Green Lighting Project

Team: Green Lighting

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Intel Cup Competition

• The Cornell Cup USA, presented by Intel, is a college-level embedded design competition

• Re-enforces the importance of the design process, finding and defining the problem's real need, and validating that that need is met

•1 of 24 teams chosen across the nation.

• Competition May 5, 2012 In Orlado Fl.

Background

20% - 50%	20% - 50%	20% - 50%
Home	School	Office

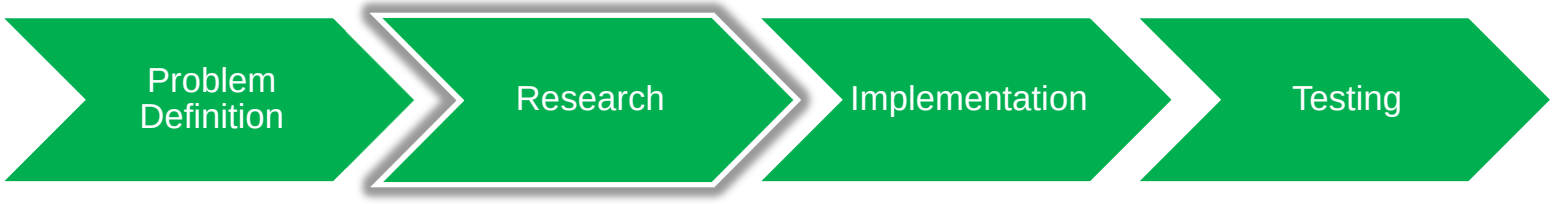
- Lights have revolutionized the way we work, live and play
- About 5% of the energy used in the nation is used for lighting homes, buildings and streets
- Lighting is about 25% of a building's electrical use, therefore efficient lighting can save a lot of money
- Natural Lighting creates a better work environment and in turn better work quality

Problem Formulation

- Use natural light to supplement the artificial light sources in the work environment.
- How to minimize energy consumption in a room while simultaneously creating a productive work environment.
- System will demonstrate how productivity is maintained and the amount a selected institution can save by using our design.

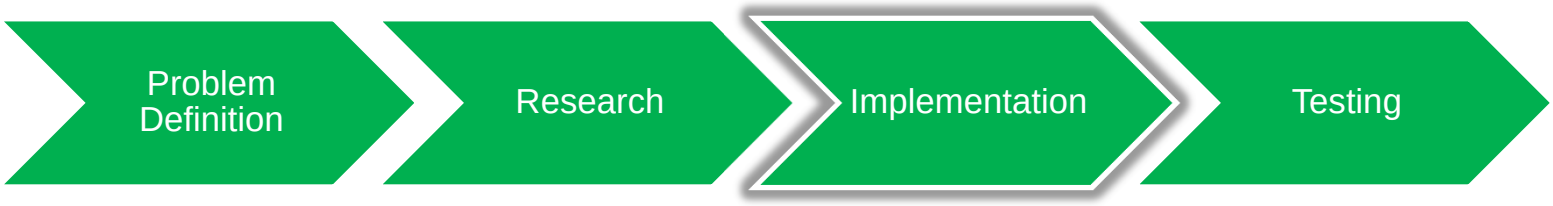
Problem Formulation (Cont)

- **Design**: the system is so discrete it is not readily recognizable
- **Implementation**: the system canread the intensity of light coming into a room and vary the amount of light being distributed throughout out the room, or turn off the affected unnecessary lights.
- **Consumer**: the system will could cut the respective institutions energy expenses by about 5- 10%

