AMERICAN INTERNATIONAL UNIVERSITY-BANGLADESH

Faculty of Engineering

Lab Report

Experiment # 01

Title: Familiarization with a microcontroller, the study of blink test and implementation of a traffic control system using microcontrollers.

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Table of Contents

Experiment Title 3
Abstract 3
Introduction 3
Theory and Methodology 3
Equipment List 3
Circuit Diagram 4
Code/Program 4
Hardware Output Results 5
Simulation Output Results 7
Discussion 8
References 8

Experiment Title

Familiarization with a microcontroller, the study of blink test and implementation of a traffic control system using microcontrollers.

Abstract

This report presents a hands-on experiment on familiarizing with microcontrollers using Arduino. The experiment was conducted with the main objectives of learning to control an LED using the delay function and implementing a traffic control system. Arduino, an open-source platform, was used to write and upload computer code to the microcontroller board. The equipment used in the experiment included an Arduino Mega 2560 board, a breadboard, LED lights, jumper wires, a computer, and the Arduino IDE. The experiment provided a foundation for further exploration into the world of Microcontrollers and its applications.

Introduction

This experiment aims to introduce you to the world of Microcontrollers using Arduino. In this this experiment, we have gained hands-on experience in controlling an LED using the delay function and implementing a traffic control system. The main objectives of the experiment are:

- Learning to make the LED blink using Arduino and the delay functions.
- Implementation of a traffic control system using Arduino.

Theory and Methodology

Arduino is an open-source platform used for creating interactive electronics projects. Arduino consists of both a programmable microcontroller and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the microcontroller board. Arduino Uno also doesn't need a hardware circuit (programmer/ burner) to load a new code into the board. We can easily load a code into the board just using a USB cable and the Arduino IDE (which uses an easier version of C++ to write code).

Equipment List

1. Arduino board (Arduino Mega 2560)
2. Breadboard
3. LED lights (red, yellow, green)
4. Jumper wires
5. Computer
6. Arduino IDE

