

BULB

Wireless Home Audio and Lighting System



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Overview

The objective of this project was to design an integrated wireless audio and lighting system that:

- Produces high quality wireless sound
- Produces bright white and colored lighting
- Is controlled by Android app through Bluetooth and Wi-Fi
- Fits in a 6" recessed lighting fixture

The most common customer complaints among similar existing systems were that of poor sound quality, weak lighting, and difficulty maintaining a good connection. Thus, prioritization of these three components guided the design of BULB.



Sound

Transducers, amplifiers, and controllers from SONOS' Play:1 were implemented to achieve clear, powerful sound.

Figure 1. Play:1 Woofer

Engineering Challenges

- Design had to fit inside 6" recessed light housing without buzzing
- Electronic components were at risk of overheating without adequate heat dissipation
- Air seal was necessary to maintain sound quality of the woofer
- Lighting needed to be bright enough to match a 40 W bulb
- Signal for Wi-Fi and Bluetooth connections had to be reliable



Figure 2. BULB

Lighting

21 white and 15 RGB LEDs are used to achieve a luminous flux of 525 lumens, exceeding the brightness of a typical 40 Watt bulb.

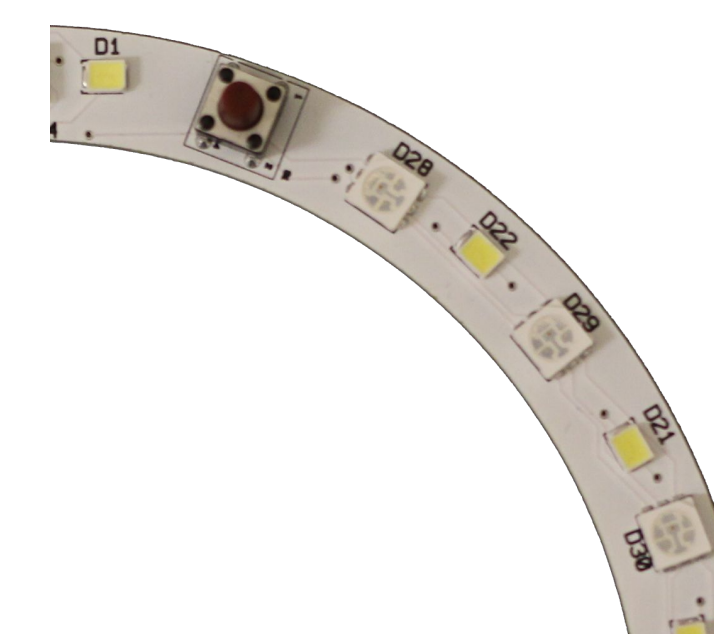
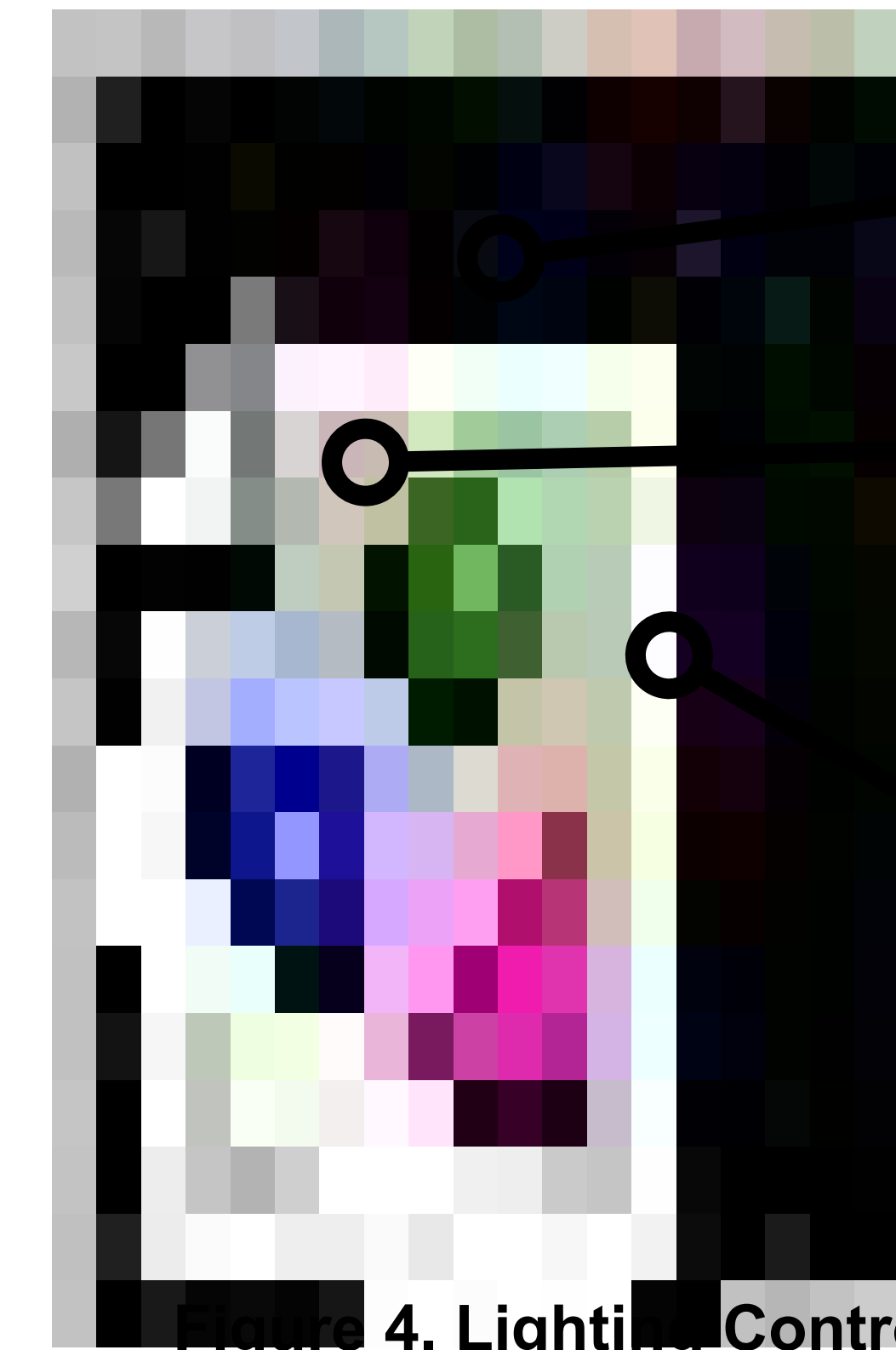


