

HOMES

Home Observable Monitoring Entry System

Group 12


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Motivation and Description

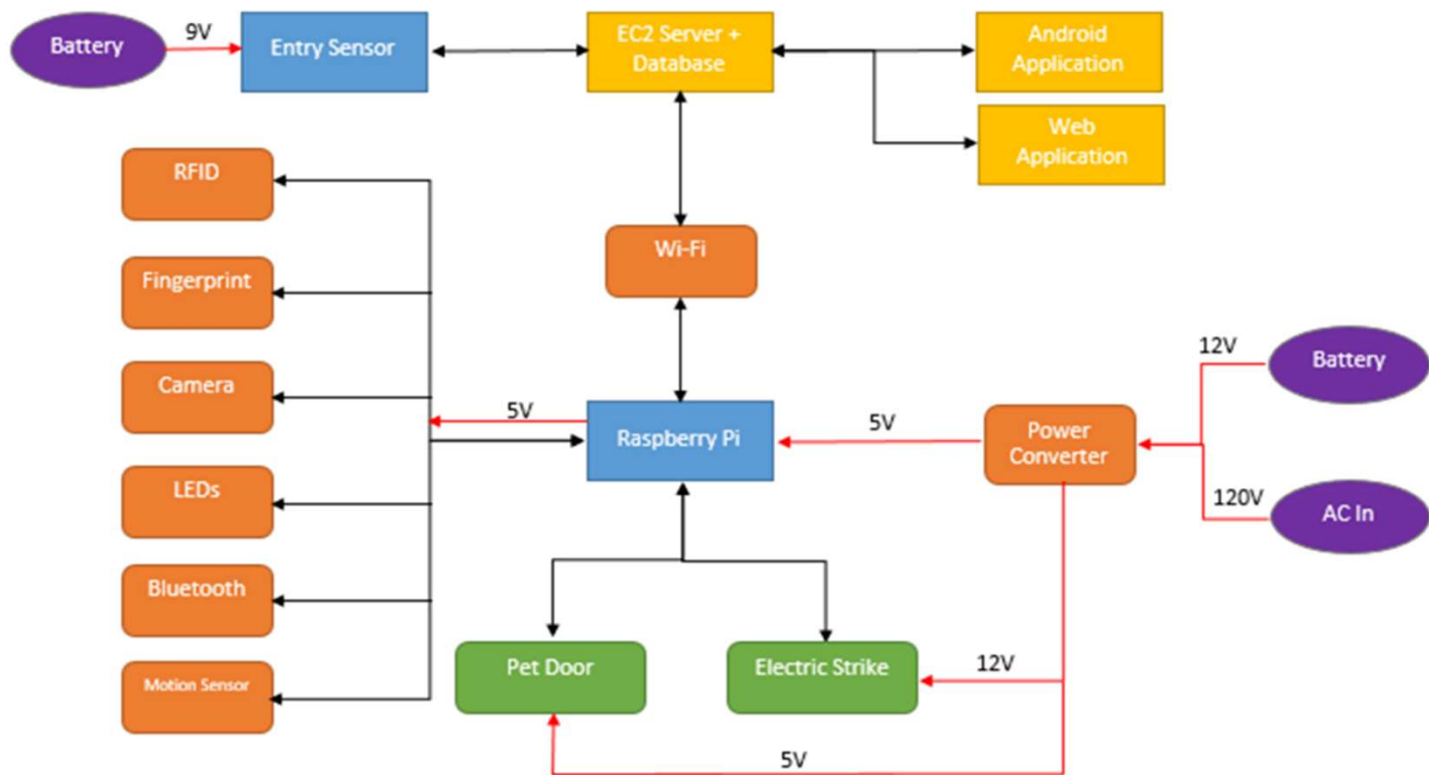
- Update the technology used to enter and monitor households
 - Multiple ways to access home
 - Monitor other entry points
 - Pet door that unlocks itself
 - Mobile and web application
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Goals

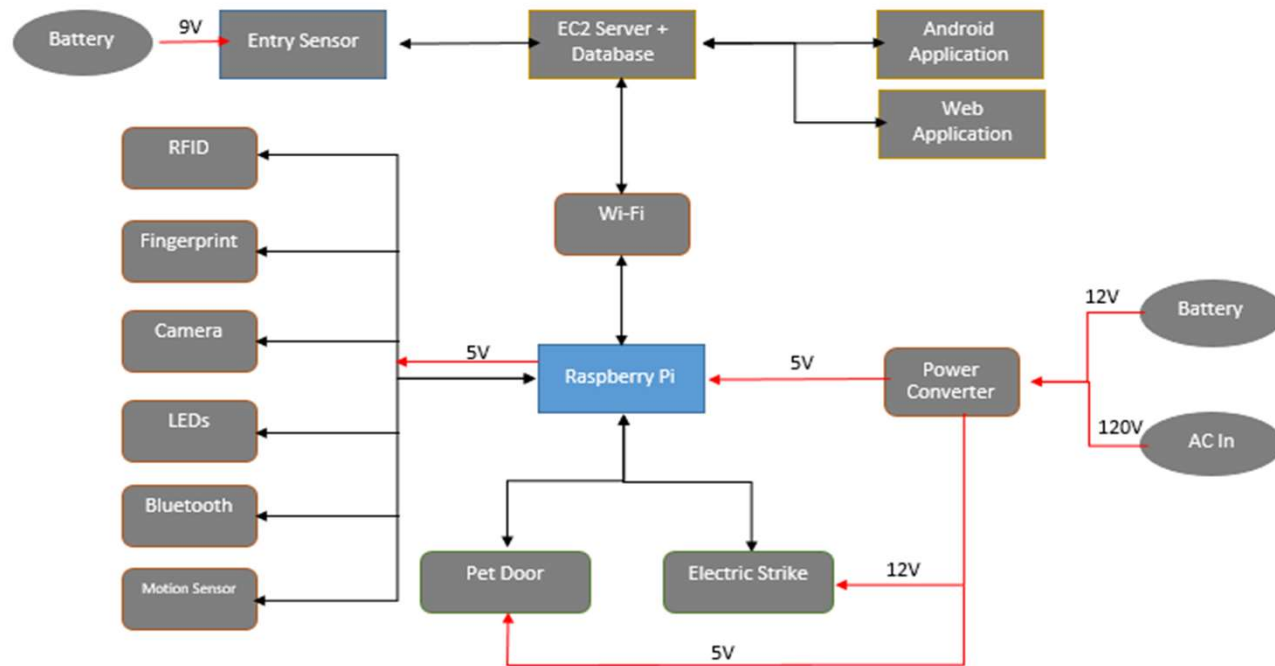
- Fully functional lock and unlock mechanism
 - Motion sensor camera/light activation
 - Detect the opening of entry points
 - Have multiple ways to access home
 - Pet collar wearable that unlocks pet door
 - Fully functional mobile and web application
- 

