/\*4x4x4 LED Cube

Connection Setup:

Columns

[(x,y)-Pin]

(1,1)-13

(1,2)-12

(1,3)-11

(1,4)-10

(2,1)-9

(2,2)-8

(2,3)-7

(2,4)-6

(3,1)-5

(3-2)-4

(3-3)-3

(3,4)-2

(4,1)-1

(4,2)-0

(4,3)-A5

(4,4)-A4

Layers

[layer-Pin]

a-A0

b-A1

c-A2

d-A3

\*/

**int column[16]={13,12,11,10,9,8,7,6,5,4,3,2,1,0,A5,A4}; //initializing and declaring led rows**

**int layer[4]={A3,A2,A1,A0}; //initializing and declaring led layers**

**void setup()**

**{**

**for(int i = 0; i<16; i++) //setting rows to ouput**

**{**

**pinMode(column[i], OUTPUT);**

**}**

**for(int i = 0; i<4; i++) //setting layers to output**

**{**

**pinMode(layer[i], OUTPUT);**

**}**

**void loop()**

**{**

**for(int i=0 ; i<5 ; i++) //runs the loop for 5 times**

**{**

**turnEverythingOn();**

**delay(250); //holds the LEDs ON for 250 milliseconds**

**turnEverythingOff();**

**delay(250); //holds the LEDs OFF for 250 milliseconds**

**}**

**turnEverythingOff(); //turn OFF al the 64 LEDs**

**delay(1000); //holds the LEDs in OFF position for 1 second**

**RowFlickering(); //calls the user defined function and flicker the LEDs row wise**

**turnEverythingOff();**

**delay(1000);**

**ColumnFlickering(); //calls the user defined function and flicker the LEDs column wise**

**turnEverythingOff();**

**delay(1000);**

**GifPattern(); // calls the user defined function and forms a particular pattern**

**}**

void turnEverythingOff() //this function consists of 2 for loop 1 for columns and the other for layers (rows ) to turn everything OFF

{

for(int i = 0; i<16; i++) //turning OFF columns

{

digitalWrite(column[i], 0);

}

for(int i = 0; i<4; i++) //turning OFF layers(rows)

{

digitalWrite(layer[i], 0);

}

}

void turnEverythingOn() //this function consists of 2 for loop 1 for columns and the other for ayers (rows ) to turn everything ON

{

for(int i = 0; i<16; i++) //turning ON columns

{

digitalWrite(column[i], 1);

}

for(int i = 0; i<4; i++) //turning ON layers(rows)

{

digitalWrite(layer[i], 1);

**}**

**}**

void RowFlickering()

{

for( int i=0;i<5;i++)

{

Int x = 75; //a variable used for time 75 milliseconds

turnEverythingOn(); // calls the user defined function to turns all the 64 LEDs ON

for(int i = 4; i!=0; i--) //this loop turns the layers(rows) OFF in order 3,2,1,0 in the interval of 75 milliseconds and comes out of loop when i=0

{

digitalWrite(layer[i-1], 0);

delay(x);

}

for(int i = 0; i<4; i++) //this loop turns the layers(rows) ON in order 3,2,1,0 in the interval of 75 milliseconds and comes out of loop when i=4

{

digitalWrite(layer[i], 1);

delay(x);

}

}

void turnEverythingOn() //user defined function to turn everything ON

{

for(int i = 0; i<16; i++) //turning ON columns

{

digitalWrite(column[i], 1);

}

for(int i = 0; i<4; i++) //turning ON layers(rows)

{

digitalWrite(layer[i], 1);

}

}

}

void ColumnFlickering()

{

for( int i=0 ;i<5; i++)

{

Int x = 75; //a variable used for time 75 milliseconds

turnEverythingOn(); // calls the user defined function to turns all the 64 LEDs ON

for(int i = 16 ; i!=0 ; i--) //this loop turns the columns OFF in order 13,12,11,10,9,8,7,6,5,4,3,2,1,0,A5 and A4 in the interval of 75 milliseconds and comes out of loop when i=0

{

digitalWrite(column[i-1], 0);

delay(x);

}

for(int i = 0; i<16; i++) //this loop turns the columns ON in order A4,A5,0,1,2,3,4,5,6,7,8,9,10,11,12 and 13 in the interval of 75 milliseconds and comes out of loop when i=16

{

digitalWrite(column[i], 1);

delay(x);

}

}

void turnEverythingOn() //user defined function to turn everything ON

{

for(int i = 0; i<16; i++) //turning ON columns

{

digitalWrite(column[i], 1);

}

for(int i = 0; i<4; i++) //turning ON layers(rows)

{

digitalWrite(layer[i], 1);

}

}

}

void GifPattern()

{

int column[16]={13,12,11,10,6,2,8,7,4,3,9,5,1,0,A5,A4}; // declearation of LED columns

for( int i=0 ;i<5 ;i++)

{

for(int i=0 ; i<6 ; i++) //runs the code for 5 times

{

if(i<3)

{ /\* here variable i is used for outer loop LEDs are ( 13,12,11,10,6,2,A4,A5,0,1,5,9 ) and the inner loop LEDs are (8,7,3,4).