Figure 3. LED Ring



Bluetooth Module

Receives commands from app

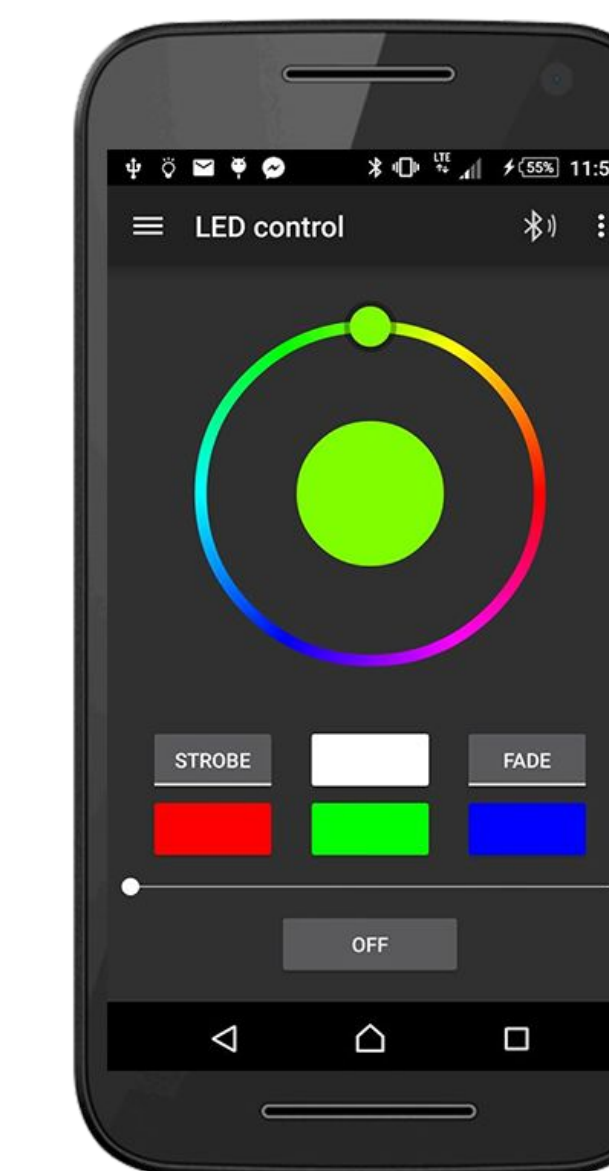
Microcontroller

Receives commands sent from Bluetooth module and sends PWM signals to LED driver

LED Driver

Powers LED ring, and can dim the lights based on PWM duty cycle

Figure 4. Lighting Control Board



Interfacing

The custom android app takes user input through the graphical interface, then sends appropriate signals to the Bluetooth module on the lighting control board, or to the Play:1 board via Wi-Fi.

Figure 5. Android App

Outcomes

The device successfully plays music and produces light without overheating. The app enables sound and light control. Physical thermal testing was performed to confirm overheating is avoided. Weight testing was performed to ensure structural rigidity. The air seal does not meet target specifications, but still adequately improves performance of the woofer. Signal strength is ensured by antenna placement and a protruding enclosure.

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Wireless Home Audio and Lighting System Exploded View

Play:1 PCB and Heatsink

This board connects to the app using Wi-Fi and contains the amplifiers and music playback electronics.

Play:1 Woofer and Tweeter

These are the transducers taken directly from the Play:1. They are aligned coaxially and reproduce sound crisply and clearly.

Lighting Control Board and Heatsink

This board receives signals from the app via Bluetooth, then powers the appropriate strings of LEDs in the LED ring.

LED Ring and Diffuser

The LED ring has 21 white LEDs and 15 RGB LEDs and can exceed the brightness of a typical 40 W incandescent bulb.

