IR HUB

INITIAL DESIGN REVIEW

By:

Jeremiah Prousalis

Nathaniel Bradley

Jesus Castro

DEVELOPMENT TEAM:

- **Jeremiah Prousalis:**
  - Project Lead
  - Firmware Lead
  - Bluetooth Module Interfacing
- **Nathaniel Bradley:**
  - Hardware Lead
  - Analog IR Design
  - Power System Design
  - PCB Layout Lead
- **Jesus Castro:**
  - Software Lead
  - Android Application

PRODUCT DESCRIPTION:

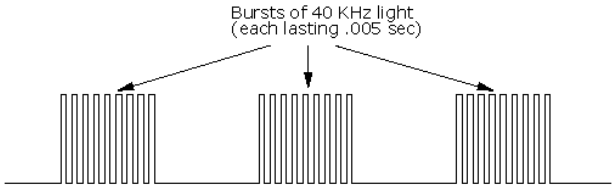
- IR Hub will feature an MCU connected to a **Bluetooth Low Energy Module**
- The BLE Module will enable users to interact with the Hub via an accompanying **Android app**
- An **IR receiver** will be used to read and store button codes from users' remote controls
- An array of **IR LEDs** will be arranged around the perimeter of the PCB allowing known button codes to be rebroadcast on command

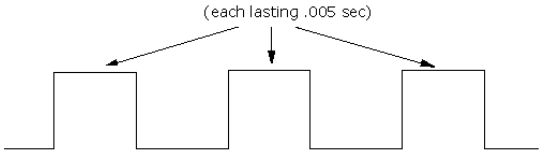
APPLICATION:

- IR Hub will solve the problem of cluttering your living room with one or more infrared remotes by turning your **phone** into a **universal remote**.
- The **IR sensor** will allow the Hub to act as a truly *universal* remote by enabling the device to **learn** the outputs of any remote control no matter how obscure the brand.
- This will all be housed in a domed casing intended to be mounted in a central location of a user's room, and any IR signals transmitted provide **360° room coverage.**

INITIAL SPECIFICATIONS:

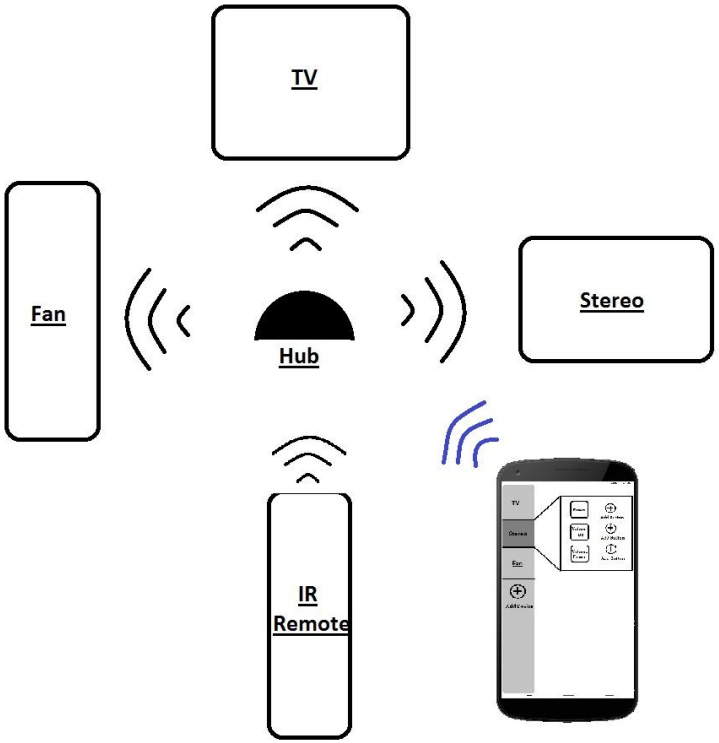
- Bluetooth
  - Bluetooth Low Energy module for communicating with user's phone
- Sensor
  - Infrared phototransistor for reading raw signal from remotes

