Design and Implementation of Smart Floor Cleaning Robot using Android App

S Monika, K Aruna Manjusha, S V S Prasad, B.Naresh

Abstract--- The advancements made in technology of robotics have made life of mankind very much easier and comfortable. This paper describes a smart floor cleaning robot that allows cleaning the floor by giving instructions to the robot. This robot makes floor cleaning process easy and fast utilizing a wireless robotic cleaning system. This wireless system consists of a transmitter application that runs on an android mobile app which allows the robot to follow commands given by the user through the transmitter app. The proposed robot consists of Arduino UNO controller which has fourteen digital input/output pins, robotic arm with cleaning pad with a water sprayer for efficient cleaning. The Arduino UNO, on receiving the commands from android device through Bluetooth receiver, decodes the given commands and controls the motors to achieve the desired path and direction.

Keywords: Arduino UNO; Android Phone; Bluetooth Module, IR Sensor, Motor Drivers

1. INTRODUCTION

In the recent years, robots have been used for various cleaning purposes. Robots have various cleaning expertise like mopping, picking up the waste, wet floor cleaning, dry vacuum cleaning etc., Depending on the cleaning mechanism, these robots may have some advantages and disadvantages.

Smart floor cleaning robot has been designed for home and office environments. This robot will be using water storage with anti-infection solution which is pumped with water pump motor. This robot on receiving the commands from the android device cleans a area using a cleaning pad by spraying water on the floor. After cleaning the wet floor, it can drain the dirty water into the required container as per the commands given to it. The robotic arm is used for efficient and effective wet floor cleaning purpose. This system can also be used to pick up the objects and carry them within the Bluetooth range. The proposed system is a manual system because it is controlled by android application which is operated by human. The proposed system functioning is entirely depended on the commands that are received from the android app.

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2. LITERATURE SURVEY

A robot vacuum cleaner is an autonomous robotic vacuum cleaner which includes self-drive mode and cleans the floor autonomously without human control. This robot vacuum cleaner consists of spinning brushes, mopping, UV sterilization and security cameras for cleaning purpose. This vacuum cleaner had some drawbacks like colliding with obstacles and stopped at a shorter distance from walls and other objects. It was not able to reach to all corners and edges of the room and left those areas unclean [3].

An automatic floor cleaner robot has brushes attached to its sides to collect the dust. This robot uses ultrasonic sensors to avoid obstacles and change its direction and it has a suction unit that sucks in the dust while moving around the room freely. But the drawback of this robot is that it cannot clean the wet floor [4].

Roomba vacuum cleaner robot is arranged at 27o angle, the sweeping brush placed under it sweeps the dust and waste from corners and edges. It has a powerful motor suction unit which sucks in the dirt into the filtered dust bin.

3. PROPOSED MODEL

The proposed model “Design and Implementation of Smart Floor Cleaning Robot using Android App” shows fig 1 for better understanding of the proposed work. This block diagram consists of 12v DC motor, L293D IC, IR Sensor, Bluetooth module, cleaning mechanism and Arduino UNO.

The power supply is given to the Arduino UNO as well as to relay. The relay works as switch so that it controls the water pump whenever the user receives the commands from transmitter app. The robotic arm used here consists of three dc motors where one dc motor is used for moving robotic arm up and down, second dc motor is used to close and open the teeth of robotic arm and last dc motor is used to rotate arm completely. Here we use L239D drivers for driving dc motors to move in forward and backward direction. Bluetooth module is used to control the robot using mobile phone application within a range. The IR sensor used here is used to detect the obstacle and gives indication of a obstacle using buzzer.

