SPEED CHECKER & OVER SPEED DETECTOR FOR HIGHWAYS

PROJECT REPORT

SUBMITTED IN PARTIAL FULFILLMENT OF REQUIREMENTS FOR THE AWARD OF

Diploma
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Submitted by

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2019-2020

CERTIFICATE

This is to certify that the project work entitled **"Speed Checker and Over Speed Detector for Highways"** being submitted by students of Diploma in Electronics Engineering V Semester **Tanvi Prachandia, Sheema Sayeed & Nivedita Majumdar** in partial fulfilment of the requirements for the award of Certificate of three years course of Diploma in Electronics Engineering in University Women's Polytechnic, Faculty of Engineering and Technology, Aligarh Muslim University, Aligarh for the academic session 2019-2020 is the record of candidate's own original work carried out under my supervision and guidance.

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It is a matter of great satisfaction and pleasure that we have completed our project work and report successfully. First and foremost, we offer our gratitude to Almighty God whose blessings have brought success.

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We are also thankful to technical staff of the Project Lab Mr. Mohan Chandra Sharma & Ms. Sameena Naaz for every possible help.

Finally, we are grateful to my parents, family members and my friends who always inspired us and provided every possible help to enable us to reach this stage. There are many other people who helped us and we appreciate their help.

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ABSTRACT

Rash driving is one of major reasons for road accidents especially occurs very frequently on the Highways due to over speed. Most of the road accidents can be prevented if the rash driving or the speed of the vehicle is controlled. This is achieved by monitoring the speed of the vehicles and accordingly generates a warning when the speed of the vehicle increases. Here, a system called **Speed Checker and Over Speed Detector for Highways** has been developed. The proposed system checks 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 and the distance chosen is 100 meters in this work. A set point consists of a pair of sensors comprising of an LDR and a LASER light, each of which is installed on either side 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 the control circuit which mainly consists of IC NE555 Timer. Based on that time it then calculates the speed and displays that on seven-segment displays. Moreover, if the vehicle crosses the speed limit which indicates the over-speed condition, a buzzer sounds alerting the police. Thus, the road accidents can be minimized to a large extent.

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1. INTRODUCTION

1.1 Project Introduction

In order to detect rash driving on vehicles, a System called Speed Checker and Over Speed Detector for Highways has been proposed. The speed checker is a device which is used to detect the speed of the vehicles and if over speeding takes place, it keeps checks on that too. Here, two sensors consisting of LDR and a LASER light are used at two different locations which are 100 meters apart on the highway, with the laser transmitter and the LDR sensor of each pair on the opposite sides of the road. This particular system also uses two timers which receives input from the two sensors and output from both the timers drive a NAND gate which in turn drives another timer to trigger a buzzer in case of the speed going more than the set limit. A decade counter shows the time count of the output pulses or counts the clock pulses, i.e. the time taken to move from first sensor position to another. A speed limit is set and the distance between the two spots are fixed. In case the timing count is less than the set time limit, the speed is known to be exceeded and correspondingly a buzzer starts ringing to give the indication of over speed. Thus, a driver ignoring the speed limits can be caught and punished.

1.2 Project Objective

Nowadays, accidents on highways are occurred very frequently and the main reason for the accident is over speed. Although all the highways do have signboards indicating maximum speed limit for the sake of driver's safety, still people do not obey the highway speed limit. This project is designed and developed by taking into consideration the problem mentioned here. So, it is basically installed on highways to take precautions or to prevent the accidents from happening while driving. While driving on highways, drivers should not exceed the maximum speed limit permitted for their vehicles. However, accidents keep on occurring due to speed violations as drivers follow their speedometers and control their speed according to them and reduce the speed if they find to be exceeding and beyond their control. A highway speed checker comes handy for the traffic police, especially against the speed limit violators as it provides the digital display as well as buzzing sound or alarm to detect any vehicle speed if the vehicle exceeds the permitted speed limit.

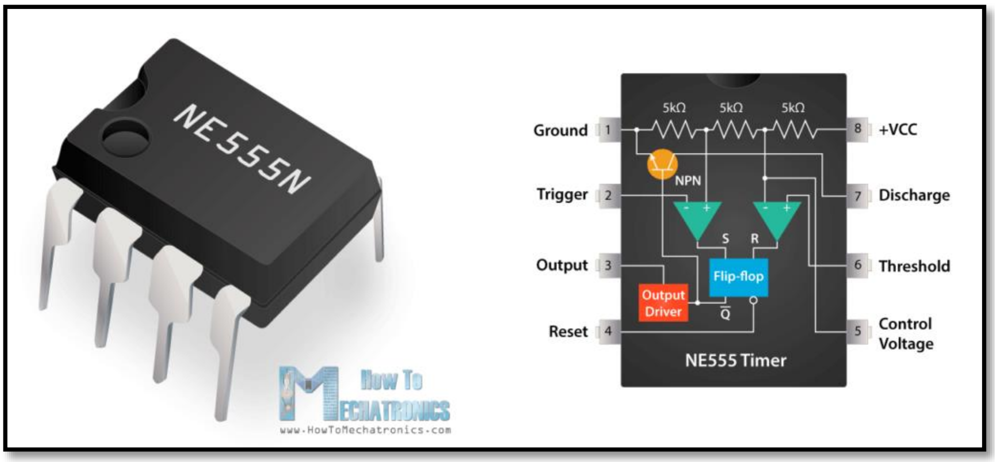
2. COMPONENTS USED & THEIR SPECIFICATIONS

2.1 List of Components Used

Semiconductors:	
IC1-IC5	- NE555 timer
IC6- IC9	- CD4026 decade counter/7-segment decoder
IC10	- CD4011 NAND gate
D1, D2	- 1N4148 switching diode
LED1	- Green LED
LED2, LED3	- Red LED
DIS1-DIS4	- LTS543 common-cathode, 7-segment display
Resistors (all ¼-watt, ±5% carbon):	
R1, R4	- 100-kilo-ohm
R2, R5, R6, R8, R10, R11, R14	- 10-kilo-ohm
R3, R7, R13, R16-R19	- 470-ohm
R9	- 470-kilo-ohm
R12, R15	- 1-kilo-ohm
VR1	- 100-kilo-ohm preset
VR3	- 20-kilo-ohm preset
Capacitors:	
C1	- 100µF, 25V electrolytic
C2, C4, C6, C8, C11	- 0.01µF ceramic disk
C3, C13, C15	- 0.1µF ceramic disk
C5	- 10µF, 25V electrolytic
C7	- 0.47µF, 25V electrolytic
C9	- 0.2µF ceramic disk
C10	- 1µF, 25V electrolytic
C12	- 47µF, 25V electrolytic
C14	- 1000µF, 35V electrolytic
Miscellaneous:	
	12V Battery
PZ1	- Piezobuzzer
LDR1, LDR2	- LDR
S2	- Push-to-on switch
S3	- On/Off switch
	- Pointed laser light

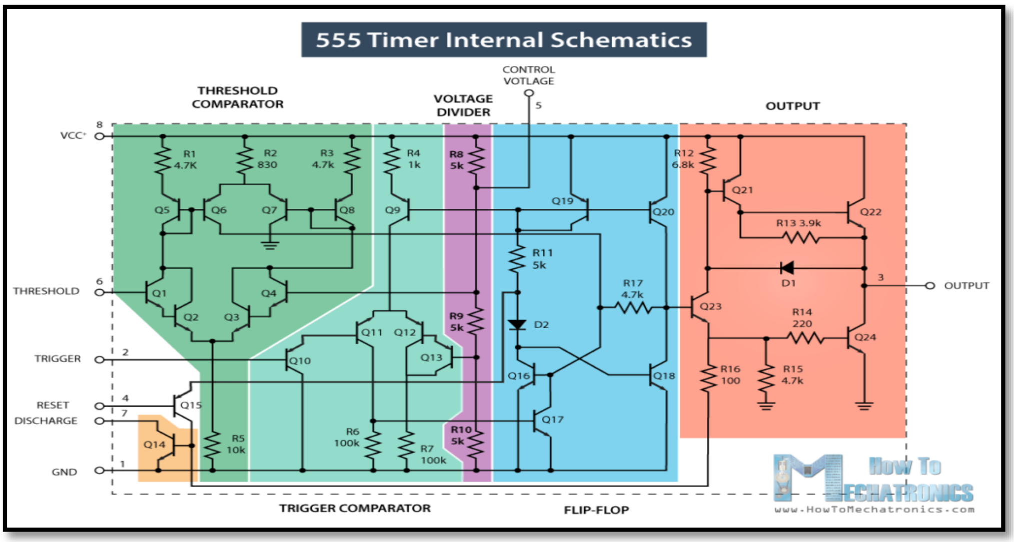
2.2 IC-NE 555 Timer

The 555 Timer, designed by Hans Camenzind in 1971, can be found in many electronic devices starting from toys and kitchen appliances to even a spacecraft. It is a highly stable integrated circuit that can produce accurate time delays and oscillations. The 555 Timer has three operating modes, bistable, monostable and astable mode.



