DELHI TECHNOLOGICAL UNIVERSITY

Electrical Devices and Circuits

LED MATRIX OSCILLOSCOPE

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DECLARATION

We hereby certify that the work presented in the Project entitled "**LED MATRIX OSCILLOSCOPE**" submitted to the Department of Electrical Engineering, Delhi Technological University, Delhi in fulfillment of the requirement for the award of the Bachelor of Technology in Electrical Engineering is an authentic record of my/our own, carried out under the supervision of "Prof. Garima Solanki''. This report's work has not been submitted to, and is not being considered for, any other course or degree at this or any other Institute/University.

SUPERVISOR CERTIFICATE

To the best of my knowledge, the report comprises original work and has not been submitted in part or full for any Course/Degree to this university or elsewhere as per the candidate's declaration

Place: Delhi **Supervisor name and Signature**

Date:

ACKNOWLEDGEMENT

We needed the assistance and guidance of some respected individuals in order to complete our important project, and we owe them our deepest gratitude.

We'd like to express our gratitude to **Prof. Garima Solanki**, our project mentor, for providing us with a solid framework for the report throughout multiple conversations. We'd also like to express our heartfelt gratitude to everyone who has helped us complete this project, both directly and indirectly.

Many people, including our classmates and team members, have offered helpful comments and suggestions on this project, inspiring us to better our work. We appreciate everyone's assistance in completing our work, both directly and indirectly.

We would also like to express our gratitude to the Department of Electrical Engineering at Delhi Technological University for providing us with the opportunity to work on this project.

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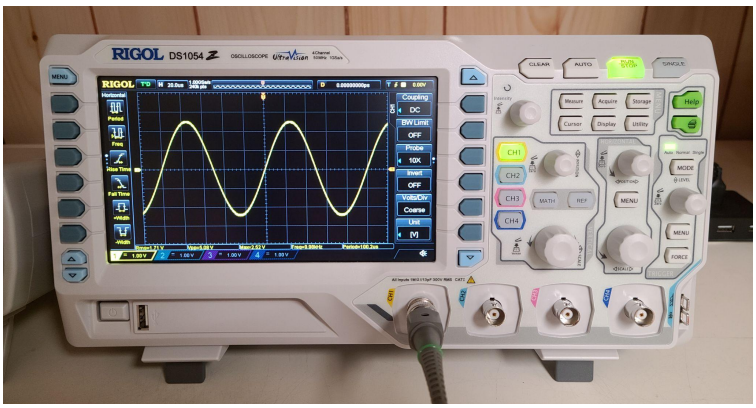
INTRODUCTION

WHAT IS AN OSCILLOSCOPE?

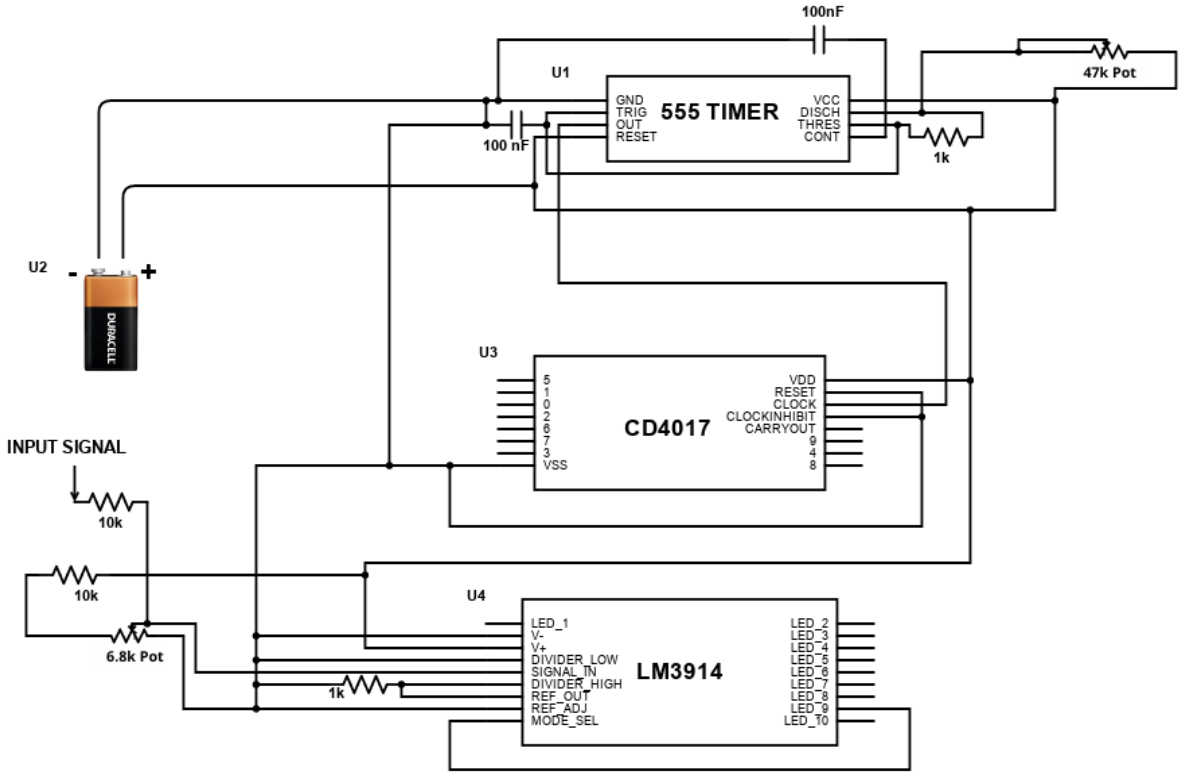
An OSCILLOSCOPE is an electronic test tool that graphically displays varying electrical voltages as a two-dimensional plot as a function of time in a two-dimensional plot. The primary goals are to display repeating or single waveforms on the screen that would otherwise occur too quickly for the human eye to notice.