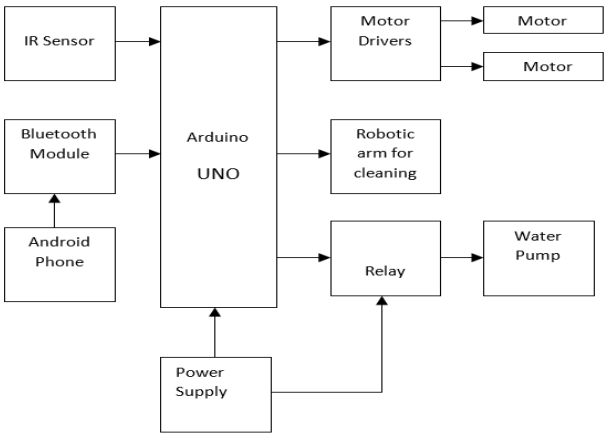

Fig. 1: Block Diagram

3.1. Arduino UNO

The Arduino UNO board consists of fourteen digital input/output pins and six analog input pins. It can be programmed using Arduino IDE via a type B USB cable. Input voltage range of Arduino UNO lies between 7 to 20 volts but the operating voltage of Arduino UNO is 5V. The Clock speed of Arduino UNO is 16MHz. It has 32KB flash memory, 2KB SRAM and 1KB EEPROM

3.2. Bluetooth Module

Bluetooth operating range is 2400-2483.5MHz. Frequency-hopping spread spectrum technology is used by Bluetooth. The data transmission is done in packets and each packet is transmitted on any one of the Bluetooth channel which has a bandwidth of 1MHz. Bluetooth 4.0 allows spacing of 2MHz for 40 channels. The starting frequency of first channel starts at 2402MHz and continues up to 2480MHz in 1MHz steps. It performs 1600 hops per second, with adaptive frequency-hopping (AFH) enabled.

3.3. L293D Motor Driver IC

L293D is a Motor Driver IC which allows DC motor to drive on either direction. L293D motor driver IC has 16 pins which are used to control a set of two DC motors simultaneously in any direction. It is based on the concept of H-bridge. The direction of voltage or current flow will be decided by the H-bridge.

4. SOFTWARE IMPLEMENTATION

The sequence of implementing the proposed model is shown below in fig 2 in the form of flow chart

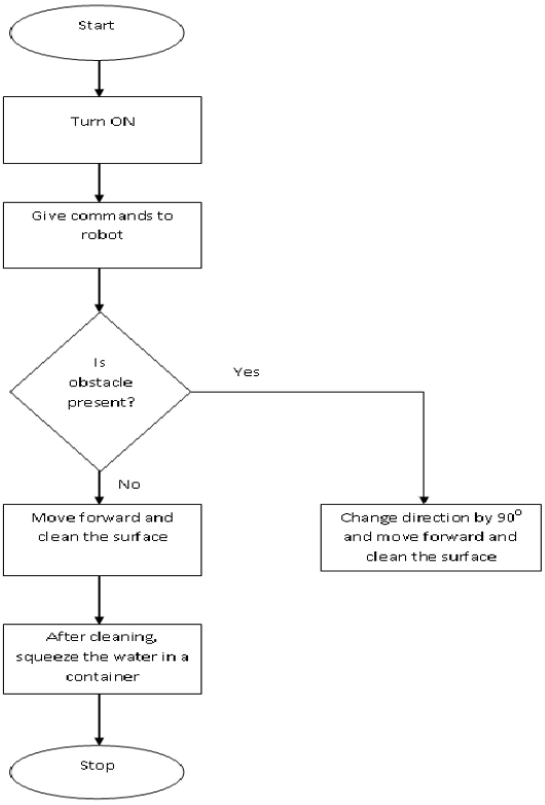

Fig. 2: Flow Chart

5. RESULT

A hardware prototype has been developed with the idea of making floor cleaning process easy, fast and comfortable, android mobile application for giving commands

The app shown below is used to send commands to the robot using the bluetooth receiver connected to it.

