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Object Avoidance Robot

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Abstract- An object-avoidance robot is an important part of autonomous systems designed to navigate the environment while avoiding obstacles. The object avoidance robot's design has a sensors, primarily an ultrasonic sensor that detects obstacles in its vicinity. These sensors allow for distance measurements, which allow the robot to make informed navigation decisions. The Arduino microcontroller processes the sensor data and implements control algorithms to steer the robot away from detected obstacles. The main parts of the proposed object avoidance robot include motor drivers for motion control, power supply and frame to support the structure. The software architecture includes sensor interface code, obstacle detection algorithms, and motor control logic. Implementation includes hardware component integration, software module development, and iterative testing to improve performance. The efficiency of the object avoidance robot is based on the robustness of the obstacle detection algorithms, the accuracy of the sensor measurements, and the efficiency of the control logic. Challenges such as sensor noise, environmental changes, and real-time processing limitations require careful planning. Potential applications for an object- avoidance robot span a number of different fields, including surveillance, environmental monitoring, and assistive robotics. Leveraging the accessibility and community support of the Arduino platform, this project aims to provide a practical framework for developing cost-effective and customizable object avoidance robots.

Keywords- Navigation, Obstacle Avoidance, ultrasonic sensor, arduino microcontroller, autonomous robot

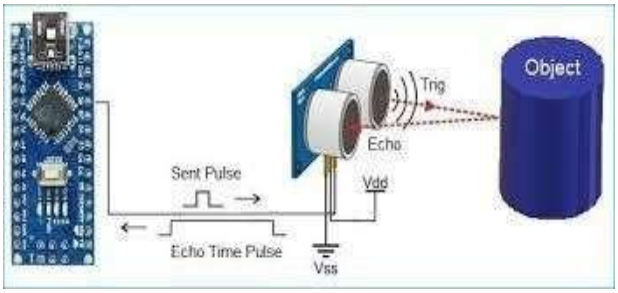
I. INTRODUCTION

Obstacle avoidance Robot is designed in order to navigate the robot in unknown environment by avoiding collisions. Obstacle avoiding robot senses obstacles in the path, avoid it and resumes its running. There are some very popular methods for robot navigation like wall-following, edge detection, line following and many more. A more general and commonly employed method for obstacle avoidance is based on edge detection. A disadvantage with obstacle avoidance based on edge detecting is the need of the robot to stop in front of an obstacle in order to provide a more accurate measurement. All mobile robots feature some kind of collision avoidance, ranging from primitive algorithms that detect an obstacle and stop the robot in order to avoid a collision, using some sophisticated algorithms that enable the robot to detour obstacles. The latter algorithms are more complex, since they involve detection of an obstacle as well as some kind of quantitative measurements concerning the obstacle's dimensions. Once these have been determined, the obstacle avoidance algorithm needs to steer the robot around the obstacle and resume motion toward the original target. The steering algorithm ensures that the robot does not have to stop in front of an obstacle during its navigation. An ultrasonic sensor is used to detect any obstacle ahead of it and sends a command to the micro-controller [10] Hence the robots may overcome

some of the problems during navigation, which are discussed above and it can navigate smoothly during its operation avoiding the collisions. if we were use the IR sensor Infrared sensors detect the object's distance with infrared radiation. When the beam detects an object, the light beam returns to the receiver with an angle after reflection there is a limitations in sensor those limitations are Performance of IR

II. ABOUT OBJECT AVOIDANCE ROBOT TECHNOLOGY

The obstacle avoidance robotic vehicle uses ultrasonic sensors for its movements. Arduino is used to achieve the desired operation. The motors are connected through motor driver IC to Arduino. The ultrasonic sensor is attached in front of the robot. Whenever the robot is going on the desired path the ultrasonic sensor transmits the ultrasonic waves continuously from its sensor head. Whenever an obstacle comes ahead of it the ultrasonic waves are reflected back from an object and that information is passed to the arduino.



The arduino controls the motors left, right, back, front, based on ultrasonic signals. In order to control the speed of each motor pulse width modulation is used (PWM). When ultrasonic sensor detect the object which is kept inside the path it will send the signal toward the arduino uno and according to that it will it will rotate the motor M3 & M4 in forward direction and rotate the motor M1 & M2 in reverse direction such way that the car get moving in left direction. Similarly in every time when ever an obstacle in found to be in path of car it will detect it and rotate the car in left direction to avoid the obstacle

III. LITERATURE SURVEY

"Obstacle avoidance robot using arduino" has been designed and developed by Aamir attar, Aadilansari, Abhishek desai, Shahid khan, Dipashrisonawale to create an autonomous robot which intelligently detects the obstacle in its path and navigates according to the actions that user set for it. So this system provides an alternate way to the existing system by replacing skilled labor with robotic machinery, which in turn can handle more patients in less time with better accuracy and a lower per capital cost [1]. "Obstacle Avoidance Robotic Vehicle Using Ultrasonic Sensor, Android and Bluetooth for Obstacle Detection" has been designed and developed by Vaghela et.al has mentioned that enormous amount of work has been done on wireless gesture controlling of robots. Various methodologies have been analyzed and reviewed with their merits and demerits under various operational and functional strategies. Thus, it can be concluded that features like user friendly interface, light weight and portability of android OS based smart phone has overtaken the sophistication of technologies like programmable glove, static cameras etc., making them obsolete. Although recent researches in this field have made wireless gesture controlling a ubiquitous phenomenon, it needs to acquire more focus in relevant areas of applications like home appliances, wheelchairs, artificial nurses, table top screens etc. in a collaborative manner [2]. "Obstacle Avoidance Robot" has been designed and developed by Paul Kinsky, Quan Zhou mentioned that robot with a few mechanical components to add two more functions to the main body, namely the laptop holder and the camera holder. AT89S52 development board is designed, developed and tested in a large scale, which was used to control the motors smoothly. the cameras with relatively low cost are fixed and adjusted on the camera holder for good calibration of the computer vision. Users establish the serial communication method between the upper laptop and the lower development board with USB port. The laptop will send out a signal of the motor condition to the development board [3]. "obstacle avoidance car" has been designed and developed by Faiza Tabassum, et.al has mentioned that

