



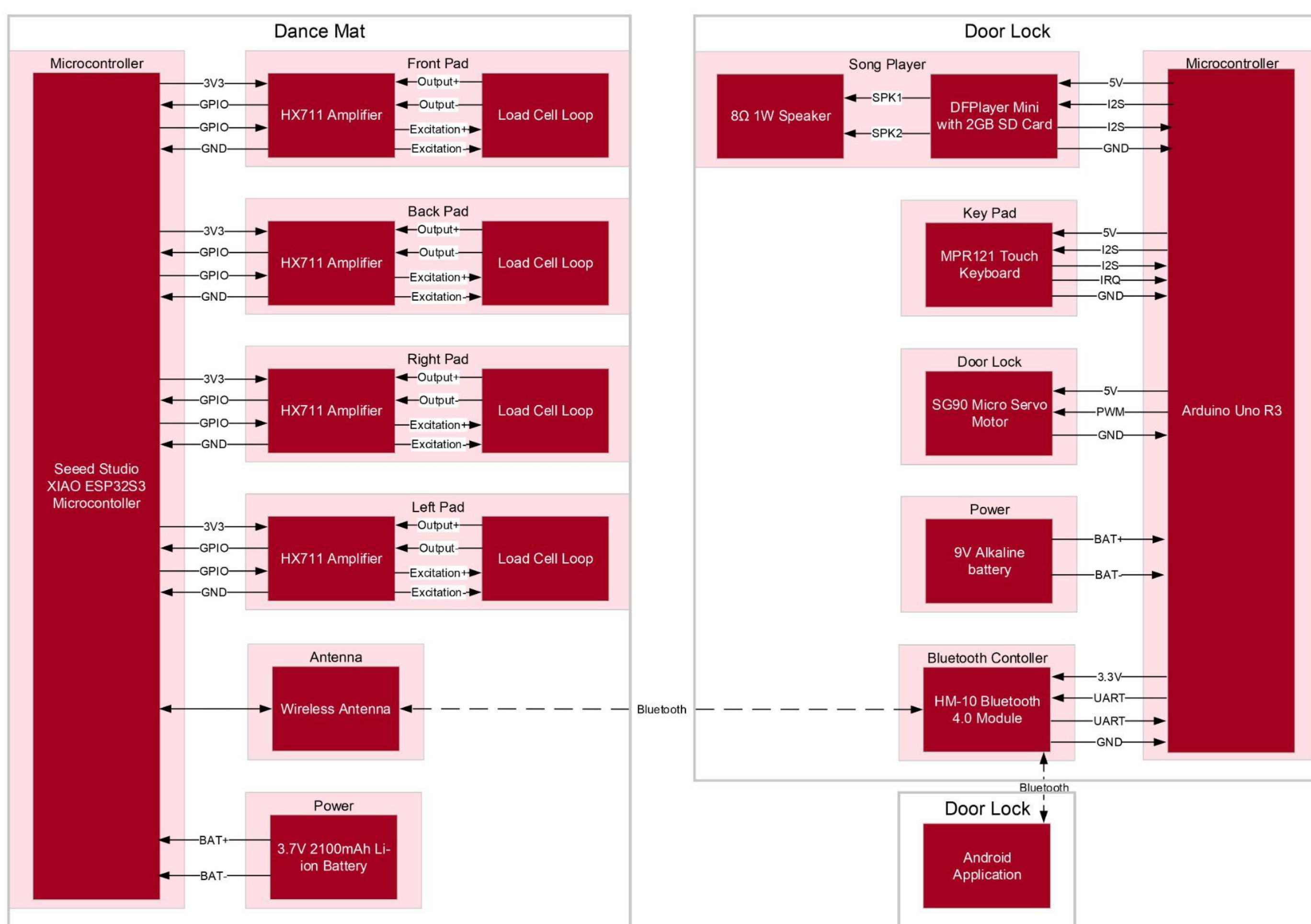
## Product Pitch

BeatLock is a dance alternative to traditional door-locking mechanisms such as keypads and physical keys. The Beatlock system comprises a dance pad doormat, a two-factor authentication app, and a wireless door lock with a speaker and a backup concealed keypad. The motivation behind BeatLock was to create a more secure home locking system that doesn't rely on remembering a physical key while creating a fun and engaging experience in a usually mundane activity. Compared to the current market, Beatlock is more secure than a traditional six-digit code, utilizing two-factor authentication and time-dependent dance moves, and is guaranteed fun with song and dance customization.