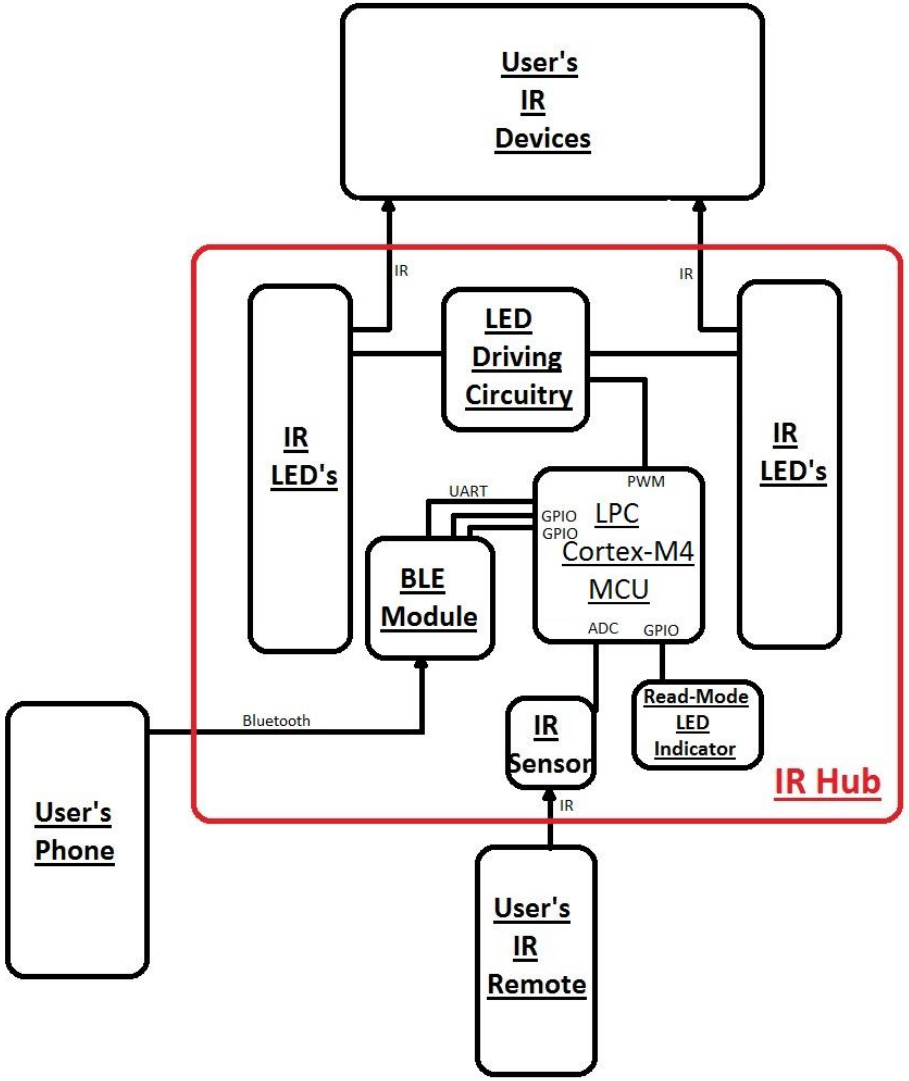




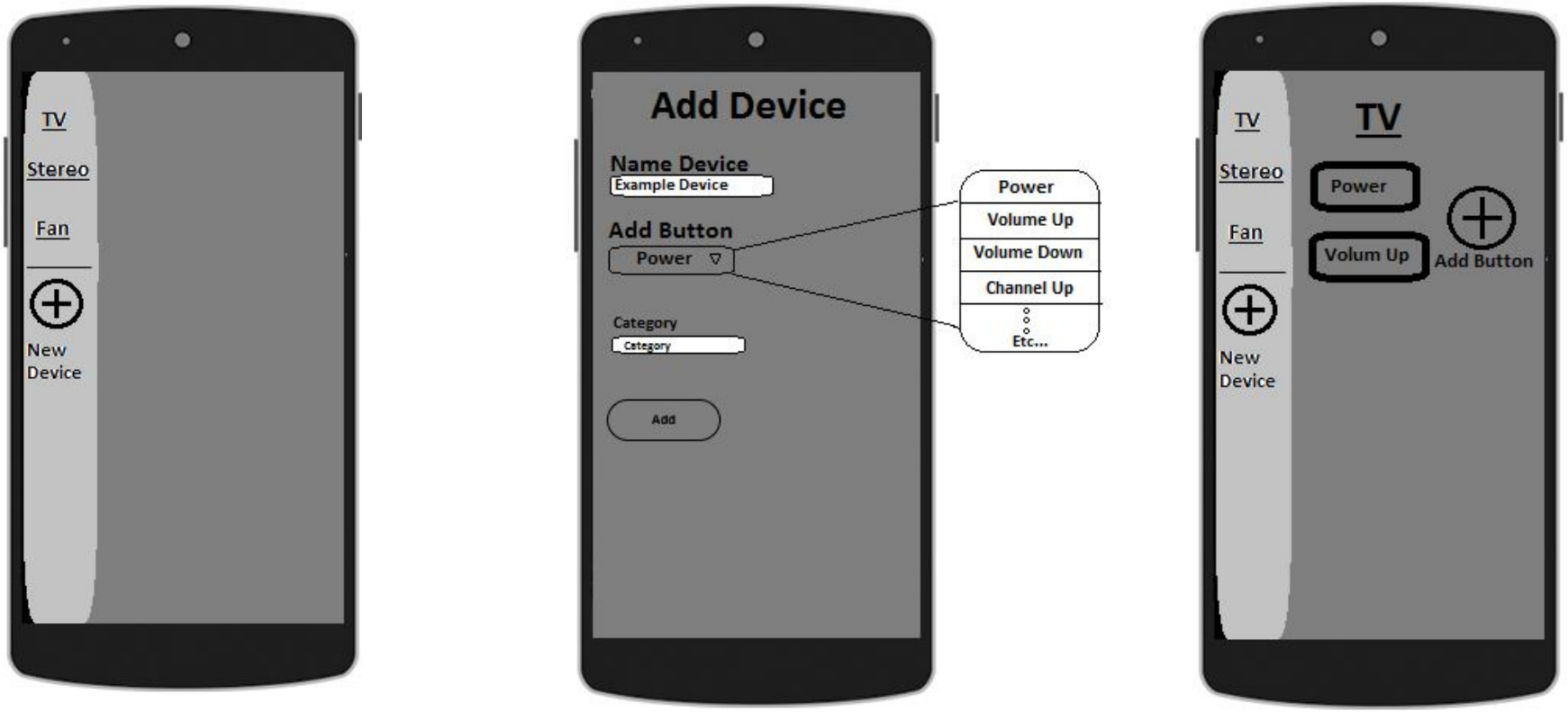
- Transmitter
  - 8 infrared LEDs arranged around the perimeter of the PCB
- Interface
  - Android Application allowing users to create, organize, and activate buttons for various devices

BLOCK DIA


TV
Fan
Hub
Stereo
IR
Remote


User's
IR
Devices
IR
IR
IR
LED's
LED
Driving
Circuitry
IR
LED's
UART
PWM
GPIO
GPIO
LPC
Cortex-M4
MCU
BLE
Module
ADC
GPIO
Read-Mode
LED
Indicator
Bluetooth
IR
Sensor
IR Hub
User's
Phone
IR
User's
IR
Remote

ANDROID APPLICATION MOCKUP:



CRITICAL ELEMENTS:

- Precise signal capturing
- Precise signal broadcasting
- Responsive handling of user input

TECHNOLOGY REUSE:

- BLE Module
  - Existing Adafruit BLE Libraries for nRF51 based modules
- LPCOpen
  - Open source libraries and code

PARTS:

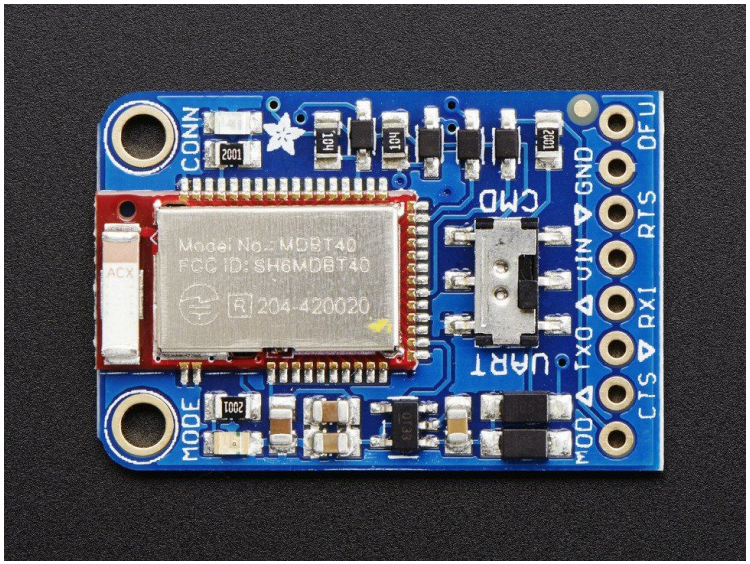
- **Microprocessor**
  - LPC4088
    - 512kB Flash
      - persistent storage used for remote codes
    - 12 bit ADC
      - 400kHz Conversion Rate
    - 120MHz Clock
    - 2.4V-3.6V Supply Voltage
    - UART Interface
    - On-Board PWM

    - **Cost:** $12.90

PARTS:

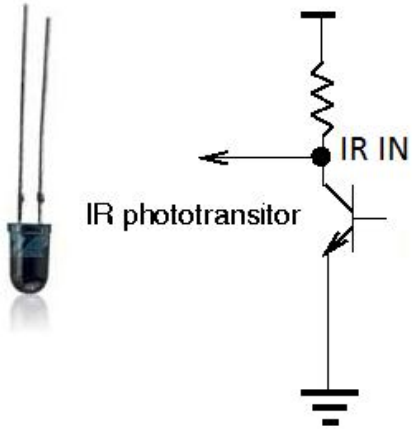
- **Bluetooth Module**
  - Adafruit Bluefruit LE
    - UART interface at 9600 baud
    - HW flow control (CTRS, RTS)
    - Simple AT command set for configuration
    - 3.3V Supply Voltage
    - 20 mA peak current consumption
    - On-board ADC for battery read

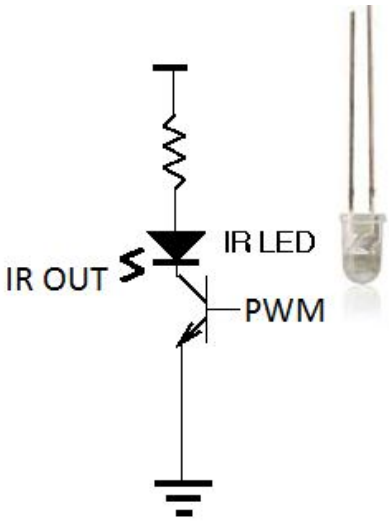
    - **Cost: $17.50**



PARTS:

- **IR I/O**
  - IR NPN Phototransistor
  - 8 IR LEDs
    - 940nm wavelength
    - 1.35V
    - 100mA
  - **Cost: ~$3.00**





APPROXIMATE BILL OF MATERIALS:

Ref Des	Part Label	Manufacturer	Manufacturer Part Number	Units per Board / System	Total Units	Unit Price	Total Price	Description
Board Mounted Components								
U1	uController	NXP Semiconductors	LPC4088FBD208,551	1	3	$13.53	$40.59	MCU 512K FLASH LQFP
U	BLE Module	Adafruit		1	3	$17.50	$52.50	BLE Module
	Phototransistor			1	3	$0.50	$1.50	IR Sensor
D	Diode			8	24	$0.79	$18.96	IR LED
D	Diode			1	3	$0.27	$0.81	Red LED
D	Diode			1	3	$0.22	$0.66	Green LED
D	Diode			1	3	$1.98	$5.94	Blue LED
							Total:	**$120.96**