COMPONENTS USED

- 100 3mm LEDS
- Veroboards
- Breadboard
- NE555 IC
- LM3914 IC
- CD4017 IC
- Jumper Wires
- Potentiometers (47K ohm and 6.8K ohm)
- Resistors (1K ohm and 10K ohm)
- Capacitors (100nF)
- 9V Battery
- Alligator Wires

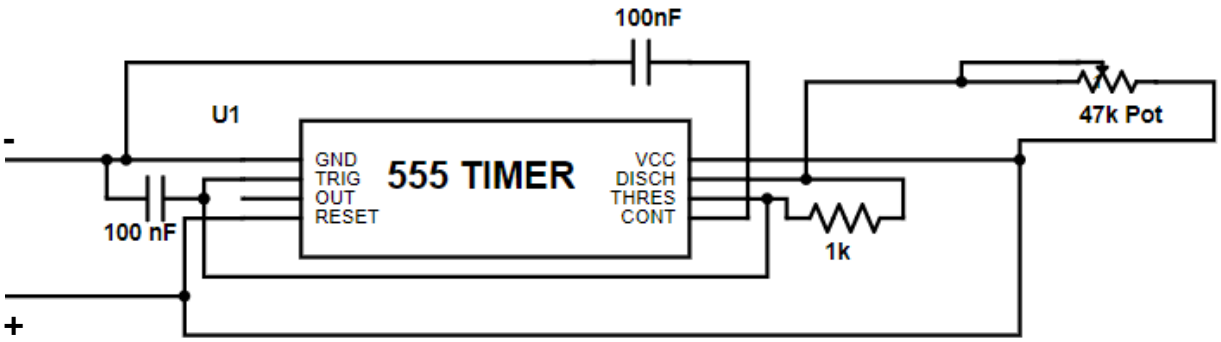
CIRCUIT DIAGRAM



WORKING

To understand the working, the functioning of important components is listed below:

- **555 TIMER IC**



Here 555 Timer is in ASTABLE MULTIVIBRATOR configuration. It produces a clock output from pin 3, which is given to CD4017, which will be discussed further.

The 50k ohm potentiometer can control the frequency of the clock produced by the 555 Timer. The minimum and maximum frequency of clock produced is calculated below:

$Time\ Period\ =\ 0.693(Ra\ +\ 2Rb)\ *\ C\ seconds\ ,\ where$

$Ra\ =\ Potentiometer\ Value\ (0\ or\ 47K\ ohm)$

$Rb\ =\ 1K\ ohm$

$C\ =\ 100\ nF\ ,\ \ So$

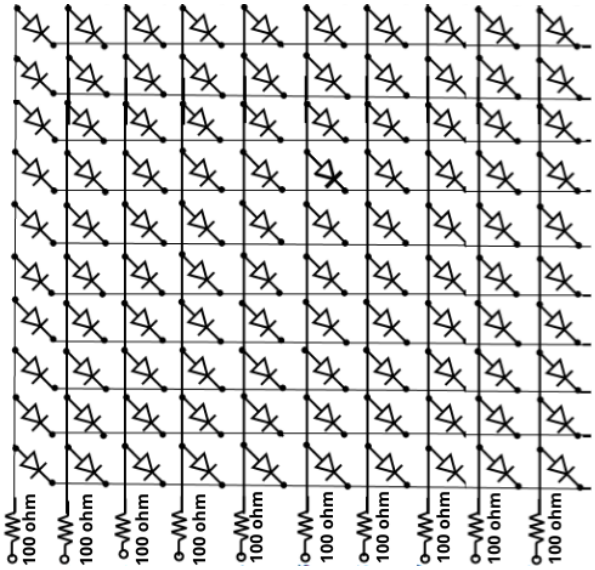
$Time\ Period\ Max\ (\ i.e.\ Ra\ =\ 47K\ ohm)\ =\ 0.0033957\ seconds$

