

Obstacle Avoiding Vehicle Using Time of Flight Sensor

Khin Thuzar linn, Ei Thinzar Aung, Aung Zaw Ko

Abstract— Obstacle avoiding vehicle will move desired direction and avoid the object that is coming in its trail. It is a vehicle that operates on Arduino microcontroller. An obstacle avoiding vehicle uses a Time of Flight distance sensor module, besides other parts. The distance of the obstacle is controlled by angle of servo motor. Arduino Nano is a compact and breadboard-friendly. The minimum number of gear motors is used to move the vehicle. So, the system is designed and built with high efficiency, low cost and fabricated in a compact design. The controller takes user input to control the distance and drives the motor. The speed control is accomplished in an integrated circuit. Therefore, this system is very useful in application where the automated supervision is required.

Index Terms— Obstacle avoidance, Microcontroller, Time of Flight Sensor, Servo motors.

1) INTRODUCTION

An obstacle avoiding vehicle is intelligent device, which can automatically sense and overcome obstacles on its path. This device will be just liked an electronic car that keep on moving in straight line until anything meet in its path. When the object is met in its path, it decides to turn into some other direction safety. So this device successfully avoids the obstacle. Time of flight principle is used to measure the distance between a sensor and an object based on the time difference between the emission of the signal and its turn to the sensor after being reflected by the object. This paper is developed for the problem where driver may not manually the vehicle can stop automatically due to obstacle. The application areas of this paper are to use of unmanned vehicles in urban areas for especially military application as a tracking system, to detect for a mining vehicle and motor vehicle as a tracking system, to avoid in dangerous environments where human penetration could be fatal and to design almost all mobile things navigation system.

2) OPERATION PRINCIPLE

Arduino is the main processing unit of the vehicle. This circuit uses Arduino Nano board, the VL53L0X sensor, servo motor (Futaba S3003), L9110S 2-channel motor driver module and four gear motors. These main components are shown in figure.1. Arduino Nano is a compact and

breadboard-friendly version board based on ATmega328 processor. The signal that controls the servo motor is series of pulses determining the angle that the servo will move to. The servo motor is used pulse width modulation technique. Four N-20 gear motor are used to move the vehicle and dual channel motor driver module is used to control the gear motor.

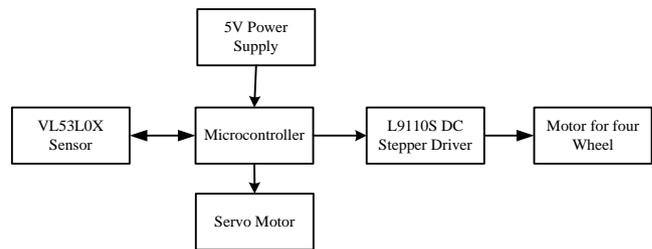


Figure .1. Block diagram of System

The 5V dc is supplied to Arduino board with program circuit. The VL53L0X sensor consists of transmitter and receiver that can measure the amount of distance range from 30mm to 1000mm. And, it uses Time of Flight measurement of infrared pulses for ranging, allowing it to give accurate results independent of the target's color and surface.

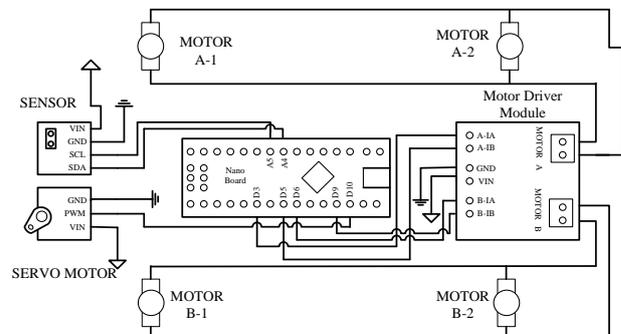


Figure .2. Circuit Diagram of the system

When the vehicle is operated, the servo motor of the VL53L0X sensor will run normally. During this time, the sensor continuously calculates the distance between the vehicle and the reflective surface. This information is processed by the Arduino. With the Arduino board the programmed control the sensor, it senses the distance of the obstacle about 150mm whether it is closer or not. If the distance is less than 150mm, the vehicle will stop. If not, it will move forward direction while servo motor rotate, the sensor reads the distances between 0° and 180°. The sensor will choose the maximum distance of the barrier. If the maximum distance is between 0° and 70°, the vehicle turns to the right. If not, it turns to the left direction. After happening any of these two conditions, it will stop just a moment. And