Specifications

Component	Desired Range or Value
Motion sensor	detect motion within 2 feet of door
Locking/unlocking mechanism	respond within 3 seconds of signal
Facial recognition	send signal within 30 seconds
Pet door	unlocks when pet is within 1 foot of door lock after wearable is out of range
External entry points	detect when opened within 1 second
Mobile and web application	update in real time



Single Board Computer



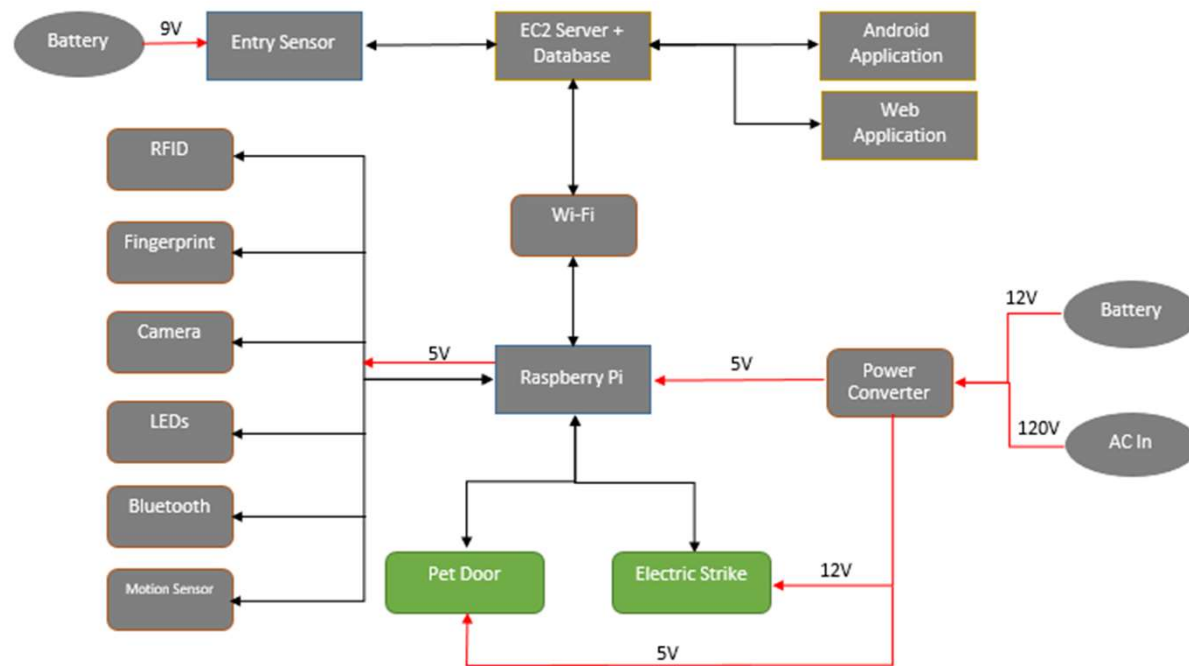
Comparison of SBC's

Specification	Raspberry Pi 2	Arduino Uno	Intel Edison	BeagleBone Black
CPU	Broadcom BCM2836 quad-core ARM Cortex-A7	Sitara AM3359AZCZ100 (ARM Cortex-A8	Intel Atom dual core 22nm SoC	TI Sitara™ AM3358 1GHz ARM® Cortex™- A8
Memory	1GB LPDDR2 SDRAM	2KB SRAM	1 GB LPDDR3 POP	512 DDR3L DRAM
GPIO pins	40	26	40	46
USB ports	4	0	2	1
Price	\$35.00	\$25.00	\$75.00	\$45.00

Our Choice

Specification	Raspberry Pi 2	Arduino Uno	Intel Edison	BeagleBone Black
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Locking Mechanism



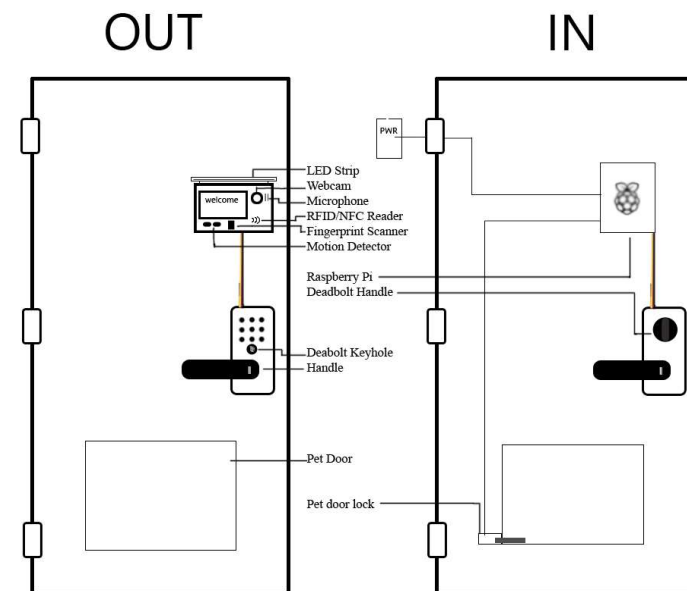
Electric Strike

- Fail Secure electric strike
- Will open with a 12V DC input
- Cheaper alternative than modifying an existing smart deadbolt
- More reliable than making our own locking mechanism