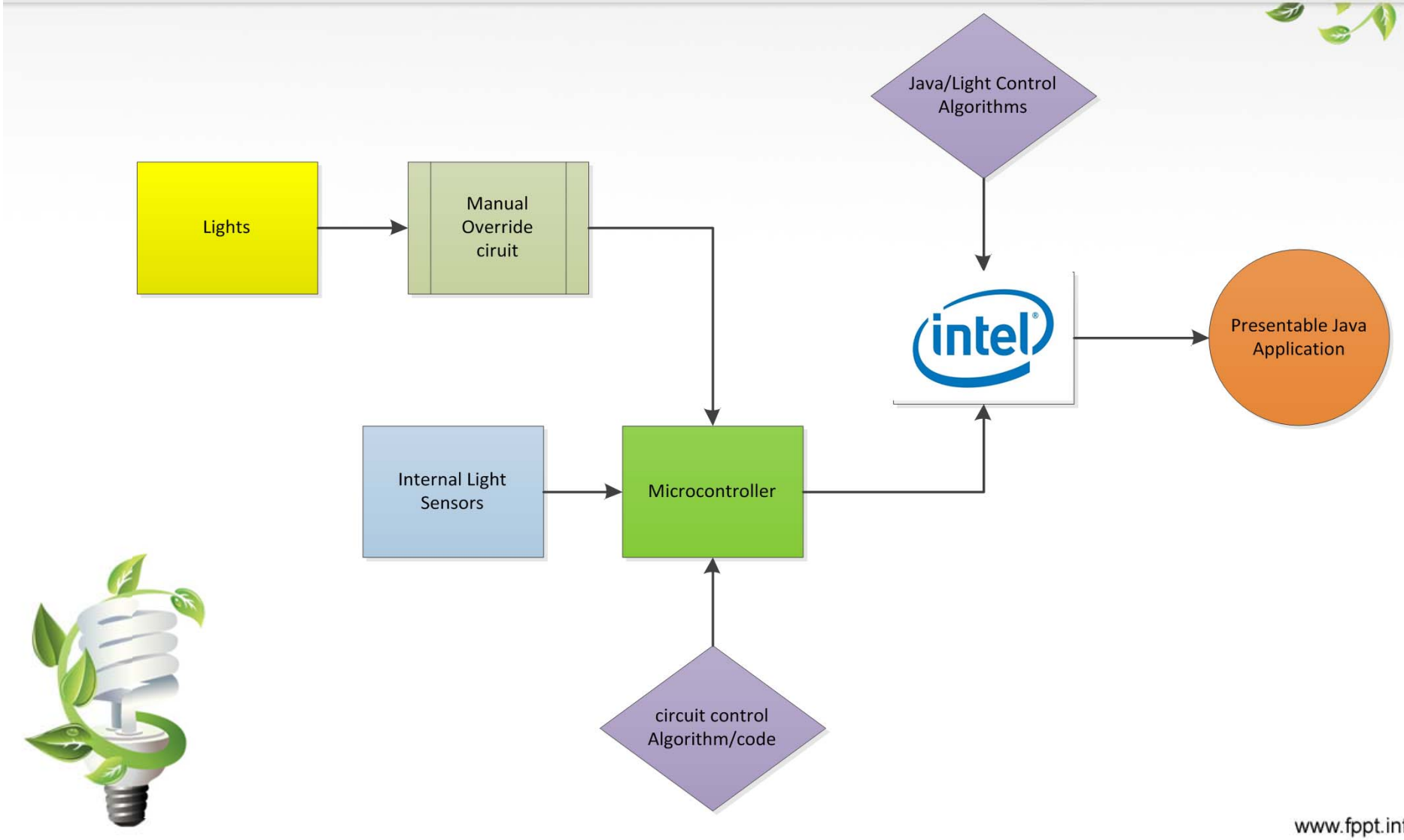


Solution Approaches

- Comprised of the application of many of the available light energy control resources that available today.
- This can be achieved using the sun's energy to complement the room's overall intensity at all times of day.
- System can work with the available light intensity from the sun and maintain the room's intensity at or about 30 foot candles if the sunlight is inadequate.
- Depending on the intensity of light received from outside, the lights are systematically brightened or shut off completely to save energy.

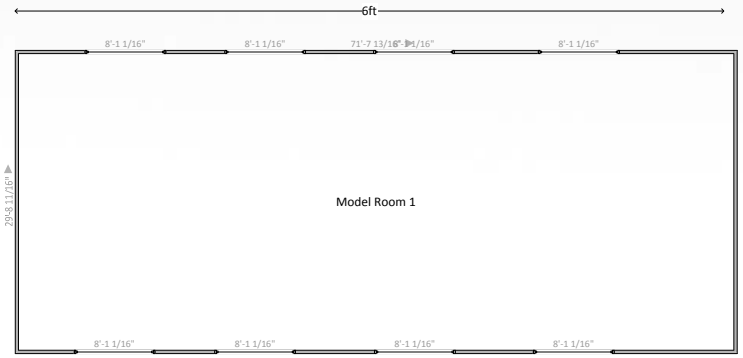


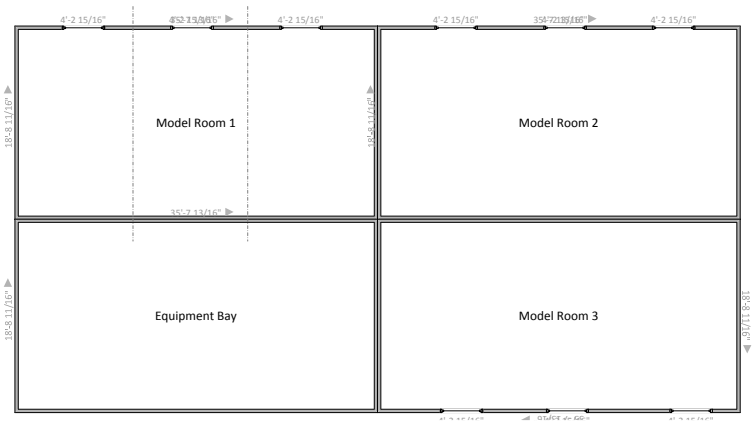
Circuit Solution Approach

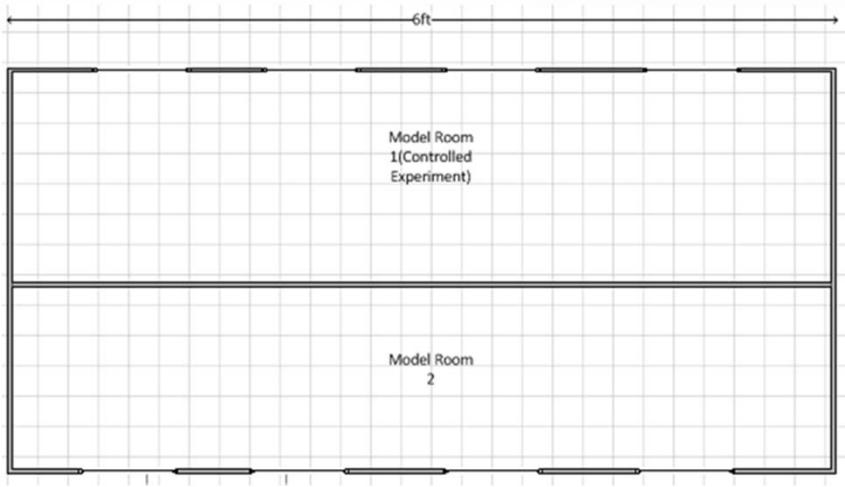


Test Environment/Demo

- Room model designs considered.

