H.A.P.P.I. SYSTEMS

Group 10
University of Central Florida
Senior Design Fall 2016

Team Members

Johnnie Greene

Physics & Photonic Science Engineer

Taylor Griffith

Computer Engineer

Philip Bent

Computer Engineer

Sidney Jean-Baptiste

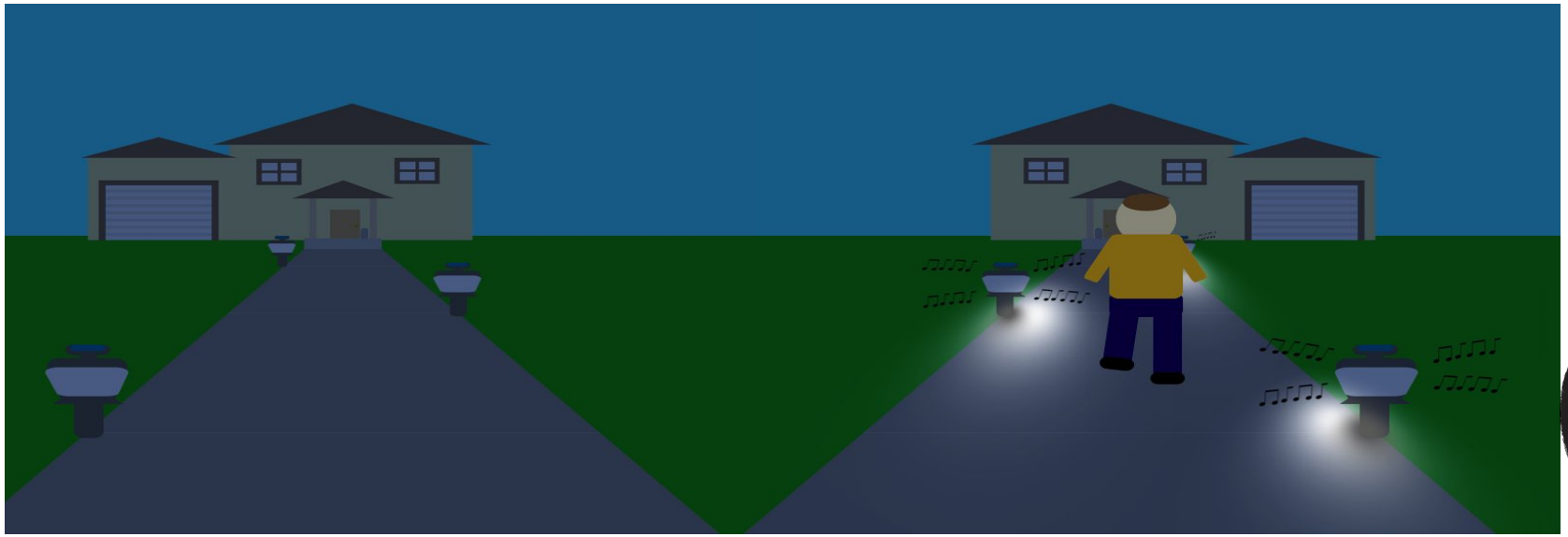
Electrical Engineer

Motivation

- A single Bluetooth receiver that can connect to multiple Bluetooth devices at once.
- Home Audio Programmable Pathway Illuminations Systems

Goals and Objectives

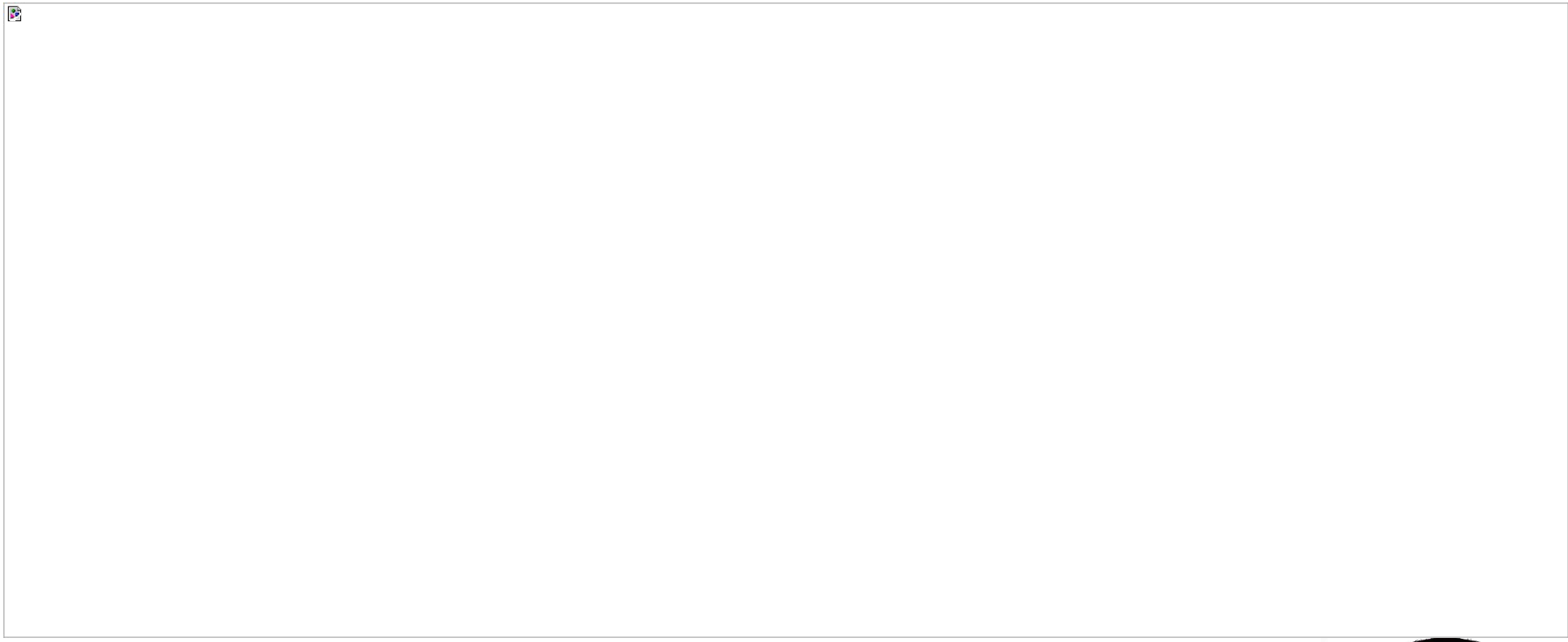
- Network of wireless lawn spike
  - *Equipped :*
    - *LEDs*
    - *Speakers*
    - *Bluetooth*
- Central Hub
  - *Equipped:*
    - Humanoid Detection
    - LEDs
    - Speakers
    - Wireless Connectivity



Specifications

- Solar Powered Charging Unit
- Rechargeable Battery
- Wireless Speaker range of 20 ft
- Dual Motion Sensor
- Range Detection of 20 ft
- 85% Accuracy of Humanoid Detection

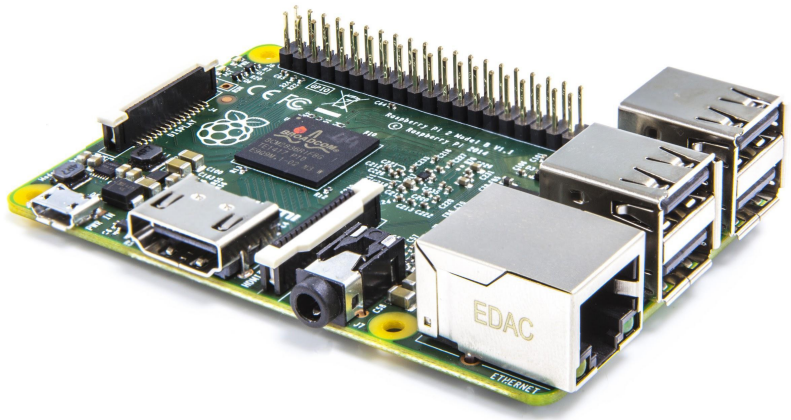
Overall Block Diagram



Central Hub

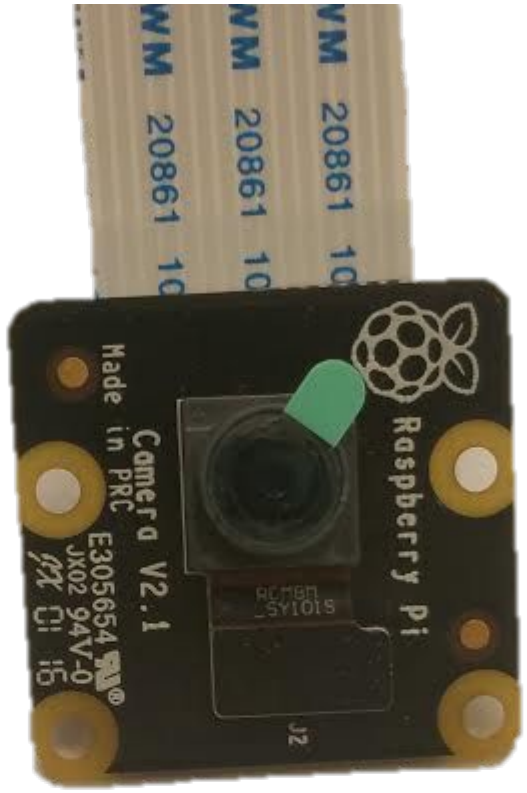
Central Hub - Single Board Computer

- Raspberry Pi 2 Model B
  - 900MHz quad-core Arm Cortex A7 CPU
  - 1GB RAM
  - 4 USB Ports
    - *Bluetooth USB Dongle*
    - *WiFi b/g/n USB Dongle*
  - 40 GPIO Pins



Central Hub - Camera

- Based on the Sony Exmor R IMX219 Sensor
  - 8MP Camera
  - 4K still pictures
  - 1080P 30 fps