Circuit Diagram

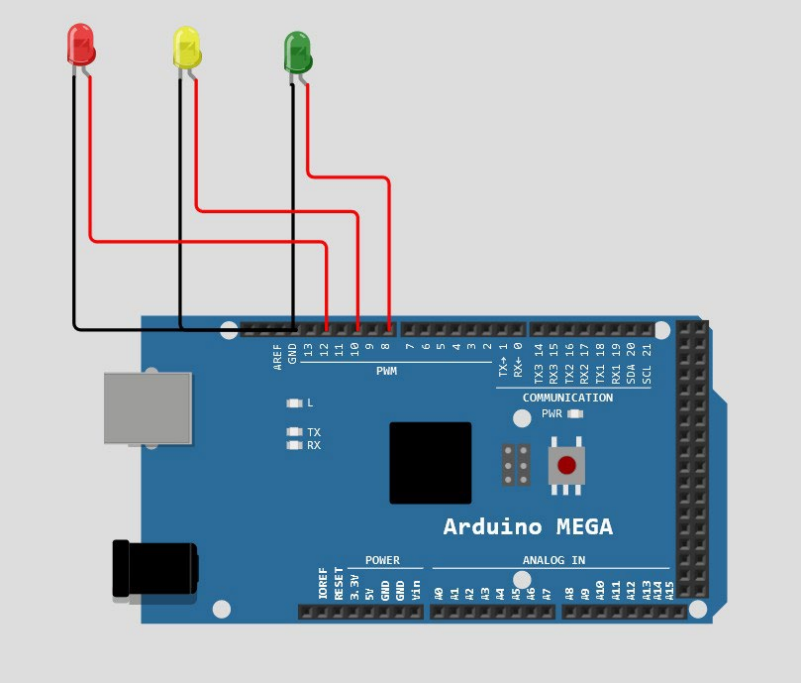

Fig. 1: Hardware circuit diagram for the traffic light

Code/Program

```
#define LED_RED 12 //defining pin 12 as “LED_RED”
#define LED_YELLOW 10 //defining pin 10 as “LED_YELLOW”
#define LED_GREEN 8 //defining pin 8 as “LED_GREEN”

void setup()
{
  // pin connections for the LED lights
  pinMode(LED_RED, OUTPUT); //for red LED
  pinMode(LED_YELLOW, OUTPUT); //for yellow LED
  pinMode(LED_GREEN, OUTPUT); //for green LED
}

void loop()
{
  digitalWrite(LED_GREEN, HIGH); //turning ON the voltage of green LED (at output 8)
  delay(5000); //green LED is ON for 5 seconds
  digitalWrite(LED_GREEN, LOW); //turning OFF the voltage of green LED(at output 8)

  //loop for turning yellow LED ON and OFF for 4 times
  for (int i = 0; i < 4; i = i + 1) {
    digitalWrite(LED_YELLOW, HIGH);//turning ON the voltage of yellow LED(at output 10)
    delay(400); //yellow LED is ON for .4 seconds
    digitalWrite(LED_YELLOW, LOW);//turning OFF the voltage of yellow LED(at output 10)
    delay(400); //yellow LED is OFF for .4 seconds
  }

  digitalWrite(LED_RED, HIGH); //turning ON the voltage of red LED(at output 12)
  delay(8000); //red LED is ON for 8 seconds
  digitalWrite(LED_RED, LOW); //turning OFF the voltage of red LED(at output 12)
}
```

Hardware Output Results

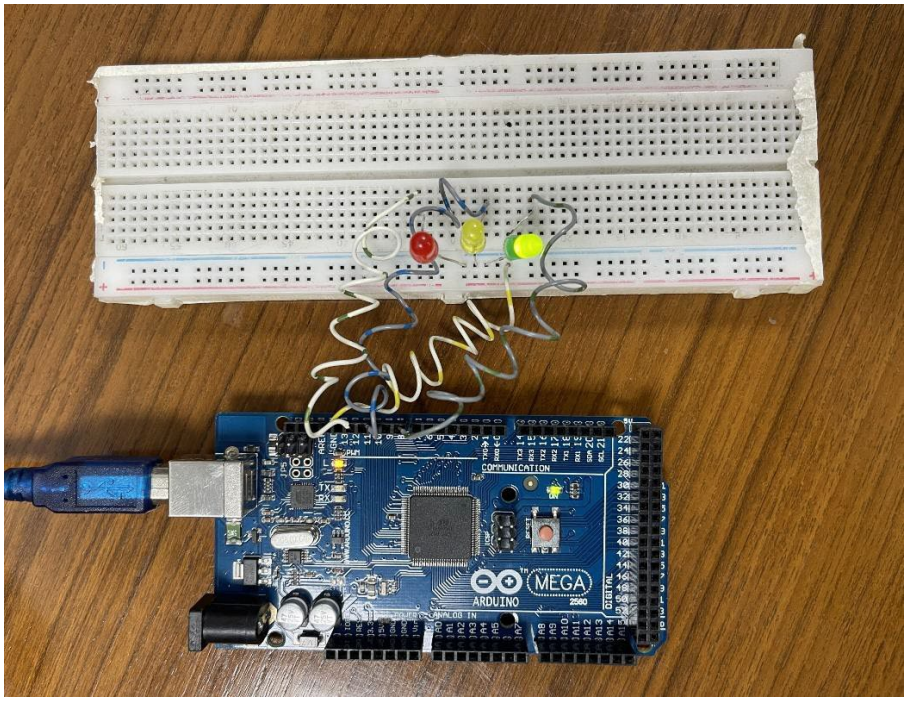

Fig. 2: Circuit of the traffic light when the green light is ON.

The traffic control system was built using the Arduino MEGA 2560, as depicted in Figure 2. The initial phase of the traffic light is depicted in Figure 2 as well. The green signal light was initially turned on for 5 seconds to permit vehicles to cross the intersection before it was turned off.