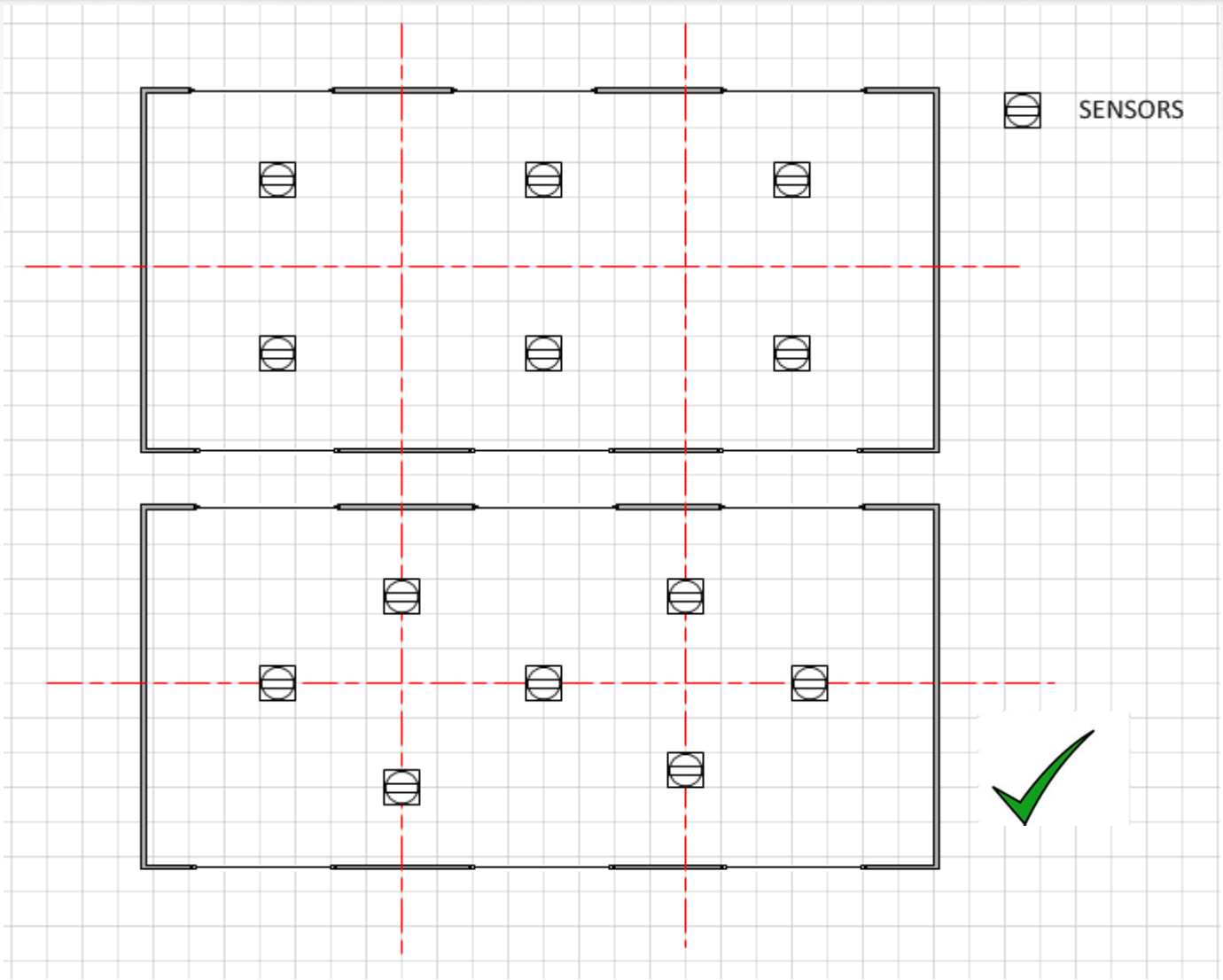






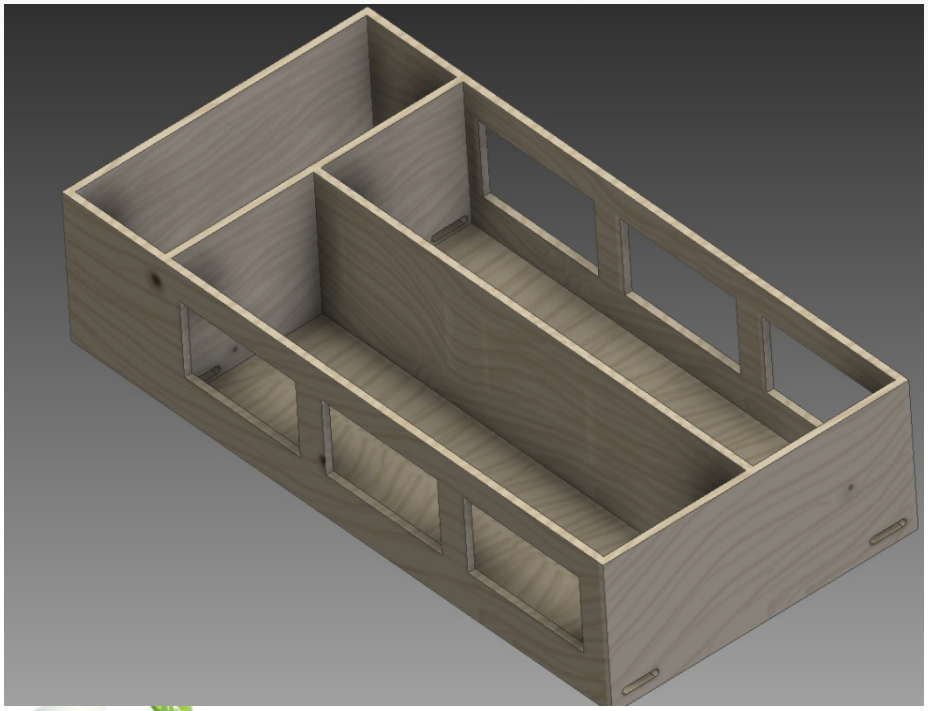
Problem Definition → Research → Implementation → Testing

