OBSTACLE DETECTION AND AVOIDANCE ROBOT WITH ULTRASONIC SENSOR

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ABSTRACT

In today's world ROBOTICS is a fast growing and interesting field. obstacle avoidance robot has sufficient intelligence to cover the maximum area of provided space. Introduces the design and implementation of an autonomous obstacle - avoiding robot using ultrasonic wave sensor in this thesis. The project is design to build an obstacle avoidance obstacle avoidance robot vehicle using ultrasonic sensors for its movement. A microcontroller (ATmega328) is used to achieve the desired operation. A obstacle avoidance robot is a machine that can perform task automatically or with guidance. The project proposes obstacle avoidance robot that has an intelligence built in it such that it directs itself whenever an obstacle comes in its path. This obstacle avoidance robot vehicle is built, using a micro-controller of AT mega 328 family. An ultrasonic sensor is used to detect any obstacle ahead of it and sends a command to the micro-controller. Depending on the input signal received, the micro-controller redirects the obstacle avoidance robot to move in an alternate direction by actuating the motors which are interfaced to it through a motor driver by sending pulses, the obstacle avoidance distance can be measured. At the same time, we can control steering gear to realize the obstacle avoidance function. The obstacle avoidance robot uses front axle steering, rear wheel drive arrangement. Two drive tires are driven by two DC motors with gear reduction mechanisms. Using Arduino MCU chip as the control core of the obstacle avoidance robot. Through the design of the hardware and software system, we build the obstacle avoidance robot platform and obtain good experimental

Keywords: Arduino UNO, motor, ultrasonic sensor HC-SR04, DC Motor, servo motor,robot

1. INTRODUCTION

Robotics is part of Today's communication. In today's world ROBOTICS is fast growing and interesting field. It is simplest way for latest technology modification. Now a days communication is part of advancement of technology, so we decided to work on ROBOTICS field, and design something which will make human life simpler in day today aspect. Thus we are supporting this cause. An obstacle avoiding robot is an intelligent device, which can automatically sense and overcome obstacles on its path. Obstacle Avoidance is a robotic discipline with the objective of moving vehicles on the basis of the sensorial information. The use of these methods front to classic methods (path planning) is a natural alternative when the scenario is dynamic with an unpredictable behavior. In these cases, the surroundings do not remain invariable, and thus the sensory information is used to detect the changes consequently adapting moving. It will automatically scan the surrounding for further path. This project is basic stage of any automatic obstacle avoidance robot.

This obstacle avoidance robot has sufficient intelligence to cover the maximum area of provided space. It has a ultrasonic sensor which are used to sense the obstacles coming in between the path of obstacle avoidance robot. It will move in a particular direction and avoid the obstacle which is coming in its path. We have used two D.C motors to give motion to the obstacle avoidance robot. The construction of the obstacle avoidance robot circuit is easy and small .The electronics parts used in the obstacle avoidance robot circuits are easily available and cheap too. Obstacle avoidance robot is designed in order to navigate the obstacle avoidance 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 obstacle avoidance 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 obstacle avoidance robot to stop in front of an obstacle in order to provide a more accurate measurement.

All mobile obstacle avoidance robot features some kind of collision avoidance, ranging from primitive algorithms that detect an obstacle and stop the obstacle avoidance robot in order to avoid a collision, using some sophisticated algorithms that enable the obstacle avoidance robot to detour obstacles. The latter algorithms are more complex, since they involve detection quantitative measurements concerning the obstacle's dimensions. Once these have been determined, the obstacle avoidance algorithm needs to steer the obstacle avoidance robot around the obstacle and resume motion toward the original target. The steering algorithm ensures that the obstacle avoidance 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 obstacle avoidance robot 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 sensors has been limited by their poor tolerance to light reflections such as ambient light or bright object colors. No object recognition at the dead zone area, for example Sharp GP2D12 IR distance sensor dead zone between 0 to 4 cm. IR sensors also give inaccurate detection result with transparent or bright color materials. Detection results also depend on the weather conditions and the sensing reliability of IR sensors decreases with moisture and humidity. Furthermore, IR sensors can sense IR radiation from the sunlight, which can cause correctable or non-correctable errors at output. Besides that, if analogue IR sensor is used, signal losses will occur at the amplifier circuit. Meanwhile, PIR motion sensor needs a long calibration time and is sensitive to thermal radiation. Besides that, PIR sensor is insensitive to very slow motions or to objects in standing mode [2].