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Khin Thuzar Linn, Electronic Engineering Department, PYAY Technological University, (e-mail: khinktzi@gamil.com). PYAY, Myanmar, 0943175580
Ei Thinzar Aung, Electronic Engineering Department, Technological University Hinthata, Hinthata, Myanma.
Aung Zaw Ko, Electronic Engineering Department, Technological University DAWEL, DAWEL, Myanmar.

then the vehicle moves forward direction and it keeps on moving without hitting any obstacle.

3) HARDWARE AND SOFTWARE IMPLEMENTATION

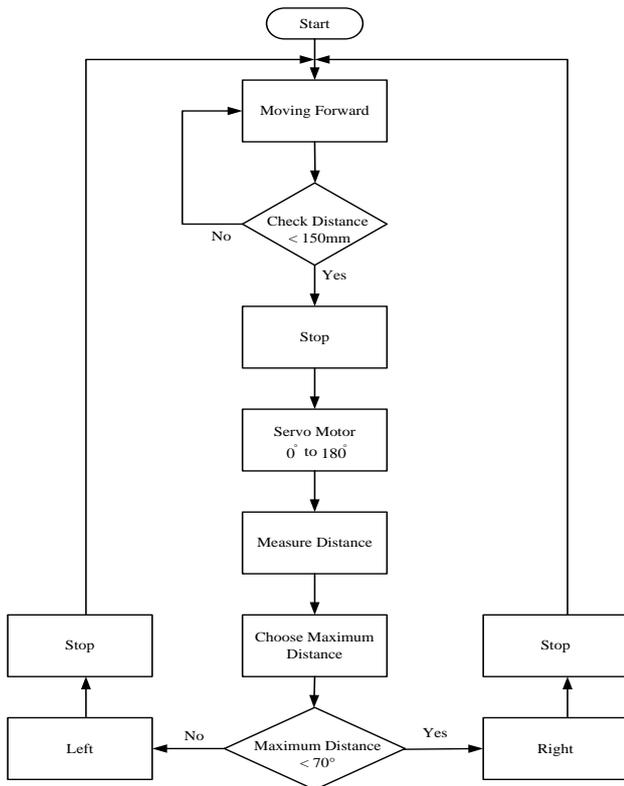


Figure .3. System flow chart

In this paper, obstacle avoiding vehicle is very compact design. As shown in figure.4 motor driver module and power unit are mounted on the lower portion of the device. Servo motor, sensor module, Arduino Nano I/O expansion shield, Arduino Nano and any other necessary components are placed at the upper portion of the device as shown in figure.5. And then four gear motor for wheels are placed under the lower Aluminium Chassic. Therefore, this type of obstacle avoiding vehicle is smart, simple and user friendly.



Figure .4. Power and motor driver module

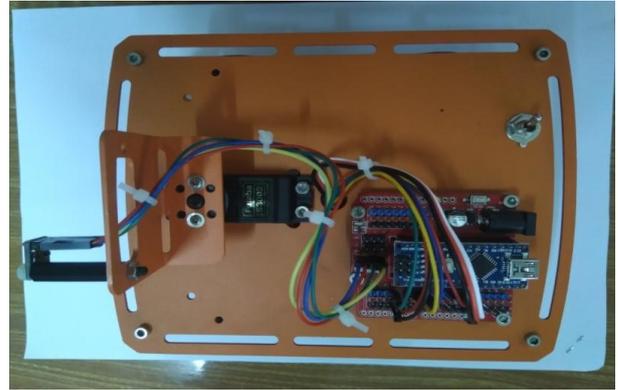


Figure .5. Controller and sensor module

4) TEST AND RESULT

In this section, the testing results of vehicle which avoid obstacles are shown in two steps. If the maximum distance between object and sensor of vehicle is greater than 70 degree, the vehicle will move to left direction of the object. If maximum distance is less than 70 degree, the vehicle will move to right direction of the object.

