



H.A.P.P.I. Systems

Group 10
University of Central Florida
Senior Design Fall 2016

Team Members



Johnnie Greene

Physics &
Photonic
Science
Engineer

Team Lead



Taylor Griffith

Computer
Engineer

Team Lead



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

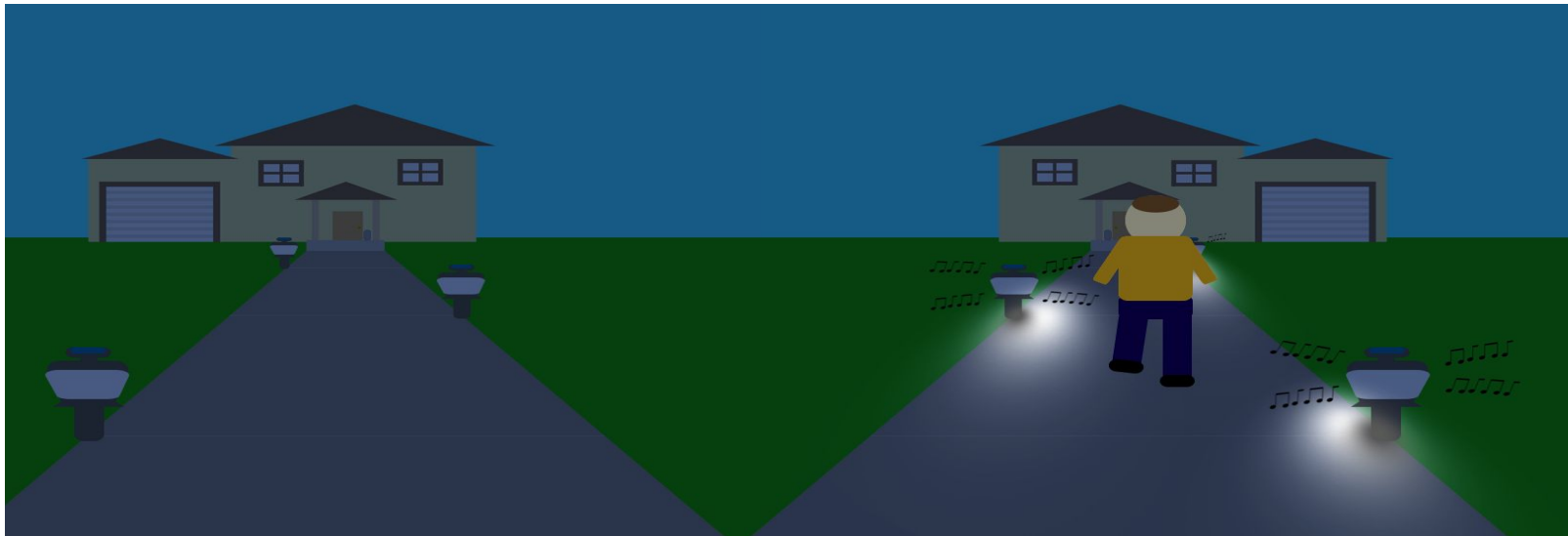
- ❖ *Equipped:*

- LEDs
- Speakers
- Bluetooth

- Central Hub

- ❖ *Equipped:*

- Humanoid Detection
- Wireless Connectivity



Specifications

- 15 Hr. to charge battery via solar
- 2 Hr. Battery life
- Wireless Speaker range of 20 ft
- Dual Motion Sensor
- Range Detection of 20 ft
- 85% Accuracy of Humanoid Detection



Overall Block Diagram

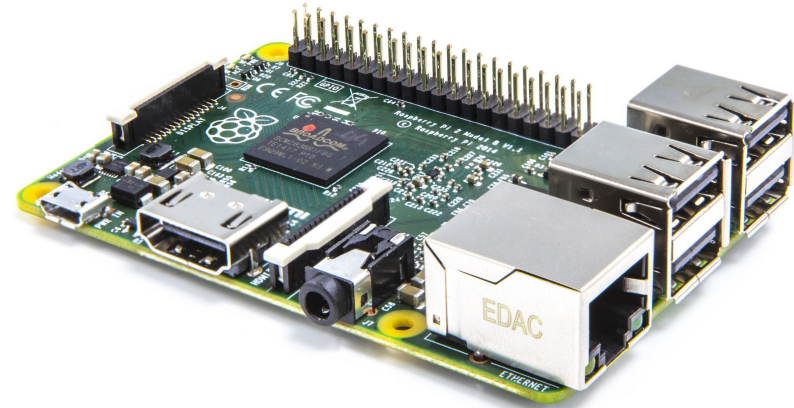


Central Hub



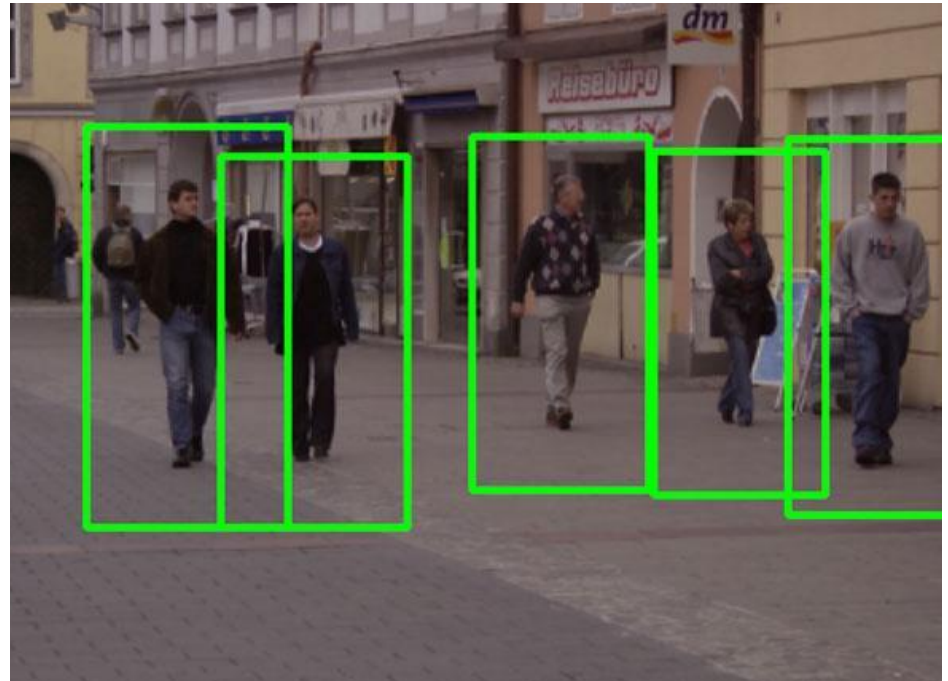
Central Hub - Single Board Computer

- Raspberry Pi 2 Model B
 - 900MHz quad-core Arm Cortex A7 CPU
 - 1GB RAM
 - 4 USB Ports
 - 3 WiFi/Bluetooth USB Dongles
 - IR Camera
 - 40 GPIO Pins
 - 3 PIR Sensors



