Hand Gesture Controlled Robot and Obstacle Avoidance System using Arduino for Cleaning Application

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Abstract: **With the advancement of technology, robots are getting more consideration of researchers to make life of mankind pleasant. This paper describes the gesture control and obstacle avoidance robot which can be controlled by our hands for cleaning applications. This robot operates in physical mode as well as automatic mode that can perform all cleaning activities such as dry cleaning, wet cleaning and sweeping. We are adding the features like battery status indication through alarm sound and full dust bag indication. In addition to it, for commercial purpose it will save the time and enhance the lifestyle of mankind. In this paper using technologies are arduino microcontroller, accelerometer, ultrasonic sensor and GSM module. Cleaning part having the components are motors, roller brushes, cleaning mop, the dust bag and 12v rechargeable battery is used as power supply. In manual mode, RF module had been used to transmit and receive the information between user and robot.**

Keywords: **Arduino, Accelerometer, Battery status indication, Cleaning, Dust bag, GSM module, Motor driver, Power supply, RF module, Ultrasonic sensor.**

1. Introduction

In recent years, robotics is very efficient to take major attention in robotic researches. Most of the robots are used to reduce the work of humans. We are introducing the robot in cleaning applications at homes, hotels, offices, hospitals and industries. The robot operates in manual mode with an autonomous mode to control the robots by our hand gestures. The user wore a gesture device arduino and accelerometer which senses the signals. And if any obstacles come in front of the robot it will be automatically change the directions using ultrasonic sensor.

The arduino Uno microcontroller reads the analog output values i.e, x-axis and y-axis value of the accelerometer and converts that analog value to respective digital value. The values are given a particular function by the use of the arduino software. The digital values are processed by the arduino and according to the tilt of the accelerometer sensor mounted on the hand. The sensor sends the commands to the receiver end which drives the motor to a particular direction in which we have set to move. The robot moves when we tilt our hand to forward, backward, left, right and stop. Then if any obstacle comes in front of the robot it will be detect and avoid the obstacle.

Robot doing all cleaning activities such as dry cleaning, sweeping, wet cleaning. The main objective of this work is to provide valuable solution to the problem of robotic cleaner utilizing local resources.

2. Literature review

Prajwal Ashwin Jawalekar, in the "Robot control by using human hand gesture using hand gestures". The gesture controlled robot can be controlled by normal hand gestures. The accelerometer controls the movement of the car.

Premangshu Chandra, Pallab kanti Mukherjee, in the "Gesture controlled robot using arduino and android" The theme of this project wireless controlled robot using arduino ATmega32 processor and an android operated application to control the gestures via Bluetooth module. The android operated phone is incorporated as an accelerometer.

Uman Khalid, Muhammad Faizon Baloch, Haseeb Haider, in the "Smart floor cleaning robot" The Robot operates in physical mode and as well as autonomous mode along with scheduling for specific time and bag less dirt container with auto dirt disposal mechanism. In this project robot is used for cleaning applications like sweeping, dry cleaning and wet cleaning.

Manisha Kukde, Sanchita Nagpurka, Akshay Dhakulkar, Akshay Amdare, in the "Automatic and manual vaccum cleaning robot" The project is to design and develop robotic floor with obstacle avoidance. RF modules have been used for wireless communication between remote and robot having range 50m.

3. Block diagram

The diagram consists of the various Parts in the robotic cleaning application that user interaction consists of arduino and accelerometer that sense gestures and given to the robot. The GSM module is used to intimate the user about battery status. The cleaning part consists of cleaning mop, dust bag, rolling brushes. It is useful to people.
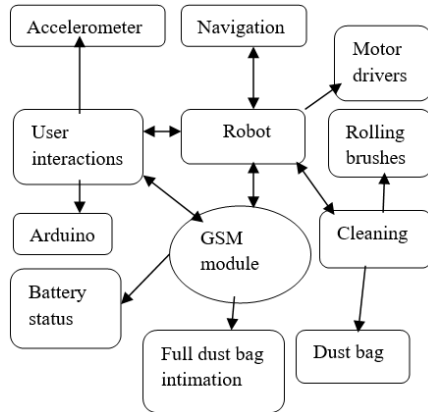
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Fig. 1. Basic block diagram

4. Existing system

The system consists of the design of human given gestures to the robot by our hands. The system consists of two parts one is transmitter part and another is receiver part. The transmitter consists of the arduino and accelerometer which gives gestures to the receiver. The receiver receives the signals and did perform relative operations. Another system did the cleaning applications in autonomous. To intimate user about battery status via blue tooth or graphical user interface. Disadvantage of this existing system is if the dust bag is full, does not known to user.
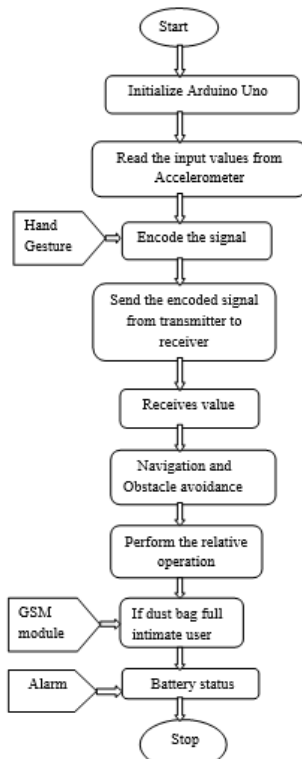
5. Proposed system

