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Smart Wi-Fi Controlled Lighting

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Abstract: Now a day, constantly growing demand for electrical energy isquite questionable. One of the most significant energy consumers is lighting. About 19% of the electrical energy produced over the world is spent to lighting. The smarter way to reduce the unnecessary usage of energy is by making applications to be controlled remotely.

Light-emitting diodes (LEDs) are becoming more popular. Most illumination applications are becoming LED based, mainly due to their long operational lifetime and high energy efficiency. In this Project, we're trying to introduce an efficient way for driving the LED and controlling its brightness level and colors in order to benefit from high efficiency, and improved light quality as well. Circuit can simply be used in smart environments, communicating with user through a cell phone application, and simultaneously being able to adjust the ambient light and colors in a smart way. This all can be done using Internet of Things (IoT). IoT is a network of communication among physical devices, which enables the objects to be sensed and controlled remotely. This indirectly creates opportunities for direct integration of physical world into computer based systems which results in improved efficiency, accurate control and economic benefit. In this project we are using a NODEMCU (ESP8266) module to control and connect through IoT and control through mobile applications.

Keywords: WiFi, LED, NODEMCU, IoT, Microcontroller.

I. INTRODUCTION

The theme of the project is to develop a lighting system that can be controlled digitally and providing exactly the right light with a wide range of colors where and when it is needed. In this project we have designed a smart light which can be controlled using a mobile application through Internet. The NODEMCU is the main component which connects and controls the physical devices, i.e. RGB LED's in this project. Here we used a transformer less rectifier circuit which takes 230V AC and converts it into 12V DC, which thereby used to power up the RGB LED's. A controller circuit is used to control the LED's color and intensity according to the control signal from the microcontroller.

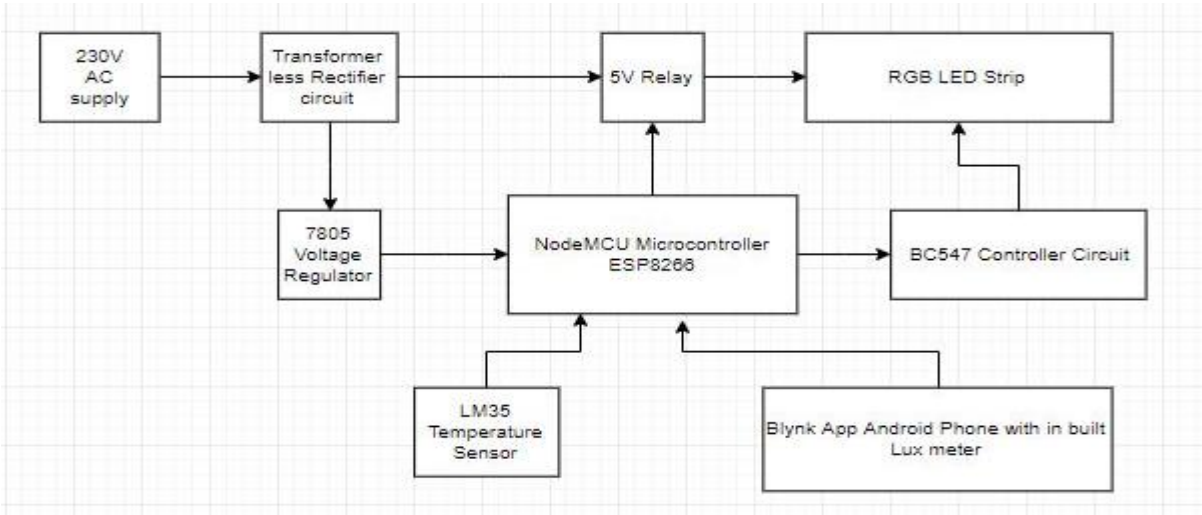

Fig 1- Block Diagram of the Wi-Fi controlled Smart Lighting System

II. DESCRIPTION

In this project we built a smart lighting system which can be controlled according to the need and mood of the user through a simple android application. The smart light is simple to use and compact in size and easy to install anywhere.

