

Twinkle Tines

SDMay23-30

Andrew Adams, Daniel Duerr, Mesa Hassel, Eileen Hillier, Kaitlyn Nolting, Stuart Pearson, Isaac Vrba

Introduction

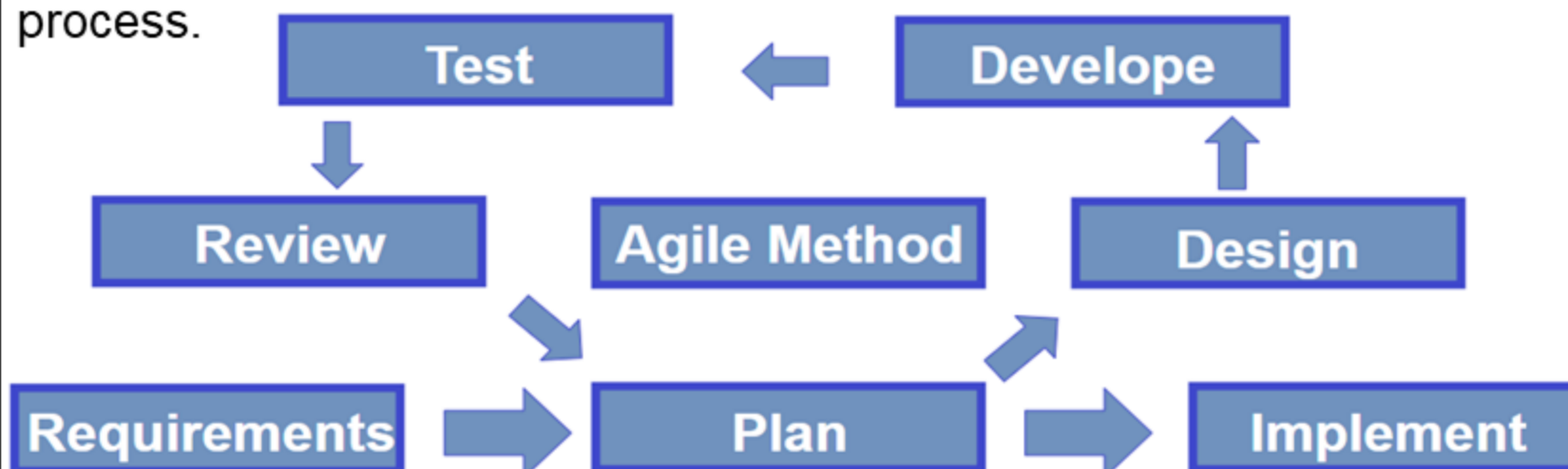
Many people use music for entertainment, relaxation, and for creativity; however, many musical instruments require high skill to sound pleasant, high skill to read music, and high effort to memorize music. The kalimba requires little skill to sound pleasant, and the Twinkle Tines attachment removes the need to read or memorize music. Together, a kalimba with Twinkle Tines lets anyone effortlessly make their own music to destress at their desk, serenade a friend, or refresh their mind.

Overview

Due to close tine proximity, it is extremely difficult to look away from a kalimba to read music while playing, and memorizing music requires a lot of effort. Twinkle Tines is a transferable mount with an LED array and note detection system that talks via Bluetooth to the Twinkle Tines mobile app where users can save their favorite songs to play. The LED array shows which tines should be plucked to play a song and provides feedback for wrong notes. Twinkle Tines is for anyone that wants the benefits of playing music without requiring significant time and effort.

Methodology

The agile design method allowed us to quickly adapt to what we learned and clarify our final design goal as we worked through the design process.