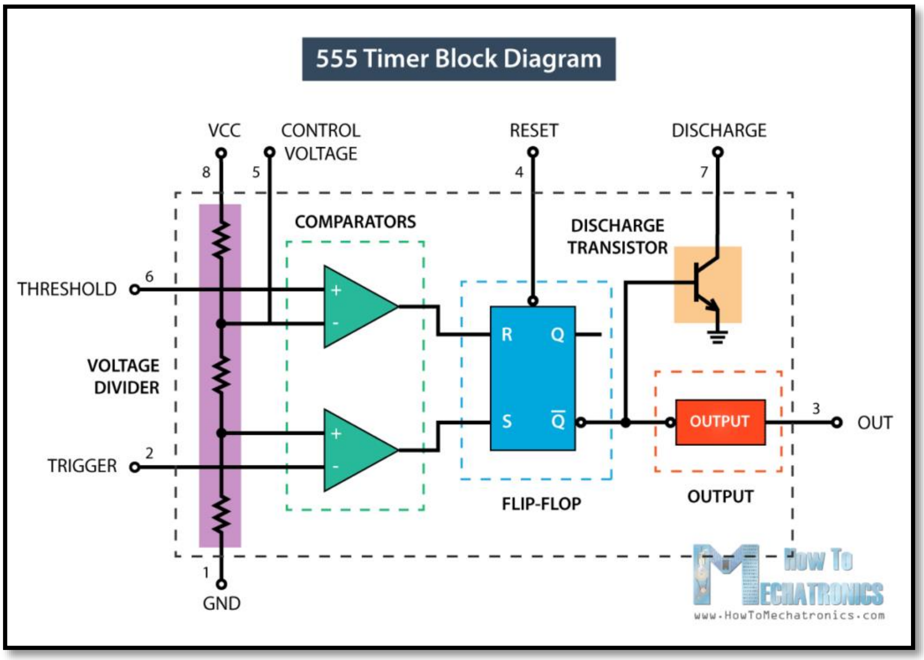
Inside the 555 Timer IC

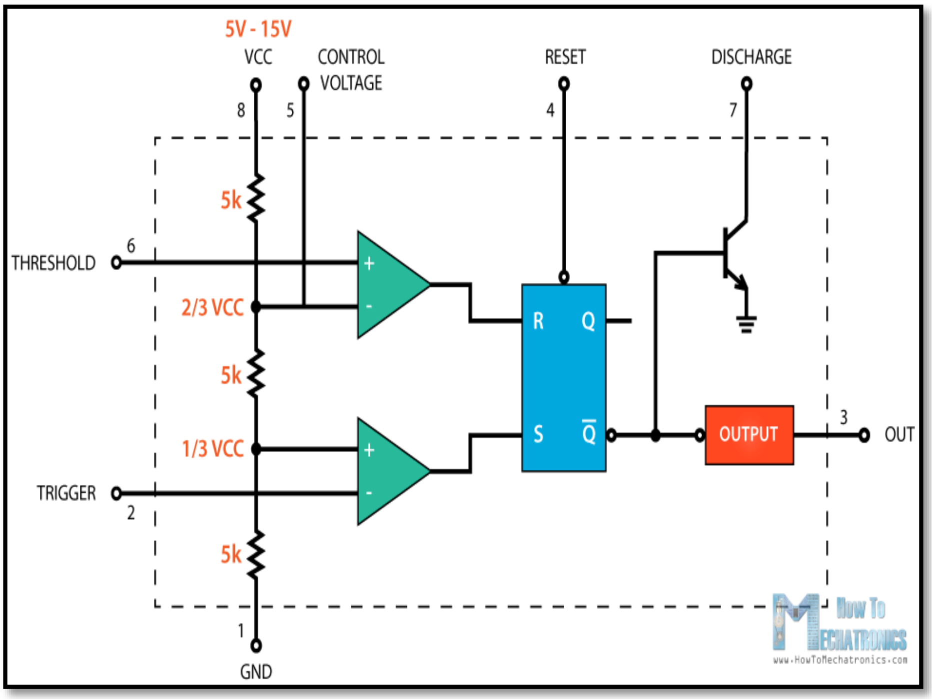
Let's take a closer look what's inside the 555 Timer and explain how it works in each of the three modes. Here's the internal schematics of 555 Timer which consists of 25 transistors, 2 diodes and 15 resistors.



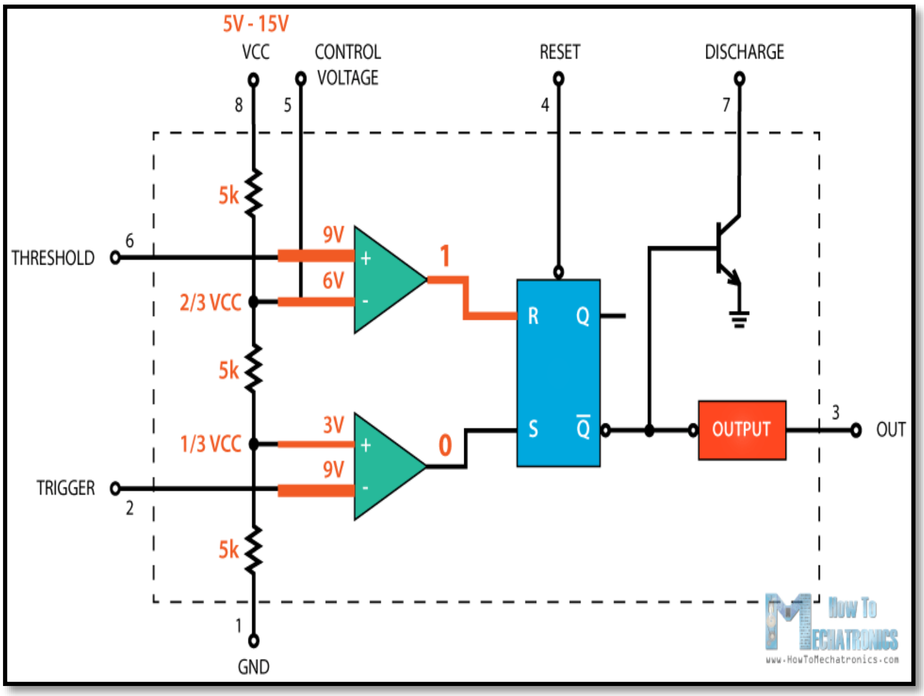
Represented with a block diagram it consists of 2 comparators, a flip-flop, a voltage divider, a discharge transistor and an output stage.

The voltage divider consists of three identical 5k resistors which create two reference voltages at 1/3 and 2/3 of the supplied voltage, which can range from 5 to 15V.





Next are the two comparators. A comparator is a circuit element that compares two analog input voltages at its positive (non-inverting) and negative (inverting) input terminal. If the input voltage at the positive terminal is higher than the input voltage at the negative terminal the comparator will output 1. Vice versa, if the voltage at the negative input terminal is higher than the voltage at the positive terminal, the comparator will output 0.

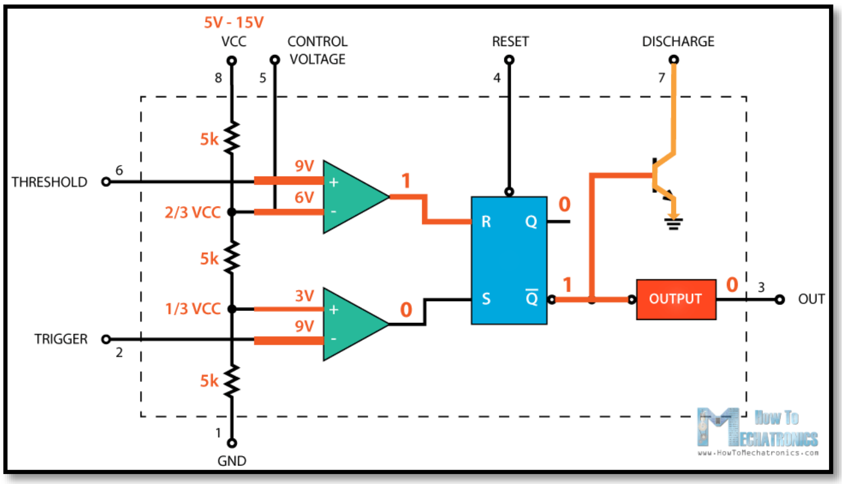


The first comparator negative input terminal is connected to the 2/3 reference voltage at the voltage divider and the external "control" pin, while the positive input terminal to the external "Threshold" pin.