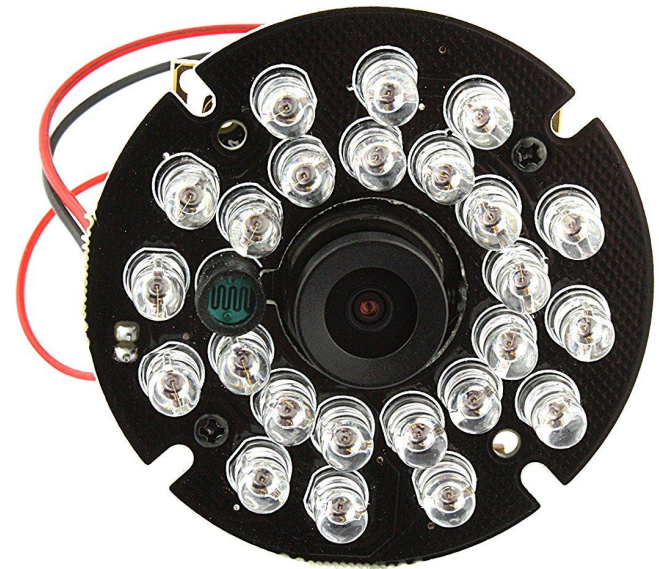
Humanoid Detection

- OpenCV Library
 - *Feature Extraction*
 - *HOG Detection*
- Other Libraries for Consideration
 - *SimpleCV*



Central Hub - Camera

- 2.8mm lens wide angle
 - *Security camera*
 - *Infrared LED*



Central Hub – PIR Sensors

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



Lawn Spike



Lawn Spike - Microcontroller

<u>Name</u>	<u>I/O</u>	<u>Flash(KB)</u>	<u>RAM(B)</u>
MSP430G2553IR HB32	24	16	512
ATmega328p	23	32	2048
ATtiny85	6	8	512

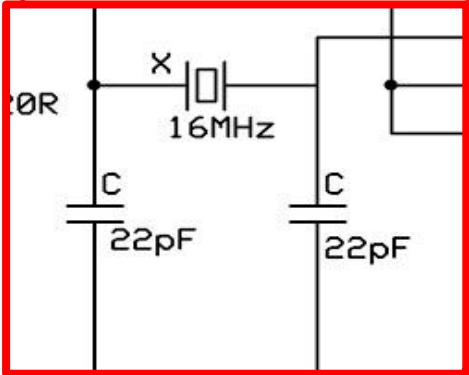
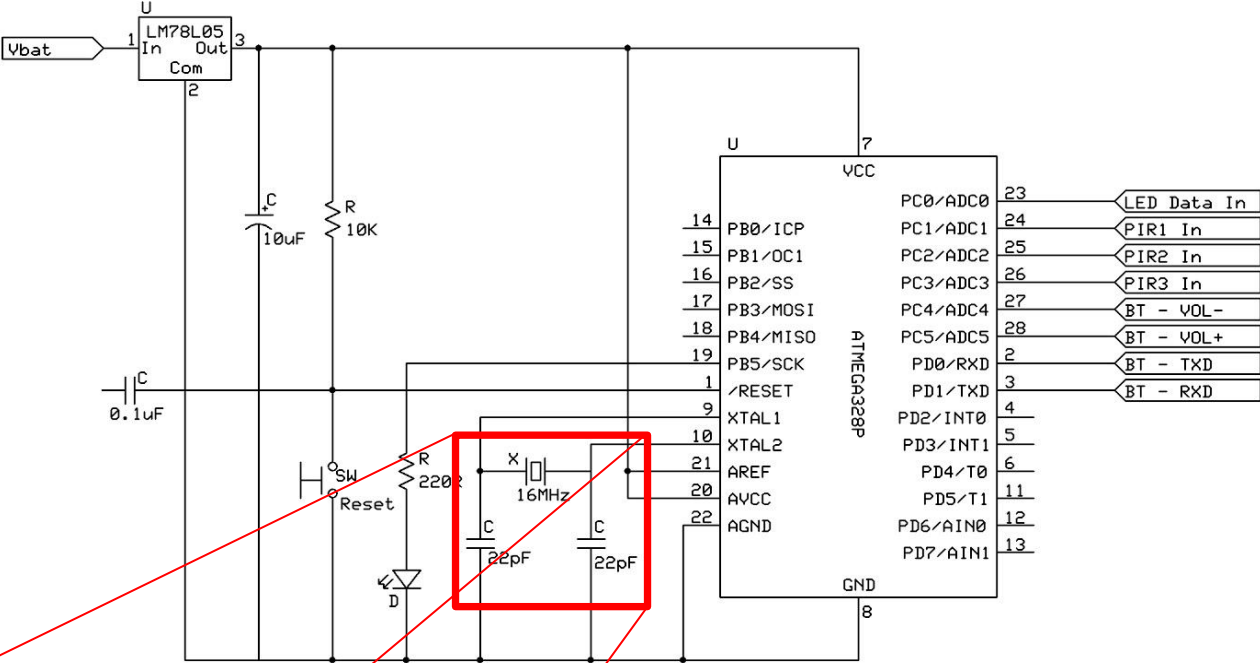


