

İTÜ



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THE PROJECT SUMMARY

GOAL

In this project, I aimed the subject about people's listening pleasure. While searching about what can be the subject, I thought in this pandemic people have been more into listening music and learning some kind of instrument. Consequently, I used this situation and turned it into a combination of visual and auditory pleasure.

SOLUTION

It is obvious that Led strips are very common this days. So I decided to use them with MATLAB. These Led strip's comes with some mods. I got inspired these and applied it to my project. These are the modes comes with my project: One Color Lightning, Fade Away and Music Visualizer.

To enable communication between MATLAB and Led strip, I used Arduino. Arduino is a physical programming platform consisting of an I/O board and it has its own programming language. Arduino can be used to develop stand-alone interactive objects, or it can be connected to software running on a computer. I sent the relevant codes from MATLAB to Arduino and got the Led strip working properly.

REQUIREMENTS

- For computer system, we need MATLAB and Arduino Support Package for Arduino Hardware. This is a software and hardware support package.
- For the rest, These are the things that should be used in this project:
 1. Breadboard. This carries the most of communication between materials with jumpers.
 2. Jumpers. This is used for connect the materials to each other.
 3. Transistor. A transistor is a semiconductor circuit element that we can use to amplify or switch small electrical signals. With the electrical signal applied to one of the legs of a transistor with 3 or more legs, we can control the electrical current between the other legs.
 4. Sound sensor. After the sound sensor was connected to the Arduino, I provided the communication with the increase and decrease of the volt. If there is no sound, the sensor will transmit 5V.
 5. Arduino. This board is used for the communication between circuit elements and MATLAB.

WORKING LOGIC

Firstly, the code I wrote accepts the mode that what user want to see. Then user have to enter the mode name properly and read the what is written and be careful while using because Led strip uses 12V electricity and Arduino receive 5V electricity from computer.

- ONE COLOR LIGHTNING

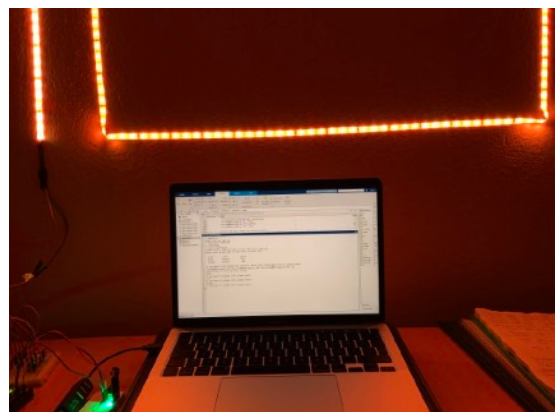
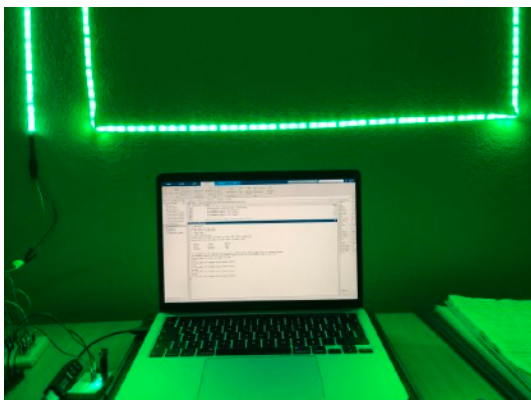
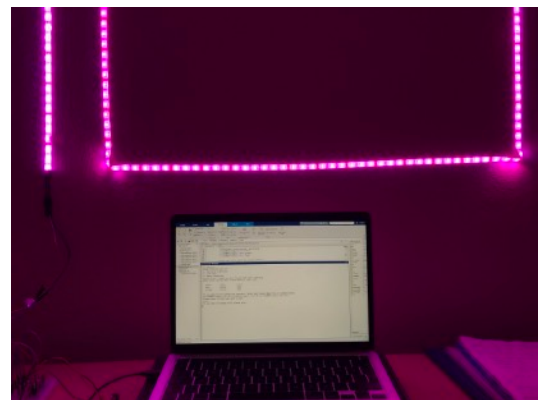
In this mode, Led strip will turn on one color. There are 9 colors coded in project. Ones user enter a color name, s/he can keep change the color if s/he wants. With this mode, ambient lighting is targeted. If I just programmed Music Visualizer, Led strip would be more useless. So that, I want to add some modes, like this one and the next one.

