Green lighting Project

Senior Design/Cornell Cup Project

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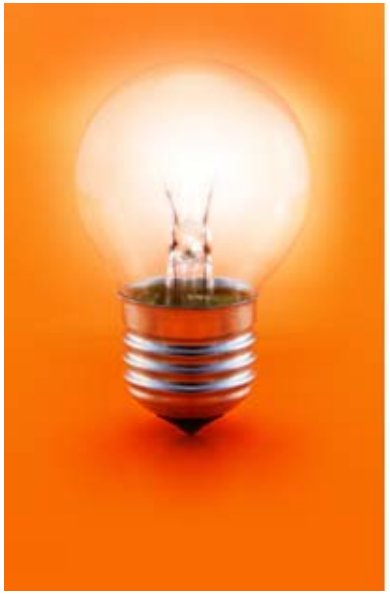
Background

Usages

- Lights have revolutionized the way we work, live and play
- About 5% of the energy used in the nation is used for lighting homes, buildings and streets
- Lighting is about 25% of a building's electrical use, therefore efficient lighting can save a lot of money
- 1000 sq. ft. area needs 30 foot-candles i.e. 30 lumens per sq. ft.



Problem Formulation

- How to minimize energy consumption in a room while simultaneously creating a productive work environment.
- System must cut consumer power and simultaneously save the institution money in energy savings.
- System will demonstrate how productivity is increased and the amount a selected institution can save by using our design.

Problem Formulation (Cont.d)

- Design standpoint: the system should be so discrete it is not readily recognizable
- Implementation standpoint: the system will read the intensity of light coming into a room and fixate the amount of light being distributed throughout out the room to meet a standard amount at all times *(323 lux)*
- Consumer standpoint: the system will cut the respective institutions energy expenses by (15-30%)

Current Status of Art

- Solar energy can be used in many ways to help conserve energy
- Some as simple as keeping the shades up so sunlight can light or warm a room
- Installing devices that trap the sun's energy or convert it to electricity

Common Ways of Saving Energy through lighting:

- Turning off lights, Using fewer electric lights, Using efficient lighting, Dimming Light switches

Innovative Ways of Saving Energy through lighting:

- Bringing different technologies together unto a common platform, using a control system to vary how energy is consumed

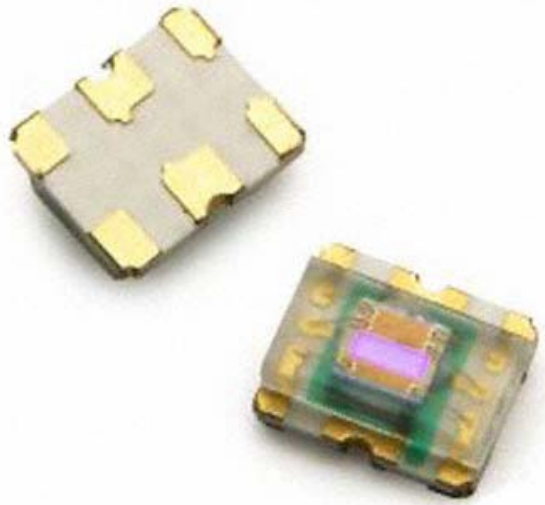
Different Technologies:

Microcontrollers	Intel Boards	Indoor Light Sensors	Relay	Control Systems	Interface
• BS2 Boards • Various Ports • Cost Range: $100 - $150	• Tunnel Creek • FPGA • Cost Range: $400 - $450	• APDS-9007 • Range of 3 lux to 70K lux • Cost Range: $1.05 - $2.00	• Relay (Switching voltage 240VAC) • Cost is $5-$7 per unit	• Develop using Java, etc. • Cost is relative to Developer	• Develop using Java, C#, etc • Cost is relative to Developer