Final Solution

Twinkle Tines Mount

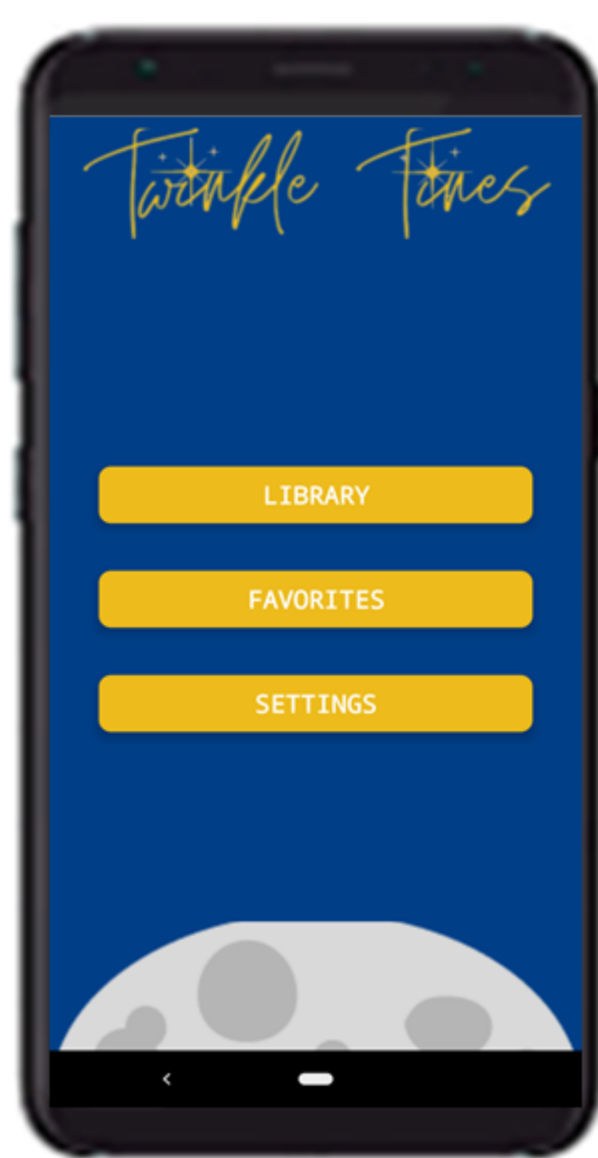
A custom 3D printed device to house the LED array, microcontroller, and battery that is transferable between most solid body, hollow body, and acrylic kalimbas.



Kalimba not included

Twinkle Tines App

A custom app for Android and IOS that connects via Bluetooth to the Twinkle Tines Mount and allows users to select songs to play and favorite songs for easy access.



Smartphone not included

Results and Impact

- The Twinkle Tines mount correctly lights up tines to be played, identifies the tine played, and can transfer quickly between kalimbas.
- The Twinkle Tines app allows users to select songs to play and create a personal library of liked songs.
- The Twinkle Tines system creates a fun, relaxing, and simple user experience, making music accessible to everyone everywhere.

Future Work

Twinkle Tines has a lot of exciting room to grow with optimization and new feature development. To join the creative team or learn more about the project, scan the QR code or visit:

<https://sdmay23-30.sd.ece.iastate.edu>



Implementation

Hardware

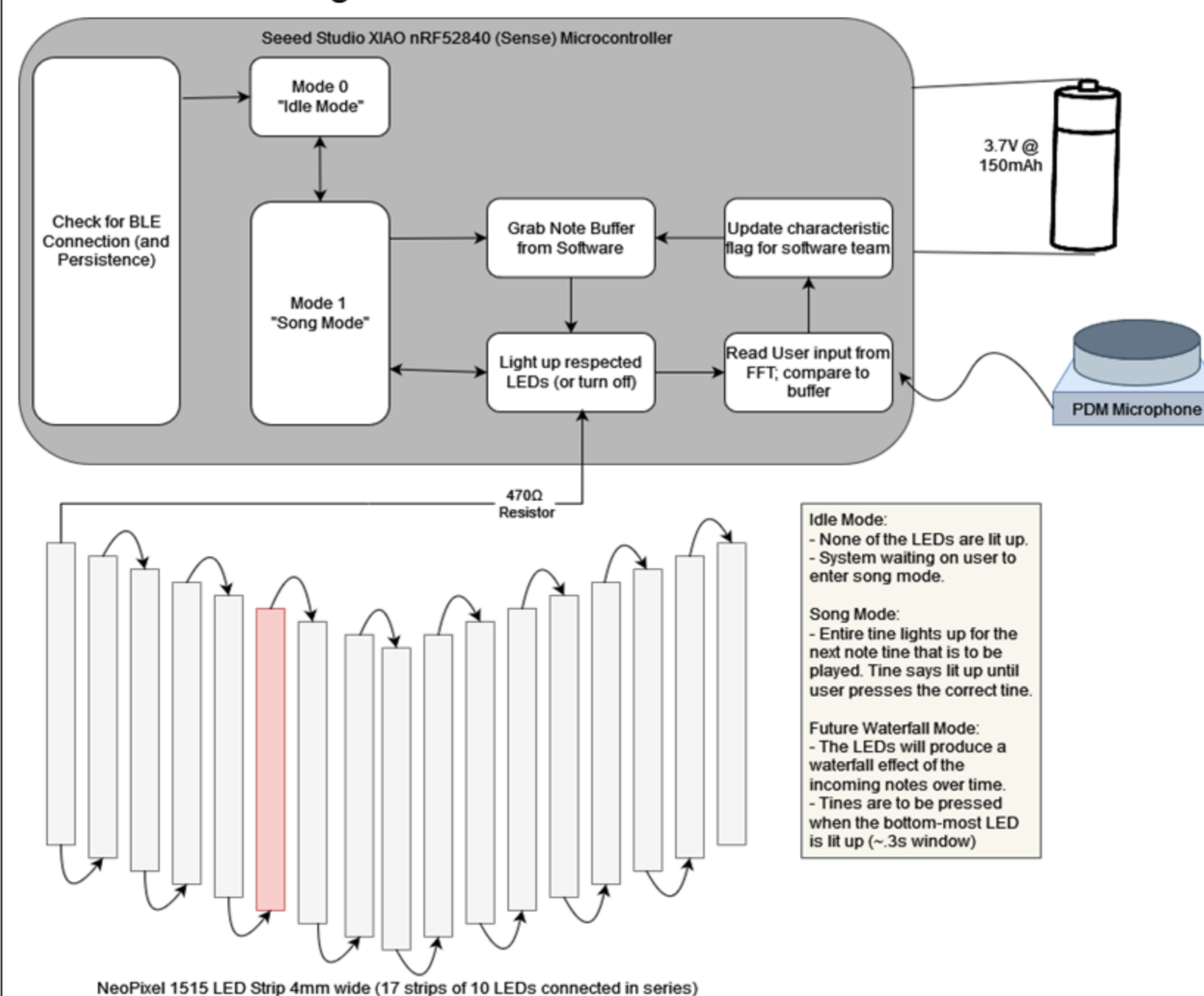
External Resources Required for Mount:

- Seeed Studio XIAO nRF52840 (Sense) Arduino-based Microcontroller
- Adafruit NeoPixel 1515 LED Strip 4mm wide
- 3.7V 250mAh Battery
- 470Ω Resistor



The code for the microcontroller includes the ability to establish a persistent Bluetooth Low Energy (BLE) connection to the Twinkle Tines app that is running on the mobile device. In addition, by feeding the analog signal detected by the built in PDM microphone into a Fast Fourier Transform (FFT), the user's precise input can be determined. Comparing the detected note(s) against the note(s) sent from the software updates the LED and BLE characteristics accordingly.

