Zagazig University
Faculty of Engineering
Computer and Systems Engineering Dept.

object trap
(stay +30)

This document is the report concerning the project done in the fall semester 2016 by our group. The group was composed of three students whostudied Computer and Systems Engineering on the 4th year at Zagazig University, Faculty of Engineering. Zagazig, Tuesday, December 20, 2016.

Participant(s):

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محمود السيد حسين سليمان Mahmoud elsayed hussien		Hardware (servo motor)	
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Abstract

- Determine the distance of object and its velocity by using ultrasonic sensor which transmit ultrasound waves and receive it, then we obtain on the time and by knowing velocity of the sound

distance = velocity * time .

- Determine the position of object by using on it ultrasonic sensor .

- By knowing distance between origin and the object , and the angle we can find the values of X ,Y .

-According to the distance and the velocity that we obtained the car will move back and forward to keep a constant range of distance between it and the object.

- we have three regions [green -yellow -red] :

green area between >> 60 – 100 cm
yellow area between >> 30 – 60 cm
red area between >> 0 – 30 cm

- If (the object position in a certain area)
a LED with this color be switch on

Introduction

For any Self-driving car or a robot it is important to sense the surroundings so in this project we divided it to two module :

first module (open loop system) :

-the car now is only a observer that determine the distance between the car and any object and it's velocity and it's Coordinates (x,y) and switch on a LED with the region that object in it .

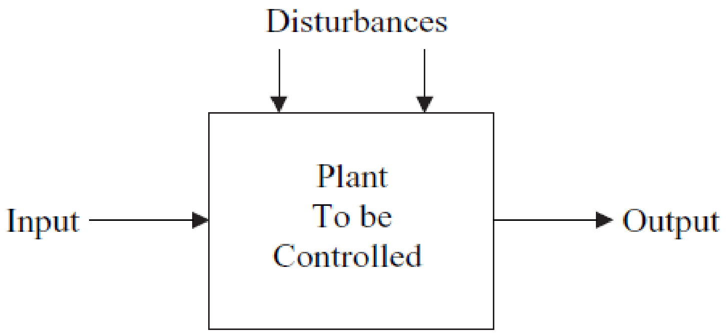


Figure 1.1 Open-loop system

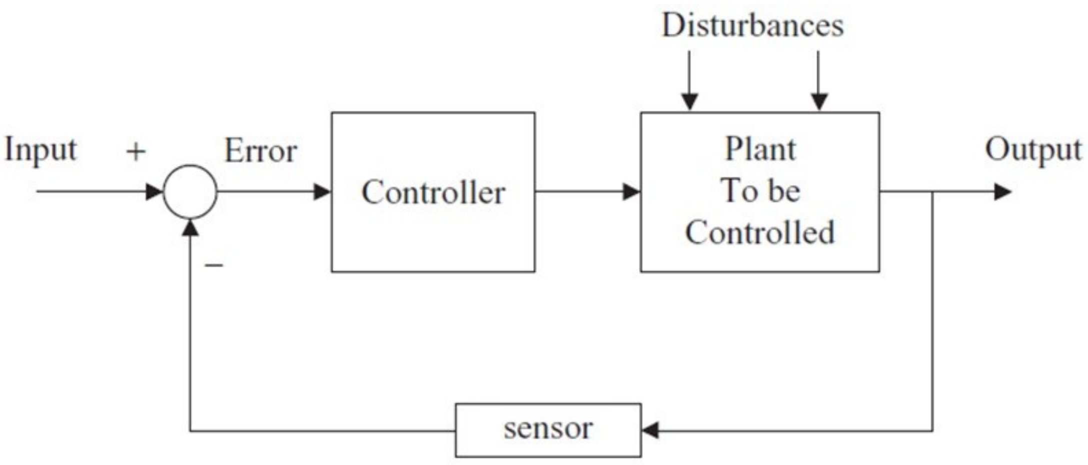
where :