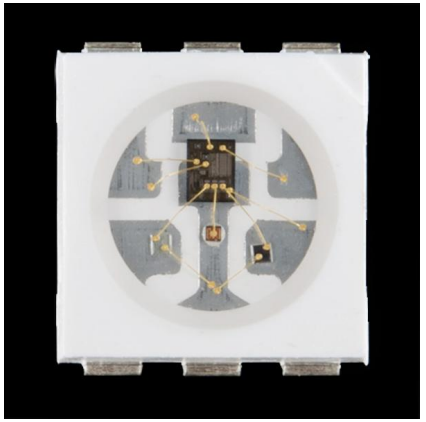


Central Hub – PIR Sensors

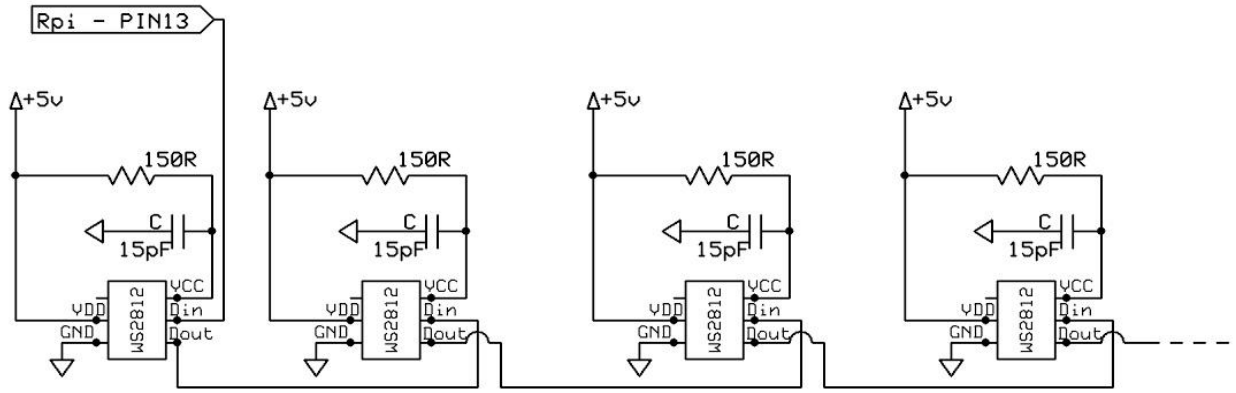
- Operating Voltage 5V – 12V
- Sentry Angle of 110 degrees
- Range of detection 20 ft

Central Hub - LEDs

- SMD 5050 WS2812
  - Tri-color LEDs
  - Integrated LED driver



Central Hub - LEDs



HAPPI - Group10		
WS2812 Daisy Chain Schematic		
Taylor Griffith	Rev 1.0 7/28/2016	-

Central Hub - Speakers

- Central Hub contains 2 speakers
- •8 ohm 1 Watt
- • Connected via 2.1 W Class D Audio Amplifier
- •Weatherproof
  - High gloss polymer

Central Hub - Power Supply

- Portability
- Sustainability
- Effective Overall Use
- DC Battery Source
- 120 AC Wall Outlet/ 12 V DC adapter

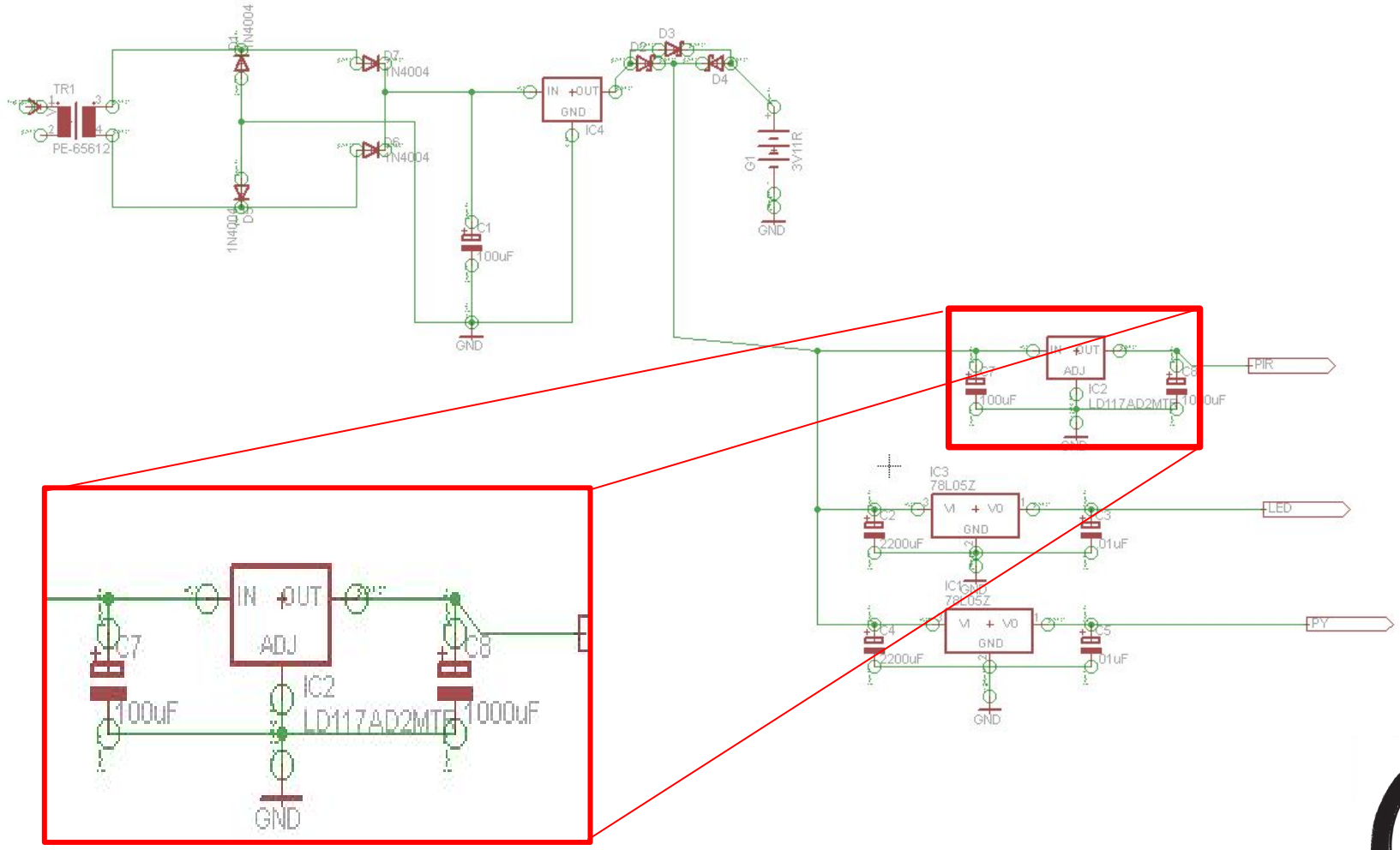
Battery Type

- •NiMH
- •Higher Charge density compared to Nickel Cadmium & Lithium Ion Batteries
- •1.2-1.5 V AA batteries
- •5000 mAh