obstacle avoidance robot is part of Todays communication. In today's world ROBOTICS is fast growing and interesting field. It is simplest way for latest technology modification. Now a day's communication is part of advancement of technology, so I decided to work on ROBOTICS field, and design something which will make human life simpler in today aspect. An autonomous obstacle avoidance robot is a car that is capable of moving on its own in an unknown and unstructured environment. An autonomous obstacle avoidance robot is equipped with software intelligence to sense its environment, detect obstacles in its path and move around an unknown environment overcoming the obstacles. There are many robotic designs that are employed in designing of autonomous obstacle avoidance robot. These designs are usually developed considering the physical environment in which the obstacle avoidance robot has to be deployed. There are autonomous robo like snake Smart Cars, walking Smart Cars, autonomous drones and autonomous obstacle avoidance robot or rovers.

This obstacle avoidance robot has sufficient intelligence to cover the maximum area of provided space. It has an infrared sensor which are used to sense the obstacles coming in between the path of obstacle avoidance robot. It will move in a particular direction and avoid the obstacle which is coming in its path. The main motto of designing such type of robot or the technology is that this technology can be used in today's very fast transportation to avoid the accident generally happen in congested by applying emergency break. If we use this technology in the car or any vehicle, it will automatically sense the obstacles then it will take a side to the available free space. An obstacle may be a living things or any object. Autonomous Intelligent robot are obstacle avoidance robot that can perform desired tasks in unstructured environments without continuous human guidance. Thus, by using this technology in vehicles we make the drive safe.

2. OBJECTIVE

The main objectives of the project are comprehended as follows:

- The obstacle avoidance robot is able to move around in an unknown environment without colliding with surrounding objects.
- The robot would have the capacity to detect obstacles in its path based on a predetermined threshold distance.
- After obstacle detection, the robot would change its course to a relatively open path by making autonomous decision.
- It would require no external control during its operation.
- It can measure the distance between itself and the surrounding objects in real-time.
- It would be able to operate effectively in unknown environment.
- Obstacle avoiding robot can be used in almost all mobile Smart Car navigation systems
- They can be used for household work like automatic vacuum cleaning.
- They can also be used in dangerous environments, where human penetration could be fatal

In this section, the prototype of robotic system is presented, in which it consists of IR flame sensors, servo motors, submersible water pump, motor driver, mini breadboard, BO motors, rubber wheels, processor, and communication module for exchanging data between the fire-fighting robot and Arduino software

3. METHODOLOGY

- Simulations of Obstacle-avoiding robot will be performed before and after optimization in Proteus Simulink, and others tools if needed.
- The methodology may include research, surveys and other research techniques, and could include both present and historical information.
- Prepare the required components to do a practical simulation by Arduino microcontrollers to make the robot
- Start to design the final project.

4. LITERATURE SURVEY

We reviewed different obstacle detecting obstacle avoidance robot mechanisms that have been built by a lot of students and other practitioners that are in existence. For an autonomous mobile obstacle avoidance robot performing a navigation-based task in a vague environment, to detect and to avoid encountered obstacles is an important issue and a key function for the obstacle avoidance robot body safety as well as for the task continuity. Obstacle detection and avoidance in a real world environment that appears so easy to humans is a rather difficult task for autonomous mobile obstacle avoidance robot and is still a well researched topic in robotics. In many previous works, a wide range of sensors and various methods for detecting and avoiding obstacles for mobile robot purpose have been proposed. Good references related to the developed sensor systems and proposed detection and avoidance algorithms can be found. Based on these developed sensor systems, various approaches related to this work can be grouped. "line follower and obstacle avoidance bot using arduino" has been designed and developed by Aamir attar, Aadilansari, Abhishekdesai, Shahid khan, Dipashrisonawale to create an autonomous obstacle avoidance 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 capita cost [1].