On the other hand, the second comparator negative input terminal is connected to the "Trigger" pin, while the positive input terminal to the 1/3 reference voltage at the voltage divider.

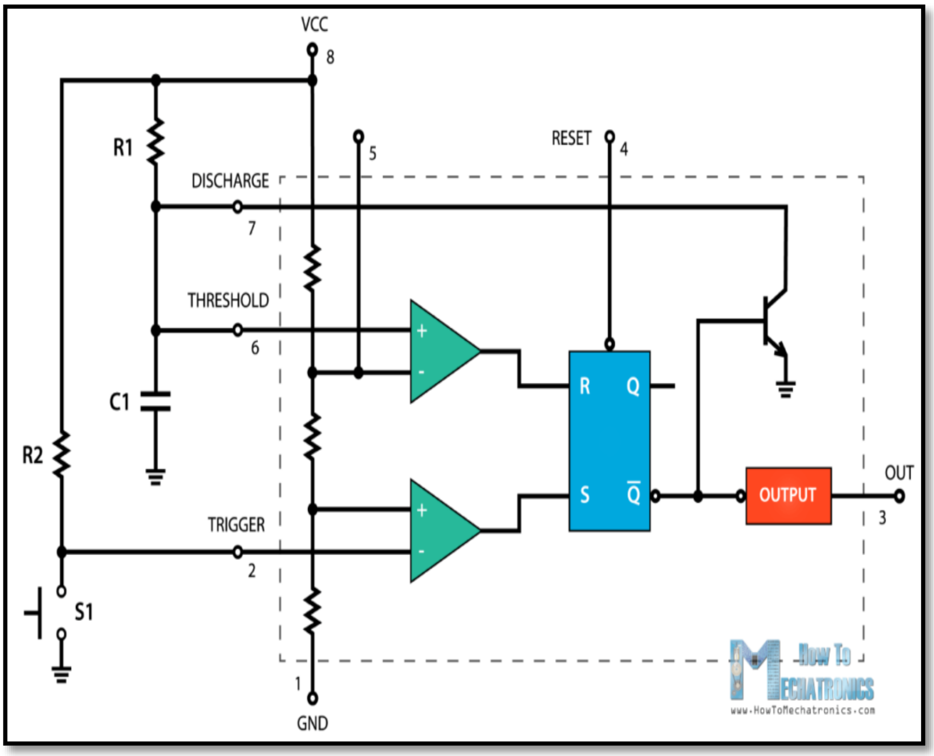
So, using the three pins, Trigger, Threshold and Control, we can control the output of the two comparators which are then fed to the R and S inputs of the flip-flop. The flip-flop will output 1 when R is 0 and S is 1, and vice versa, it will output 0 when R is 1 and S is 0. Additionally, the flip-flop can be reset via the external pin called “Reset” which can override the two inputs, thus reset the entire timer at any time.

The Q-bar output of the flip-flip goes to the output stage or the output drivers which can either source or sink a current of 200mA to the load. The output of the flip-flip is also connected to a transistor that connects the “Discharge” pin to ground.

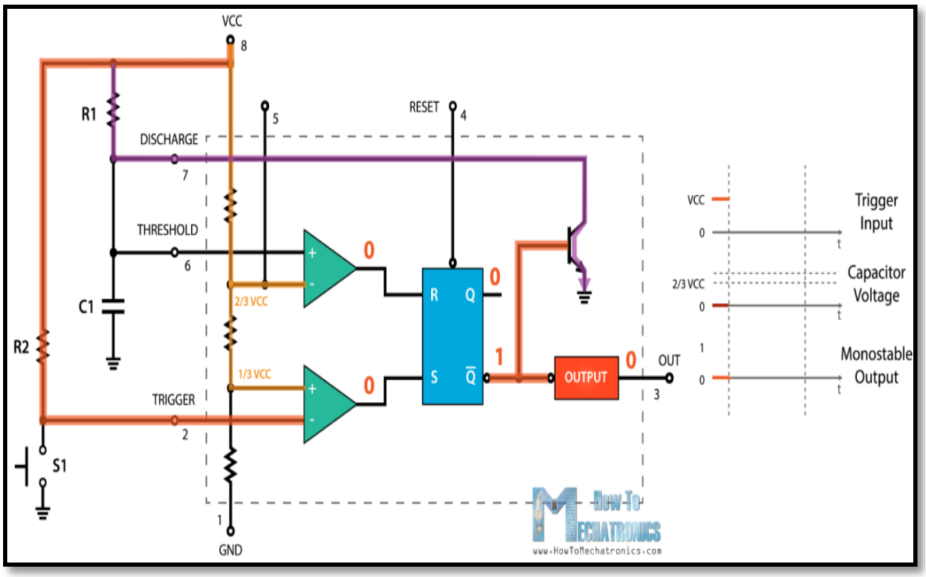


555 Timer – Monostable Mode

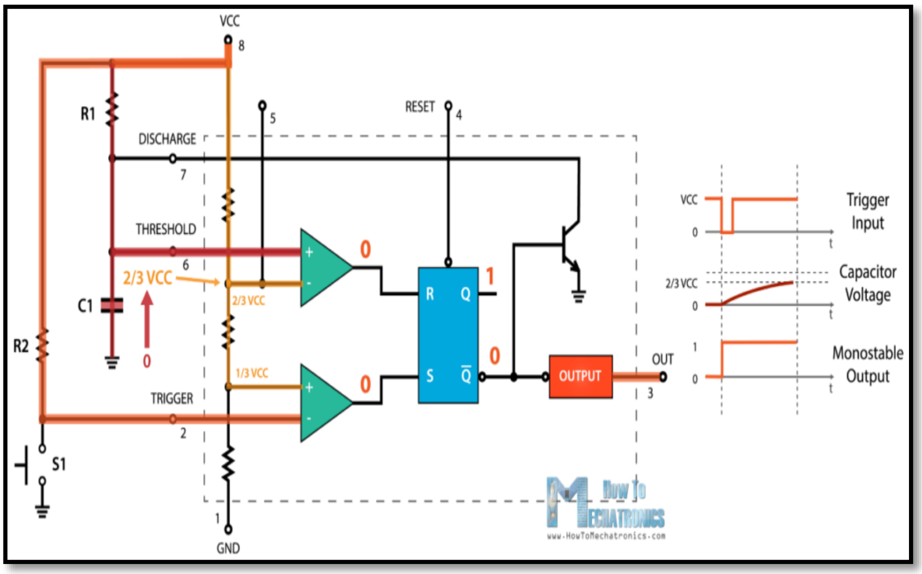
Next, let’s see how the 555 Timer works in a monostable mode. Here’s an example circuit.



