

**Building a Self
DRIVING Obstacle
avoidance Car**

Computer Science 207

Ritesh Patel

Gaurang Patel

Meet Patel

December 3rd, 2014

Table of Contents

Introduction

Inspirations

Designing Process

Building Process

User Manual for Laser Harp

Setbacks and Failures

Milestones

The Groups Contributions

Conclusion

References

Introduction:-

Obstacle Avoiding Robot is an intelligent device that can automatically sense the obstacle in front of it and avoid them by turning itself in another direction. This design allows the robot to navigate in an unknown environment by avoiding collisions, which is a primary requirement for any autonomous mobile robot. The application of the Obstacle Avoiding robot is not limited and it is used in most of the military organizations now which help carry out many risky jobs that cannot be done by any soldier.

Before going to build the robot, it is important to understand how the ultrasonic sensor works because this sensor will have an important role in detecting an obstacle. The basic principle behind the working of the ultrasonic sensor is to note down the time taken by sensor to transmit ultrasonically beams and receiving ultrasonic beams after hitting the surface. Then further the distance is calculated using the formula. In this project, the widely available **HC-SR04**

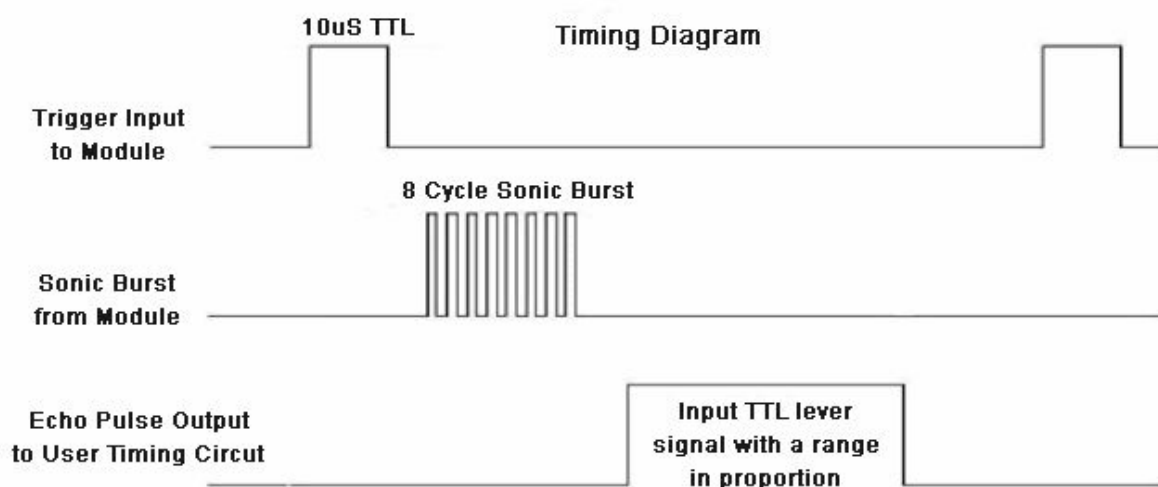
Ultrasonic Sensor is used. To use this sensor, a similar

The approach will be followed as explained above.



So, the Trig pin of HC-SR04 is made high for at least 10 μ s. A

The sonic beam is transmitted with 8 pulses of 40KHz each.



The signal then hits the surface and returns back and captured by the receiver Echo pin of HC-SR04. The Echo pin had already made high at the time sending high.

The time taken by the beam to return back is saved in a variable and converted to distance using appropriate

calculations like below

Time = Width of Echo pulse, in μs (microsecond)

- Distance in centimeters = Time / 58
- Distance in inches = Time / 148
- Or you can utilize the speed of sound, which is 340m/s

The components for this obstacle avoiding robot can be found easily. In order to make chassis, any toy chassis can be used or can be custom made.