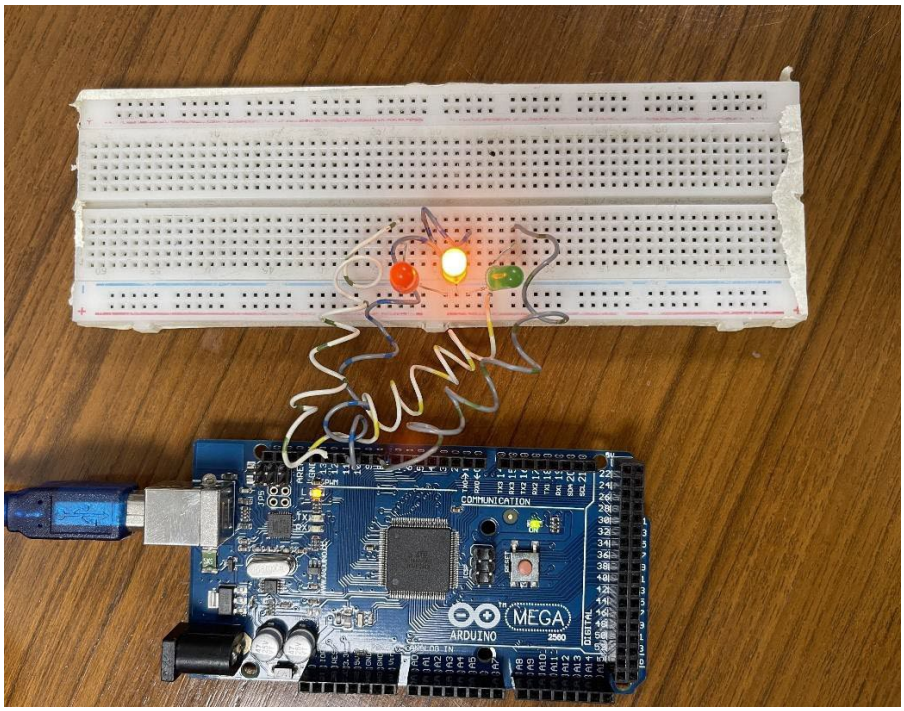

Fig. 3: Circuit of the traffic light when the yellow light (ON) is flashing.

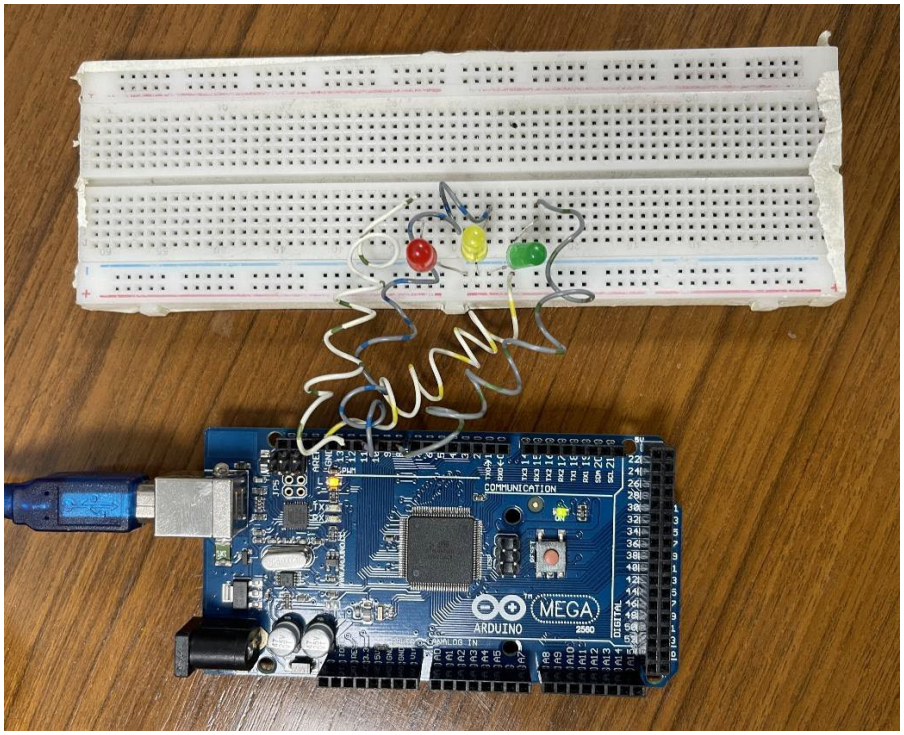

Fig. 4: Circuit of the traffic light when the yellow light (OFF) is flashing.

