Smart Power Efficient Light Automated System

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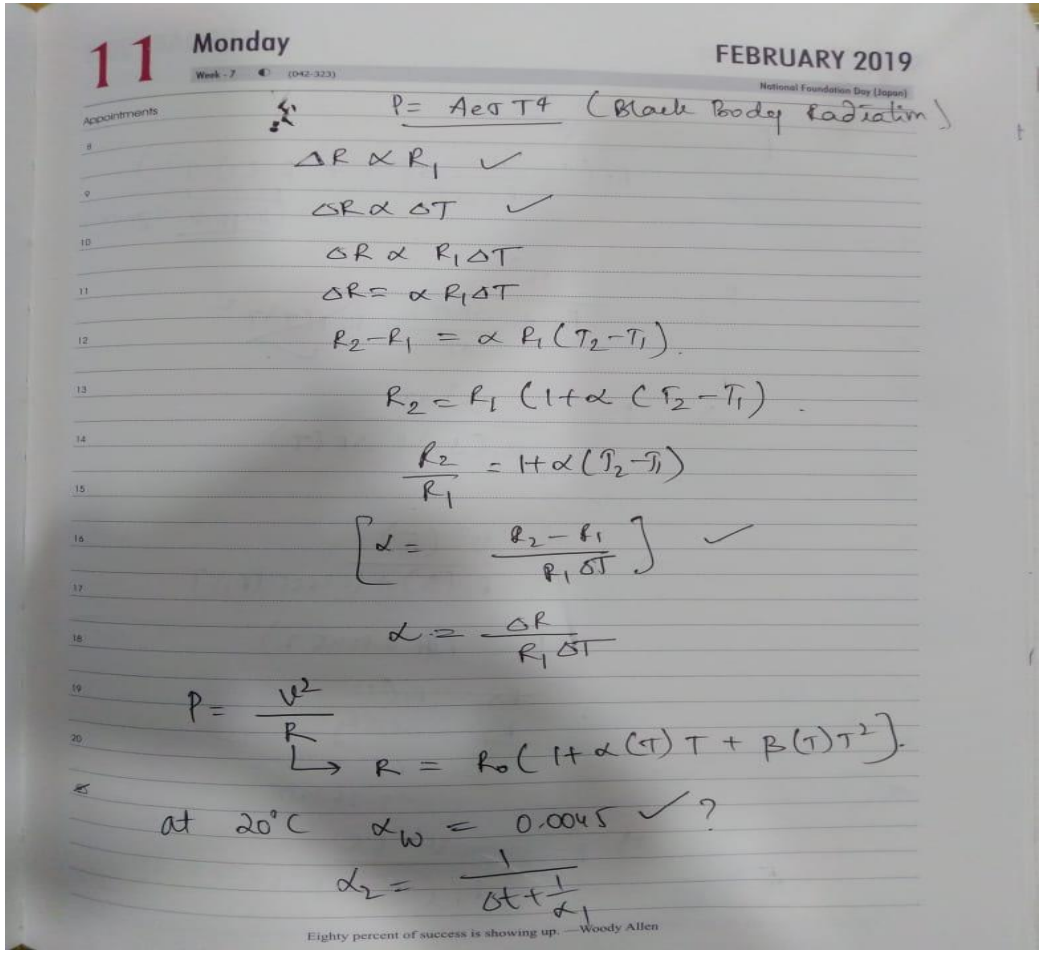
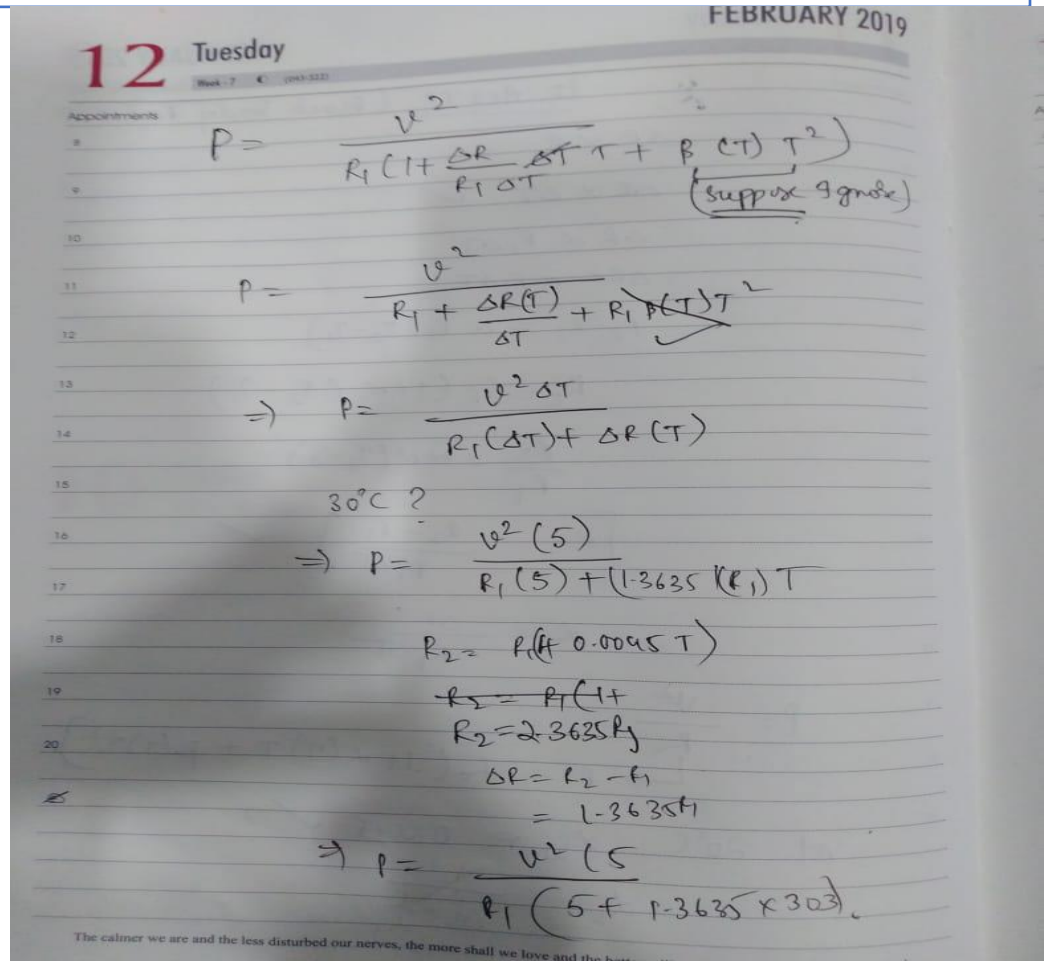
Problem Statement:

Smart Selection of Most Power Efficient Combination of light devices present in a room at the place of operation based on ldr sensor detection and requirement of user(different modes like sleep, study,etc),optimising solution by analyzing RMS AC Voltage Power Variation Curve

Mathematics of Power-Voltage Curve Optimization





- We are basically trying to optimize power consumption by selecting the combination of light devices which has minimum power voltage gradient so as to maximize o/p from given input with low consumption of power

13 Wednesday FEBRUARY 2019

Week 7 (044-321)

Appointments

$P = \frac{V^2 (5)}{R_1 (418.1405)}$

$P = \frac{V^2 (0.01195)}{R_1}$

120 − 250 V

$\frac{200^2}{15} = \frac{4200}{15}$

4200 Ω

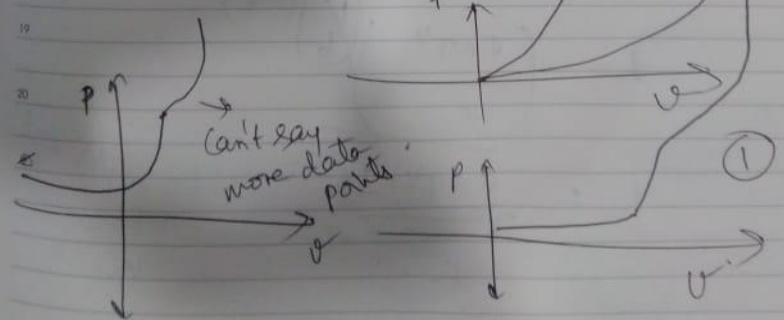
P

$P = \frac{V^2 (0.01195)}{4200}$

$P = 4.64 V^2$?

