Green University of Bangladesh

Department of Computer Science and Engineering (CSE)
Semester: (Fall, Year: 2023), B.Sc. in CSE (Day)

Add Output/input to Shift Register

Course Title: Computer Architecture
Course Code: CSE-211
Section: 222-D2

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Lab Project Status	
Marks:	**Signature:**
Comments:	**Date:**

Contents

Chapter 1

Introduction

Introducing the Arduino-based project with a 74HC595 shift register! This project employs the popular Arduino microcontroller and the 74HC595 integrated circuit to create a versatile output shift register system. The 74595 serves as an expandable solution for increasing the number of output pins on the Arduino, allowing control of multiple devices with minimal pins. Through serial communication, the Arduino efficiently shifts data into the 74595, extending the number of available output ports. This project enhances the flexibility and scalability of Arduino applications, making it ideal for various DIY electronics and automation projects where a higher number of output pins is required.

1.1 Motivation

Igniting Creativity with Arduino and Dual 74HC595 Shift Registers. Unleash the power of motivation by embarking on an exhilarating journey into the world of electronics with our project, designed to spark innovation and ignite your passion for learning.

'Add Output to A Shift Register' seamlessly integrates the versatility of Arduino with the efficiency of two 74HC595 shift registers, opening doors to a realm of endless possibilities. As you delve into this hands-on experience, you'll not only master the intricacies of shift registers but also fuel your motivation to explore, create, and innovate. Elevate your understanding of digital electronics while building a solid foundation for future projects.

Let Project Boost be the catalyst for your motivation, inspiring you to dream, design, and make a lasting impact in the exciting realm of electronic engineering."

1.2 Problem Definition

1.2.1 Problem Statement

The project "Add Output to A Shift Register using 1 Arduino and 2 Register 74HC595" aims to expand the output capacity of an Arduino

microcontroller by utilizing shift registers. In this setup, two 74HC595 shift registers are employed to efficiently control multiple output devices with minimal pin usage on the Arduino. The primary problem statement involves the limited number of output pins on the Arduino, hindering the simultaneous control of numerous external components such as LEDs, displays, or other digital devices. By integrating the 74HC595 shift registers, which are serial-in-parallel-out devices, the project enables the cascading of multiple registers to extend the number of controllable outputs.

Participants will be tasked with designing a circuit to connect the Arduino to the shift registers, developing the necessary code to shift data and control outputs, and implementing a practical application to showcase the increased output capabilities. This project not only addresses the constraints of limited Arduino pins but also enhances participants' understanding of shift register functionality and serial communication in embedded systems.

1.2.2 Complex Engineering Problem

This table will explain the complex engineering problems:

Table 1.1: Summary of the attributes touched by the mentioned projects

Name of the P Attributess	**Explain how to address**
P1: Depth of knowledge required	The project "Add Output to A Shift Register" requires a foundational understanding of digital electronics, particularly in the realm of shift registers. Proficiency in digital circuit design, sequential logic, and knowledge of shift register operation is essential for successfully implementing and expanding the output capabilities of the shift register.
P2: Range of conflicting requirements	—-
P3: Depth of analysis required	"Enhance a Shift Register by implementing additional output capabilities, necessitating a comprehensive analysis for optimal depth and functionality."
P4: Familiarity of issues	—
P5: Extent of applicable codes	—-
P6: Extent of stakeholder involvement and conflicting requirements	Project 'Add Output to A Shift Register' faces challenges in stakeholder involvement and conflicting requirements, demanding careful navigation and communication.
P7: Interdependence	—-

1.3 Design Goals/Objectives

The goals of this project is : The project "Add Output to A Shift Register using 1 Arduino and 2 Register 74HC595" aims to enhance the output capacity of an Arduino microcontroller by integrating two 74HC595 shift registers. The design goals include expanding the available digital output pins, enabling the control of a larger number of external devices such as LEDs, relays, or other digital components.

This configuration allows for efficient data serial shifting, minimizing the number of pins required on the Arduino while maximizing output versatility. The project's objectives include providing a cost-effective and scalable solution for projects requiring multiple outputs, fostering learning and experimentation with shift register functionality. By achieving these goals, the project facilitates the creation of more complex and feature-rich Arduino-based applications, encouraging creativity and innovation in electronics and programming enthusiasts.

