Adam Franklin
Alex Girtonea
Bryon Long
Alex Lung
Mark Ma
Mahyar Yousefi

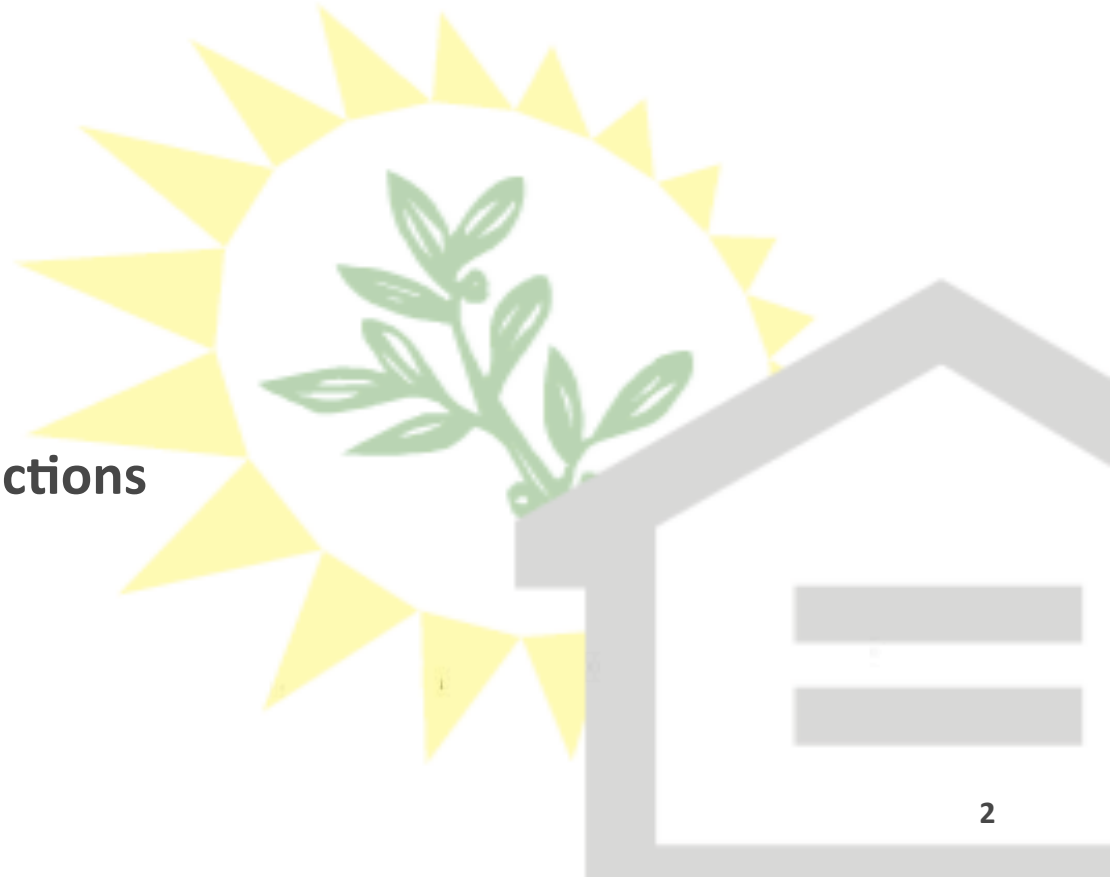
EVA Control System

The Home Automation System Everyone is TALKING About

Presentation Outline

EVAControls

- **Introductions**
- **Motivation**
- **System Design**
  - Overview
  - Voice Control Hardware
  - Controller Specifications
  - Web Based User Interface
- **Business Aspects**
  - Budget & Financing
  - Project Timeline
  - Competition & Marketing
- **Future Development & Reflections**
- **Acknowledgments**
- **Conclusion**
- **Questions**
- **Project Demonstration**



INTRODUCTIONS

EVAControls

DEVELOPMENT TEAM

Adam Franklin

Chief Executive Officer (CEO)

- Project Management
- Electrical Design/ Work

Alex Girtonea

Chief Marketing Officer (CMO)

- Web Interface Design
- Document Editing

Bryon Long

Chief Design Officer (CDO)

- Microcontroller Programming
- Component Interfacing

Alex Lung

Chief Finance Officer (CFO)

- Daylight Harvesting / IR Circuit Design
- Finance Management

Mark Ma

Chief Technical Officer (CTO)

- Voice Control Circuit Design
- Meeting Minutes

Mahyar Yousefi

Chief Operating Officer (COO)

- Voice Control Circuit Testing
- Timeline Management

MOTIVATION

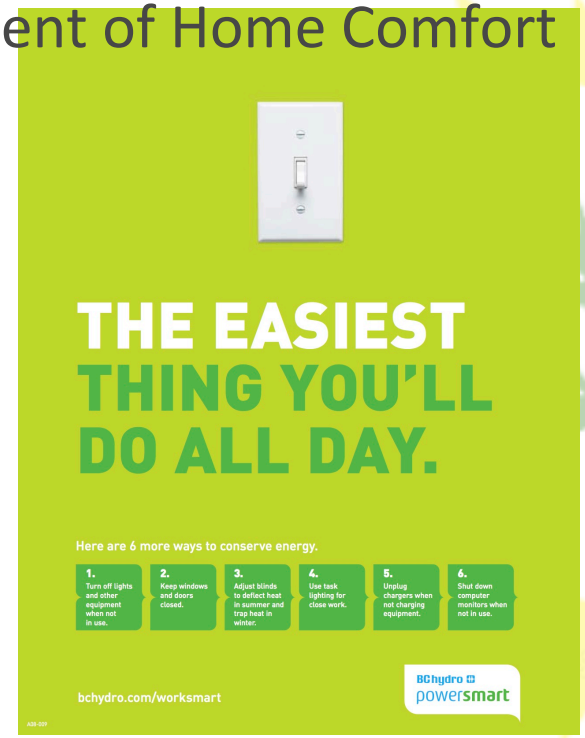
"For all people, both with and without disabilities, a home is the cornerstone of a person's independence and provides a sense of belonging."

