

# Open Sesame

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# Description

Open Sesame is a portable, affordable, compact and easy-to-use door security accessory, that can unlock your door remotely with Wi-Fi through an android or iOS app, or can unlock your door through a Bluetooth proximity detector, discriminating between only authorized users. It requires only a very simple, non-invasive installation, and runs off of a portable solar-rechargeable battery pack.

# Team Sesame

- Grant Apodaca - team leader, bluetooth, and security
- Jeff Bolin - wifi, networking, and server
- Eric Taba - motors, motor controllers, and mobile application
- Richie Agpaoa - power management and camera interface
- Evin Sellin - camera interface and web development

# Application

- Open Sesame is designed be a multi-use locking accessory which simplifies the way people lock and unlock their doors
- After a simple, non- invasive installation, the user can unlock their door in 1 of 3 ways:
  - Automatically by approaching the door
  - Manually by use of the included app
  - Manually by use of the web interface

# Application II

- The user can then lock their door in the same 3 ways
  - Automatically by walking away from the door
  - Manually by use of the included app
  - Manually by use of the web interface

# Application III

- The App allows for user control of the lock, and settings adjustment, as well as permission control, to allow other users access to unlock the lock
  - This can be done through the web interface too
  - Permission control done by sharing encrypted keys securely, or by blocking user ID's

# Application IV

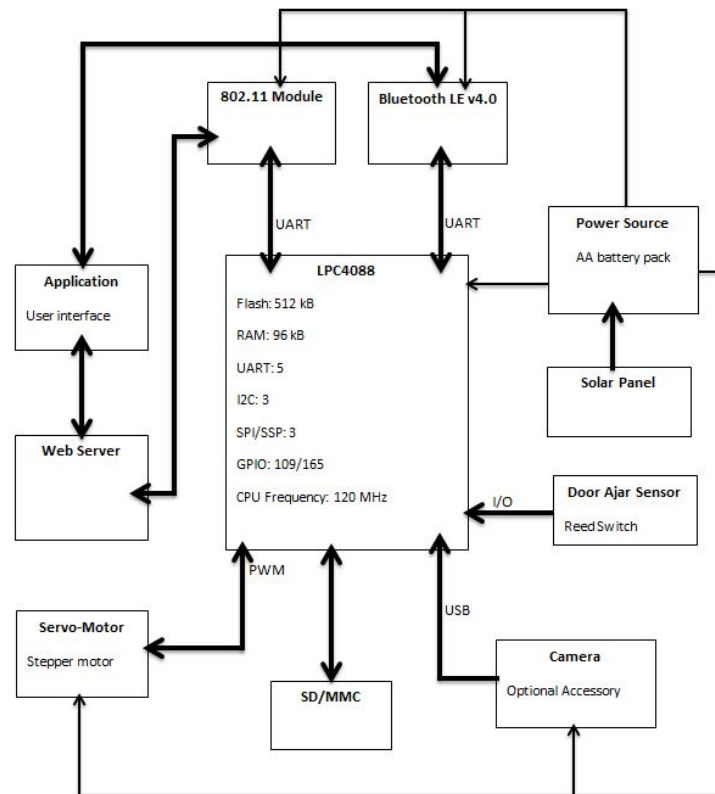
- The App and web interface also offers device health data
  - Door status (lock/ unlock/ ajar)
  - Battery health
  - Camera access

# Parts list

Component	Part number	Notes	Primary features	Interface
Processor	LPC4088		5 UART, 1 USB, 120 MHz	5 UART, 1 USB
Wifi module	RTX4100		low energy, wifi b/g/n, built in controller for ascii interfacing	UART
Bluetooth Module	BLE113-A-M256K	low power and desired 30 ft range	class 2, BLE, version 4.0, low power sleep mode	UART
Camera		Simple to use library for universal camera control	small resolution for fast response	USB
Battery	standard AA rechargeable	Will be compatible with solar charger, as well as easy to use for consumer	Easy to use standard	
Motor	QSH4218	Stepper with optical encoder for better control for locking mechanism	Bipolar, Hybrid, 50 oz*in torque, 4.5 V, 1 A	UART
Quadrature	RenkoP25i	5V, customizable, 500 kHz	Used to calibrate and securely lock door	UART



# Top Level Block Diagram



# Critical Elements

## Bluetooth

- Used to detect proximity and valid user to open or close lock
- Establishes Wifi connection