Lawn Spike - Microcontroller

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



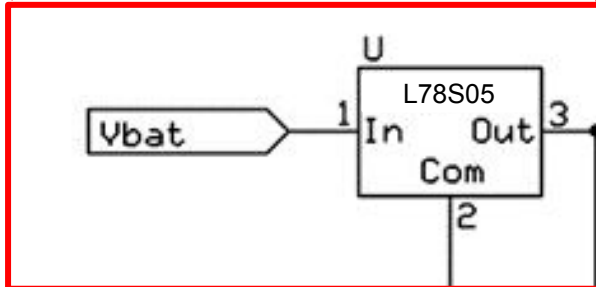
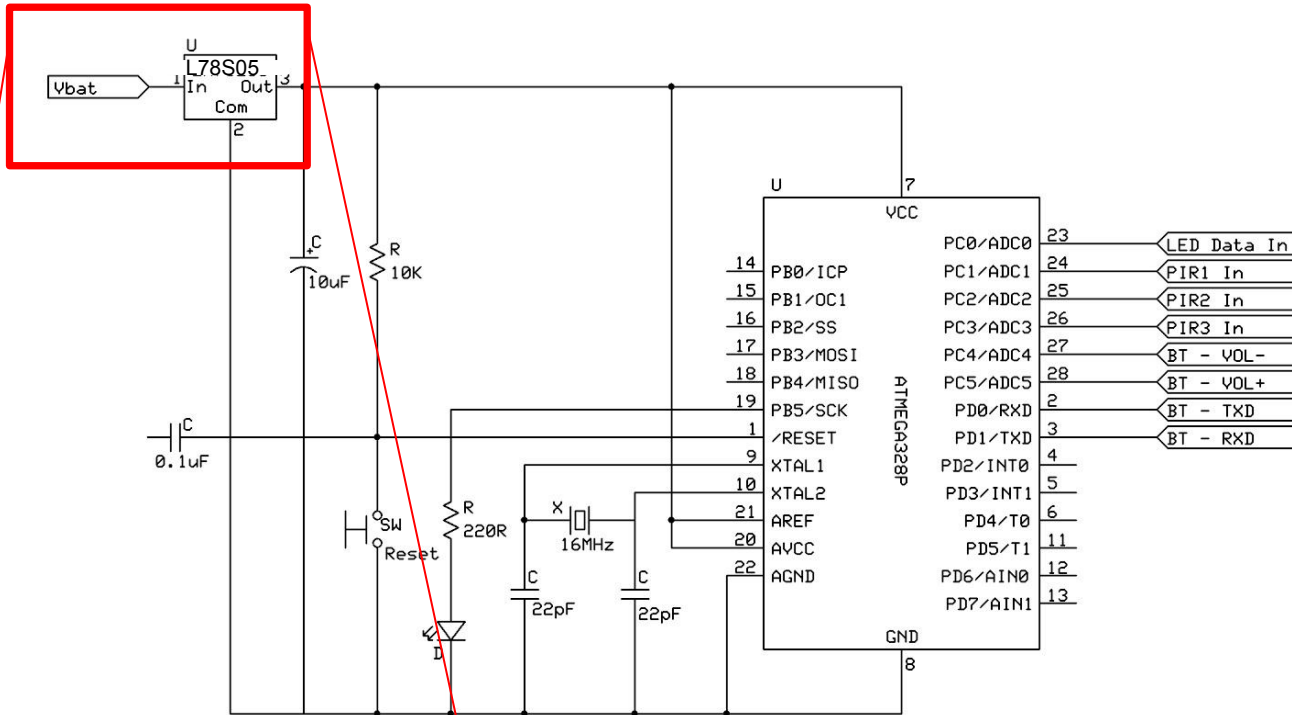
Lawn Spike - Microcontroller



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



Lawn Spike - Microcontroller



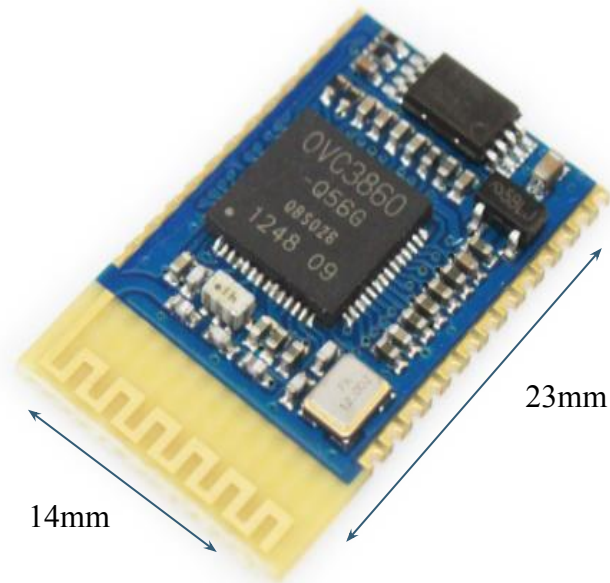
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Lawn Spike Microcontroller		
Designer's name	Rev 1.0 7/24/2016	Page # or name



Lawn Spike - Bluetooth Transceiver

■ BLK-MD-SPK-B

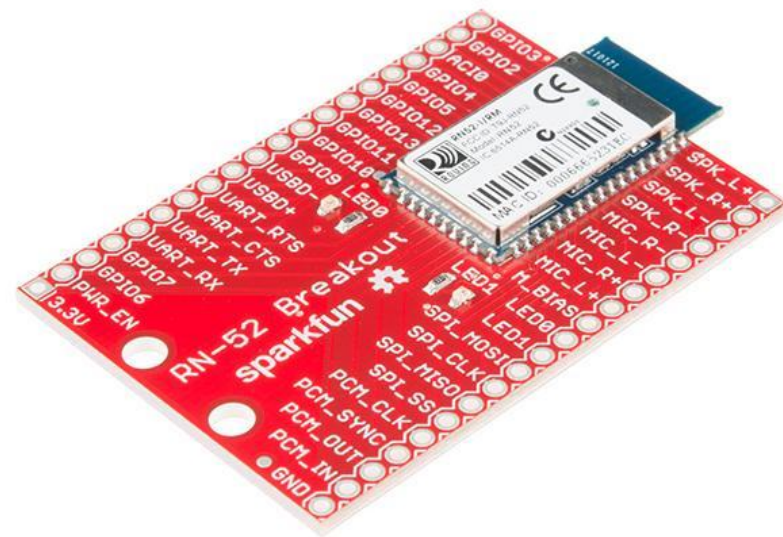
- Operation voltage: 3.4 - 4.2
- A2DP/AVRCP
- Stereo Audio Output