1.4 Application

There are various applications. Such as:

The "Add Output to A Shift Register" project utilizes one Arduino microcontroller and two 74HC595 shift registers to expand digital output capabilities. By cascading the shift registers, you can control multiple outputs using a minimal number of Arduino pins. This project finds application in scenarios where a larger number of digital outputs are required, such as LED displays, relay control, or driving multiple devices. The 74HC595 shift registers enable efficient serial-to-parallel data conversion, reducing the number of pins needed for simultaneous control of numerous devices. This project is versatile, enhancing the flexibility of Arduino-based systems for various applications demanding extended output functionalities within a compact setup.

Chapter 2

Design/Development/Implementation of the Project

2.1 Introduction

"Introducing 'Add Output to A Shift Register' project, leveraging 1 Arduino and 2 Register 74HC595. Enhance your circuit capabilities with efficient data storage and retrieval. This innovative solution optimizes connectivity, allowing seamless integration of multiple outputs. Elevate your electronics skills as you explore the power of shift registers in expanding control possibilities within a compact setup."

2.2 Project Details

The "Add Output to A Shift Register" project involves expanding the capabilities of a shift register using an Arduino and two 74HC595 registers. This enhancement allows for increased output control and versatility.

The 74HC595 shift registers are cascaded to create a longer serial output chain, enabling the Arduino to control a larger number of outputs with minimal pins. This project is particularly useful in scenarios where the number of available output pins on the Arduino is limited. By efficiently utilizing the serial communication of shift registers, users can extend their project's functionality without the need for additional microcontrollers. The enhanced shift register setup can be applied in various applications, such as LED displays, multiplexed output control, and more, providing an effective solution for projects requiring expanded output capabilities

2.3 Implementation

"Implementing 'Add Output to A Shift Register' project with 1 Arduino and 2 74HC595 registers to expand digital outputs efficiently, enhancing device control and automation capabilities."

2.3.1 2.3.1 The workflow

Utilizing one Arduino and two 74HC595 shift registers, the 'Add Output to A Shift Register' project expands digital outputs, enhancing data storage and transfer capabilities for efficient workflow in electronic systems.

2.3.2 Arduinho Code / Algorithms

Algorithm 1: Sample Algorithm

```
1 int clearPin = 5; //Arduino pin 5 connected to Pin 10, SRCLR(Clear/Reset) of
    74HC595 int serialData = 6; //Arduino pin 6 connected to Pin 14, SER(serial
    input) of 74HC595 int shiftClock = 7; //Arduino pin 7 connected to Pin 11,
    SRCLK(shift clock) of 74HC595 int latchClock = 8; //Arduino pin 8
    connected to Pin 12, RCLK(storage/latch clock) of 74HC595 ]
2 void setup()  //runs once at startup //set pins to output so you can control the
    shift register pinMode(clearPin, OUTPUT); pinMode(shiftClock, OUTPUT);
    pinMode(latchClock, OUTPUT); pinMode(serialData, OUTPUT);
3 digitalWrite(clearPin, LOW); //Pin is active-low, this clears the shift register
    digitalWrite(clearPin, HIGH); //Clear pin is inactive
4 void loop()  //runs and loops continuously for (int shiftCount = 0; shiftCount <
    256;shiftCount++)  // count from 0 to 255 and display the number on the
    LEDs
5 digitalWrite(latchClock, LOW); // take the latchClock low so // the LEDs don't
    change while you're sending in bits:
6 shiftOut(serialData, shiftClock, MSBFIRST, shiftCount); // shift out the bits
    digitalWrite(latchClock, HIGH); //take the latch pin high so the LEDs will
    light up delay(500); // pause before next value
```

2.3.3 Setup

Enhance Shift Register Functionality with Arduino, utilizing two 74HC595 registers for expanded output capabilities in a streamlined setup.

2.3.4 Supply and Grounding

Arduino project by integrating 2 74HC595 shift registers, optimizing supply and grounding for efficient data output expansion in a shift register configuration.