Inspiration:-

Trajectory planning is one of the most important pivotal points in pick and place tasks done by robotic manipulators. In this work, we have presented a robot, which is compact, autonomous and fully functional. This robot or a smart car is built to sense any obstacle in its path, to avoid it and resume its running involving the pre-computation of an obstacle-free path. Ultrasonic sensors were adapted to

implement a real-time obstacle avoidance system for wheeled robots so that the robot can continually detect surroundings, avoid obstacles, and move toward the target area. This model has tremendous applications in vacuum cleaners, avoiding concealed paths, parking systems, assembling automobiles and in chemical industries, in scientific exploration, emergency rescue and in other isolated environments. We use an Arduino UNO with a Motor Shield along with Stepper Motors to make the car, and for sensing, we incorporate an Ultrasonic Sensor which accurately and efficiently detects any obstacles in the smart car's path. The Arduino is coded such that the smart car moves backward when an obstacle arises in front of it with a maximum limit of 50cms in ideal testing conditions. Throughout the construction of this model, we educated ourselves to the Arduino coding language, the Motor Shield functionality, and comprehensively, with the working of an ultrasonic sensor and its features. In conclusion, through this project, we aim to construct a model of a smart car that is beneficial to the quotidian problems of the present generation.

Designing Processos:-

The designing Processos was pretty simple as all the parts were like assembly using screws or frame as all were able to fit in the car chassis that I bought online and its parts like

motors, wheels, motor shield and Arduino on the top and also The battery pack on the top of the car which made its design pretty simple and for the ultrasonic sensor I did the assembly using a frame that I bought online from a website where I bought a chassis.

The frame was selected because it has a hole in it and it is easy to fit in the motors and to the motors, the wheels and the chassis were open so it can be neatly used and modifications can be done easily. The selection of motor The shield was purely based on the fact that instead of using the breadboard and making connections it was easy to use rather than using all kind of jumper wire and making a mess for just controlling the 4 motors which eas used to move the car in all directions.

The sonar ultrasonic sensor was installed at the topmost part of the car and facing 90 degrees in the front and on a servo motor so that it can moke the sensor to face towards both on the right and left direction so it can calculate both the distance and proceeds accordingly and decide whether to go left or right and then the servo comes back to its original position making the sensor face in the forward direction.

Building Process:-

The building process was pretty simple as the car Chassis that I purchased had already pre-build holes for Motors and the motor shield including a hole which I placed the battery pack and the Arduino Uno which I used from my lab kit and all of them were powered by a battery pack which can be used any rechargeable battery or one-time-use batteries well enough to power the car and run the motors.

The idea of using sensor was like great and important for our project but it does have some backlogs and had to decide the best position for my ultrasonic sensor and the best use of it so we can get the accurate output and well-specified direction to travel to since the position of the ultrasonic sensor decides the best direction and gives the output and obstacle avoidance respectively.

Then comes in place the car shield which I purchased from a website which had many features in it including the Bluetooth module and the ultrasonic sensor module and had pins for the motor shield which made me purchase this shield due to

which I purchased this shield as it not only does the wiring process cut short but also cut short the use of the breadboard. It can be powered also using a specific wire pin or a battery Pack.

Finally, after putting things all together it was just the coding for the coding I do have to use the specific The library which can be used to control the servo and to move the servo to a specific location or angle as in servo language. The ultrasonic sensor was connected to analog pins A5 and A6 for specifically the Trig and Echo. The servo was connected to the specific digital pin no 3 for the control of the servo which is thereafter connected to the ultrasonic sensor.

User Manual for the autonomous driving vehicle:-

The car build by me is very easy to use actually you need to do nothing just upload the code and the car will drive autonomously and without hitting the obstacles using the servo Motor and on it the ultrasonic sensor which calculates the distance in front and decided if there is an obstacle and decides to go left and right according to the distance in the direction respectively.

Then if you want you can also add a Bluetooth module and

then program it to control using your phone and then controlling accordingly according to the base program that I used to create this project and can be easily done just by adding the Bluetooth module. Also, it had an IR sensor which can be used to control the car using any remote control And control the car to go in directions specified after the buttons are pressed in the IR remote and coding is also very Easy.