CIRCUIT DIAGRAM:

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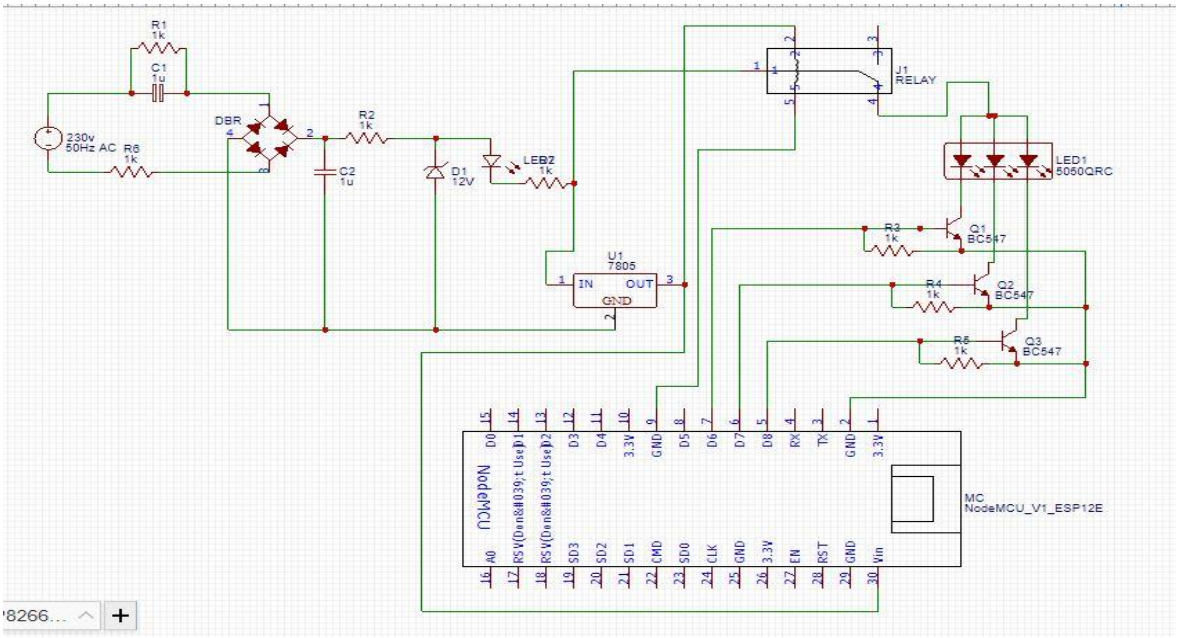

Fig-2 Circuit Diagram

For this project we used NodeMCU (ESP8266 12E module) which is used to interface the user application to the light controller circuit. The NodeMCU comprises of different GPIO pins which can be able to produce PWM signals according to the input from the user based upon the program which is uploaded to the microcontroller. A transformer less rectifier circuit which converts 230V AC supply to 12V DC which is fed to a RC filter circuit to avoid ripples in the DC supply to avoid unnecessary flickering of LED's.

A.COMPONENTS:

1. NPN Transistor: The controller circuit comprises of 3 BC547 (NPN) transistors which are used to control the intensity of the RGB LED's.BC547 is a very sensitive device which can change output with a slightest change in input. This is helpful in varying the intensity of the light, and when used together simultaneously a wide range of colors can be produced easily.

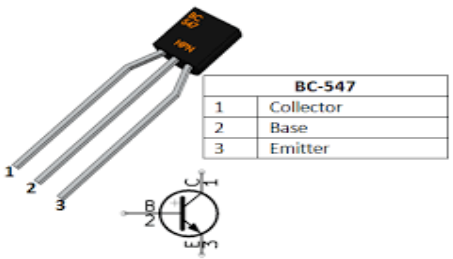

Fig - 3 – BC5437 Transistor

2. Relay: By using a relay we can easily switch on and off the RGB LED's and for this a 5V regulator (7805) is used to magnetize the coil inside the relay. And a parallel output is given from regulator to the NodeMCU controller which works best at 5V supply.