$4V^2$

V^2



Thousands of candles can be lighted from a single candle. Happiness never decreases by being shared. — Gautama Buddha

FEBRUARY 2019

14 Thursday

Week 7 (045-320)

Appointments

$P = 4.64 V^2$

$P = A \sigma T^4$

$P = \frac{V^2}{R}$

$\frac{V^2}{R} = 4.64 V^2$ (K)

Suppose $\frac{V^2}{R} \simeq K V^b$

V ↑ T of filament ↑ ⇒ R

I ↓

$\frac{V^{2-b}}{K} = R$

$K V^b = \sigma A T^4$

Voltage ← $(V) = \left(\frac{\sigma A T^4}{K}\right)^{1/b}$

$R = \left(\frac{\sigma A T^4}{K}\right)^{\left(\frac{1}{b}\right)^{(2-b)}}$

$R = \frac{(\sigma A T^4)^{\frac{2-b}{b}}}{K^{\frac{2-b}{b}+1}} = \frac{(\sigma A T^4)^{\frac{2-b}{b}}}{K^{2/b}}$

The power of imagination makes us in[illegible]

So if $b > 2$

$R \propto T^{-a}$ → negative dependence.

So we can't actually predict behaviour of an function
→ so many data pts.

$$P = \frac{v^2}{R} = \frac{v^2}{(\sigma A T^4)^{2-b/b}} \Big/ k^{2/b}$$

$$P = \frac{(v^2)\, k^{2/b}}{(\sigma A T^4)^{2-b/b}}$$

Temperature last real life value ~~=~~

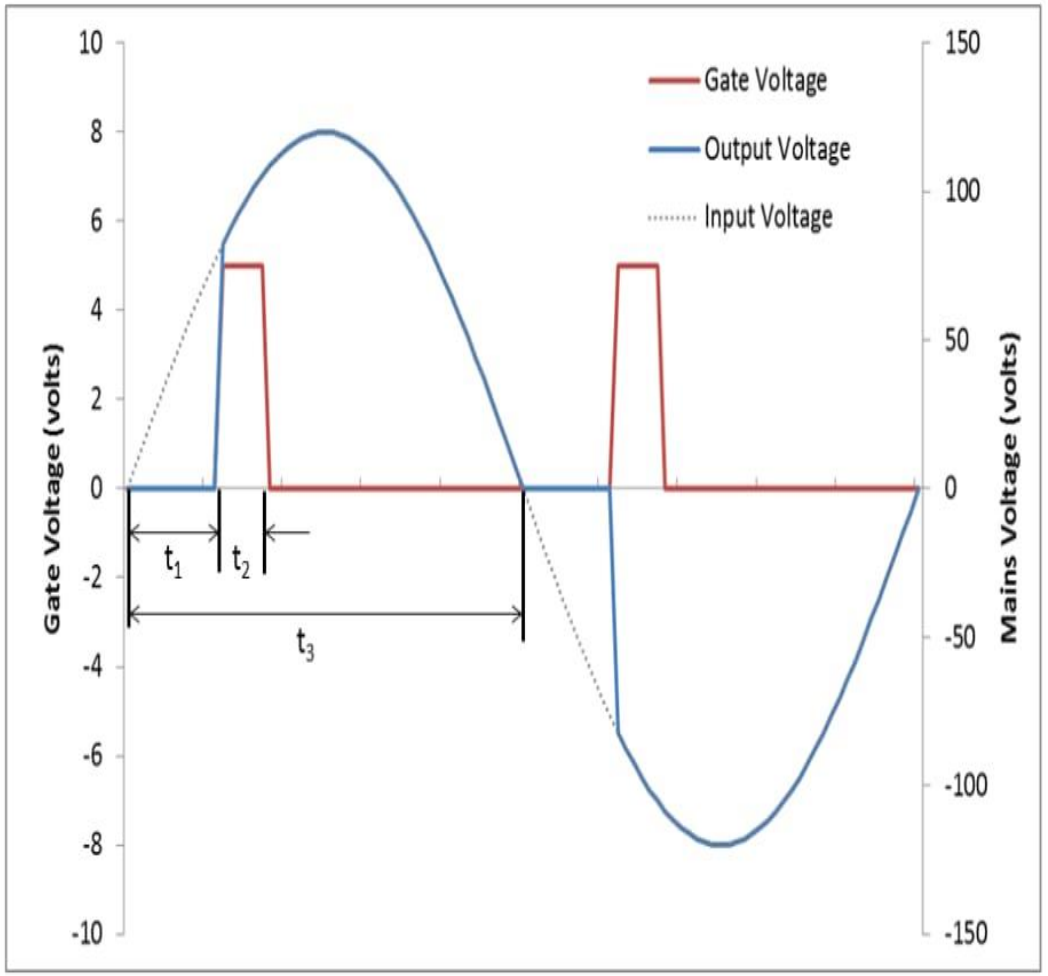
At const. temp.