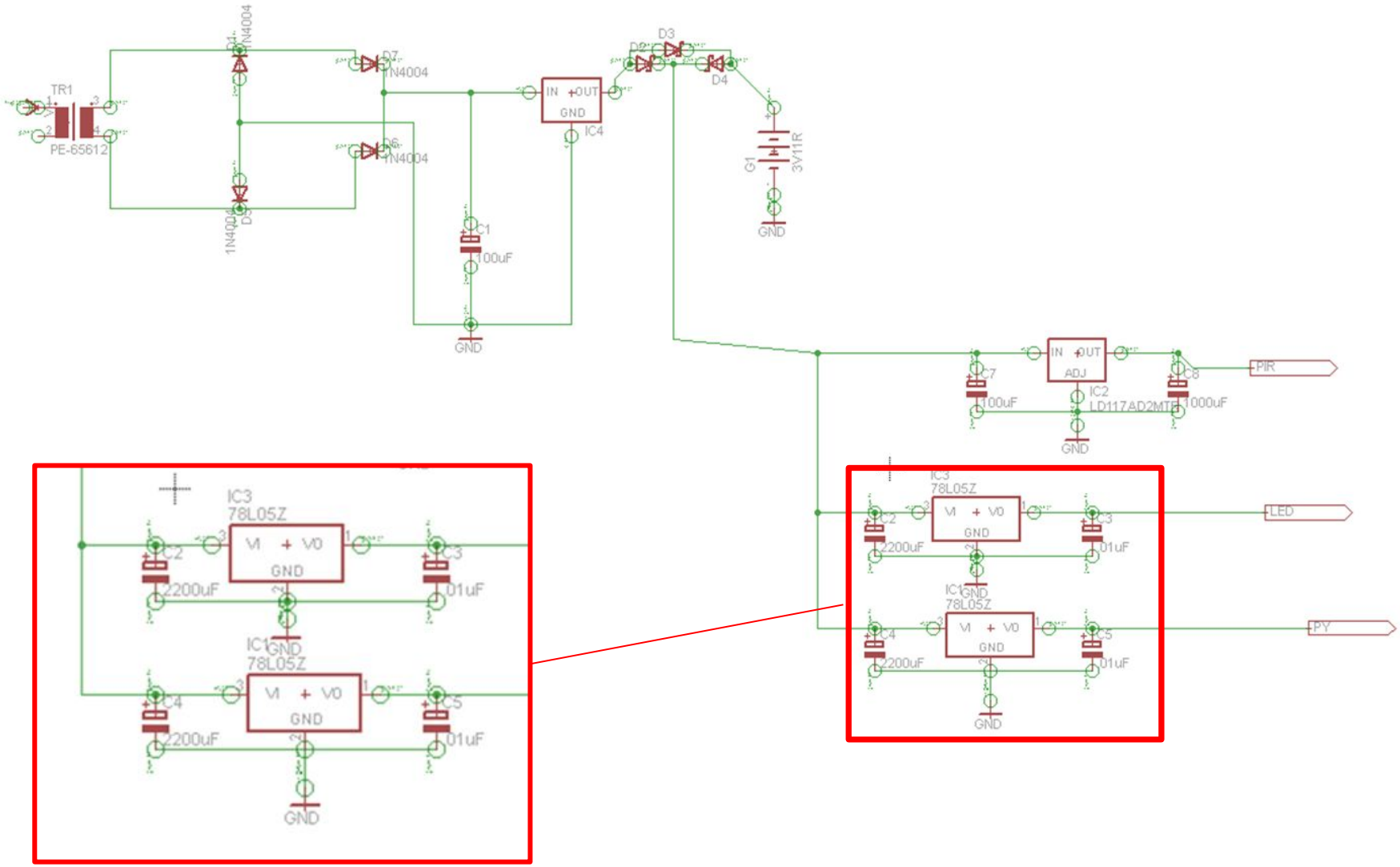
Wall Power

- 12 Volt AC to DC adapter

Central Hub - PCB



Central Hub - PCB



Lawn Spike

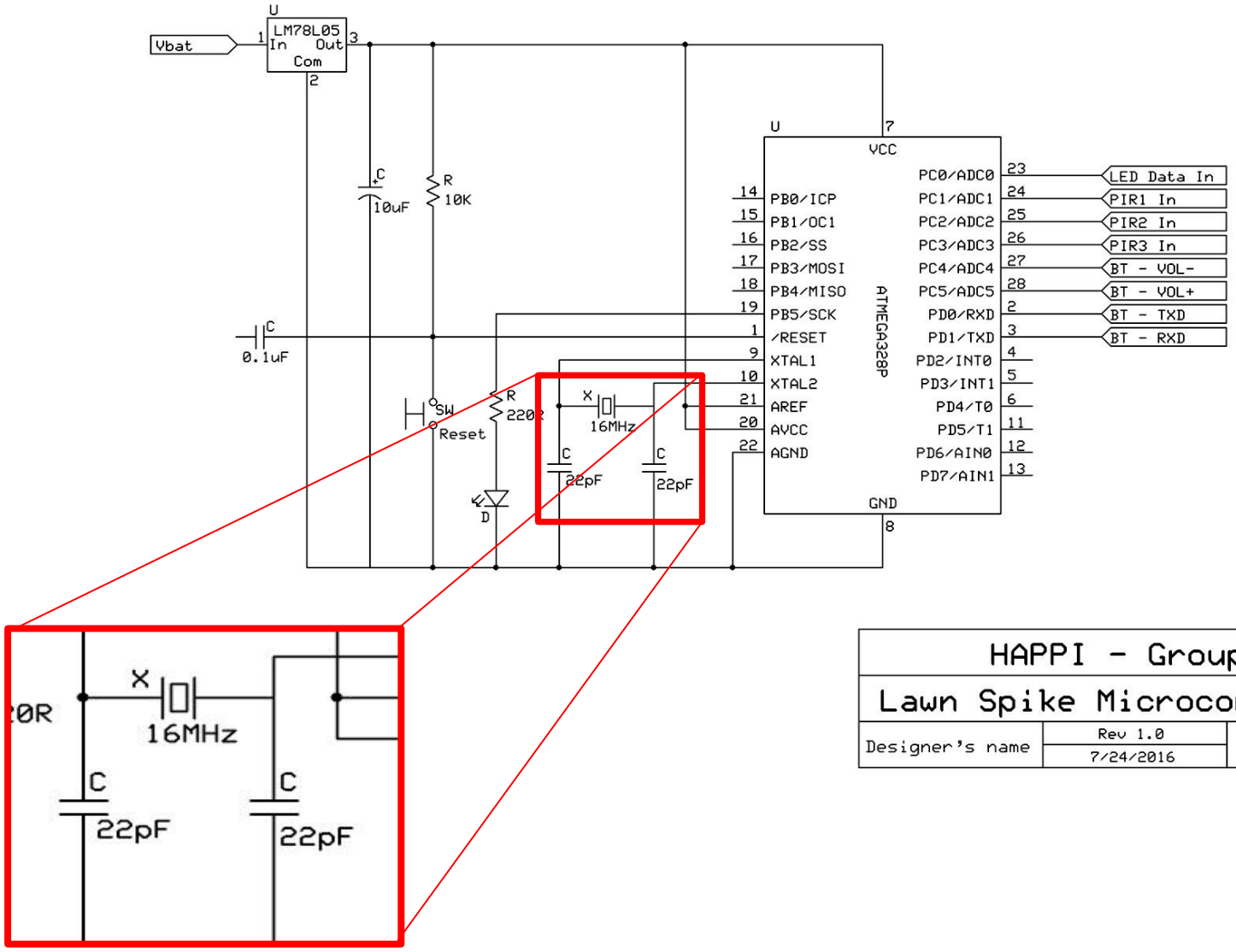
Lawn Spike - Microcontroller

Name	**I/O**	**Flash(KB)**	**RAM(B)**
MSP430G2553IRHB32	**24**	16	512
ATmega328p	23	**32**	**2048**
ATtiny85	6	8	512

Lawn Spike - Microcontroller

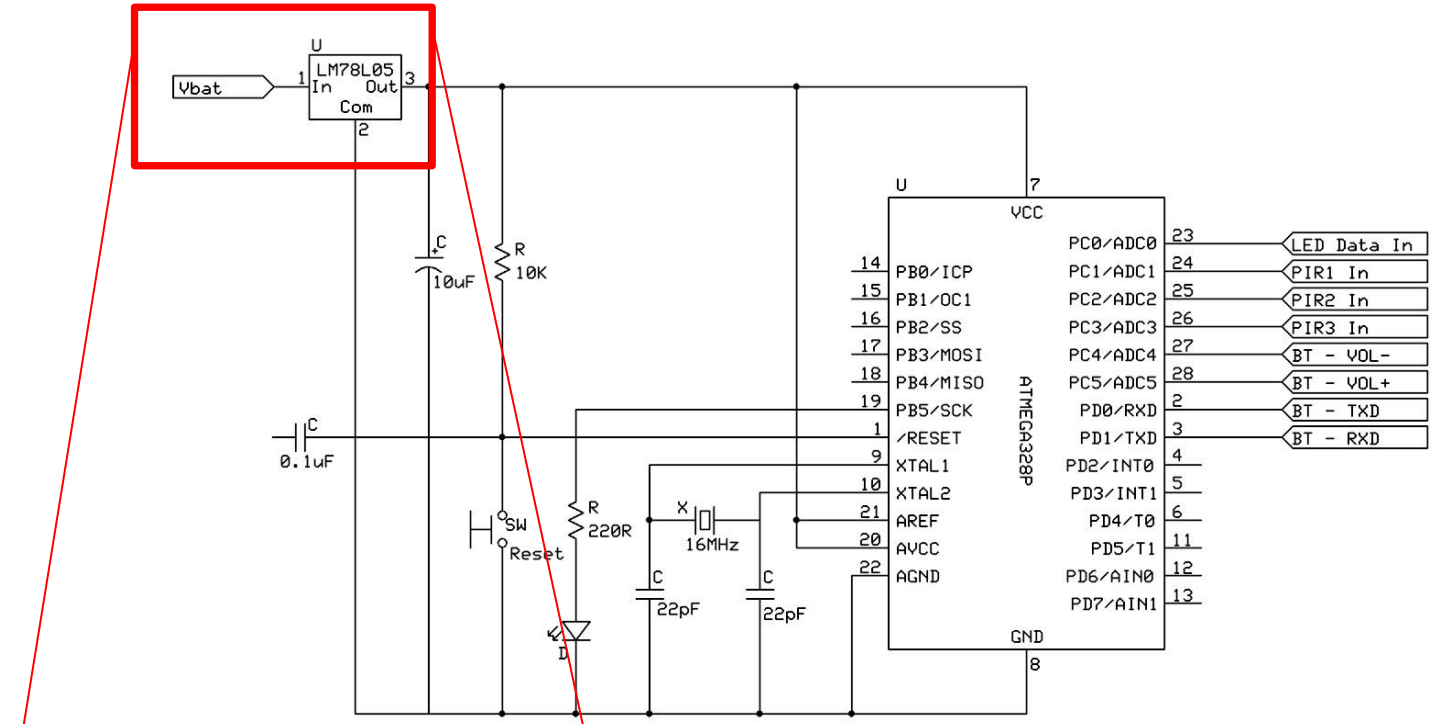
- ATmega328p
  - 28 Pins
  - Operation Voltage: 3.3 - 5V
  - Max. Operating Freq: 20 MHz

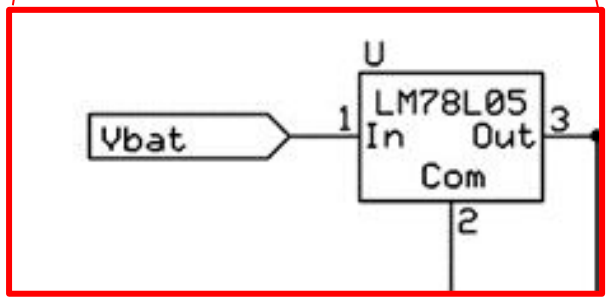
Lawn Spike - Microcontroller



HAPPI - Group10		
Lawn Spike Microcontroller		
Designer's name	Rev 1.0 7/24/2016	Page # or name

