



Project Name - Obstacle & Edge Avoiding Robot

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1. Introduction

The project is to build an obstacle avoidance robotic vehicle using ultra sonic sensors for its movement. A micro-controller is used to achieve the desired operation. The project proposes robotic vehicle that has an intelligence built in it such that it directs itself whenever an obstacle comes in its path. This robotic vehicle is built using a micro-controller. An ultra sonic sensor is used to detect any obstacle ahead of it and sends a command to the microcontroller. Depending on the input signal received, the micro-controller redirects the robot to move in an alternate direction by activating the motors which are interfaced to it through a motor driver.

2. Blueprints

BASIC DESIGN OF ROBOT

This 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 provide power to the actuators. Actuators are used to move robot in Forward, Backward, Left and Right directions.

Input pins for movement of Robot

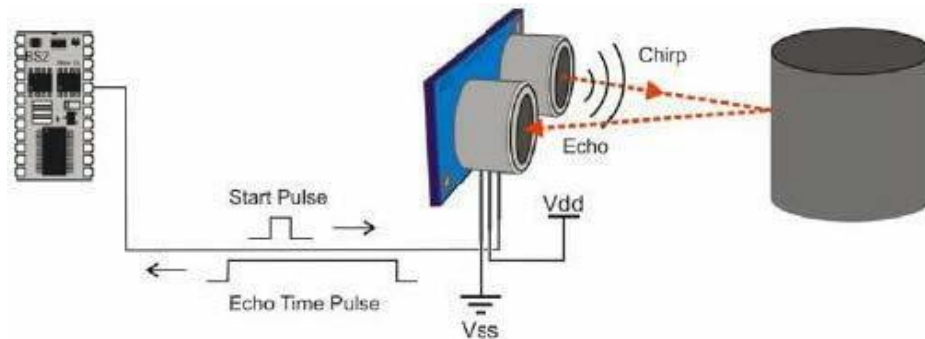
Movement	Pin 10	Pin 11	Pin 12	Pin13
Forward	1	0	0	1
Backward	0	1	1	0
Left	1	0	1	0
Right	0	1	0	1

The movement of robot will be stopped whenever there is an obstacle present on its path. This can be detected by ultra sonic sensors. Ultra sonic sensors give time in length to the microcontroller as an input for further actions.



SENSORS FOR OBSTACLE AVOIDANCE

Varieties of sensors are available which can be used for the detection of obstacles. Some of the very popular sensors are: Infrared sensors (IR), Ultrasonic sensors, in the design of robot, we are using ultrasonic sensors for obstacle detection and avoidance. The ultrasonic sensors continuously emit the frequency signals, when obstacle is detected this signals are reflected back which then considered as input to the sensor.



The ultrasonic sensor consists of a multi vibrator, which fixed at its base. The multi vibrator is combination of a resonator and vibrator. The ultrasonic waves generated by the vibration are delivered to the resonator. Ultrasonic sensor actually consists of two parts: the emitter which produces a 40 kHz sound wave and detector which detects 40 kHz sound wave and sends electrical signal back to the microcontroller.

We are using an HC-SR04 ultrasonic sensor which consists of 4 pins VCC, Trigger, Echo and GND.

Features:

Power Supply: +5VDC

Working Current: 15mA

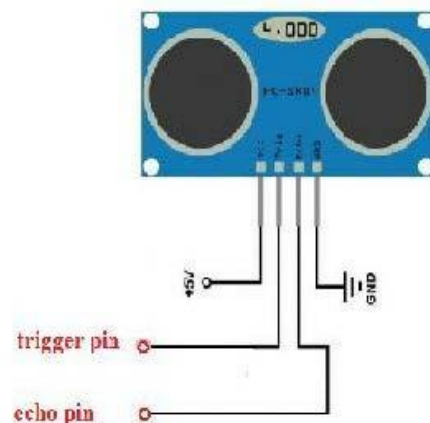
Effectual Angle: <15degree

Ranging Distance: 2cm –400cm / 1"-13ft

Resolution: 0.3cm

Measuring Angle: 30degree

Input Pulse Width: 10uS





3. Working

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.

