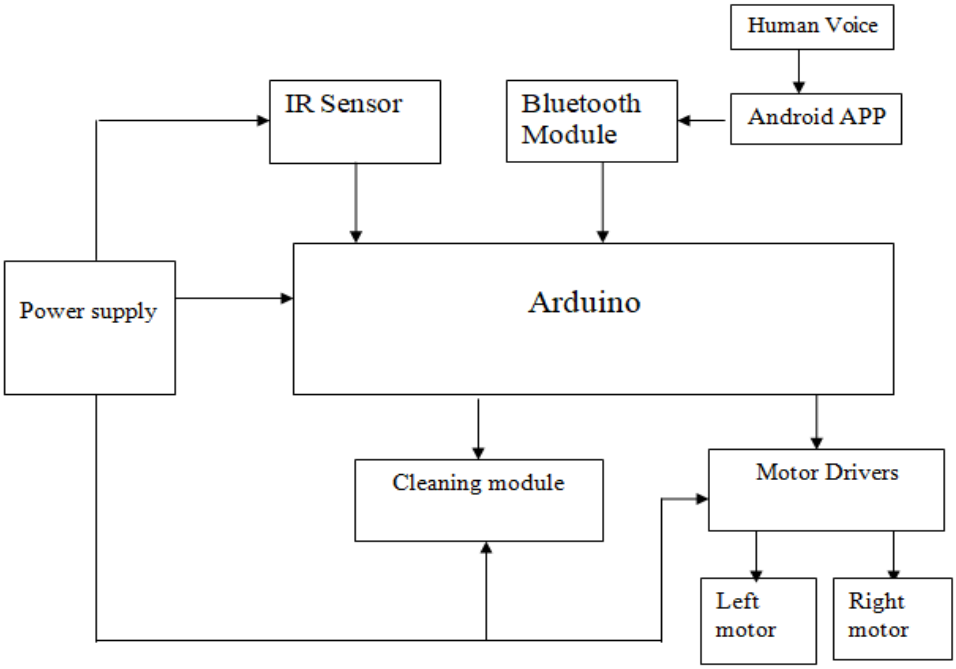


Fig. 1 Block Diagram of Smart Floor Cleaning Robot

B. *Results*

1) *Android Application:* The mobile application is receiving the voice command through Bluetooth and sending it to Arduino so that robot can act as user-specified.

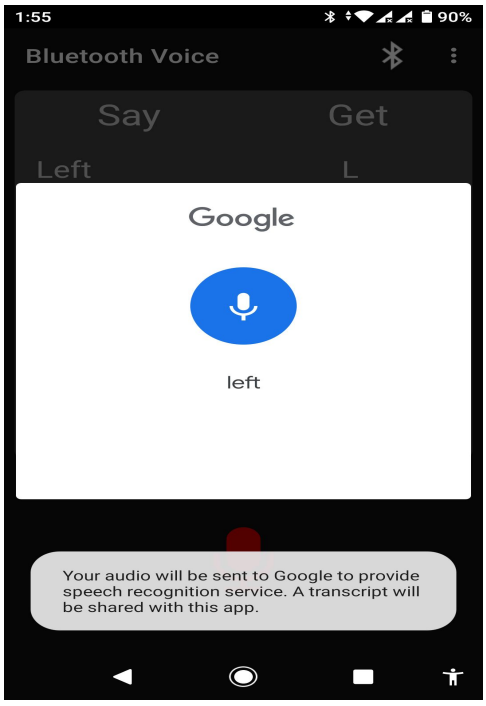


Fig. 2 Application accept command through voice

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2) *Hardware Implementation:* The hardware components Arduino, Bluetooth HC-05, DC motors, IR sensors, and cleaning equipment are assembled to perform the floor cleaning process.