- 2010 Federal Disability Report

MOTIVATION

EVAControls

- The most common types of disabilities among adults are pain, mobility and agility-related [1]
- Energy Conservation
- General Improvement of Home Comfort



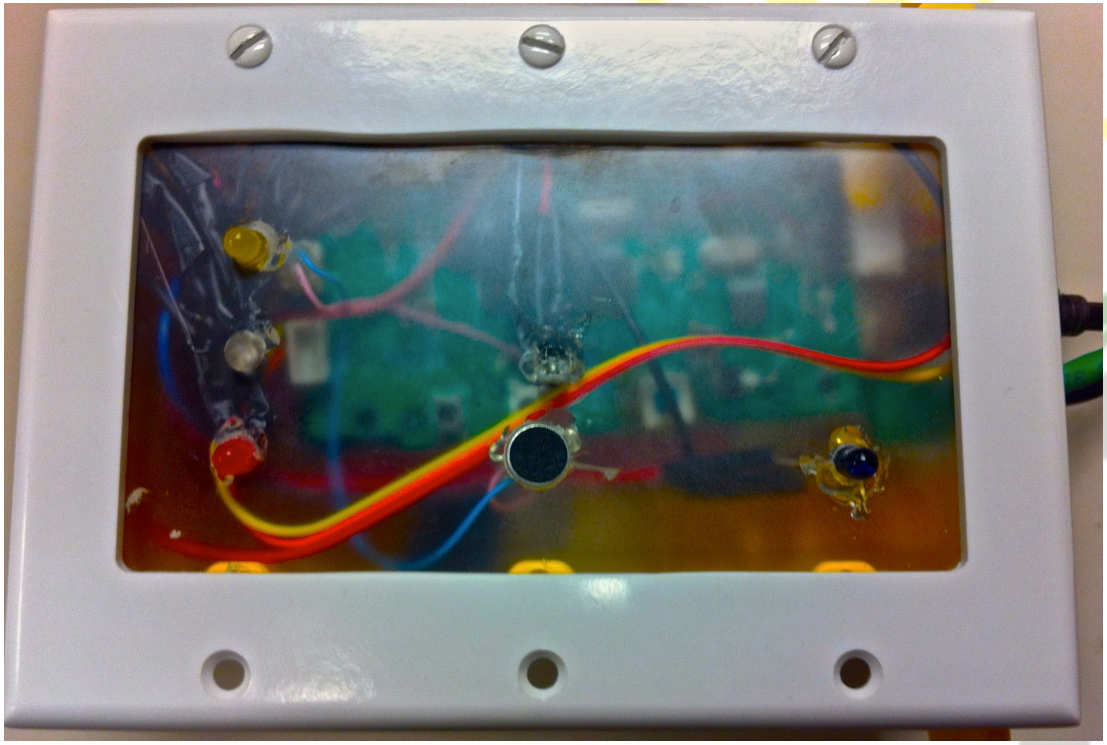
[1] http://www.hrsdc.gc.ca/eng/disability_issues/reports/disability_profile/2011/disability_profile.pdf

Our Solution

EVAControls

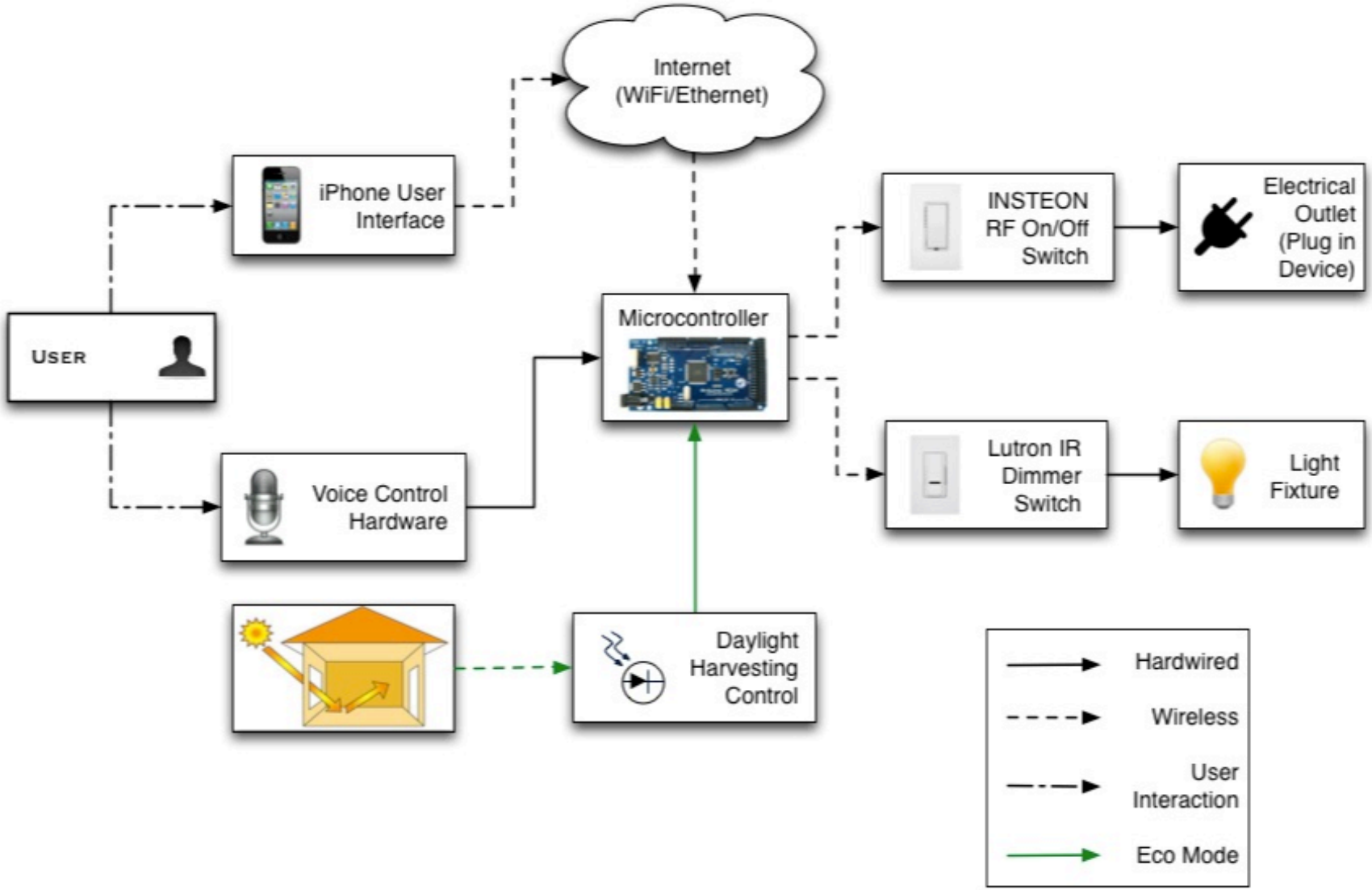
Eco Voice Automation (EVA) Control System