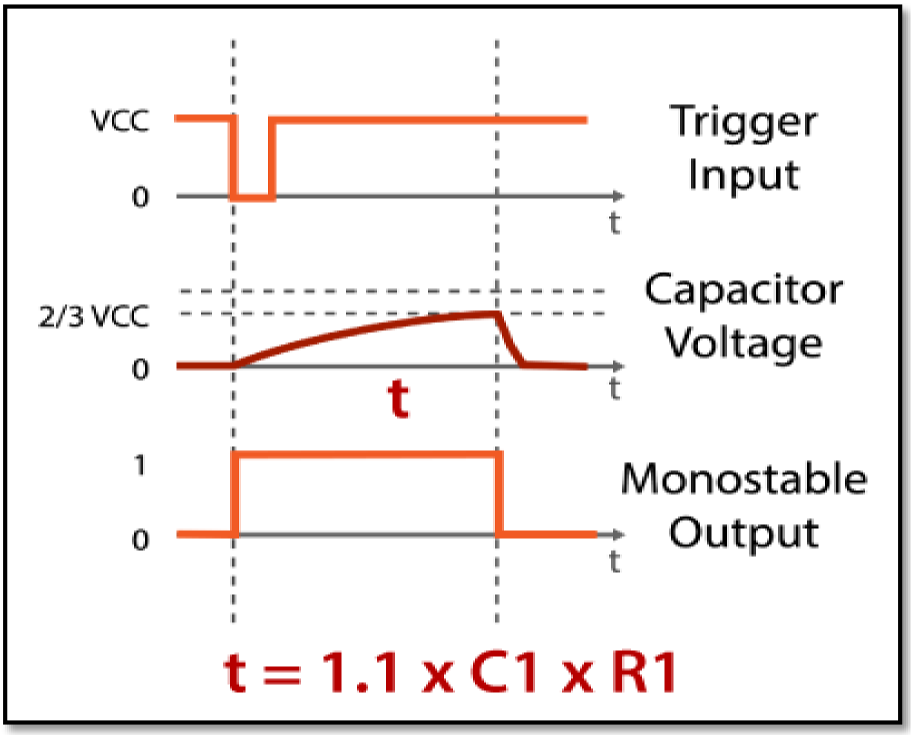
The trigger input is held high by connecting it to VCC through a resistor. That means that the trigger comparator will output 0 to the S input of the flip-flop. On the other hand, the Threshold pin is Low and that makes the Threshold comparator out 0 as well. The Threshold pin is actually Low because the Q-bar output of the flip-flop is High, which keeps the discharge transistor active, so the voltage coming from the source is going to ground through that transistor.



In order to change the 555 Timer output state to High we need to press the pushbutton on trigger pin. That will ground the trigger pin, or the input state will be 0, thus the comparator will output 1 to the S input of the flip-flip. This will cause the Q-bar output to go Low and the 555 Timer output High. At the same time, we can notice that the discharge transistor is turned off, so now the capacitor C1 will start charging through the resistor R1.



The 555 Timer will remain in this state until the voltage across the capacitor reaches 2/3 of the supplied voltage. In that case, the Threshold input voltage will be higher and the comparator will output 1 to the R input of the flip-flip. This will bring the circuit into the initial state. The Q-bar output will become High, which will activate the discharge transistor as well as make the IC output Low again.



So, we can notice that the amount of time the output of the 555 Timer is high, depends on how much time the capacitor needs to charge to 2/3 of the supplied voltage, and that depends on the values of both the capacitor C1 and the resistor R1. We can actually calculate this time with the following formula, T=1.1*C1*R1.

2.3 IC-CD 4026 Decade Counter/7 Segment Decoder

CD4026 Pin Configuration

Pin Number	Pin Name	Description
1	Clock (CLK)	The counting happens when this clock pulse goes high, this pin is normally connected to 555 timer or other uC to produce a pulse
2	Clock Inhibit (INH)	Connected to the Ground (low) of the circuit, to enable clock pin
3	Enable Input (DEI)	This pin is connected to +5V (high) to enable the output pins (Out A to Out G)
4	Enable Output (DEO)	This is an output which always stays high, this pin will be only if more than one CD4026 IC is used (cascaded)
5	Divide by 10 (CO)	This is the carry over output pin; it produces a pulse after counting till 9. This pin will be only if more than one CD4026 IC is used (cascaded)
6,7,9,10,11,12,13	Out A, B, C, D, E, F, G	These are the decoded output pins which should connected to 7-Segment display.

8	Ground	The ground pin should be connected to ground of circuit
14	Not 2 out (UCS)	This is Ungated C segment pin. This is an output pin which will be rarely used when division is required.
15	Reset	This input pin when made high (+5V) will reset the count to 0.
16	Vcc	This pin powers the IC, typically +5V is used.

Features

- Counter for 7-Segment display
- Can drive a common cathode 7-Segment display directly
- Easy to interface with timer or micron rollers (TTL compatible)
- Can be easily cascaded with more IC to display higher range of number
- Maximum Clock Frequency: 6Mhz
- Available in 16-pin PDIP, GDIP, PDSO packages

Where to use CD4026 IC

The IC CD4026 is an IC which can perform the function of both a counter as well a 7-segment Drive**r**. One single IC can be used to count form zero (0) to nine (9) directly on a Common Cathode type 7-segment display. The count can be increased by simply giving a high clock pulse; also, more than one digit (0-9) can be created by cascading more than one CD4026 IC. So, if you have a 7-segment (CC) display on which you have to display numbers that are being counted based on some condition then this IC will be a perfect choice.

How to use a CD4026 IC

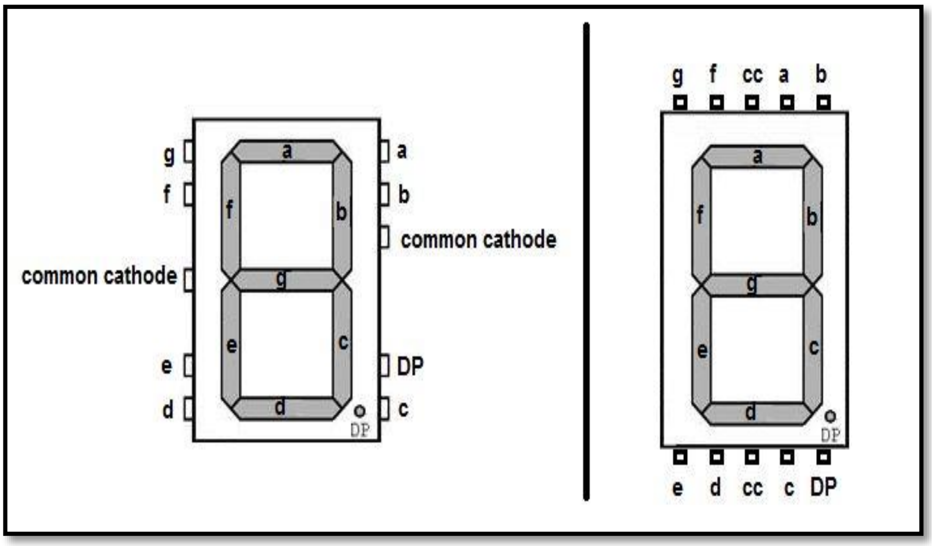
The IC can work from 3V to 15V, but normally powered with +5V to the Vdd/Vcc pin and the Ground/Vss pin is connected to ground. We have 7 output pins naming from Out A to Out G which is directly connected to the 7-segment

display. The clock inhibit pin (pin 2) has to be held low (ground/0V) so that the clock signals can be sent to the IC also the Enable Input pin (pin 3) should be made high (+5V) so that the output pins (Out A to G) can be made active.
The 7-segment pins will increment the count by one number each time when the clock pin (pin 1) is made high. This clock source can either be obtained from a 555 IC or any other digital IC which is TTL compatible. They simply have to generate a pulse of low voltage 0V and high voltage 5V. In the circuit below, a clock source of 1Hz has been used to increment the count. So, the number will get incremented for every (T=1/F) 1 second.

2.4 LTS 543 Seven Segment Display

A seven-segment display is commonly used in electronic display device for decimal numbers from 0 to 9 and in some cases, basic characters. Use of light emitting diodes (LEDs) in seven segment displays made it more popular, whereas of late liquid crystal displays (LCD) displays have also come into use. Electronic devices like microwave ovens, calculators, washing machines, radios, digital clocks etc. to display numeric information are the most common applications. Let’s take a look at the 7-segment display pinout to have a better understanding.

7 Segment Display Pinouts



A 7-segment display is made of seven different illuminating segments. These are arranged in a way to form numbers and characters by displaying different combinations of segments. The binary information is displayed using these seven segments. LED or light emitting diode is P-N junction diode which emits the energy in the form of light, differ from normal P-N junction diode which emits in the form of heat. Whereas LCD use properties of liquid crystal for displaying and do not emit the light directly. These LED's or LCD's are used to display the required numeral or alphabet.

