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Smart robot using in smart homes

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ABSTRACT: The smart robot is an important part of the smart homes system, in this research the Arduino Vacuum Cleaner we built is very compact and practical for potential office and home use. The developed robot is disk-shaped, equipped with vacuuming and cleaning technology and controlled by Arduino nano.

It sucks dirt via a retractable dustbin, using a fan within a motor. the device will be deployed for office and home use thereby making cleaning a fully autonomous duty. This robot will have ultrasonic sensors and an IR proximity sensor. The ultrasonic sensor will allow the robot to avoid obstacles so that it can move freely until the room is properly cleaned, and the proximity sensor will help it to avoid falling from stairs.

One of the most important features of our floor cleaning robot is that it is fast and flexible in movement, able to deal with all dirt and stains on floors without human intervention.

It is also characterized by the fact that it can be disassembled and installed with ease and simplicity, so that in the event of a malfunction, any malfunction will be repaired at the same time. It is also characterized by possessing sensors, so it can identify the .It is possible to develop this technique to become more used in various fields. Because we are in the world of technology development, it becomes very easy to develop such projects to benefit from them in daily life

Keywords: robot, smart home, smart cleaner, wireless sensor

1. INTRODUCTION

Technology is important because it is used in all areas of our working life. When you contemplate your daily routine and count all the technical tools you consume in just one day, you will realize how important technology is, Manual work is taken over the robot technology and many of the related robot appliances are being used extensively also. Here represents the technology that proposed the working of robot for Floor cleaning. Households of today are becoming smarter and more automated. Home automation delivers convenience and creates more time for people. Domestic robots are entering the homes and people's daily lives [1], developers and companies are working everyday all over he world to develop techniques to make our daily life easier. Some movies and TV shows have depicted a future world in which robotic devices will take over routine household tasks, allowing family members to spend more time together and helping the elderly to live independently for longer. Moreover, Robot vacuums are of great benefit in facilitating the cleaning process for patients allergic to house dust, who must clean the floors daily. These Robots have many distinctive characteristics, which make it superior to humans in many cases, including that it is easy to obtain, and it is also characterized by its small size and ease of handling, as it is made of materials that can be changed, in the event of damage to one of its parts, it thus helps in facilitating and accomplishing many household chores with ease.

[2] In a present-day scenario, we all are so busy with our work that we don't have the time for cleaning our house properly. The solution to the problem is very simple, you just need to buy a domestic vacuum cleaner robot such as irobot

roomba which will clean your house with the press of a button. But such commercial products share one common issue, which is cost. So we decided to make a Floor cleaner robot, that costs very less compared to commercial products available in the market [3].

With the aim of keeping our robot as simple as possible, while able to perform the initial goals, i.e. an autonomous vacuum cleaner robot able to randomly navigate through a room or a house with the minimum human assistance, We offer in your hands a Vacuum Robot for Autonomous floor cleaning application [4]. Vacuum cleaner Robot is designed to make the cleaning process easier rather than by using manual vacuum. This project will explore "Smart Vacuum Cleaner Robot" and discuss it. [5]

2. LITERATURE

Cleaning robots are used in domestic and industrial environment .The floor cleaner available in the market requires a lot of human efforts and assistance. Manually cleaning may not wipe off the dust properly as some dust particles may remain on the floor and it can affect the human health adversely. This problem gives a fantastic idea to engineers and researchers to design a robot that can be a helping hand in this work. The smart floor cleaning robot using Arduino is designed using embedded technology. The wireless communication is implemented using Bluetooth to communicate with the robot via android application [1]. The electronic circuitry of the robot consists of the HC-05 Bluetooth module which sends the command to the microcontroller Arduino – UNO on which the software program is directly loaded. L293D chips are used as motor drivers for controlled movement of robot and moppers.

A smart floor cleaner is an electronic device that is intelligently programed to clean a specific area using Arduino based technology. Some features that are seen in smart floor cleaners include wet and dry mopping, vaccum cleaning, detection of obstacles, security cameras and UV sterilization. Some of the Smart Floor Cleaners available are: A. CLEAR [6] operates on dual modes i.e. automatic and manual. In automatic mode, decision is made on the basis of outputs of sensors being processed by Arduino and control actuators by H-Bridge driving circuitry. In manual mode, robot cleans the particular area of room by using laptop with GUI in Visual Studio via. Bluetooth Connectivity.

