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| **School of Computer Science and Engineering**  VIT Chennai  Vandalur - Kelambakkam Road, Chennai - 600 127  **CSE3010**  **Robotics and It’s Applications**  **SMART VACCUM CLEANER ROBOT**  **By**  **Guggilam Amarnath(20BCE1543)**  **Jayanth Reddy Siddenki(20bce1793)**  **Perubhotla Srinivasa Aditya Manish(20bce1932)**  **Submitted To**  **Dr.Rajesh.R (CSE)**  **APR 2022-2023** |  |
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| **Abstract**  The purpose of this project is development of a vacuum cleaner robot using an Arduino. Vacuum cleaner robot is designed to make cleaning process become easier rather than by using a manual vacuum. The main idea is primarily by having the sensor to sense any object like wall and other objects like chairs, sofa etc., Then send the output data to an Arduino that will control the robot vacuum movement. To facilitate targeted functions interactivity in conjunction with quality sensors play essential roles.  **Objectives:**   * Efficient Cleaning: The robot should be able to clean floors and surfaces thoroughly and efficiently, reducing the amount of manual labor required. * Navigation and Mapping: The robot should be able to navigate and map the cleaning area, avoiding obstacles, and creating a cleaning plan based on the map. * Adaptability: The robot should be able to adapt to different floor types, surfaces, and cleaning environments, and adjust its cleaning methods accordingly. * User-Friendliness: The robot should be easy to operate and maintain, with a user-friendly interface and minimal maintenance requirements. * Energy Efficiency: The robot should be energy-efficient, consuming minimal power, and having a long battery life. * Safety: The robot should be designed to be safe for use around people, pets, and other objects, avoiding collisions and entanglements. * Affordable: The robot should be affordable, providing a cost-effective cleaning solution for households and businesses. |  |
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| **Introduction:**  Now a days people are becoming very busy by doing jobs and getting tired when they are coming to home. So they are unable to clean the house every day or they are appointing a person for cleaning the house, by which they have to give salary for that. Which makes waste of money and also but no trust on cleaners. So many peoples are looking for a thing which can do this work at low cost and make things easier.  So now a days many researches are happening on the vacuum cleaner Robots are developed as home appliances recently as there are a huge demand on the individuals. Smart vacuum cleaner robot is designed to improve cleaning process become easier for a human task that will assist people at home who are too busy for daily or weekly floor cleaning and particularly for the elderly who does not have the strength to clean up the house. Currently, various robotic vacuum cleaners have been presented. However, they have focused on ground cleaning and lack interactivity between the robot and the user. |  |
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| **Software and Hardware requirements**  The software that we are using in the project is Arduino Programming.    Arduino Programming:    To communicate with sensors, actuators, and other linked devices, microcontroller boards like  the Arduino Uno are programmed using the Arduino programming language. The language is  actually based on C++ and was created to be user-friendly for novices and non-programmers.  The Arduino programming language has several key features:   1. It is open source**:** The Arduino software and hardware are open source. In essence, this means users have access to the source code and can modify it to suit their needs. 2. It is based on C++**:** The Arduino programming language is based on C++, a widely used and well-known programming language. 3. It has a large library of pre-written code**:** Arduino has a large library of pre-written code called the Arduino library. Basically, this simplifies common tasks and makes it easy to interact with sensors and other devices connected to the board. 4. It has a simple syntax**:** The Arduino programming language has a simple syntax. Hence, it is easy to learn and understand, even for beginners.   **Hardware**  And the hardware used are Arduino uno, Arduino motor shield, ultrasonic sensor,  Bluetooth sensor, jumper wires, Rechargeable Battery, Gear Motor, Wheels, Servo Motor, 6v Motor, |  |