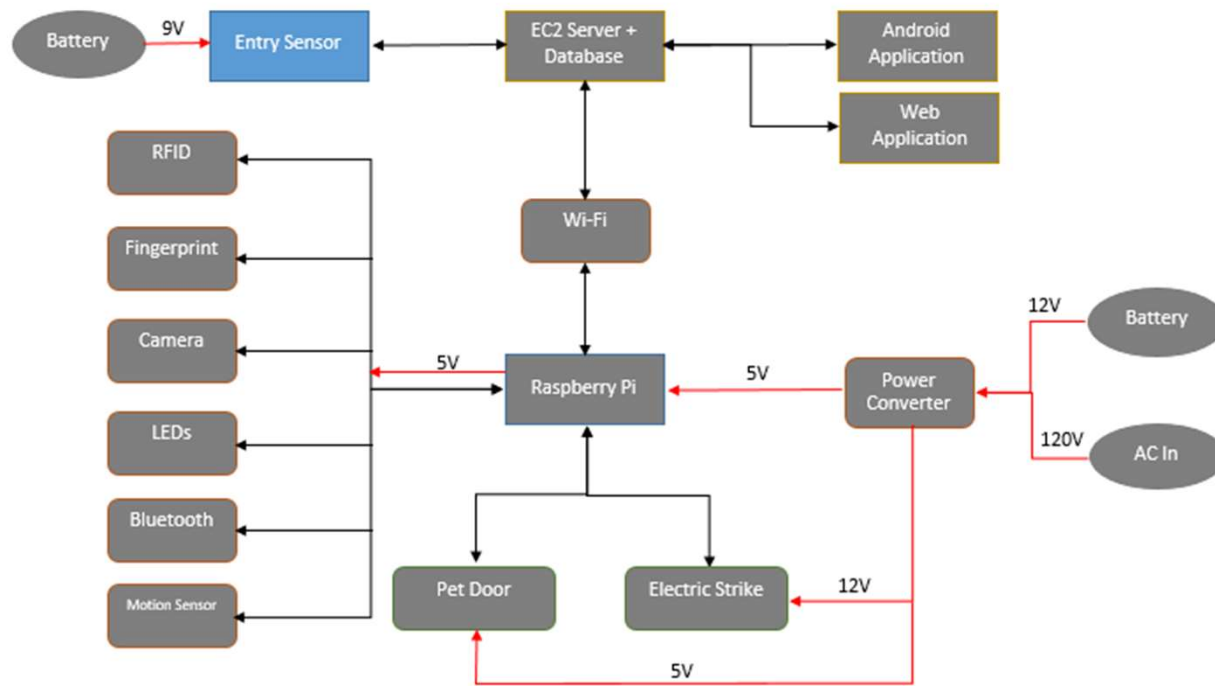


Pet Door

- Responds within 3 seconds of signal
- Unlocks within 1 foot of door
- Locks after wearable is out of range
- Access via pet collar wearable



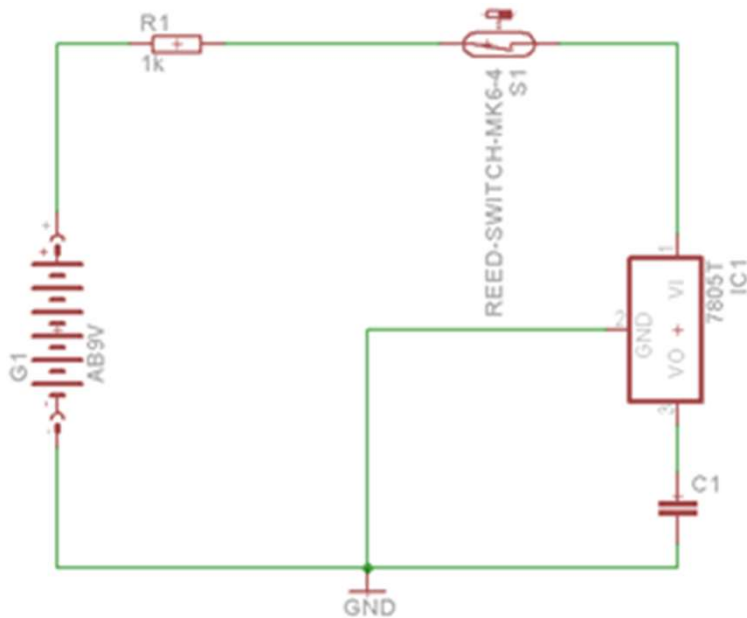
External Entry Points



Sensors

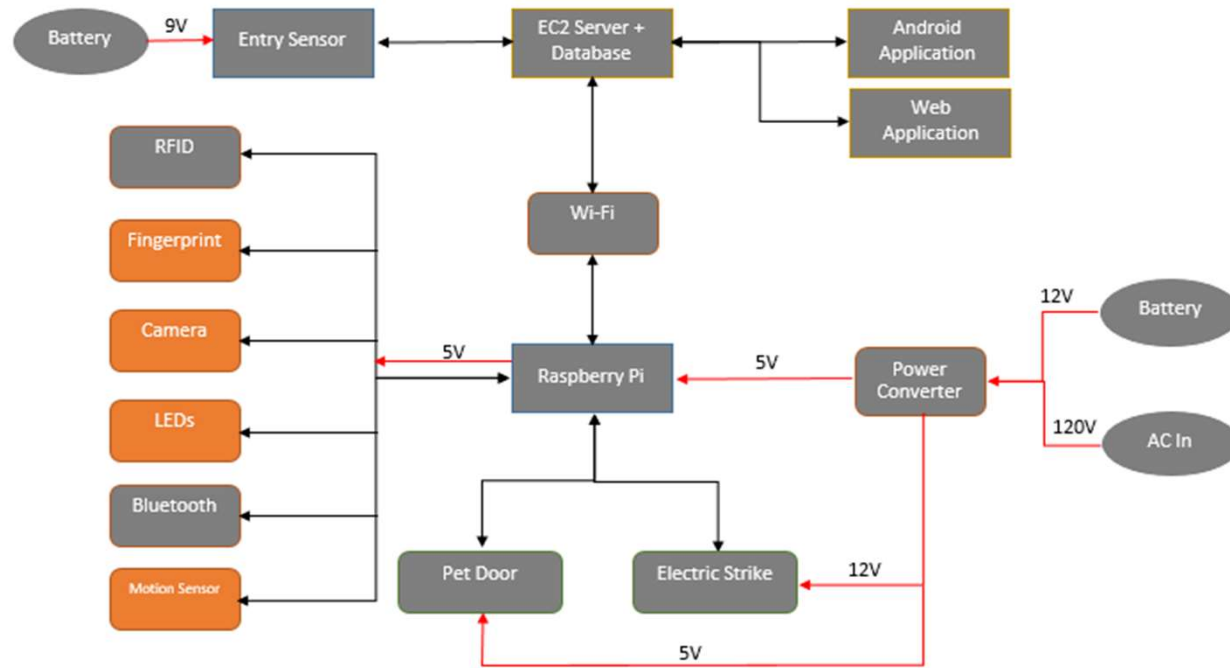
- Reed Switch
 - Open in absence of magnetic field
 - Closed in presence of magnetic field
- Displacement Sensor
 - Calculate the displacement
 - If the sensor has been moved then the displacement will be greater than zero
- Accelerometer
 - Measure the acceleration
 - If the entry point is being opened then there will be acceleration