Lawn Spike - Microcontroller

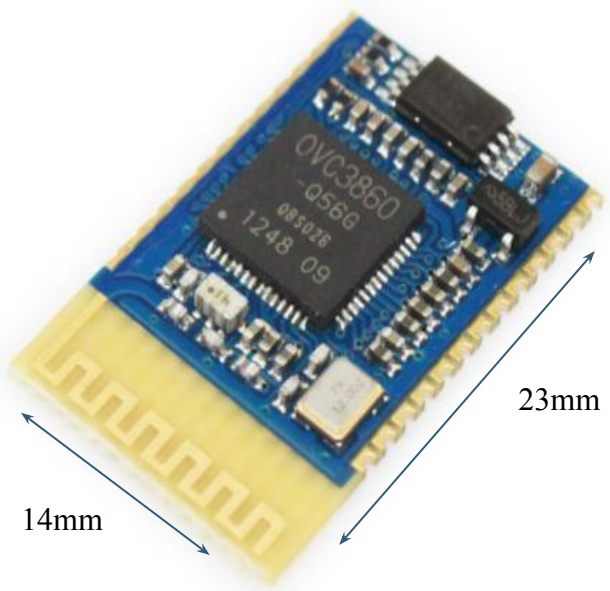




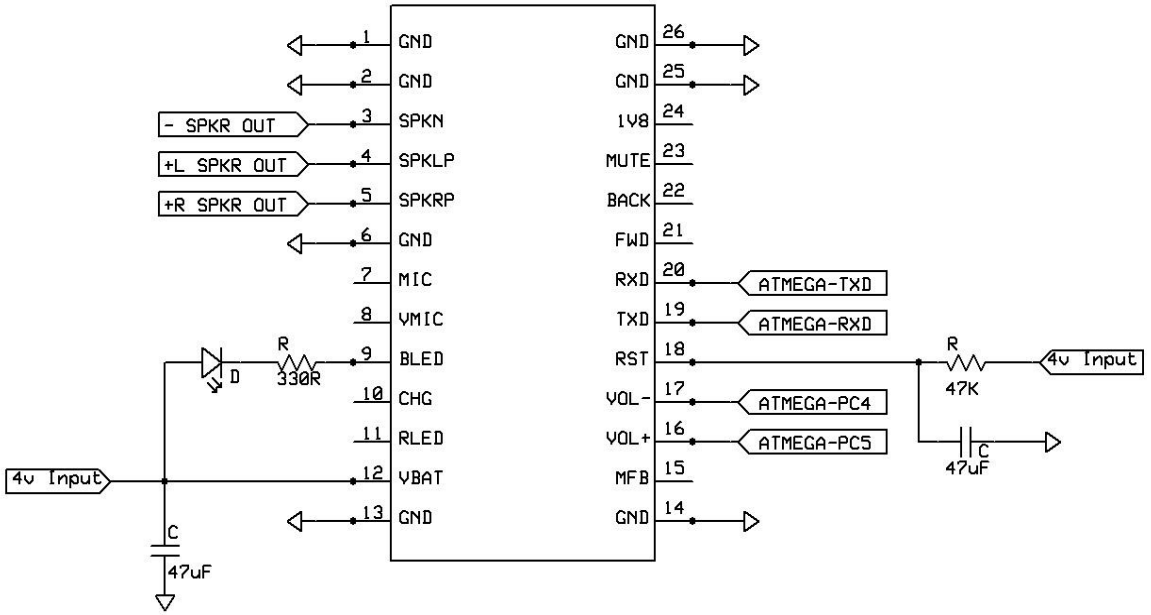
HAPPI - Group10		
Lawn Spike Microcontroller		
Designer's name	Rev 1.0 7/24/2016	Page # or name

Lawn Spike - Bluetooth Transceiver

- **BLK-MD-SPK-B**
  - Operation voltage: 3.4 - 4.2
  - A2DP/AVRCP
  - Stereo Audio Output



Lawn Spike - Bluetooth Transceiver



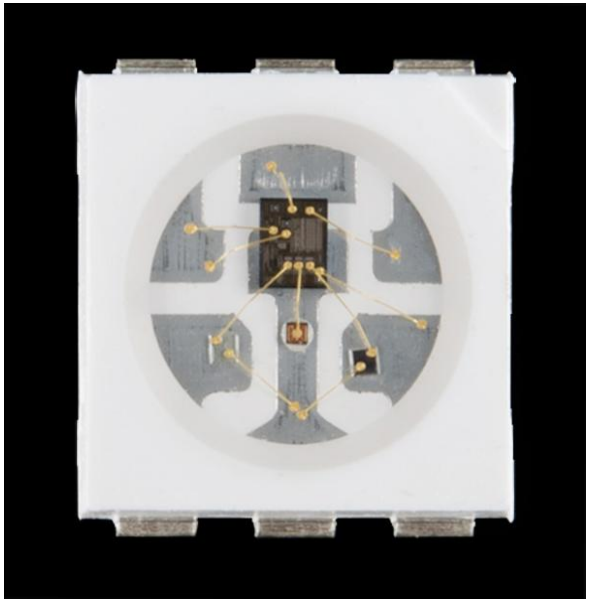
HAPPI - Group10		
OVC3860 Schematic		
Taylor Griffith	Rev 1.0 7/24/2016	-

Lawn Spike– PIR Sensors

- Operating Voltage 5V – 12V
- Sentry Angle of 110 degrees
- Range of detection 20 ft

