LED Traffic Light with Single Display

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***Abstract*—A single display traffic light system is a multifunction system that used bicolor bipolar Light Emitting Diode (LED) to enhance the conventional traffic lights on the road. This traffic light is able to display green, yellow and red color on the same screen by applying the difference current for each color. Besides, the screen also can display turning arrows (right turns and left turns) at the same time. The system design is controlled by Peripheral Interface Microcontroller (PIC) and is simulated by using Proteus software.**

Keywords—bicolor bipolar LED; PIC; Proteus ; simulation

I. INTRODUCTION

Traffic light as known as signal lights is a device that can signal the position at road junction in order to control the congestion of flow traffic. The common features of traffic light are; it consists of 3 lamps per set (red, amber, and green) or for some types, it has additional lanterns which are include turning arrows and digital countdown. Hence, it consumes more space and power and also required strong wires to hold the weights. The system of single display traffic light is designed in order to overcome the drawback of the conventional arrangement. Besides that, LED is introduced as replacement for the bulb inside traffic lantern due to low power consumption and long lifetime [1].

Bicolor bipolar LED as shown in Fig. 1 that was employed in the system design can display three colors in one LED instead of using 3 different colors of LED. The colors of the signals are illuminated by programming in the microcontroller and injecting the different current to the LED pin [2]. The basic operation of the bicolor bipolar LED as represented in Fig.2 is once current is fed into LEDs in a first direction, it will display first color and when vice versa, the second color will be glowed. The third color will be shown when the current is fed into the array alternately in both directions [3].

This paper is based on the simulation of bicolor bipolar LED traffic light with single display by using Proteus simulation and PIC18F with 16 bits is used as a controller for the system design. This simulation is about to generate traffic signals which is the green light, yellow light, red light and turning arrows in a single display of traffic light.

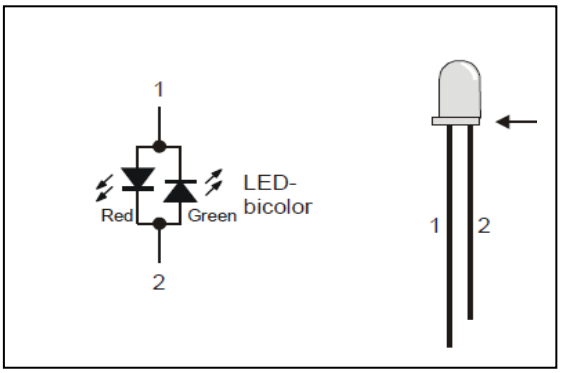

Figure 1: Schematic symbol of bicolor bipolar LED

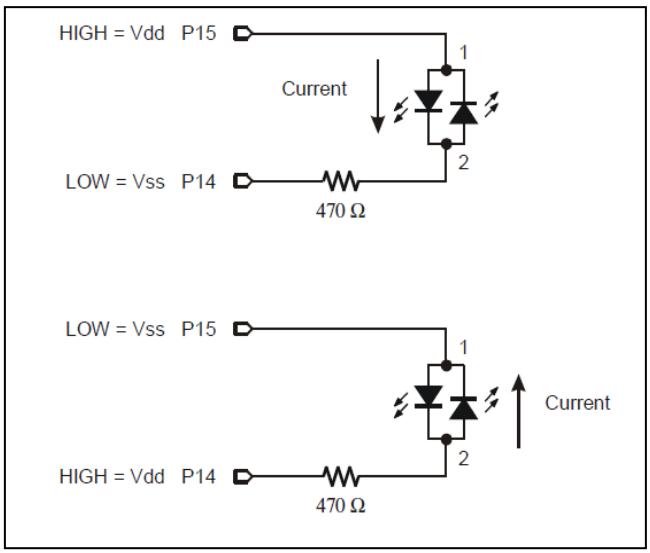

Figure 2: Manual bicolor bipolar LED test

II. METHODOLOGY

The road layout as depicted in Fig. 3 just shows the rough ideas how the LED traffic light with single display is functioning and the basic steps as follows:

i) Initialize the PIC
ii) Change the lights on the main road (K1) to green with straight and left arrows
iii) K2 in red light mode
iv) Then, change the K1 to yellow light for a period of time
v) K2 change to green light when K1 in red light
vi) Return to step (ii)