Entry Point Schematic



- Reed switch and magnet
- Open circuit when no magnetic field
- Switch closes when magnet gets close

Modules



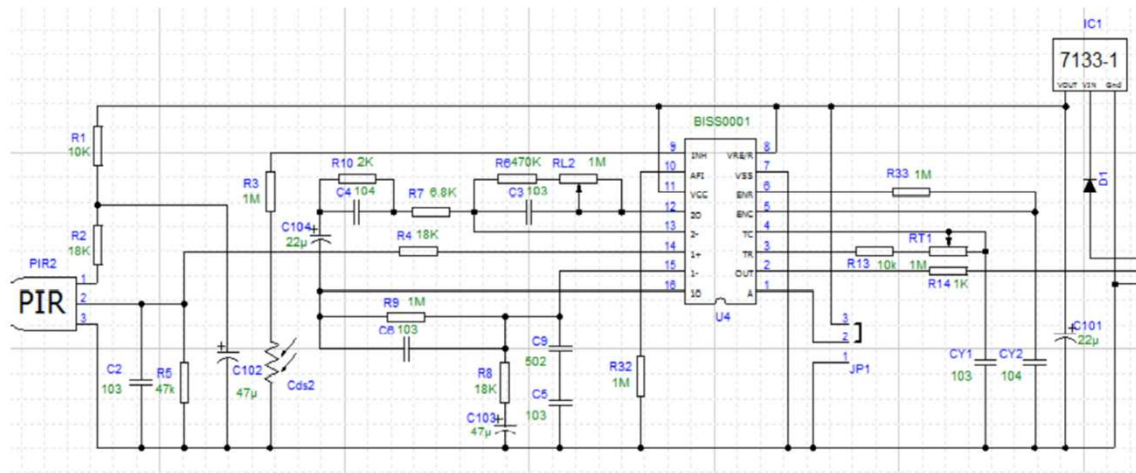
Fingerprint Scanner

TTL GT511C1R

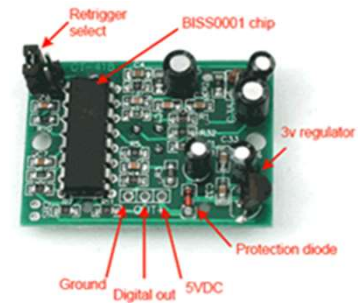
- 3.3 - 6 volt
- SmackFinger 3.0 algorithm
- R/W fingerprint templates and databases
- Simple UART protocol
- 360° recognition



Motion Sensor

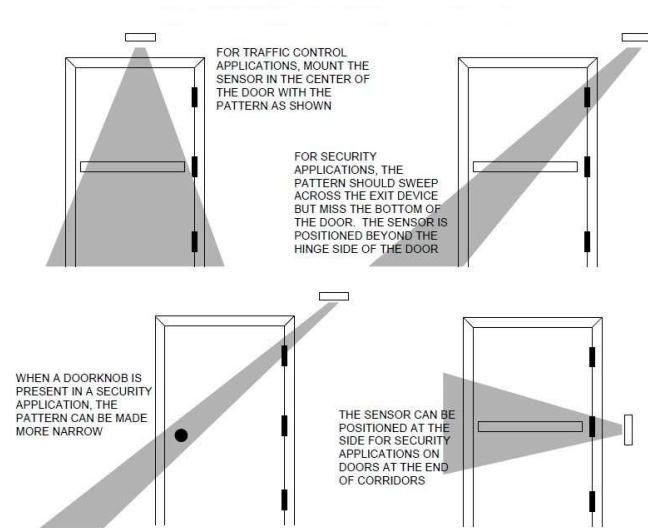
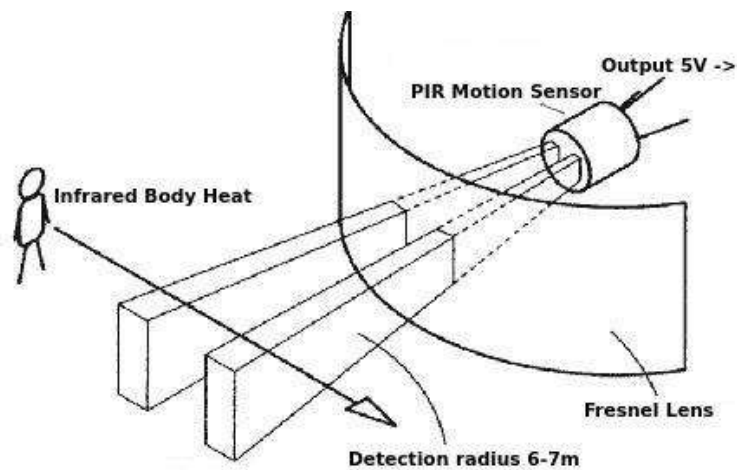