## Motor

- Used to turn the lock to the open or closed position

## Server

- Hosts specific user logins and accounts

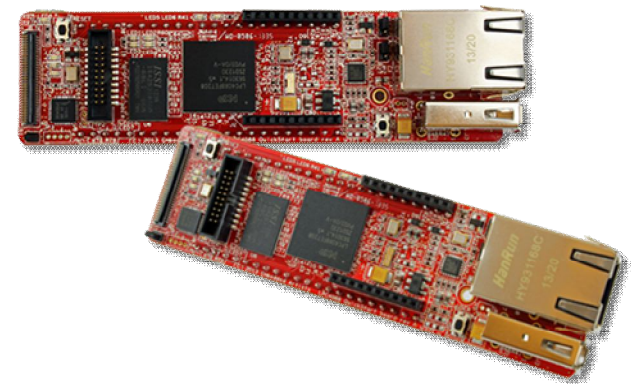
## Wifi

- Acts as server providing device statistics to the internet

# Processor

## LPC4088

- Memory: 512KB Flash, 96KB RAM, 4KB EEPROM
- Timers: 9 Standard Timers, 18 PWM Channels
- Serial Interfaces: 5 UART, 3 I2C, 3SPI/SSP, 1I2S, 1 USB, 2 CAN, 1 Ethernet
- Analog Interfaces: 8-ch/12 b ADC channels, 10b DAC channel, 2 comparators
- 8/16/32 External Bus Interface
- 109/165 GPIO pins
- Max CPU Frequency: 120 MHz
- Supply Voltage: 2.4-3.6V
- Temperature Range: -40° to 85°C



# Motor

- DigiKey QSH4218 41-10-035
- Operates bolt, locking and unlocking door
- Bipolar Hybrid Stepper Motor
- Step Resolution:  $1.8^\circ$  - 200 steps
- Full-Step Motion: lower power consu
- Torque: 50 oz\*in
- 4.5 V @ 1 A



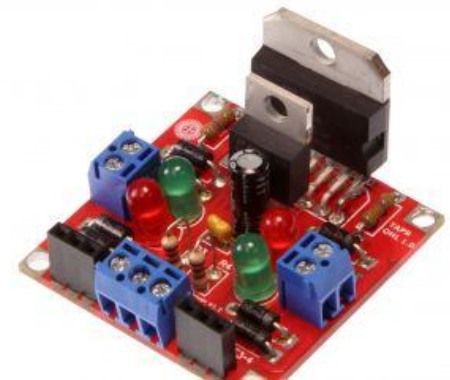
# Quadrature Encoder

- R35i Modular Encoder from Renco
- Attaches to motor shaft
- Rotary encoders provide feedback to the microprocessor via GPIO.
- Frequency of output signal provides speed of the motor and distance traveled.
- Allows for precise monitoring of bolt position due to powered motion or manual rotation (occurs during device configuration)
- 5 V



# Motor Driver

- Solarbotics L298 Compact Dual Motor Driver Kit
- Provides interface between microcontroller and motor
- Has diodes and components to protect the microcontroller from back EMF and voltage spikes
- Has transistors for direction switching (H-Bridge)
- 6-50V Output
- Well documented
- Previously used in Capstone projects



# Wifi

## RTX4100

- Connectivity: Wi-Fi, 802.11 b/g/n 2.4GHz
- Dimensions: 30mm x 18mm x 2.4mm
- Data Rate: 2.1Mbps (UDP)
- Application Memory Space: 36kB Flash, 4kB RAM
- Interface: Integrated Antenna, Coaxial connector to Antenna, SPI, UART, I2C, GPIOs, JTAG, Flash Program Interface
- Power Consumption: Peak=230mA, Average=0,5mA, Standby=1.4uA
- Operating Supply: Min 2.2V, Max 5.25V
- Security: WPS, WPA2



# Bluetooth

## BLE113-A-M256K

- Bluetooth v4.0 BLE
- Class 2 to limit power usage and range
  - max 4dBm
- UART with data communication capability
- 16 Mb internal flash
- 12.4 x12.4 x1.8mm
- Low power sleep mode





# Technology Reuse

- Wifi modules and bluetooth modules were researched to be reused, but in the end, the newer technologies seemed to suite our power and compatibility needs better.
- The motor controller will be reused though, because of its reliability, and low cost.

# Technologies to Consider

We are also considering the use of GPS technologies to better improve proximity accuracy, and the use of Magnetometers to more compactly detect door openings. Sonar, and Infrared are also being explored to aid the GPS with proximity ranging to prevent erroneous door unlockings.

# Thank You!

Questions?  
Comments?  
Concerns?