

Smart Lights



By: Group 2

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Project Overview

- Using a Android application, a user can control their lights.
- A user will be able to play a song and have LEDs synchronize to the music playing
- Communication between the LEDs and the cellular device will be based on Wi-Fi communication

Motivation

- Groups interest in IOT
 - It's estimated by 2020 25 billion devices will be connected to the internet
- Make home automation lighting cheaper than what is available today
- Implement a system that is capable of reacting to music and display different light patterns

Project Goals and Objectives

- Develop a system that is capable of being compact and efficient
- Develop a mobile application such that the user can fully control the LED's
- Have a database to store user information and configurations
- Utilize Wi-Fi to ensure that the cellular device is connected to the microcontroller which will then turn on the LEDs when the music is playing from the application.

Why is it needed?

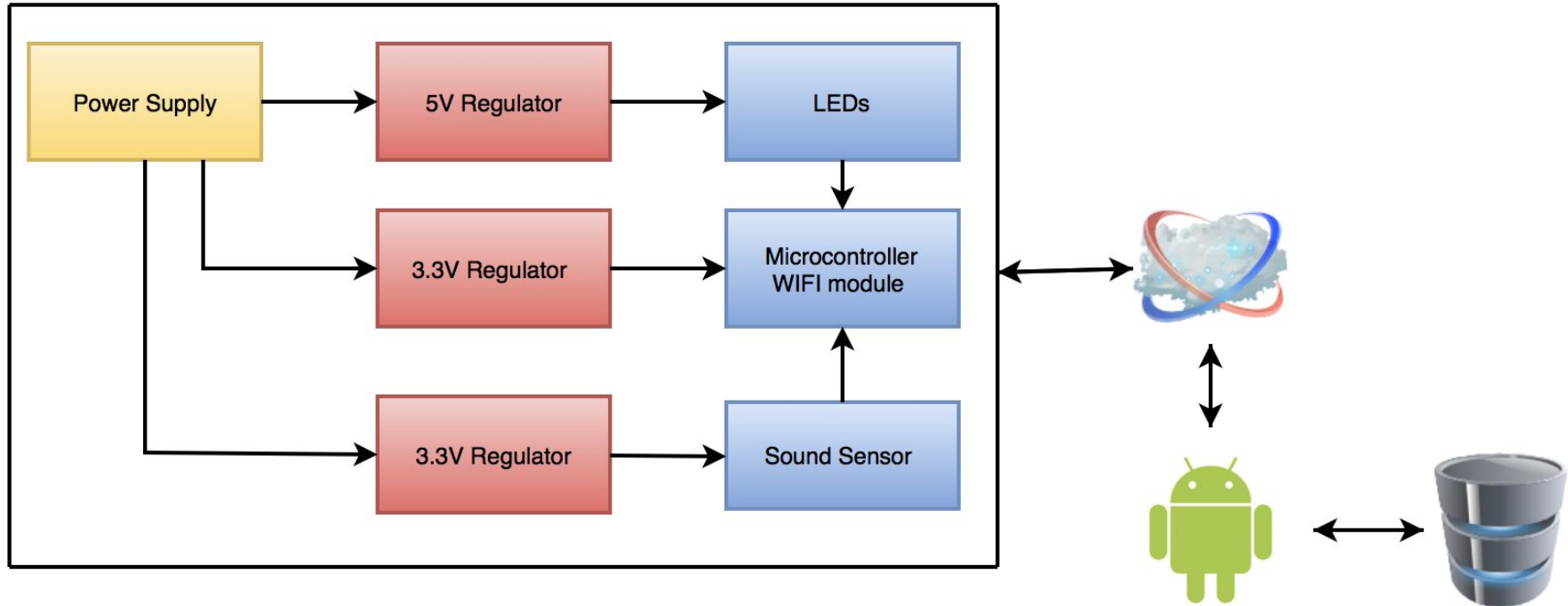
- Not many major competitors
 - PHILIPS HUE
 - LIFX
- Expensive
 - PHILIPS HUE - \$200
 - LIFX - \$60