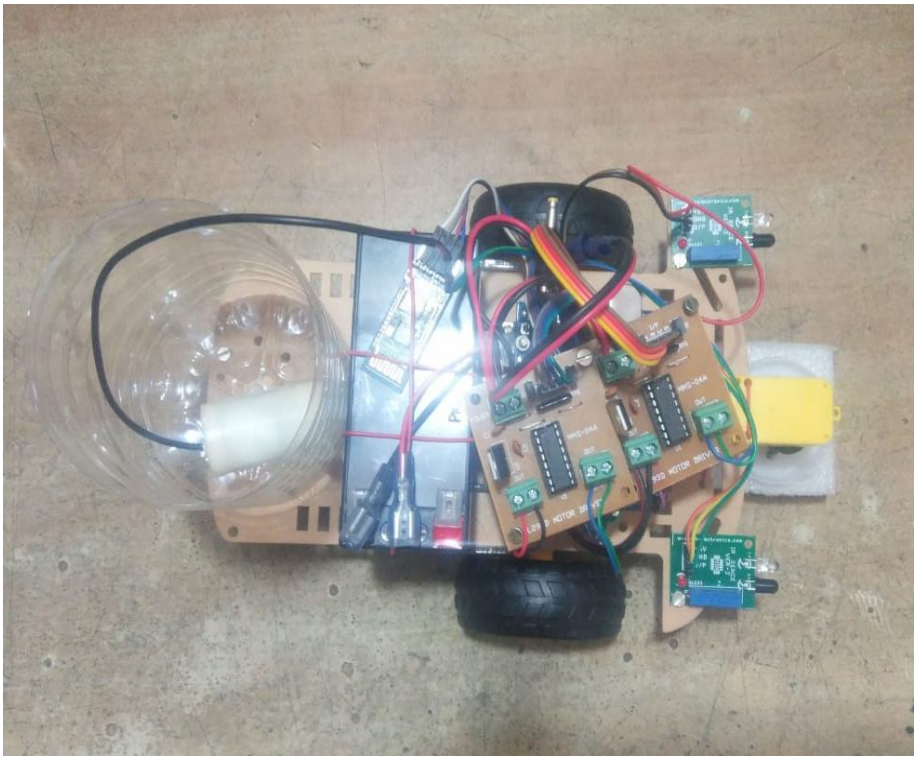


Fig. 3 Kit

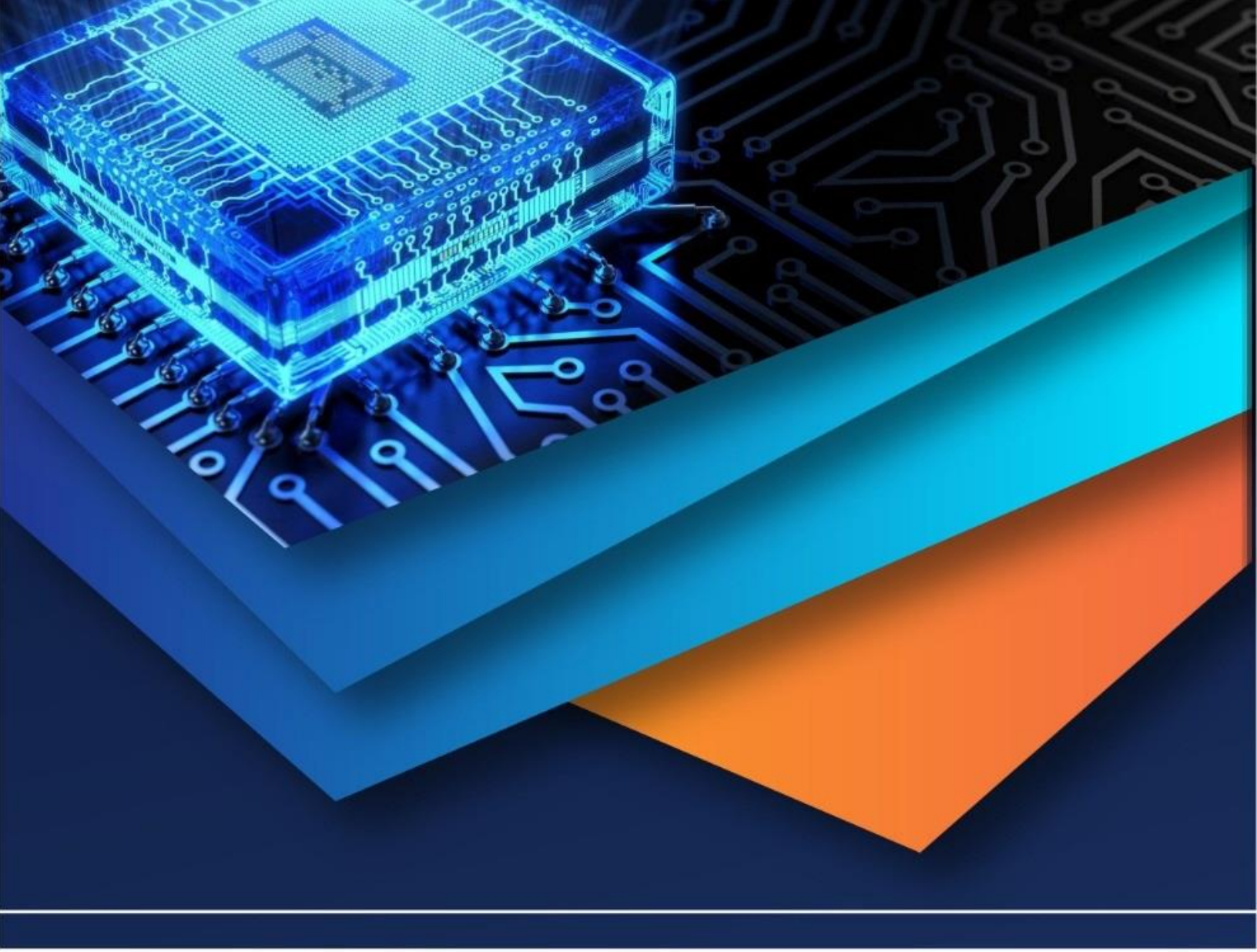
III. CONCLUSION

The proposed "Voice Controlled Smart Floor Cleaning Robot" facilitates an easy way to clean the floor with less human effort. This robot will be more helpful for the old age people who cannot complete all the work by themselves, and also for the people who are physically disabled and pay more money to the maids. This robot works in two modes automatic and manual for user convenience. If any obstacle is detected in its way it avoids collision and takes corrective path accordingly. This robot will have water storage with an anti-infection solution which is pumped with the water pump motor. This robot on receiving the voice commands from the user cleans the area by spraying water on the floor and wipes it using a mop fixed to its base.

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