Obstacle Avoidance Car successfully detects and avoids obstacles. Simple algorithms used to steer and reducing the turning radius, successfully navigated the vehicle. In conclusion, the group successfully interfaced every component that was originally planned. Timer interrupts for IR pulse generation. Obstacle detection using IR transceiver. Servo mechanism using

IV. PARTS OF THE SYSTEM

1. Arduino Uno

Arduino/Genuino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.. You can tinker with your UNO without worring too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again

Figure 1: arduino Uno

This IDE is accessible both online and offline, providing a user-friendly platform for coding and development.

2. ML293D Motor Driver

The L293D is a standard motor driver integrated circuit (IC) that facilitates the operation of DC motors in either direction. With its 16-pin configuration, the L293D can control a pair of DC motors simultaneously, allowing movement in both forward and reverse directions. This means that a single L293D IC can effectively manage the operation of two DC motors.

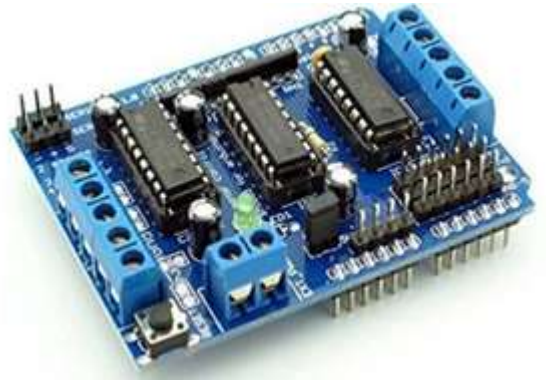


Figure 2: ML293D motor driver

3. TT Gear Motor

The obstacle detection and avoiding robot uses two 200rpm and 12V DC geared motors. The motor used has a 6mm shaft diameter with internal holes. The internal holes are for easy mounting of the wheels by using screws. It is an easy to use

Figure 3: TT Gear Motor

lowcost motor for robotics application An Electric DC motor is a machine which converts electric energy into mechanical energy. The working of DC motor is based on the principle that when a current carrying conductor is placed in a magnetic field, it experiences a mechanical force. The direction of mechanical force is given by Fleming's Left-hand Rule and its magnitude is given by F = BIL Newton. DC motors are seldom used in ordinary applications because all electric supply companies furnish alternating current.

4. Ultrasonic Sensor

Figure 4: Ultrasonic sensor

An ultrasonic sensor is an electronic device designed to measure the distance of an object by emitting ultrasonic sound waves and converting the reflected sound into an electrical signal. These ultrasonic waves travel faster than audible sound, which humans can hear. Typically, ultrasonic sensors consist of two main components: the transmitter, which emits the sound using piezoelectric crystals, and the receiver, which detects the sound after it has traveled. They are commonly employed in vehicle self- parking technology and collision avoidance systems. Additionally, ultrasonic sensors are integral to automated obstacle detection systems and manufacturing technology. In comparison to infrared (IR) sensors used in proximity sensing, ultrasonic sensors are less susceptible to interference from smoke, gas, and other airborne particles, although environmental factors like heat can still affect their performance. The frequency range of ultrasonic waves is above 20 kHz. These are mainly used in measuring distance applications. The following image indicates the ultrasonic transducer

V. RESULT

The result is obtained for obstacle avoidance robot using Arduino, if the robot moves forward if any obstacle detect it check for other directions and moves where there is no obstacles it moves in forward direction, to sense the obstacle ultrasonic sensor is used. We used servo motor to rotate the ultrasonic sensor. The working principle of the robot is transmitting sensed signal to the micro controller to control the DC motors for obstacle avoidance. The direction of the motors to move either clockwise or anticlockwise directions as provided by the micro controller. Ultrasonic sensor detect a moving object while IR sensor does not detect any object, the robot will move backward (motor 1 and motor 2 counter clockwise). The sensor also detects object, the robot will stop . After 50 ms, motor 1 will move clockwise and the robot will turn left. After 500 ms, the robot will move forward (motor 1 and motor 2 clockwise) and after 1000ms, both motors will stop. From the flow chart in Figure 10, it shows that the IR sensors are very effective in sensing signals in their path for the obstacle avoiding robots to evade obstacles in its path.

VI. CONCLUSION

The goal of our project is to create a autonomous robot which intelligently detects the obstacle in his path and navigate according to the actions we set for it. The above Arduino controller and ultrasonic sensor were studied and the HcSR-04 ultrasonic sensor was selected, as the controlling result are satisfying for its use in the automobile prototype system bring developed. It was used to sense the obstacle and avoidance them. On successful implementation of obstacle avoidance algorithm was successfully carried out too with minimal errors, by coding the algorithm in python. Obstacle avoidance is a very good application to be used in vehicle preventing many accidents and loss of life. This project developed an obstacle avoiding robot to detect and avoid obstacles in its path. The robot is built on the Arduino platform for data processing and its software counterpart helped to communicate with the robot to send parameters for guiding movement. For obstacle detection, three ultrasonic distance sensors were used that provided a wider field of detection. The robot is fully autonomous and after the initial loading of the code, it requires no user intervention during its operation.

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