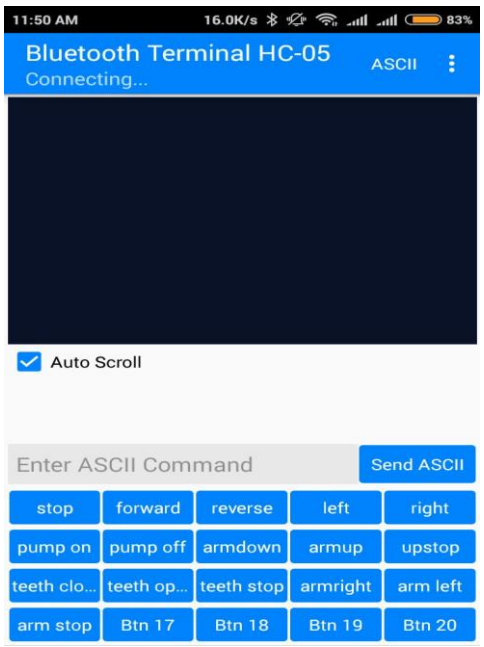

Fig. 3: Android App For Transmitting Commands

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HARDWARE MODULE

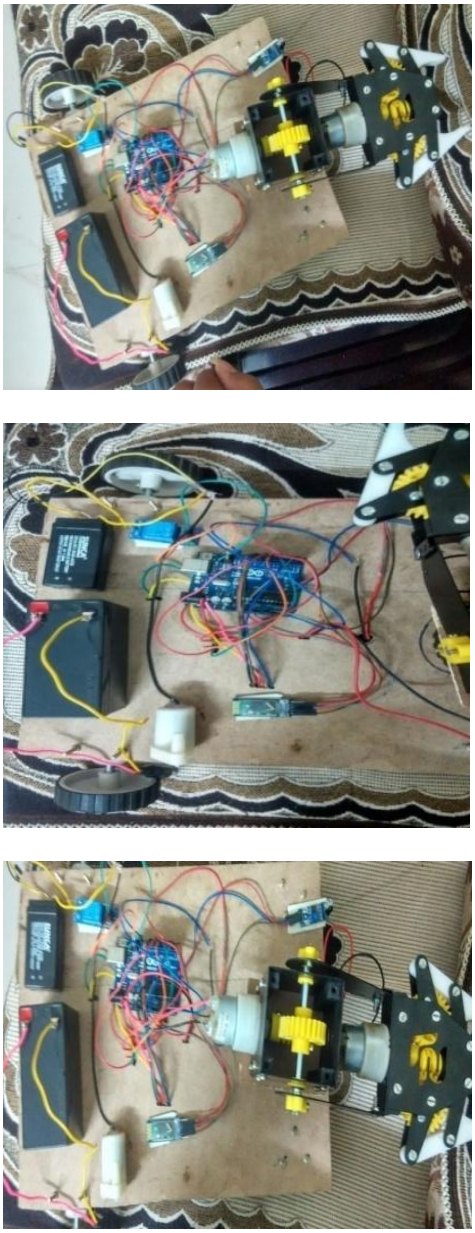

Fig. 4: Hardware Outputs at different angles

Table 1: Comparison of types of robots for A4 Papers

Types of Robots	Roomba	Braava	Proposed Robot
Type of use	Dry vacuum	Floor mopping, dry cleaning	Wet cleaning of floor
Technology used	IR, RF and auto-charging mechanism	IR with virtual wall accessories	IR, Bluetooth and Android App
Pros	Easy to use, Easy to operate	Easy to use, cleans effectively	Easy to use , cleans under furniture
Cons	Noisy	Noisy	Not noisy
Power Consump tion	High(33W)	Medium (7.1W)	Less(5W)
Price	$700	$300	$118

6. CONCLUSION

This research paper presents that floor cleaning process can be done in an easier manner and more efficiently by robot utilizing wireless robotic system. This proposed robot reduces the time and cost of labor. In the previous research papers like robot vaccum cleaner and automatic floor cleaner, robot had some drawbacks like colliding with objects in front of it and this vaccum cleaner couldn't reach to small areas and left those areas unclean and the automatic floor cleaner robot collects the dust but the drawback overhere is that it doesnot clean the wet floor. These two drawbacks have been overcame in this research paper.

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