The next stage of the traffic signal is illustrated in Figures 3 and 4, with Figure 3 displaying the yellow signal light turned on and flashing and Figure 4 displaying the yellow signal light turned off and flashing. The yellow signal light will flash four times during this stage, alternating between being turned on and off every 0.4 seconds for a total of 3.2 seconds. This serves as a cautionary signal for drivers to reduce their speed and come to a stop, as the green signal light is about to turn red, indicating that all traffic must stop.

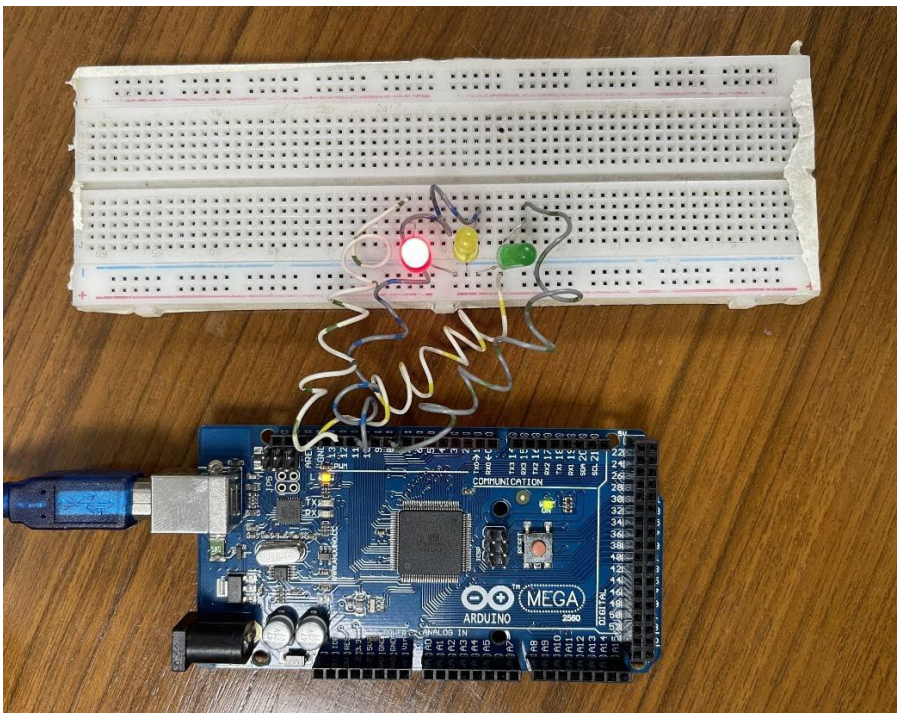

Fig. 5: Circuit of the traffic light when the red light is ON.

The third phase of the traffic light is seen in Figure 5. When the red traffic light comes ON for 8 seconds and traffic must halt until the green light comes ON.

The traffic light will cycle through these three stages until the microcontroller is turned off.

Simulation Output Results

We ran a simulation of our traffic control system using the online simulator at www.wokwi.com. We chose to utilize this simulator since it was simple to use and closely resembles a real-world circuit.