Voice Controlled Home Automation



System Overview

EVAControls



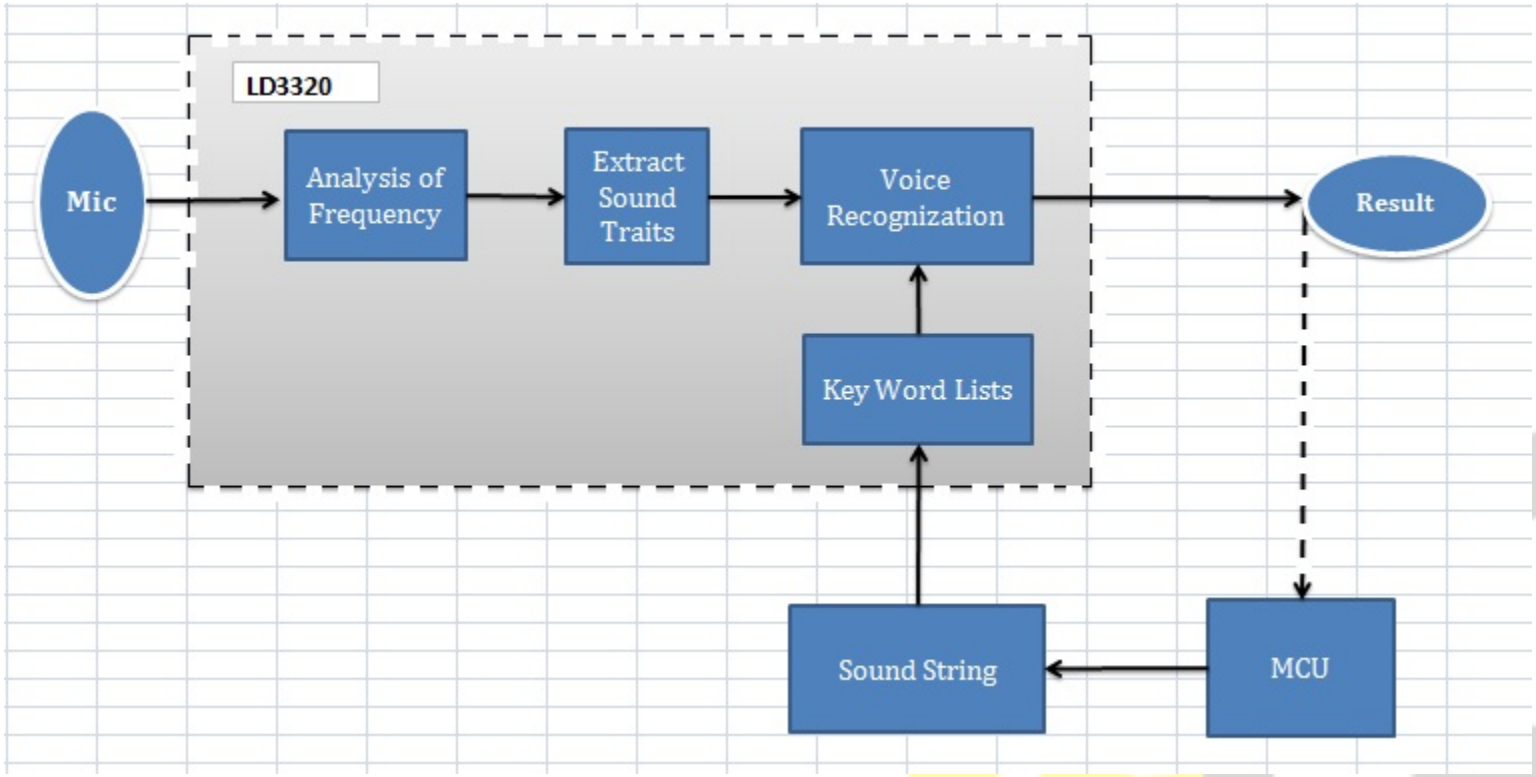
FEATURES

EVAControls

- Infrared (IR) Transmitter
  - Possibility to Control Any IR Device!
- Daylight Harvesting
  - Automatically Control Light Levels Based on Incoming Daylight
  - Save $!
- Voice Commands
  - Hands Free Control
- Web Interface
  - Control From Any Internet Device

