



DESIGN AND BUILD OBSTACLE AVOIDANCE ROBOT BY USING ARDUINO UNO R3

Muhammad Faisal Amien^a, Nurhendra Pratama^b, Muhammad Amin^{c*}, Masniati Murni Ritonga^d

^{a-d} Computer Engineering Study Program Politeknik LP3I Medan, Indonesia
^{*}Email: mhdamin9977@gmail.com

Abstract

This robot is able to read the distance of objects or obstacles on the front, right and left in accordance with the distance that has been set. In order for the robot to read the obstacles on the front, right and left, the robot is paired with HC-SR04 sensor combined with a Mini Motor Servo Pro SG90 RC that is useful to move the sensor HC-SR04. Important main series of obstacle robots are Arduino Uno R3 Microcontroller that functions as a robot brain and Adafruit Shield L293D Motor Driver that serves as a supporter of DC Motor crusher. If the robot is stuck in the center of the front-right-left, then the robot will take a long time to get out. The design of the obstacle avoidance robot includes three things: mechanical systems, electronics, and Arduino software for programming robots. The language used in robot installation is the Arduino programming language. In the design of this robot will be seen aspects that can be considered as the development of robots.

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Key-word: - Obstacle Avoidance, Arduino, Motor Servo.

1. Introduction

a. Background of the study

This Technology science has been used to fulfill human need within easier all part of activity in the world. One proof that technology has spread rapidly is that Robot making and operated well and efficiently by human being. Robot is a machine that can do what people asked to do automatically based on the program that has installed in a robot making. Commonly it is a combination between computation and machine motor, especially this Robot obstacle.

Robot obstacle is a robot that can run oriented the surrounding and it is not focused on one location. It can avoid from barrier from the front, right, and left is main part of robot obstacle making. In applying robot obstacle used in industry world, because robot can run its duty better and efficiently. Many methods are often times in making navigation robots such as robot wall follower, fire detection robot, robot line follower. One of the robotic systems used in this method in a very wide or long space is a floor cleaning robot. All of robot have a kind of obstacle avoidance method with better algorithms, algorithms that can stop robots to avoid collisions.

The purpose of robot obstacle build is that to create a robot that can move to avoid barrier in the front view, right, left with distance and stable speed. The robot is managed to turn left or right if there no barrier detected by robot sensor. If the robot reads that barrier coming over, therefore it's going to be continued front and back towards no barrier. There are some problem discussed in this study such as, the explanation in a form of video tutor with the work way, principles from the movement of robot obstacle avoidance that is documented in a presentation.

The running of this robot movement also discussed the ways of working from the sensor of the robot. The next stage is that the discussion of the way of robot obstacle avoidance programmed by using Arduino program language that suitable with the used applied. This paper will discuss about the way of making robot obstacle avoidance can read the distance from the right and left side.

The main component in the design obstacle avoidance robot is Arduino Uno R3. Physically real, the Arduino is a small blue microcontroller board that has a logo like the number 8 with a 180 degree position that has symbols - and + in the middle of each circle (Kumadi, 2015). The Arduino microcontroller has 16 pin Digital, 6 pin Analog and pin for VCC Ground. The sensor used is HC-SR04 sensor. The HC-SR04 sensor in principle can interpret distances based on the reflection of sound waves (Santoso, 2015). Driver Motor Adafruit Shield L293D run to control as a mover Motor DC with Motor Servo Pro SG90 RC. While Motor DC runs to move wheels from the robot and Motor Servo Pro SG90 RC that runs to round sensor HC-SR04 that will detect the distance around barrier area. Robot in the program used Arduino language.

2. Methodology

The stages of obstacle avoidance design consist of :

2.1 Obstacle Avoidance Design System

Robot obstacle avoidance has some materials and componenet such as: *Chasis*, baut spacer, Microcontroller Arduino Uno R3, Driver Motor Adafruit Shield L293D, 1 Sensor HC-SR04, 1 Motor Servo Pro SG90 RC, 2 gearbox with every DC Motor. The design can be seen in the figure no.1 below :