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| **Literature Survey:**   1. **Robotic Vacuum Cleaner**   This paper addresses about the robot is bring controlled by the android application through a Bluetooth module . Here, The application sends every collected information to microcontroller to have control over robot. Micro controller collects the information from various input devices such as sensors and others. The distance of the obstacles is detected using the ultrasonic sensors and the distance is displayed on LCD and as well as on application. Here man controls the overall operation indirectly.   1. **Bluetooth Based Automatic Floor Cleaning System**   In This paper they have designed a floor cleaning robot by using Bluetooth module which user can control the robot from an app this leads to the movement of the robot moving front, coming back, and going left, right. The Bluetooth module is used for controlling entire system with the help of remote or mobile. It’s basically DC motors wired in a wheeled plastic container with a cleaning solution placed on top and a scrub attached in the bottom through one of the motors. It works great and seeing the mechanism is like seeing a robot assistant on duty. Definitely makes cleaning easier and merrier while enabling anyone to build something rather than buy.   1. **Improving Robot Vacuum Cleaner**   The purpose of this study was to examine the cleaning efficiency of an autonomous vacuum cleaner robot; namely, reducing the cleaning time needed in an empty room. To do this we explored how the path planning could be improved upon given access to a dust map that would allow for more sophisticated algorithms depending on the state of the room. The approach we employed in order to compare different preprogrammed path patterns and our own greedy heuristic was to create a simulation environment in Unity3d. In this environment we could create a two dimensional plane to represent the length and width of a room with the size of our choosing. This plane was then subdivided into squared cells that would discretise the environment, which represented the dust map of the room. The tests were conducted in rooms with different dimensions in order to examine how different strategies’ efficiency developed in relation to each other. Employing an algorithm like our greedy heuristic after an initial zigzag sweep resulted in a significant improvement in comparison to a robot that is restricted to template patterns only. Future work could involve finding the optimised solution for our heuristic in order to make full use of the dust map and thereby achieve minimal cleaning time for the robot. |  |
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| 1. **Design and Development of an Automated Floor Cleaning Robot for Domestic Application**   Designing a Bluetooth controlled mobile robot . Here Raspberry Pi3 is the main component but can’t control the robot . By using a ultrasonic sensor which senses when there is an object nearby and sends it’s output to the raspberry pi3 , which will stop the robot immediately and also the buzzer will ring. The moping operation will be started or stopped at any point of your time as per the need. The moping brush is actuated by the DC motor fixed thereto. Signal to the present motor is fed by the controller. An LCD displays each and every operation applied by the robot.    **Modules:**  A smart vacuum cleaner robot can have several modules that enable it to efficiently and effectively \ clean a room or an entire house. Some of these modules include:  Cleaning Module: This module consists of brushes, suction, and filtration systems that enable \ the robot to pick up dust, dirt, and debris from the floor. The brushes can be side brushes that  sweep dirt into the path of the robot, or a central brush that agitates dirt and dust from the floor.    Mobile App Module: This module enables the user to control the robot using a mobile app on  their smartphone or tablet. The app can be used to start and stop the cleaning, schedule cleaning  times, and view the robot's cleaning history.    Voice Control Module: This module allows the user to control the robot using voice  Commands from an app.  Obstacle Detection Module: This module uses sensors to detect obstacles such as stairs, cliffs,  or drops. It can prevent the robot from falling down stairs or getting stuck in tight spaces. |  |
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| **Implementation:**  **Arduino Programming:**  Firstly, libraries are included.  #include <Servo.h>  #include <AFMotor.h>  Secondly, ultrasonic sensor pins, servo motor pin, motor speed, and servo motor starting point are \ defined.  #define Echo A0  # define Trig A1  #define motor 10  #define Speed 170  #define spoint 103    Thirdly, some variables have been created to help the program.  char value;  int distance;  int Left;  int Right;  int L = 0;  int R = 0;  int L1 = 0;  int R1 = 0; |  |
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| then, objects are created for the Servo Library and the AFMotor Library.  Servo servo;  AF\_DCMotor M1(1);  AF\_DCMotor M2(2);  AF\_DCMotor M3(3);  AF\_DCMotor M4(4);  Then the setup function, Ultrasonic pins are set to INPUT and OUTPUT. Also, the gear motor speeds \ have been included.  void setup() {  Serial.begin(9600);  pinMode(Trig, OUTPUT);  pinMode(Echo, INPUT);  servo.attach(motor);  M1.setSpeed(Speed);  M2.setSpeed(Speed);  M3.setSpeed(Speed);  M4.setSpeed(Speed);  }  In the loop function, the three main functions are included. we can run these functions one by one. \ \ These are described below.  void loop() {  //Obstacle();  //Bluetoothcontrol();  //voicecontrol();  }  This function includes the Bluetooth control code. The code lines are described one by one in the code  void Bluetoothcontrol() {  //gets the serial communication values and puts them into the char variable.  if (Serial.available() > 0) {  value = Serial.read();  Serial.println(value);  } |  |