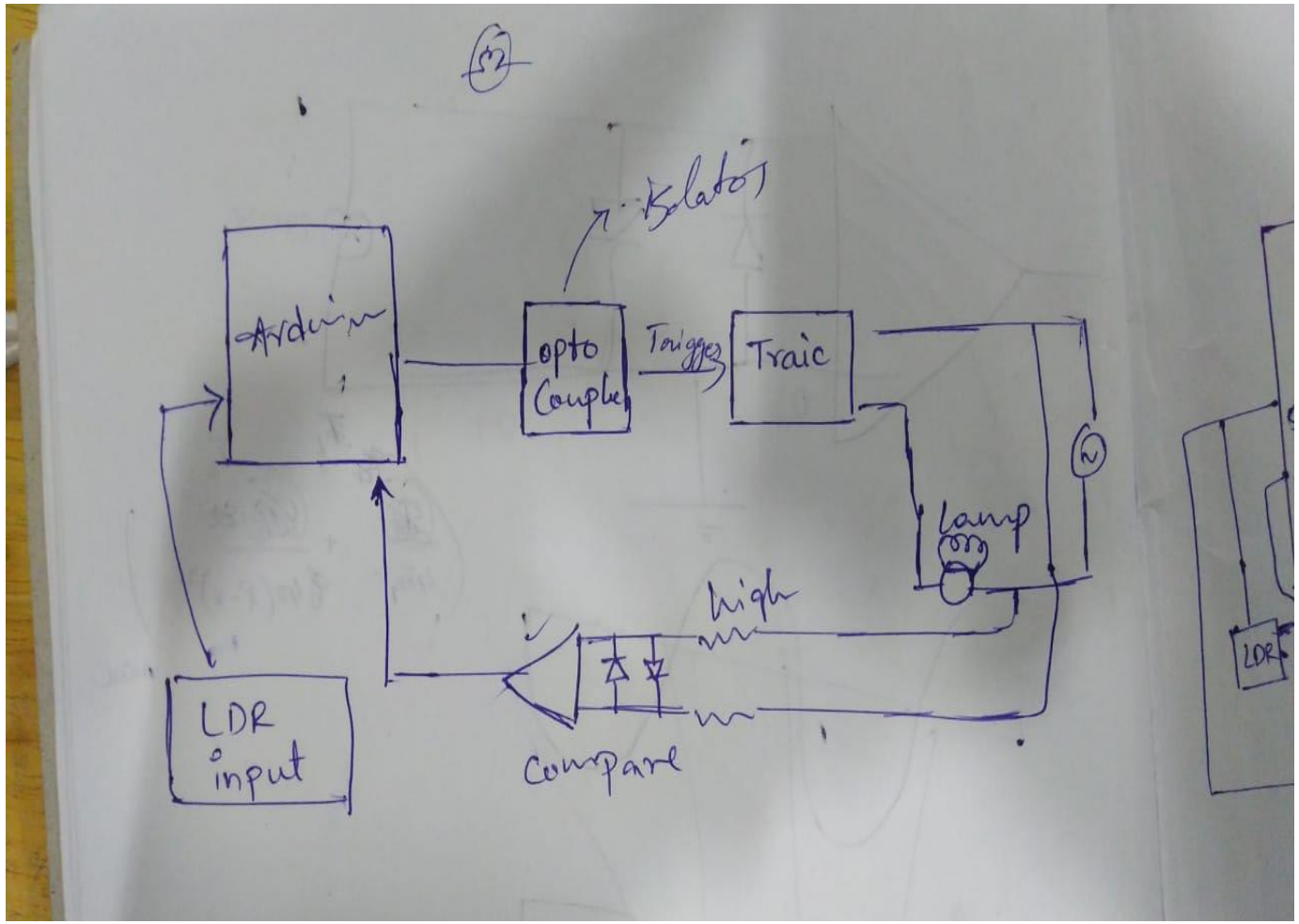
$$\frac{dP}{dv} = 2v \cdot \left[\frac{k^{2/b}}{(\sigma A T^4)^{2-b/b}}\right]$$

