Research Article

Automatic Eatery Table Cleaning Bot

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Abstract

Now a day, the field of automation plays an important role not only in industries but also in most of the places especially restaurants, canteens, mess etc. In the above said places, the normal human beings are subject to clean the eating table in order to maintain the sanitation level. This leads the people to have the disgusting feel and as well the time consumption if they are aged whenever cleaning the eatery table. In order to avoid these shortcomings, the proposed system implements a simplest and mobility bot in order to clean the eatery table especially the dry materials automatically without any human interventions. The proposed system consists of Arduino UNO controller, batteries, Ultrasonic sensor, IR sensor, pump motor, wiper and vacuum cleaner setup. Whenever the bot is placed on the eatery table, IR sensor detects the dust particles and hence the vacuum cleaner sucks those particles. Then, pumping motor will pour the water in order to clean sticky contents on the table through the wiper setup. The entire hardware components are controlled by Arduino UNO controller. In this, ultrasonic sensor will come into the picture whenever the bot deviates from the table surface. The above said operation is repeated until the entire table gets cleaned. This system would certainly be helpful in making the eatery table so clean and provide facilitation for the people who clean the table with disgusting feel.

Keywords: Ardino UNO; Ultrasonic sensor; Wiper Setup; Vacuum Cleaner.

Introduction

Robots are machines which are programmable and are able to carry out complex tasks with minimal human interventions. Robots find applicants on man domains, even for household applications [2]. Robots for domestic application have been rising [1]. Automatic eatery table cleaning robots are especially famous [6].

Among various robots present in the world only some robots can be used especially for doing the household chores of man. Among those robots, one special kind of robot that is very useful for everyone is cleaning and mopping robot. A simple automatic robot that uses some prefixed algorithms and programs [9] to clean the eatery table is called a cleaning robot.

The main use of this robot is to reduce the human interaction in the cleaning process which can be a time taking process. These robots can be used anywhere i.e., in offices, houses, hotel. These robots can be activated with the press of a single button or can be pre-set to activate at a particular time.

Existing system

In this existing method, Arduino controller [9], Ultrasonic sensor, motors and its driver are used to control the robot movement. 5V battery power is connected to the motor driver. It provided two cleaning wheel in front of the robot. They are connected in antiparallel to each other which will make assure that the robot will not deviate from the path and keep the cleaning process correctly.

An ultrasonic sensor is placed on the front middle and somewhat in front of the cleaning wheels. It will make sense the robot that is at the edge of the table. It is floor cleaner robot based on Arduino MEGA. This autonomous robot can perform mope and cleaning function. Ultrasonic sensor is used to sense the obstacles. If any obstacle found in a robotic path, then the robot take diversion and cleans the remaining surface. Automatic water sprayer attached on top of the system which automatically supplies the

water for cleaning operation. Sensors are used to avoid the robot dropping down from the table.

Sensors and motors are connected to the input / output ports of the controller. Robot roams around the table, if any obstacles available on the table it sucks and spray water to clean the surface. Wiper based wheels are attached with the robot to remove the dust particles on the surface.

Proposed method

The proposed system block diagram is shown in Fig. 1. It primarily consists of the following hardware components. The heart of the system is Arduino UNO microcontroller which uses Arduino IDE software for writing the instructions on it.

