SLIIT

COMPUTING | BUSINESS | ENGINEERING

IE2070
Embedded systems
2nd Year, 2nd Semester

Individual Assignment

LED lamp remotely operated using an IR remote Controller.

Submitted to

Sri Lanka Institute of Information Technology

In partial fulfilment of the requirements for the

Bachelor of Science Special Honors Degree in Information Technology

04-05-2024

Declaration

I certify that this report does not incorporate without acknowledgement, any material previously submitted for a degree or diploma in any university, and to the best of my knowledge and belief, it does not contain any material previously published or written by another person, except where due reference is made in text.

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(01) Introduction

This project focuses on crafting a remotely controlled LED lamp employing an Arduino UNO microcontroller and an infrared (IR) remote controller, akin to those used for TV remotes commonly found in households. The lamp, powered by batteries, features four white LEDs and one multicolored LED for portability. Activating the lamp is initiated by pressing the channel up button on the IR remote controller. Once activated, press any button cycles through the colors of the multicolored LED before sequentially turning on the white LEDs. Furthermore, by holding down the volume up and down keys, users can adjust the brightness of the white LEDs.

(02) Design Methodology

The forthcoming discussion will focus on the techniques employed to incorporate the essential components of the circuitry design for the remote-controlled LED lamp.

(2.1) Initial Circuit Design:

The design process commenced with the creation of the initial circuit in Tinker cad. Careful consideration was given to every aspect of the design. To facilitate brightness modulation of the white LEDs, PWM pins 5, 6, 9, and 10 on the Arduino board were allocated. Additionally, pins 7, 8, and 12 were reserved for operating the RGB LED. The output of the IR receiver was assigned to pin 13.

(2.2) LED Configuration:

The LED lamp will include four white LEDs and one multicolor LED with a common cathode. The multicolor LED will provide additional functionalities and aesthetic elements, while the white LEDs will be used for general illumination. To ensure each LED receives the appropriate current, resistors will be connected to the anode of each LED. A total of seven resistors will be used. A 2.2kΩ resistor will be connected to the VCC pin of the IR sensor, while six 330Ω resistors will be used—one for each of the six anodes of the white LEDs and the common-cathode multicolor LED.

(2.3) IR Remote Testing:

A practical examination was carried out on both the IR remote and IR receiver. The IR codes, which corresponded to the designated buttons for regulating the circuit, were identified, and documented for system integration.

Button	IR Decimal Value	Activity
Channel Up	284099070	Powering On LED
Channel Down	284127630	Powering Off LED
Volume Up	284148030	Increase Brightness of White LED
Volume Down	284123550	Decrease Brightness of White LED

(2.4) Precautions:

After finishing the breadboard circuit, the components were soldered onto a dot board for physical integration, ensuring proper connections and alignment.

(03) Code Implementation

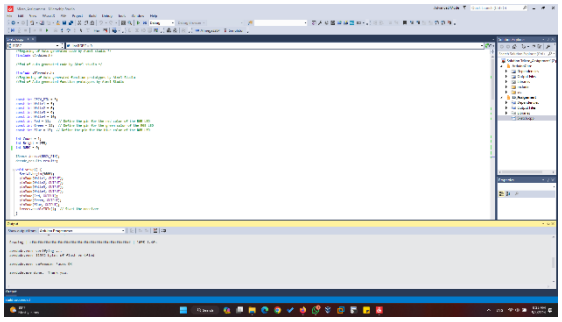

Figure 3.4: Code Implementation Part 1.

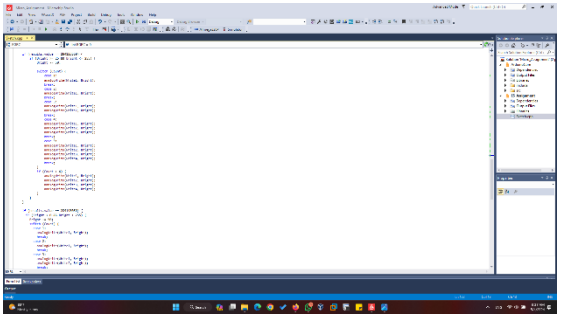

Figure 7: Code Implementation Part 4.