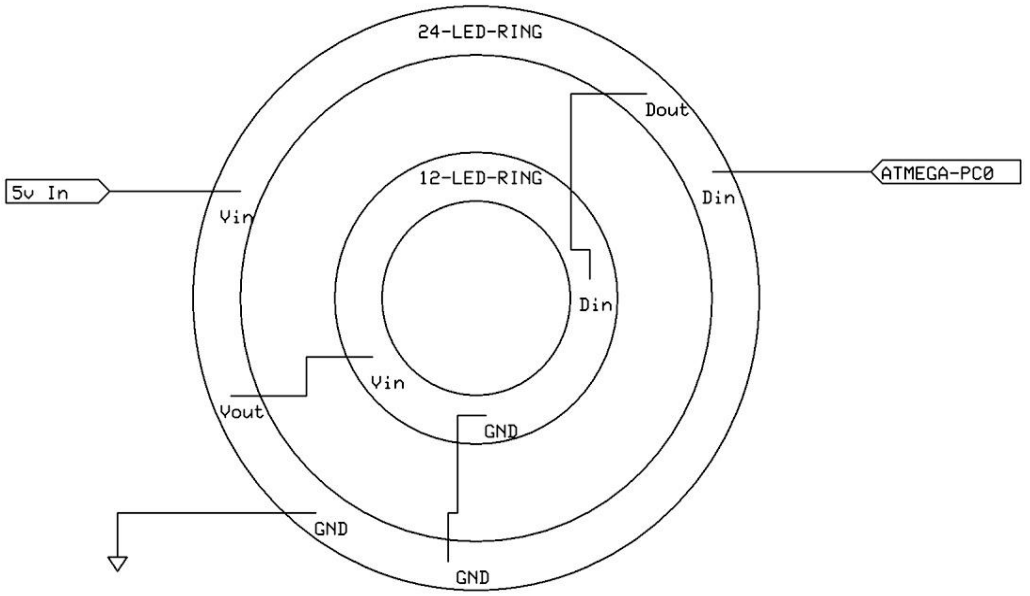
Lawn Spike - LEDs

- SMD 5050 WS2812
  - Tri-color LEDs
  - Integrated LED driver



Lawn Spike - LEDs

- 24 LED Ring
- 12 LED Ring

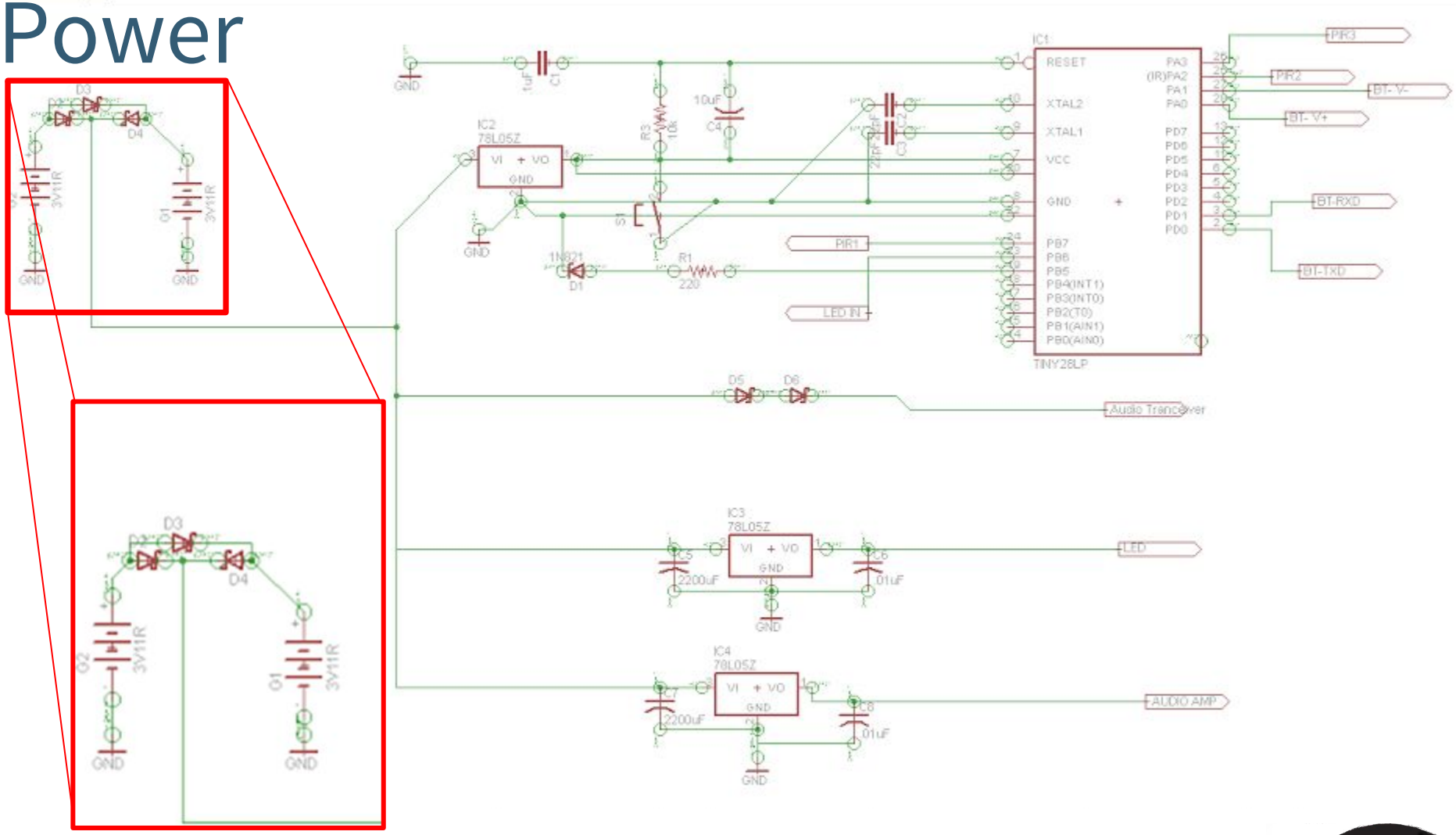


HAPPI - Group10		
WS2812 LED RINGS		
Taylor Griffith	Rev 1.0 7/24/2016	-

Lawn Spike Speaker

- Lawn Spike contains 1 speakers
- 8 ohm 1 Watt
- Connected via 2.1 W Class D Audio Amplifier
- With Mono-Amp Converter
- Weatherproof
  - *High gloss polymer*

Power


D3
D4
3V11R
Q1
Q2
GND
IC1
RESET
XTAL2
XTAL1
VCC
GND
PB7
PB6
PB5
PB4(INT1)
PB3(INT0)
PB2(T0)
PB1(AIN1)
PB0(AIN0)
PA3
(IR)PA2
PA1
PA0
PD7
PD6
PD5
PD4
PD3
PD2
PD1
PD0
TINY28LP
IC2
78L05Z
VI + VO
GND
C1
1uF
C4
10uF
R3
10k
C2
22pF
C3
S1
1N821
D1
R1
220
PIR1
LED IN
PIR3
PIR2
BT- V-
BT- V+
BT-RXD
BT-TXD
D5
D6
Audio Transceiver
IC3
78L05Z
C5
2200uF
C6
01uF
LED
IC4
78L05Z
C7
2200uF
C8
01uF
AUDIO AMP

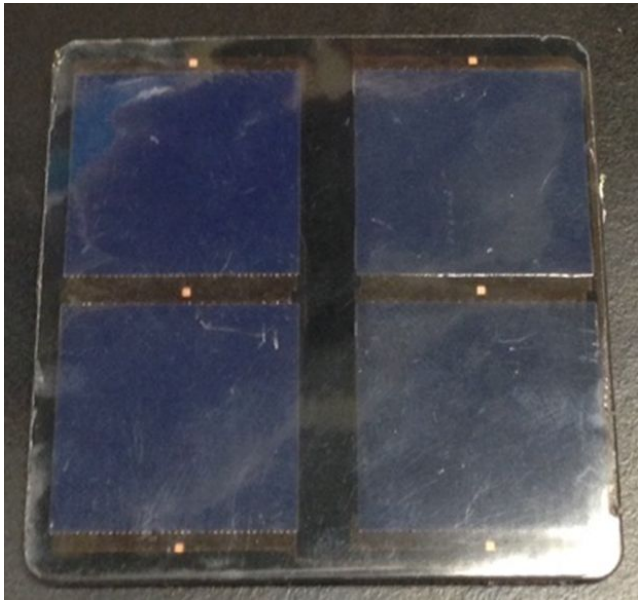
Battery

- NiMH
- Higher Charge density compared to Nickel Cadmium & Lithium Ion Batteries
- 1.2-1.5 V AA batteries
- 5000 mAh

Solar Power

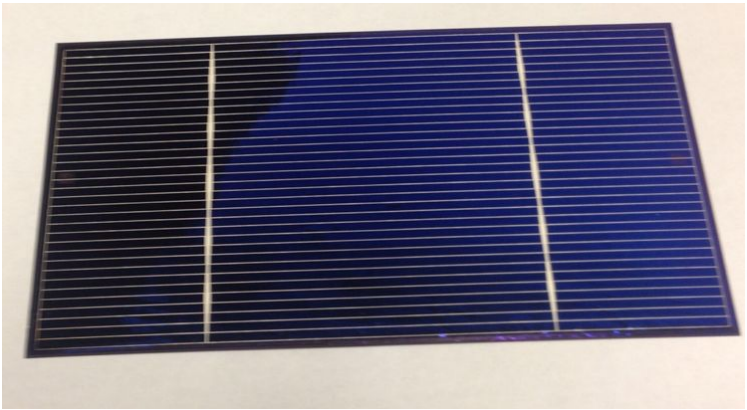
Monocrystalline

- Efficiency rating of 15-20%
- 150-200W per square meter
- More optimal space



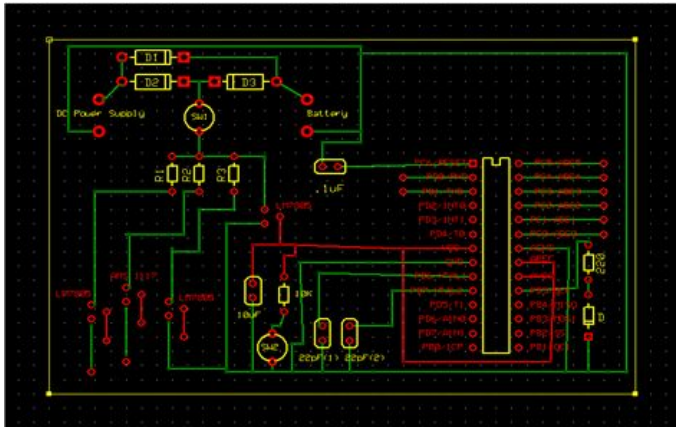
Polycrystalline

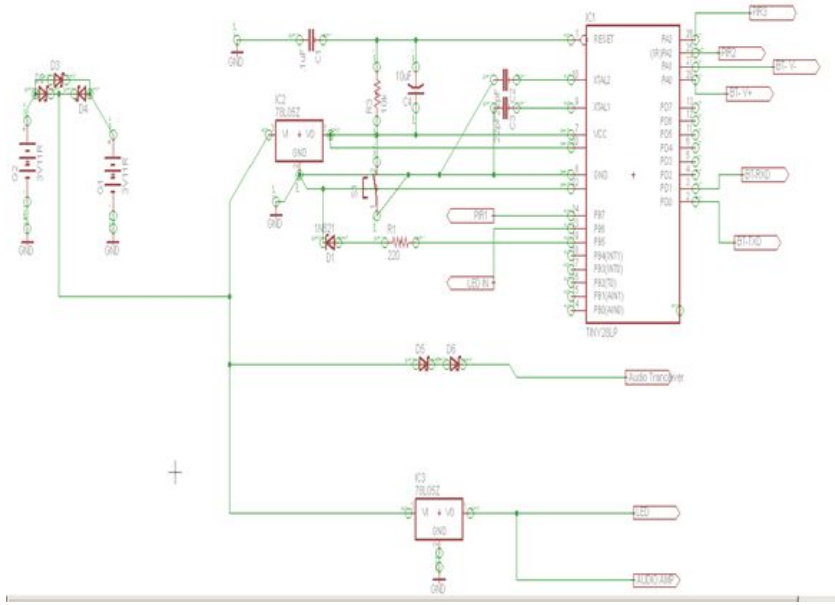
- Efficiency rating of 13-16%.
- Average the solar cells generate 130-160W per square meter
- Cheaper than Monocrystalline Cells



Spike PCB Schematic

- •Microcontroller – 5 V 2 A
- •LEDs – 5 V 2 A
- •Audio Transceiver – 3.8-4.2 V 1 A
- •Audio Amplifier – 5 V 1 A