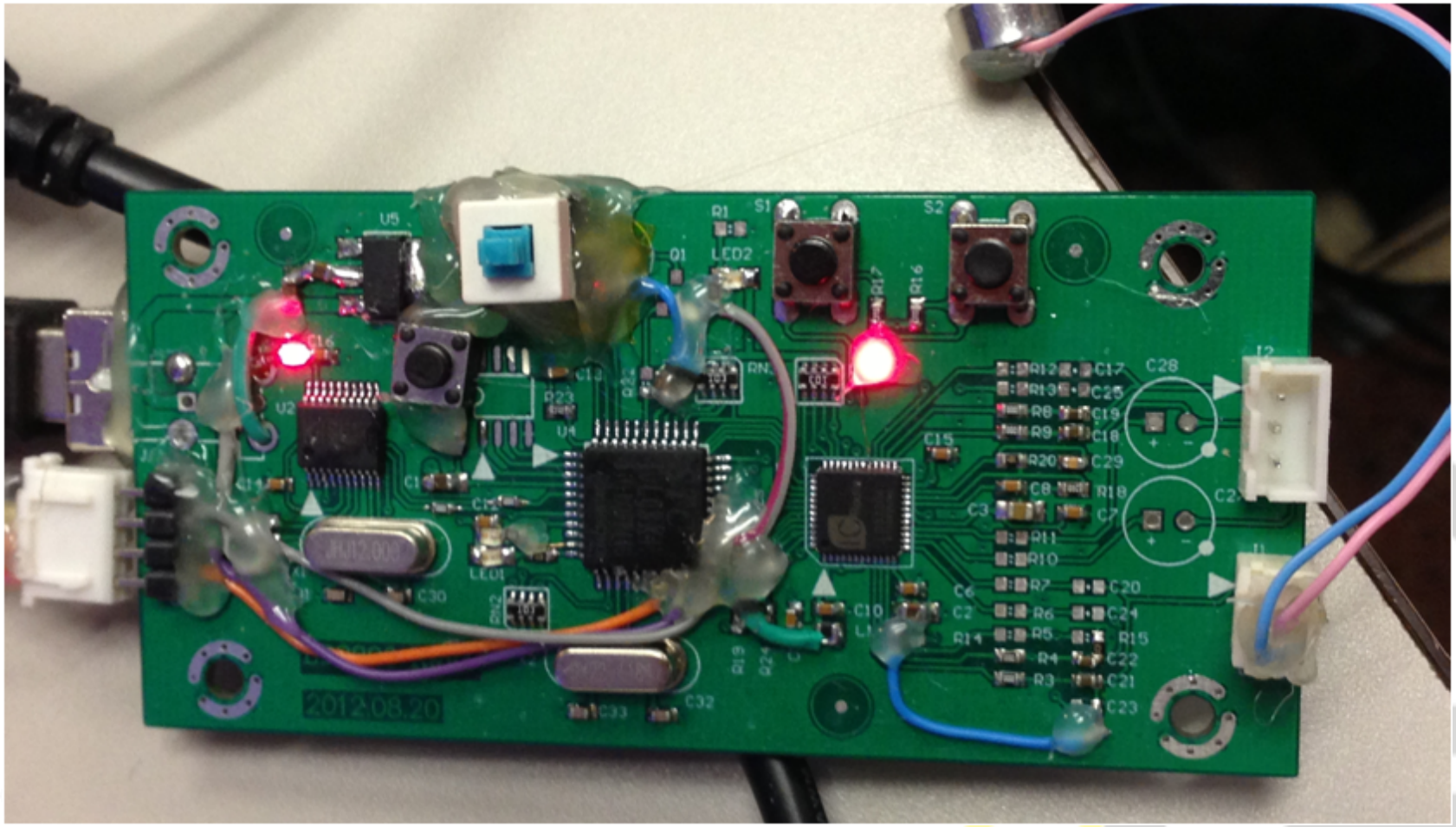
VOICE RECOGNITION OVERVIEW

EVAControls



VOICE CONTROL HARDWARE

EVAControls



How it Works

EVAControls

- Activate the system by speaking the key word "EVA"
- Speaks "light turn on" to turn on the light
- Speaks "close" to turn off the light
- Speaks "Done" to shut down the system
- Lights will remain open if command "close" is not received

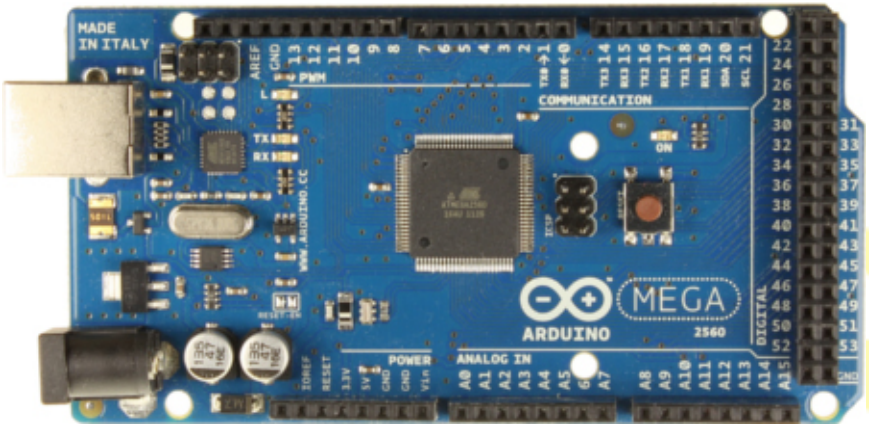
More About the PCB

EVAControls

- If EVA is not properly inputted, the LED represent the light flashes twice
- If other commands are not recognized, the LED beside start button flashes once
- Talking distance is currently limited to a fairly short range