In the code, the first case is about this mode. Basically, there are two arrays, first one is color's names and the second one is color's RGB combination voltages. When user enter a color name, code find its index and the RGB combinations from the second array. For example, If Index is '1', then the color's RGB combination voltages are the first three elements of the second array. The first of the first three elements is the blue channel and the second of this combination is the green channel and last one is red channel. So, this is the 'One Color Lightning's working principle.

```
Modes that you can use:
1- One Color Lightning
2- Fade Away
3- Music Visualizer
Please enter a mode you want to use: One Color Lightning
Which color do you want to see? Here is color list.

Green      Blue      White
Pink       Purple     Cyan
Orange     Yellow     Red

If you want to out please use control+c. After that please copy this on commad window:
writePWMVoltage(a,'D9',0);writePWMVoltage(a,'D10',0);writePWMVoltage(a,'D11',0);
Please enter a color you want to see:
Pink
If you want to change color please enter:
Orange
If you want to change color please enter:
Green
If you want to change color please enter:
|
```



- **FADE AWAY***

In this part of the project, I processed the interlacing of different colors. I created this part because I want it to look like rainbow. In real life, white light coming from sun creates all of rainbow's colors but for Led strip it is something about low voltage or high voltage combination RGB channels. I could do this with 'for loops'. I settled all with increasing and decreasing voltages. There are two different versions of this increases and decreases. The first one is while one color channel is stable the other one is increasing. The second version is that when both colors are at maximum voltage, the first fixed one drops. Then the first happens again and then the second one. With 'for loops', I controlled this increasing and decreasing.

With this mode, I aimed that while people are doing something monotone, they can use this mode as back-lightning. So, the user will feel better.

- **MUSIC VISUALIZER****

This part is the main part of this project. In this part, different from other parts, I used sound sensor to recognize volume changes. The sound sensor works with 5 volts. If there is no sound, Arduino will measure 5 volt as output. But if there is sound, the sound sensor will work and it gives output to Arduino less than 5 volts. In the code, I arranged things like this principle. If there is sound, Led strip will change its color and if there is not, the last color will last a bit more.

I let MATLAB to read voltages from "Arduino's Analog Pin" and write color voltages on "Arduino's Digital Pin". In this part, It was challenging because I did not know how I can control Led strip's color and how I can read sound impulse with analog pin at the beginning. Later then, I learned about its work principle with electricity.

THE MOST USED FUNCTIONS

- `arduino('....')` : This function is used for connecting Arduino board to MATLAB system.
- `writePWMPWMVoltage(a,'D9',0)` : Actually, I mentioned it as 'digital pin' but I used its PWM side. This function sends the amount of voltages to Arduino then breadboard, with transistors it will change to 12V as maximum value. So that, Led strip turns on. Here is given 0v, then Led strip's one of RGB channels which is connected with pin 9 will turn off.
- `readVoltage(a,'A0')` : This function reads the voltage which is coming from sound sensor.
- `pause(n)` : This function pause running code for n seconds before continuing.
- `rand` : This function generates values between 0 and 1.

CONCLUSION

At the end of this project, we learned MATLAB and Arduino board will work together without any issues. It was hard before because I didn't know what Arduino is. I got help from different websites and MATLAB's toolbox examples. My brother helped me electrical side of this project i.e. hardware connections. I had a hard time when I realized that the ingredients and materials in my early research were not the same. So I had to change my programming style. There are two types of Led strips out: 3 with 3 pins and with 4 pins. While the Leds in the projects I took as an example were 3-pin, mine was 4-pin. That was the problem I had.

* This modes video uploaded in presentation video.

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REFERENCES:

- <https://youtu.be/lU1GVVU9gLU?list=PLtHkvVG-VLbra2GKWf0x7dEqViYMSvIwX>
 - <https://youtu.be/lBiDakKEbNA?list=PLtHkvVG-VLbpcr82jGS58z5j4RkBIHNSd>
 - <https://youtu.be/9hJyyUTfIXA?list=PLtHkvVG-VLbpcr82jGS58z5j4RkBIHNSd>
 - <https://youtu.be/RwHGiogIbk8?list=PLtHkvVG-VLbpcr82jGS58z5j4RkBIHNSd>
 - <https://youtu.be/CSEgffOS5h4?list=PLtHkvVG-VLbpcr82jGS58z5j4RkBIHNSd>
 - <https://youtu.be/6K6OZ2APbKk?list=PLtHkvVG-VLbpcr82jGS58z5j4RkBIHNSd>
 - <https://youtu.be/G-zCNkNp4RY?list=PLtHkvVG-VLbpcr82jGS58z5j4RkBIHNSd>
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- Initially, I learned about Arduino and then I learned how I use these information in MATLAB with help in MATLAB.