-the input is >> the distance of the object from the car

- the output is >> a LED will be switched on

second module (closed loop system) :

- we keep the object tracked in a certain region and don’t allow the object to get close or far from the car



If the object close to me   -ve velocity >> move back

if the object move away from me   >>   +ve velocity >> moveforward

the components :

1- robot car
2- servo motor
3- ultrasonic sensor
4- arduino UNO
5- 3 Leds
6- buzzer
7- 4 transistors
8- 4 resistors
9- wires
10-battery

Background Theory

- the main idea of detecting the object that using ultrasonic sensor that consider as a car eye this ultrasonic sensor fixed on a servo motor

how ultrasonic sensor work :

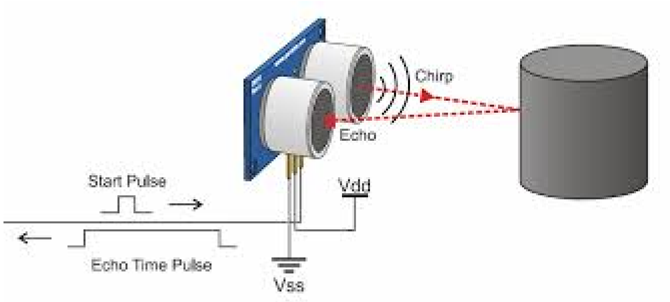
The Ultrasonic Sensor sends out a high-frequency sound pulse and then times how long it takes for the echo of the sound to reflect back. The sensor has 2 openings on its front. One opening transmits ultrasonic waves, (like a tiny speaker), the other receives them, (like a tiny microphone).

The speed of sound is approximately 341 meters (1100 feet) per second in air. The ultrasonic sensor uses this information along with the time difference between sending and receiving the sound pulse to determine the distance to an object. It uses the following mathematical equation:

Distance = Time x Speed of Sound divided by 2

Time = the time between when an ultrasonic wave is transmitted and when it is received

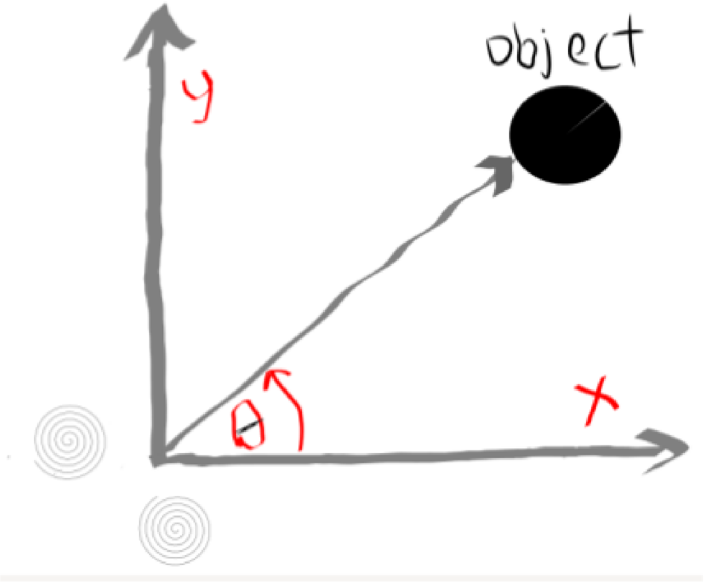
we divide this number by 2 because the sound wave has to travel to the object and back



How calculate the Coordinates (x,y) :