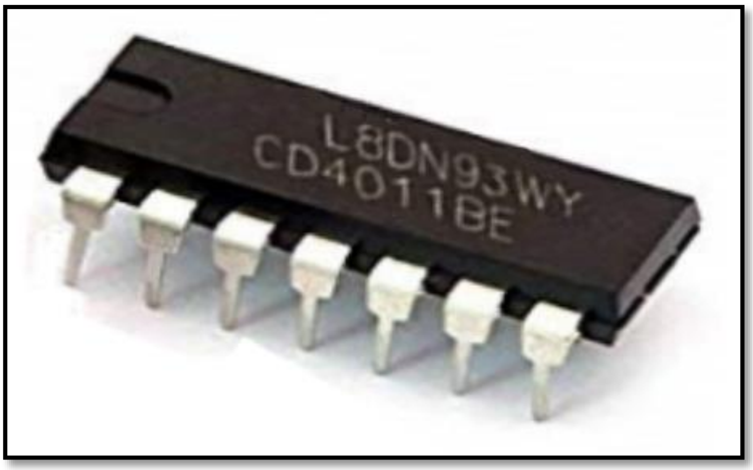
Types of 7 segments

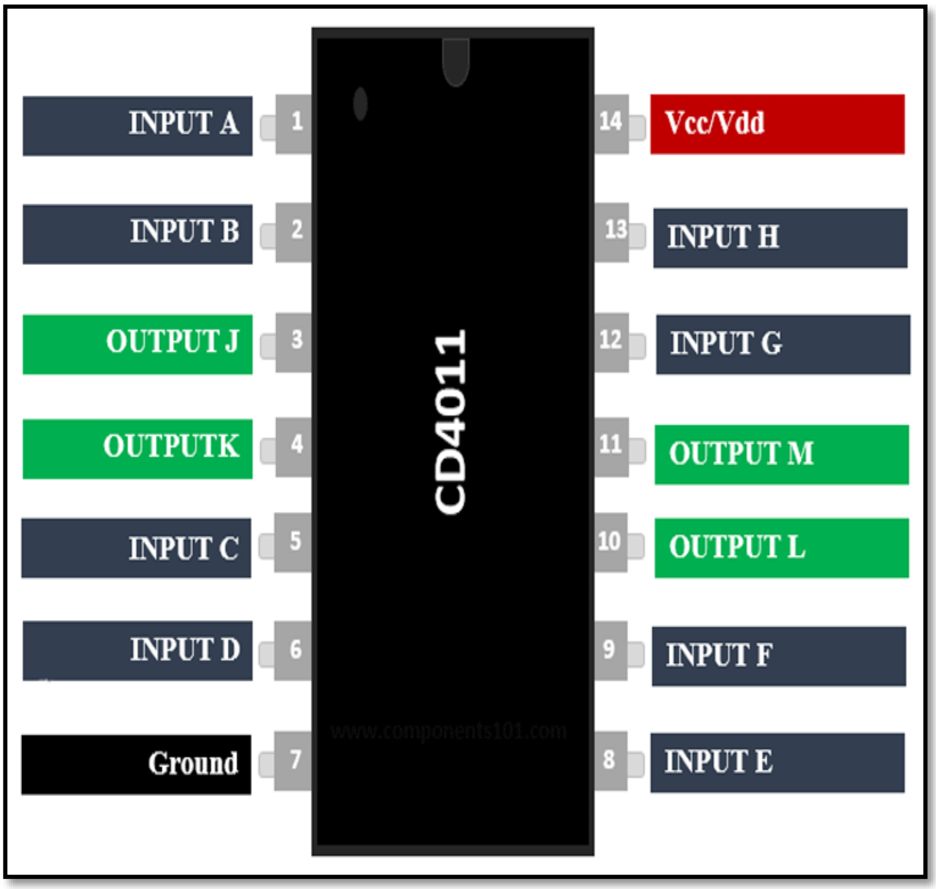
There are basically 2 types of 7 segment LED display namely,

Common Anode: All the Negative terminals (Anode) of all the 8 LEDs are connected together. All the positive terminals are left alone.

Common Cathode: All the positive terminals (Cathode) of all the 8 LEDs are connected together. All the negative thermals are left alone.

2.5 CD4011 CMOS 2-Input NAND Gate





CD4011 Pinout

CD4011 is a member of the CD40xx CMOS IC series. The CD4011 IC contains four independent NAND gates. The devices perform the Boolean function Y = A × B or Y = A + B in positive logic. This IC is used in AV Receivers, Portable Audio Docks, and Blu-Ray Players.

Pin Description of CD4011

Pin Number	Pin Name	Description
1,2,5,6,8,9,12,13	NAND Gate Input pins	First Input pin for the NAND gate
3,4,10,11	NAND Gate Output pins	Output pin for the NAND gate
7	Ground	Connect to the ground of the circuit.

14	Vcc (Vdd)	Used to power the IC. Typically, +5V is used

Where to use the CD4011 IC

CD4011 is a 2-input 4 NAND gate IC and used in many electronic circuits. CD4011 used for performing the Logic NAND function. When you want to use it as a logic inverter, NAND gates in this chip can be reconfigured to make them NOT gate. So, we can make SN54LS00 a four NOT gate chip if necessary. It can be used where high-speed NAND operation is necessary. This chip has less transition times which are needed for high-speed applications. So SN54LS00 can be used in high-frequency systems.

2.6 Zener Diode

A Zener diode is a silicon semiconductor device that permits current to flow in either a forward or reverse direction. The diode consists of a special, heavily doped p-n junction, designed to conduct in the reverse direction when a certain specified voltage is reached.

The Zener diode has a well-defined reverse-breakdown voltage, at which it starts conducting current, and continues operating continuously in the reverse-bias mode without getting damaged. Additionally, the voltage drop across the diode remains constant over a wide range of voltages, a feature that makes Zener diodes suitable for use in voltage regulation.

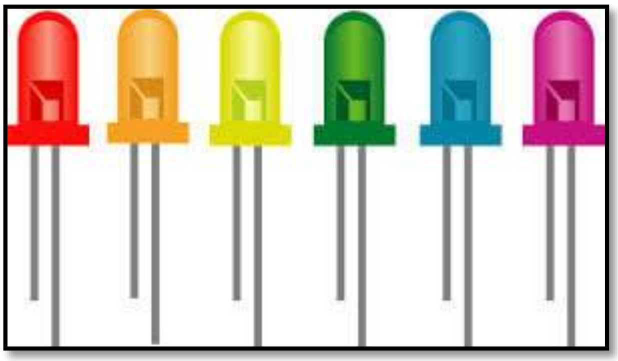
Zener diode operation

The Zener diode operates just like the normal diode when in the forward-bias mode, and has a turn-on voltage of between 0.3 and 0.7 V. However, when connected in the reverse mode, which is usual in most of its applications, a small leakage current may flow. As the reverse voltage increases to the predetermined breakdown voltage (Vz), a current start flowing through the diode. The current increases to a maximum, which is determined by the series resistor, after which it stabilizes and remains constant over a wide range of applied voltage.

2.7 Light Emitting Diode (LED)

Light Emitting Diodes (LEDs) are the most widely used semiconductor diodes among all the different types of semiconductor diodes available today. Light emitting diodes emit either visible light or invisible infrared light when forward biased. The LEDs which emit invisible infrared light are used for remote controls.

A light Emitting Diode (LED) is an optical semiconductor device that emits light when voltage is applied. In other words, LED is an optical semiconductor device that converts electrical energy into light energy.



When Light Emitting Diode (LED) is forward biased, free electrons in the conduction band recombines with the holes in the valence band and releases energy in the form of light.

The process of emitting light in response to the strong electric field or flow of electric current is called electroluminescence.

A normal p-n junction diode allows electric current only in one direction. It allows electric current when forward biased and does not allow electric current when reverse biased. Thus, normal p-n junction diode operates only in forward bias condition.

Like the normal p-n junction diodes, LEDs also operates only in forward bias condition. To create an LED, the n-type material should be connected to the negative terminal of the battery and p-type material should be connected to the positive terminal of the battery. In other words, the n-type material should be negatively charged and the p-type material should be positively charged.

The construction of LED is similar to the normal p-n junction diode except that gallium, phosphorus and arsenic materials are used for construction instead of silicon or germanium materials.

In normal p-n junction diodes, silicon is most widely used because it is less sensitive to the temperature. Also, it allows electric current efficiently without any damage. In some cases, germanium is used for constructing diodes.

However, silicon or germanium diodes do not emit energy in the form of light. Instead, they emit energy in the form of heat. Thus, silicon or germanium is not used for constructing LEDs.

2.8 Resistor

Resistors of all types are used in vast quantities in manufacturing electronic equipment. In fact, the resistor is probably the most common type of electronic component used in electrical and electronic circuits.