$Time\ Period\ Min\ (\ i.e.\ Ra\ =\ 0\ ohm)\ =\ 0.0001386\ seconds$

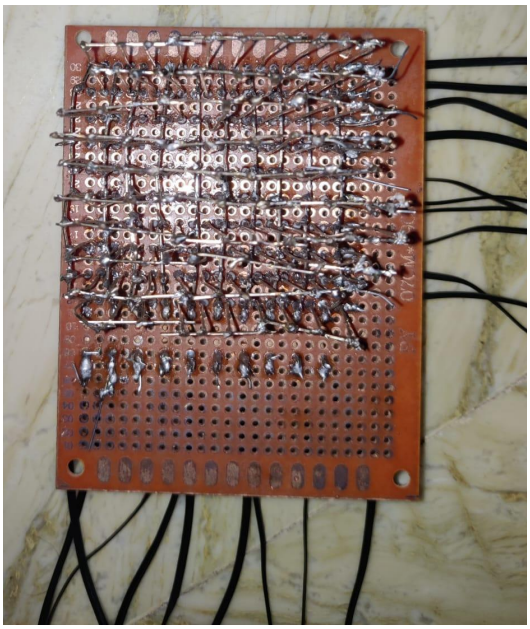
$Frequency\ Min\ =\ 1/Time\ Period\ Max\ =\ 294.49\ Hz$

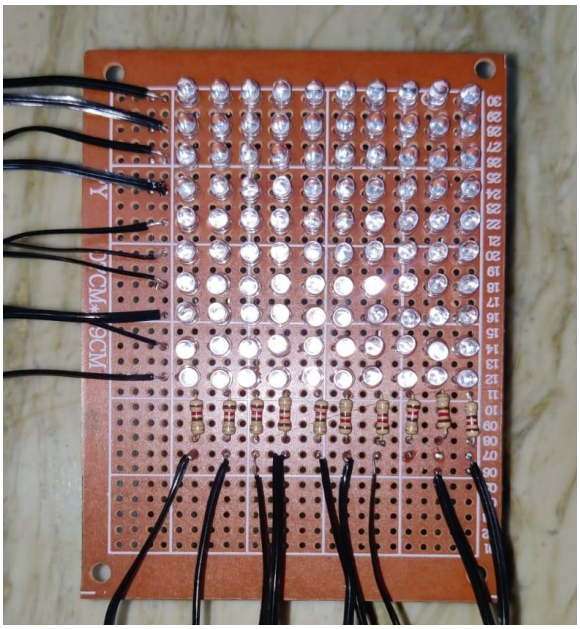
$Frequency\ Max\ =\ 1/Time\ Period\ Min\ =\ 7215\ Hz$