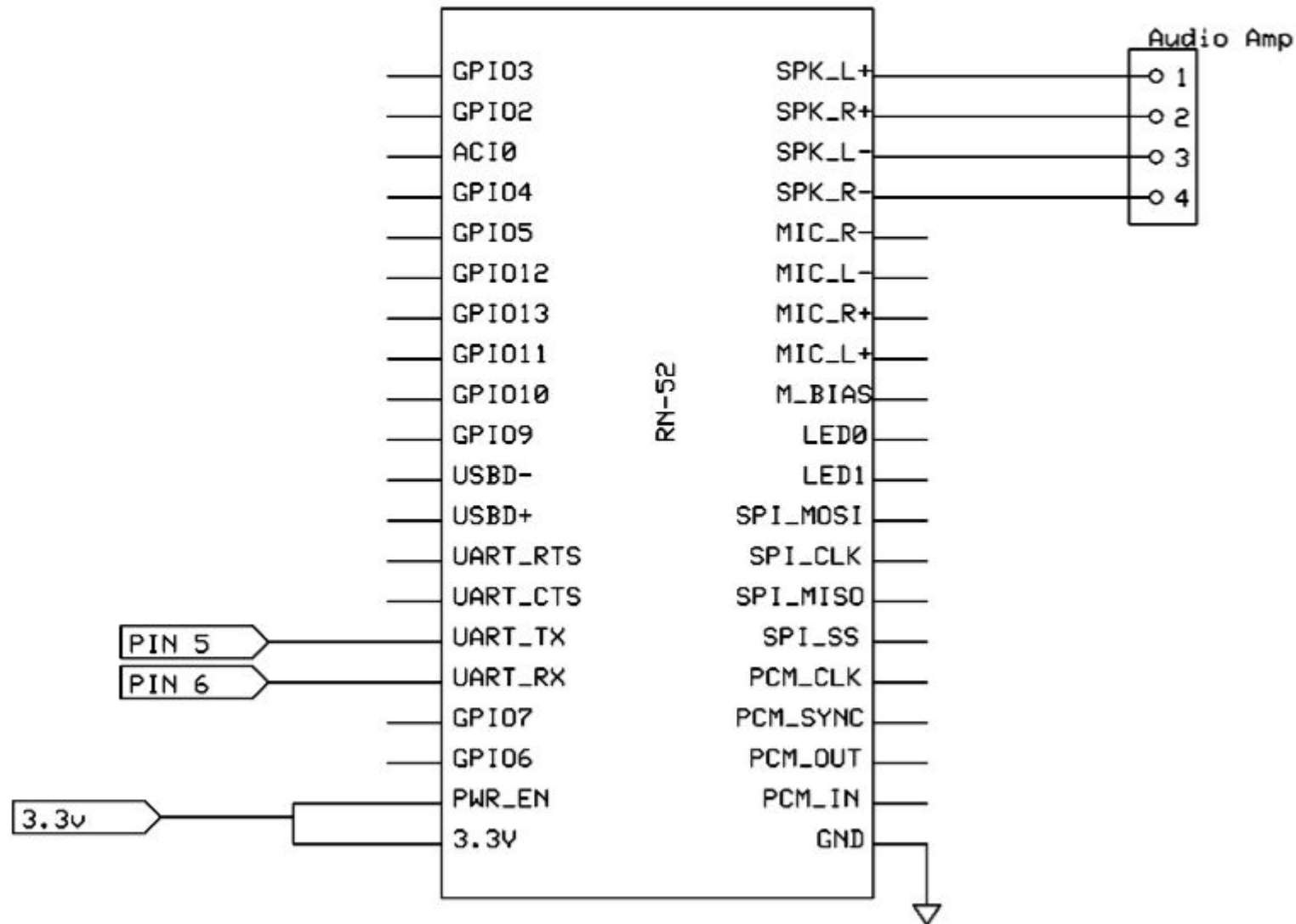
Lawn Spike - Bluetooth Transceiver

- **RN-52 Bluetooth Audio Module**

- Operation voltage: 3.0 - 3.6V
- Supported Bluetooth Profiles
 - SPP
 - A2DP
 - HFP
 - AVRCP
- Audio Codecs
 - I2S
 - S/PDIF

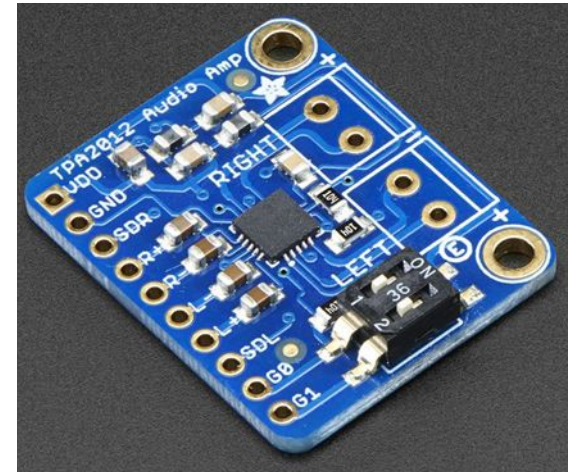


Lawn Spike - Bluetooth Transceiver



Stereo 2.1W Class D Audio Amplifier - TPA2012

- Able to run from 2.7V-5.5VDC
- 89% efficient
 - 8Ω speaker at 1.5 Watt
- 1.4W at 8Ω , 10% THD, with 5V Supply
- Built in thermal and over-current protection
- Thermal shutdown protection



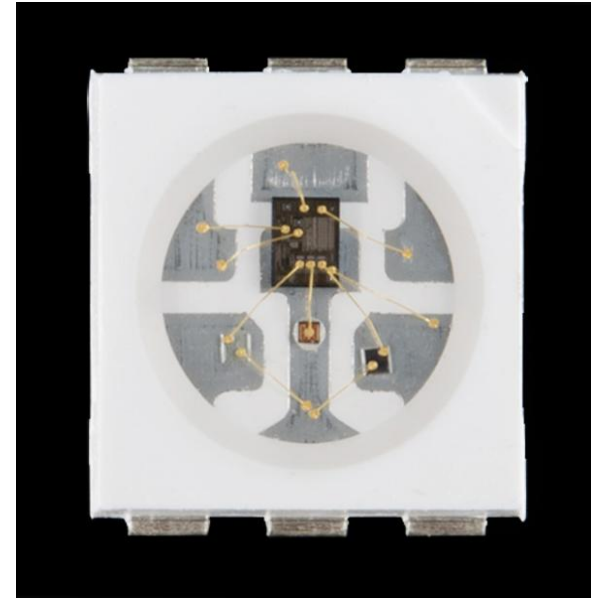
Lawn Spike– PIR Sensors

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



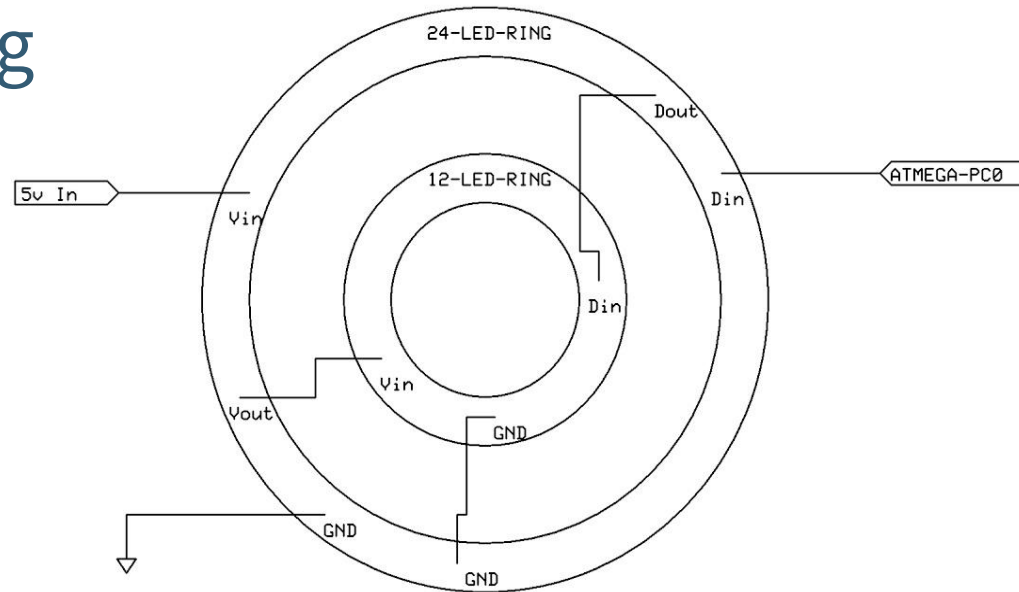
Lawn Spike - LEDs

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



Lawn Spike - LEDs

- 24 LED Ring
- 12 LED Ring



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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*