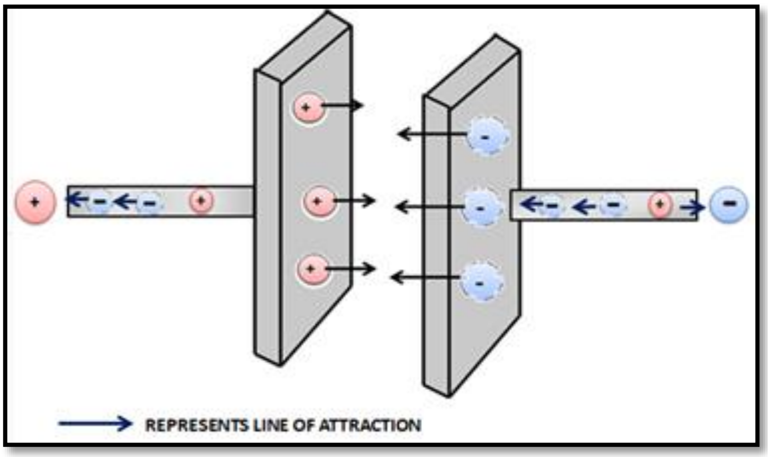
There is a large number of different types of resistor that can be bought and used. The properties of these different resistors vary, and it helps to obtain the right type of resistor for any given design to ensure that the best performance is obtained.

Although many resistors will work in a variety of applications the type of resistor can be important in some cases. Accordingly, it is necessary to know about the different resistor types, and in which applications each type of resistor can be used.

Resistors are used in virtually all electronic circuits and many electrical ones. Resistors, as their name indicates resist the flow of electricity, and this function is key to the operation most circuits.

2.9 Capacitor

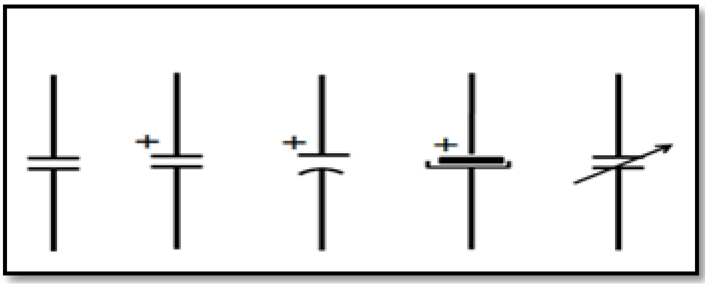
A capacitor in its most primitive form consists of two conductive plates separated by a dielectric medium. The term dielectric is just a fancy word for an insulator that can be polarized, i.e. form negative and positive charges on opposite faces. When voltage is applied across these two plates, current flows through the conductive plates. One side gets positively charged (lack of electrons) and the other side gets negatively charged (excess electrons). We’re all familiar with the fact that unlike charges attract, so since the plates are oppositely charged, the charges on the plates attract.



It is to be noted that there’s an insulator between the plates, so the charges cannot ‘flow’ to equalize each other and are (ideally) stuck in a state of mutual attraction and stay put. And that is how capacitors carry out their most basic function – retention or storage of charge.

Symbol of Capacitors

Since the capacitors have two parallel metal plates as discussed above, their symbol kind of represents the same.

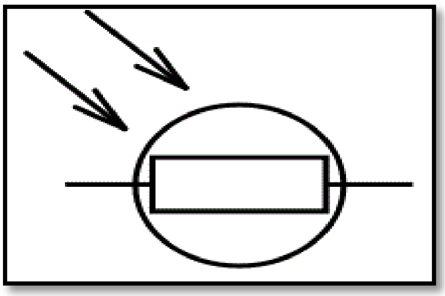


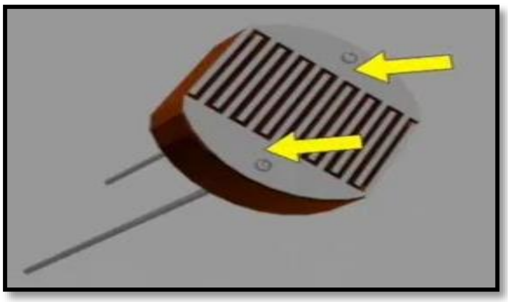
In a practical case, Capacitors are no longer just two plates with a gap between them, in the case of aluminium electrolytics the two plates take the form of metal foil rolled up with a spacer between them in a tube.

The second set of symbols stand for polarized capacitors, meaning ones which have defined positive and negative terminals by internal design. Accidentally reversing these terminals will almost certainly result in a spectacular failure (especially for larger specimens), ejecting bits of foil and paper meters from the site of failure and most of the time smelling very bad.

2.10 Light Dependent Resistor

An LDR or a photo resistor is a device whose resistivity is a function of the incident electromagnetic radiation. Hence, they are light sensitive devices. They are also called as photo conductors, photo conductive cells or simply photocells. They are made up of semiconductor materials having high resistance. There are many different symbols used to indicate an LDR, one of the most commonly used symbols is shown in the figure below. The arrow indicates light falling on it.



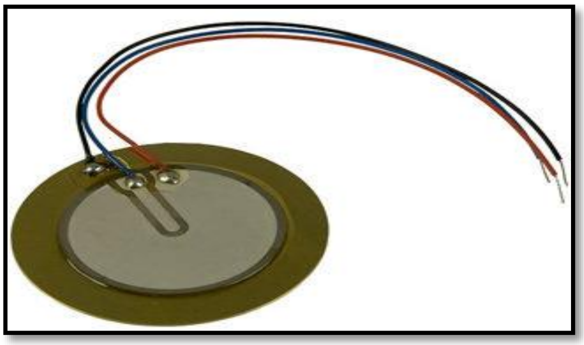


Working Principle of LDR

An LDR works on the principle of photo conductivity. Photo conductivity is an optical phenomenon in which the materials conductivity is increased when light is absorbed by the material. When light falls i.e. when the photons fall on the device, the electrons in the valence band of the semiconductor material are excited to the conduction band. These photons in the incident light should have energy greater than the band gap of the semiconductor material to make the electrons jump from the valence band to the conduction band. Hence when light having enough energy strikes on the device, more and more electrons are excited to the conduction band which results in large number of charge carriers. The result of this process is more and more current starts flowing through the device when the circuit is closed and hence it is said that the resistance of the device has been decreased. This is the most common working principle of LDR.

2.11 Piezo buzzer

Piezo buzzers are one of the most common buzzers available around, they got their name from the piezoelectric material used as the active element. These buzzers are usually driven at a relatively higher voltage but low current, consumes a little power, but still capable of producing very high sound. The Piezo element must be a three terminal one as shown below.



The blue wire is connected to feedback (F) terminal, red wire to the main (M) terminal and the black wire to the piezo element's ground (G) plate. The inductor coils value and shape are not crucial. You can use any coil from 1mH to 10mH or more, or even no measured value at all. I used a 40-turn coil on a small ferrite toroid in the final design.

3. DEVELOPMENT OF THE CIRCUIT

3.1 Circuit Diagram

The circuit diagram of the speed checker and over speed detector for highways is shown in figure 3.1. It has been designed assuming that the maximum permissible speed for highways is 40 kmph as per the traffic rule.