## System Architecture

BeatLock consists of three subsystems: the mobile app, the dance mat, and the door lock. All three subsystems connect via Bluetooth.

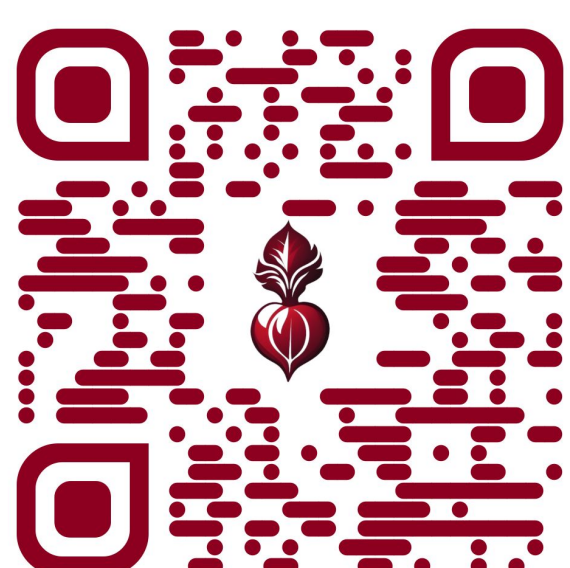
- 1) The mobile app was created using Expo and React Native for an Android smartphone.
- 2) The dance mat is controlled with a Seeed Studio Xiao ESP32S3 microcontroller and utilizes four sets of force sensitive resistors and ADCs.
- 3) The lock is controlled with an Arduino Uno R3, utilizing a capacitive touch keypad, Bluetooth module, DAC Amplifier, 8 Ohm speaker, and micro servo motor.



Block Diagram

## Conclusions & Additional Information

Check out our website here!