The car is pretty simple to build and is good powerful with 4 motors and travel at a good speed and fun to play with kind of toy.

Setbacks and Failures:-

Another problem we faced was obstacle detection. As this is an autonomous vehicle, it is a must for us to ensure the The obstacle detection system is working correctly. We used Ultrasonic sensors for this purpose. Though we couldn't be as precise as we wanted to be, still it helped us to have a safer driving our car.

Also, we tried to get our car go to coordinates of Gps driving autonomously and bought a GPS shield for it but we ended up trying and trying but we were not able to select the

proper coordinates and ended up not using the Gps shield and we were also not able to complete the path description and create the shortest path to the waypoint and then also getting the coordinates and using them was also hard for us so we have to drop the idea of using a GPS shield and then had to drive our car just using an Ultrasonic sensor and had GPS.

Using the ultrasonic sensor was also a challenge because We had to set the sensor such that it gives us the best result of the distance and getting to stop the car because of the

The sensor had to be set such that it senses the object in front

but it doesn't sense the object that is down the sensor height but had not height well enough that it could sense so it gets stuck at that place and don't move and it doesn't use the sensor to turn left or right so for that we have to use the looping A technique so that when it is stuck at a place but doesn't come in sensor so that it turns left or right accordingly, after some time, after it is stuck at someplace.

Milestones:-

The project should be considered a success as we had an autonomously driving car or can say an obstacle avoidance car

which decided its path by itself if it encounters an obstacle in front of it and steers itself in right or left direction and keeps on driving until its battery goes down or power supply goes out and this project will continue to develop and will have future upgrades.

The thing that was not achieved was that was the driving using GPS coordinates and using the shortest path to drive to the Waypoint and which we were not able to achieve since we found it difficult to work with it and set the direction of the heading of the car always headed the wrong direction and takes too much time in going to right path so we had to drop that idea accordingly and had to improvise and build this Project.

The major milestone was achieved in the project and the A car could steer itself and go around without striking the objects and avoiding them which was a nice thing for us and which is important for our project. the car worked properly and was avoiding the obstacle which is what we intended to do and had a good result and due to teamwork, it was possible Easily.

Group Contributions:-

Talking about group contribution the whole team worked hard and due to the work is done by all the teammates, this The project was possible and led to success.

The research work is done by Ritesh and Meet that also bought up the idea that what to do new in the project and the parts that we needed was assembled or say ordered by gaurang and then after the initial stage of idea and part gatherings were done we all are roommates so we could easily gather and do this project so we started the project so with the help of Gaurang and Meet we were able to complete the initial build needed to test the car and basic function of the motor shield and then we decided to place the ultrasonic sensor which was debatable and taken our time to decide to where to place the sensor and finally we decided to place it over the servo so that it can move in al direction and all the work needed for the hardware was done and then comes the part of coding.

The coding we all had laptops in our lap and everyone is like typing the codes and doing different things playing with the car and uploading different kind of codes which made car

do a silly thing like going in everywhere sometimes fast or slow playing with a number which made us get and understand the codes and the function properly and finally, Ritesh wrote a proper code and which was neatly indented by Meet. and then we uploaded the code it had some error which we fixed and made the car run properly and maintaining the proper distance to calculate and stop at an appropriate distance duration to calculate the direction it wants to go which we had to put in proper code.

Github was done by gaurang and final project write up my The whole team as no one wanted to write the whole writeup alone so everybody wrote something and we put it up it together and here is it our final project writeup and this The part is written by me(Ritesh) the contribution thing.

The overall experience was great and we had a great experience learning new things and working with the motors and had a great learning new things and overall our learning The experience was great and we learned new thing working with servo and motor and shield and calculating the distance using servo and using an ultrasonic sensor and selecting distance and due to this teamwork, our project was a success and us

were able to complete this project on time and let's see what
The grade we get for our hard work hoping for good.