Battery

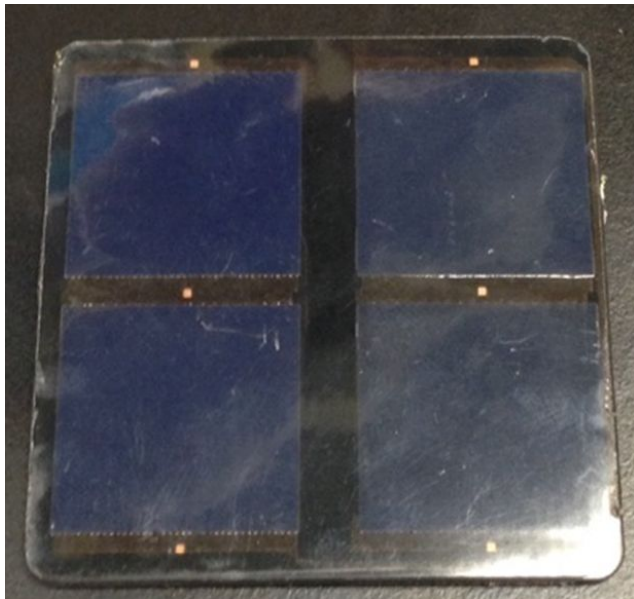
- NiMH
- Higher Charge density compared to Nickel Cadmium & Lithium Ion Batteries
- 1.2-1.5 V AA batteries
- 2500 mAh