Specification and Requirements

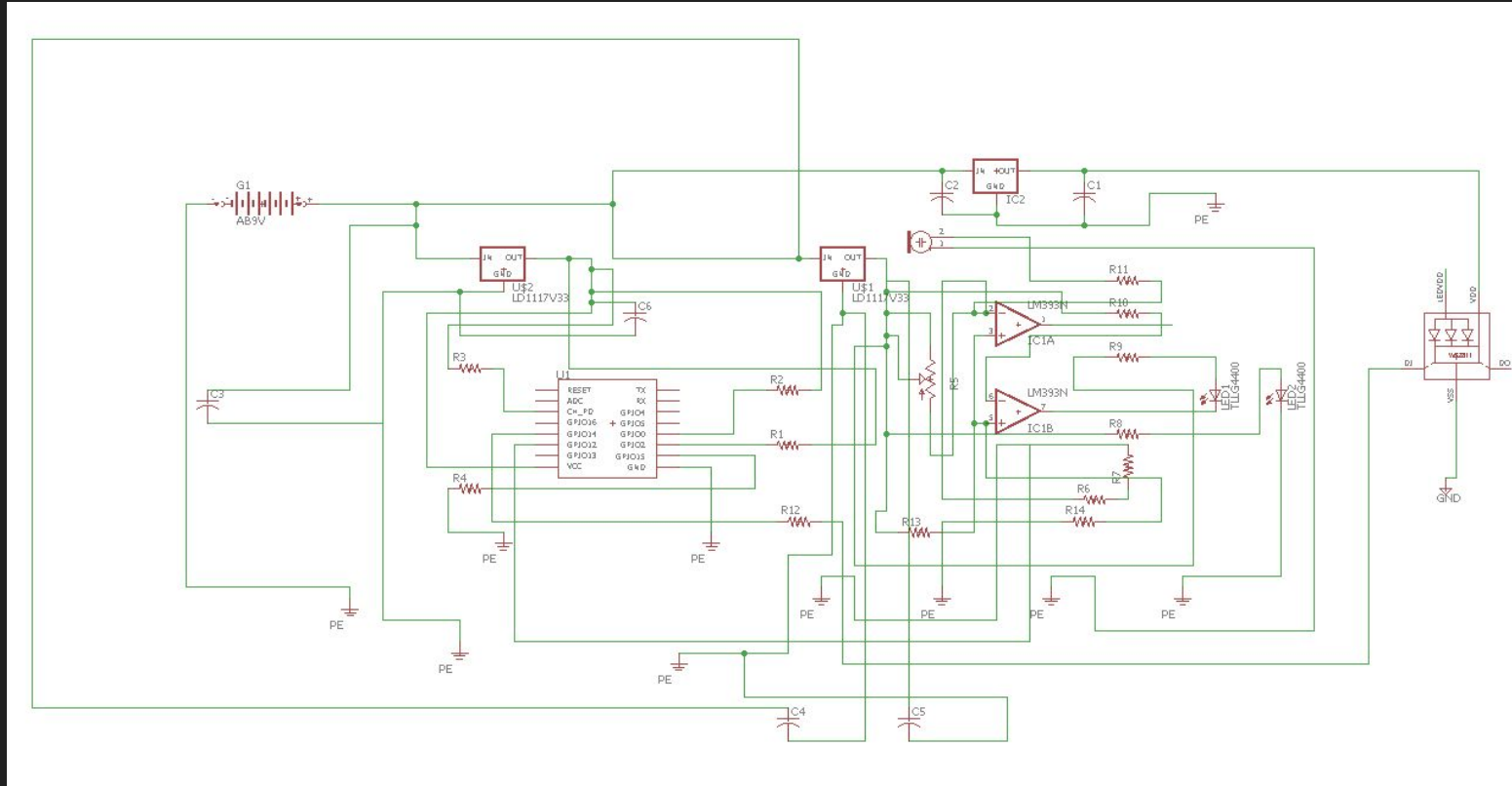
- The system will use a maximum of 5 watts
- Sound will be detected up to a minimum of 6 inches
- Must be able to control light from any room in a house
- We must implement 3 lights each with 10 leds for a total of 30
- User has to control system from mobile device
- LED's react to the beat of different music

System Block Diagram



Smart Lights: Hardware System

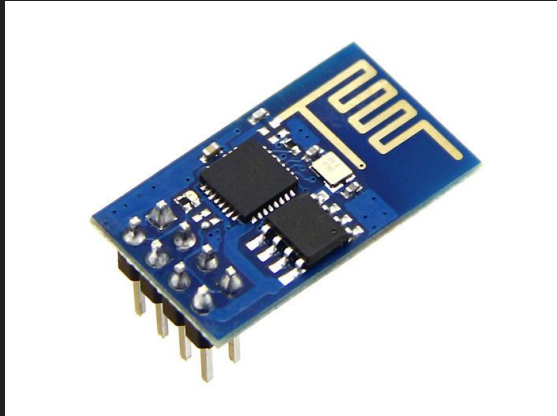
System Design Schematic Diagram



Microcontroller

ESP 8266 ESP-01

- Has 2 GPIO pins
- Operates at 3.3V
- Utilizes only 60mA of current
- Consumes only 0.20 W of power



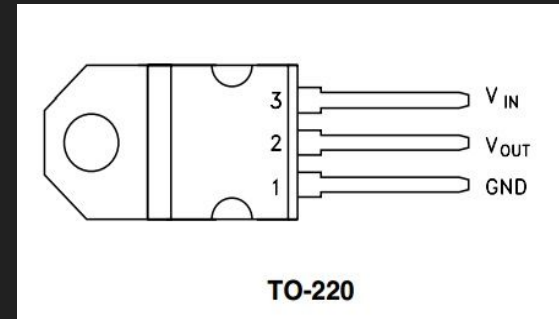
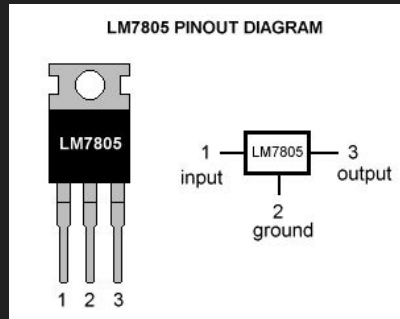
ESP 8266 ESP-12

- Has 11 GPIO pins
- Operates 3.3V
- Contains an Analog-to-Digital Converter
- Utilizes only 80 mA of current
- Consumes 0.26 W of power



Voltage Regulators

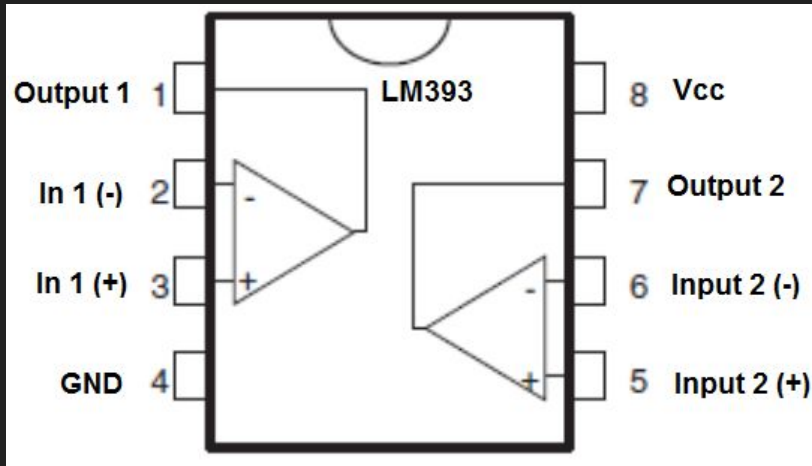
	LM7805	LD1117V33
Output Voltage	5 V	3.3 V
Output Current	1.5 A	0.95 A
Power Consumption	7.5 W	3.1 W