MICROCONTROLLER UNIT

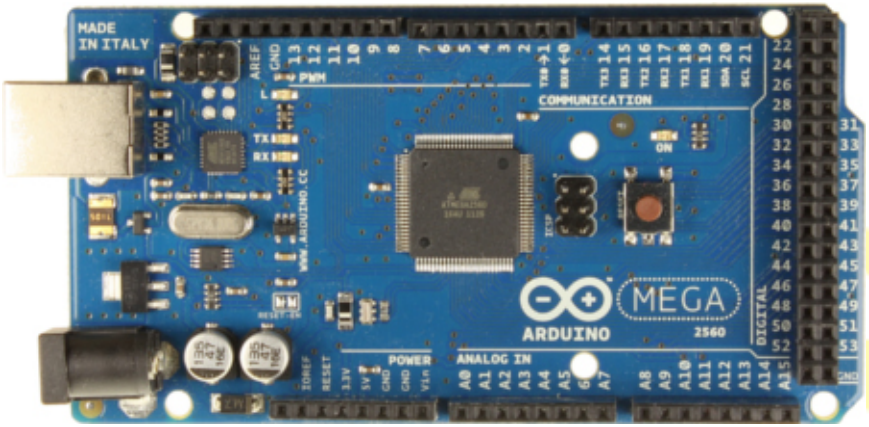
EVAControls



- Atmel's ATmega2560 microcontroller
- Arduino – prototyping platform

Microcontroller Unit

EVAControls



- Interfaces with:
  - Voice Control
  - IR transmitter
  - Daylight Harvesting
  - Ethernet

Microcontroller Unit

EVAControls

- Commands:
  - Full on: Turns light to max level
  - Full off: Turns light off
  - Up: Brightens light by 1 increment
  - Down: Dims light by 1 increment
  - Eco: Utilizes the Daylight Harvesting unit
  - Normal: Default operation

MICROCONTROLLER UNIT

EVAControls

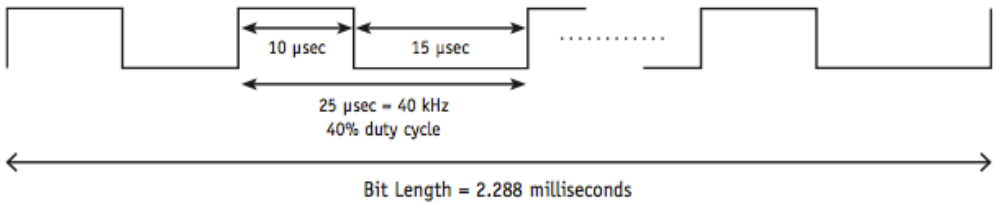
INFRARED (IR) TRANSMITTER

Appendix C: Infrared (IR) Integration

APPENDIX

Lutron Infrared Technical Specifications

IR Carrier Frequency	40.0 kHz
Duty Cycle	40%
Single Bit Time	2.288 milliseconds
Baud Rate	437 bps
Command Length	36 bits
Command Duration	82.368 milliseconds
Logic One	Presence of IR modulated at 40.0 kHz
Logic Zero	Absence of IR
Transmit Order	Transmit the most significant bit first
General Function	IR code is transmitted while a button is held down
Timeout Function	Timeouts may not occur until at least seven seconds of continuous IR transmission has taken place

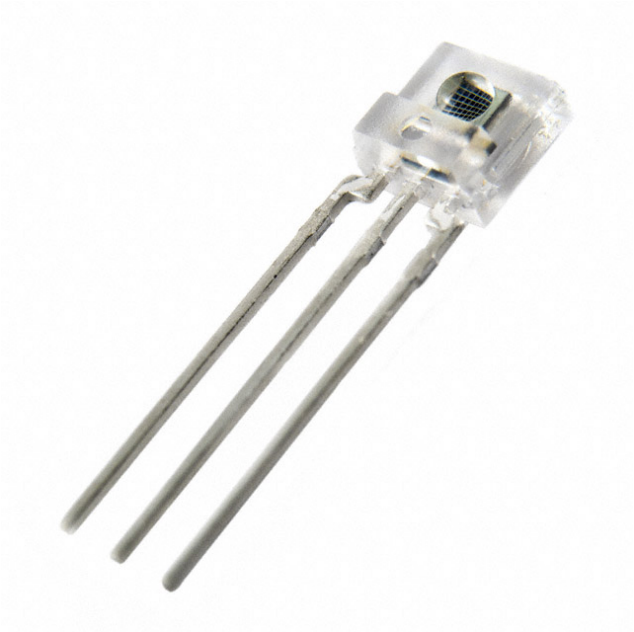


IR Duty Cycle

Microcontroller Unit

EVAControls

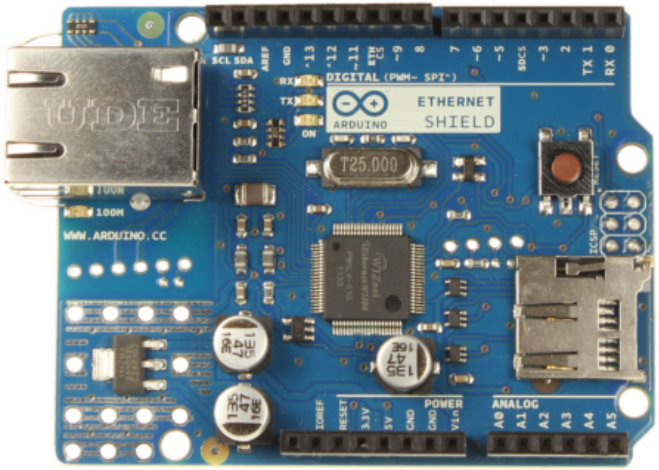
Daylight Harvesting



- Uses the TSL235R from TAOS
- Converts light to frequency
- Outputs a square wave

MICROCONTROLLER UNIT

ETHERNET MODULE



- Interfaces with the microcontroller
- Acts as a server
- Transmits data between the client and the microcontroller
- Displays the webpage

