

# SPEED CHECKER ON HIGHWAYS FOR ACCIDENT AVOIDANCE AND DETECTION

PINAKI SATPATHY<sup>1</sup>, JOYDEEP MANDAL<sup>2</sup>, KANCHAN KR. PAUL<sup>3</sup>, KALLOL MONDAL<sup>4</sup>,  
PRITISH KR. NASKAR<sup>5</sup>

<sup>1</sup>Assistant Professor-Dept. Of ECE, Haldia Institute Of Technology, Haldia, India  
<sup>2,3,4,5</sup>B.Tech Students ECE, W.B.U.T., Haldia Institute Of Technology, Haldia, India  
<sup>1</sup>[pinaki.sat@gmail.com](mailto:pinaki.sat@gmail.com), <sup>2</sup>[joydeepmandal1993@gmail.com](mailto:joydeepmandal1993@gmail.com), <sup>3</sup>[kp78898@gmail.com](mailto:kp78898@gmail.com),  
<sup>4</sup>[kallol047@gmail.com](mailto:kallol047@gmail.com), <sup>5</sup>[pritishnaskar@gmail.com](mailto:pritishnaskar@gmail.com)

## ABSTRACT

The main aim of our work is to develop a device to detect rash driving on highways and to alert the traffic authorities in case of any speed violation. Accidents due to rash driving on highways are on the rise and people are losing their lives because of others mistakes. In the present system, to detect rash driving the police has to use a handheld radar gun and aim at the vehicle to record its speed. If the speed of the vehicle exceeds the speed limit, nearest police station is informed to stop the speeding vehicle. This is an ineffective process as after detecting one has to inform the same and a lot of time is wasted.

The proposed system will check on rash driving by calculating the speed of a vehicle using the time taken to travel between the two set points at a fixed distance. A set point consists of a pair of sensors comprising of an IR transmitter and an IR receiver, each of which are installed on either sides of the road. The speed limit is set by the police who use the system depending upon the traffic at the very location. The time taken by the vehicle to travel from one set point to the other is calculated by a microcontroller program. Based on that time it then calculates the speed and displays that on an LCD. Moreover if the vehicle crosses the speed limit, a buzzer sounds alerting the police.

## [1] INTRODUCTION

While driving to keep the speed of the vehicle under the safety limit is essential. But sometimes, we see that the drivers somehow drive the vehicles crossing the speed limit and the drivers tend to ignore their speedometers. This violation may lead to various fatal accidents.

This speed checker will come handy for the highway traffic police as it will not only provide a digital display in accordance with a vehicle's speed but also sound an alarm if the vehicle exceeds the permissible speed for the highway.

The system basically comprises two laser transmitter-LDR sensor pairs, which are installed on the highway 100 meters apart, with the transmitter and the LDR sensor of each pair on the opposite sides of the road. The installation of lasers and LDRs is shown in Fig. 1. The system displays the time taken by the vehicle in crossing this 100m distance from one pair to the other with a resolution of 0.01 second, from which the speed of the vehicle can be calculated as follows:

$$\begin{aligned} \text{Speed (kmph)} &= \text{Distance} / \text{Time} \\ &= 0.1 \text{ km} / ((\text{Reading} \times 0.01) / 3600) \end{aligned}$$

or,

$$\text{Reading (on display)} = 36000 / \text{Speed}$$

As per the above equation, for a speed of 40 kmph the display will read 900 (or 9 seconds), and for a speed of 60 kmph the display will read 600 (or 6 seconds). Note that the LSB of the display equals 0.01 second and each succeeding digit is ten times the preceding digit. You can similarly calculate the other readings (or time).