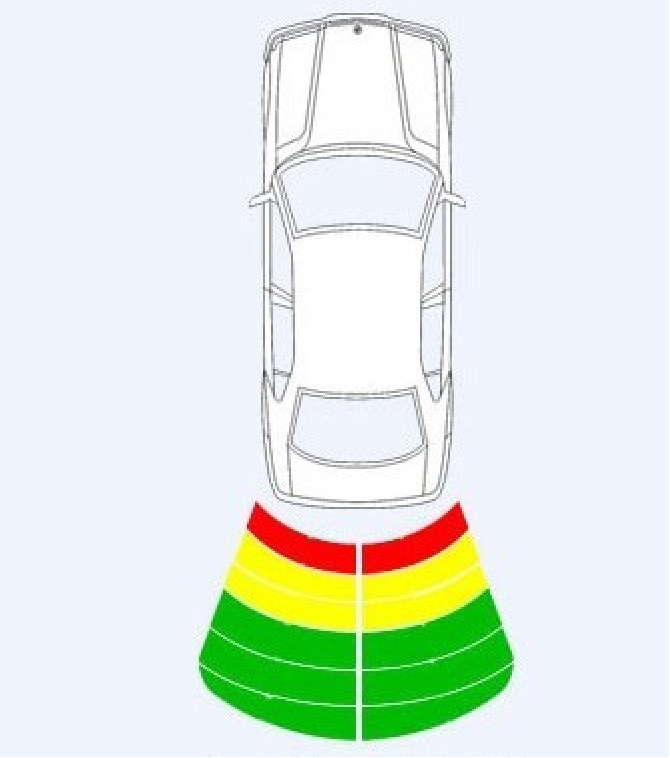
now we have the direct distance between the object and the car
and we also have the angle of servo motor
so we can get Coordinates (x,y) from the relation :

x=distance*cos(angle of servo motor)
y=distance*sin (angle of servo motor)



now according the object position a LED with the same color of the region that object in it will switch on

green area between >> 60 – 100 cm
yellow area between >> 30 – 60 cm
red area between >> 0 – 30 cm

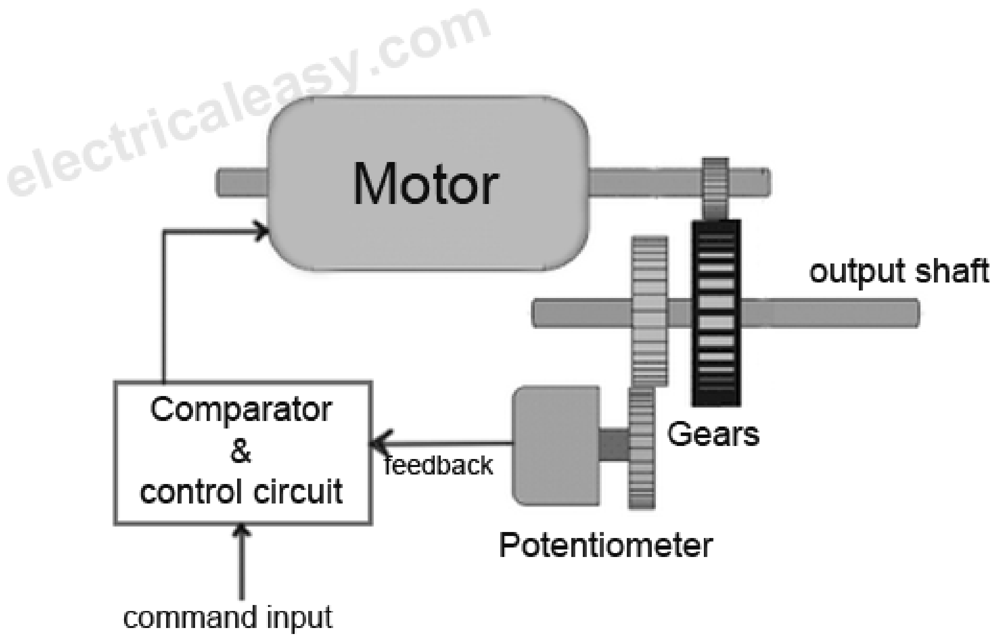


How servo motor work :