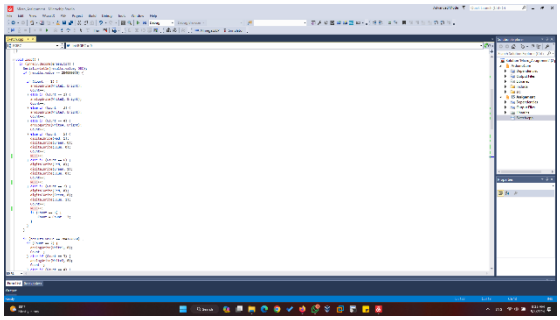

Figure 5: Code Implementation Part 2.

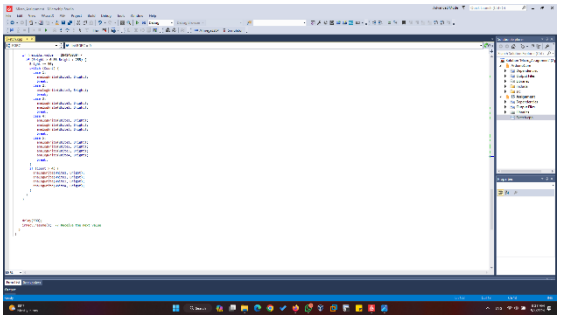

Figure 8: Code Implementation Part 5.

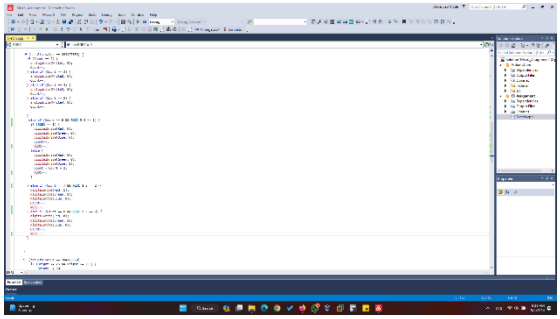

Figure 6: Code Implementation Part 3.

(04) Circuit Diagram

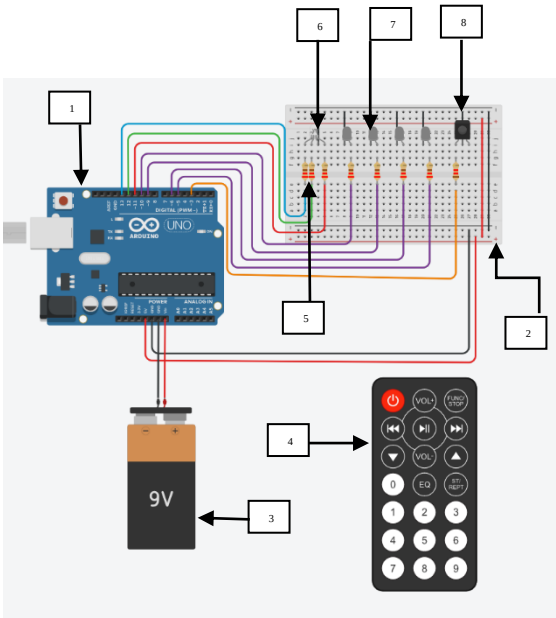

Figure 4.1: Breadboard Circuit.

No	Component.	Quantity
1	Arduino UNO board	1
2	Breadboard	1
3	Power Supply (9V battery)	1
4	IR remote	1
5	220Ω resistor	8
6	RGB Bulb	1
7	White color LED Bulb	4
8	IR Sensor	1

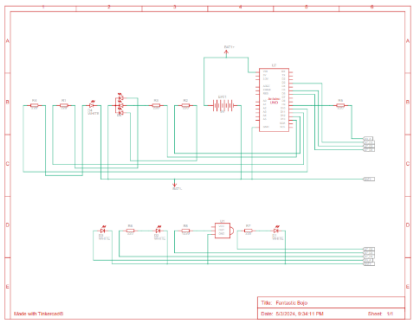

Figure 4.2: Schematic View.