Microphone Chips

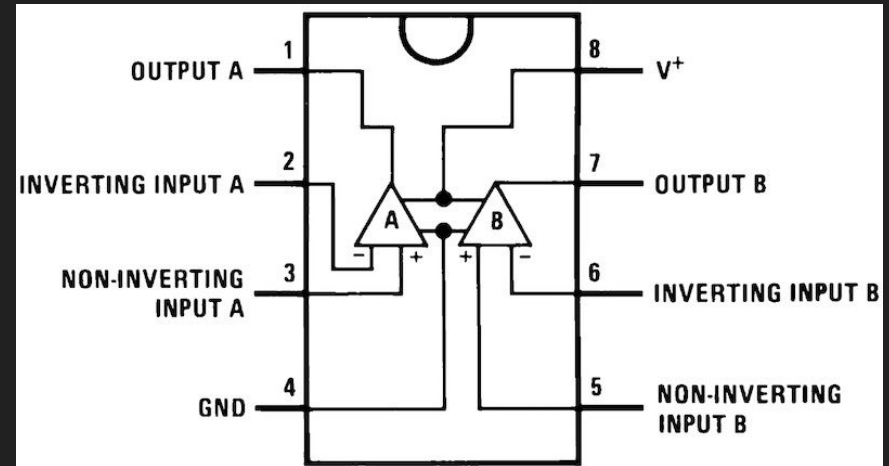
LM393 Comparator

- Operates ideally at 3.3 Volts
- Operates at 1 mA current
- Power Consumed is 0.0033 W



LM358 Operational Amplifier

- Operates at 3.3 V
- Operates at 2 mA of current
- Power consumed 0.0066 W

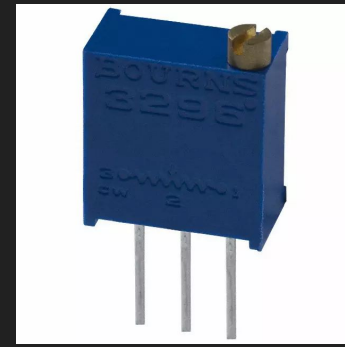


Microphone



	Adafruit Electret Microphone
Operating Frequency	1 KHz
Operating Voltage	1.5 V
Operating Current	0.5 mA
Power Consumption	0.00075 W

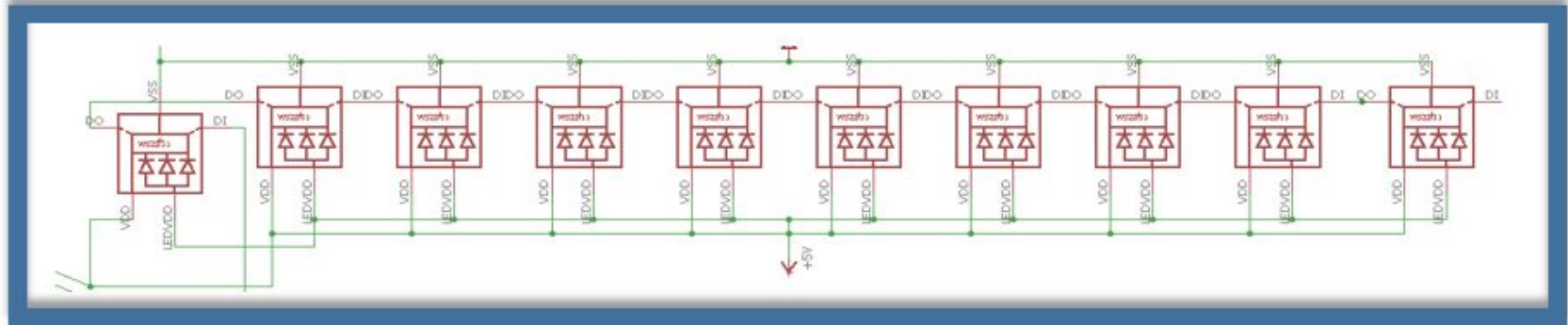
Potentiometer



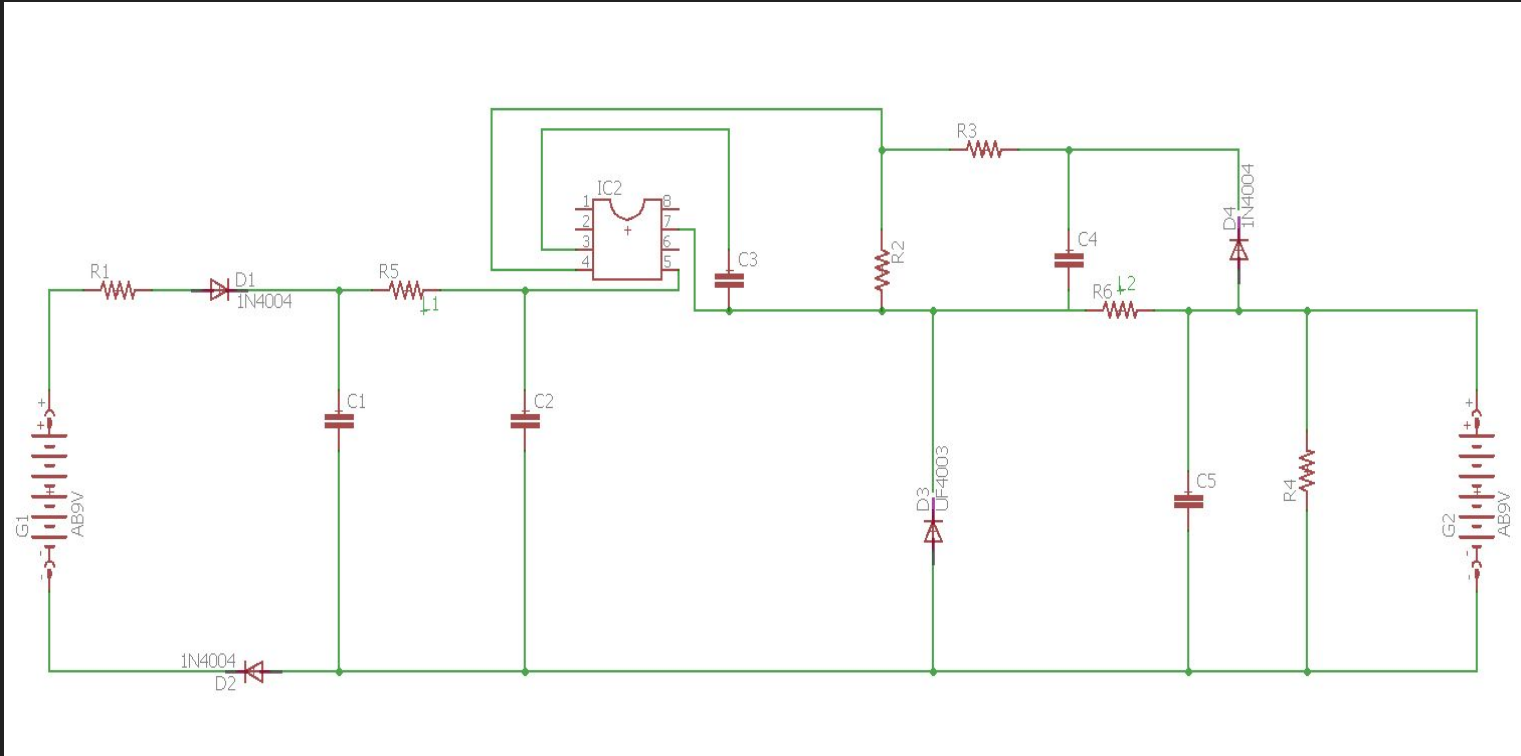
	Bourns 3296
Resistance	100 K Ohms
Maximum Voltage	300 Volts
Rotational Life	200 cycles