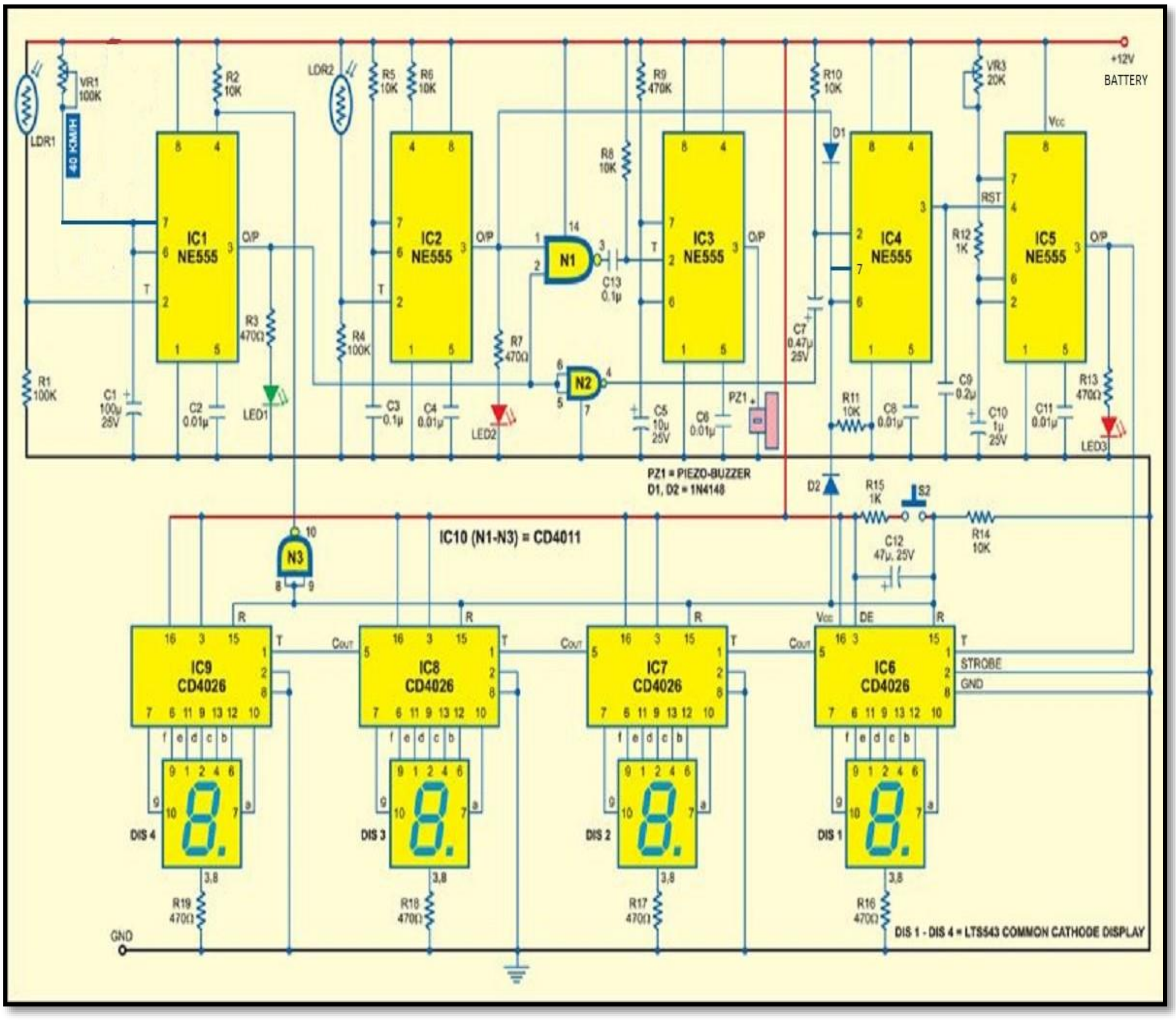


Fig. (3.1). Circuit diagram of Speed Checker for Highways

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 monostable, 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 100 Hz (period = 0.01 second) astable timer IC5.

3.2 Circuit Description

The system basically comprises of two laser transmitter-LDR sensor pairs, which are installed on the highway 100 metres 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 figure 3.2.

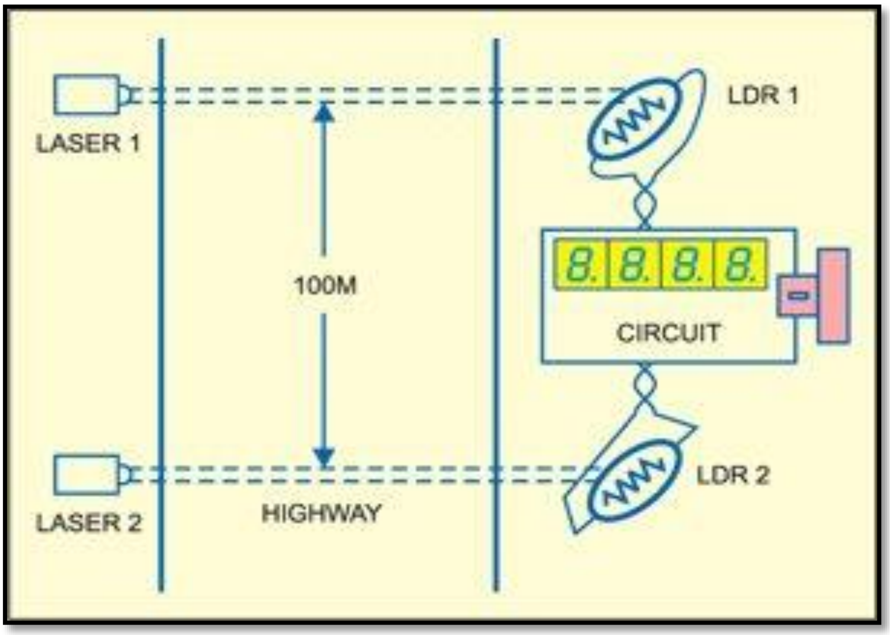


Fig. (3.2). Installation of Lasers and LDRs on Highways

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:

$$\text{Speed (kmph)} = \frac{\text{Distance}}{\text{Time}}$$

$$= \frac{0.1\text{ km}}{(\text{Reading}\times 0.01)/3600}$$

or,

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

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

The time period of timer NE555 (IC1) count-start monostable multivibrator is adjusted using preset VR1 and capacitor C1. For 40 kmph limit the time period is set for 9 seconds using preset VR1. The junction of LDR1 and resistor R1 is coupled to pin 2 of IC1.

Normally, light from the laser keeps falling on the LDR sensor continuously and thus the LDR offers a low resistance and pin 2 of IC1 is high. Whenever light falling on the LDR is interrupted by any vehicle, the LDR resistance goes high and hence pin 2 of IC1 goes low to trigger the monostable. As a result, output pin 3 goes high for the preset period (9 seconds) and LED1 glows to indicate it. Reset pin 4 is controlled by the output of NAND gate N3 at power-on or whenever reset switch S2 is pushed.

For IC2, the monostable is triggered in the same way as IC1 when the vehicle intersects the laser beam incident on LDR2 to generate a small pulse for stopping the count and for use in the speed detection. LED2 glows for the duration for which pin 3 of IC2 is high.

The outputs of IC1 and IC2 are fed to input pins 2 and 1 of NAND gate N1, respectively. When the outputs of IC1 and IC2 go high simultaneously (meaning that the vehicle has crossed the preset speed limit), output pin 3 of gate N1 goes low to trigger monostable timer IC3. The output of IC3 is used for driving piezo buzzer PZ1, which alerts the operator of speed-limit violation. Resistor R9 and capacitor C5 decide the time period for which the piezo buzzer sounds.

3.3 Circuit operation

The output of IC1 triggers the bistable (IC4) through gate N2 at the leading edge of the count-start pulse. When pin 2 of IC4 goes low, the high output at its pin 3 enables astable clock generator IC5. Since the count-stop pulse output of IC2 is connected to pin 6 of IC4 via diode D1, it resets clock generator IC5. IC5 can also be reset via diode D2 at power-on as well as when reset switch S2 is pressed. IC5 is configured as an astable multivibrator whose time period is decided by preset VR3, resistor R12 and capacitor C10. Using preset VR1, the frequency of the astable multivibrator is set as 100 Hz. The output of IC5 is fed to clock pin 1 of decade counter/7-segment decoder IC6 CD4026.

4. RESULT & CONCLUSION

4.1 Result & Discussion

The proposed system **speed checker and over speed detector for highways** has been developed and tested successfully. The results obtained are discussed below:

- Here, the LASER1 and LASER2 are installed in such a way that they point towards the LDR1 and LDR2. The hardware model of the proposed system is shown in figure 4.1. The time period of count start MSMV (IC1) is set as 9 seconds for 40 kmph speed limit. Thus, red LED (LED1) glows for time duration of 9 seconds and after that it turns off.

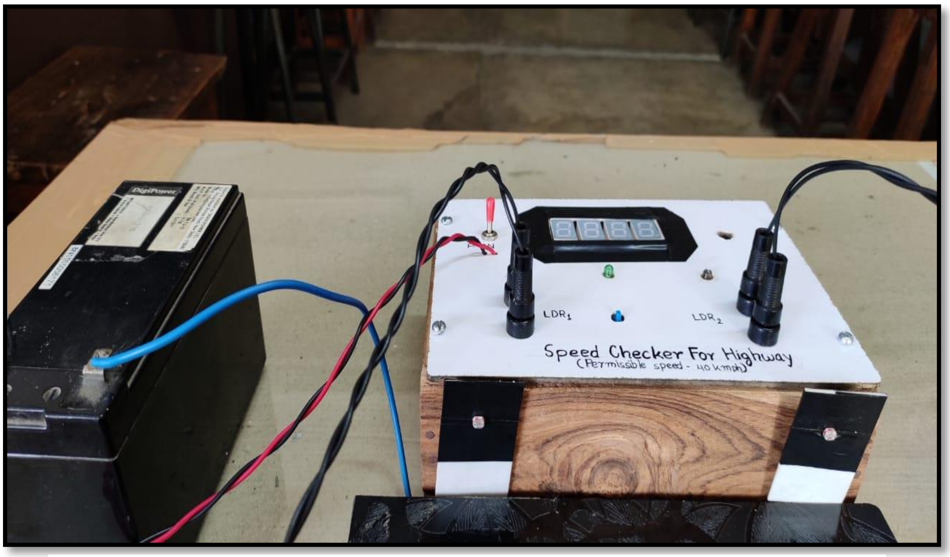


Fig. (4.1). Hardware Model of Speed checker for highways

- **When the vehicle crosses the LASER1**, the light falling on the LDR1 is obstructed and first MSMV (IC1) that is count start MSMV is triggered. In this condition, the output of IC1 goes high due to which the red LED (LED1) glows for the set time. The output of IC1 also triggers/sets the BSMV (IC4) which enables ASMV (IC5) that causes the yellow LED (LED3) to glow for the time the vehicle crosses the LDR2 and count starts simultaneously. The system also displays the time/count but at this time, the buzzer remains turned off as shown in figure 4.2. Here, ASMV (IC5) can be reset by pressing the switch S2.