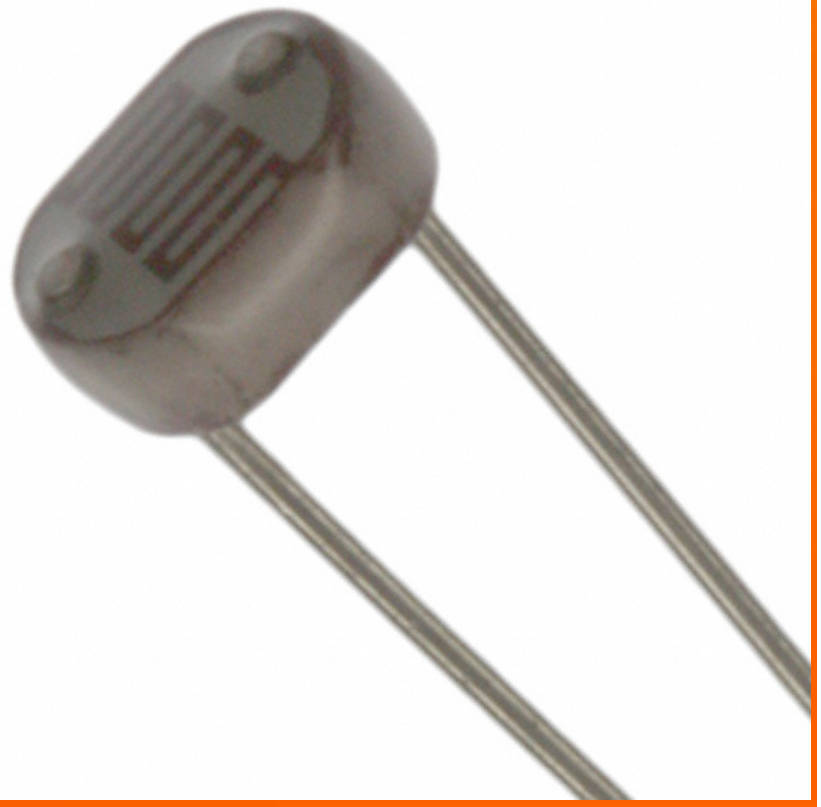
Current Status of Art

Photo courtesy of Politics in the Zero

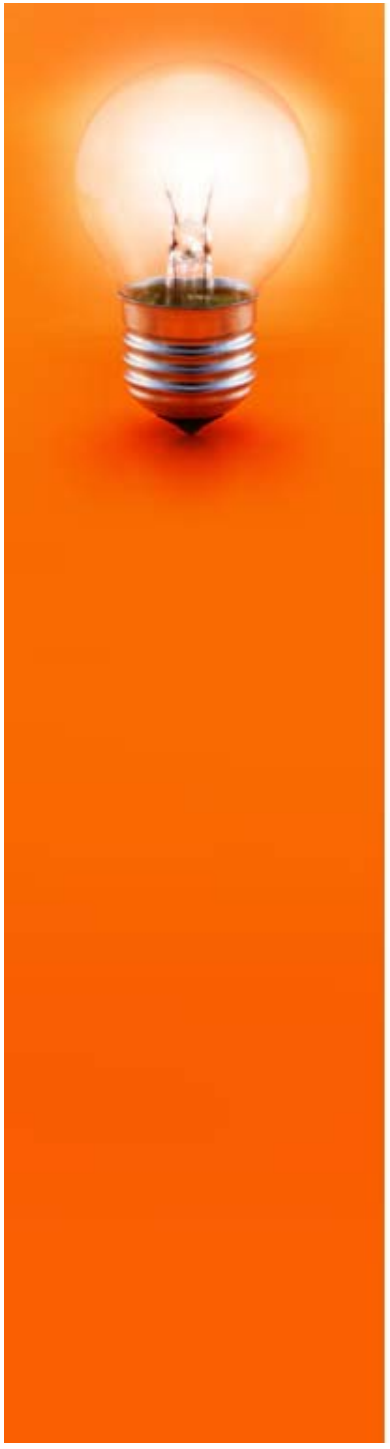
Light Sensors



Ambient Light sensor
Photo current response to wide dynamic range of 3 lux to 70K lux