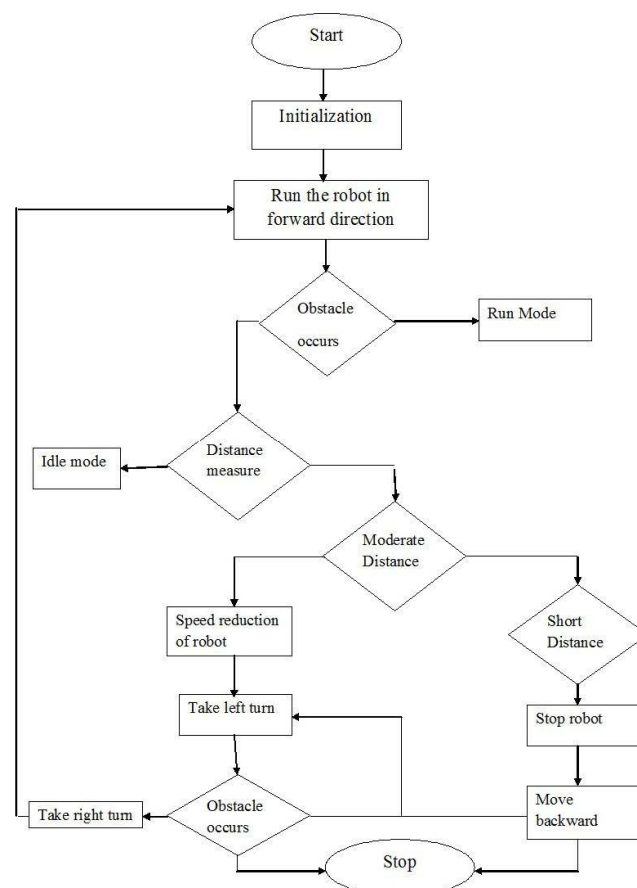
Firstly we initialize Trigger and Echo pin as low and push the robot in forward direction. When obstacle is detected Echo pin will give input as high to microcontroller.

`pulseIn()` function is used for calculating the time of distance from the obstacle.

Every time the function waits for pin to go high and starts timing, then timing will be stopped when pin go to low. It returns the pulse length in microseconds or when complete pulse was not received within the timeout it returns 0.

The timing has been determined means it gives length of the pulse and will show errors in shorter pulses. Pulses from 10 microseconds to 3 minutes in length are taken into consideration.

After determining the time, it converts into a distance. If the distance of object is moderate then speed of robot gets reduced and will take left turn, If obstacle is present in left side then it will take right turn. If the distance of object is short then speed of robot gets reduced and will turn in backward direction and then can go in left or right direction.





4. Construction

The implementation of obstacle avoidance strategy for robot involves the writing and compilation of program using Arduino software. Arduino is a popular programmable board used to create projects.

It consists of a simple hardware platform on which microcontroller is placed as well as a free code editor which has a “one click compile or upload” feature. Hence it is designed for the people in such a way that they can use it without necessarily being an expert programmer.

Arduino offers an open-source electronic prototyping platform that is easy to use and flexible for people who are beginners in robotics field with both the software and hardware perspective.

Sensors are connected with the Arduino board using breadboard. Microcontroller is able to sense the environment through receiving input from sensors. It is also able to control its surrounding through controlling motors and other actuators.

The Arduino programming language that is based on the processing are used to program the microcontroller found on the board. Due to its open source environment, we can able to easily write and upload codes to the I/O board. Arduino environment is written in Java hence it can be run on Linux, Mac OSX and Windows platforms.

The output of the comparator is given to the microcontroller, which then moves actuator in left or right direction by giving power through DC motor.