Sensor Arrangements Considered

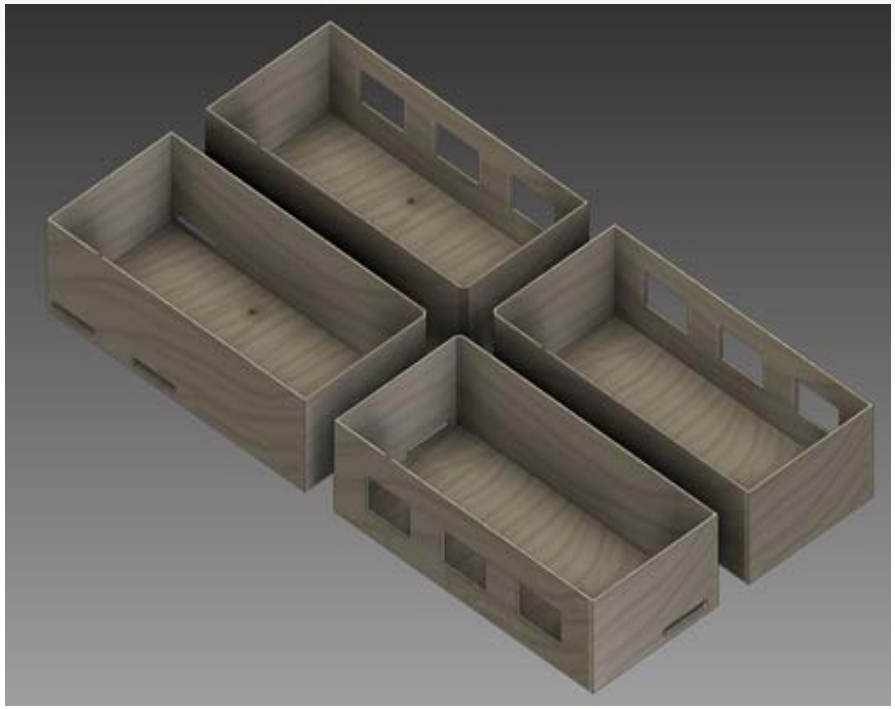


Text Box Design

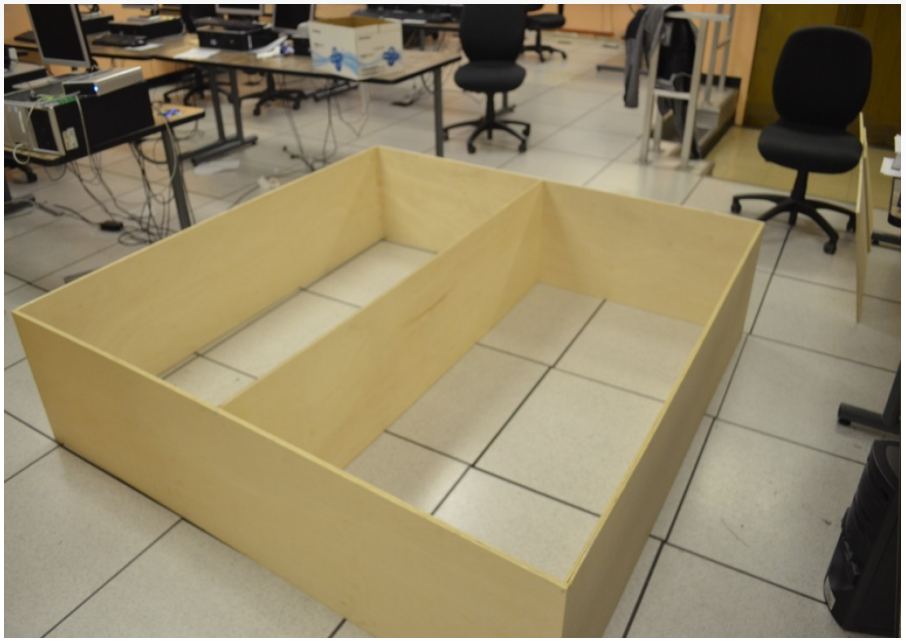
Final test box design



Previous test box design



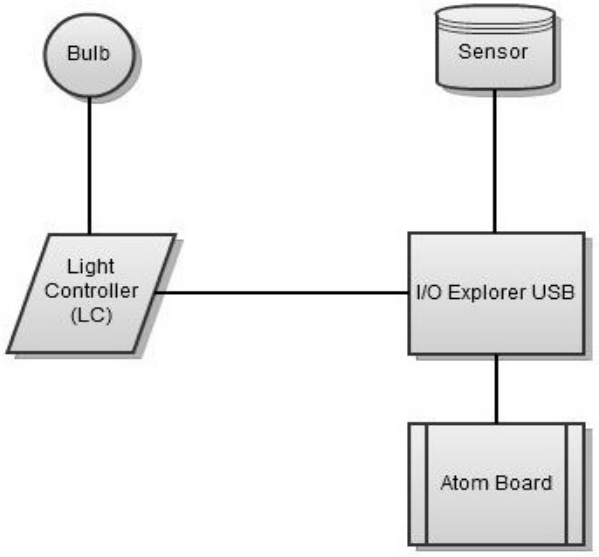
Text Box Design