(05) Testing & Validation

- The channel up button stimulates the first White LED

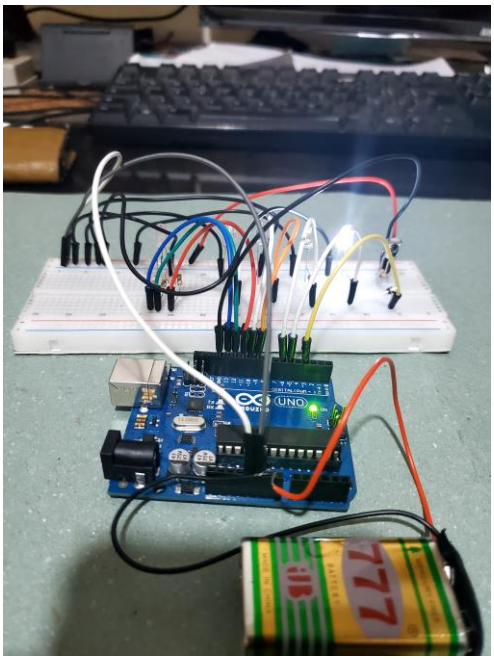

Figure 5.1: First white Bulb.

- Pressing the channel up for the second time stimulates the second LED concurrently.

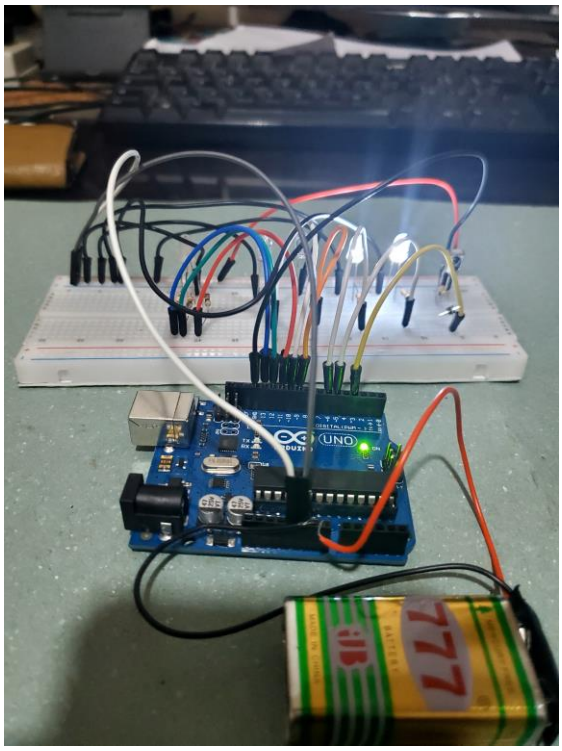

Figure 5.2: Second white bulb.

- Pressing the channel up for the third time stimulates the third LED concurrently.

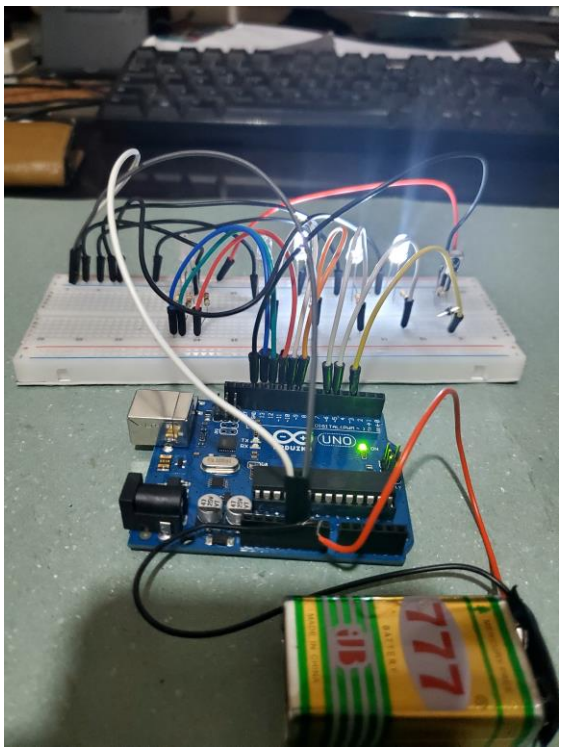

Figure 5.3: Third white bulb.