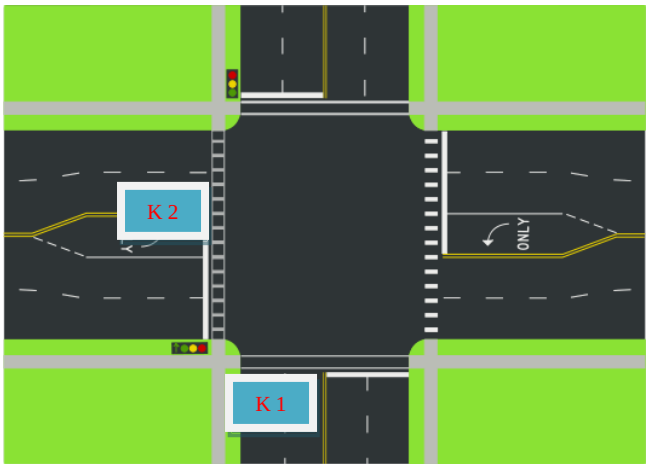

Figure 3: Simulation circuit of LED traffic light

The LED traffic light with single display system consists of an input device, PIC as controller and the last part is LED panel which is using bicolor bipolar LED as depicted in Fig.4.

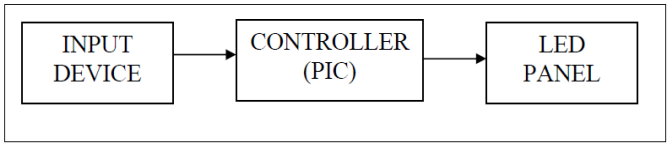

Figure 4: Block diagram of LED traffic light

The complete circuit diagram for this system that was built in Proteus software as illustrated in Fig. 5.The source in this system is $5V_{DC}$ as the input for PIC18F4620 that act as the controller. The language for the programming in software program is C language and the program is written in MPLAB IDE software. Fig. 6 shows the initialization coding of PIC used. In this system, it consists of 39 bicolor bipolar LEDs which 1 pin connected to 3 LEDs in parallel. It needs more LEDs in order to show clearly the arrow sign. It also contains 39 resistors 330Ω to protect the bicolor LED from overcurrent.

Fig. 7 and Fig. 8 represented the coding of the LED display with red and green and also yellow display respectively. Bicolor LED has 2 pins which are anode and cathode, which when anode is connected to the positive supply, the green color will display and if the connection is switched, the LEDs will become red color. According to the yellow display coding, a big difference with red and green display is the delay time. In order to display the yellow color, the red and green color needs to alternate in a very fast sequence because the combination of red and green color will produce the yellow color.

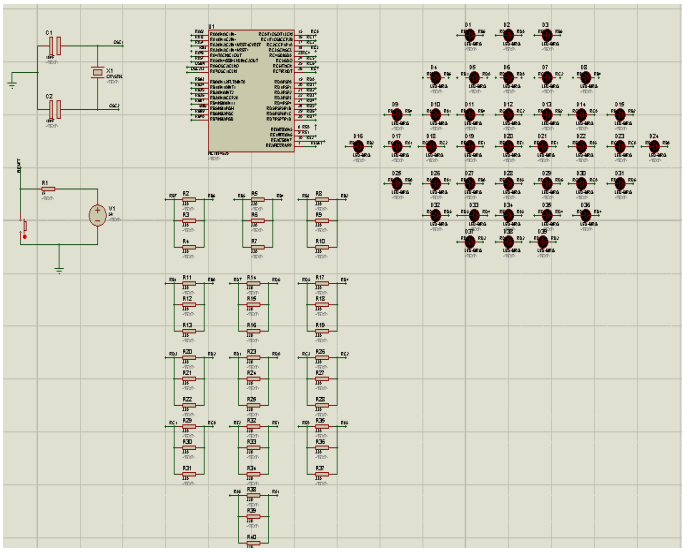

Figure 5: Simulation circuit of LED traffic light

```
#include <18F4620.h>
#fuses HS,NOWDT,NOLVP,NOPROTECT
#use delay (clock=10M)
```

Figure 6: Initialization coding of PIC18F4620

```
while (TRUE)

{
    output_high(COLOR1);
    output_low(COLOR2);
    delay_ms(10000);

    output_high(COLOR2);
    output_low(COLOR1);
    delay_ms(10000);
```

Figure 7: Coding of GREEN and RED display

```
while (TRUE)

{
    output_high(COLOR1);
    output_low(COLOR2);
    delay_ms(10);

    output_high(COLOR2);
    output_low(COLOR1);
    delay_ms(10);


}
```

Figure 8: Coding of YELLOW display

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III. RESULT AND DISCUSSION

Fig. 9 illustrates that the certain LEDs that was programmed into PIC appear the green color with turning arrows which are straight and right arrow and it means that the road users at the junction can move either straight way or to the right way. Meanwhile, other LEDs will shut off. This is because the LEDs that connected to anode pin will let the current flow through it when voltage is applied and the bicolor LEDs glow green. From programming code, to ON the green color, the entire selected anode pin must be in high input and the cathode pin should be getting the low input.