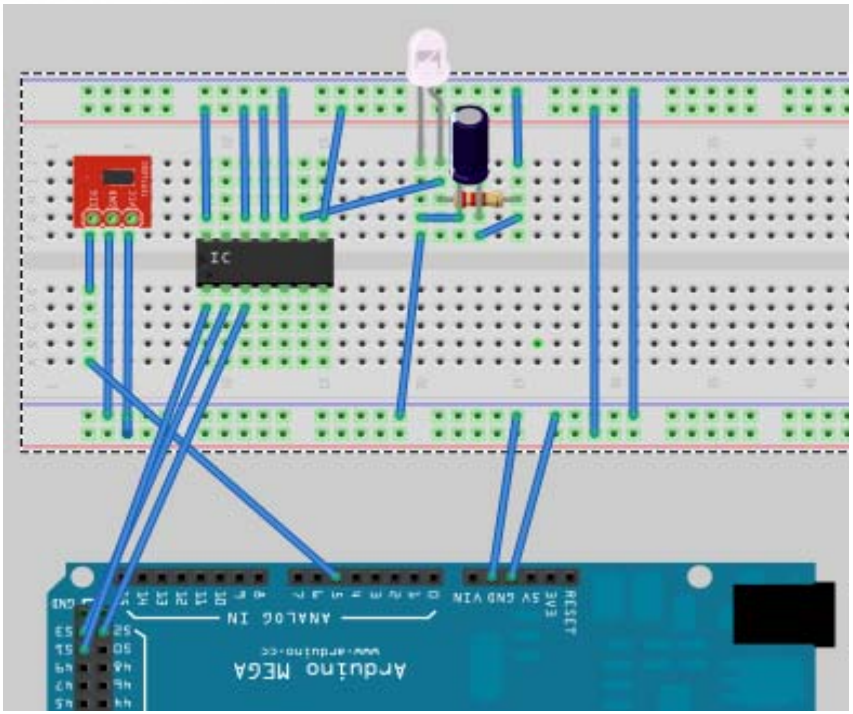


Building the Model room

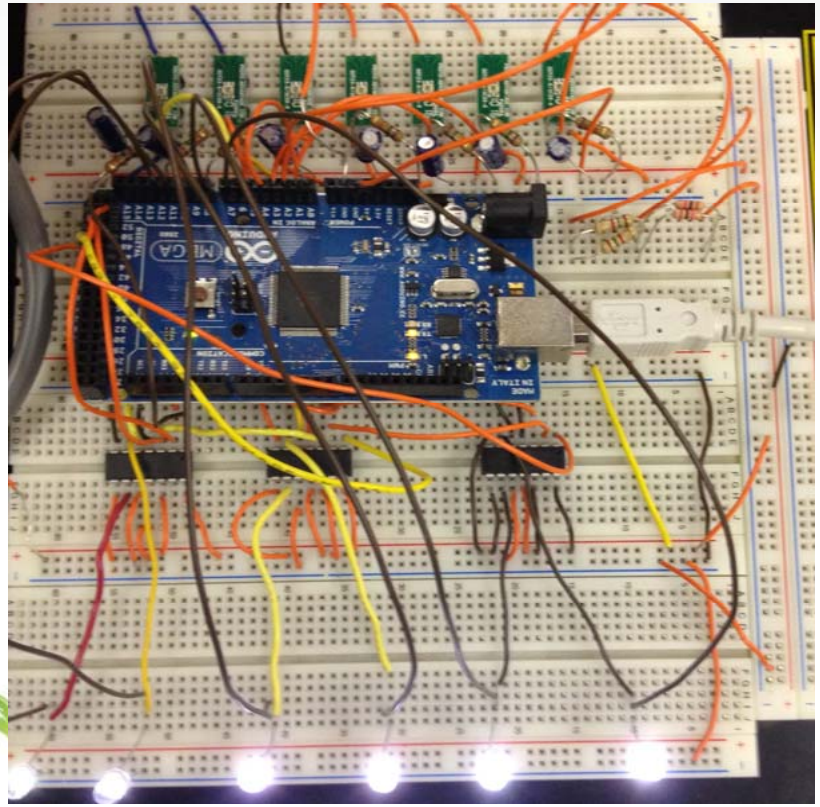
One Light Bulb Model

- In Order to test our equipment and code, we employ a one-light bulb model. i.e. One light bulb, One sensor , and One I/O board.