Lawn Spike Housing

Solar Panel

Spike Cap

LED Ring Housing

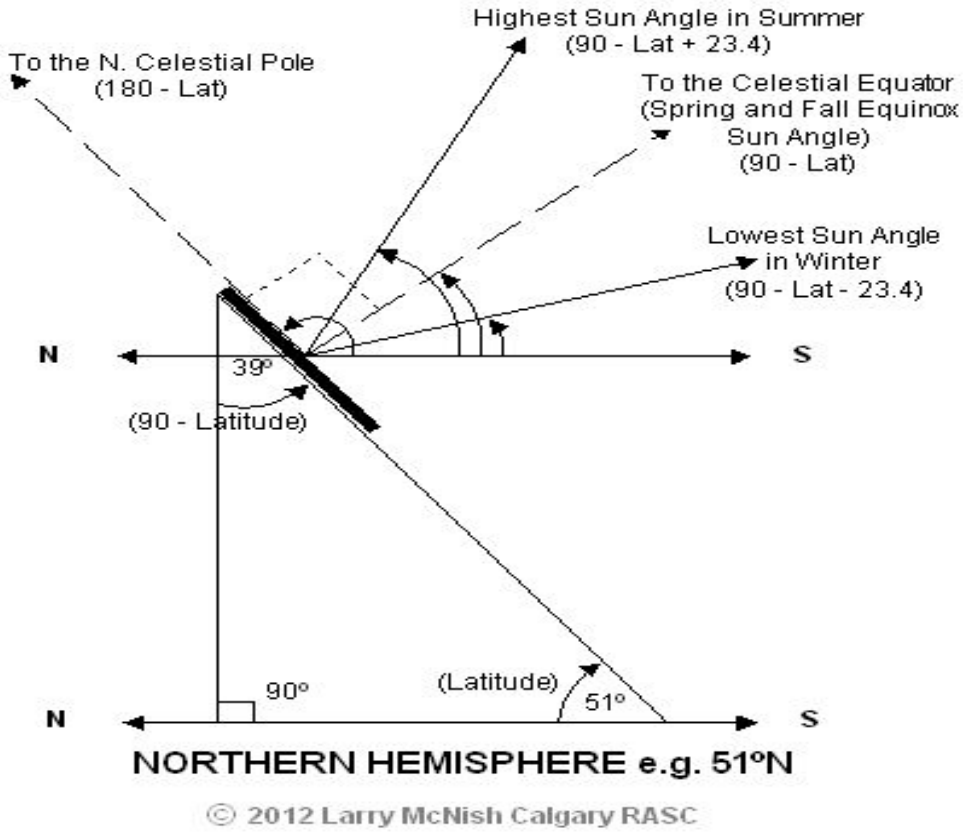
PIR Sensor Housing

Speaker Housing

Bottom Spike/ Battery Housing

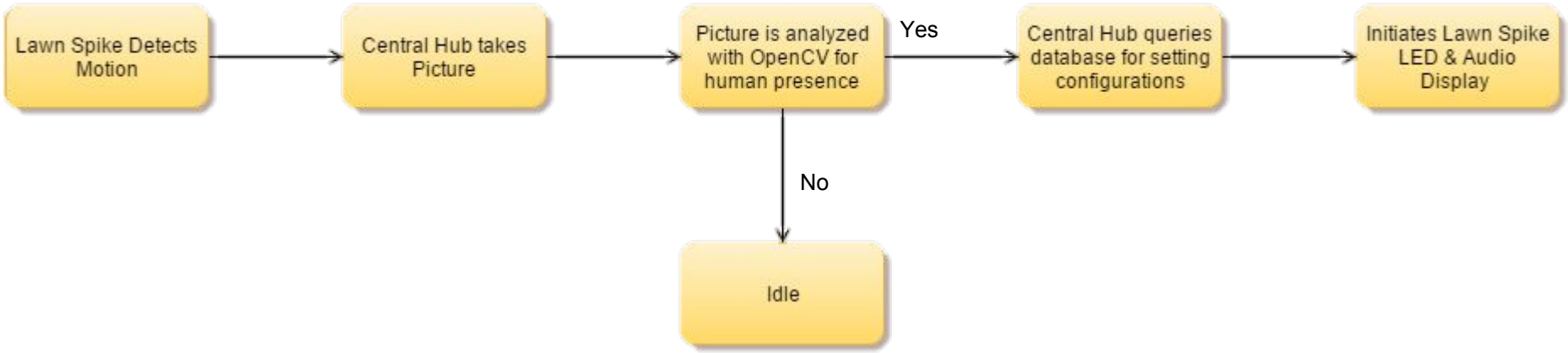
Adjustable Use

- •Built with swivel motion to angle the solar cells for optimal use and attain the most solar energy
- •Optimal Orlando conditions:



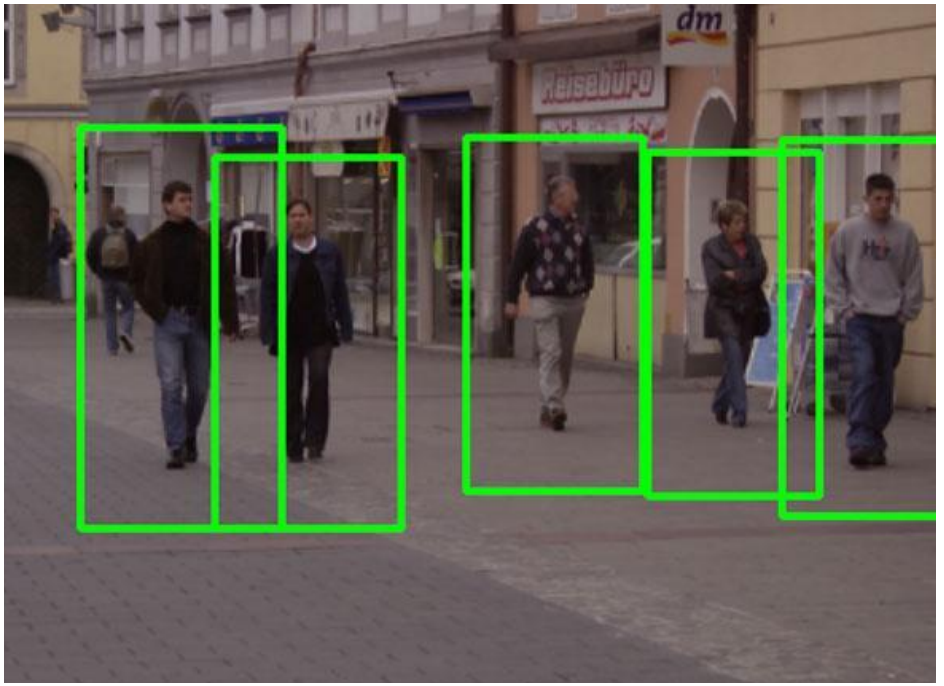
Season	Tilt (Approximately)
Summer	38°
Spring	62°
Fall	62°
Winter	86°

Lawn Spike/Central Hub Interface



Humanoid Detection

- OpenCV
  - *Feature Extraction*



Application

Why Android Studio

- Codling Language: Java and XML
- Available Windows, Linux, and Mac
- Code editing, debugging, performance tooling, and a flexible build system
- Great emulator
- Familiarity amongst developers
- Online Resources

Mobile Application Features

Functional Components

Splash Page
Inteface to HAPPI
Facilitate turning on Bluetooth
Google Play Music Interface