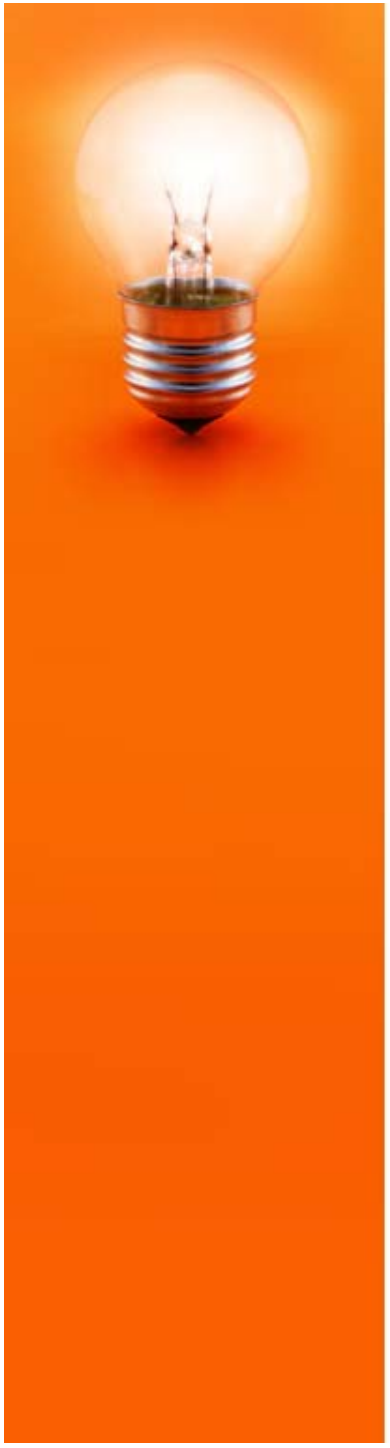


Photoconductive Photocell
Can sense light from 400 to 700 nm



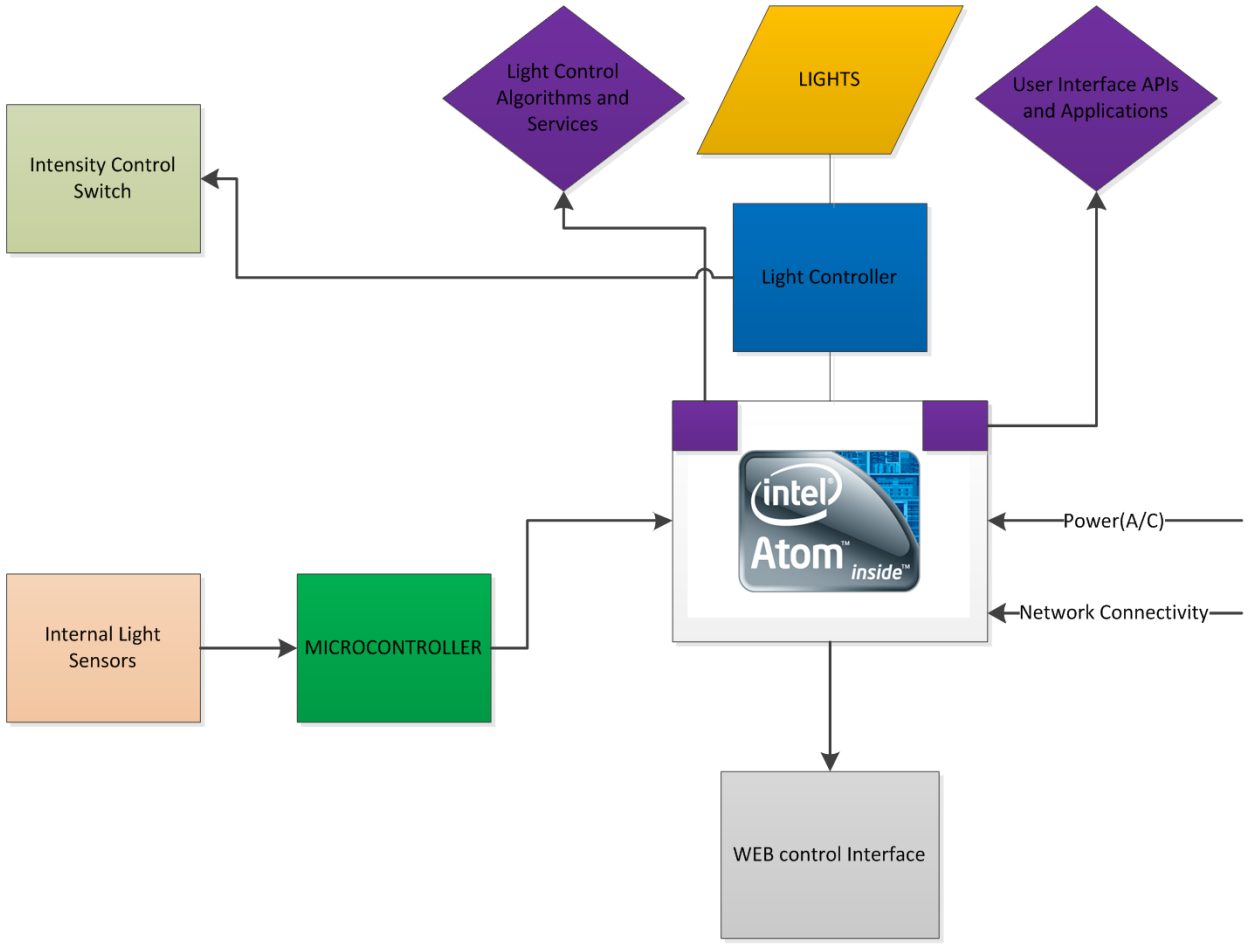
Solution Approaches

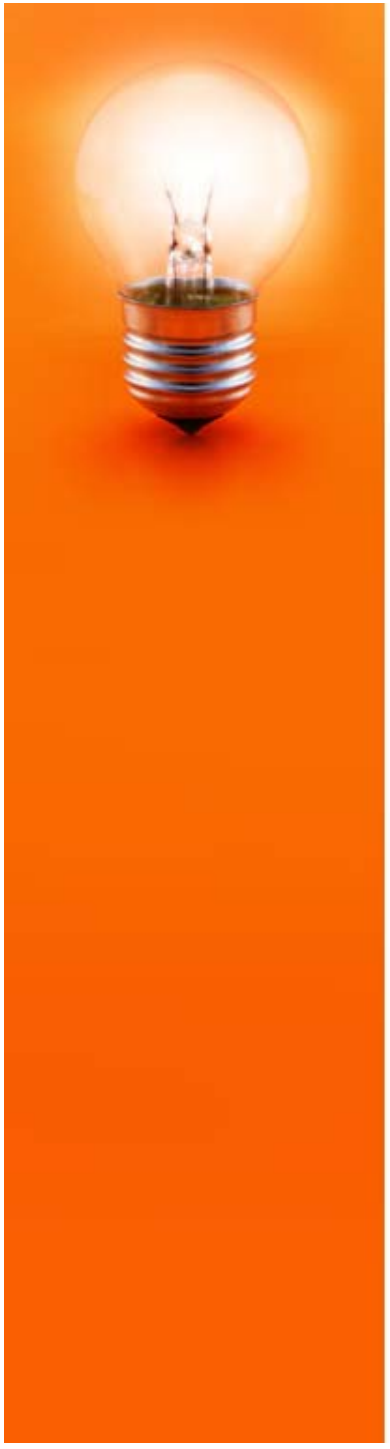
- Comprised of the application of all the available light energy control resources that available today.
- This would be achieved using the sun's energy to complement the room's overall intensity at all times of day.
- System will work with the available light intensity from the sun to maintain the room's intensity at about 30 foot candles.
- Includes the use of a Tunnel creek(Intel Atom board) along side other electrical components.



Solution Approaches (Cont.d)

- Layout depends on the positioning of the lights in the room.





Solution Approaches (Cont.d)

- The system will respond to sudden changes, such as clouds passing by, or closing the blinds.
- Testing will be simulation based. Takes a lot of time to test a physical testing environment such as a room.
- Surveys will also be employed to observe consumer reactions to the lights.
- We will build a prototype office with dimensions 5Lx4Wx5H to test the capabilities of our system.

Example of Digital Interface

Photo courtesy of simplehome.com

Photo courtesy of everythingtechling.com

Time and Project Management

Timeframe	Deliverables
November 2011	• Determine current power consumption of a Howard University • Determine location to test our system
