ECGR 4161 LECTURE 12 7/24/2012

Teamwork

Forming
Storming
Norming
Performing

You have a vehicle that you wish to add a collision avoidance system. It will be sound-based. The goal is to stop 5 m before the object. assume the max speed will be 150 km/hr. The stopping distance of your vehicle is 125 m. How far in front of your vehicle should your sensor be able to sense a stopped object so you can stop in time.

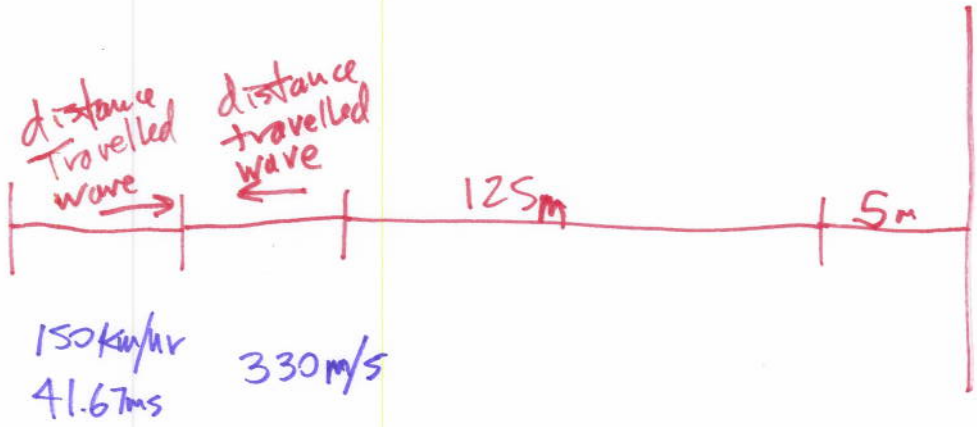
100 km/hr = 40 m

speed of sound = 330 m/s

ECGR 4161

7/24/12

(2)



d_{car} = distance the car travels before it receives the sound back

$V_{car} = 41.67 m/s$

d_{air} = distance the car travels (d_{car}) + distance that breaking needs to start (2*130)

$V_{air} = 330 m/s$

$$\frac{d_{car}}{V_{car}} = \frac{d_{air}}{V_{air}}$$

$$\frac{d_{car}}{41.67 m/s} = \frac{d_{car} + (2 \cdot 130 m)}{330 m/s}$$

$d_{car} = 37.58m$

So distance
= 37.58 + 130
= 167.58

ECGR4161 7/24/12

(3)

A. Light sensor works between 0 and 5 volts. When a black stripe is detected on a white floor, the output voltage is between 0 and 1V. When the white floor is detected, the voltage is between 4 and 5V. Assume you have a 10-bit ADC.

A) what is the max digital value for detecting a black line?

B) what is the minimum digital value for detecting the white floor.

$$n = \left[\frac{V_{in}\ 2^N - 1}{V_{+ref}} + \frac{1}{2} \right] int$$

Black

$$n = \left[\frac{1V * 2^{10} - 1}{5V} + \frac{1}{2} \right] int$$

$$= \left[\frac{1023}{5} + \frac{1}{2} \right] int = 205$$

White

$$n = \left[\frac{4V * 2^{10} - 1}{5} + \frac{1}{2} \right] int$$

$$= \left[\frac{4092}{5} + \frac{1}{2} \right] int = 818$$