Datasheet HC-SR501

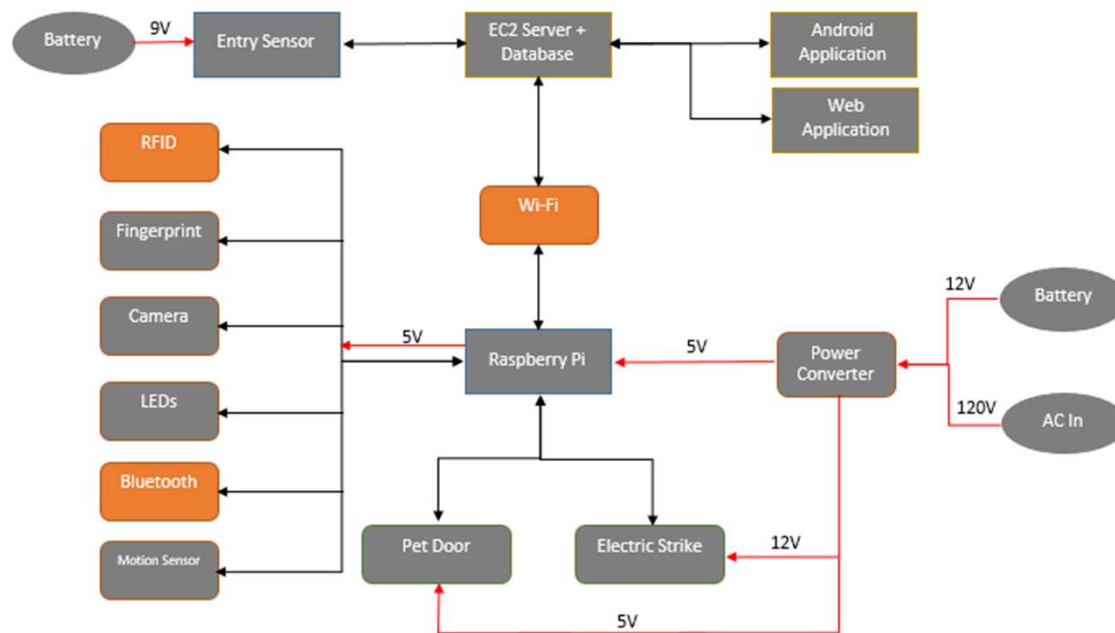


Vin: 5-20V
Vout: 0V Low / 3.3V High
Range: 20ft
Sensing Angle: 110°

Motion Sensor



Communications



Comparison

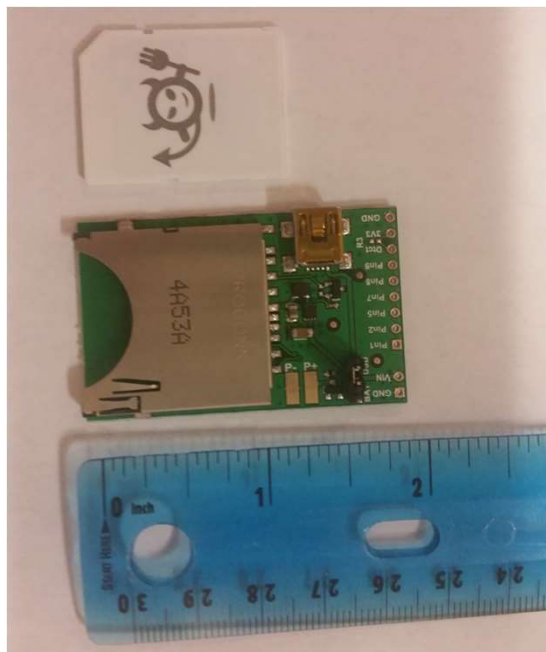
Wi-Fi vs Bluetooth vs ZigBee

Component	Bluetooth	Wi-Fi	ZigBee
Frequency	2.4 GHz	5 GHz	915 MHz
Bandwidth	24 Mbits/s	6.93 Gbits/s	250 Kbits/s
Range	20-35 meters	10 meters	10-100

Wi-Fi

- ESP 8266
 - Cheap.
 - Not well documented.
 - Hard to change configuration.
- TI CC3200
 - Free Sample, but dev board \$30.
 - Documented, but very limited tutorials.
- Electric Imp
 - Dev board + Module \$37.50.
 - Documented, tutorials, and more widely used.

Wi-Fi for Entry Sensor



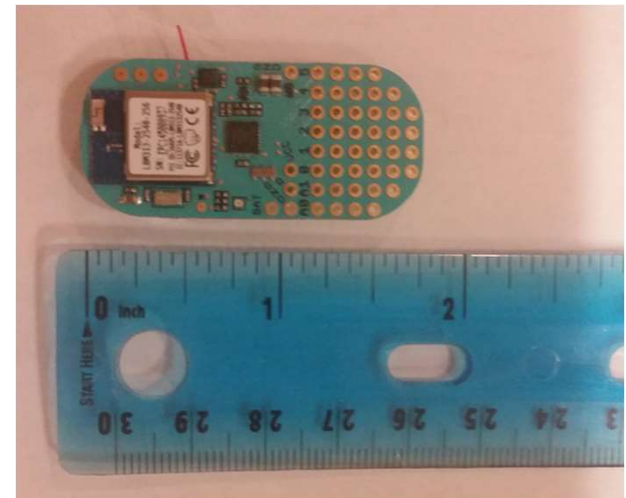
Electric Imp with April Dev Board

- WEP, WPA and WPA2 encryption
- Cortex-M3 core
- Low power consumption
- 6 I/O pins
- Operate from any DC voltage from 3.3V to 17V
- Easy Setup

Bluetooth for Pet Collar

LightBlue Bean

- CR2032 coin cell battery
- Bluetooth 4.0 Low Energy
- 3V operating voltage
- 6 digital I/O pins, 2 analog pins
- Wireless programming