Adafruit NeoPixel LEDs

- A thin strip of RGB LEDs that is capable of being controlled to display different LED colors
- Operates at a DC voltage of 5V
- Output current is 0.6 A for 10 LEDs
- Power consumed is 3W.



Power Supply

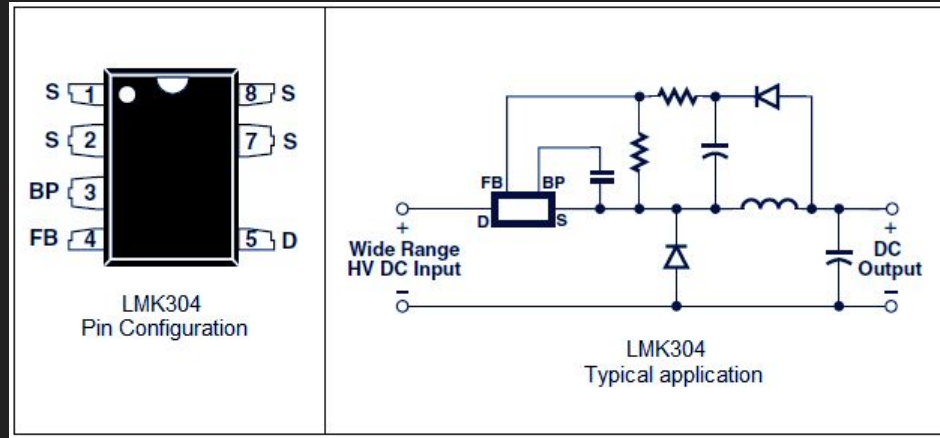


Power Supply

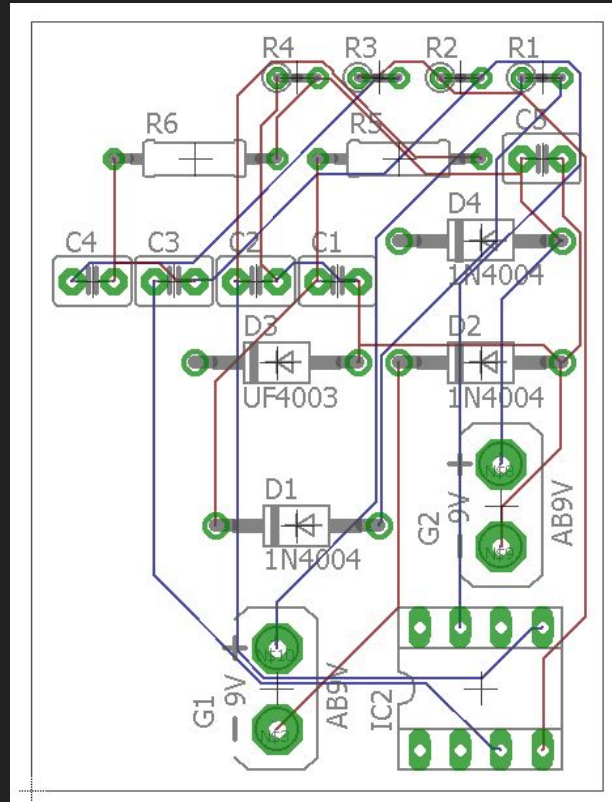
	Power Supply
Input Voltage	120 VAC
Output Voltage	12 V DC
Output Current	1 A

AC/DC Converter Chip

	LNK304
Maximum Input Voltage	265 VAC
Maximum Output Current	120 mA
Maximum Power Consumption	80 mW