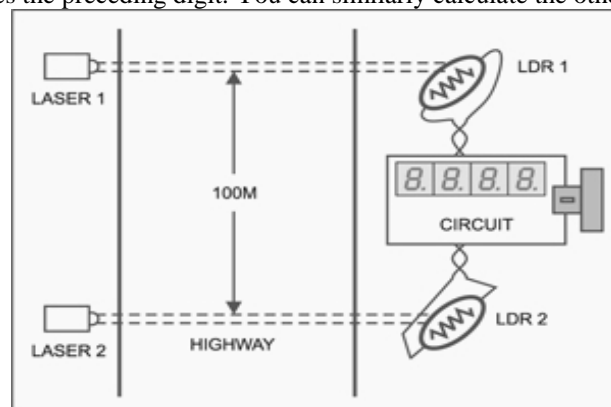


Fig. 1: Installation of lasers and LDRs on highway



## 2. CIRCUIT DESCRIPTION

This circuit has been designed assuming that the maximum permissible speed for highways is either 40 kmph or 60 kmph as per the traffic rule.

The circuit is built around five NE555 timer ICs (IC1 through IC5), four Cd4026 counter ICs (IC6 through IC9) and four 7-segment displays (DIS1 through DIS4). IC1 through IC3 function as monostables with IC1 serving as count-start mono, IC2 as count-stop mono and IC3 as speed-limit detector mono, controlled by IC1 and IC2 outputs. Bistable set-reset IC4 is also controlled by the outputs of IC1 and IC2 and it (IC4), in turn controls switching on/off of the 100Hz (period=0.01 second) astable IC5

The time period of timer NEE555 (IC1) count-start monostables multivibrator is adjusted using preset VR1 or VR2 and capacitor C1. For 40kmph limit the period is set for 9 seconds using preset VR1, while for 60kmph limit the time period is set for 6 seconds using preset VR2. Slide switch S1 is used to select the time period as per the speed limit (40 kmph and 60 kmph, respectively). The kmph and 60 kmph, respectively). The junction of LDR1 and resistor R1 is coupled to pin 2 of IC1.

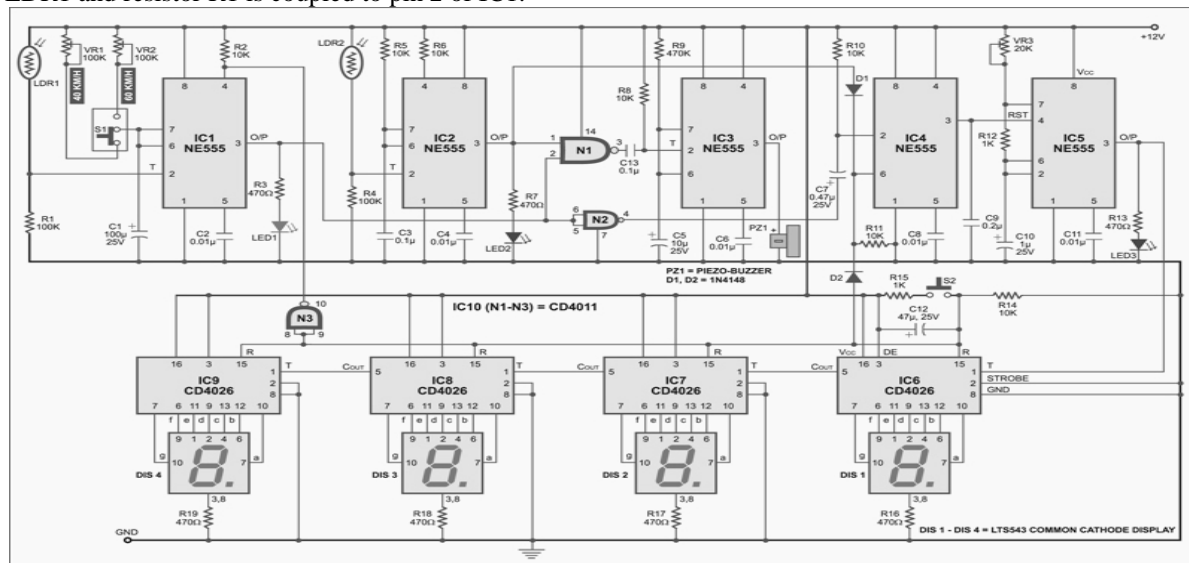


Fig. 2: Circuit of speed checker for highway.

