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Automatic Speed Detection and Reporting System Using Arduino

Manipriya Vutturi[1], Susmitha Palle[2], Sathyam Bonala[3]

[1,2] B. Tech students, Department of Electronics and Communication Engineering, Vaageswari College of Engineering, Karimnagar-505527, Telangana, India

[3]Associate Professor, Department of Electronics and Communication Engineering, Vaageswari College of Engineering, Karimnagar-505527, Telangana, India

Abstract: ***From the advent of increased transportation, over speeding of vehicles has become one of the major causes for accidents and killing many lives. This paper presents a system, developed for over-speed detection of the vehicle or human beings and alert corresponding persons by giving buzzer automatically and also sends messages to their mobiles. Presently, RADAR gun or LIDARS are extensively used for over speed detection but it requires a person to pull the trigger for detecting the speed. In this work it has been proved that automation provides better performance than a human handled system.***

Keywords: Doppler Effect, IR sensors, Arduino Uno, RADAR gun and Traffic logger

1. Introduction

We all know that over speed is the major cause for road accidents. In this busy life schedule, people always prefer to drive at very speed rather than low speed to reach their respective places in time. Thus, it is necessary to understand the need of a technology which would be used as a speed limit enforcement system. A system which helps to limit the speed of the vehicles and the owner would be punished under the law due to over speed and this is the best method for making people to drive at normal designated speeds. In some places, traffic policemen are there to monitor to proper functioning of traffic on roads and at some places, traffic places RADAR system is used and this is a technology which is based on the Doppler Effect and with just one trigger it can determines the speed of the vehicles. Every system whether it is a RADAR or any other it manually requires a human to take for watching the vehicles passing by and to report if any vehicle breaks the law or over speeds. Every system uses advancements in technology to prioritize the automation over human handled machines. So, the traffic monitoring system should also be made as automatic which is possible in many ways. This paper is an idea of one of such system. The project is developed by keeping in view all the disadvantages mentioned above and is named as Speed Check and over speed detector. This system mainly focuses on calculating the speed of approaching vehicle that over speeds.

The literature related work to the automatic speed detection systems is presented in section 2. Implementation details of the proposed system are in Section 3. Section 4 gives the mathematical model of the system and the results are discussed in section 5. Finally section 6 concludes the paper followed by references.

2. Related Work

Vishal Pande et.al [1] has proposed a framework for autonomous speed control of over speeding vehicle using Radio Frequency to design a controller to control vehicles speed and display to monitor the zones which can run on an embedded system platform.

Monika Jain [2] presented a device to detect the rash driving and alerts the traffic authorities in case of any violation. This frame of reference intends to design a system aimed at early detection and alerts vehicles driving patterns which is related to rash driving. The speed limit is by the police at very location who uses the system depending on the traffic. This device reports, displays and data base system for over speed violation management.

Ni Hlaing et.al [3] designed a system that detects the speed of the vehicle in the roads, main highways and the places where the drivers over speed. If the speed exceeds the limit, the information will be sent to PC (Personal Computer) which starts the camera which captures the vehicle of over speed.

Amarnarayan et.al [4] developed speed estimation system that alerts drivers about driving conditions, robust and reliable and helps to avoid joining traffic jams is an important problem that has attracted lots of attention recently.

Nehal Kassem et.al [5] introduced a novel RF-based vehicle motion and speed detection system which can detect vehicle motion estimates the vehicle speed in typical streets with an accuracy of 90% and detects motion with an accuracy of 100%.

Rajesh Kannan Megalingam et.al [6] developed a wireless sensor network that performs efficient traffic routing but also track over speeding vehicles i.e, smart traffic controller. MicaZ motes (MRP2400, a 2.4 GHz IEEE 802.15.4, TWMS (Tiny Wireless Measurement System) from Crossbow are utilized for this purpose. To acquire, transmit and receive data, a gateway and DAC (Data Acquisition Card). Over Speed detection unit comprises microcontroller for interrupt generation and speedometer simulation.

Muhammad Tahir Qadri et.al [7] developed a system which detects Automatically and recognizes the number plate and for security control of a highly restricted area like military zones or area around top government offices like Parliament, Supreme Court etc, is deployed at the entrance. The developed system detects the vehicle and then captures the vehicle image. Using the image segmentation in an image, the Vehicle number plate is extracted.