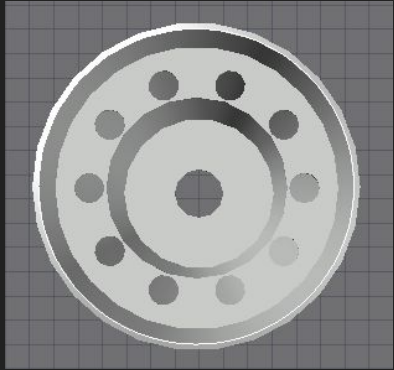
Power Supply PCB Design



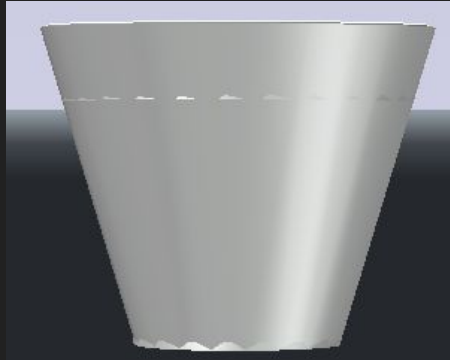
Casing

Autocad Design

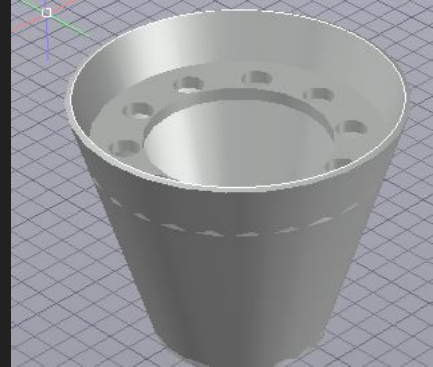
Top view



side view



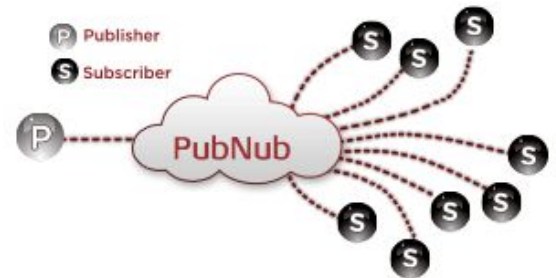
Overall view



Smart Lights Software Overview

Pubnub

- Global data stream network
- Realtime publish subscribe service
- Great for IOT projects
- Give us the ability to scale project easily



Firebase

- Used primarily:
 - Authentication
 - Database
- Email Notification



iOS vs Android

Android:

- Java Programming Language
- Multiplatform support

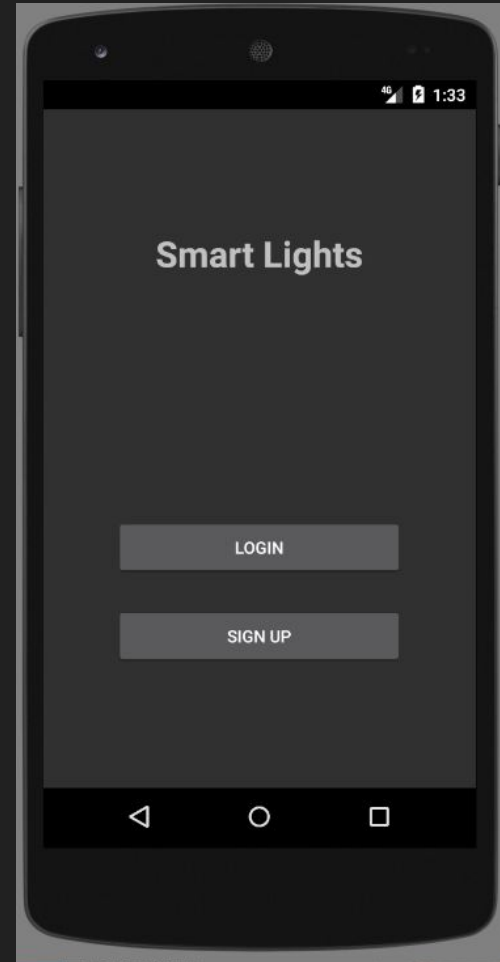
iOS

- Swift
- macOS only
- More expensive

Android Application

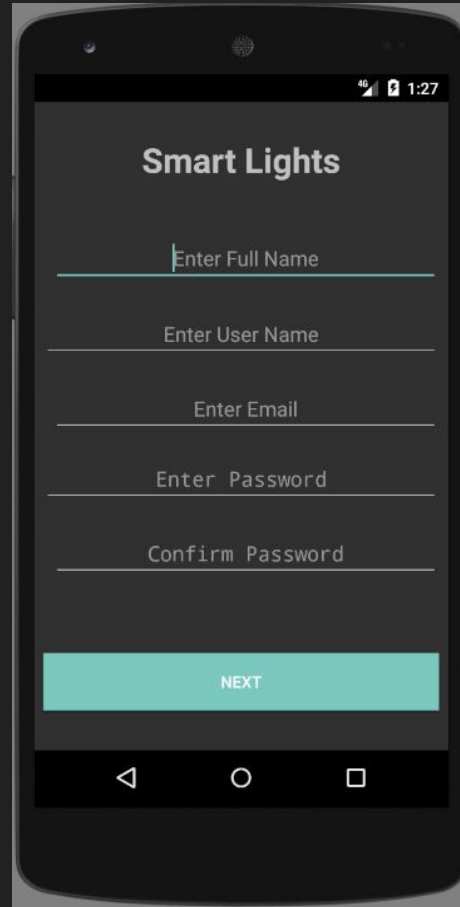
- Allows user to easily control lights
 - Changing the color
 - Switching the state

- Create light presets for different situations
 - Home Setting
 - Away Setting



User Authentication

- User can create an account, authentication uses:
 - Email
 - Password
- User can also store other personal information
- Name each of their lights