↳ Compare combination lower slope is selected =

Components

- Arduino board
- BT136 Triac
- 220V AC lamp
- LM339 comparator
- Optocoupler (MOC3021)
- 2 x 1N4007 diode (or 1N4001)
- LDRs


Gate Voltage
Output Voltage
Input Voltage
Gate Voltage (volts)
Mains Voltage (volts)
10
8
6
4
2
0
-2
-4
-6
-8
-10
150
100
50
0
-50
-100
-150
t1
t2
t3


Arduino
opto Couple
Triggers
Traic
Lamp
LDR input
High
Compare
LDR

Code

- ```
  #define triac_gate   8
  #define pot         A0
  #define iot         A1
  int ldr=0;
  int app=0;
  bool ZC = 0;
  uint16_t alpha;
  int value=0;

  void setup(void) {
    pinMode(triac_gate, OUTPUT);
    digitalWrite(triac_gate, LOW);
    attachInterrupt(0, ZC_detect, CHANGE);       // Enable external interrupt (INT0)
  }

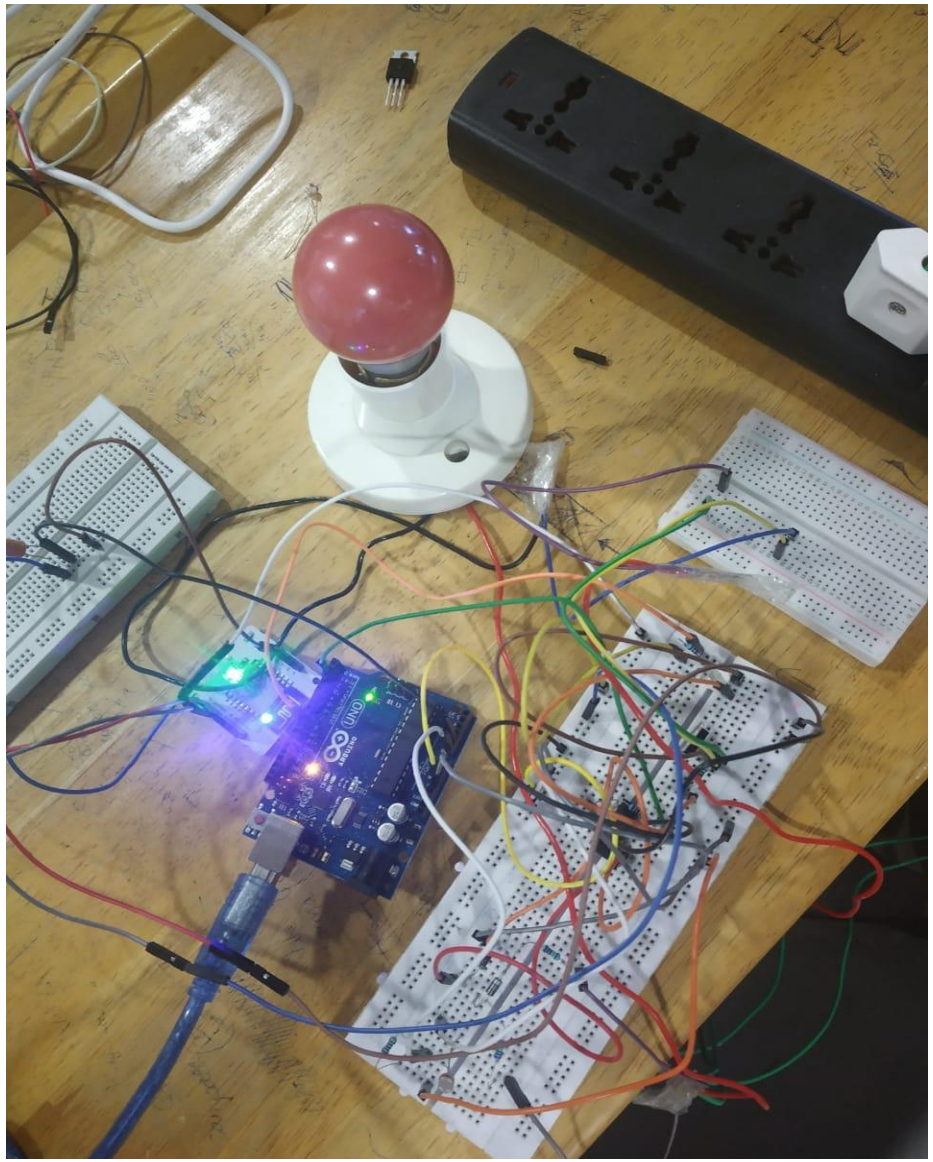
  void ZC_detect() {
    ZC = 1;
  }

  void loop() {

    if( ZC){
      if(alpha < 9500) {
        delayMicroseconds(alpha);
        digitalWrite(triac_gate, HIGH);
        delayMicroseconds(200);
        digitalWrite(triac_gate, LOW);
      }
  ```
  ```

- ZC = 0;