Nov-Dec	• Determine how best to implement the light sensors given the specifics of our test room. • Test compatibility of ATOM board with BS2 software
December	• Being testing the different components & documenting compatibility issues • Determine algorithm for the digital interface
Jan-March	• Begin testing the components of and document any issues that may arise • Sketch design possibilities for digital interface • Commence construction of the system beginning with the sensors and microprocessors.
April	• Present completed and fully functional system for Intel Cup and EECE department

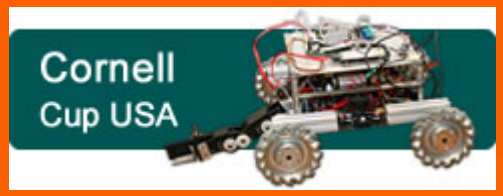
Cost and Resources

Budget

Device	Quantity	Cost
Relay(Switching Voltage 240VAC)	2	$14.00
Ambient Light Sensor (Avago Technologies)	10	$9.35
Basic Stamp 2 Module	3	$299.98
Intel ATOM Board	1-2	Free
Simulation software	1	Free
	Total	$323.33

Conclusion

- The system will help save energy and improve the work rate of whoever uses the system
- The user friendly interface should help keep track of what's going on within the system and notify of how many energy is actually being saved
- The room would always have an intensity equivalent 30 foot candles.
- Our Lighting Efficiency System design solution will accomplish our goal, please building administrators with a lower electricity bill and please the users as they would have better conditions conducive to working.



Questions