- Pressing the channel up for the fourth time stimulates the fourth LED concurrently.

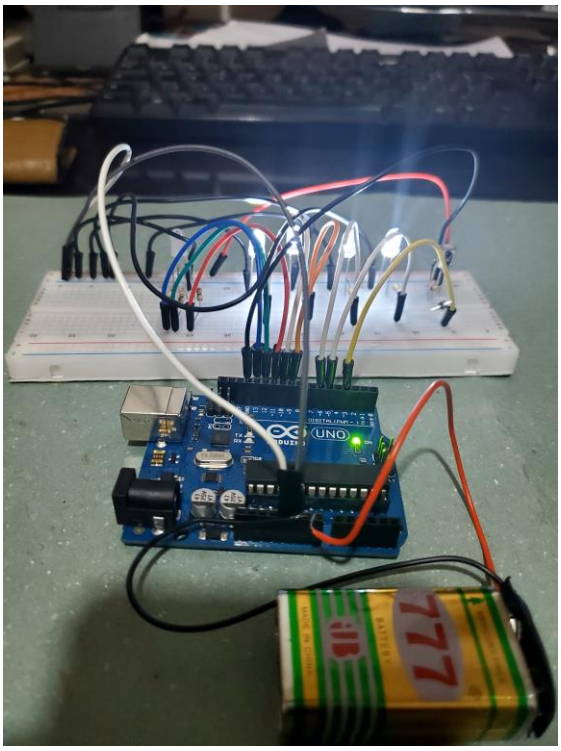

Figure 5.5: Forth white bulb.

- Pressing the channel up for the fifth time stimulates the RGB LED turning it RED.

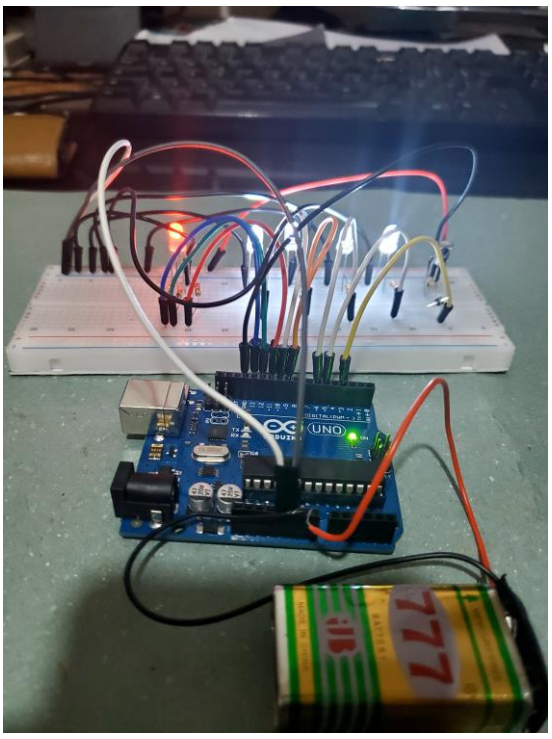

Figure 5.4: Red bulb.

- Pressing the channel up for the sixth time stimulates the RGB LED turning it GREEN.