Smart Lights

4G 1:27

Enter Full Name

Enter User Name

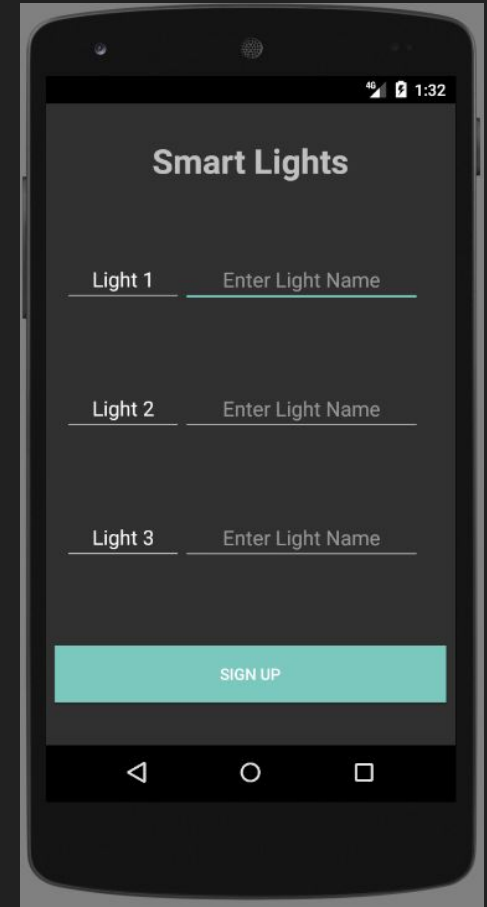
Enter Email

Enter Password

Confirm Password

NEXT

This is a mobile application screen for 'Smart Lights' showing a registration form. The form has five input fields: 'Enter Full Name', 'Enter User Name', 'Enter Email', 'Enter Password', and 'Confirm Password'. A red 'NEXT' button is at the bottom. The status bar shows 4G signal and 1:27 time.



Smart Lights

4G 1:32

Light 1 Enter Light Name

Light 2 Enter Light Name

Light 3 Enter Light Name

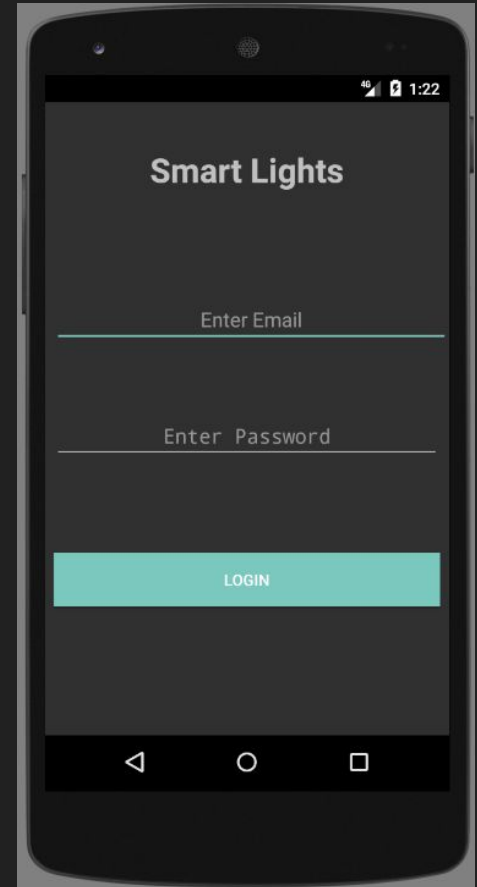
SIGN UP

This is a mobile application screen for 'Smart Lights' showing a naming screen. It has three input fields labeled 'Light 1', 'Light 2', and 'Light 3', each followed by 'Enter Light Name'. A red 'SIGN UP' button is at the bottom. The status bar shows 4G signal and 1:32 time.

Login Screen

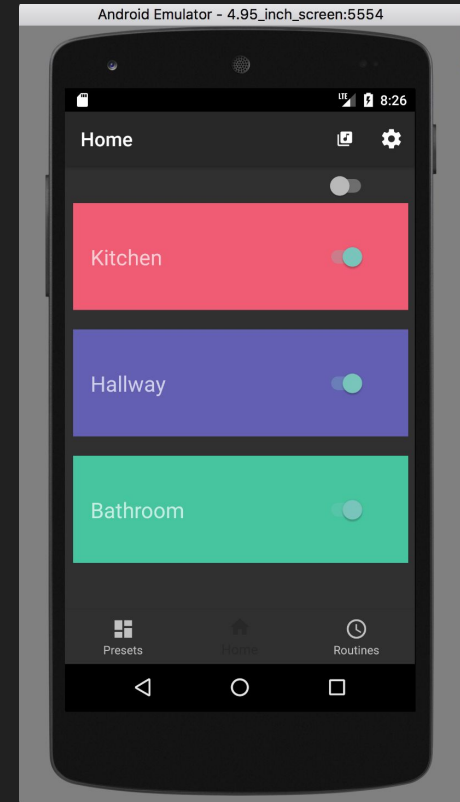
- Login with credentials
- View user specific data

- Firebase Error Checking:
 - Wrong password
 - Unregistered Account



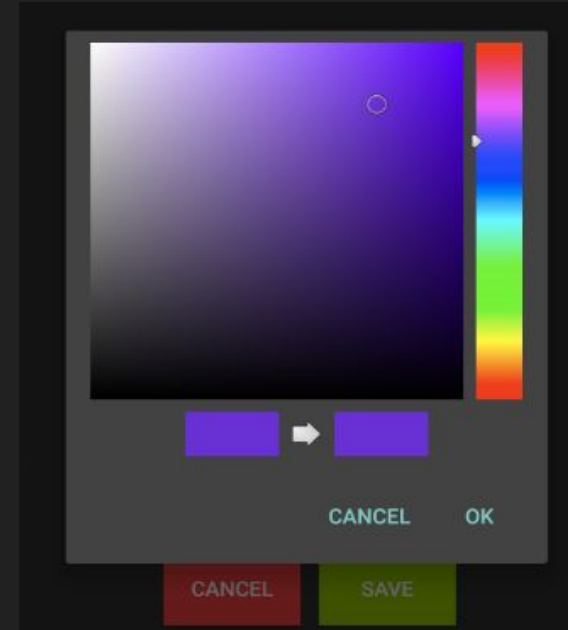
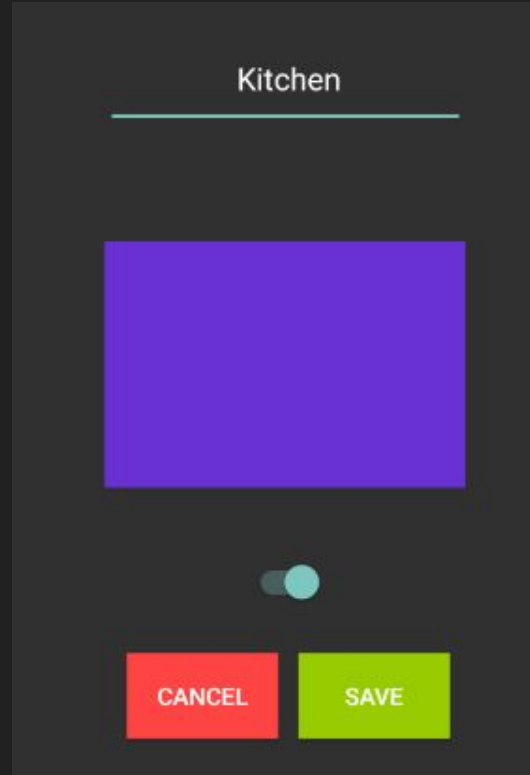
Home Page