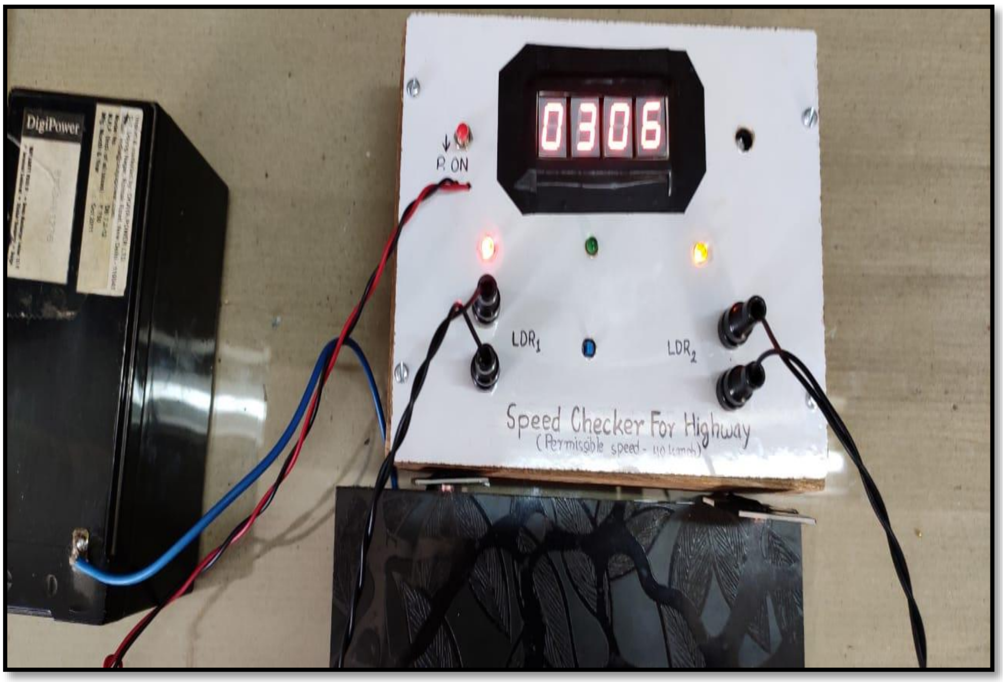


Fig. (4.2). Working Model of Speed checker for highways

- In the proposed system, the outputs of the first and second MSMV are fed to the third MSMV (IC3) that is speed-limit detector MSMV through Nand gate. When the outputs of IC1 and IC2 go high simultaneously, the output of Nand gate goes low to trigger the third MSMV (IC3) which drives the buzzer and alerts the driver of speed-limit violation.
- **When the vehicle crosses the LASER2 before the set time (i.e., 9 seconds)**, the light falling on the LDR2 is obstructed and second MSMV (IC2) that is count stop MSMV is triggered. In this condition, the output of IC2 goes high that causes the green LED (LED2) to glow for the duration for which the output of IC2 is high and red LED (LED1) remains turned on for the set time of 9 seconds. Now, the output of IC2 resets the BSMV (IC4) which disables ASMV (IC5) which results in turning off the yellow LED (LED3) and count stops simultaneously. The system displays the time taken by the vehicle in crossing the 100 m distance from one sensor pair to the other. As the vehicle crosses

LDR2 before the set time, **the buzzer beeps which indicates that the vehicle exceeds the permissible speed for the highway** as is depicted from figure 4.3.

Fig. (4.3). Working Model of Speed checker for highways showing over speed

- **When the vehicle crosses the LASER2 after the set time of 9 seconds**, the light falling on the LDR2 is obstructed and second MSMV (IC2) that is count stop MSMV is triggered. In this condition, the output of IC2 goes high that causes the green LED (LED2) to glow for the duration for which the output of IC2 is high. Then green LED will become off after generating a small pulse for stopping the count and it is also used in the speed detection. The red LED (LED1) remains turned off after set time. Now, the output of IC2 resets the BSMV (IC4) that disables ASMV (IC5) which results in turning off the yellow LED (LED3) and count stops simultaneously. The system displays the time taken by the vehicle in crossing the 100 m distance from one sensor pair to the other. As the vehicle crosses LDR2 after the set time, **the buzzer does not beep which shows that the vehicle does not exceed the permissible speed for the highway** as is depicted from figure 4.4.

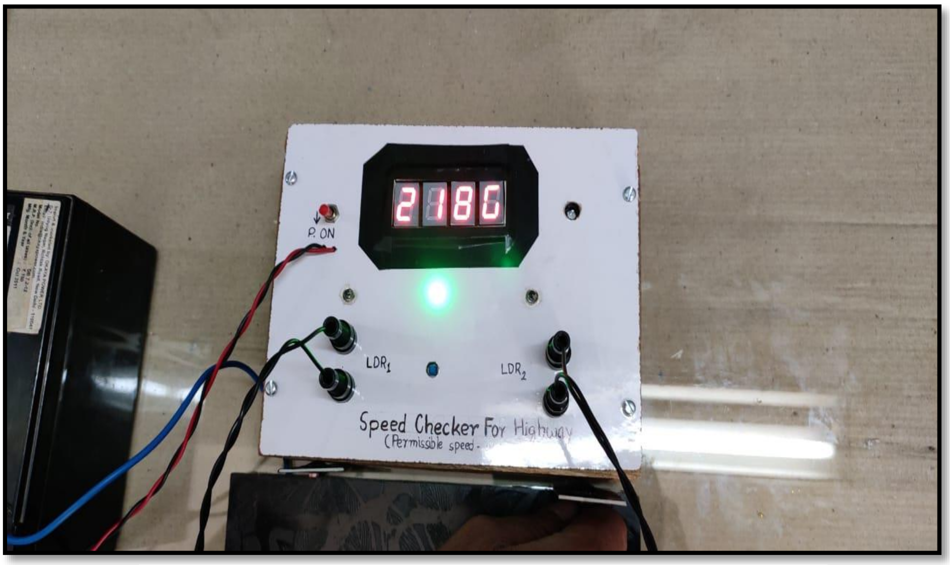


Fig. (4.4). Working Model of Speed checker for highways showing no over speed

4.2 Advantages

1. There are many accidents due to high speed, so by using this technology on highway, we can stop these types of accidents.
2. The people also feel safe on road and during crossing the road.
3. Though the major application is for speed detection on highways, it can be used for internal roads in city or even on internal roads inside a university campus, educational campus, society etc.

4.3 Limitation

The proposed circuit can only be implemented and successfully work for single lane road on highways.

5. CONCLUSION

Since number of accidents on highways increases day by day so it is necessary to check the speed of the vehicles on highways so as to reduce accident cases and to provide a safe journey by controlling high speed of the vehicle. The proposed speed checker and over speed detector for highways works fairly as per our design. This particular system can be used to minimize the difficulties of traffic police department and make ease to control the rash driving on highways. The police can perform their duties while sitting in control room and can provide their service with more ease and accuracy. This concept can be extended in future by integrating a camera with the system which could capture the image of the number plate of the vehicle to send that to the traffic authorities. Hence, the driver can be caught and punished if he ignores the speed limit and occurrence of accidents can be reduced to a large extent.

6. FUTURE SCOPE

As far as future development is concerned, following features can be added in the developed circuit:

1. 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.
2. A voice announcement system can be added which will intimate the driver that he/she has crossed the over speed condition.
3. The GSM technology can be implemented. So, that the nearest highway security authorities will be informed about the vehicle which has over speed.

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