Solar Power

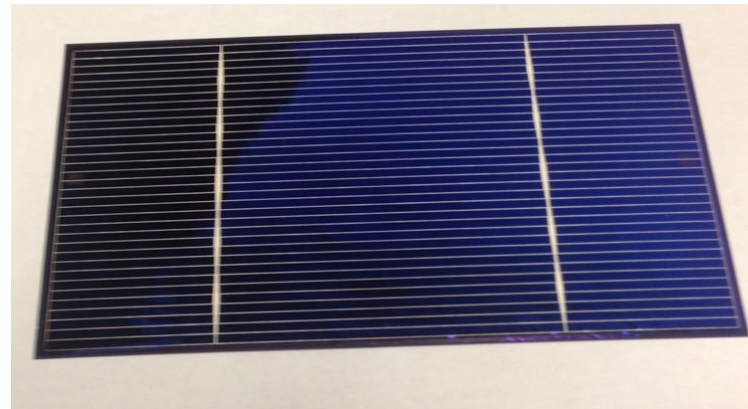
Monocrystalline

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

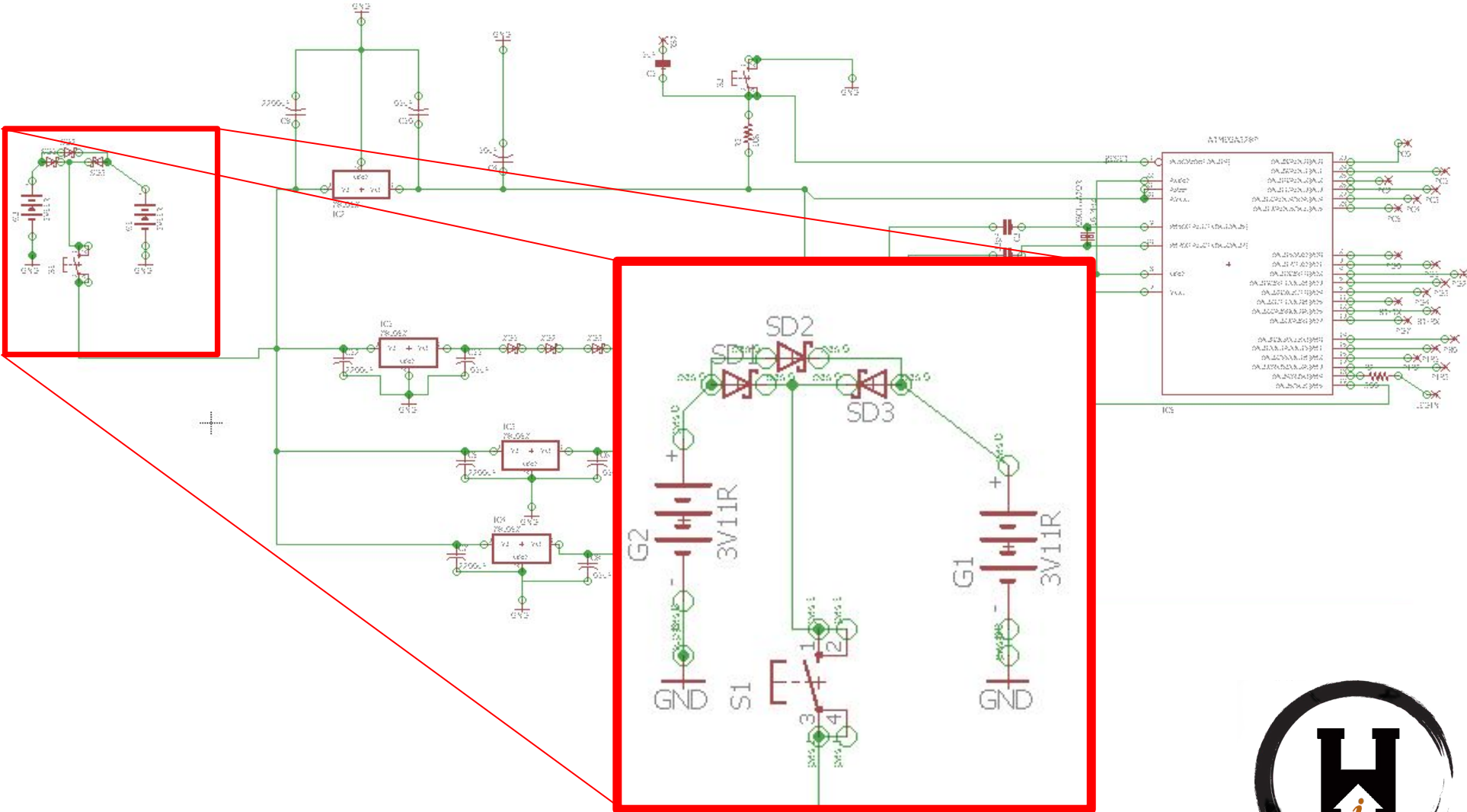


Polycrystalline

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

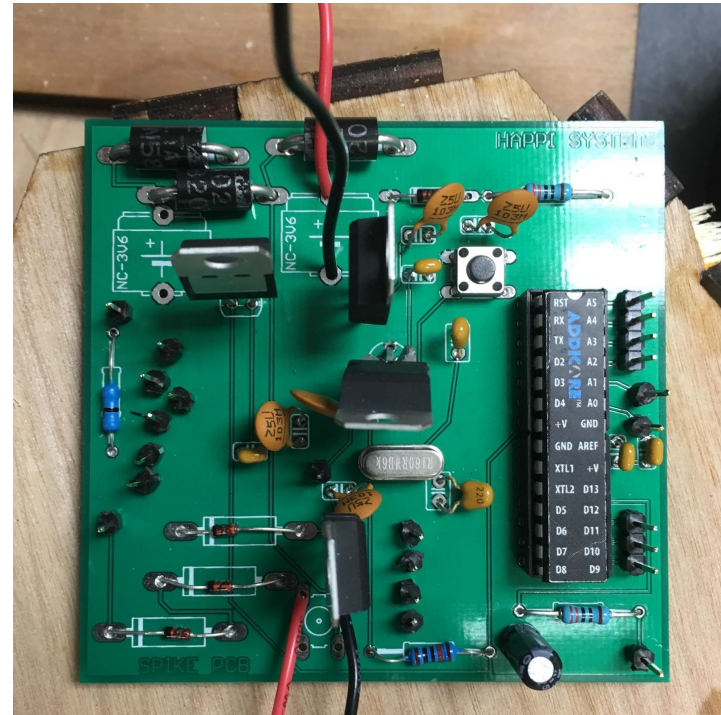


Power

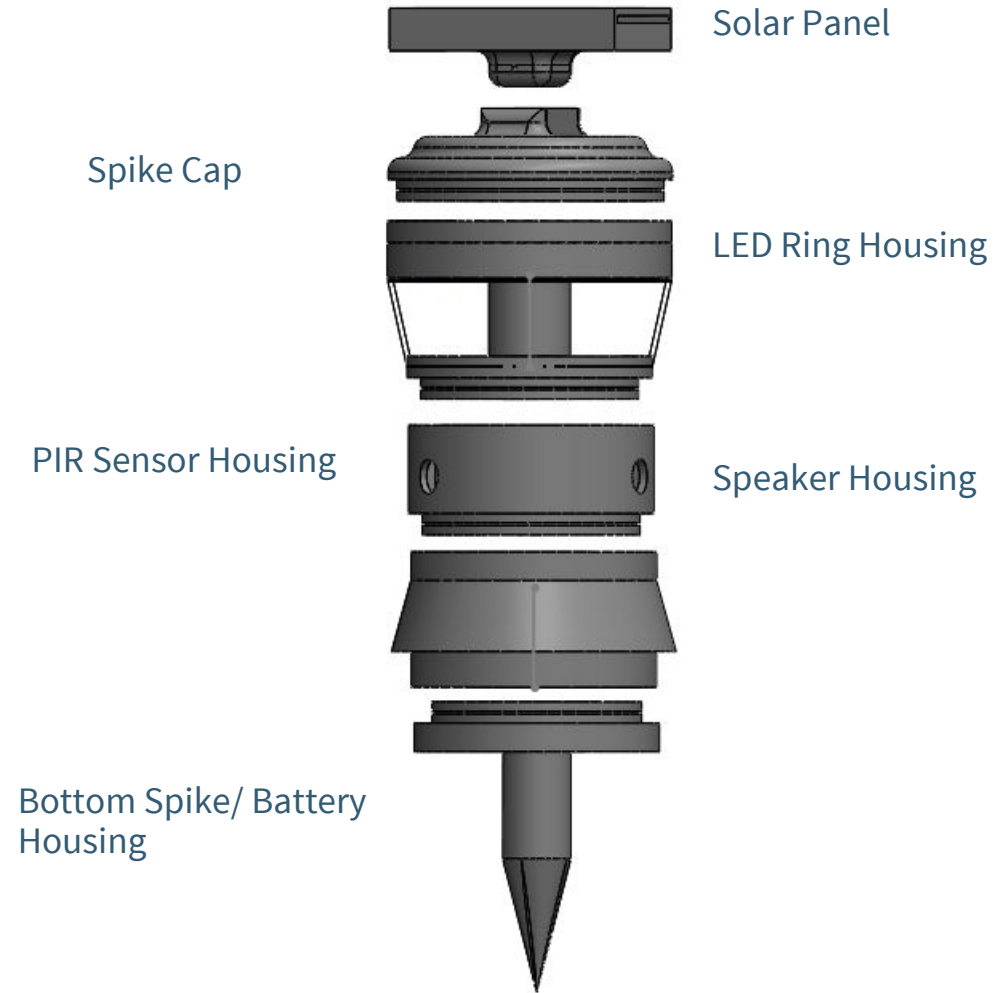


Spike PCB Schematic

- Microcontroller – 5 V 2 A
- LEDs – 5 V 2 A
- Audio Transceiver – 3.3-3.7 V 1 A
- Audio Amplifier – 5 V 1 A