When the LEDs turn into red color, the turning arrow will disappear and all LEDs will glow into red color as portrayed in Fig. 10. So, the cathode pin is high input and the anode input must be in low input as programmed in MPLAB IDE. In order to change the LEDs into red color which connected to cathode pin, the voltage applied is reversed and the red LEDs turn ON and current passes through it in opposite direction. While, the green LEDs shut off because no current flow through it.

In the simulation, as mentioned in methodology part, the yellow color is produced from alternating of red and green color in very short delay and hence, the result cannot be captured because it display in a very short time which is in this design it just 10ms. It is based on the natural phenomenon which, the yellow color is formed from the combination color of red and green.

The single display traffic light can give many advantages to the government side due to small space is needed compared to the common traffic light that have 3 to 6 lanterns which required large space to install it. Thus, the system can be easy to install at small roads and junctions. Other than that, the usage of LEDs can be cut off because it just uses a single display instead of using 3 displays. Thus, the cost to build up and also its maintenance can be minimized.

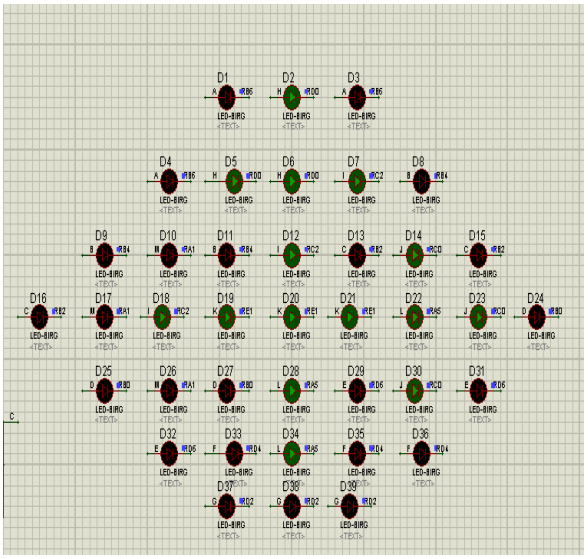

Figure 9: Green color and turning arrow display

Besides that, the benefit of the LED traffic light in term of electrical part is about the electricity bills which it can save approximately 90% of bills due to low power consumption of LED. Furthermore, its lifespan the use years about 5 to 10 times if compared to the exist traffic light [1]. The I/O port lines used in PIC also can be reduced by using bipolar LEDs that only two port lines are sufficient compared to the common LED which need three port lines due to display three different colors.

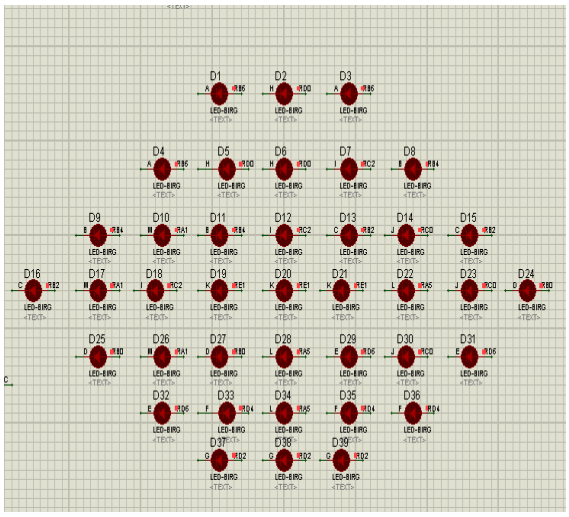

Figure 10: Red color display

IV. CONCLUSION

The single display traffic light by using bicolor bipolar LEDs have generated the green light with turning arrows, yellow light and red light as controlled with PIC18F4620. The implementation of the system can give many advantages to road users, government and also the environment

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