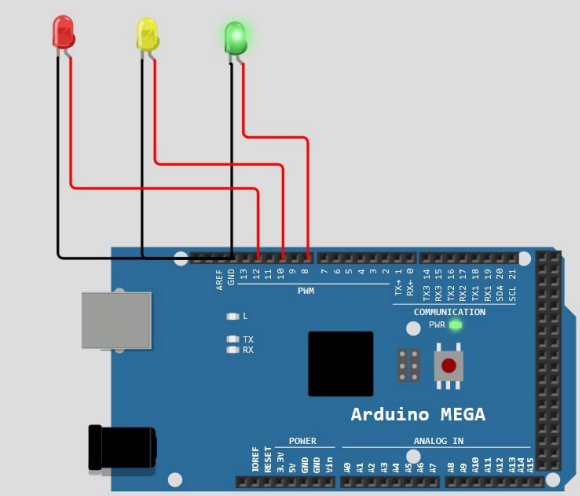

Fig. 6: Simulation circuit of the traffic light when the green light is ON

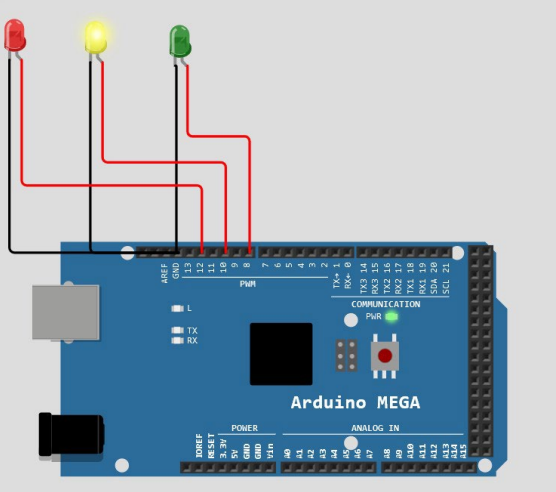

Fig. 7: Simulation circuit of the traffic light when the yellow light (ON) is flashing.

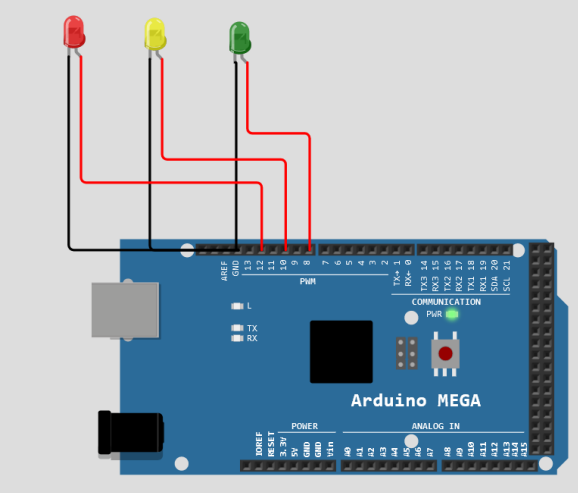

Fig. 8: Simulation circuit of the traffic light when the yellow light (OFF) is flashing.

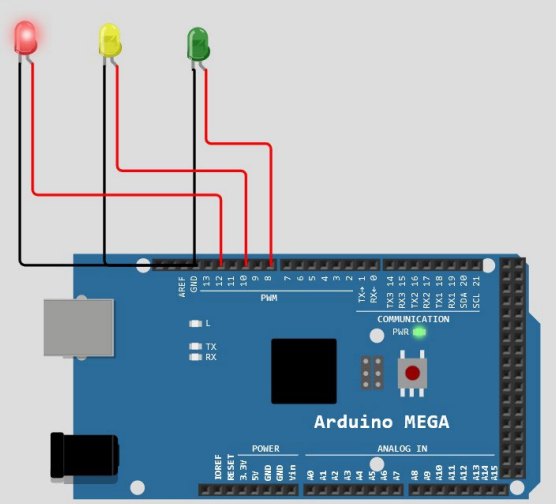

Fig. 9: Simulation circuit of the traffic light when the red light is ON.

Discussion

The main objective of this experiment was successfully achieved as we were able to implement a functioning traffic control system using an Arduino MEGA 2560 microcontroller. The results of the experiment were analyzed and found to be effective. To further understand the function and operation of the microcontroller, a simulation of the system was conducted. This provided a deeper understanding of how the system worked and helped reinforce the concepts learned during the experiment.

In addition to implementing the traffic control system, we also gained valuable experience in programming an Arduino microcontroller using the Arduino IDE. This aspect of the experiment highlighted the ease and simplicity of designing a system using a microcontroller. Overall, the experiment provided a comprehensive introduction to the world of microcontrollers and the limitless possibilities they offer for designing interactive electronic systems.

References

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