RFID for Key FOB

ID-3LA reader

- 2.8 – 5V operating voltage
- Low cost

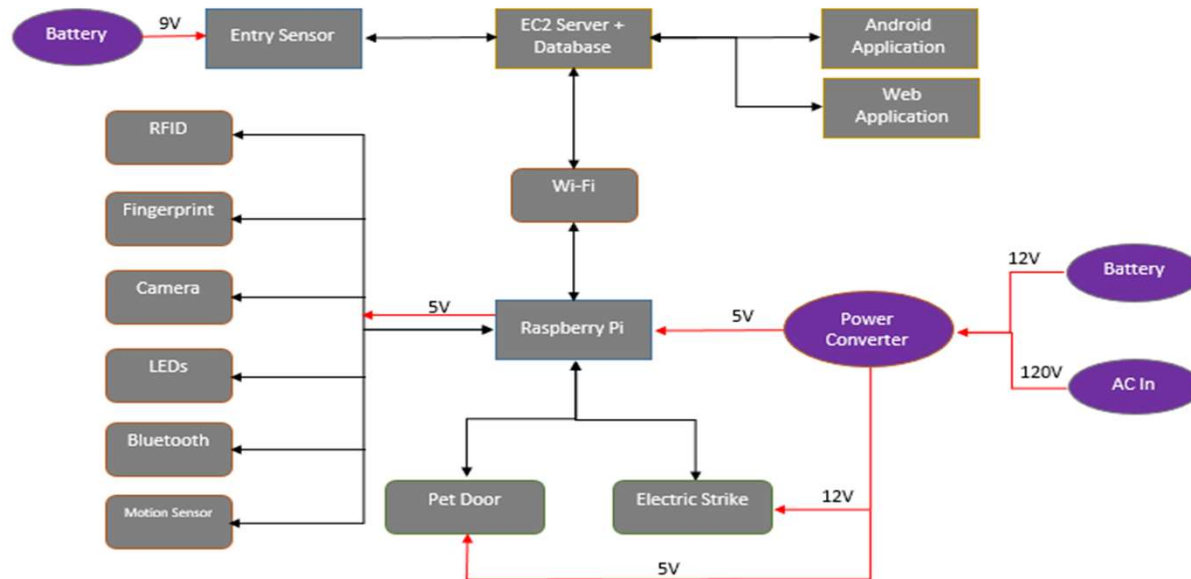


EPC Gen2 RFID card

- long range
- 0.1 lbs
- \$2.99

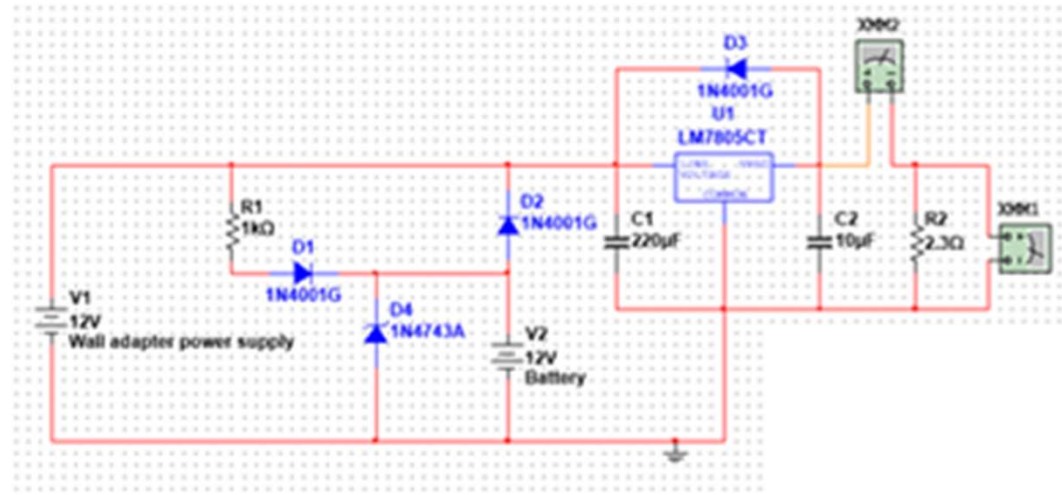


System Power

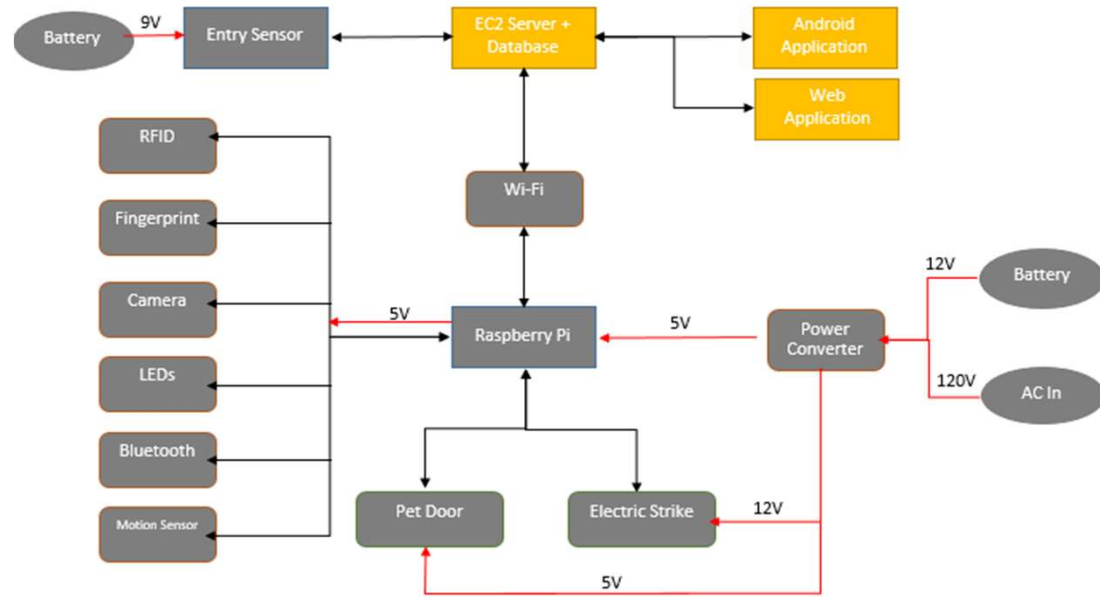


Battery Backup

- Take power from wall outlet
- Step it down to appropriate amounts
- Provide a battery backup in case power goes out