Conclusion:-

The obstacle avoidance was fun and interesting to build
and as we were not able to complete the GPS thing though we
were able to complete what we tring and achieve was planned to
do so.

The project was successful due to teamwork and hard work
of all the team members and had a great experience and us also
decided to continue this project in our spring-summer and
would like to complete the project to be working with the GPS
coordinates and decide the shortest path and travel
accordingly, so that it goes to the waypoint and without
hitting obstacle which our project does now so a small
modification in hardware and great work in coding will make it
worm we are looking forward to it.

The cs 207 labs also help us in coding as we can get the
reference form the old labs and use their codes to get the
project is done and so we enjoyed working with it and had a
great experience learning the subjects and had a great

Experience.

References

[1] Bluetooth controlled car

<https://www.instructables.com/id/Arduino-Bluetooth-Controlled-Robot-Car-1/>

[2] ultrasonic sensor distance measurement

<https://create.arduino.cc/projecthub/Junezriyaz/distance-measurement-using-arduino-ultrasonic-sensor-409169>

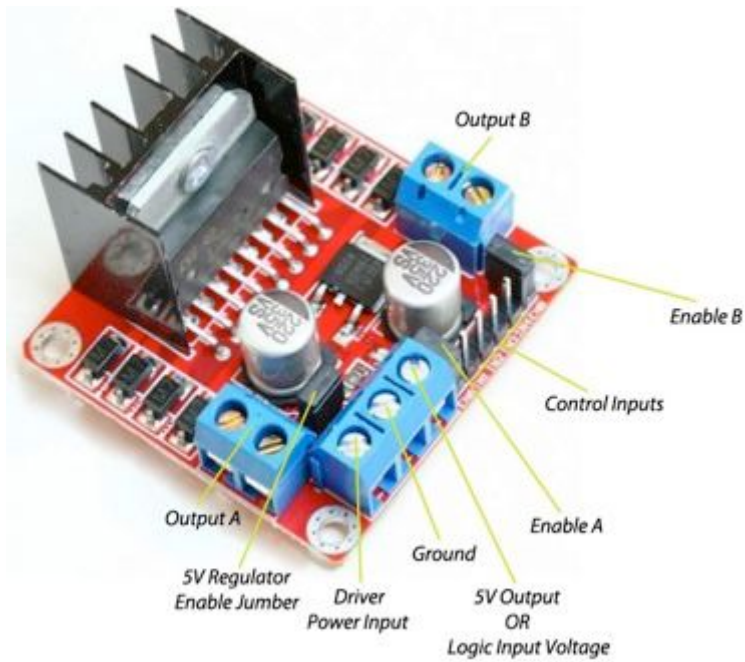
[3] Using servo motors

<https://www.instructables.com/id/Arduino-Servo-Motors/>

[4] Getting GPS coordinate in Arduino using GPS shield

<https://cyaninfinite.com/getting-location-co-ordinates-using-the-gps-shield/>

Appendix

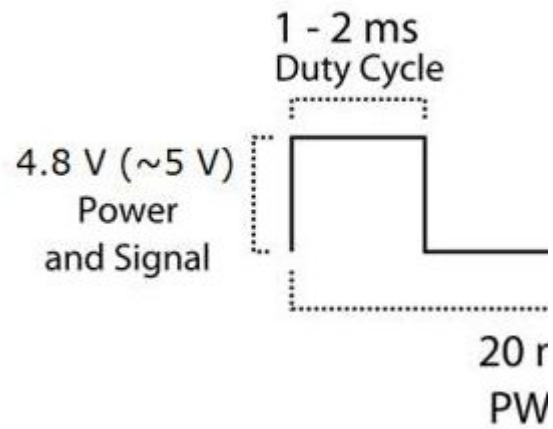


The dual Motor bridge used in my program.