Shyr-Long Jeng et.al [8] presented a device that detects rash driving on highways and alerts the traffic authorities in case of any violation. Lots of devices have been made to detect rash driving on highways in the past. The main aim of the system is early detection and alerts the dangerous vehicle driving patterns related to rash driving. Most of the approaches requires human concentration and involve a lot of effort, which is difficult to implement.

Nurhadiyatna A et.al [9] developed an Intelligent Transportation System (ITS) which has become a world wide solution for traffic problem. In this the vehicle speed measurement is made by using a camera as sensor. It uses a method to estimate vehicles speed using video processing in real time. Principal Component Analysis (PCA) is used to classify vehicles. Kalman filter is harnessed to track and identify passing vehicles in real time. Then vehicle speed can be estimated via Euclidean Distance method.

3. Implementation

The proposed system consists of two major components viz. hardware and software.

3.1 Transmission Section

There is a transmitter and receiver depends on the direction of the vehicle that is there is no particular specification on these Infra Red (IR) sensors they act as both transmitter and receiver. The main aim of this is to calculate the speed of the vehicle or human being.

3.2 Power Supply

The board requires a 5 Volts power to make it work, the sensor and all other hardware devices works in this much of power.

3.3 Arduino Uno

The Arduino is having the following pin configuration:
There are some 28 pins for making the input and output from the Arduino board. These pins are very much helpful for the making the board do some useful work for example it can be used to take some sensor values from the sensors and make the decision based on the programming we have done on it. The board is having a ATMEGA microcontroller which is like a heart of the board.

Figure 1: Arduino Uno

Table 1: Aurduino board specifications

Microcontroller Features	ATmega328P
Operating Voltage	5V
Input Voltage	7-12V
Clock Speed	16MHz
Digital I/O Pins	14(of which 6 provides PWM output)
Analog Input Pins	6
Flash Memory	32KB (ATmega328)
SRAM	2KB

3.4 LCD Display

The below figure is a simple LCD display device which is available in the market its 16X2 display where one can able to view the 16 characters in each line and having a maximum of 2 lines. In most the embedded projects, LCD modules are very commonly used because of its cheap price, programmer friendly and availability. LCD is a very important part of the application to display the speed of the particular moving object. LCD's are thinner and lighter when compared to LED and cathode ray tube. it has major application in the field of science and engineering on electronic devices. LCD's provides excellent contrast. LCD's consists of some microwatts for display in comparison to some mill watts for LEDs. The major applications in the field of science and engineering as well on electronic devices.

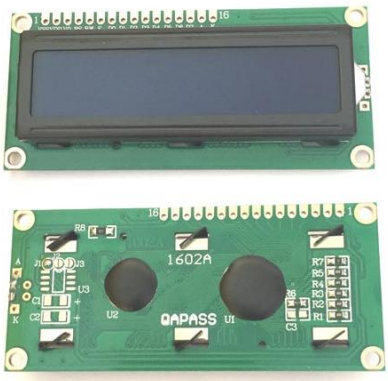

Figure 2: LCD Display

3.5 IR Sensors

First two digital IR Sensors are used, which is of an IR Transmitter i.e., IR LED and an IR Receiver i.e., Photo diode, a Comparator IC and a few supporting components. To form a Reflective Type IR Sensor, IR Transmitter and Receiver pair are placed side-by-side.

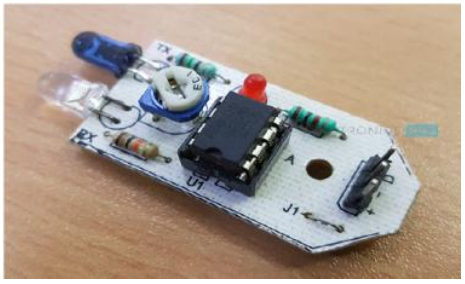

Figure 3: IR Sensor

In this type, the IR Transmitter continuously emits Infrared radiations and if there is object in front of the sensor, some of the infrared radiation hits the object and gets reflected back.

The reflected radiation falls on the IR Receiver, which means that detects the object by the sensor. But if there is no object in front of the sensor, none of the Infrared Radiation gets reflected back to the IR Receiver.

Some IR Sensors has option to produce both Analog and Digital Outputs but the module used has digital outputs but the module used has only digital output i.e if object is detected the output is HIGH and if no object found the output will be LOW.