B. Vito M guardi [7] developed an android application for a robot driven by a microcontroller. His idea of The idea of his work is to show that android app can be operated using totally different electronic devices. He also invented a communication protocol for android smartphone and robot using Bluetooth.

3. OVERVIEW OF THE ROBOT VACUUM CLEANER

The design of the robot requires considerations of pressure, efficiency and intelligence Choosing the geometry of the disk shape puts it at the forefront of the available conceptual designs With the shape of the disk We were able to reduce the number of robotic wheels to two rear wheels for traction and one servo front wheel The sweepers were also analytically placed in the best position, which increases From the cleaning space of the robot without increasing its overall size, the trash bin has been developed to function simultaneously as a dirt repository and a cyclone device when fully integrated with the cooling fan. Ensure that the trash is in constant contact with the floor

from which dirt is being sucked. [8] In electrical design considerations, the power bank uses the services of the Arduino and the motor shield independently because their power consumption rates vary while the motor shield drives all the motors on board the robot, the Arduino board acts as the brain that receives an impulse from the ultrasonic sensors and controls the motor shield also works An additional lithium-ion battery powers the suction fan which makes the battery work overall i.e. the frame is made of cardboard due [9].

4. HARDWARE DESIGN

We have 4 ultrasonic sensors that detect obstructions for that, we need to connect all the ultrasonic sensor grounds and connect them to a common ground also we connect all 4 VCC of the sensor and connect that at 5v in the Arduino port, and then we connect all the GND to the GND port of the Arduino We connect the sensor port Trigpin1 to port D3, then Trigpin2 to port D5, then Trigpin3 to port D7, then Trigpin4 to port A1, then we connect sensor ports Echopin1 to port D4, then Echopin2 to port D6, then Echopin3 to port D8, then port Echopin4 With A2 port . also connect the IR Module's the output pin of the IR sensor module goes to digital pin D2 on the Arduino. For L293D Motor Driver, we connect the enable pins to 5V and also the motor voltage pin to 5V because we are using 5V motors. the I2C module is used along with the LCD, which only uses 4 pins where we connect VCC pin, GND with V5, common GND, SCL pin with A4 port and SDA with A5 port. The Arduino, Ultrasonic, motor driver and motors run on 5 Volt, high voltage will kill it so we use a Power Bank 10,000mAh, Lithium-Ion battery Next connect the vacuum cleaner directly to the main circuit. The Bluetooth HC-06 connects the VCC connection to 5V in the Arduino port, then the RX contact unit connects to the TX connection

of the target device, the Arduino, and the TX contact connects to the RX of the device. Here a 20x4 alphanumeric LCD is connected to the Arduino using the I2C module, to display a set of words we have added in the code.

5. MYTHOLOGY

At the beginning of the work, the device consists of 3 switch, where the first is responsible for operating the LCD screen, which in turn displays some of the texts that we have added, and the second is responsible for operating the Arduino and other devices associated with it, and the third and last is responsible for operating the motor installed on the draft fan. And also the robot device consists of four sensors whereby this sensor enables us to know the exact distance between it and the objects in front of it. Time x speed) and it is known that the speed of sound in air is constant and equal to 343 m/s, and using the above equation, we can calculate the distance traveled by the ultrasound wave back and forth to determine the distance of the object between the device and the barrier, where the range of these sensors measure the distance from (4 m - 7m). As for the design of this device, a distance of (15 cm) is measured. When the device is operated through the switches in the device, the Ultrasonic (sensor) gives commands to the device to measure the distance between the barriers and the device [10].

Ultrasonic on the front side be No. (1), on the right side No. (2), on the left No. (3), and on the back side No. (4).For example, the front ultrasonic gives a command to measure the front distance, if the distance is less than (15cm), this means that there is a barrier in the front direction, so the device returns to take a distance from the ultrasonic located on the Right and left sides.

6. PROGRAMMING THE ARDUINO BOARD

For this project we have to write a program that uses the HC-SR04 ultrasonic sensor to measure the distance of an object in front of it when the distance is about 15 cm The work is very simple first the transmitter unit sends an ultrasonic wave that travels through the air, hits an obstacle, bounces back and the receiver receives that wave By calculating the time using the Arduino so we have to turn off the motors when there is an object in front of us.