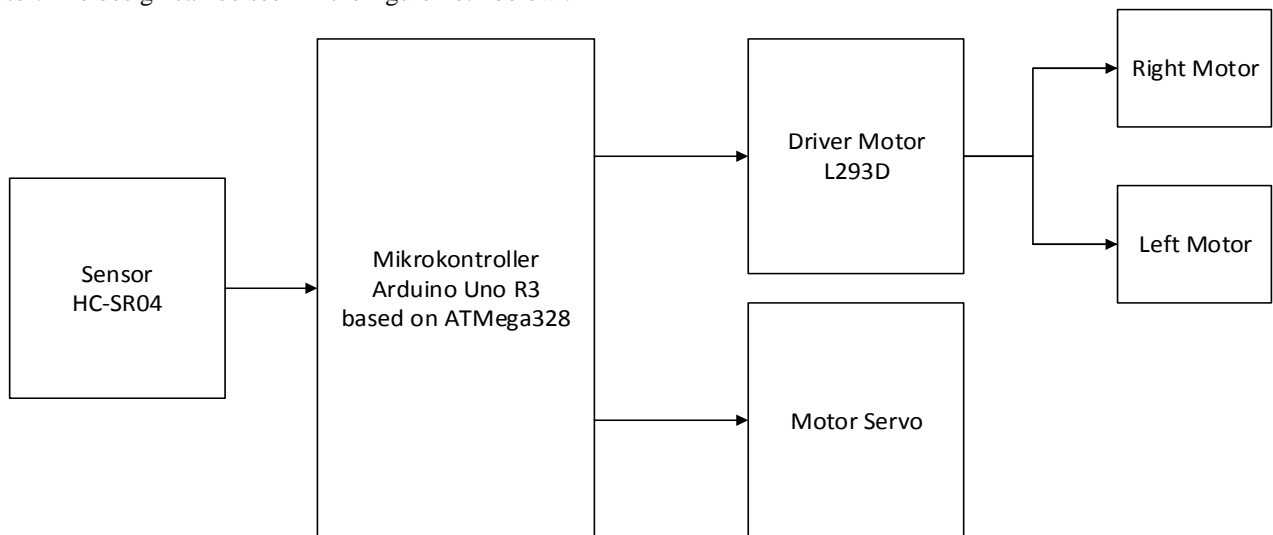


Figure 1 Microcontroller system design

This robot circuit can avoid barrier around it that can be divided into three parts. The main part is Microcontroller Arduino Uno R3 ATmega328 based that occupied as the brain of the robot therefore it is the t input output in the robot. Then, ultrasonic sensor as input data through surrounding that going to Arduino and it will be the basic of robot movement. A motor servo as handle and mover of ultrasonic sensor, 2 DC Motor with driver motor.

2.2 Mechanism Design System

This robot design is made 2 layers; the first layer is to put motor dc and wheels, box battery, motor servo and ultrasonic sensor. robot obstacle avoidance design can be seen on figure 2.

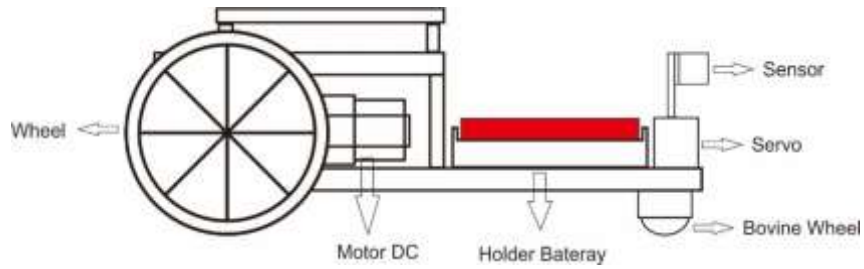


Figure 2 Robot installation view from the side

2.3 Software Design

Rancangan perangkat lunak adalah alur proses pembuatan program yang akan dijalankan oleh mikronkroller Arduino. Program ini akan tertanam pada mikrokontroller Arduino setelah di *upload*. Sehingga program ini akan menjadi kegiatan robot yang akan dilakukan secara berulang ulang ketika mikrokontroller dalam keadaan menyala. Program robot obstacle avoidance dibuat berdasarkan keadaan arena yang akan digunakan. Dibawah ini adalah flowchart program :