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| //Next, these values are checked using the IF condition.  //Then, if the char value is 'F', the car moves forward.  if (value == 'F') {  forward();  //If the char value is "B", the car moves backward.  } else if (value == 'B') {  backward();  //If the char value is "L", the car moves left.  } else if (value == 'L') {  left();  //If the char value is "R", the car moves right.  } else if (value == 'R') {  right();  //If the char value is "S", the car is stopped.  } else if (value == 'S') {  Stop();  }  }    This function includes the obstacle-avoiding code. The code lines are described one by one in the \ code.  void Obstacle() {  //gets the ultrasonic sensor reading and puts it into the variable.  distance = ultrasonic();  //then, these values are checked using the IF condition.  //If the value is less than or equal to 12,  //the robot is stopped and the servo motor rotate left and right.  // Also, gets both side distance.  if (distance <= 12) {  Stop();  backward();  delay(100);  Stop();  L = leftsee();  servo.write(spoint);  delay(800);  R = rightsee();  servo.write(spoint); |  |
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| //After, if the left side distance less than the right side distance. The robot turns right.  if (L < R) {  right();  delay(500);  Stop();  delay(200);  //After, if the left side distance more than the right side distance. The robot turns left.  } else if (L > R) {  left();  delay(500);  Stop();  delay(200);  }  //Otherwise, the robot moves forward.  } else {  forward();  }  }  This function includes the voice control code. The code lines are described one by one in the code.    void voicecontrol() {  //gets the serial communication values and puts them into the char variable.  if (Serial.available() > 0) {  value = Serial.read();  Serial.println(value);  //If the char value is "^", the car moves forward.  if (value == '^') {  forward();  //If the char value is "-", the car moves backward.  } else if (value == '-') {  backward(); |  |
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| //If the char value is "<", the car moves left.  } else if (value == '<') {  L = leftsee();  servo.write(spoint);  if (L >= 10 ) {  left();  delay(500);  Stop();  } else if (L < 10) {  Stop();  }  //If the char value is ">", the car moves right.  } else if (value == '>') {  R = rightsee();  servo.write(spoint);  if (R >= 10 ) {  right();  delay(500);  Stop();  } else if (R < 10) {  Stop();  }  //If the char value is "\*", the car is stopped.  } else if (value == '\*') {  Stop();  }  }  } |  |
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| **Circuit Diagram:**    ***Figure 1-Circuit Diagram of vacuum cleaner robot*** |  |
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| **Working Model of Smart Vaccum Cleaner Robot:**   1. Start by assembling the chassis or body of the robot. 2. Attach the wheels or other means of movement to the chassis. 3. Install the sensors on the robot. Here we used Ultrasonic Sensor for the obstacle avoidance and Bluetooth sensor for controlling the robot . 4. Connect the Arduino motor shield to the Arduino. We have to program the arduino to control the movement of the robot based on the sensor readings.   5. a piece of a bottle to the mouth of the pipe for the collection of dust.  6.Power the robot using batteries or a power cord, and test it out in a room with floors  that need to be cleaned.  **Results:**    Fig2: picture of smart vacuum cleaner Robot when working. | | |
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| **Conclusion:**  Overall, a smart vacuum cleaner robot can be a convenient and time-saving solution for keeping floors clean, especially in busy households or commercial environments .We have used ultrasonic sensor for the avoiding the obstacle and by using the blue tooth sensor we can control robot from our mobile phone and by giving voice commands we can control the robot .This robot is cost efficient. As technology continues to evolve, we can expect to see even more sophisticated and intelligent robots designed to perform a wide range of household and commercial tasks      **References:**   * P. Aishwarya, S. More, D. Kadam, V.A. Patil, “Automatic Floor Cleaner”, IJECT vol. 8, 2017. * T. Ajith, M. S. Rohith, J. Febin, J. Cheriyan, R, Mary George, “An Advanced Mobile Robot for Floor Cleaning”, International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, vol. 5, no. 3, 2016. * R. Vaibhavi and S. T. Bagde, “A Review on Design of Automated Floor Cleaning System”, International Journal on Recent and Innovation Trends in Computing and Communication, vol. 3, no. 2 * Hess, Jürgen, Maximilian Beinhofer, Daniel Kuhner, Philipp Ruchti, and Wolfram Burgard. "Poisson-driven dirt maps for efficient robot cleaning." In 2013 IEEE International Conference on Robotics and Automation, pp. 2245-2250 * https://www.ijraset.com/research-paper/automated-domestic-vacuum-cleaner-robot |  |
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