We will also use the on-board LCD display associated with the Arduino nano to display some details from the project title and the names of the work participants.

We also use an IR Module sensor, which consists of a transmitter and an infrared receiver that sends infrared radiation into the surrounding area, up to a distance of 30 cm, much less than the acoustic sensor. Then, if the radiation is reflected and the infrared receiver responds, if the distance between the device and the ground increases.

Step 1: Open the Arduino IDE and open a new window:

In this step using LCD with IC2 so we need to add two libraries "wire.h" and "Liquid

CRYSTAL_I2C.h" to improve communication between Arduino and display then I configure the library with the used ports (0x27,20,4). In this part, we define a set of variables for the ultrasonic sensor (4 sensors) in addition to a port for the infrared sensor that receives the wave and sends it, then I define constants that I will need to determine the directions (left, right, front) I know them from among the constants to give a fixed length that I need later.

Step 2: Now we need to program the setup part: First set the echo Pin from 1 to 4 as "INPUT" and from 1 to 4 as "OUTPUT" trig Pin as "OUTPUT" using the pin Mode keyword and ir pin as "INPUT" Then I configure the ports to the driver that takes port (9, 0, 11, 12) Mark it as "OUTPUT".

Here we add the Serial that is used by Bluetooth to send after that "lcd.init" These are instructions for a screen library that works on the backlight of the LCD, and the "lcd.back light" is for lighting the screen, then I prepare the column and lines to add the codes for the texts that appear on the screen, The following keywords are used: "lcd.set Cursor" Initialize the LCD screen and specify its dimensions (columns, rows), "lcd.print", print text on the display screen, "delay", delay the text, "lcd.clear" hide text from the screen

```
#include <Wire.h>
#include <LiquidCrystal_I2C.h>
LiquidCrystal_I2C lcd(0x27,20,4);
const int trigPin1 = 6; //For four sensors I know trig-
pin port and echopin
const int echoPin1 = 8;
void setup() {
pinMode(trigPin1, OUTPUT); //Configuration 4 ports take
trigpin which is 1-2-3-4 because 4 sensors
pinMode(echoPin1, INPUT); //Configuration 4 ports take
echopin which is 1-2-3-4 because 4 sensors
pinMode(irpin, INPUT);
pinMode(9, OUTPUT);
pinMode(10, OUTPUT);
pinMode(11, OUTPUT);
pinMode(12, OUTPUT);
lcd.init();
lcd.backlight();
lcd.setCursor(6,1);
lcd.print("Welcome");
delay(3000);
lcd.clear();
```

Step 3: In the voice loop () we need to connect between Bluetooth and the application used in this robot (Bluetooth RC Controller). When the robot gets a certain reading, the motor moves forward and if it does not read backwards, and so on, among the conditions is to convert the movement of the broom automatically through the application mentioned above and also As the application did not get any reading stops.

7. RESULTS

We have designed and implemented an automatic smart floor cleaning robot using embedded technology. It is an effective solution with simple approach utilizing local resources while making it available in an affordable amount. The Risk Factor for this Robot is very Minimum since the water pathway is separately made so it does not Coincide with the Electronic circuitry. Also the robot does not uses high voltage thereby reducing threat and making it more user friendly. It is of great usage to Aged Citizens.

8. CONCLUSIONS

The effectiveness of the Robot can be increased by using sensors and applying Algorithms, so that it can detect obstacles and turns into other directions without human Assistance. The Bluetooth Module HC -12 Can be used instead of HC-05 to increase the wireless communication rate. More techniques of Reducing cost of the Robot can be considered

1. Providing an overview of technology, especially artificial intelligence technology, its importance in daily life, ways to develop it to serve the community, as well as how to

2. Facilitate work using a robot to clean floors in an easy and effortless way

3. The tools that can be used to form the project and identify it in detail and how to connect it to the Arduino and know its use. These tools include ultrasonic sensors, infrared sensors, and many more tools.

4. Learn the Arduino language, how to program the Arduino piece, how to connect devices together, know the work steps in detail and provide high efficiency in work and use the device anywhere and also in the way of remote communication.

5. Learn about the benefits of the project, its applications, how to develop it, and its

Importance in homes, because one of the advantages of the project can be used at any time because it does not have a lot of noise, the quiet sound, and also one of its advantages is the light size.

CONFLICTS OF INTEREST

The author declares no conflict of interest.

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