```
    ldr=analogRead(pot);
    app=analogRead(iot);
     if(app<60)
     {alpha=9000;
     }
    else if(app>660)
     {alpha=2000;
     }
     else if(app>140 && app<270)//sleep
     { if(ldr<780)
       alpha=alpha+1;
       else if(ldr>830)
       alpha=alpha-1;
       else
       {alpha=map(ldr,0,680,9600,0);
        if(alpha > 9500)
        alpha = 9500;
        }
      }
      else if(app>320 && app<440)//study
     { if(ldr<920)
       alpha=alpha+1;
       else if(ldr>980)
       alpha=alpha-1;
       else
       {alpha=map(ldr,0,680,9600,0);
        if(alpha > 9500)
        alpha = 9500;
        }
      }
     if(alpha > 9500)
     alpha = 9500;
     else if (alpha<0)
     alpha=0;
  }
}
```



bolt | Arduino 1.8.12 (Windows Store 1.8.33.0)

File Edit Sketch Tools Help

bolt §

```
#include <SPI.h>
#include <ESP8266WiFi.h>
int lpin =  6;
char ssid[] = "Redmi";
char pass[] = "kalhonaho";
int keyIndex = 0;
int status = WL_IDLE_STATUS;

WiFiServer server(80);
void setup()
{
  Serial.begin(9600);
  Serial.println();

  if (WiFi.status() == WL_NO_SHIELD) {

    while (true);
  }

  while ( status != WL_CONNECTED) {

    status = WiFi.begin(ssid, pass);

    delay(10000);
  }
  server.begin();
  printWifiStatus();
}
void loop() {
  WiFiClient client = server.available();

  if (client) {

    String currentLine = "";
    while (client.connected()) {
```

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NodeMCU 1.0 (ESP-12E Module), 80 MHz, Flash, Legacy (new can return nullptr), All SSL ciphers (most compatible), 4MB (FS:2MB OTA:~1019KB), 2, v2 Lower Memory, Disabled, None, Only Sketch, 115200 on COM3

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GLOW

CONTROL OF LIGHT INTENSITY FOR CARRYING OUT DIFFERENT MODES

Microcontroller Device Status

LIGHT OFF

LIGHT ON

MODES

SLEEP MODE 

STUDY MODE 

Circuit Implementation