User Based Security

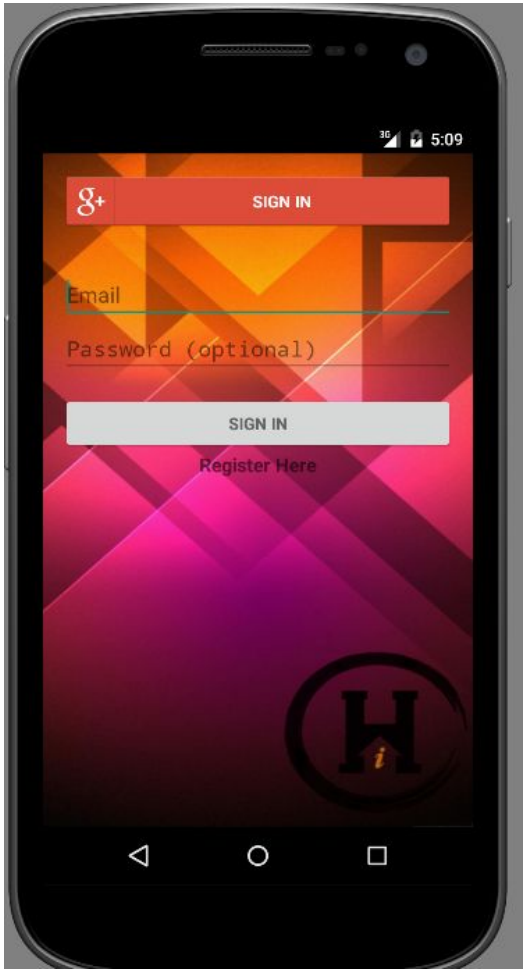
Login Page
Register Page

User Interface

Easy navigation
Pleasant visual display

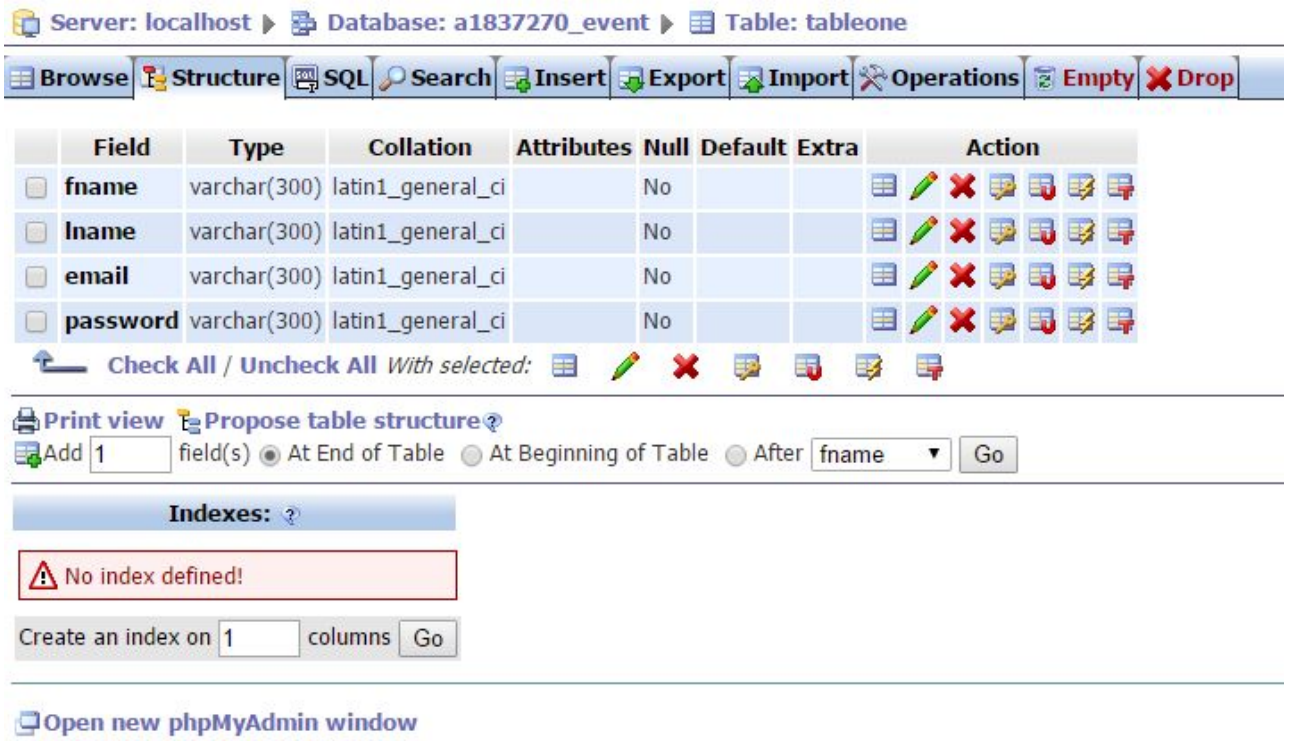
Setting Preferences

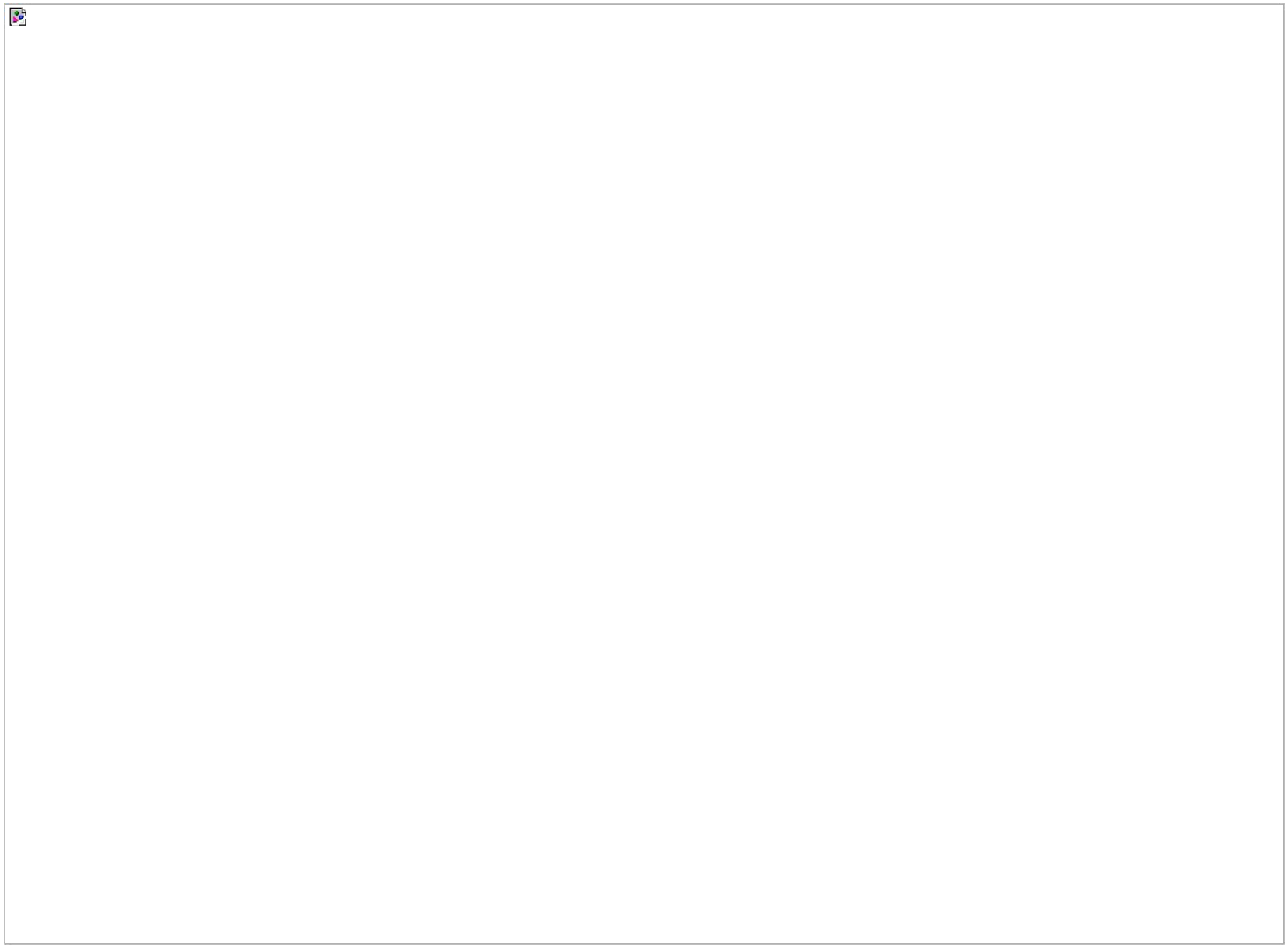
Light color selection
Wi-Fi configuration
Turn LEDS on or off
Speaker volume
Saving User Preferences