Fig. 2. Flowchart

Our proposed system is to developing the gesture based control robot in cleaning application. As shown in Fig 1, proposed system block diagram. The wireless vacuum cleaner has dust bag, if dust bag is full it will automatically send notifications to mobile phone through GSM module. The 12V battery is used in vacuum cleaner. The battery status would be in below 15%, it automatically produce the sound like alarm in every one hour. The technologies used in proposed system arduino, accelerometer, ultrasonic sensor, GSM module, 12V battery. This project is used in industries, houses and restaurants etc. The aim of the project is saves the time and consumes less energy and effectively used for people. It reduces the human work. People can be accessing easily on that sitting places.

6. Methodology

In our project consists of two modes one is manual mode and another is autonomous mode. In manual mode accelerometer is used to sense the gestures and given to the arduino. The instruction code is given to the arduino software. In autonomous mode ultrasonic sensor is used to detect and avoid the obstacles. It is implemented in cleaning application, process the all cleaning activities like sweeping, dry cleaning and wet cleaning. Sense the dust bag if it is full immediately intimate user through messages by using GSM module. Then iMost of the people has not time to cleaning so we introduce the concept is scheduling for specific time. It consists of the rolling brushes, cleaning mop and dust bag. This project is used for housemates.

7. Hardware requirements

A. Arduino

Arduino UNO is a microcontroller based on ATmega328.Arduino has 20 digital inputs and output pins. It has open source hardware. Operating voltage is 5V. Input voltage is 6-20V. Analog input pins are 6. Arduino is a main part of the robot.
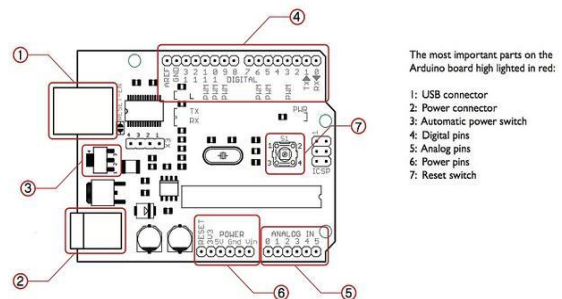

Fig. 3. Arduino diagram

B. Accelerometer

Accelerometer is a kind of sensor that measures changes in gravitational acceleration in a device. Accelerometers are used to measure the stimulation, tilt and vibration in numerous devices. It is used to sense the information and given that information to the arduino.

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C. Ultrasonic Sensor

An Ultrasonic Sensor is used to detect and avoid the obstacles comes in front of the robot. It is connected in the receiver side. Ultrasonic sensor is used measure the distance within a wide range of 2 cm to 400 cm. The Ultrasonic transmitter transmits a wave, this wave travels in air and when it gets objected by any material.

Fig. 4. Ultrasonic sensor

D. Battery

A battery is a utensil consisting of one or more electrochemical cells. A battery converts chemical energy to the electrical energy. The battery supply 12 volts power to give motor driver. The battery is connected via GSM module. It indicates the battery status to the user. The battery status indication is given below Fig. 5.

Fig. 5. Battery status indication

E. GSM module

GSM is a mobile communication modem, it is stands for global system for mobile communication GSM is an open and digital cellular technology used for transmitting mobile voice and data services operates at the 850MHz, 900MHz frequency bands. GSM network consists of the following components.

1. A mobile station
2. Base station subsystem
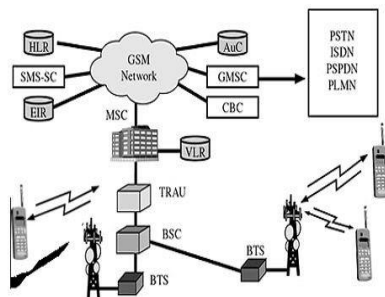3. Network subsystem

Fig. 6. GSM Network architecture

GSM module is used to establish communication between a computer and a GPS system. GSM MODEM can perform the following operations.

1. Receive, send and delete SMS messages in a SIM.
2. Read, search phonebook entries of the SIM.
3. Make, Receive or reject a voice call.

8. Conclusion

We have developed hand gesture controlled robot and obstacle avoidance in cleaning application that performs all cleaning activities act as manual mode as well as autonomous mode. The user gives hand gestures to the robot and performs well. In autonomous mode we are adding features battery status indication and dust bag full indication. It senses the wall, edges, corners that cleaning properly. This robotic application is used in houses, offices, industries such environments. It saves the time and improving the life style of mankind.

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