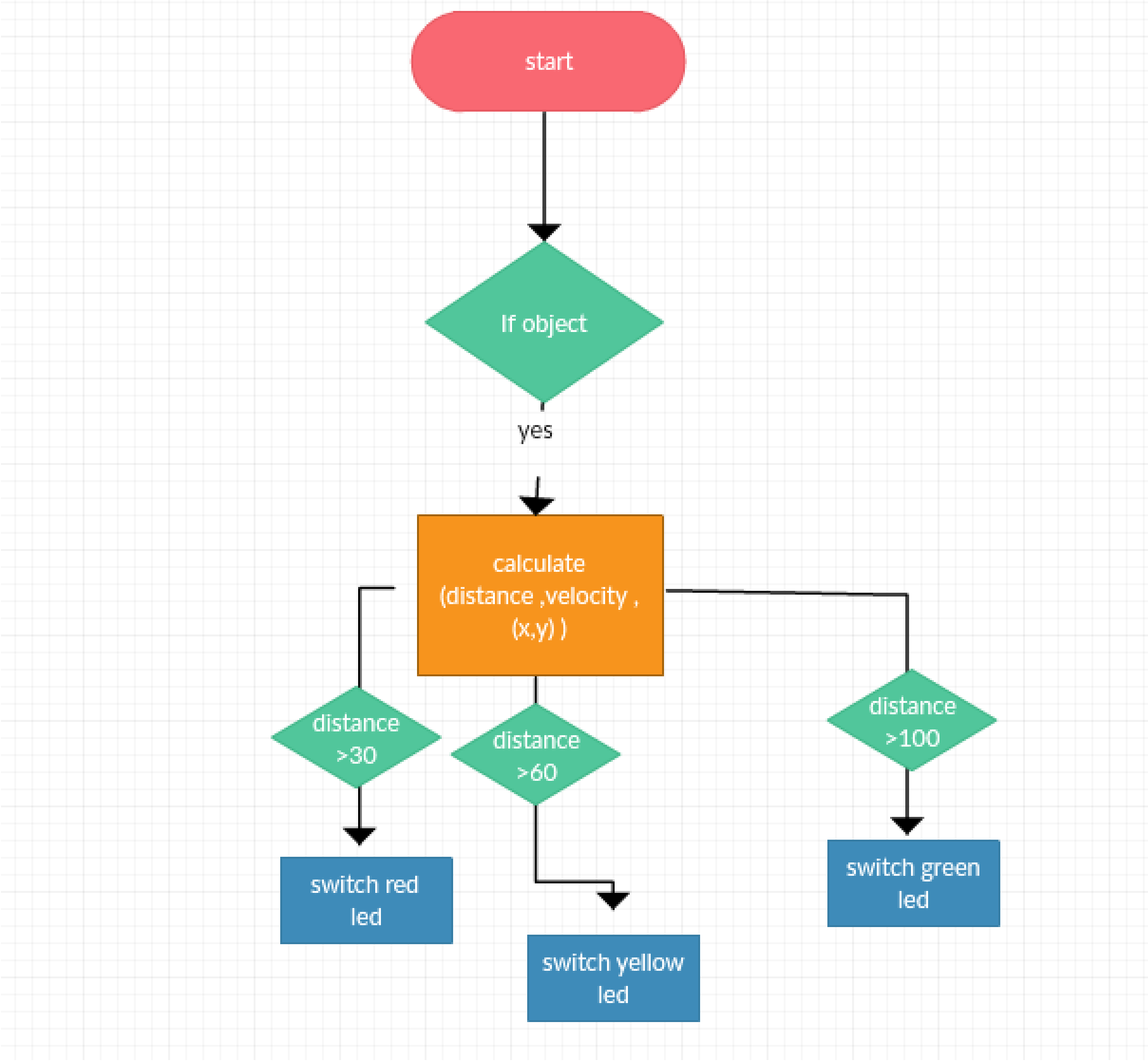
Servo motors are specially designed motors to be used in control applications and robotics. They are used for precise position and speed control at high torques. It consists of a suitable motor, position sensor and a sophisticated controller

Servo motors are used to control position and speed very precisely, but in a simple case, only position may be controlled. Mechanical position of the shaft can be sensed by using a potentiometer, which is coupled with the motor shaft through gears. The current position of the shaft is converted into electrical signal by the potentiometer, and the compared with the command input signal. In modern servo motors, electronic encoders or sensors are used to sense the position of the shaft.