## 3. COMPONENTS USED IN THE CIRCUIT

1. 555 timer
2. LDR(light dependent resistance)
3. LASER
4. 7 segment display
5. NAND gate

### 3.1. 555 timer:

The 555 timer integrated circuit (IC) has become a mainstay in electronics design. A 555 timer will produce a pulse when a trigger signal is applied to it. The pulse length is determined by charging then discharging a capacitor connected to a 555 timer. A 555 timer can be used to denounce switches, modulate signals, create accurate clock signals, create pulse width modulated (PWM) signals, etc. A 555 timer can be obtained from various manufacturers including Fairchild Semiconductor and National Semiconductor. 555 is an IC used to generate a clock. The two attributes of a clock are:

- a) Frequency.
- b) Duty cycle.

Both of these can be changed using this IC, however the duty cycle is always <50%.

There are two modes in which 555 can run:

- 1) Astable mode
- 2) Monostable mode

#### 3.1.1. MONOSTABLE MODE

As the name suggests; in this mode the output is stable in only one (mono) state i.e.~ 'off' state~ Thus it can stay only for a finite time, if triggered, to the other state i.e.~ 'on' state~ This time can be set choosing appropriate values of resistances in the formula:  $T=1.1 \cdot R1 \cdot C1$

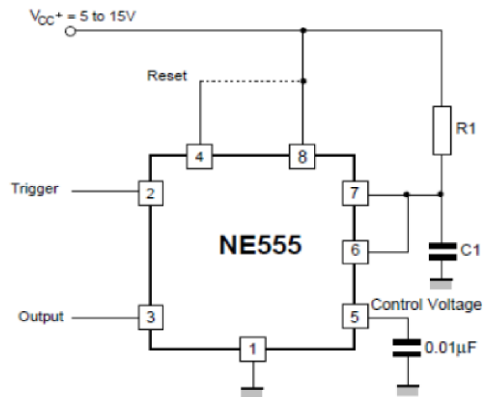


Fig. 3: Monostable Mode

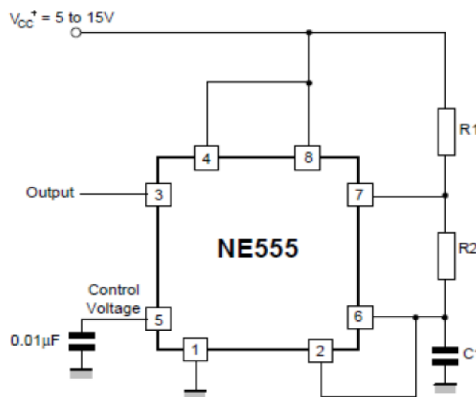


Fig. 4: Astable Mode

NOTE: Capacitor C2 is just to filter the noise and its value can be suitably chosen to be 0~01µF~ It can also be neglected.

### 3.1.2. ASTABLE MODE

In this mode; the output is stable neither in 'high' state nor in 'low' state~ Hence it oscillates from one state to another giving us a square wave or clock. We can set the clock frequency and Duty cycle D by the formulae:

$$F = \frac{1.44}{(R1+2R2)C1} \quad D = \frac{R1+R2}{R1+2R2}$$

#### Features

- Low turn-off time
- Maximum operating frequency greater than 500 kHz
- Timing from microseconds to hours
- Operates in both astable and monostable modes
- Output can source or sink up to 200 mA
- Adjustable duty cycle
- TTL compatible
- Temperature stability of 0.005% per °C

## 3.2. LDR(Light Dependent Resistor):

### 3.2.1. What is LDR?

LDR stands for light dependent resistor. A LDR is a component that has a (variable) resistance that changes with the light intensity that falls upon it. This allows them to be used in light sensing circuits. The light dependent resistor, LDR, is known by many names including the photoresistor, photo resistor, photoconductor, photoconductive cell, or simply the photocell. It is probably the term photocell that is most widely used in data and instruction sheets for domestic equipment.

The photo resistor, or light dependent resistor, LDR, finds many uses as a low cost photo sensitive element and was used for many years in photographic light meters as well as in other applications such as flame, smoke and burglar detectors, card readers and lighting controls for street lamps. Often within the literature the photoresistor is called the photocell as a more generic term.