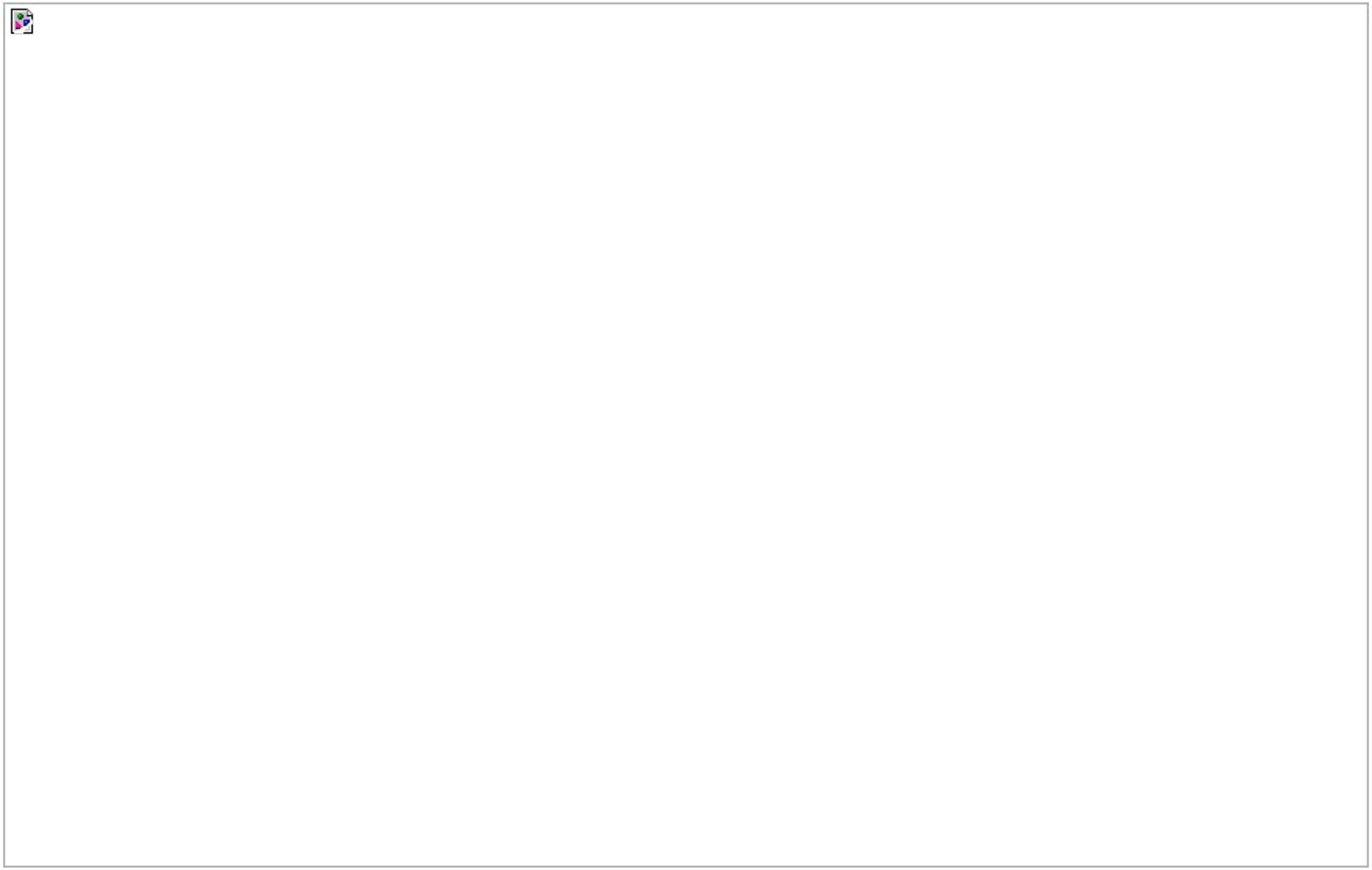


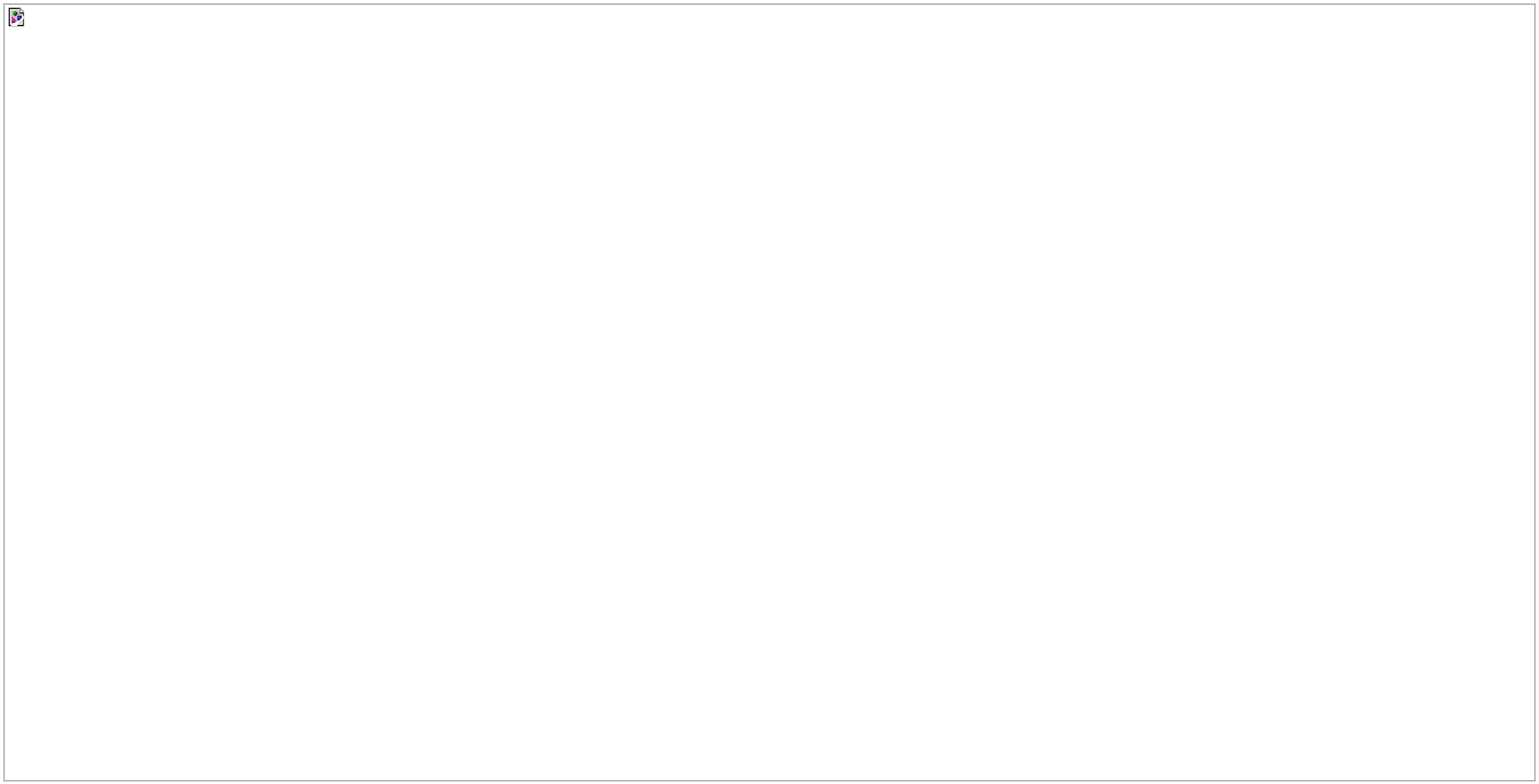
Database

- https://www.000webhost.com
- phpMyAdmin
- Used for Login Page, Music Selection, and Setting Preferences









Administrative Content

Work Distribution

	LEDs	Humanoid Detection System	Motion	Single Board Computer	Microcontroller	Wireless Transceivers	Power	Software
Johnnie	1st	1st	1st				2nd	
Taylor				1st	1st	2nd		2nd
Philip				2nd	2nd	1st		1st
Sidney	2nd	2nd	2nd				1st	

Budget

Project Items	Product Number	Date Order	Date Received	Cost	Quantity	Shipping Cost	Tax	Total Cost
Stereo Audio Bluetooth	901149203	06-08-2016	06-25-2016	$6.59	3	$0.00	$0.00	$19.77
SoundBot Bluetooth USB Dongle		06-08-2016	06-10-2016	$9.32	1	$0.00	$0.00	$9.32
Momentary Tactical Buttons		07-19-2016	07-21-2016	$0.05	100	$0.00	$0.00	$4.50
Voltage Regulator 78L05		07-19-2016	07-22-2016	$1.05	5	$0.00	$0.00	$5.25
ATmega328p-pu DIP28		07-17-2016	07-19-2016	$4.25	4	$0.00	$0.00	$17.00
1n5227B Zener Diode		07-17-2016	07-25-2016	$0.20	20	$0.00	$3.03	$7.03
CERAMIC CAPACITOR 22PF	46P6472	07-18-2016	07-21-2016	$0.22	10	$0.88	$0.00	$3.96
ALUMINUM ELECTROLYTIC CAPACITOR 10UF	69K7855	07-18-2016	07-21-2016	$0.04	5	$0.88	$0.00	$1.96
METAL FILM RESISTOR 10KOHM 500mW	88K0648	07-18-2016	07-21-2016	$0.02	5	$0.88	$0.00	$1.86
METAL FILM RESISTOR 220 OHM 500mW	78R4895	07-18-2016	07-21-2016	$0.04	5	$0.88	$0.00	$1.96
LED 5MM RED	40K0080	07-18-2016	07-21-2016	$0.37	5	$0.88	$0.00	$3.61
CRYSTAL 16MHZ	96F2831	07-18-2016	07-21-2016	$0.26	5	$0.88	$0.00	$3.06
Stereo 2.1W Class D Audio Amplifier	ID:1552	07-17-2016	07-21-2016	$9.95	1	$2.94	$0.00	$15.83
3" Diameter - 8 Ohm 1 Watt	ID:1313	07-17-2016	07-21-2016	$1.95	1	$2.94	$0.00	$7.83
3" Diameter - 4 Ohm 3 Watt	ID:1314	07-17-2016	07-21-2016	$1.95	1	$2.94	$0.00	$7.83
40 Prime Solar Cell DIY Kit with Solar Tabbing, Bus, Flux and Diode		07-17-2016	07-21-2016	$44.09	1	$0.00	$0.00	$44.09
Passive Infrared Motion Sensors	HC-SR501	7-13-2016	07-15-2016	$25.47	15	0	0	$25.47
24 5050 RGB LED	WS2812	07-13-2016	07-15-2016	$30.00	3	0	0	$30.00
12 5050 RGB LED	WS2812	07-13-2016	07-16-2016	$24.00	3	0	0	$24.00
							Total Cost	$234.33

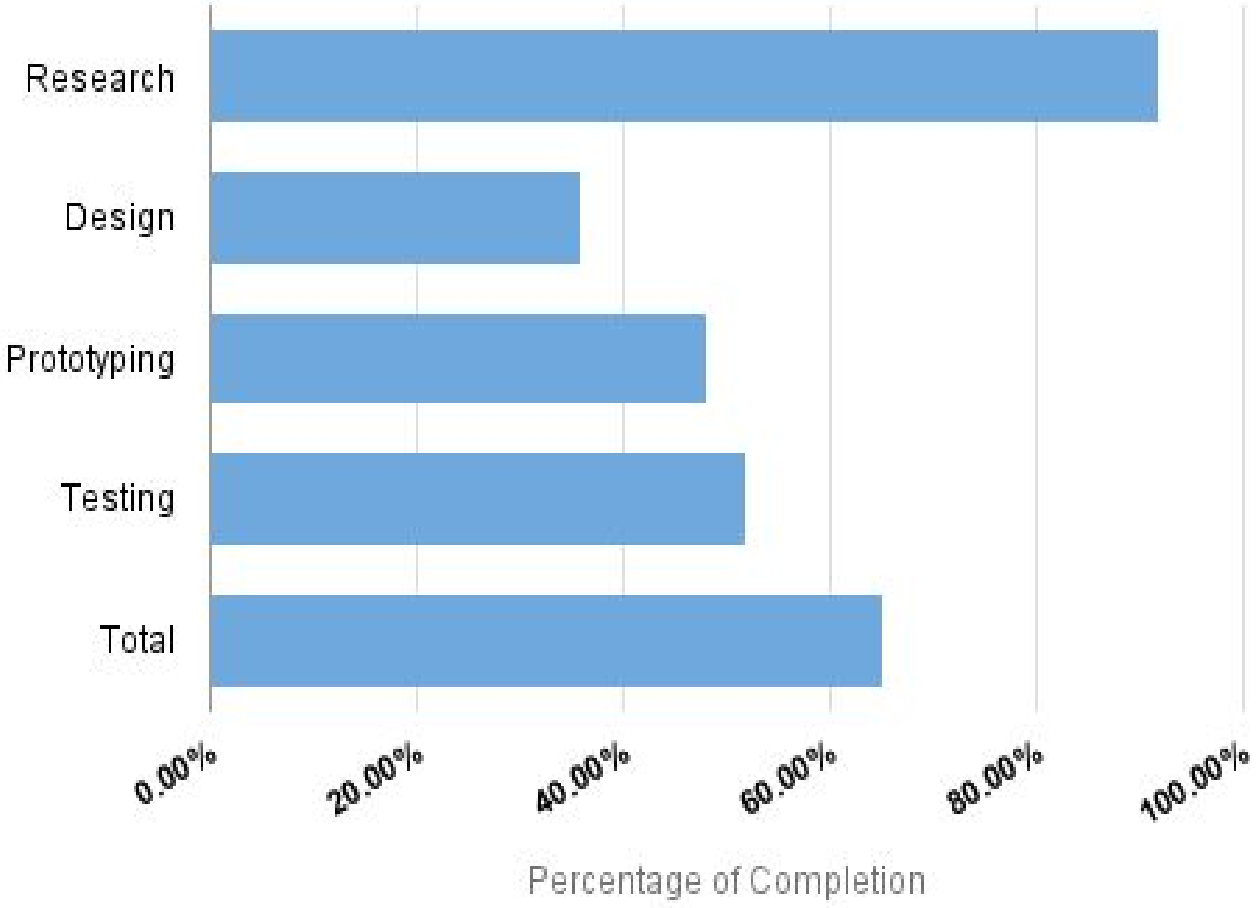
Financing

- We have collective decided to finance ourselves

Issues

- PIR Sensors
- PCB
- LED 5050 Individuals
- Soldering Components

Progress


Research
Design
Prototyping
Testing
Total
0.00%
20.00%
40.00%
60.00%
80.00%
100.00%
Percentage of Completion

Questions?