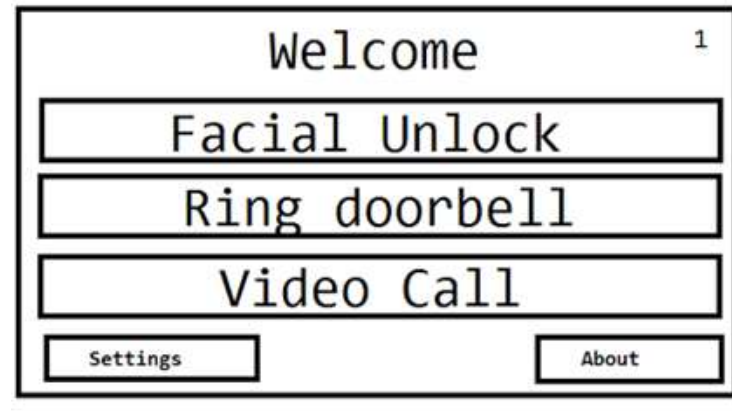


Software



Door User Interface

- How an outside user interacts with the system.
- Displayed on touch screen LCD.
- User can choose to:
 - Face recognition entry
 - Ring the owner
 - Video call



Facial Recognition

- Implemented in Python using OpenCV.
 - OpenCV FaceRecognizer class
 - Eigenfaces
 - Users will register new faces in admin console.
- Using a Logitech HDC310
 - Due to price and compatibility



WebApp (FrontEnd)

Bootstrap 3.0

- .Responsive design
- .Cross-platform support

jQuery

- .Most popular JS library
- .Eliminates cross-browser incompatibilities

HTML5 + CSS3

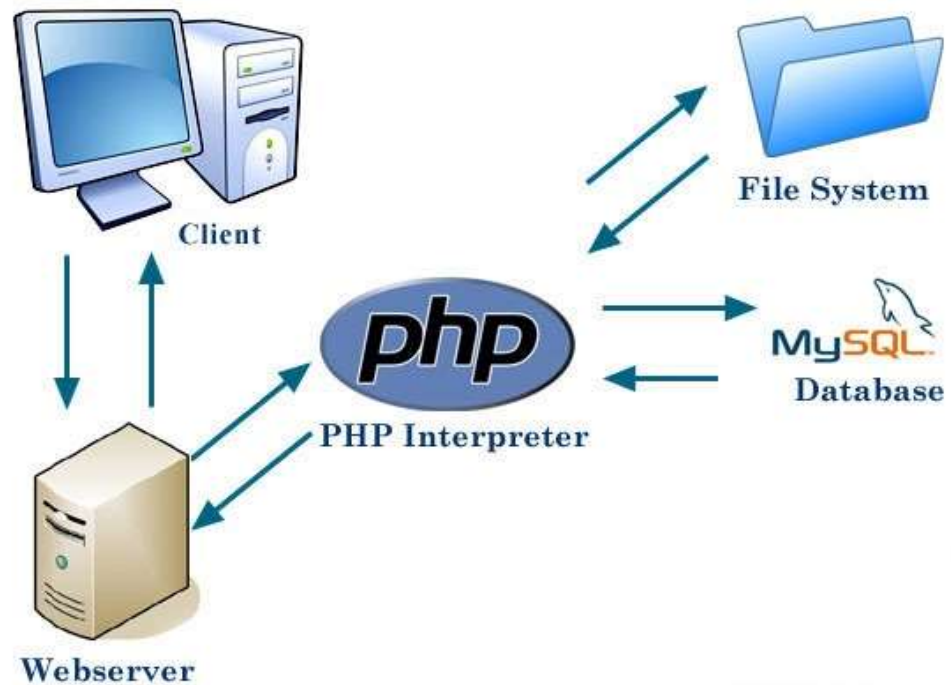
- .Page reformatiing
- .Site-wide consistency
- .Offline & Storage
- .Performance & Integration



WebApp (BackEnd)

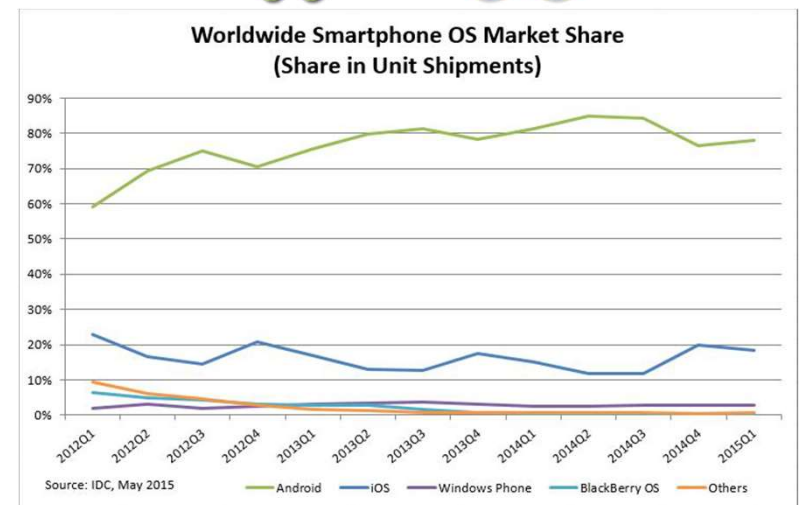
PHP+MySql

- Generate dynamic page content
- Encrypt data
- Collect form data
- Modify data in database
- Modify files on server
- Send and receive cookies