### 3.2.2. LDR mechanism:

A photoresistor or photocell is a component that uses a photoconductor between two contacts. When this is exposed to light a change in resistance is noted.

Photoconductivity - the mechanism behind the photoresistor - results from the generation of mobile carriers when photons are absorbed by the semiconductor material used for the photoconductor. While the different types of material used for light dependent resistors are semiconductors, when used as a photo-resistor, they are used only as a resistive element and there are no PN junctions. Accordingly the device is purely passive.

There are two types of photoconductor and hence photoresistor:

- Intrinsic photoresistor: This type of photoresistor uses a photoconductive material that involves excitation of charge carriers from the valence bands to the conduction band.
- Extrinsic photoresistor: This type of photoresistor uses a photoconductive material that involves excitation of charge carriers between an impurity and the valence band or conduction band. It requires shallow impurity dopants that are not ionized in the presence of light.

Extrinsic photoresistors or photocells are generally designed for long wavelength radiation - often infra-red, but to avoid thermal generation they need to be operated at low temperatures.

### 3.2.3. Basic LDR structure:

Although there are many ways in which light dependent resistors, or photo resistors can be manufactured, there are naturally a few more common methods that are seen. Essentially the photoresistor or photocell consists of a

resistive material sensitive to light that is exposed to light. The photo resistive element comprises section of the material with contacts at either end.

A typical structure for a light dependent or photo resistor uses an active semiconductor layer that is deposited on an insulating substrate. The semiconductor is normally lightly doped to enable it to have the required level of conductivity. Contacts are then placed either side of the exposed area.

Within the basic photoresistor or photocell structure, the resistance of the material itself is a key issue. To ensure the resistance changes resulting from the light dominate, contact resistance is minimised. To achieve this, the area around the contacts is normally heavily doped to reduce the resistance in this region.

In many instances the area between the contacts is in the form of a zig zag, or inter digital pattern. This maximises the exposed area and by keeping the distance between the contacts small it reduces the spurious resistance levels and enhances the gain.

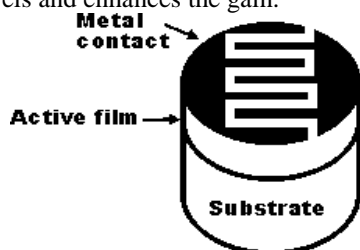


Fig. 4: LDR Structure

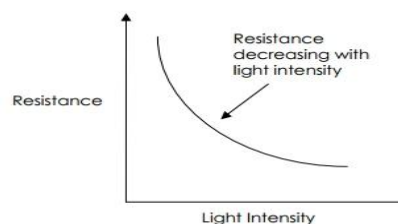


Fig. 5: Resistance Vs. Light Intensity graph

The most common type of LDR has a resistance that falls with an increase in the light intensity falling upon the device (as shown in the image above). The resistance of an LDR may typically have the following resistances:

Daylight = 5000ohm

Dark = 20000000 ohms

You can therefore see that there is a large variation between these figures. If you plotted this variation on a graph you would get something similar to that shown by the graph shown above.

### 3.3. LASER:

A laser is a device that emits light through a process of optical amplification based on the stimulated emission of electromagnetic radiation. The term "laser" originated as an acronym for "light amplification by stimulated emission of radiation". A laser differs from other sources of light because it emits light coherently. Spatial coherence allows a laser to be focused to a tight spot, enabling applications like laser cutting and lithography. Spatial coherence also allows a laser beam to stay narrow over long distances (collimation), enabling applications such as laser pointers. Lasers can also have high temporal coherence which allows them to have a very narrow spectrum, i.e., they only emit a single color of light. Temporal coherence can be used to produce pulses of light—as short as a femtosecond.

Lasers have many important applications. They are used in common consumer devices such as optical disk drives, laser printers, and barcode scanners. Lasers are used for both fiber-optic and free-space optical communication. They are used in medicine for laser surgery and various skin treatments, and in industry for cutting and welding materials. They are used in military and law enforcement devices for marking targets and measuring range and speed. Laser lighting displays use laser light as an entertainment medium.