4. Mathematical Model

Now Arduino measures the speed of vehicle which is measured by distance and time relationship

$$s=d/t$$

Where s = speed of the moving object, d = distance between the two sensors and t = the time measured by Arduino.

5. Results and Discussion

The clear representation of the speed detector and the LCD display which gives the accurate results are shown And this is more useful than any other equipments.

Figure1, automatic speed detector is used to detect the vehicles speed and displays the result.

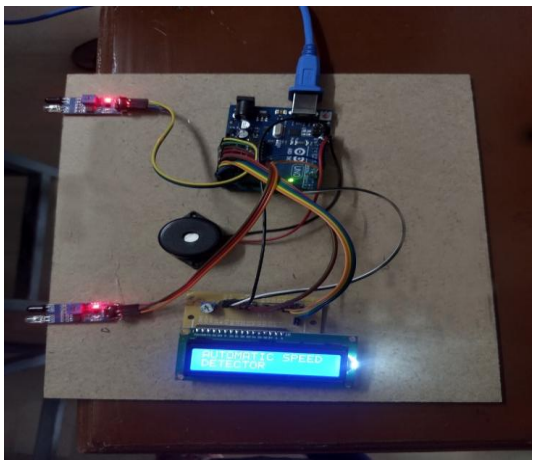

Figure 4: Automatic speed detector

Figure 5, While an object is moving the normal speed of the object/vehicle is displayed here as km/hr.

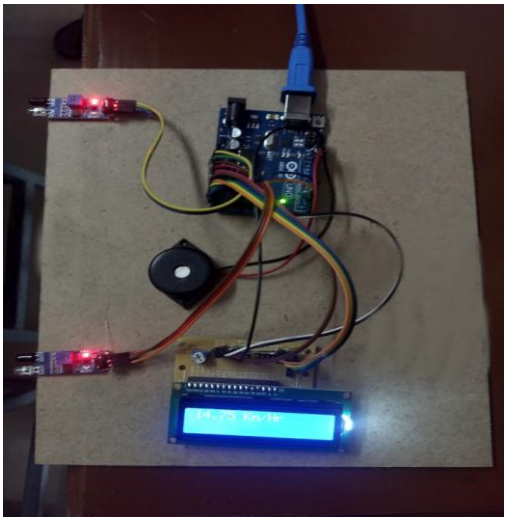

Figure 5: Normal speed

Figure6, If the setup limit speed is exceeded then the speed is displayed with an over speed recognition and the buzzer is going to ring for few seconds

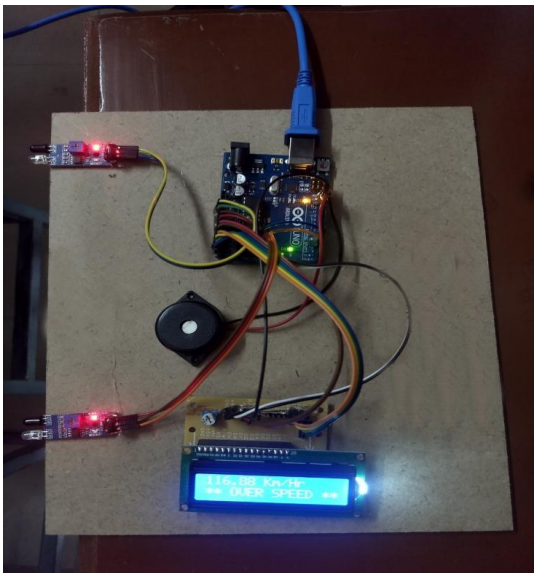

Figure 6: Over speed

6. Conclusions

In this paper, we can easily detect the speed of vehicles/human by utilizing Arduino and IR sensors so that it alerts the over speed of vehicles/human. This paper is mainly used as sport check, to control over speed near prohibited areas. The system accumulates information of vehicle/human speed(moving objects) by displaying on LCD display and if over speed occurs it alerts by giving buzzer. The designed detection system continuously monitors the speed of the approaching vehicle.

It minimizes the difficulties of traffic department and make ease to control the rash driving / over speed vehicles on highways. So that, the police can provides their service with more ease and accuracy while sitting in control room. In

future, this system can be extended by integrating a camera which could capture the image of the number plate of the vehicle and sends to the traffic authorities or the corresponding vehicle owner.

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Author Profile

Mani Priya Vutturi IV B. Tech, ECE department, Vaageswari College of Engineering, JNTUH University, Hyderabad, Telegana, India