- View and control current light states
 - Light Name
 - Color
 - State



Light Details

- Edit all light information
 - Name
 - Color
 - State
- Select color using color picker



Preset Light Settings

- User can create preset light settings for quick selection
- Such as:
 - Home settings
 - Away Settings

- Routines: Time activated light settings

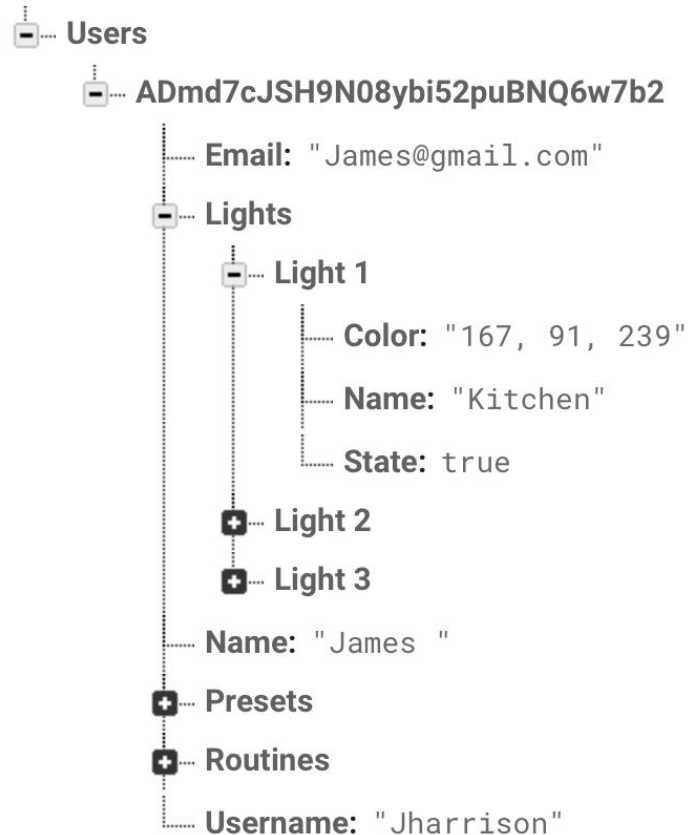
Espresso Testing Framework

- An API in the Android Testing Support Library
- Create reliable UI test based on user actions

Database Structure

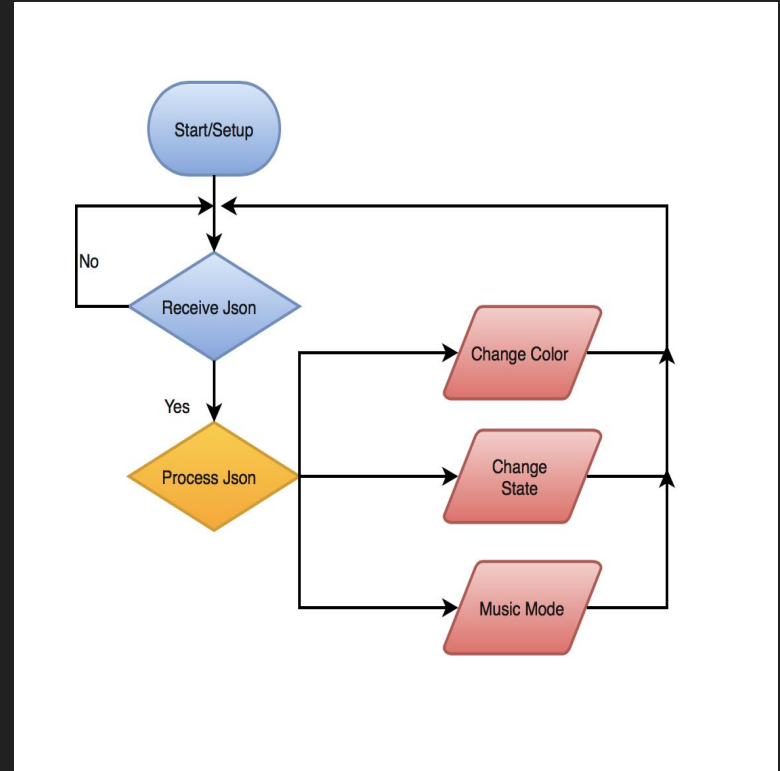
- Stores users information:
 - Name
 - Email
 - Username
- Stores the users light information
 - Color
 - State
 - Name
- Stores the users light presets
- Stores Routines information

smart-light-hub



Embedded software Design

- Start/Setup
 - Connects to Wi-Fi network
- Payload Check
 - Json Object
- Process payload
 - {"0": R, "1": G, "2": B, "3": state, "4": music mode}.
- Active modes
 - Change color
 - Change state
 - Music mode