Fig- 4 5V Relay

3. Rectifier Unit: It is a simple Diode Bridge Rectifier is placed in the circuit which converts AC sine wave into pulsating DC, which further passed through a resistor and a 12V Zener diode is placed across the output which

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bypasses any voltages which are more than 12V. RC filter circuits are used to filter the ripple contents in the output of the rectifier.

4. RGB LED: The Working of RGB LED is very simple. Mixing is different combinations of colors will lead to a different color output.

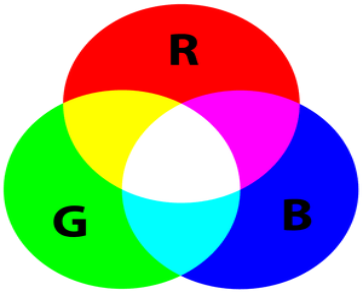

Fig – 5 RGB Color Output


fig – 6 RGB LED Strip

5. Micro Controller NodeMCU: It is a open source IoT platform which includes firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module. It is a low-cost, Wi-Fi Module chip that can be configured to connect to the Internet for Internet of Things (IoT). Basically, normal Electrical and Mechanical equipment cannot connect to the Internet on their own. They don't have the in-built setup to do so. We can setup ESP8266 with thisequipment and doControlling, Monitoring etc. A System on a Chip or System on Chip (SoC) is an integrated circuit that integrates all components of a computer or other electronic systems.


Fig – 7 NodeMCU ESP8266 module

III. PROGRAM & CODING

Programming:

```
#defineBLYNK_PRINTSerial
#include<ESP8266WiFi.h>
#include<BlynkSimpleEsp8266.h>
//YoushouldgetAuthTokenintheBlynkApp.
//GotothеProjectSettings(nuticon).
charauth[]="a1xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx9h";
//YourWiFicredentials.
//Setpasswordto""foropennetworks.
charssid[]="SmartWiLi";
charpass[]="xxxxxxxxx";
voidsetup()
{
//Debugconsole
Serial.begin(9600);
Blynk.begin(auth,ssid,pass);
//Youcanalsospecifyserver:
//Blynk.begin(auth,ssid,pass,"blynk-cloud.com",8442);
//Blynk.begin(auth,ssid,pass,IPAddress(192,168,1,100),8442);
}
voidloop()
{
```

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```
Blynk.run();
}
```

Colour combinations:

Colour Name	HexCode#RRGGBB	DecimalCode(R,G,B)
Black	#000000	(0,0,0)
White	#FFFFFF	(255,255,255)
Red	#FF0000	(255,0,0)
Lime	#00FF00	(0,255,0)
Blue	#0000FF	(0,0,255)
Yellow	#FFFF00	(255,255,0)
Cyan/Aqua	#00FFFF	(0,255,255)
Magenta/Fuchsia	#FF00FF	(255,0,255)
Silver	#C0C0C0	(192,192,192)
Gray	#808080	(128,128,128)
Maroon	#800000	(128,0,0)
Olive	#808000	(128,128,0)
Green	#008000	(0,128,0)
Purple	#800080	(128,0,128)
Teal	#008080	(0,128,128)
Navy	#000080	(0,0,128)

IV. RESULTS

The user desired output is obtained through a mobile application in a smart environment which saves a considerable amount of power and also gives user the vicinity to enjoy a wide range of colors. By using a simple application "Blynk" which is easily available free on Playstore is used to connect and control the lights as desired and needed by the user. It is very simple to connect and control the lighting system from this application.

V. CONCLUSION

Lighting is still a vast and rapidly growing source of energy demand which needs an energy efficient lighting technologies to compensate the extra generation of energy. Currently, more than 35 billion lamps are operating worldwide, which consume more than 2700 TWh of energy annually. Our first priority should develop energy saving lighting systems while ensuring quality of luminous environment as high as possible. The results presented in this report show that it is achievable to control lighting systems even with minimum power consumption. But for professional lighting design energy efficient and quality lighting can be reached. Better lighting quality doesn't mean higher energy consumption, it is better when user can enjoy visual performance and can controlled by him easily and remotely, and there are always light levels above which a further increase in the light level does not improve performance.

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