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Obstacle Avoiding Car Using Arduino & Ultrasonic Sensors

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Abstract – *Robots are more efficient if they can perform autonomously and without human interaction. Our paper presents the idea of a robot car that can sense any obstacle and maneuver around it. The current situation in world scenario demands of such more robots that can be employed in military uses, autonomous interconnected cars, in drones as delivery services and even as a general multipurpose safety device to avoid accidents.*

Key Words: Obstacle Avoidance, Arduino, Ultrasonic Sensors, Robot

1. INTRODUCTION

Going by the basic definition of obstacle avoidance, it means to be able to identify and detect any kind of interference, which can also be termed as obstacles, and either avoid collision into it or even maneuver its path around it. Such a project would be very helpful in helping robots in factories, warehouses, or even in day to day house chores.

Our project uses ultrasonic sensors in support with Arduino Uno development board, which houses ATmega328 microcontroller chip. It works on a very simple principle. An ultrasonic sensor has a source and an echo receiver. It sends bursts of ultrasonic signals and the echo receiver receives it and determines how far or how close any object reflecting the signals is in front of it. It is controlled by an Arduino Uno board, which is programmed to control the motors in the car, to stop or proceed as per information received by the sensor. The programming involved follows a very simple algorithm. If a distance is fixed as a threshold, say 10cm by the ultrasonic sensor, it will give a high signal if distance is more than it, otherwise it give a low signal. If the signal received is high, the Arduino signals the motor driver module to move forward, or else stop. If the signal received is low, that is, if any obstruction is found, first the car moves to right, and if the signal is still low, it moves to left. If the car is obstructed on both sides, it reverses back and then takes a turn.

2. LITERATURE REVIEW

We reviewed some technical papers and found that many different kinds of mechanism and methodology can be and has been used, including one using IR and PIR sensors, as reported by Aniket D Adhvaryu, in "*Obstacle-avoiding robot with IR and PIR motion Sensors*" [1]. The project proposed the use of PIR sensors as it was more sensitive compared to others in detecting human beings (and other objects radiating infrared signals) but was less accurate in handling general obstacles like walls and objects lying around.

A remotely controlled device, as planned and developed by Vaghela Ankit, Patel Jigar and Vaghela Savan in "*Obstacle Avoidance Robotic Vehicle Using Ultrasonic Sensor, Android and Bluetooth For Obstacle Detection*"[2], shows the versatility that this project has. This device can be used in modular forms, and can be adapted to perform different kinds of tasks, having many different kinds of application, and in different work environments. This project shows the control of an obstacle avoiding robot vehicle in conjunction with manual control. This shows the future scope this project has.

3. COMPONENTS USED

Table -1: System Components

S.No.	Components Name	Quantity
1	Arduino Uno	1
2	5V DC Motors	2
3	HC-SR04 Ultrasonic Sensors	1
4	LM298N Motor Driver Module	1
5	Wheels	2
6	Power Source for Arduino and Motors	-
7	Connecting Wires	-

4. COMPONENTS DESCRIPTION

4.1 Arduino Uno

Arduino Uno is a development board housing an ATmega328 microcontroller, and has fourteen digital and 6 analog pins as input-output ports, for connections to different peripherals [3]. It has an open sourced design which makes it much cost effective, and was introduced in 2005 to provide an easy and inexpensive way for students, hobbyists and professionals alike to create devices working with different actuators and sensors.

It requires an external power source with voltage in the range of 9-12V. Apart from the fourteen digital and six digital

pins, it also has a USB connection, a power jack, and a reset button.

Fig -1: Arduino Uno Board [3]

4.2 HC-SR04 Ultrasonic Sensor

It is an ultrasonic range finder, which works on the principle of a RADAR, but instead of using radio waves, it uses ultrasonic sound waves. It consists of a transmitter which emits ultrasound of the frequency 40 KHz [4], and an echo receiver which receives reflected sound waves. The time difference between emitting and receiving of the waves gives the distance between the sensor and the surface off which waves are reflecting.

It works in the range of 2-400cm in 15° effective measuring angle. It has 4 pins, one for +5V power supply, one neutral, or ground pin, one signal pin to trigger the transmitter and one echo pin to obtain the results.

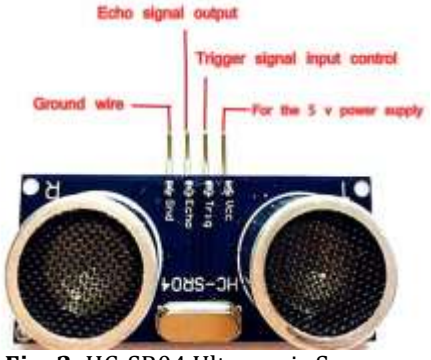

Fig -2: HC-SR04 Ultrasonic Sensor

4.3 LM298N Motor Driver Module

LM298N is a motor driver module shield, which can be interfaced with Arduino Uno board. It is a high voltage, high current dual full bridge driver. It can be operated in the range of 5-35V and has a current output of 2-3A. It has a voltage drop of about 2V, which is due switching transistors in H-Bridge circuit. It can be used to run 2 DC motors at once.

5. CIRCUIT DIAGRAM

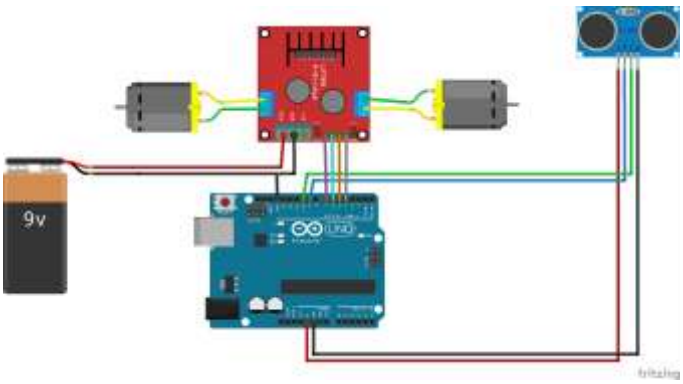

Fig -3: Circuit Diagram on Fritzing

6. CONCLUSION

Ultrasonic sensor HC-SR04 was chosen after reviewing many articles that pointed out the less accurate operation of IR and PIR sensor HC-SR501.

The hardware project performed as per our expectations, and worked autonomously, that is, after feeding the code, it required no human interaction and could work on its own, even in unknown and dynamic environments.

7. FUTURE SCOPE

This model was a very basic one, saving both time and money, and clearly demonstrates the idea we had. For better and more accurate results, preferable three ultrasonic sensors can be used for a wider field of view, to cover a greater region. Alternatively, an ultrasonic sensor on a rotating servo motor can also be used to sweep through a larger coverage area.

Also, otherwise it can be fitted with camera modules and AI can be implemented so that it can be used in real life applications, like on roads, judging other vehicles speed, pot holes, speed breakers, traffic light signals and even change lanes, which is same as the technology used in currently some of the most advanced autonomous driving cars made by tech giants.

Further for military uses, it can be fixed with a GSM Module or a Radio Module and be provided with a manual control, for even better maneuvers. We can conclude that this project of ours has a vast scope in future applications.

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