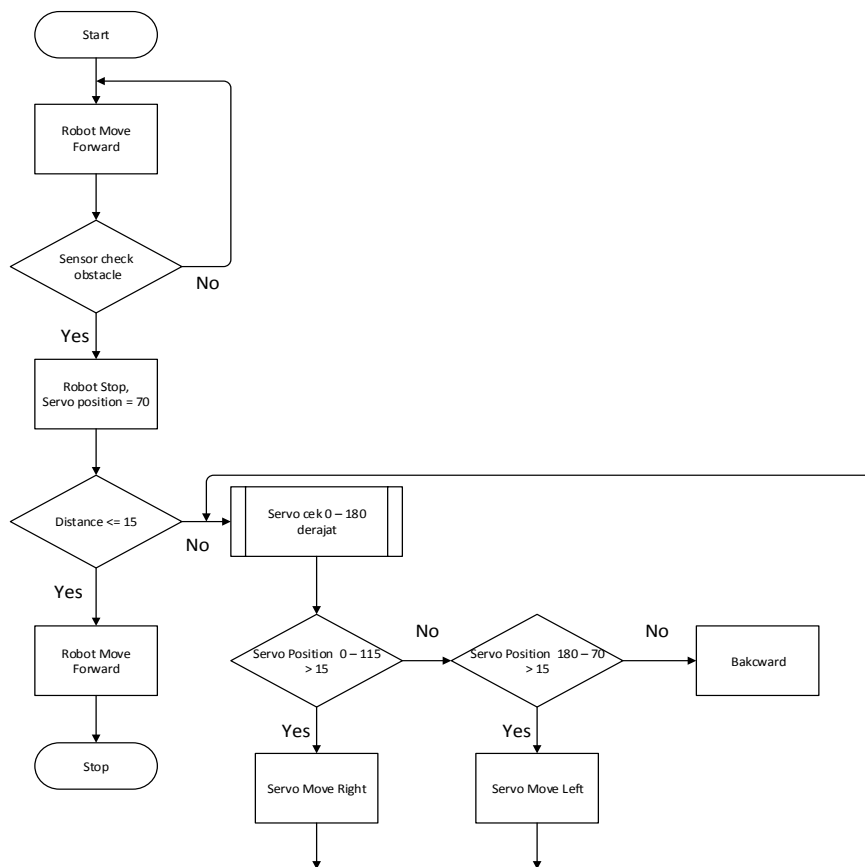


Figure 3 Flowchart Program

2.4 Implementation of Assembly

2.5

This section is going to design robot build obstacle avoidance that consist of connection component that connect it one to others with jumper cable. Then after all parts connected and ready, enter robot program that has designed. Each component connected to Arduinio microcontroller, servo motor part, and dc motor is combined with robot chasis while motor driver is connected to Arduino. The main part of obstacle avoidance is Ardino Microcontroller ATmega328 based, as it can be seen in figure no.4. there is a port at Arduino to connect the robot with computer through USB primer cable.



Figure 4 Arduino Uno R3 ATmega328

Driver motor L293D has 13 pin digital, 5 pin Analog with 4 pin Power. Every pin has different function. Driver also has slot to connect to jumper cable to control Motor DC, Motor servo, and there is slot ground and vcc that connected to power slot with jumper cable.



Figure 5 Driver L293D

Motor DC operates to run the wheels at the robot. Motor DC is installed with Gearbox to slower DC motor cycle and has its own cycle.

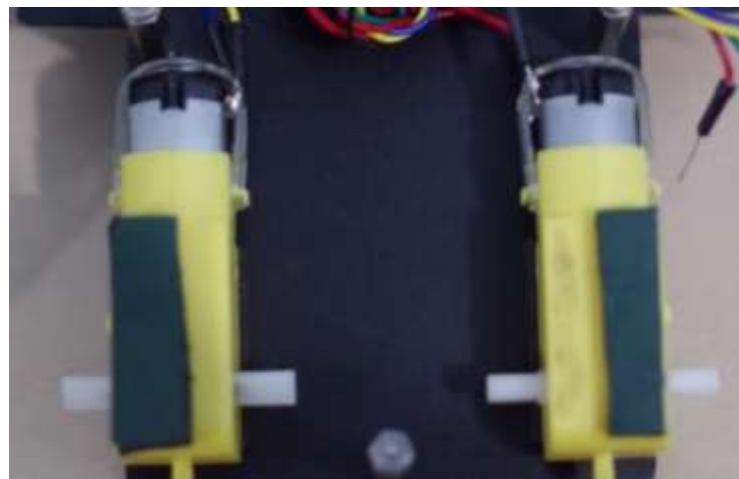


Figure 6 Motor DC

Motor Servo is to run or control sensor based on the area and surrounding. Until sensor can work well.