- Arduino UNO Microcontroller
- DC Motors and Batteries
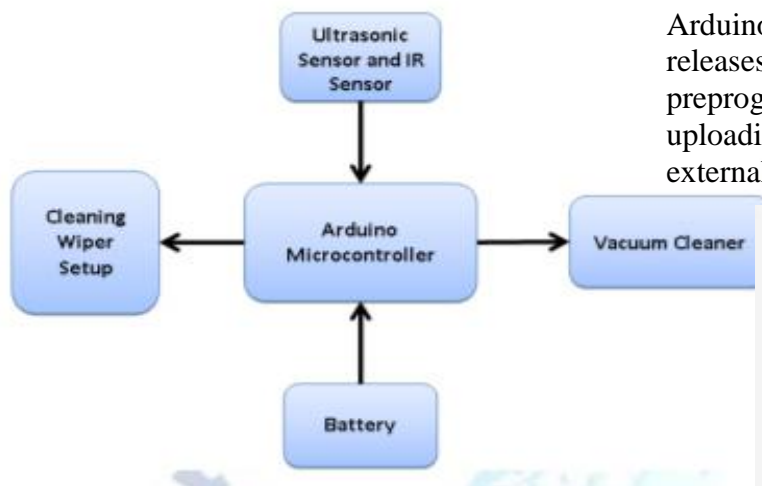- Ultrasonic and IR Sensor
- Wiper and Vacuum Cleaner Setup.

Fig. 1. Block diagram

Working principle and operation

The proposed system has the vacuum cleaner at the top and the cleaning wiper setup in the front in order to clean the dust particles in the eatery table. When the robot is powered by the battery, it will start to traverse as DC motors are connected at the back wheels of the bot and IR sensor will come into the picture to detect the dust particles on the table. During traverse on the eatery table, the vacuum cleaner will suck the dry waste food and store it in the container. Simultaneously, the robot will spray the water on the table to clean the sticky content. If the robot reaches to any of the corner of the eatery table, it

will turn around with the help of the ultrasonic sensor. All the above said operations of the proposed system are controlled through Arduino Controller which has all kinds of instructions to be executed without any interventions.

Arduino UNO

The Arduino UNO is an open-source microcontroller board shown in Fig. 1. It is based on the Microchip ATmega328P 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 I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable. It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts. The Uno board is the first in a series of USB-based Arduino boards; it and version 1.0 of the Arduino IDE were the reference versions of Arduino, which have now evolved to newer releases. The Atmega328 on the board comes preprogrammed with a bootloader that allows uploading new code to it without the use of an external hardware programmer.

FIG.2 ARDUINO UNO

DC motor

A simple DC motor as shown in Fig. 3 has a stationary set of magnets in the stator and an armature with one or more windings of insulated wire wrapped around a soft iron core that concentrates the magnetic field. Brushless DC motors have electronics that switch the DC current to each coil on and off and have no brushes. In any DC motor, RPM and torque are inversely proportional. Hence, the gear having more torque will provide a lesser RPM and converse. In a geared DC motor, the concept of pulse width modulation is applied. In a geared

DC motor, the gear connecting the motor and the gear head is quite small, hence it transfers more speed to the larger teeth part of the gear head and makes it rotate. The larger part of the gear further turns the smaller duplex part.

Fig. 3. DC Motor

Ultrasonic sensor

An ultrasonic sensor shown in Fig. 4 is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal. Ultrasonic waves travel faster than the speed of audible sound (i.e. the sound that humans can hear). Ultrasonic sensors have two main components: the transmitter (which emits the sound using piezoelectric crystals) and the receiver (which encounters the sound after it has travelled to and from the target. In order to calculate the distance between the sensor and the object, the sensor measures the time it takes between the emissions of the sound by the transmitter to its contact with the receiver. The formula for this calculation is $D = ½ \ T \ xC$ (where D is the distance, T is the time, and C is the speed of sound ~ 343 meters/second).

Fig. 4. Ultrasonic sensor

IR Sensor

An infrared (IR) sensor is an electronic device that measures and detects infrared radiation in its surrounding environment. Infrared radiation was discovered by an astronomer named William Herchel in 1800. IR is invisible to the human eye, as its wavelength is longer than that of visible light. The IR sensor is shown in Fig. 5. There are two types of infrared sensors: active and passive. Active infrared sensors both emit and detect infrared radiation. Active IR sensors have two parts: a light emitting diode (LED) and a receiver. 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. Active IR sensors act as proximity sensor, and they are commonly used in obstacle detection systems (such as inrobots).Passive infrared (PIR) sensors only detect infrared radiation and do not emit it from an LED.