Web Based Interface

EVAControls

- Started with iPhone interface

- Decided to expand to all platforms => WEB

=> => =>

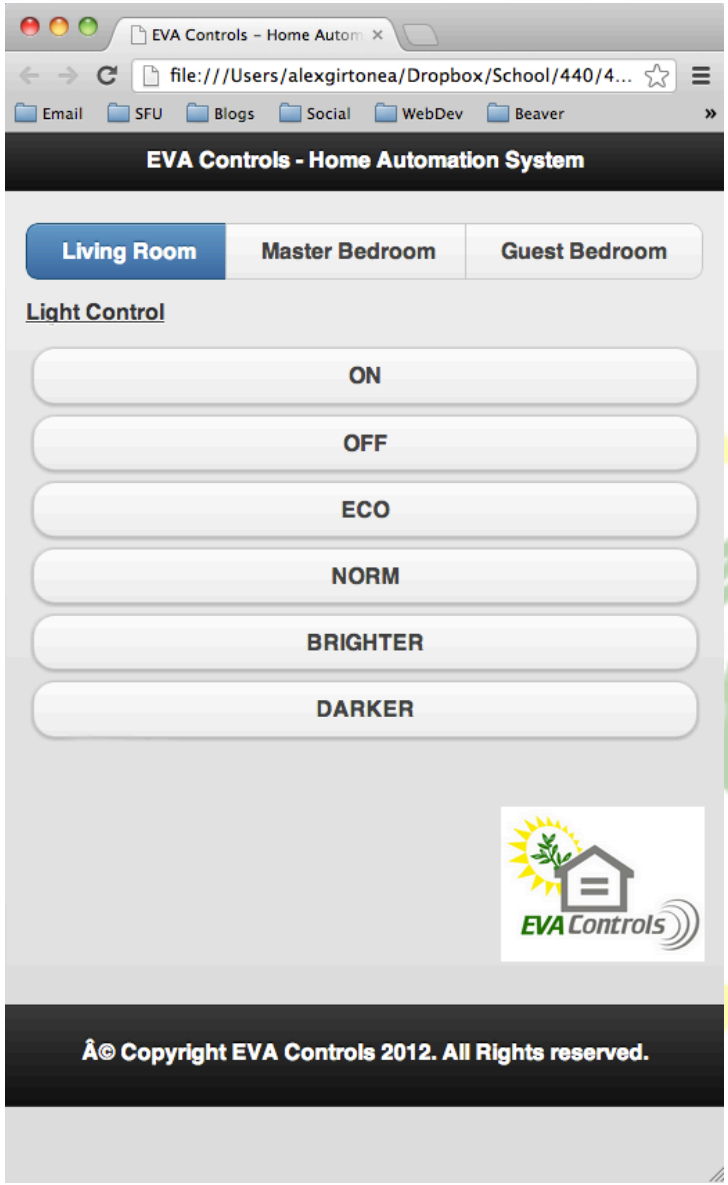
Web Based Interface

EVAControls

- Page runs on Arduino
- Can be accessed from any device connected to the network
- Can be accessed from anywhere with an Internet connection through port-forwarding

WEB BASED INTERFACE

EVAControls



WEB BASED INTERFACE

EVAControls

- Designed using the jQuery mobile framework
- Compatible with any kind of mobile device that has internet browsing capability
- Versatile and user-friendly

Budget & Financing

EVAControls

	Unit Price	Quantity	Subtotal
Arduino Mega2560	$62.23	1	$62.23
Arduino Ethernet Shield w/o POE REV3	$47.42	1	$47.42
Lutron IR Dimmer	$42.54	1	$42.54
INSTEON RF Switch	$86.22	1	$86.22
Philips Dimmable LED Bulb	$22.37	1	$22.37
Various Electrical Components	$40.16		$40.16
Mounting Platform	$8.05	1	$8.05
RF Transmitter	$44.42	1	$44.42
IR LED (751-1204-ND)	$1.20	5	$6.00
Photodiode (751-1002-ND)	$2.31	3	$6.93
Light to Frequency Converter (TSL235R-LF)	$4.70	3	$14.10
PCB	$42.53	1	$50.53
Voice recognition Chip LD3320	$30.72	1	$30.72
Display LEDs (5/PK)	$3.30	1	$3.30
PC Header Pins	$1.90	2	$3.80
NPN Transistors (10/PK	$3.15	1	$3.15
Case Material	$18.65		$18.65
Total Expenses			**$482.59**
Total Financing			**$500.00**
			$17.41
Original Budget			**$595.00**

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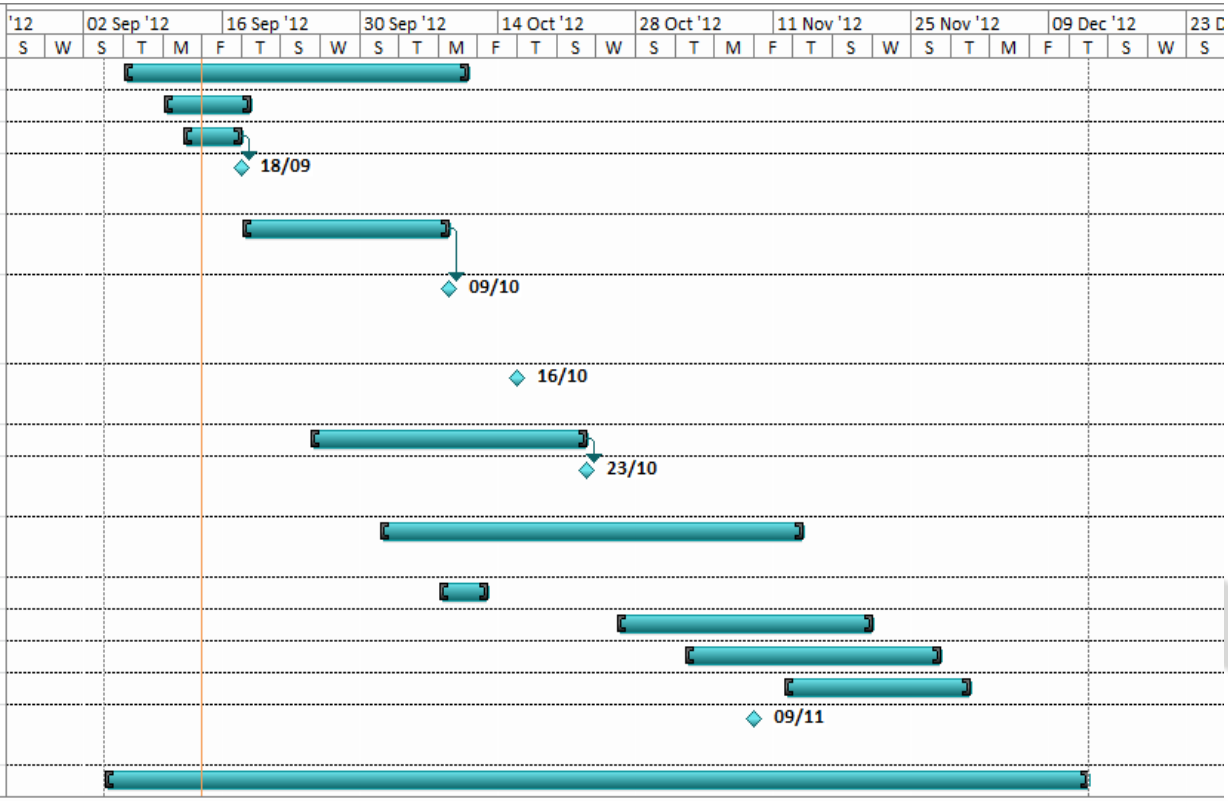
PROJECT TIMELINE

