



**Ahmedabad  
University**

A project report on

**“8 \* 8 \* 8 - 3D LED Matrix”**

Submitted to

**Professor Harmeet Kaur**

By

Section 3 | Digital Design

Group Members:

Name	Enrolment No.
Deepayu Ninama	AU2240190
Aarsha Shah	AU2240163
Hetav Shah	AU2240253

### **Introduction:**

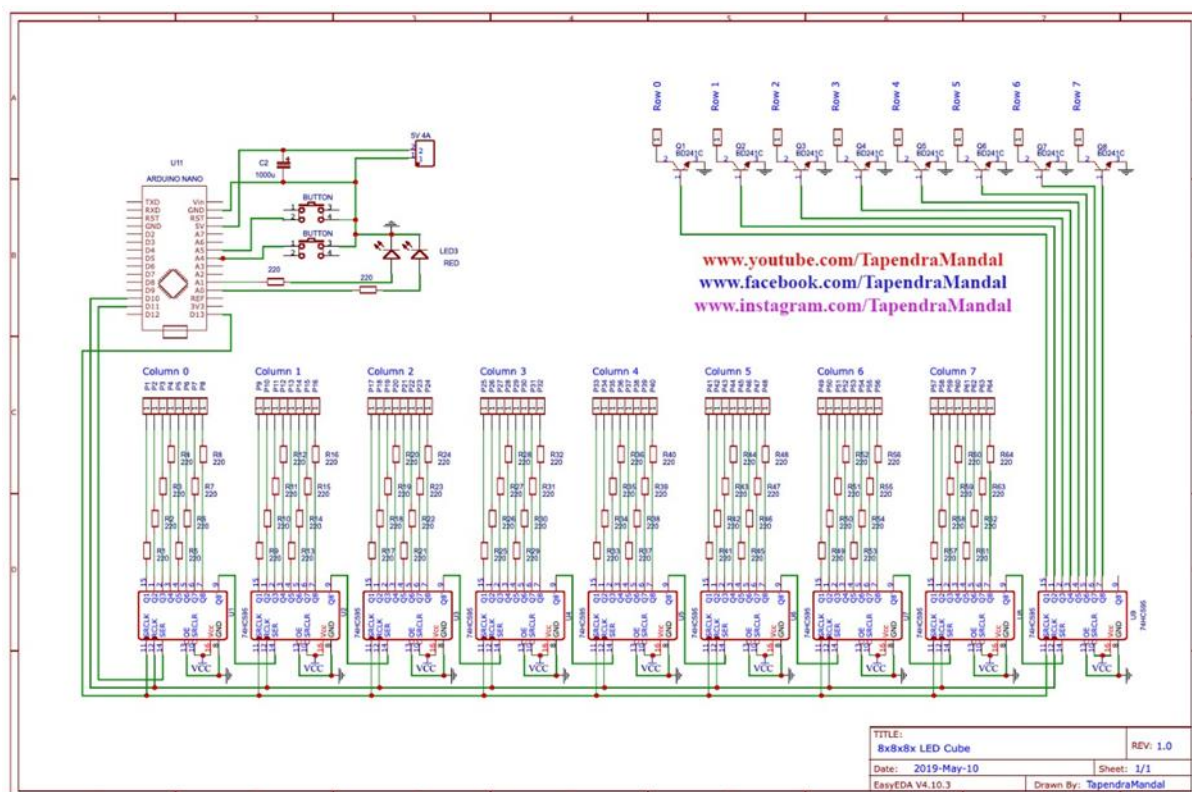
An 8 \* 8 \* 8 - 3D LED Matrix is a fascinating electronic device that showcases 512 LEDs arranged in a three-dimensional cube structure, enabling the display of various patterns, animations, and even text messages. To effectively control this intricate arrangement of LEDs, a combination of electronic components is employed, each playing a crucial role in achieving the desired visual effects.

### **Components:**

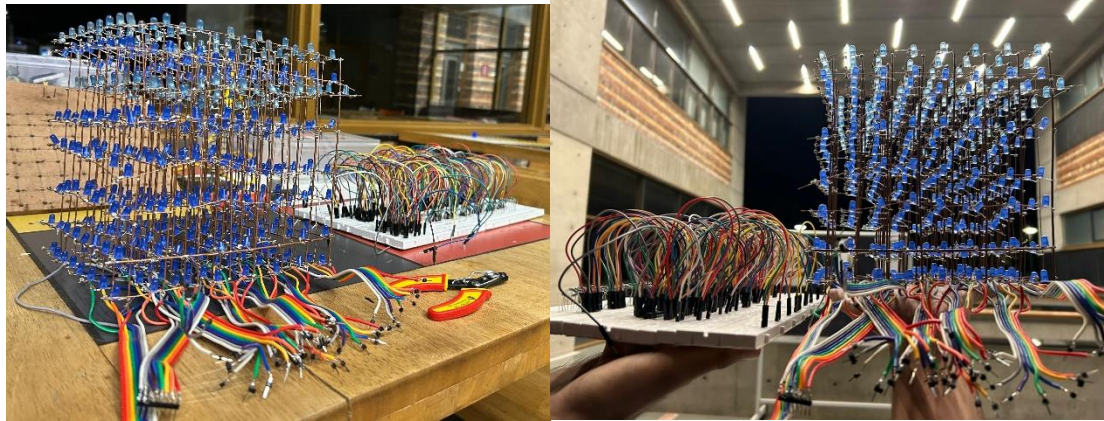
- **Arduino NANO:** This Device is used to compute the code which we are uploading using Arduino IDE software. It basically operates the signals and functions that is to be carried out by 3D Matrix.
- **IC 74HC595N:** This IC Chip is consisting of Left Shift Resistor, D-Latch Flip Flop. 9 Such IC chips are connected in series which carries helps to send required data to LED matrix in a sequence such that Data from 1<sup>st</sup> IC will be carried out first and rest each will have some delay margin (9600ms) respectively.