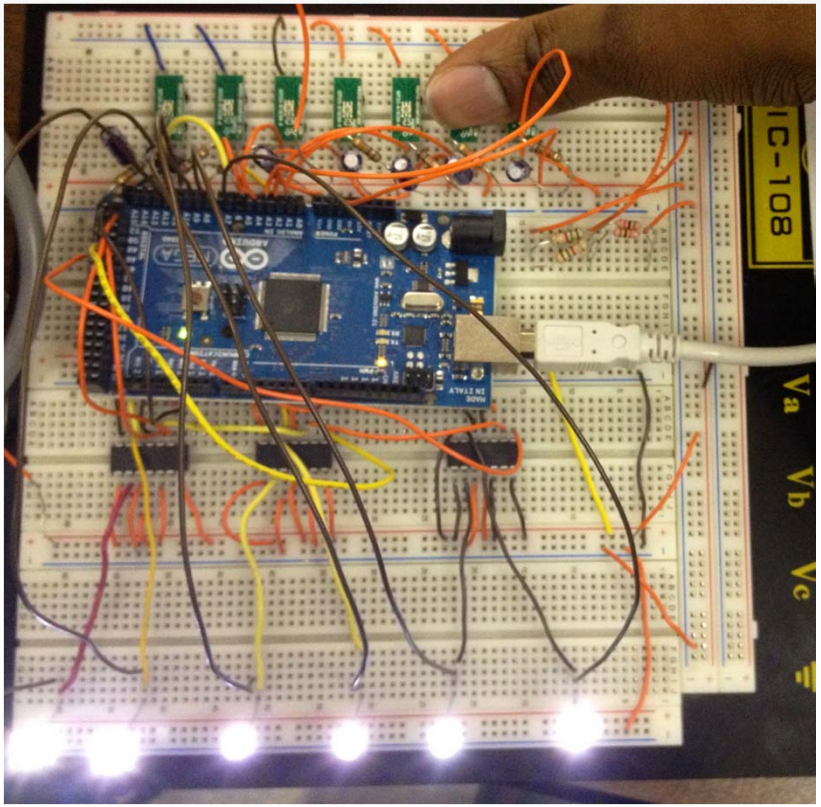




Complete Circuit Outline



Complete Circuit

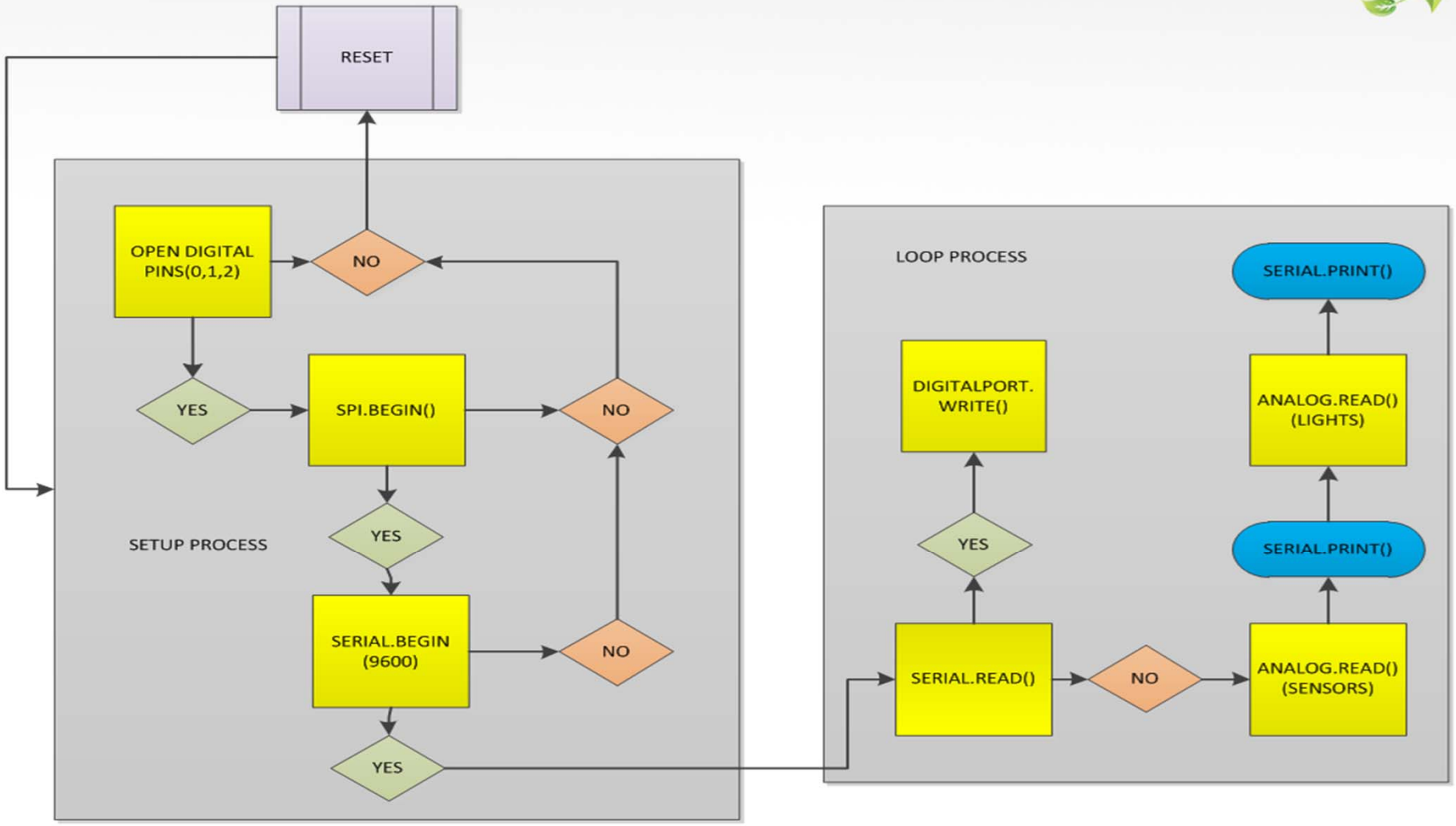


Circuit During
LED test

Arduino Code (Pseudo)

```
1
2   //This method is called when the board is turned On.
3   void Setup()
4   {
5   //The Digital resistor we are using has 2 channels/resistors
6   //So we only need 3 pins
7    Open Digital Pins {0,1,2} as OUTPUT; //This sets the corresponding pins as select/output
8    SPI.Begin(); //This Method initializes the Serial Peripheral Interface
9    Serial.Begin(9600); //Sets up USB serial out with BAUD rate 9600
10   }