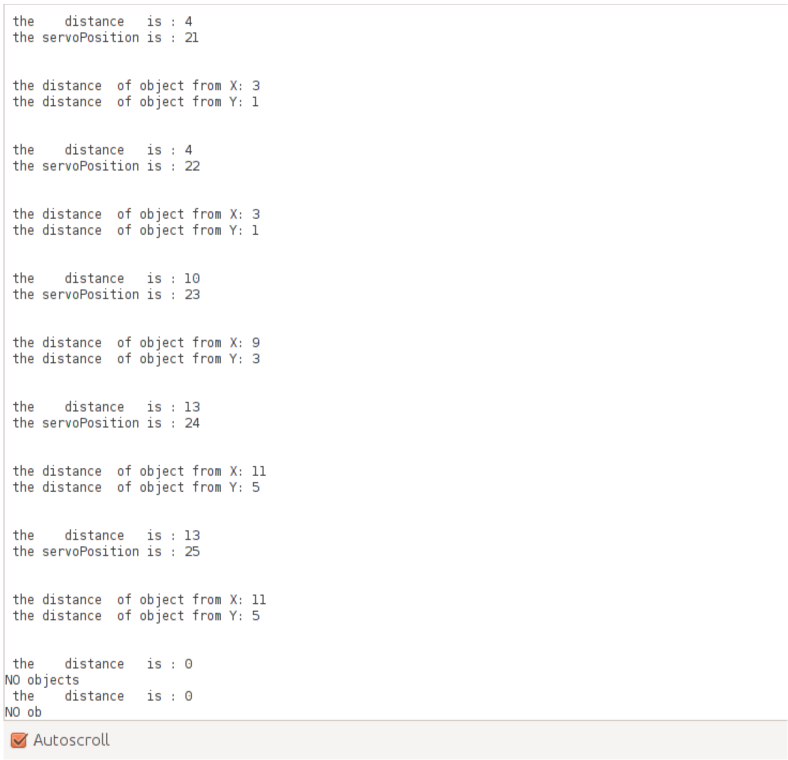
Command input is given according to the required position of the shaft. If the feedback signal differs from the given input, an error signal is generated. This error signal is then amplified and applied as the input to the motor, which causes the motor to rotate. And when the shaft reaches to the required position, error signal becomes zero, and hence the motor stays standstill holding the position.



flow chart


start
If object
yes
calculate
(distance ,velocity ,
(x,y))
distance
>30
distance
>60
distance
>100
switch red
led
switch yellow
led
switch green
led

Results



```
 the    distance   is : 4
 the servoPosition is : 21


 the distance  of object from X: 3
 the distance  of object from Y: 1


 the    distance   is : 4
 the servoPosition is : 22


 the distance  of object from X: 3
 the distance  of object from Y: 1


 the    distance   is : 10
 the servoPosition is : 23


 the distance  of object from X: 9
 the distance  of object from Y: 3


 the    distance   is : 13
 the servoPosition is : 24


 the distance  of object from X: 11
 the distance  of object from Y: 5


 the    distance   is : 13
 the servoPosition is : 25


 the distance  of object from X: 11
 the distance  of object from Y: 5


 the    distance   is : 0
NO objects
 the    distance   is : 0
NO ob
```

Comments:

The movement of the car wasn’t stable, as we were working on the distance and the speed in the same time. In order to solve that, we worked on the distance only and ignored the velocity of the object.

Appendix

source code

The source code available on Github

https://github.com/mostafaelgohry0/faculty