As the oueter loop contains 12 LEDs and inner loop contains 4 LEDs for each inner loop LED there are 3 outer loop LED . \*/

digitalWrite(column[i],1); // i=0 representing column 13 is ON and the cycle continues upto i=2

digitalWrite(column[15-i],1); // i=0 representing column A4 is ON and continues upto i=2

digitalWrite(column[8],1); // for LED 8 outer LEDs are 13,12,11

digitalWrite(column[3],1); //for LED 3 outer LEDs are A4,A5,0

delay(500); // diagonally 4 LEDs are set ON for 500 milliseconds

digitalWrite(column[i],0); //i=0 representing column 13 is 0FF and the cycle continues upto i=2

digitalWrite(column[15-i],0); // i=0 representing column A4 is OFF and continues upto i=2

}

/\* as the inner LED represents 3 outer LEDs the inner LED will be ON till a the three outer LEDs are ON and OFF \*/

if(i==2) //checks the value of i=2 or not and executes when true

{

digitalWrite(column[8],0**);**  //for LED 8 outer LEDs are 13,12,11

digitalWrite(column[3],0); //for LED 3 outer LEDs are A4,A5,0

}

if(i>2 && i<6)

{

digitalWrite(column[i],1); //i=3 representing column 10 is ON and the cycle continues upto i=5

digitalWrite(column[15-i],1); // i= 3 representing column 1 is ON and continues upto i=5

digitalWrite(column[7],1); //for LED 7 outer LEDs are 10,6,2

digitalWrite(column[4],1); //for LED 4 outer LEDs are 1,5,9

delay(500); // diagonally 4 LEDs are set ON for 500 milliseconds

digitalWrite(column[i],0); //i=3 representing column 10 is OFF and the cycle continues upto i=5

digitalWrite(column[15-i],0); // i= 3 representing column 1 is OFF and continues upto i=5

}

if(i==5) //checks the value of i=5 or not and executes when true

{

digitalWrite(column[7],0); //for LED 7 outer LEDs are 10,6,2

digitalWrite(column[4],0); //for LED 4 outer LEDs are 1,5,9

}

}

}

}

**EXPLANATION of CODE**

|  |
| --- |
| **13 12 11 10**  **9 8 7 6**  **5 4 3 2**  **1 0 A5 A4** |

// let the box represents the top view of the 3D LED cube

// each no represents one LED ( column LED )

This code consist of 4 types of parttern

1 Blinking of LED cube

2 Row wise flickering

3 Column wise flickering

4 Gif Pattern

All the LEDs are inicialized in Columns and Layers ( rows)

There are 16 columns (13,12,11,10,9,8,7,6,5,4,3,2,1,0,A5, A4)

And 4 layers ( rows)

( A3, A2, A1, A0)

All the LEDs are set for OUTPUT by using for loop for column and layers in void setup ( )

Function called void loop ( ) is used to run the code many times

Used defined function such as

turnEverythingOn( ) ;

trunEverythingOff( ) ;

RowFlickering( ) ;

ColumnFlickering( ) ;

GifPattern( ) ;

Are called inside the void loop( ) ;

turnEverythingOn( ) ;

This function turns on all the LEDs column wise as well as Layer wise by using 2 separate for loops for column and layers

turnEverythingOff( ) ;

This function turns off all the LEDs column wise as well as Layer wise by using 2 separate for loops for column and layers

RowFlickering( ) ;

This function turns all the layers ON and OFF in a certain sequence that is from up to down or down to up by using for loop in order to switch on all the layers and then switch off all the layers

ColumnFlickering( ) ;

This function turns all the columns ON and OFF in a certain sequence that is from 13th column to the A4th column and again in the reverse order by using for loop in order to switch on all the columns and then switch off all the columns

GifPattern( ) ;

This function is used for a specific pattern in which basically there are 2 loop inner loop and the ourt loop

The outer loop consists of 12 LEDs and the inner loop consists of 4 LEDs

So there are 3 outer loop LEDs for 1inner loop LED which means the time taken by LED ( 13,12,11) to be on and off till that time LED 8 must remain on and it should be off as soon as LED 11 is Off

Similarly LED 3 is linked to A5, A4 and 0 and both LED 3 and 8 are working simultaneously at the same time so column [ i ] and [ 15 - i ] are written one after the other

After each pattern all the LEDs are OFF and this is hold for a time interval of 1 second so that all the patterns are clearly visible to the viewer

**Bibliography**

<https://youtu.be/56sA2-qQzn0>

<https://youtu.be/BDYeAH2AtNc>