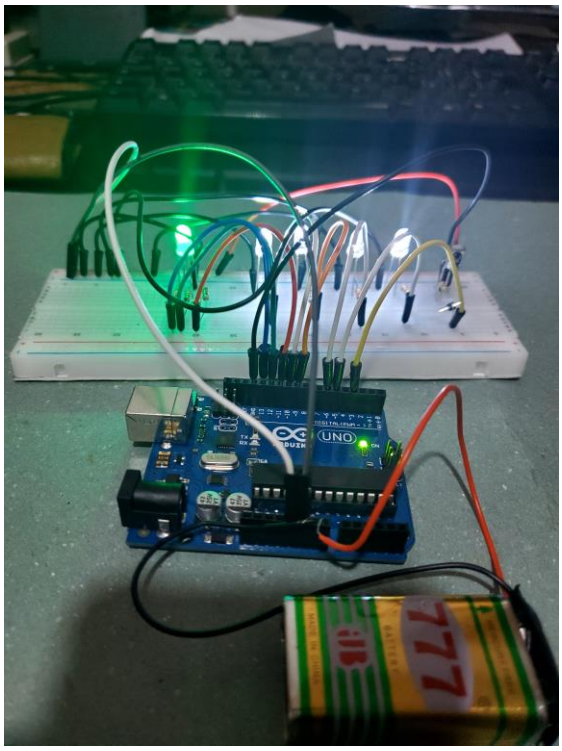

Figure 5.6: Green bulb.

- Pressing the channel up for the seventh time stimulates the RGB LED turning it BLUE.

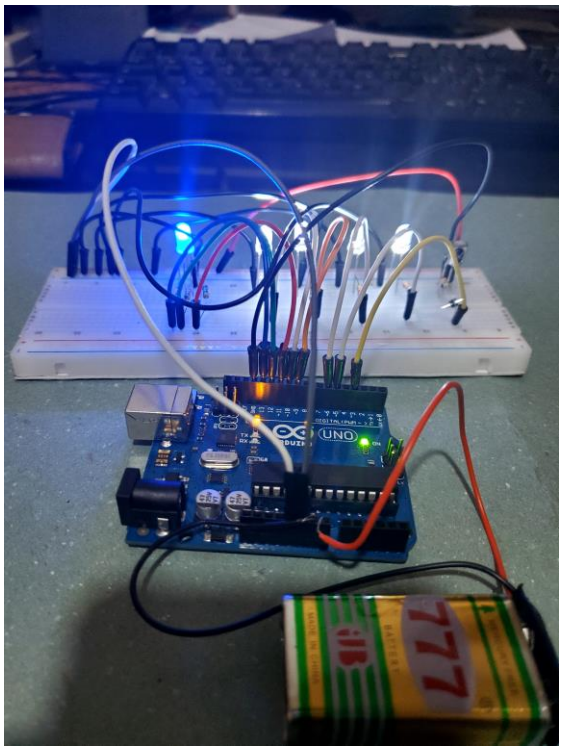

Figure 5.7: Blue bulb.

- Pressing down on the channel down button reverses the process by adhering to the synchronization of turning backwards in the same order that the channel up button stimulated. (BLUE > GREEN >RED > WHITE4 > WHITE3 > WHITE2 > WHITE1.)
- Volume button stimulates the brightness of the LEDs. Volume UP Brightens the LEDs, Volume Down Dims the LEDs. {This is effective only for WHITE LEDs}.

(06) Discussion

The development of the remote-controlled LED lamp project involved a thorough exploration of design, execution, and testing. During the project's initiation, crucial design decisions were made, with the Arduino UNO and the IR remote controller chosen as the system's foundation due to their adaptability and user-friendly interface, respectively. The combination of four white LEDs and an RGB LED not only served a functional purpose but also enhanced the lamp's visual appeal. Integrating the hardware and optimizing the software presented challenges, particularly in achieving seamless communication and ensuring smooth transitions between LED colors. Through extensive testing, valuable insights were gained regarding the lamp's reliability, responsiveness to commands, LED transitions, and brightness adjustments, leading to necessary improvements. The lamp received praise for its responsiveness and user-friendliness. However, feedback highlighted areas for improvement, such as brightness adjustment and color selection methods. In conclusion, this project showcases a successful fusion of innovative design, precise execution, and comprehensive testing. It is recognized for its potential in driving future advancements in home automation and electrical engineering.

(07) References

- https://www.circuitbasics.com/arduino-ir-remote-receiver-tutorial/
- https://www.youtube.com/watch?v=2tphX8scoM8&t=412s
- https://www.youtube.com/watch?v=2tvplTFWi28
- https://www.youtube.com/watch?v=qHPZSCOWPD8&t=560s