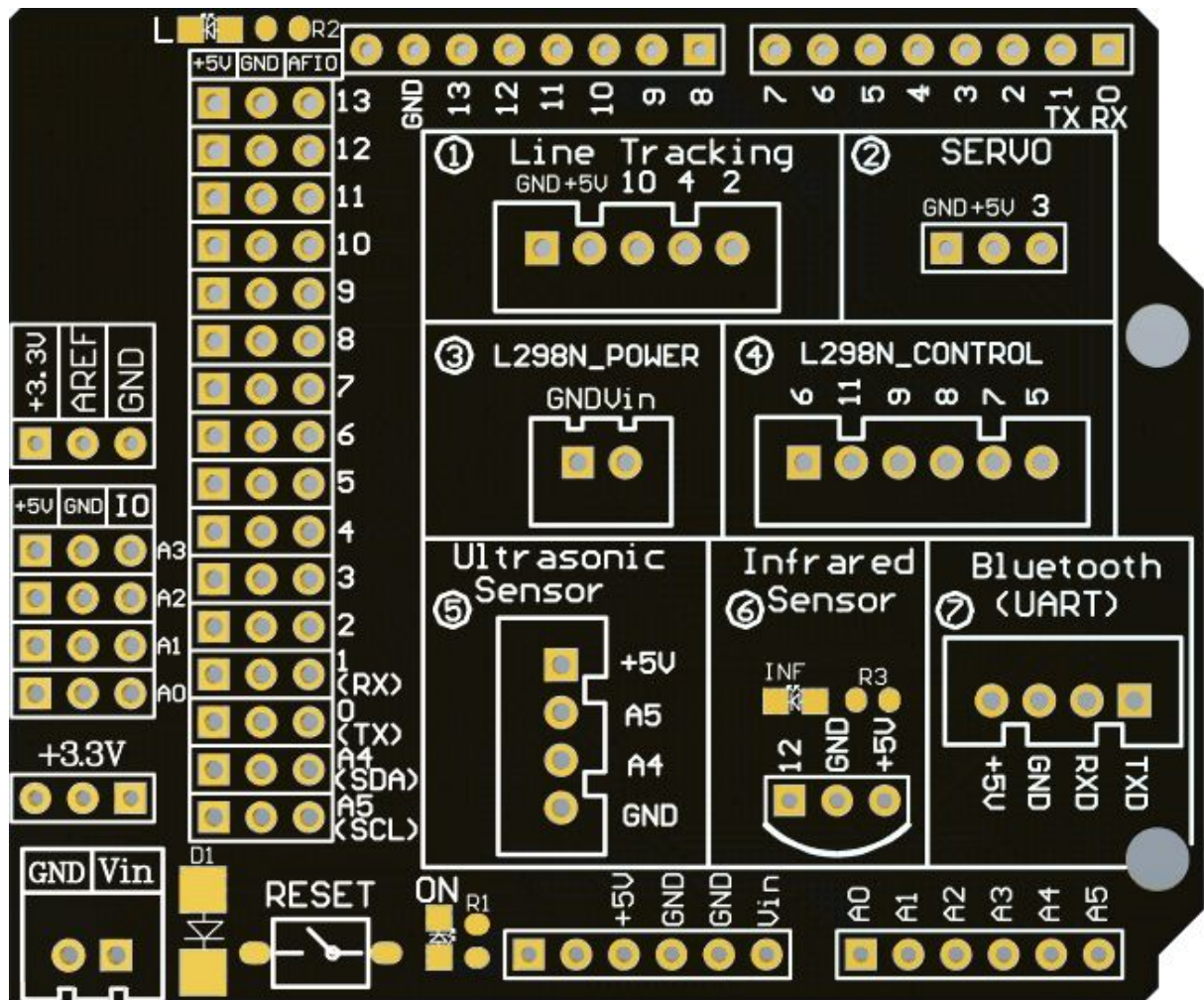


The connection of the motor and with the Arduino.

Vcc = Red
Ground = Brown



The working of the servo motor and its specified locations.



The car shield that was purchased and bought online and was used to get it neatly done.



The GPS shield was used and was not a success and we are looking forward to completing the project and advanced in it.



Magnetometer which was used to get the direction the car is heading.