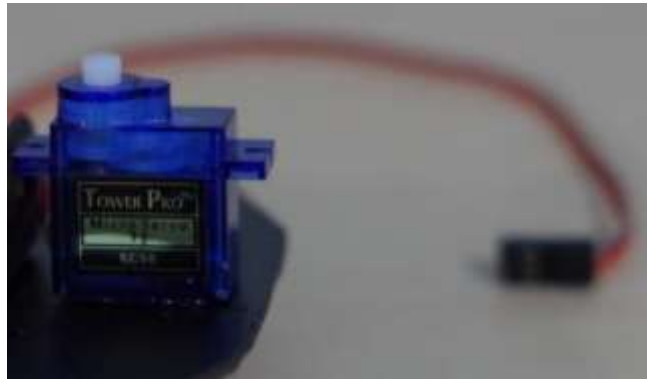


Figure 7 Motor Servo

Ultrasonik sensor or HC-SR04 run to read the distance at the robot in surrounding that run through sound wave reflection.



Figure 8 Ultrasonic Sensor / HC-SR04

Motor DC that has installed to Gearbox will be installed to the chasis below to control robot movement.

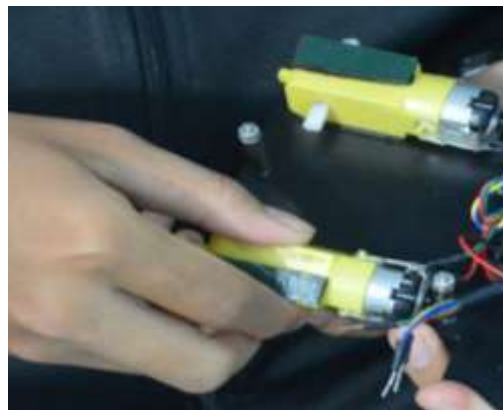


Figure 9 Motor DC Installation

Then, install Motor Servo on chasis and installed ultrasonic sensor to Motor Servo by using bracket sensor.



Figure 10 Motor Servo Installation

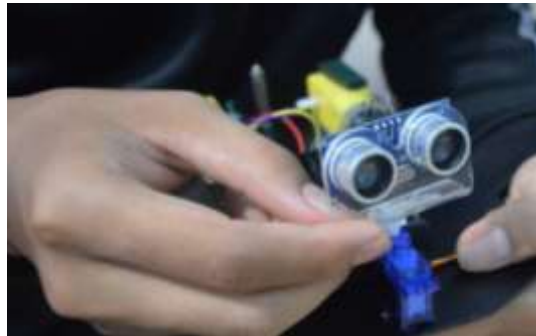


Figure 11 Ultrasonik Sensor Installation

Install Arduino at the small chasis and join Driver Motor to Arduino then installed on Motor Dc, then installed Roda at gearbox and free wheels ahead.