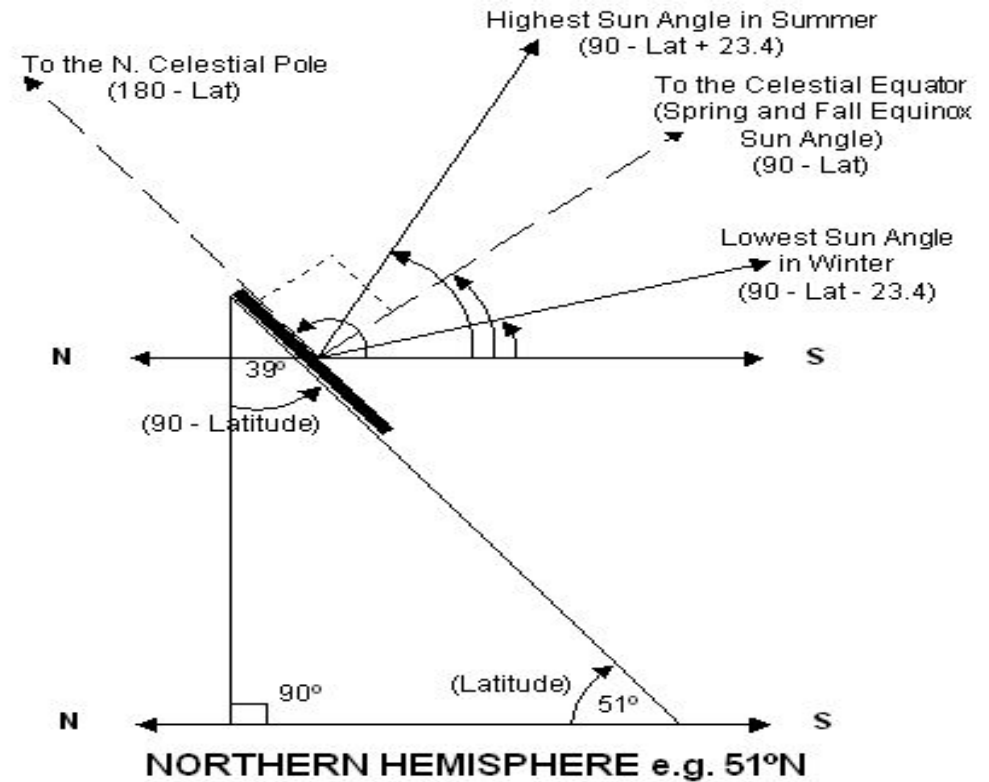


Lawn Spike Housing



Adjustable Use

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

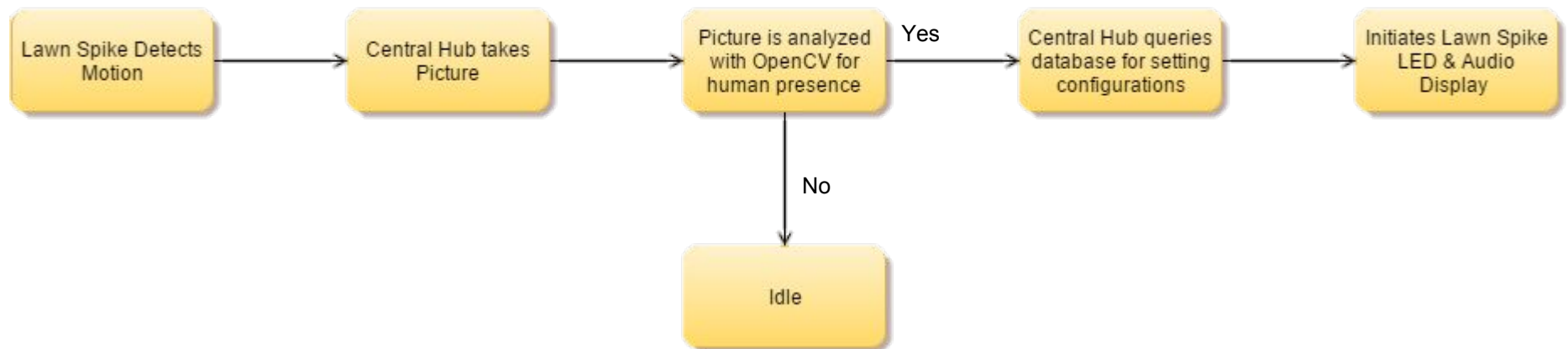


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Season	Tilt (Approximately)
Summer	38°
Spring	62°
Fall	62°
Winter	86°



Lawn Spike/Central Hub Interface



Application

Why Android Studio

- Coding 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

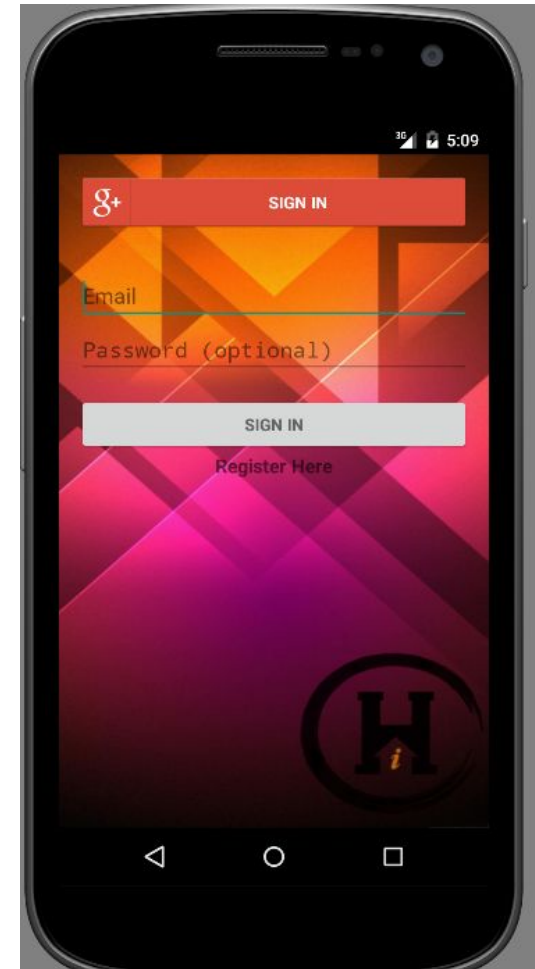
*Login Page
Register Page*

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

Server: localhost Database: a1837270_event Table: tableone

Browse Structure SQL Search Insert Export Import Operations Empty Drop


	Field	Type	Collation	Attributes	Null	Default	Extra	Action
<input type="checkbox"/>	fname	varchar(300)	latin1_general_ci		No			    
<input type="checkbox"/>	lname	varchar(300)	latin1_general_ci		No			    
<input type="checkbox"/>	email	varchar(300)	latin1_general_ci		No			    
<input type="checkbox"/>	password	varchar(300)	latin1_general_ci		No			    

Check All / Uncheck All With selected:     


Print view Propose table structure

Add 1 field(s) At End of Table At Beginning of Table After fname

Indexes: ?

 No index defined!

