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Overspeed Detection Using Arduino Uno-based IR Infrared Sensor

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Abstract

The goal of this project is to measure the speed of an object as it passes through the sensor being utilized. The tool that will be developed as a result of this project has already been designed in software simulation to ensure that it will work as intended. This device uses two infrared sensors as input signals to be processed in accordance with orders.I will be connected to an Arduino Uno through a middle whiteboard as a communication hub between various parts. The parameter used in this tool is the movement of the object going through the infrared sensor because that is what is measured when an object goes through the sensor in this tool. The input data will be processed and then shown on the programmed I2C 16x2 LCD to show the output signal that results from processing the input signal. Making this tool will allow users to minimize unintended incidents and control their speed while driving.

Keywords*: Speed, Displacement, Infrared Sensor, Arduino Uno*

Abstrak

Proyek ini dirancang untuk mendeteksi kecepatan suatu objek yang melewati sensor yang digunakan. Alat yang dihasilkan dari proyek ini merupakan alat yang telah dirancang pada simulasi software terlebih dahulu agar memastikan alat yang digunakan berfungsi dengan baik. Pada alat ini menggunakan 2 sensor *infrared* yang mana menjadi sinyal input untuk nantinya diolah sesuai dengan perintah yang diberikan dan akan dihubungkan dengan Arduino uno yang melalui perantara *whiteboard* sebagai unit penyatu komunikasi dari satu komponen ke komponen lainnya. Dalam alat ini yang diukur ialah pergerakan suatu benda ketika melewati sensor *infrared* sehingga parameter yang digunakan dalam alat ini ialah perpindahan benda yang melewati sensor. Setelah melalui proses pengolahan maka data input tersebut akan ditampilkan pada LCD I2C 16x2 yang telah diprogram untuk menampilkan sinyal output yang berasal dari oengolahan sinyal input. Tujuan dibuatnya alat ini ialah agar masyarakat dapat mengontrol kecepatan ketika berkendara dan meminimalisir terjadinya kejadian yang tidak diinginkan.

Kata kunci: *Kecepatan, Perpindahan, Sensor Infrared, Arduino Uno*

Introduction

Every day, there are many vehicles for transportation, and even entire communities can have their own vehicles for transportation [1]. This happened since the significant growth in private transportation necessitates that we understand how to utilize and make the most use of them. Many people are unconcerned with the risks posed by private vehicles, particularly the excessively high speeds that can result in disasters or accidents for other motorists. The speed itself can be stated in terms of meters per second and is a derivative magnitude derived from a number of magnitudes, including length and time [2].

The speed can be measured using a speedometer since a sensor detect the movement [3]. By modifying a device and also the function of a component, it can create

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a device that detects the speed of a vehicle that has just passed and display the results of the speed obtained. Many drivers seem to ignore their speed on the road, which can be dangerous to other drivers [4]. Although a society might be tough to organize and difficult to stabilize, each individual has the right to contribute in his or her own unique way to making our country a better place.

An infrared sensor is an electronic device that measures and detects infrared radiation in the immediate environment. It transmits an infrared signal that is carried by an object's surface and then picked up by an infrared receiver to detect movement of an object in front of Receiving (IR) [2]. These sensors can be used to gauge a vehicle's speed in order to ensure that it stays within a set speed limit as well as to gauge the speed of an object in front of it [5].

An infrared sensor is a device that can detect infrared rays around and detect the movement of an object that emits infrared radiation. Infrared light itself is a light that cannot be seen by the human eye because it has a short wavelength of about 0.7 μm to 1000 μm [6]. Generally speaking, everything in nature emits infrared light radiation, but human eye cannot detect it. Infrared radiation can only be felt by certain components that are sensitive to microwave radiation from infrared. The way infrared sensor works is similar to the motion detection sensor, i.e. the sensor will detect infrared waves emitted by an object, then the beam will be altered by the circuitry inside the sensor which become a digital output signal and sent to the microcontroller network used [5].

Methodology

Figure 1 of a simulation series that has been developed using Proteus 8 Professional. On the simulation set consists of three main parts: Arduino uno, infrared sensor, Buzzer and LCD I2C 16x2 to display outputs that have been written in Arduinos coding as well as used to display the results of speed detection derived from two installed and functionally adjusted infrared sensors.