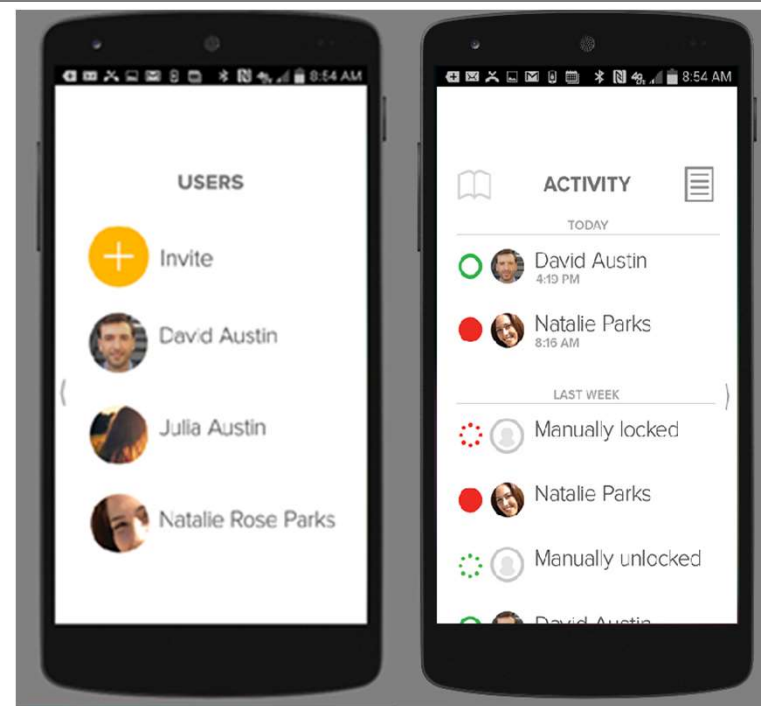
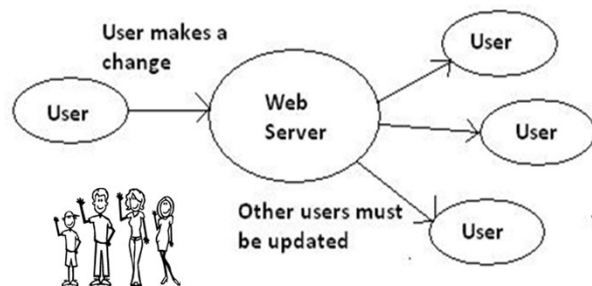
Android vs iOS

Factors	Android	iOS
Market	78%	18%
Publishing Cost	\$25 one-time	\$99/yr
Hardware	Any Computer	Apple Computer
Language	Java	Objective-C
Distribution	Play Store, Amazon AppStore, etc	AppStore
Widget Capability	Yes	No



Mobile App

- Homeowner creates admin account
- Family members create user account
- Admin adds users to account
- Admin full access, users limited access



Difficulties and Concerns

- A lot of parts to integrate
- Creating a prototype that is easily portable
 - Buy premade door vs making one out of plywood
- Too much for the Pi to handle
- Time

Member Responsibilities

Member	Power	Locking Mechanism	Entry Sensor	Web/Mobile application	System programming	Hardware Design
Colleen	+	-	+	-		-
Rick	-	-	-	+	-	+
Bruno		+	-	-	+	-

Budget

Part	Quantity	Budgeted Price	Total Cost
Raspberry Pi	1	\$40.00	\$40.00
PiTFT 480x320 Touch LCD Screen	1	\$45.00	\$45.00
Bluetooth 4.0 USB adapter	1	\$10.00	\$8.98
Micro USB AC Power Supply adapter	1	\$10.00	\$7.99
Fingerprint Scanner	1	\$33.50	\$31.95
LightBlue Bean	1	\$20.00	\$30.00
Motion Sensor	1	\$15.00	\$5.00
Electronic Strike	1	\$40.00	Free

Budget

Part	Quantity	Budgeted Price	Total Cost
Electric Imp	1	\$10.00	\$37.50
CuteDigi RFID card	1	\$28.00	\$2.99
Magnets (pack of 10)	1	\$5.86	\$5.86
Batteries	1	\$12.00	\$12.18
Door handle	1	\$14.99	Free
Spray Paint	1	\$3.87	\$3.87
PCB materials	2	\$15.00	\$30.00
Total		\$303.22	\$261.32

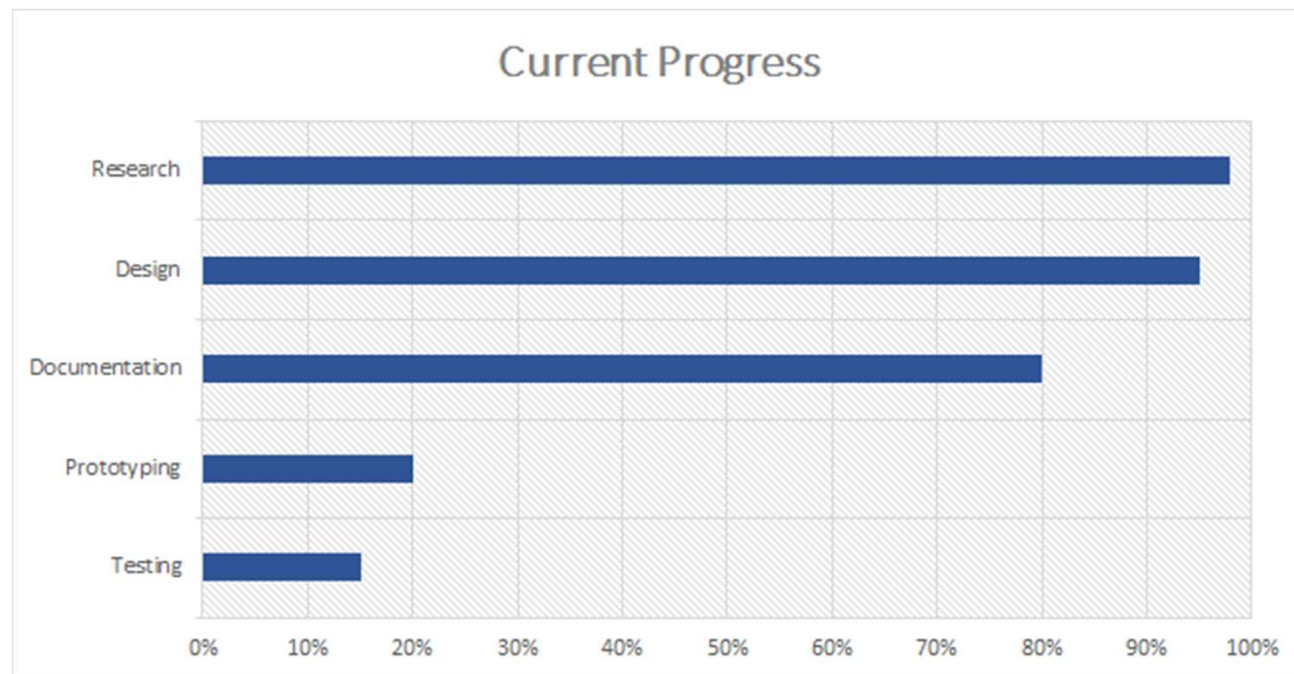
Financing

Financed by Boeing for \$334.53

Any amount over will be funded by the group



Current Progress



QUESTIONS?