#### 3.3.1. Design:

A laser consists of a gain medium, a mechanism to supply energy to it, and something to provide optical feedback. The gain medium is a material with properties that allow it to amplify light by stimulated emission. Light of a specific wavelength that passes through the gain medium is amplified (increases in power).

For the gain medium to amplify light, it needs to be supplied with energy. This process is called pumping. The energy is typically supplied as an electrical current, or as light at a different wavelength. Pump light may be provided by a flash lamp or by another laser.

The most common type of laser uses feedback from an optical cavity—a pair of mirrors on either end of the gain medium. Light bounces back and forth between the mirrors, passing through the gain medium and being amplified each time. Typically one of the two mirrors, the output coupler, is partially transparent. Some of the light escapes through this mirror. Depending on the design of the cavity (whether the mirrors are flat or curved), the light coming out of the laser may spread out or form a narrow beam. This type of device is sometimes called a laser oscillator in analogy to electronic oscillators, in which an electronic amplifier receives electrical feedback that causes it to produce a signal.

### 3.4. SEVEN SEGMENT DISPLAY:

A seven-segment display (SSD), or seven-segment indicator, is a form of electronic display device for displaying decimal numerals that is an alternative to the more complex dot matrix displays.

Seven-segment displays are widely used in digital clocks, electronic meters, basic calculators, and other electronic devices that display numerical information.

### 3.4.1. Concepts and visual structures:

The seven elements of the display can be lit in different combinations to represent the Arabic numerals. Often the seven segments are arranged in an oblique (slanted) arrangement, which aids readability. In most applications, the seven segments are of nearly uniform shape and size (usually elongated hexagons, though trapezoids and rectangles can also be used), though in the case of adding machines, the vertical segments are longer and more oddly shaped at the ends in an effort to further enhance readability.

The numerals 6, 7 and 9 may be represented by two or more different glyphs on seven-segment displays, with or without a 'tail'.

The seven segments are arranged as a rectangle of two vertical segments on each side with one horizontal segment on the top, middle, and bottom. Additionally, the seventh segment bisects the rectangle horizontally. There are also fourteen-segment displays and sixteen-segment displays (for full alphanumeric); however, these have mostly been replaced by dot matrix displays.

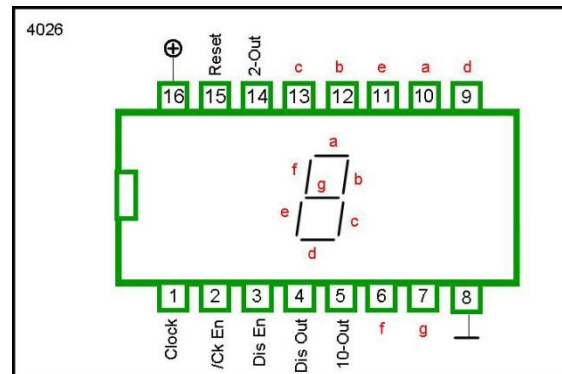


Fig. 5: Pin diagram for CD4026 decade counter.

## 4. CONSTRUCTION AND WORKING

Assemble the circuit on a PCB. Before operation, using a multimeter check whether the power supply output is correct, if yes apply power supply to the circuit by flipping switch S3 to 'on'. In the circuit, use long wires for connecting the two LDRs, so that you can take them out of the PCB and install on one side of the highway, 100 meters apart. Install the two laser transmitters (such as laser torches) on the other side of the highway exactly opposite to the LDRs such that laser light falls directly on the LDRs. Resets the circuit by pressing switch S2, so the display on the LDRs. Resets the circuit by pressing switch S2, so the display shows '0000'. Using switch S1, select the speed limit (say, 60 kmph) for the highway.

When any vehicle crosses the first laser light, LDR1 will trigger IC1. The output of IC1 goes high for the time set cross 100 meters with the selected speed (60 kmph) and LED1 glows during for period. When the vehicle crosses the second laser light, the output of IC2 goes high and LED2 glows for this period.