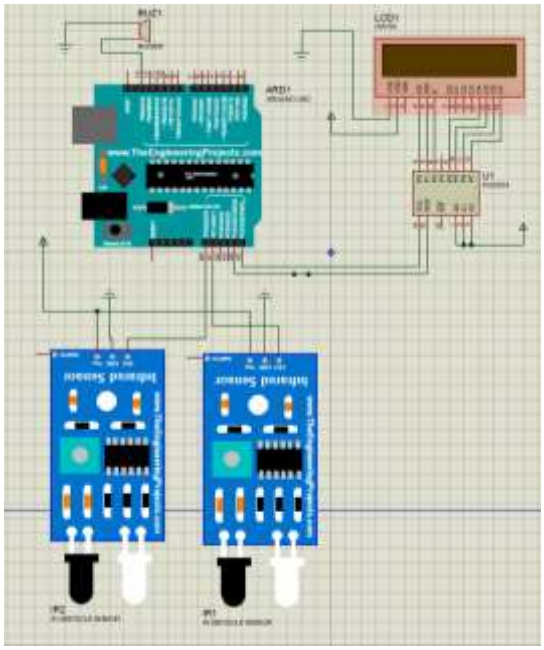

Figure 1. Simulation Network

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The device works using an infrared sensor that has been mounted on a whiteboard that unites several devices such as an Arduino uno, two infrared sensors, a buzzer, and a 16x2 I2C LCD. The use of two infra-red sensors in this device is expected to increase the level of accuracy and speed in the detection of the speed of an object passing through the detector.

Table 1. PIN Settings

Pin Input :

Arduino Uno	Sensor Infrared
5v	Vcc
Gnd	Gnd
A0 dan A1	Out

Pin Output :

Arduino Uno	LCD I2C 16x2	Arduino Uno	Buzzer
5v	Vcc	13	Pin +
Gnd	Gnd	Gnd	Gnd
A4	SDA		
A5	SCL		

The next step is to connect all the pins according to the table using a jumper cable. Each device can communicate and generate outputs with valid input data. Then, creating the source code to program Arduino Uno to run according to the desired command. The programming of the one itself uses the C programming language, which has become a programing language that is often used to program a tool and becomes a common programming tongue amongst the society. After doing the software design and simulation using the software, the next step is to create a hardware device which at the time of simulation testing can be assured that with the design this detection tool can run according to the command and can detect the speed of an object.

Figure 2. Hardware Devices

Results and Discussion

In this section we will discuss the results and experiments that have been carried out both simulated and experimental hardware devices:

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1. Initial view

Once all tools are confirmed to be able to communicate between components, then run the tool with the given program. The power source used in this experiment is the power source from the laptop where the program code is inserted into the Arduino uno. After running it will appear on the I2C LCD as in Figure 3.

Figure 3. Preview

2. Over Speeding Condition

The condition of over speeding can occur when an object moving too fast in front of an infrared sensor. When the speed of an object passing through the sensor exceeds 60 km/h, the I2C LCD screen will display "Over Speeding". The Buzzer will sound for 3 seconds and will indicate that the object passed by the sensor has exceeded the specified speed. Here is the display of the over speeding condition as shown in Figure 4.

Figure 4. Over Speeding Condition View

3. Normal Condition

Under normal conditions, the speed of an object passing through the sensor does not exceed the programmed limit of less than 60 km/h. If the speed is still below the standard, the I2C 16x2 LCD will display "Normal Speed" and the buzzer does not turn

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on. This indicates that the speed remains below the specified speed standard. Here's the normal condition view as shown in Figure 5.

Figure 5. Normal Condition View

4. Loop Condition

This condition is a transitional condition after the sensor detects the speed of an object passing through it. The data is processed and displayed on the I2C LCD, then the device restarts the program and is ready to re-detect passing through the sensor and quickly re-recognize the speed of the object without any delay or reboot process. Here's the view of the loop condition on Figure 6.

Figure 6. Loop Condition View

Conclusion

After conducting experiments and simulations on both hardware and software devices, the measured parameters can be determined and the sensors used correctly. The use of two infrared sensors can also increase the accuracy of the device thus it can identify the speed of objects passing through the sensor installed on the hardware device. There were difficulties in testing the validity of the speed values displayed on the I2C LCD due

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to the lack of comparison tools for measuring the speed that had more accurate validity in measuring speed.

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