- **Transistor BD241B:** The Data from the IC chip is computed by 8 Transistor which respect to their connected IC chips and they further more send this final computed electrical data to LEDs to display our carried output.
- **Tinned Copper Wire:** Copper wires (without coating) is used to stack and connect LEDs in a manner that all the LEDs (512) can be operated through signals provided in code simultaneously.
- **Capacitor 1000uf :** It is necessary to store input current to a capacitor first so that we can control the flow of current as per the requirement of the functions and operations.
- **Push Button \* 2:** Push-Btns are used to switch operations in LED and change the Input and output of the Logic built (8 bits- 8 features).
- **Resistor 220 OHM:** Resistors are used here to control the overflow of current as each LED require 5V current supply and to safely provide the current signal to all 512 LEDs, it is essential to connect resistor for safety.

### Circuit Diagram:



## Project Image:



## Working:

1. **Data Preparation:** The Arduino Nano prepares the data for the LED matrix, converting the desired patterns or animations into a series of binary digits (bits). These bits represent the on/off state of each LED.
2. **Serial Data Transmission:** The prepared data is then transmitted serially to the 74HC595N shift registers. The shift register receives the bits sequentially, storing them in its internal registers.
3. **Parallel Data Output:** Upon receiving the complete data sequence, the shift register shifts the stored bits to its parallel outputs. These outputs are connected to the transistors, which in turn control the power supply to the LED layers.
4. **LED Illumination:** Based on the signals received from the transistors, the corresponding LEDs illuminate or dim, creating the desired pattern or animation on the 3D LED matrix.
5. **Continuous Loop:** The process of data preparation, transmission, and illumination continues in a loop, ensuring the continuous display of the desired visual effects on the LED matrix.

## Additional Considerations:

1. **Power Supply:** A stable power supply is crucial for proper operation. The voltage and current requirements should match the specifications of the LEDs and transistors.
2. **Wiring:** Careful wiring is essential to avoid short circuits and ensure proper signal transmission between components.
3. **Programming:** The Arduino Nano requires programming to translate user input or predefined patterns into commands for the LED matrix.

**4. Troubleshooting:** Familiarizing oneself with common troubleshooting techniques is beneficial for addressing any issues that may arise during construction or operation.

## Applications

1. **Art Installations:** 3D LED matrices are often used in art installations to create eye-catching and immersive experiences. The ability to display complex patterns, animations, and even text makes them versatile tools for artists.
2. **Interactive Displays:** 3D LED matrices can be used to create interactive displays that respond to user input. For instance, they can be used to display touch-sensitive games, interactive advertisements, or data visualizations.
3. **Educational Tools:** 3D LED matrices can be used as educational tools to teach concepts in science, technology, and art. For example, they can be used to demonstrate the properties of light, the structure of molecules, or the principles of coding.
4. **Product Demonstrations:** 3D LED matrices can be used to create product demonstrations that are more engaging and interactive. For instance, they can be used to showcase the features of new electronic products or the capabilities of manufacturing processes.
5. **Decorative Lighting:** 3D LED matrices can be used to create decorative lighting effects, such as simulated flames, cascading waterfalls, or twinkling stars. They can add a unique touch to interiors and exteriors.

## Usage

1. **DIY Projects:** 3D LED matrices are popular among hobbyists and DIY enthusiasts for their versatility and ease of use. They can be used to create a wide range of projects, from simple LED cubes to complex interactive displays.
2. **Commercial Products:** 3D LED matrices are also used in various commercial products, such as digital signage, gaming consoles, and automotive displays. Their ability to capture attention and convey information makes them valuable for businesses.
3. **Educational Institutions:** 3D LED matrices are increasingly being used in educational institutions to enhance learning experiences. They can be used to create interactive learning environments and demonstrate scientific concepts in an

engaging way.

4. **Research and Development:** 3D LED matrices are also used in research and development for various purposes, such as developing new lighting technologies, exploring human-computer interaction, and testing algorithms for computer vision.
5. **Public Art:** 3D LED matrices are sometimes used in public art installations to create immersive and interactive experiences for viewers. They can be used to display abstract patterns, animations, or even real-time data visualizations.