EVAControls

PROPOSED TIMELINE

ID	Task Name	Duration	Start	Finish
1	Research	25 days	Thu 06/09/12	Wed 10/10/12
2	Funding	7 days	Mon 10/09/12	Tue 18/09/12
3	Proposal	4 days	Wed 12/09/12	Mon 17/09/12
4	Milestone #1 - Proposal Complete	0 days	Tue 18/09/12	Tue 18/09/12
5	Functional Specifications	15 days	Tue 18/09/12	Mon 08/10/12
6	Milestone #2 - Functional Specifications	0 days	Tue 09/10/12	Tue 09/10/12
7	Milestone #3 - Oral Progress Report	0 days	Tue 16/10/12	Tue 16/10/12
8	Design Specifications	20 days	Tue 25/09/12	Mon 22/10/12
9	Milestone #4 - Design Specifications	0 days	Tue 23/10/12	Tue 23/10/12
10	Hardware/Software Development	31 days	Tue 02/10/12	Tue 13/11/12
11	Parts Acquisition	5 days	Mon 08/10/12	Fri 12/10/12
12	Integration	18 days	Fri 26/10/12	Tue 20/11/12
13	Testing/Defect Fix	18 days	Fri 02/11/12	Tue 27/11/12
14	Verification	15 days	Mon 12/11/12	Fri 30/11/12
15	Milestone #5 - Written Progress Report	0 days	Fri 09/11/12	Fri 09/11/12
16	Documentation	72 days	Tue 04/09/12	Wed 12/12/12



ACTUAL TIMELINE

EVAControls

ID	Task Name	Duration	Start	Finish
1	Research	25 days	Thu 06/09/12	Wed 10/10/12
2	Actual	47 days	Thu 06/09/12	Fri 09/11/12
3	Funding	7 days	Mon 10/09/12	Tue 18/09/12
4	Proposal	4 days	Wed 12/09/12	Mon 17/09/12
5	Milestone #1 - Proposal Complete	0 days	Tue 18/09/12	Tue 18/09/12
6	Functional Specifications	15 days	Tue 18/09/12	Mon 08/10/12
7	Actual	14 days	Mon 24/09/12	Thu 11/10/12
8	Milestone #2 - Functional Specifications	0 days	Tue 09/10/12	Tue 09/10/12
9	Milestone #3 - Oral Progress Report	0 days	Tue 16/10/12	Tue 16/10/12
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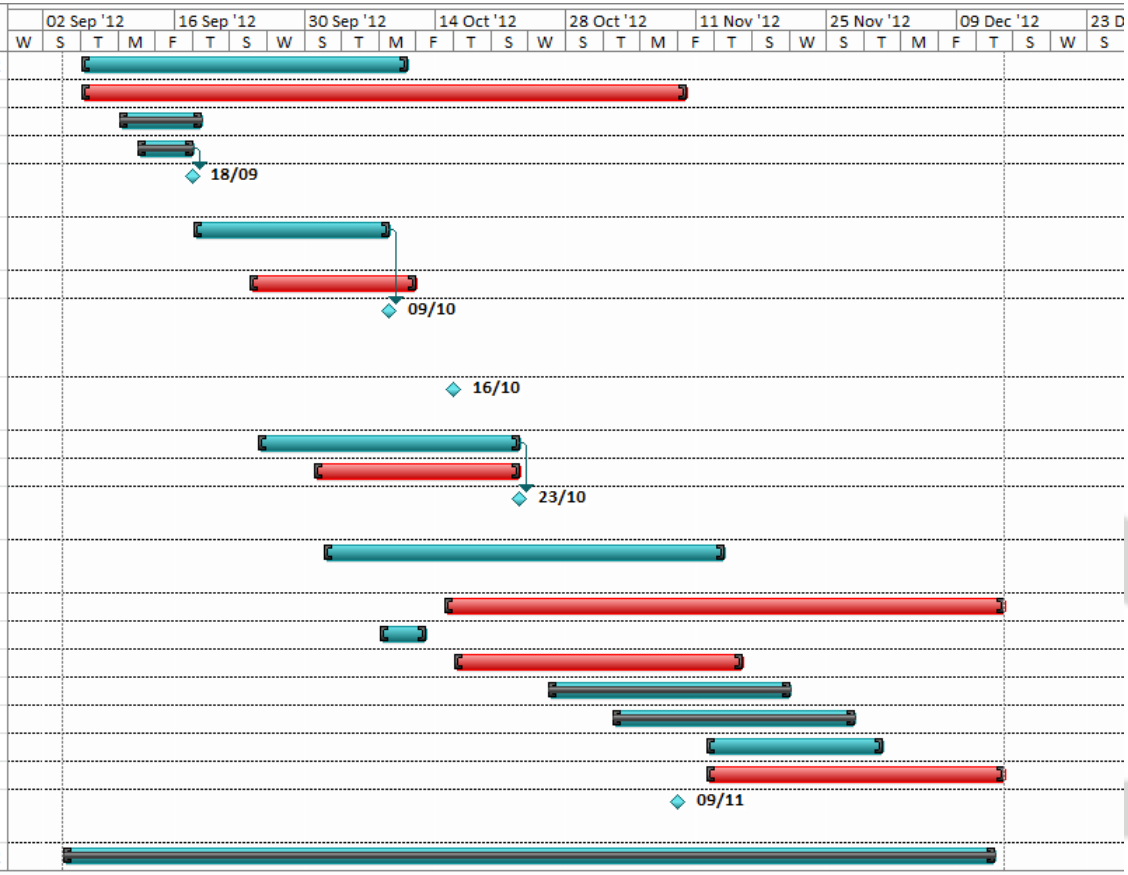