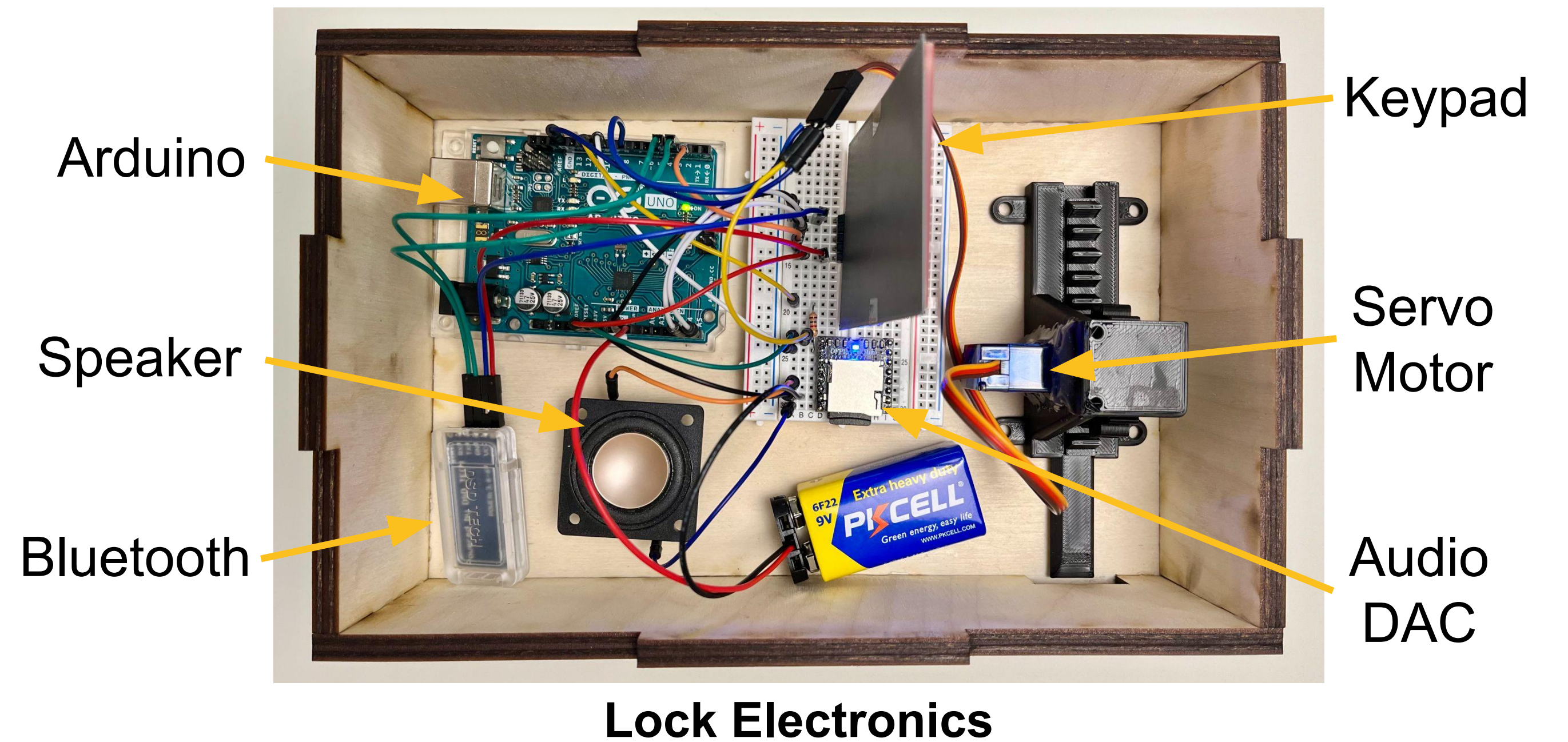


<https://course.ece.cmu.edu/~ece500/projects/s24-team4/>

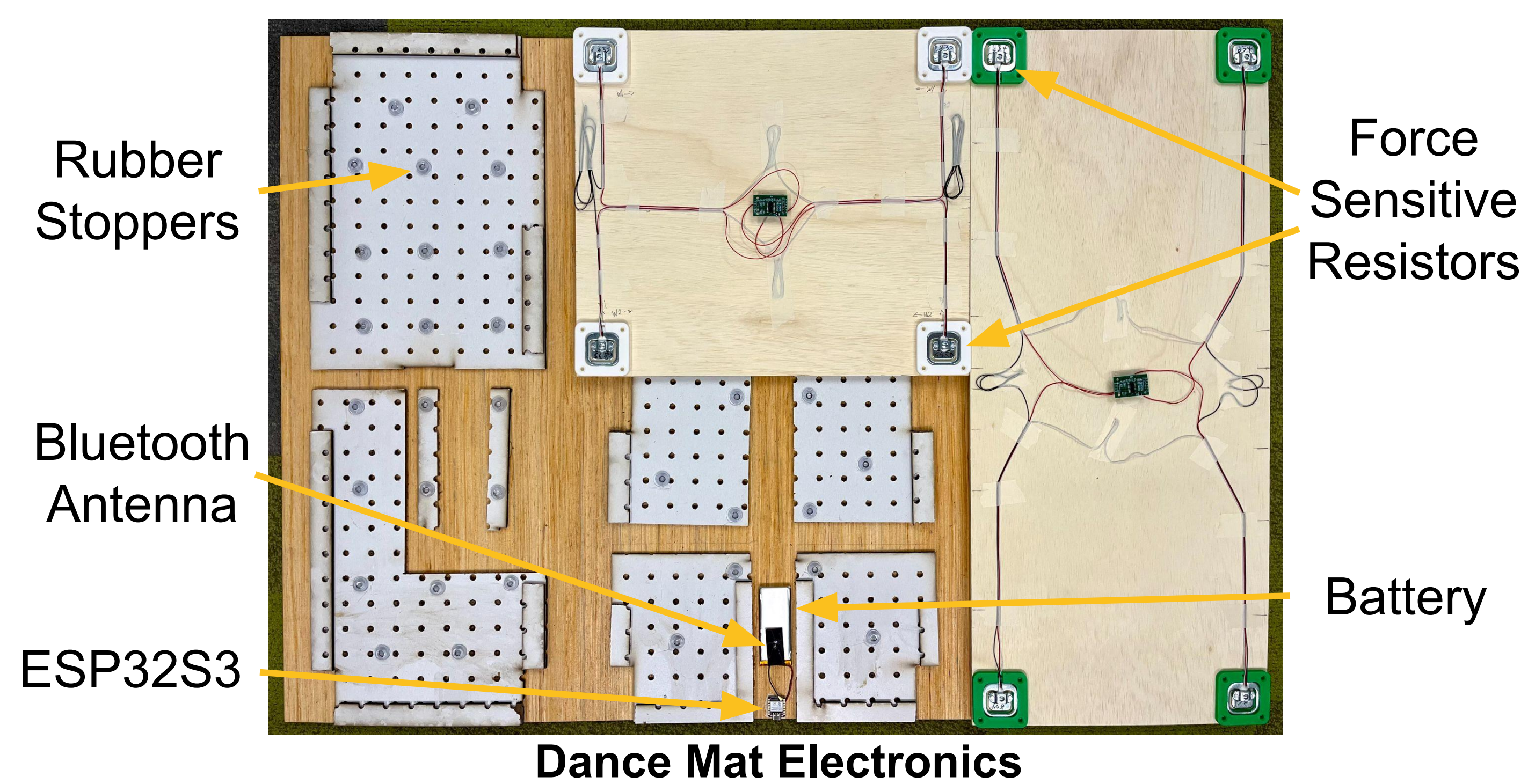
BeatLock has achieved its goal of making a secure and enjoyable alternative to traditional door security. We believe that this can be reproduced at a relatively low cost and meets the needs of our use case.

