Real-time LED Musical Visualizer

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Project Goal

In this project, we will create an embedded system which is able to play music and concurrently drive LED strings aligned with the rhythm.

Project Approach

In some timing-critical applications, the real-time response requirements of the peripherals are too demanding for the main processor to adequately handle without affecting other functionality. To address this issue, we can use a real-time unit (RTU), which is designed to enable timing-accurate control at architecture level, as a supplement in an embedded system.

Resources

Our plan is to put our program on a heterogeneous embedded system platform and use it to drive NeoPixels LEDs. We are planning on using either the FlexPret RTU (designed by our graduate student mentor) by flashing it onto a MyRIO board or the RTUs built into the the Beaglebone Black.

The first goal will be to generate a sound with a single note and turn on a single LED string when the note is played. After that, we will generate harmonious music by combining different frequencies, and turn on and off multiple LED strings simultaneously according to the music. We plan to have 16 notes and 16 LED strings total, each LED corresponding to each note. Additionally, we will integrate a sensor to it so the music starts and stops whenever the system senses a clap. If possible, we want to add a voice recognition feature so the music starts when we say “start” and stops when we say “stop.” We will add these additional feature if we can, but if not, the base plan would be to make a system that generates a song and light LED strings corresponding with the music.

Schedule

- October 21: Finish project charter; set up online collaboration environment
- October 28: Choice of platform finalized after discussion with GSIs
- November 4: Get development environment ready; finalize detailed system specs
- November 11: Generate sound notes and lit up LEDs
- November 18: *Mini project update*: Demo simple programs (sound and LED)
- November 25: Achieve the design spec for sound and LEDs
- December 2: If possible, achieve the design spec for sensors
- December 9: System testing, measure false positives, assess timing effectiveness.
- December 16: Demonstration video made, slides prepared.
- December 17: Final presentation and demo.
- December 19: Project report and video turned in.

Risk and Feasibility

There are many unknowns. Although the RTU makes it easier to program timing-critical systems in principle, we may spend more time and effort than expected to solve the potential problems during actual development, due to our lack of knowledge and platform on this novel and prototypical platform.