MARKETING

EVAControls

- Designed for integration
  - No need to replace current household devices (dimmers/lights)
- Voice Control
  - Presents users the ability to control their lighting through speech if more convenient/desired
- Web based Control
  - Allows for any device with internet access to remotely control the lighting
- Budget Alternative
  - Less costly Home Automation Lighting compared to current options out on the market

COMPETITION

EVAControls

INSTEON

- Wi-Fi control requires Netlinc($100) and individual Lamplinc($50) or Light Bulbs($30)
- Replace current dimmers with INSTEON dimmers($60)

LUTRON

- Wireless Daylight Sensor($80) as a separate unit that requires batteries and performs one function

LEVITON

- Huge selection of light control switches are offered, but most have similarities that could be resolved through customization options

Logitech Harmony

Future Development

EVAControls

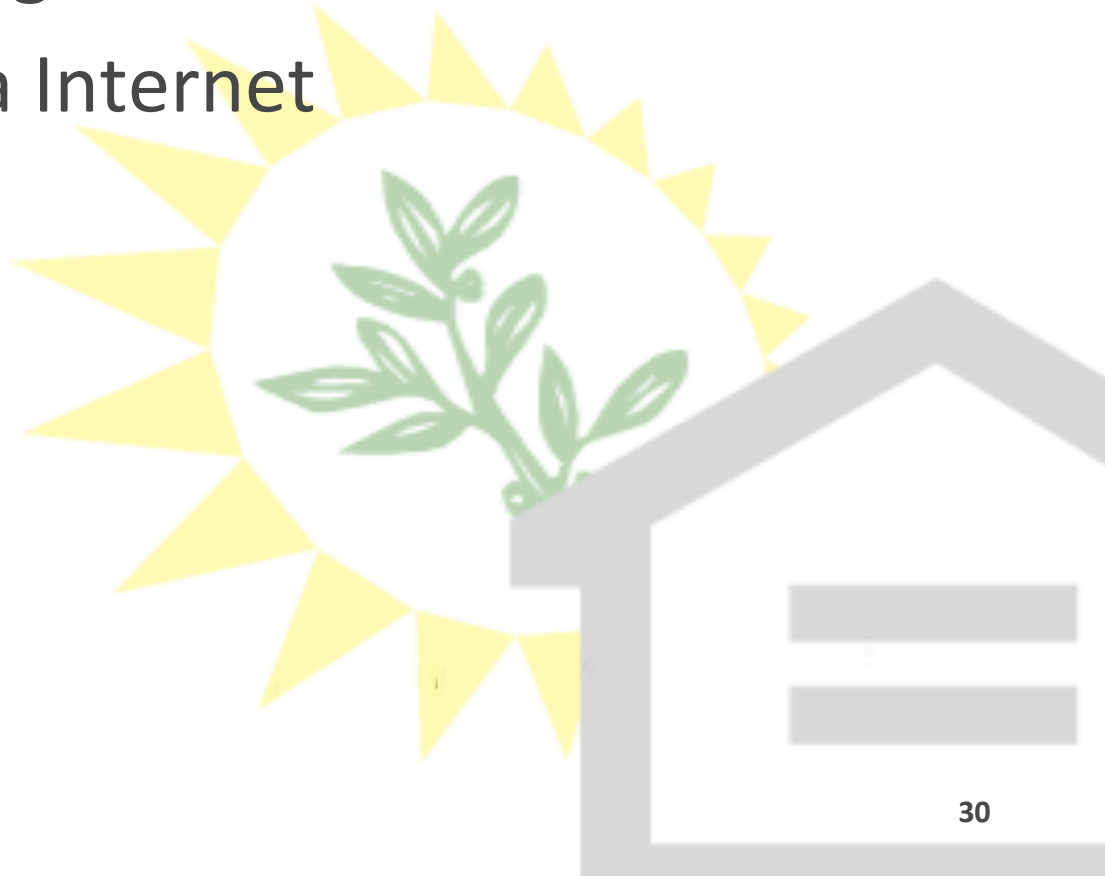
- Increasing Communication Options
  - Developing X10 and RF compatibility will allow for easier integration of the product for more users
- Additional Voice Commands
  - More commands will be available compared to prototype with limited pins
- Expanding Product Compatibility
  - Broadening our Automation system to more household devices than just lighting control
- EVA Voice Interaction
  - Voice commands will be met with a vocal response, adding to the sense of home automation

REFLECTIONS

EVAControls

PROJECT GOALS

- ☑ On/Off Via Voice Control
- ☑ Daylight Harvesting
- ☑ Device Control Via Internet
- ☑ IR Control
- ☒ RF Control



ACKNOWLEDGEMENTS

Dr. Andrew Rawicz
Steve Whitmore
Jamal Bahari
Michelle Cua
Ali Ostadfar
Peng Chen
Fred Heep

… All of Our Friends & Family

Conclusion

EVAControls

- Fundamental Proof-of-Concept
- Various improvements can still be made
  - Replace Ethernet with WiFi
  - Implement RF/X10 Compatibility
  - Ability to “Learn” New Devices
- Built On Time & Under Budget
- Future of EVA Controls?
  - Undecided…

QUESTIONS

EVAControls