Throughout the process of designing, assembling, and testing BeatLock, we learned lessons in microcontroller architecture, ordering materials online, time management, and the power of YouTube videos and online forums. With more time, we would implement power saving measures, increase audio quality, and improve mat materials, and design an iOS app.

## System Description



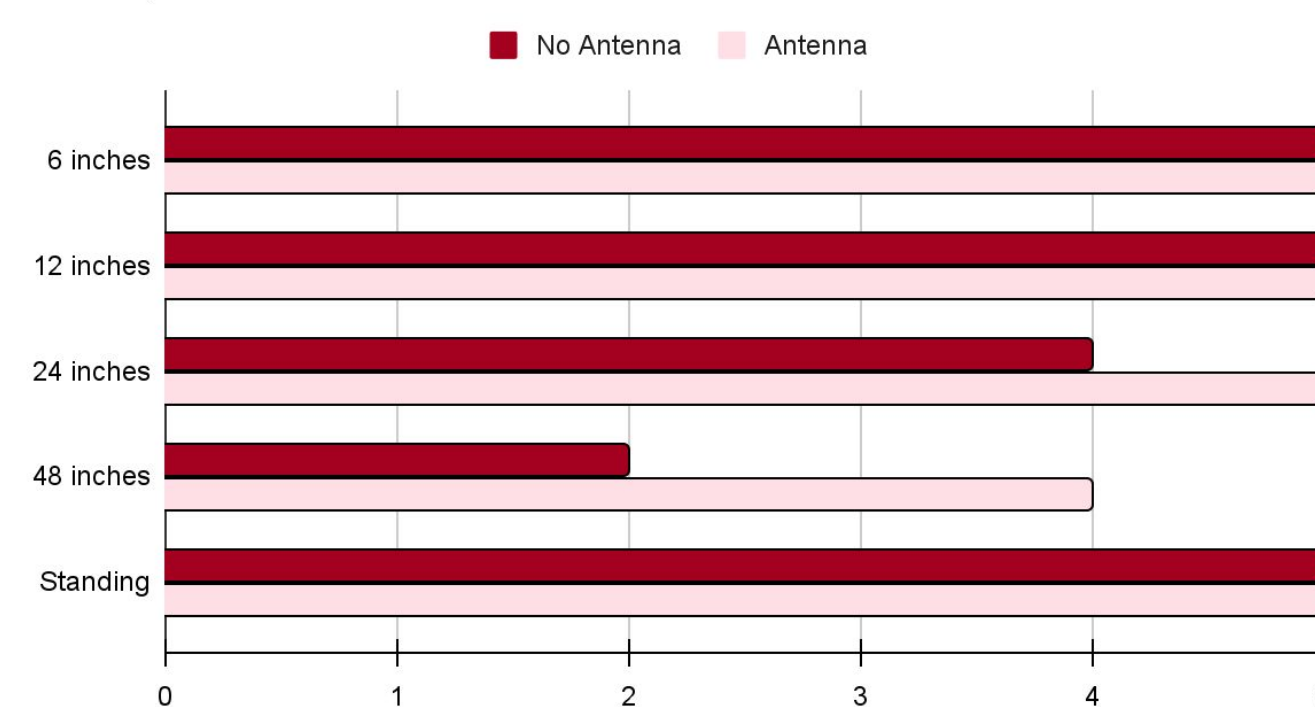
Lock Electronics



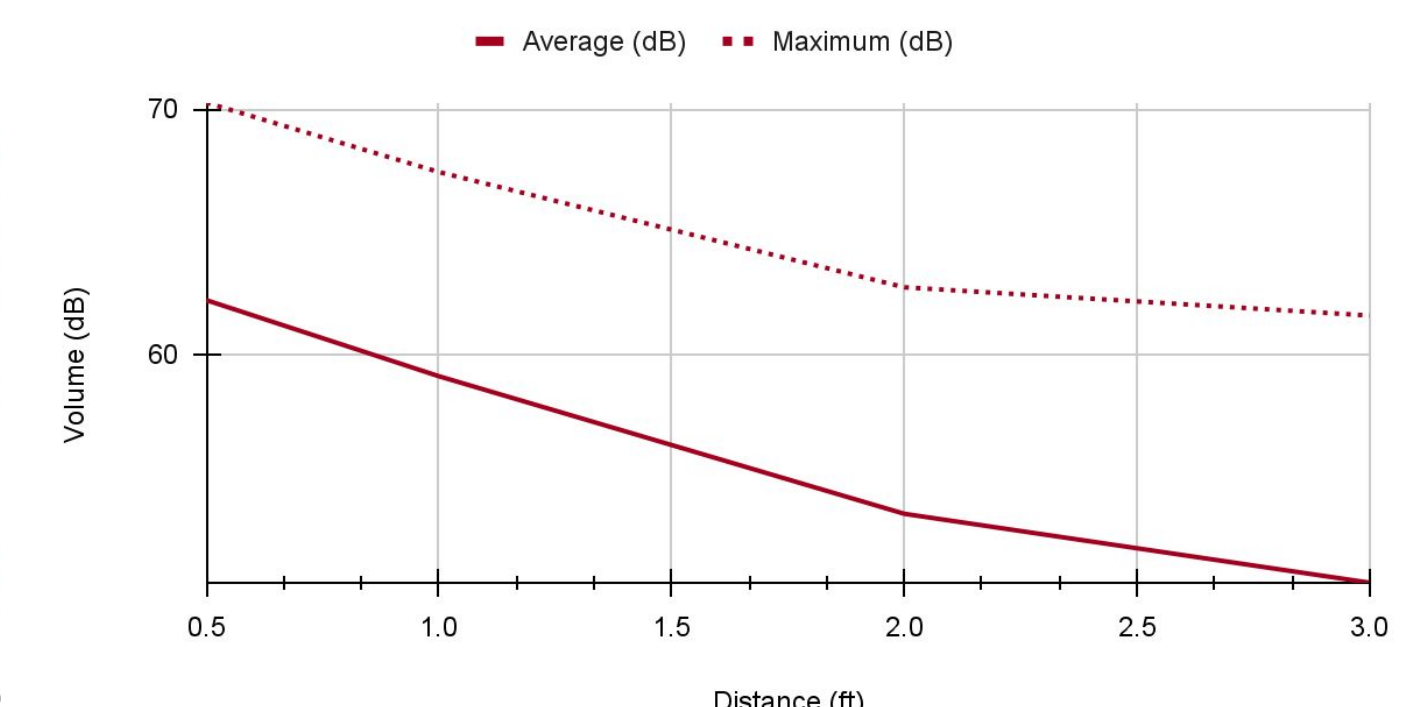
Dance Mat Electronics

## System Evaluation

Timely Bluetooth Connections



Speaker dB Rating



Most of our testing conducted was to ensure the correct functioning of each module or strength of each material. Tests had quantitative benchmarks that we designed for, such as a maximum of 75 dB from the speaker. Mat materials were tested for flexibility and durability. Song selection and Bluetooth connection were tested for the mobile app. The backup keypad was also tested with a security cover.

Component	Functionality
Dance Pad Sensors	100% detection on all pads for all weights
LiPo Battery	Functional power and charging
Wooden Pads	Supports approximately 1800N, partial flexibility, no waterproofing
Polycarbonate Pads	Supports approximately 1800N, complete flexibility, complete waterproofing
Metal Pad Supports	Supports approximately 1800N, complete flexibility, unnecessary bulk

### Trade-Offs

Design Choice	Trade-Off
Arduino Uno R3 for Lock	Size, Complexity, and Cost
6mm Plywood and Rubber Stoppers	Mat Thickness, Durability, and Cost
Micro Servo Motor	Power Consumption vs. Visual