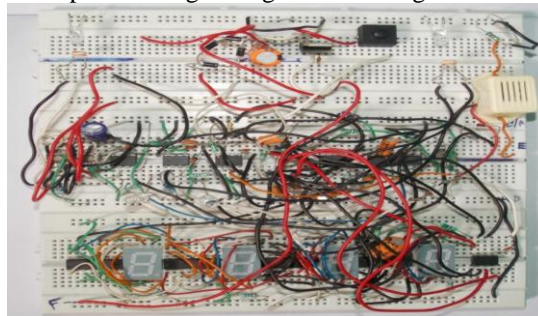


Fig. 6: Circuit of speed checker for highway in breadboard

Piezobuzzer PZ1 sounds an alarm if the vehicle crosses the distance between the laser set-ups at more than the selected speed (lesser period than preset period). The counter starts counting when the first laser beam is intercepted and stops when the second laser beam is intercepted. The time taken by vehicle to cross both the laser beams is displayed on the 7-segment display. For 60 kmph speed setting, with timer frequency set at 100 Hz, if the display count is less than '600'. It means that the vehicle has crossed the speed limit (and simultaneously the buzzer sounds). Reset the circuit for monitoring the speed of the next vehicle.

## 5. APPLICATIONS:

- We can direct display speed of vehicle using 8085 microprocessor.
- It will maintain the safety the Human Life on road.
- It can be used on Highways to control the speed of the vehicles.
- Use of this technology will help the traffic control department to avoid .

## 6. FUTURE DEVELOPMENT:

- A CCTV camera can be placed on the highway. If any vehicle has crossed the maximum speed limit then this camera will be triggered to take a picture of the vehicle.



- We can add voice announcement system. It will intimate the driver that he/she has crossed the over speed condition.
- We can implement the GSM technology. So that the nearest highway security authorities will be informed about the vehicle which has over speed.

### CONCLUSION

Here we implemented the “SPEED CHECKER FOR HIGHWAYS” from point of view of safety on the Mega Highway. We feel that if Mega Highway is supported with such a faithful system then it will not only help to maintain the traffic rules but also reduces accidents. As circuit is compact and user friendly one man can handle the system efficiently.

### ACKNOWLEDGMENT

The work is carried out through the research facility at the Department of Electronics and Communication Engineering, Haldia Institute Of Technology, Haldia, West Bengal. The Authors also would like to thank the authorities of HIT, Haldia for encouraging this research work. Our thanks to the experts who have contributed towards development of this paper.

### REFERENCE

- [1] Zutao Zhang, Jiashu Zhang, “A Novel Vehicle Safety Model: Vehicle speed Controller under Driver Fatigue”, “IJCSNS International Journal of Computer Science and Network Security”, VOL.9 No.1, January 2009.
- [2] M. Bertozzi, A. Broggi, M. Cellario, A. Fascioli, P. Lombardi, and M.Porta, “Artificial vision in road vehicles,” *Proceedings of the IEEE*, vol. 90,no. 7, pp. 1258–1271, 2002.
- [3] S. Tsugawa and Sadayuki, “Vision-based vehicle on japan: Machine vision systems and driving control systems,” *IEEE Trans. on Ind. El.???*, vol. 41, no. 4, pp. 398–405, 1994.
- [4] *Vehicle-highway automation activities in the United States*. U.S. Dept of Transportation, 1997
- [5] C. Thorpe, J.D. Carlson, D. Duggins, J. Gowdy, R. MacLachlan, C. Mertz, A. Suppe, and C. Wan, “Safe robot driving in cluttered environments,” *11<sup>th</sup> International Symposium of Robotics Research*, 2003.
- [6] Qian Martin Eriksson, Nikolaos P. Papanikolopoulos, Eye-Tracking for Detection of Driver fatigue. Proceedings of the international Conference on intelligent Transportation System, Boston, MA, November 1997, pp.314-319.
- [7] Qiang Ji, Zhiwei Zhu, and Peilin Lan, Real-Time Nonintrusive Monitoring and Prediction of Driver Fatigue. *IEEE Transactions on Vehicular Technology*, VOL. 53, NO. 4, July 2004, pp.1052-1068.