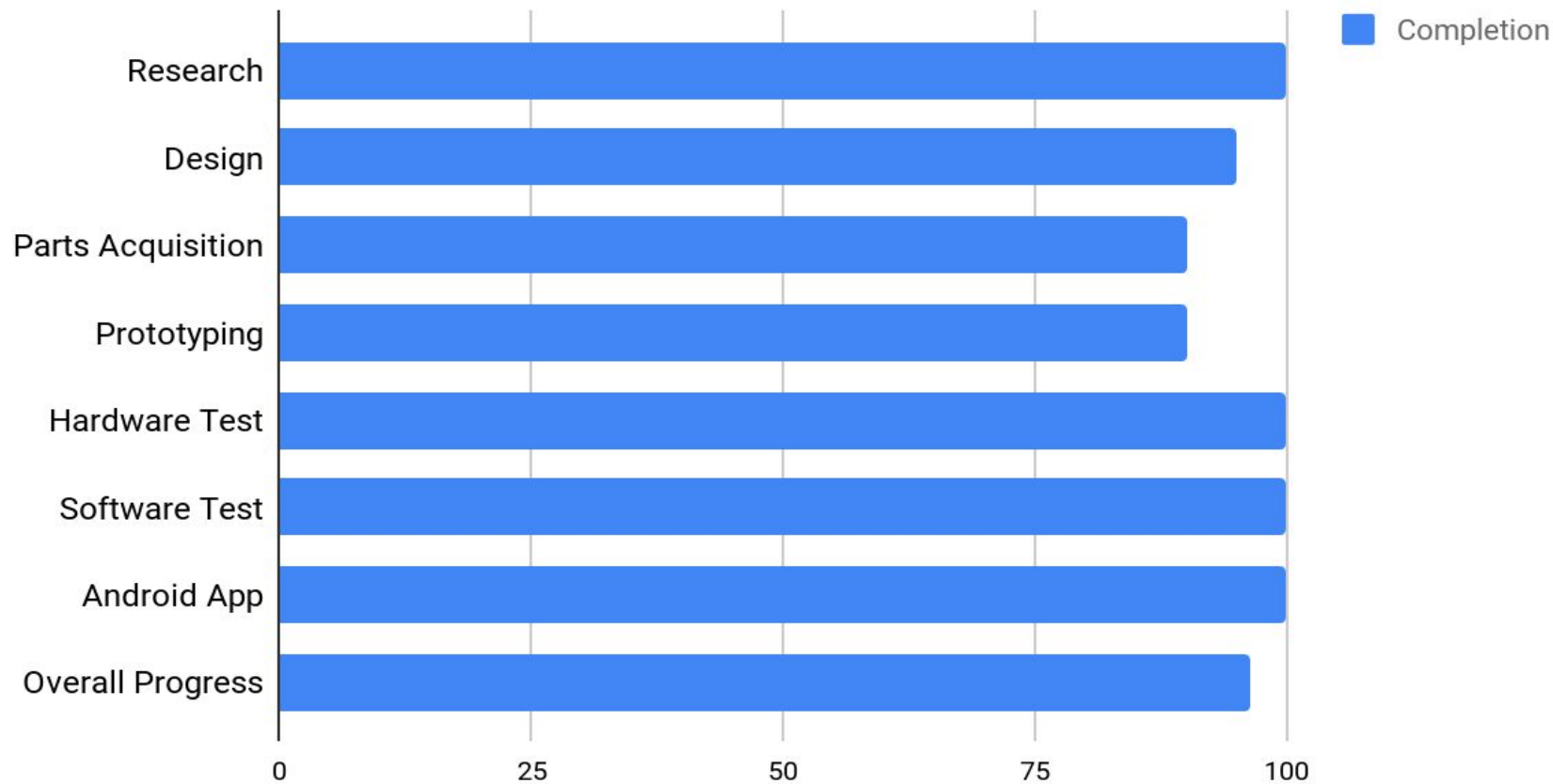


Administrative Content

Budget

Description	Vendor	Price Per Unit	Amount	Total Estimated Price
RGB LED	Adafruit	\$29.99	2	\$59.98
ESP8266 Wi-Fi Module	MakerFire	\$3.99	4	\$15.99
ATmega328P MicroChip	Arduino	\$4.50	3	\$13.49
16 MHz Clock Oscillator	Quartz	\$1.05	10	\$10.50
LM7805CT Linear Voltage Regulator	DataAlchemy	\$5.38	2	\$10.76
LM7805CT Linear Voltage Regulator	ELITE CITI	\$0.67	12	\$7.99
LD1117V33 Low Voltage Regulator	jekewin	\$1.38	6	\$8.33
PCB	PCBWay	\$0.05	10	\$5
Shipping	DHL	\$21	N/A	\$21
LM393 Sound Sensor	Atomic Market	\$6.99	4	\$27.96
Battery Clip Connectors	Pangda US	\$0.30	20	\$5.99
Battery	Energizer	\$7.47	3	\$22.41
TOTAL				\$209.40

Progress



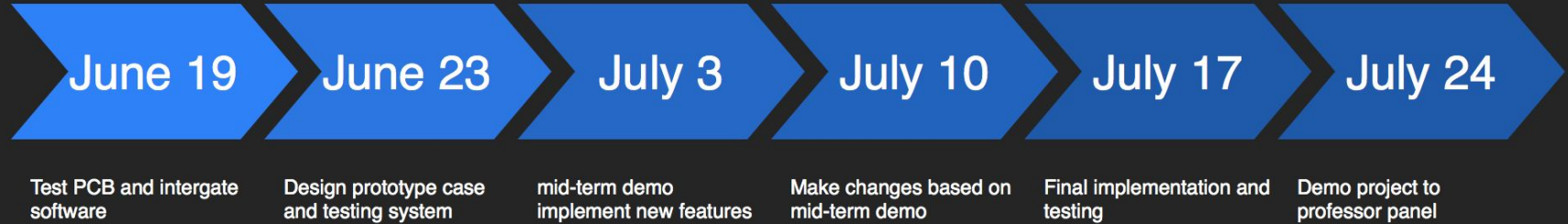
Work Distribution

	Ryad	Kevin	Anthony	James
Research	P	P	P	P
PCB Design	P	S		
System Design	S		P	
Embedded Programming			P	S
PCB Testing	S	P		
Power Distribution	P	P		
Database			S	P
Android App			S	P
Application Test			S	P

Issues

- Microcontroller Issues
 - ESP-01 vs ESP-12
- PCB Issues
 - Power Supply PCB
 - Smart Light PCB
- Power Supply Issues
 - No output DC voltage from design

Project Schedule



Questions?