"Obstacle-avoiding robot with IR and PIR motion Sensors" has been designed and developed by Aniket D. Adhvaryu et al has proposed that developed robot platform was not designed for specific task but as a general wheeled autonomous platform. It can therefore be used for educational, research or industrial implementation. Students can use it to learn the microcontroller programming using C++, Arduino Uno 1.6.5 compiler, IR and PIR sensors characteristics, motor driving circuit and signal condition circuit design. Research on obstacle avoidance robot at the polytechnic level can help students to develop communication, technical skills and teamwork. The design of such robot is very flexible and various methods can be adapted for another implementation. It shows that PIR sensors are more sensitive compared to IR sensors while detecting human being [2].

"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 [3]. "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 [4]. "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 PWM. Steering system using Lego and Servo. [5].

5. PROJECT DESCRIPTION

The project is designed to build an obstacle avoidance robot vehicle using ultrasonic sensors for its movement. An Arduino uno is used to achieve the desired operation. A obstacle avoidance robot is a machine that can perform task automatically. Robotics is generally a combination of computational intelligence and physical machines (motors). Computational intelligence involves the programmed instructions. The project proposes obstacle avoidance robot that has an intelligence built in it such that it guides itself whenever an obstacle comes ahead of it. This robot vehicle is built, using an Arduino uno. An ultrasonic sensor is used to detect any obstacle ahead of it and sends a command to the Arduino. In today's world robotics is a fast growing and interesting field. obstacle avoidance robot has sufficient intelligence to cover the maximum area of provided space. Autonomous Intelligent Smart Cars are robots that can perform desired tasks in unstructured environments without continuous human guidance. The obstacle detection is primary requirement of this autonomous robot. The obstacle avoidance robot gets the information from surrounding area through mounted sensors on the obstacle avoidance robot.
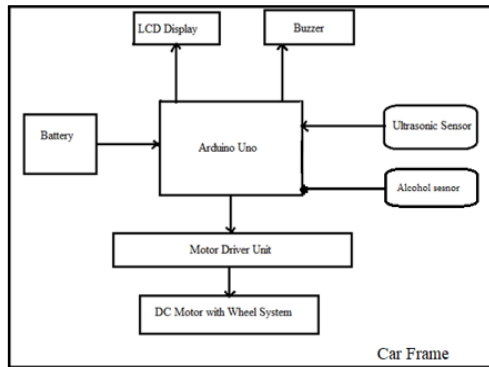
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INTERNATIONAL JOURNAL OF PROGRESSIVE RESEARCH IN ENGINEERING MANAGEMENT AND SCIENCE (IJPREMS)

www.ijprems.com
editor@ijprems.com

Vol. 04, Issue 03, March 2024, pp: 294-299

e-ISSN : 2583-1062

Impact Factor: 5.725
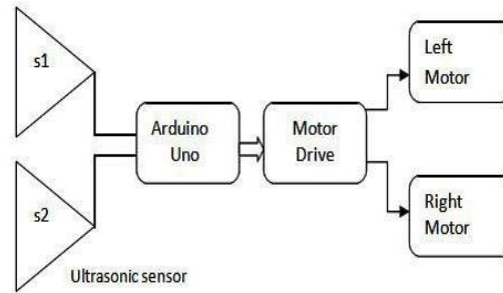
Figure 1 Block Diagram

Figure 2 Basic functional diagram

Figure.1

6. WORKING

The sonar system is used in HC-SR04 ultrasonic sensor to determine distance to an object like bats do. It offers excellent non-contact range detection from about 2 cm to 400 cm or 1feet to 13 feet. Its operation is not affected by sunlight or black material. The ultrasonic sensor emits the short and high frequency signal. If they detect any object, then they reflect back echo signal which is taken as input to the sensor through Echo pin .Firstly user initialize Trigger and Echo pin as low and push the robot in forward direction. When obstacle is detected Echo pin will give input as high to microcontroller. Pulse In function is used for calculating the time of distance from the obstacle.