Fig. 5. IR Sensor

Wiper cleaning setup (includes pumping motor and its image)

A Motor pump is a mechanical device, used to move the liquids/gases from one place to another by using mechanical action. The working principle of the water pump is, it converts the motor's energy from mechanical to fluid flow. These are classified into various types based on the technique they use for supplying the liquid like direct, gravity and displacement. The working principle of a water pump mainly depends upon the positive displacement principle as well as kinetic energy to push the water. These pumps use AC power otherwise DC power for energizing the motor of the water pump otherwise can energized other kinds of drivers. The water pump (Fig. 6) is a portable device and can be applied in several household application .Water pumps are classified into two type namely positive displacement and centrifugal.

Fig. 6. Pumping Motor

Hardware setup

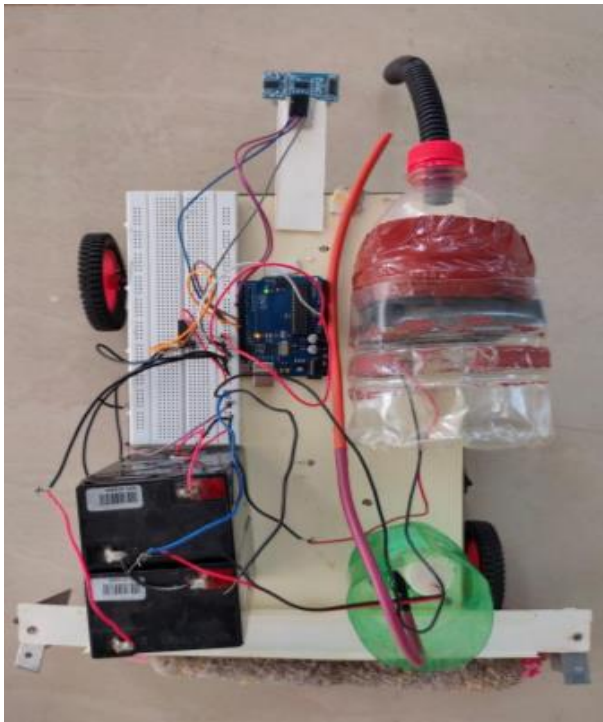The complete hardware setup is shown in fig. 7.

Fig. 7. Hardware setup

Results and discussion

Today's modern world consists of all kinds of devices in all fields with the help of available and emerging technology. As automation plays an important role, this automatic eatery table cleaning bot will be playing a vital role in eatery. This automatic bot can reduce the inconvenience of the servers who work in the eatery. During the trial testing, this bot is normally powered by 9V battery. Once powered, it is traversing on the surface of the table. During the period of traversing, the IR sensor, which normally detects upto 5 cm range, identifies the wasted food materials and hence it will be cleaned for the level expected. In this, ultrasonic sensor which will maintain the bot on the table itself. Its range can be configured according the table position and its ground clearance.

The mobility bot has the following features,

- Simple and Portable device
- It can be used in any kind of tables to clean it

It helps the server to get rid of the disgusting feel whenever they clean the sticky contents available on the surface of the table. This would make the customer's feel so pleasant and the eatery can be more hygienic within short period of time.

Conclusion

The "Automatic Eatery Table Cleaning Bot" will serve the humanity in a wide range. Having food is essential for the survival of the living being. Every human need full freedom to enjoy the taste of food at any time at home and as well in the eatery. Whenever the people like to have food, then, there is a possibility of wasting or spilling it on the eatery table. In order to clean the eatery table, the proposed system will provide the facilitation for the server and as well owner to clean it with so tidy without any human interventions. Even though there are many cleaning and mopping robots, the proposed system is so simple, economic and portable. It will help the aged server physically and as well to save their timing whenever the table is getting cleaned.

Conflict of interest

Authors declared no conflict of interest.

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