

**Team:** Lyuda Panina and Vincent Benenati

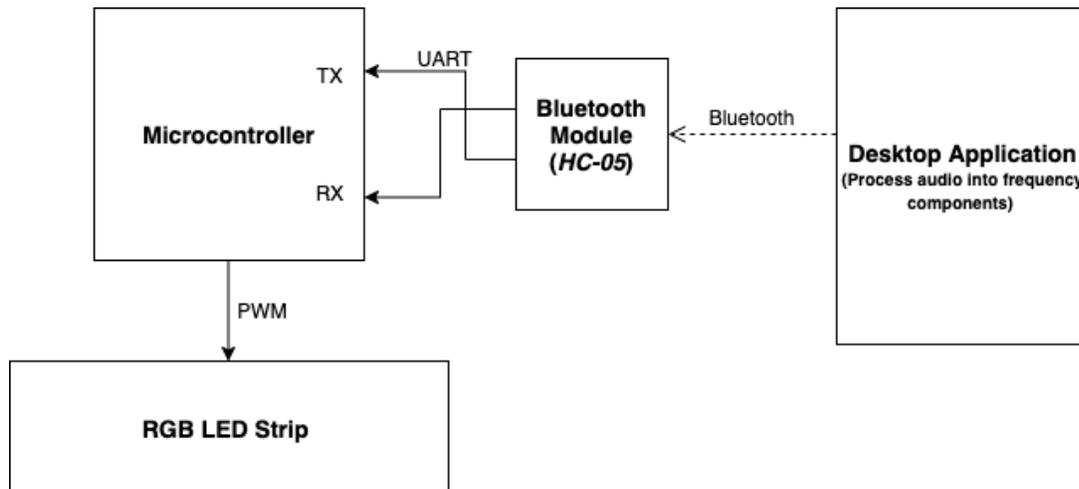
**Abstract:** The goal of this project is to create a beat visualizer that will provide a visual dimension to any audio source, especially music, through the use of a PWM-controlled addressable RGB LED strip, a Bluetooth-to-UART receiver (HC-05), and an STM32L476VG microcontroller development board. The user will be able to play any audio source from their Bluetooth-connected computer and a custom application will process the played audio using a Short-time Fourier transform (STFT) to find the relative magnitudes of lower frequencies that are often perceived as the beats of a song. The application will then map these frequencies to an RGB value that is sent to the microcontroller. The microcontroller then displays this color at the starting LED. After each timestep, each past color is moved to the next LED until it eventually reaches the end of the strip.

**Website:** <https://sites.google.com/view/ece153b-w2021-l-v/home>

**Peripherals:** HC-05 Bluetooth Module and Addressable RGB LED strip

**Serial Interface Protocols:** PWM and UART

### Block Diagram:



### Responsibility Delegation:

Lyuda:

-Website management, Frequency-to-RGB Mapping, Command Rx (from HC-05)

Vincent:

-Signal Processing (STFT), Command Tx (using Bluetooth), Updating LED strip (using PWM)

### Software Structure:

Desktop Application:

- Using a software splitter, the desktop's audio will be fed into our application and the computer's default playback device\*

- Our application will then use a Short-time Fourier transform algorithm (or related algorithm) to separate the frequency components from the audio source in near real-time
- The bass frequencies will then be mapped to a specific RGB value
- This RGB value is sent via Bluetooth to the microcontroller

Microcontroller:

- The STM32L476VG will use interrupts to determine if a new UART command is available
- A PWM waveform will be generated using interrupts to update the addressable RGB LED strip

\*=If performance constraints real-time signal processing, the audio will be delayed to the playback device