Alcohol Sensor, Crystal Oscillator Which are connected as a input and LCD Display, Relay driver are connected as an output microcontroller. When person blow in the flow sensor it detect the person properly blown or not then it gives the next command to alcohol sensor to check the alcohol. If person did not found alcoholic microcontroller gives command to relay person is clean it gives power supply to ignition system and we can start our vehicle.
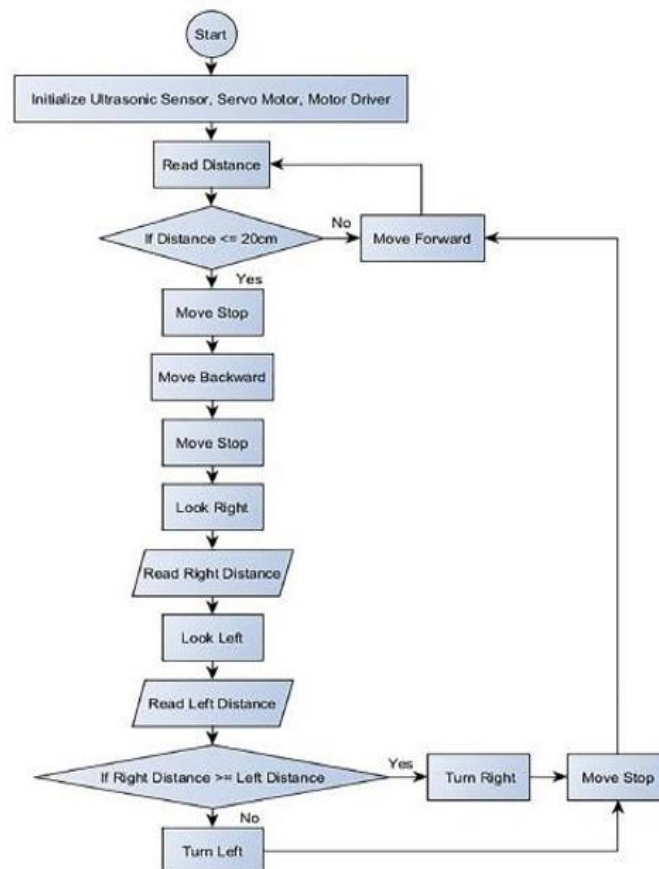

Figure. The Algorithm/ Flowchart Diagram of The Obstacle-avoiding Robot Car Based on Arduino Microcontroller

This obstacle avoidance robot was built with an Arduino development board on which microcontroller is placed. Arduino board is connected with DC Motor through Motor driver board (pin10, pin11, pin12, pin13) which provides power to the actuators. Actuators are used to move robot in Forward, Backward, Left and Right directions. The brief description of inputs pins for movement of obstacle avoidance robot is given in below in table. The movement of obstacle avoidance robot will be stop whenever there is an obstacle is present on its path which can be detected by ultrasonic sensors. Ultrasonic sensors give time in length to the microcontroller as an input for further actions

7. CONCLUSION

Today we are in the world of robotics. Knowingly or unknowingly, we have been using different types of obstacle avoidance robot in our daily life. The project is "OBSTACLE DETECTION AND AVOIDANCE ROBOT WITH ULTRASONIC SENSOR" is practically proved by using the Ultrasonic sensor for sensing the robot, Motor Shield Driver for the driving the dc motors, dc motor is used for the movement of the robot with the help of the Arduino Microcontroller. A lot of factors determined the accuracy of the robot we designed. These factors were the environmental phenomenon in which the robot was tested, the number of obstacles present making the test space crowded or relatively less crowded the type and shape of the obstacle (the obstacle avoidance robot is designed for a uniform shaped obstacle). These factors majorly affected the sensors. The accuracy of the robot is dependent on the sensors used. Thus, the nature of the sensor and its accuracy defined the accuracy of my obstacle avoidance robo.

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