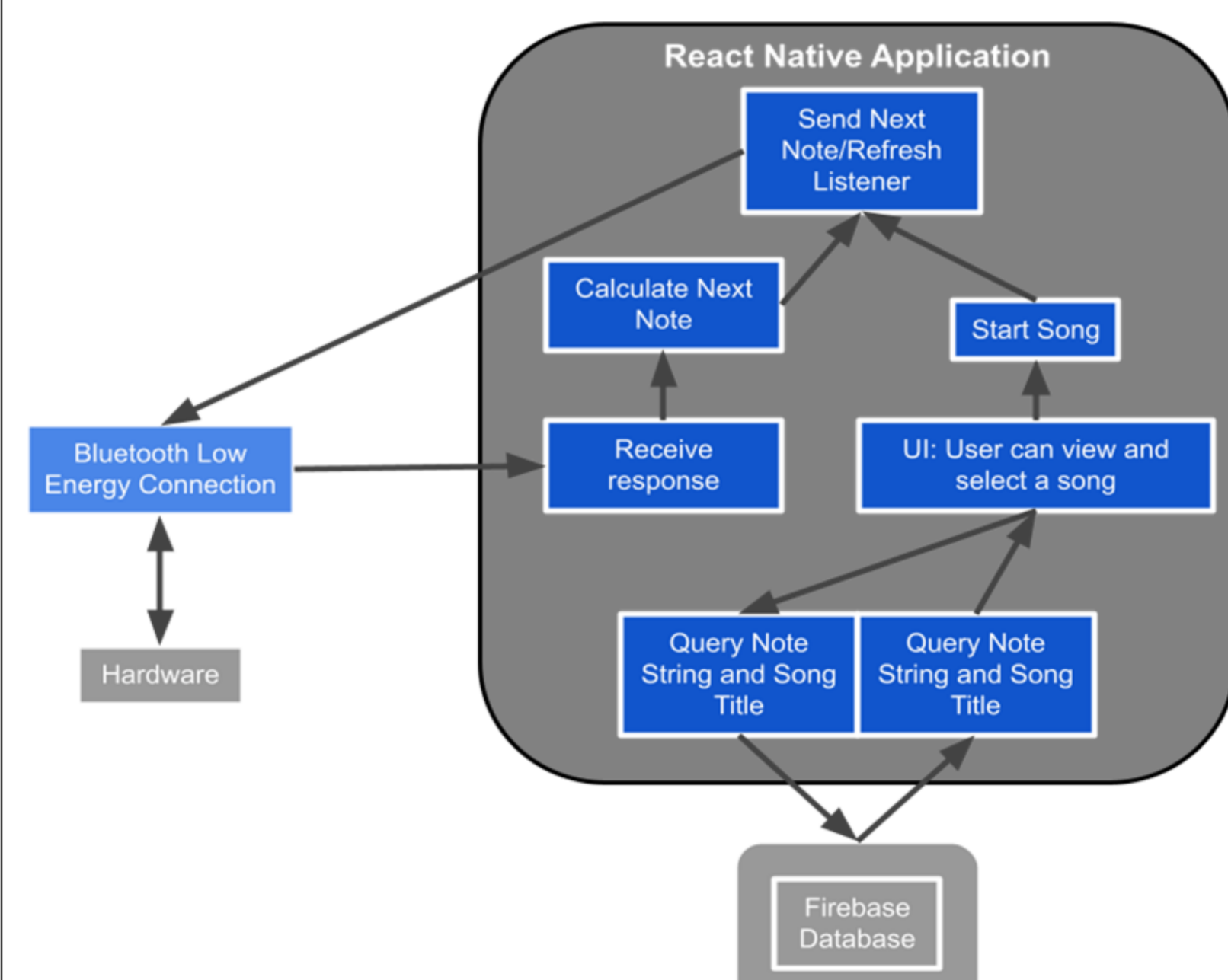
Hardware Challenges: Accurate Note Detection - Getting an accurate frequency reading and eliminating noise from the signal proved difficult and time consuming.



Software

- The **React-Native** environment is responsible for running the Twinkle Tines application that the user interfaces with in order to control the microcontroller/LEDs on the kalimba mount.
- **Figma** was used to help collaboratively design the pages for the application.
- **Firebase** is the tool used to setup a working database for the app that holds all the songs available and the notes that correspond to a particular LED strip

Software Challenges: Getting a working BLE connection - Learned about the basics of Bluetooth and the necessary services and characteristics required to work.



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