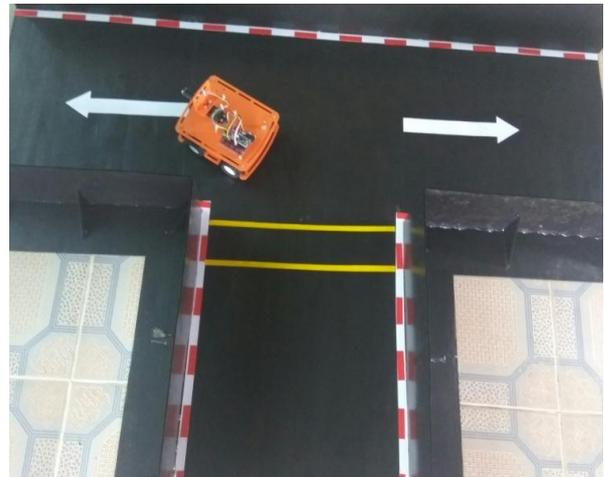


Figure .6. Condition of vehicle when Maximum Distance is $>70^\circ$

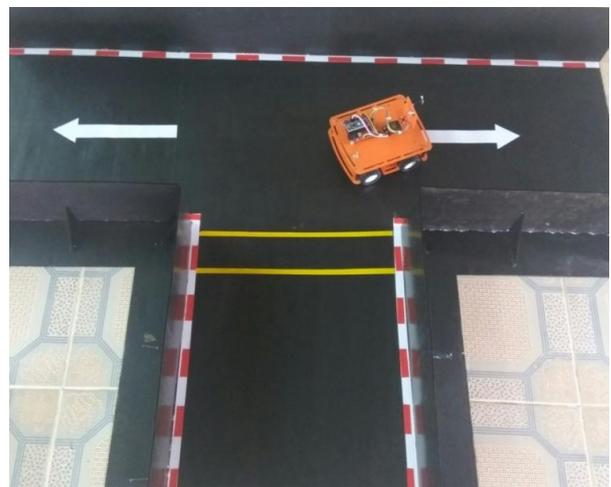


Figure .7. Condition of vehicle when Maximum Distance is $<70^\circ$

5) CONCLUSION

The goal of this paper is to create autonomous vehicle which intelligently detects the obstacle in this path and navigate according to the actions the user set for it. This paper is designed and implemented with Arduino Nano Board in embedded system domain. Experimental work has been carried out systematically. Sensor output will be given to the controller. According to the program written in the controller will give instruction to all devices. In this paper mainly whenever vehicle senses any obstacle automatically diverts its position to left or right and follows the path. This project has the goal of manipulating different paths of the vehicle to make it react according to the user's desire. This vehicle consists of four motors which control the side pair wheels of each and helps in moving left and right directions. The vehicle senses the object with help of obstacle sensor. The two basic parts for working with Time of Flight sensor are transmitter and receiver.

The advantages of this system are portable and easy to use, easy to control, easy to maintain and repair, low power consumption, help the community and the programming of the Arduino is easy. The disadvantages are only use for short distance and can't afford the backward direction.

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REFERENCES

- [1] <http://www.Electronic projects.com>
- [2] <http://www.ijareeie.com>
- [3] <http://www.allaboutcircuit.com>
- [4] <http://www.adafruit.com>
- [5] <http://www.electronicshub.org>
- [6] Faiza Tabassum, Susmita Lopa, Muhammad Masud, Tarek & Dr. Bilkis Jamal Ferdosi, "Obstacle Avoiding Robot", Global Journal of Researches in Engineering: H Robotic & Nano-Tech, Volume 17 Issue 1 Version 1.0 Year 2017

Khin Thuzar linn received her ME(Electronics) degree from Mandalay Technological University, Mandalay, Myanmar. She is currently a lecturer at Pyay Technological University .

Ei Thinzar Aung received her ME(Electronics) degree from Mandalay Technological University, Mandalay, Myanmar. She is currently a lecturer at Hinthata Technological University .

Aung Zaw Ko is a BE candidate under the department of Electronic Engineering, Dawei Technological University.