11
12   //This method is called several times a second for
13   //the duration of the time the device is ON
14   void Loop()
15   {
16   //Sensors
17   Analog_Read{Pin0 - Pin6};
18   Serial.Print{Analog_Read};
19
20   //LEDs
21    Analog_Read{Pin0 - Pin6};
22   Serial.Print{Analog_Read};
23
24   //Read Resistor steps from Serial, and Set resistor value
25   Value = Serial.Read();
26   Digital_Port_Write(Value);
27   }
28
29   Print Format = "<s Value Device_number>"
```

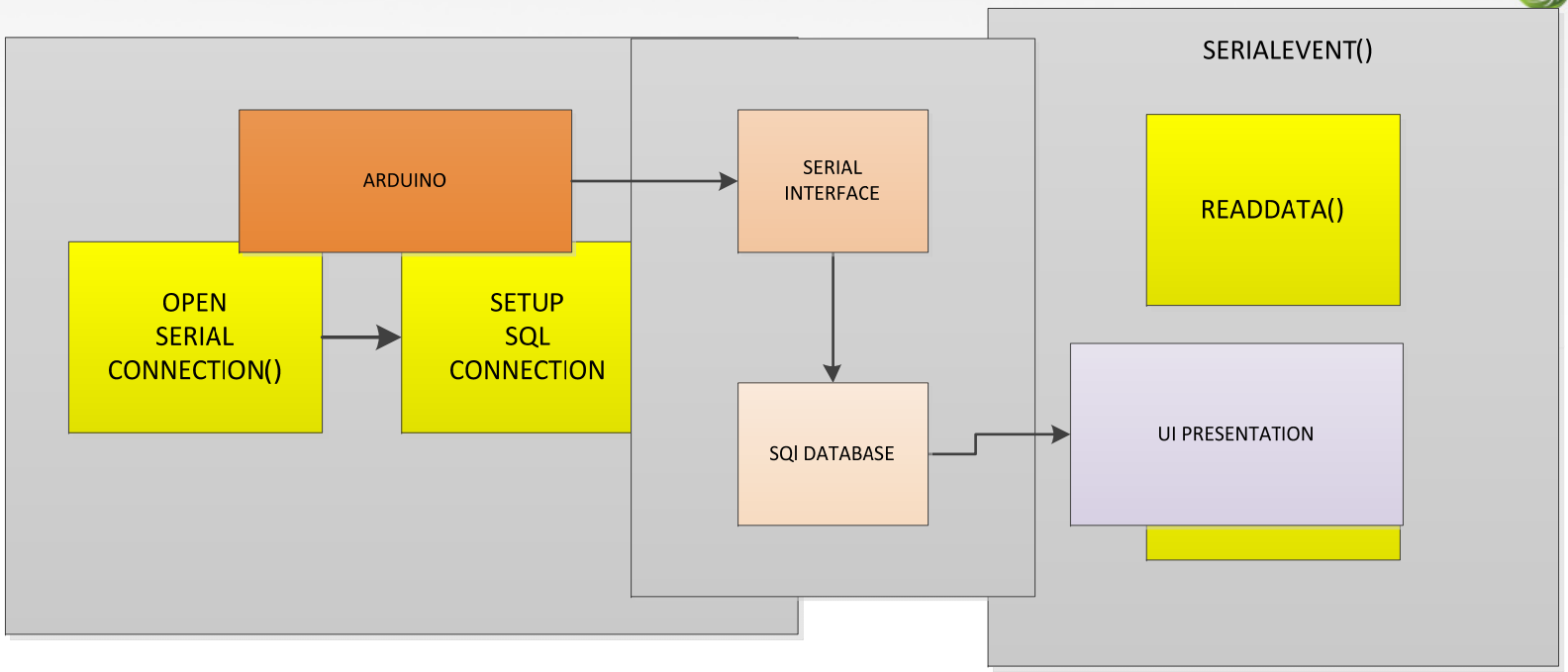
Flow Chart (Arduino)

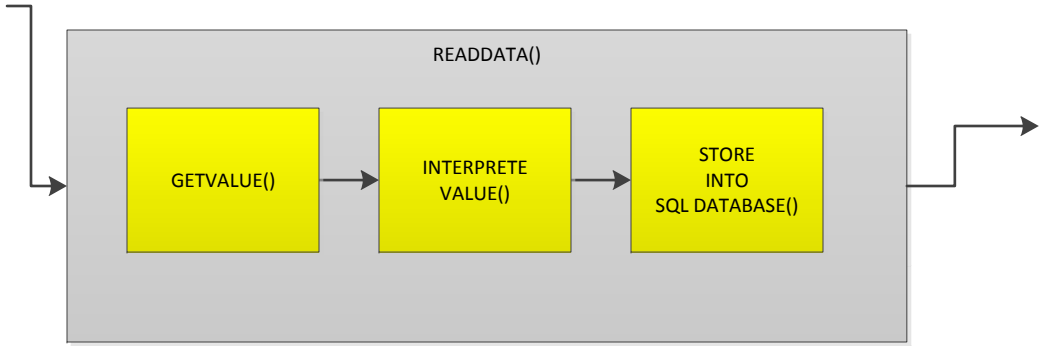


Java (Atom) Code (Pseudo)