- **LED MATRIX**

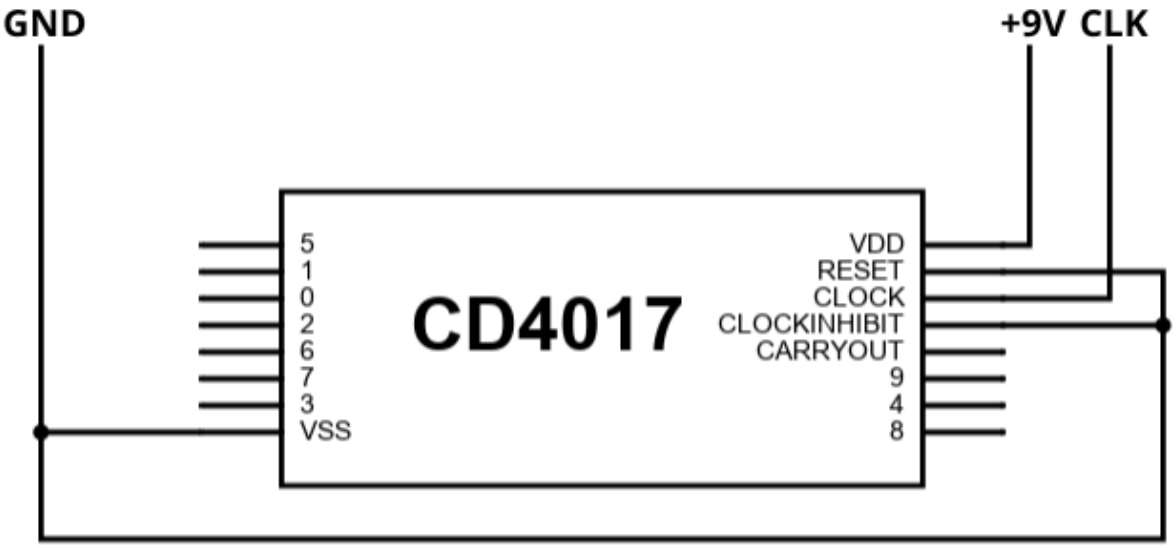


The LED matrix containing 100 3mm LEDS is made on a veroboard. The anodes of all the LEDs in a column are shorted. The Cathodes of all the LEDs in a row are shorted.





- **CD4017**

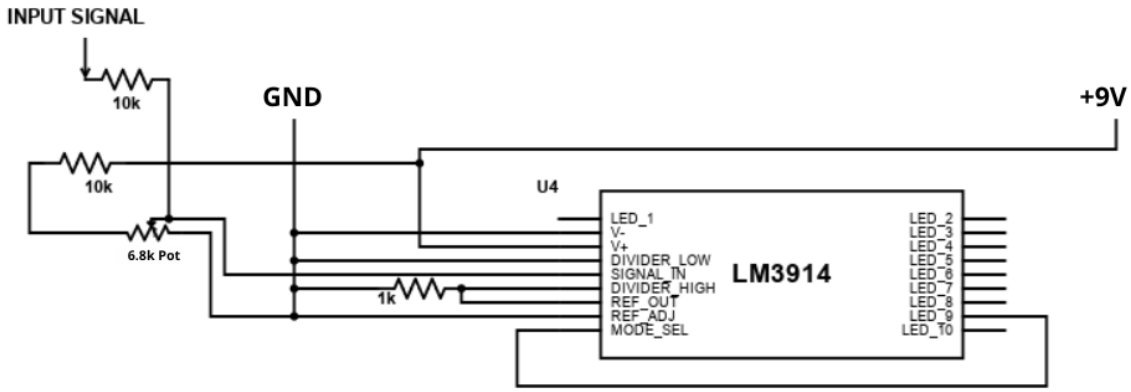


CD4017 is a decade counter with 10 decoded outputs. CD4017 also exhibits sequentially activating outputs from pin 3 towards pin 11, however, this sequential shifting of the outputs is in response to the clock pulses at pin 14(clk in) that is provided by the 555 Timer. This counter is positive edge triggered.

All the LED anode columns of the LED Matrix are connected to this IC column-wise as shown by the numbering in the diagram.

This IC controls the X axis of the Oscilloscope.

- **LM3914**



The LM3915 is a dot/bar display driver IC. The outputs of this IC activate sequentially from pin 1 towards pin 10, one after the other, in response to an increasing voltage level across its pin 5 and ground.

This IC is an active low IC, that means when the output is activated it gets low, while deactivated outputs get high. All LED Cathode rows are connected to this IC row-wise as shown in the diagram.

Pin 5 gets the Input i.e. function to be displayed. The 6.8k potentiometer controls the amplitude of the input thus controlling the X axis level. This IC controls the Y axis of the oscilloscope.

Pin 9 is the mode pin. If connected to Vcc, the IC behaves in BAR mode. When left unconnected, it behaves in DOT mode, like in this circuit.

The LEDs on the Y-axis are controlled by the LM3915 outputs, which indicate the amplitude of the waveform. The LEDs on the X-axis are controlled by the CD4017 outputs, which indicate the time base frequency of the oscilloscope.

The IC LM3915 detects the amplitude of the waveform, and generates a correspondingly shifting up and down low logic across the connected LEDs.

Since the CD4017 also supplies a shifting logic with some frequency, the up/down LED illumination on the Y-axis from the LM3915 outputs is swept across the X-axis, so that it corresponds to the time period of the waveform.

This allows a sweeping waveform pattern to be simulated on the 10 x 10 LED matrix.

The speed at which the outputs of the LM4017 shift determines the direction of the waveform.

If the speed is less than the time period of the waveform, the LED waveform appears to move from right to left, and when the speed is higher than the waveform time period, the LED waveform appears to move from left to right.

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