Create an index on 1 columns


 Open new phpMyAdmin window









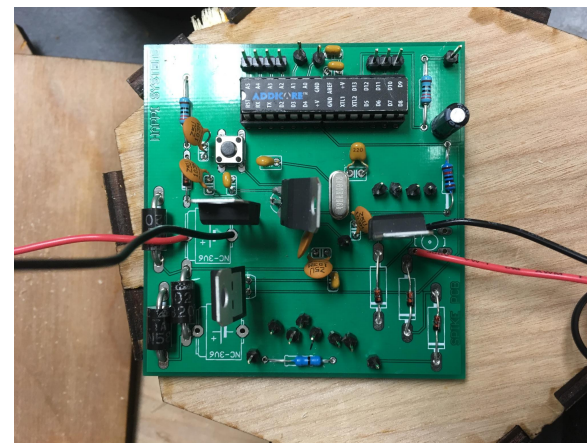
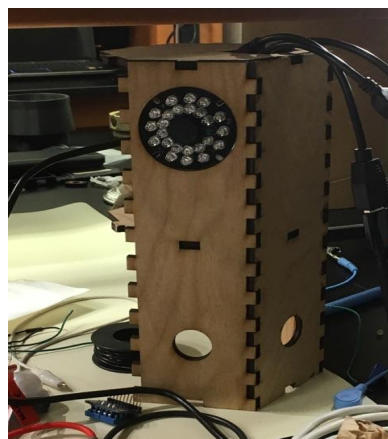
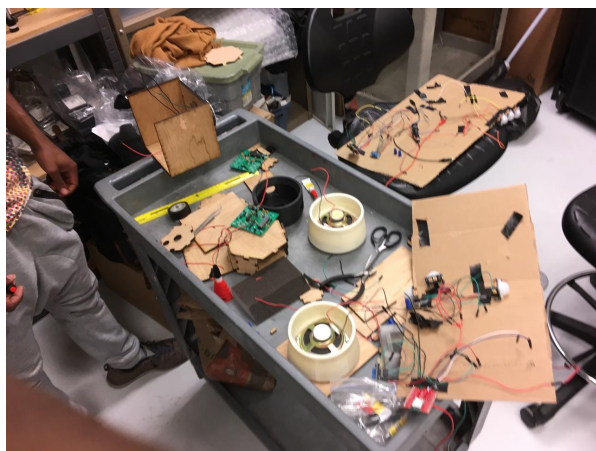


Construction of H.A.P.P.I. Systems

Facilities

- C.R.E.O.L Senior Design Lab
- Our own 3D Printer
- Physics Undergraduate Room
- Innovation Lab
 - Laser Cutter
 - 3D Printer

Prototyping



Administrative Content



Work Distribution

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



Budget

Project Items	Product Number	Date Order	Date Received	Cost	Quantity	Shipping Cost	Tax	Total Cost
Stereo 2.1W Class D Audio Amplifier - TPA2012		11-10-2016	11-11-2016	\$10.00	4	\$26.00		\$66.00
RTL-8723 WIFI/Bluetooth Adaptor		10-15-2016	10-17-2016	\$16.00	3	\$0.00	\$0.00	\$48.00
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
Speakers				\$2.99	3	\$12.00	\$0.00	\$32.97
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 Tapping, 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
PCB		10-20-2016		\$34.95	1	\$18.99		\$53.94
RN-52/Stereo Audio Bluetooth				\$50	3	0		\$150
							Total Cost	\$540.32

Total Cost = \$540.32



Financing

- We have collectively decided to finance ourselves

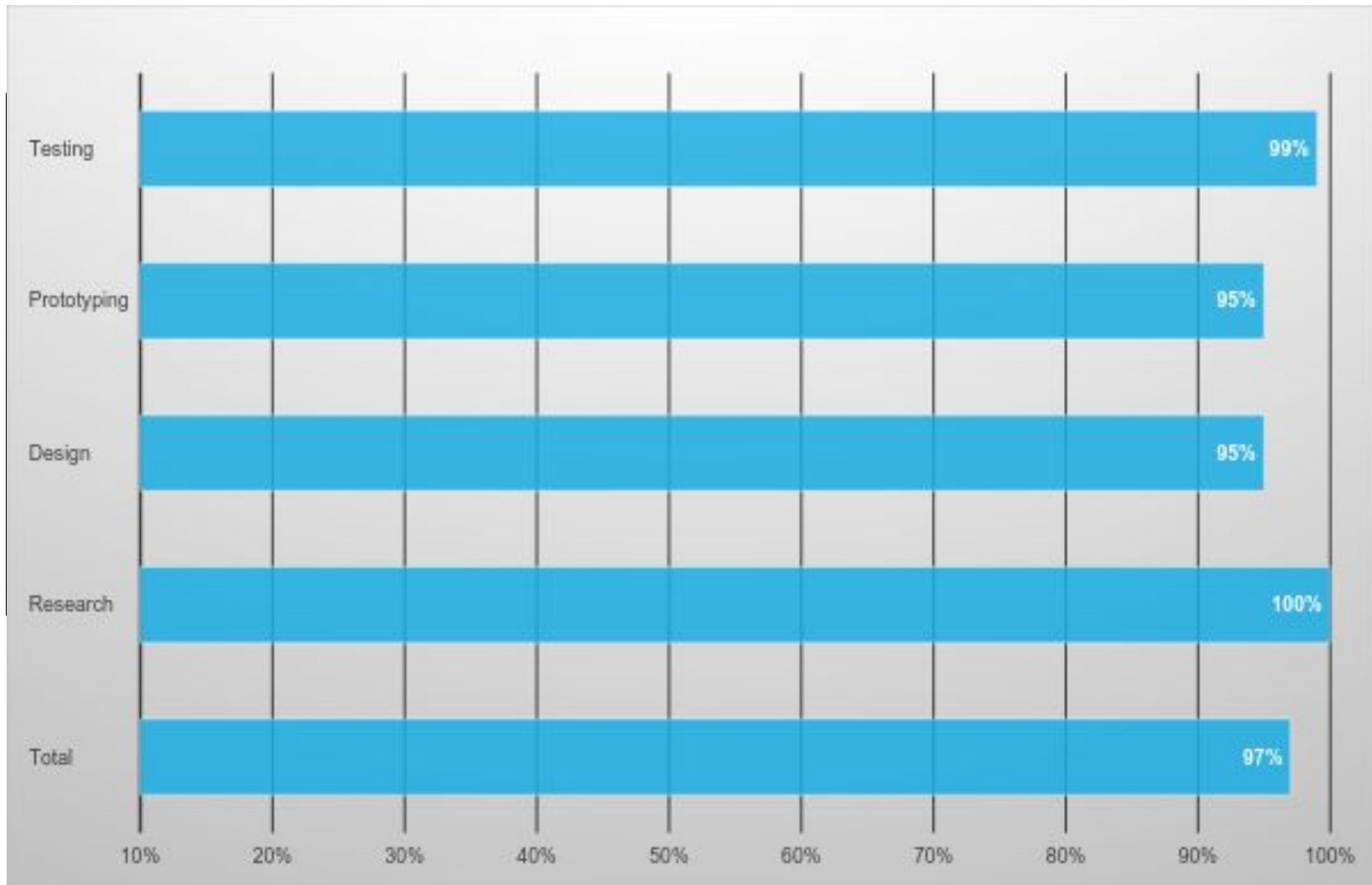


Issues

- PIR Sensors
- PCB
- LED 5050 Individuals
- Soldering Components
- Wireless Transceivers
- OpenCV
- Camera



Progress





Questions?