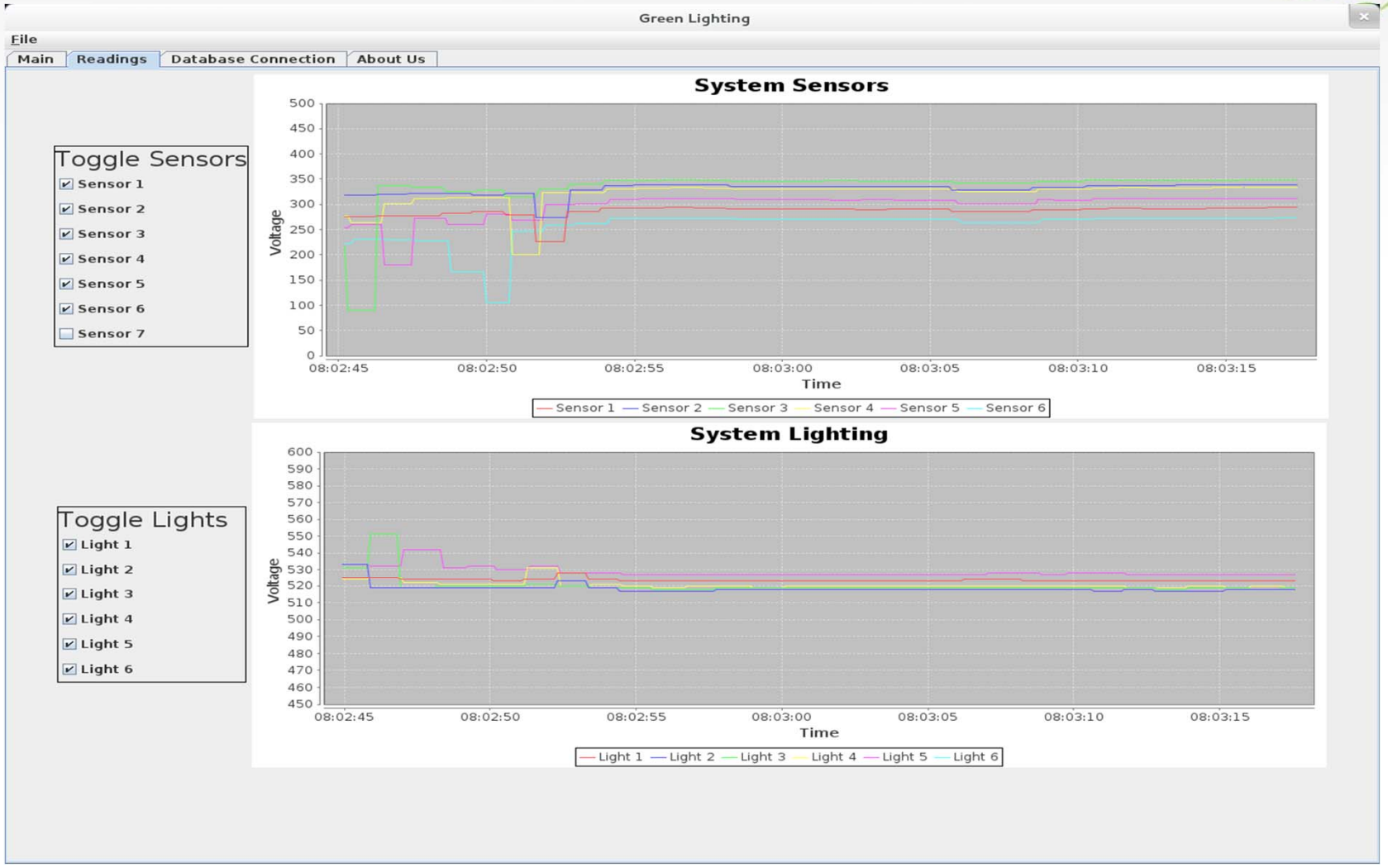
```
//This method is called when the program is rum
void Setup()
{
    Open_Serial_Connection(Port);//Open a connection to selected port
    Setup_SQL_Connection();//Setup connecction to SQL database
 }

//Similar to the Loop() function in Arduino
//This method is called whenever the serial buffer is filled
 void SerialEvent()
 {
    Read_Data();//Reads the data in the buffer
    Write_Data();
    //====================================
    //Resistor Behavior Code goes Here
    //
    //====================================


 }

//Returns a string with the Data Or stores it
//directly into the Database
Read_Data()
{
Value = Read_Until("\n");//Reads the buffer until a newline
Interprete_Value("<type Value Device");//Interpretes the Data based agreed format
Store_into_DB();//Stores data into Database
}

//This function handles writing data into Serial link
Write_Data()
{
Write_Format("type Value Device");
}
```

Flow Chart(Java)





Java Application(Demo)



Cost and Resources

Device	Quantity	Cost
Digital resistor	4	$8.00
Ambient Light Sensors	7	$97.02
Arduino Mega 2560	1	$65.00
Intel ATOM Board	3	Provided
Test Environment	1	$230
LED Bulbs	12	$24.00
	Total	$424.02

Conclusion

- The system could assist in saving energy and compliment the work enivronment of whoever uses the system
- The user friendly interface helps to keep track of what's going on within the system.
- The room would always have a productive lighting environment at increased efficiency
- With further innovation our Lighting Efficiency System design solution will accomplish our goal of providing the consumer with a lower electricity bill and please the users as they would have better conditions conducive to working.

Question