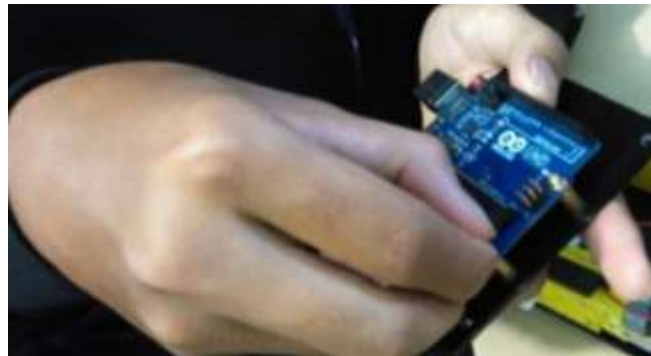


Figura 12 Arduino Making

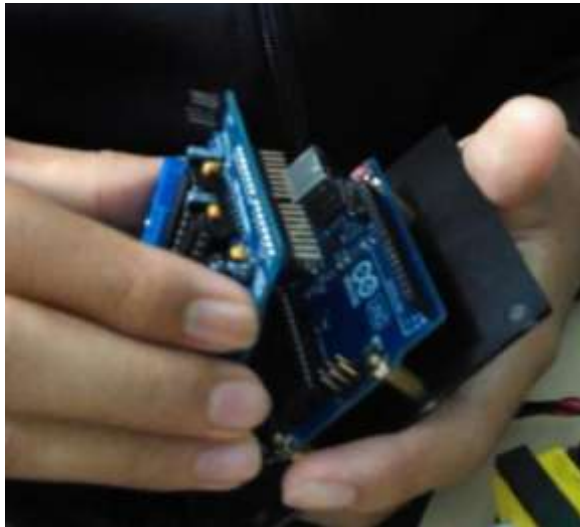


Figure 13 Combining Driver Motor

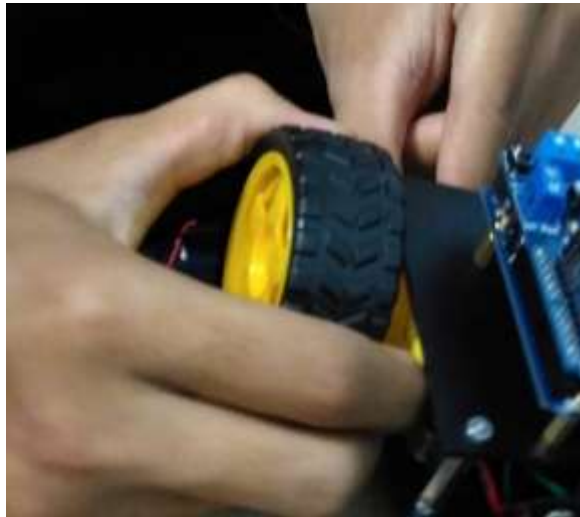


Figure 14 installation Roda at gearbox



Figure 15 Install the free wheels

Then, upload the design program to robot obstacle avoidance through USB cable Arduino software. At the robot, the program uploaded to Arduino by using Arduino program language.

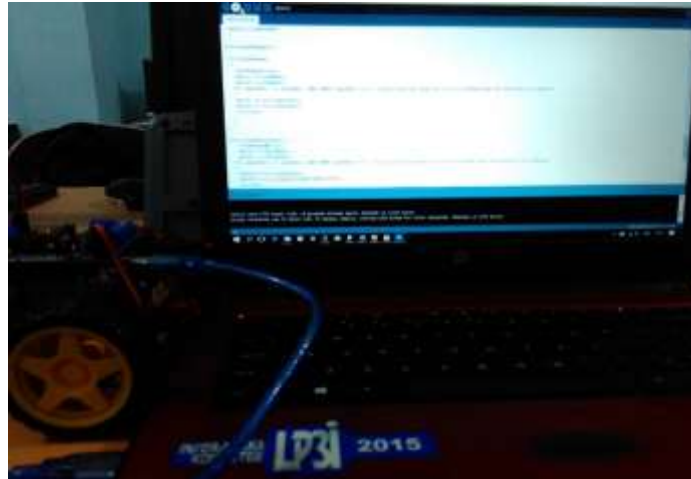


Figure 16 Upload Program Process

3. Obstacle Avoidance Robot

After assembling to be complete and committing an experiment at the Robot by making bonder around the robot, here is the figure of the robot.



Figure 17 Robot view from the front



Figure 18 Robot view from the back

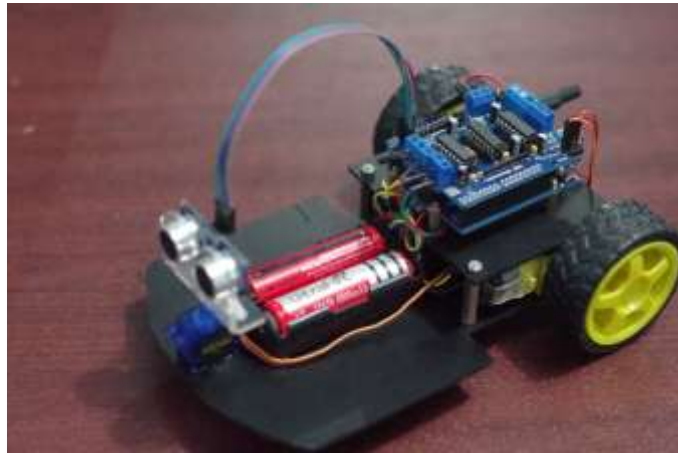


Figure 19 Robot view from the side.

4. Conclusion

This robot is design to avoid bonder around the area. Ultrasonic sensor or HC-SR04 runs to navigate robot to see the distance through sounding wave reflection. If the sensor sees the distance determined in the program, yet the program can move ahead and back. For the next research about Robot obstacle avoidance can be applied in daily life such as, robot obstacle avoidance by applying vacuum cleaner or by applying floor cleaner system. Yet, it will be useful and easier for human life.

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