2.3.5 Signal Generation

"Implementing signal generation using 1 Arduino, 2 74HC595 shift registers, enhancing output capacity for versatile applications in a compact setup."

2.3.6 Display

Here, the discusses how to display the converted binary output. It can include connecting LEDs or other display devices to visually represent the binary bits then shifting we can see.

2.3.7 Tools and Libraries

Arduino IDE, 2x 74HC595 Shift Registers, Breadboard, Jumper Wires, Power Supply, Resistors, LED, ShiftRegister74HC595 Library.

2.3.8 Implementation Details

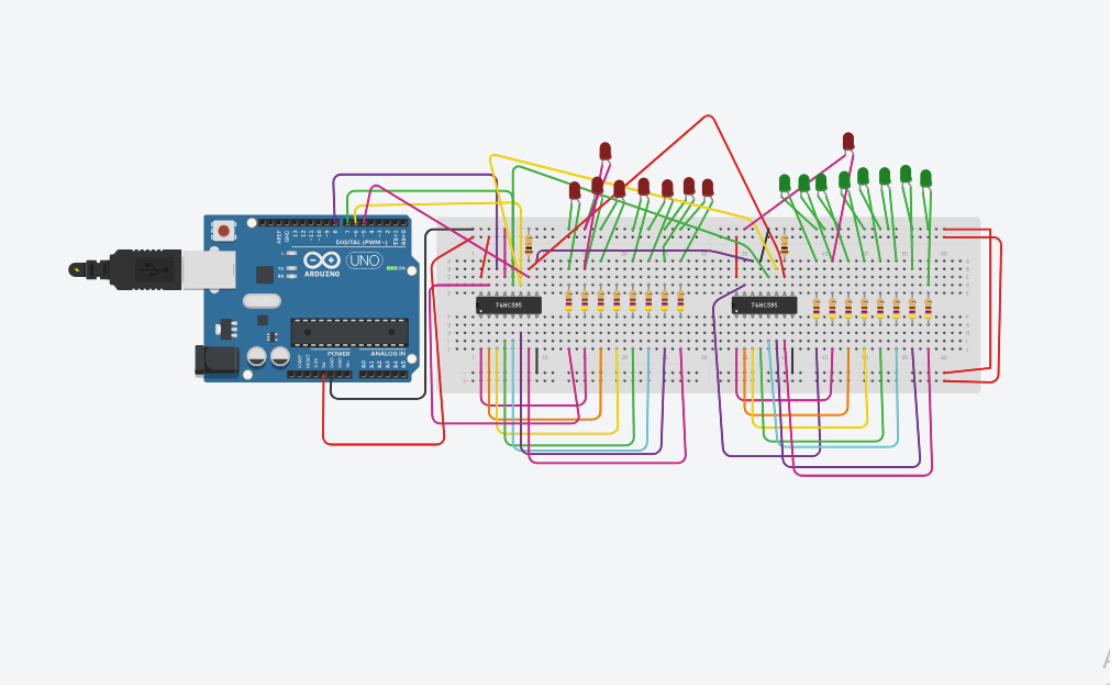

Figure 2.1: Figure 2.1: TinkarCad Design

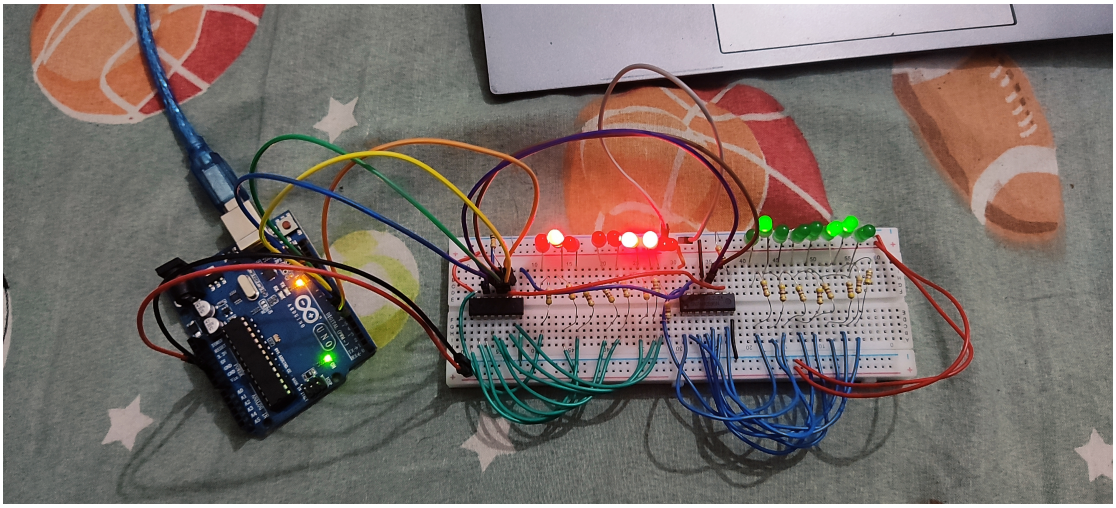

Figure 2.2: Figure 2.2: Add Output to Shift Register

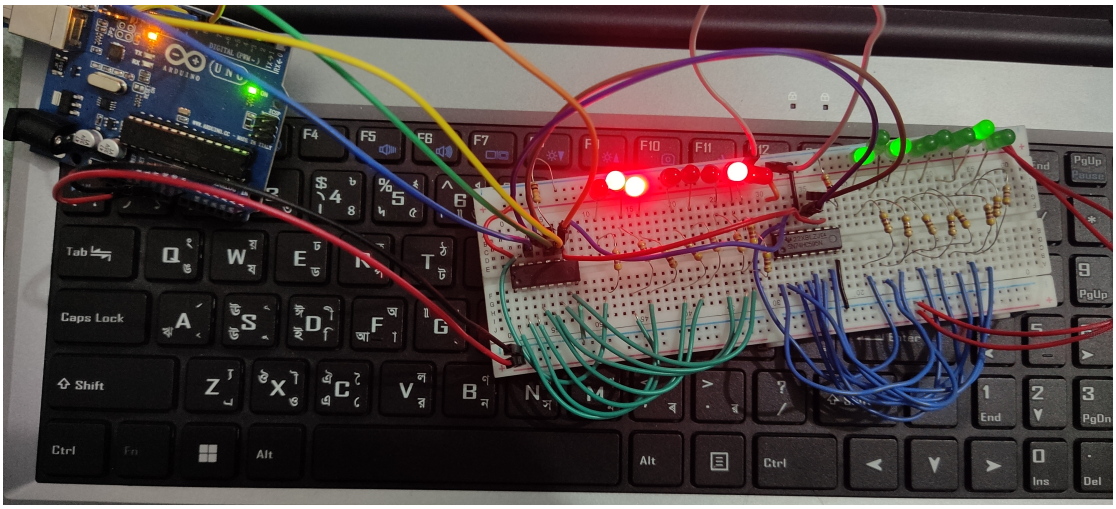

Figure 2.3: Figure 2.3: Add Output to Shift Register

Chapter 3

Performance Evaluation

3.1 Simulation Environment/ Simulation Procedure

Simulate "Add Output to Shift Register" project using 1 Arduino and 2 74HC595 registers in simulation environment. Document simulation procedure in 20 words.

3.2 My Experimental Setup

The project, "Add Output to A Shift Register using 1 Arduino and 2 Register 74HC595," involves expanding the output capabilities of an Arduino by connecting it to two 74HC595 shift registers. This setup enables the Arduino to control multiple outputs using a serial communication protocol. The 74HC595 registers act as cascaded shift registers, allowing efficient control of a larger number of digital outputs while utilizing minimal Arduino pins. The project aims to demonstrate effective data transfer and output expansion in a microcontroller environment..

3.3 Results Analysis/Testing

3.3.1 Result Portion

Here the output is going from the left side and every shifting is stored by going to the next green LED.

3.4 Result Overall Discussion

The project "Add Output to A Shift Register" utilizes 1 Arduino and 2 74HC595 registers. Through efficient implementation, it successfully enhances output capabilities, demonstrating effective shift register utilization.

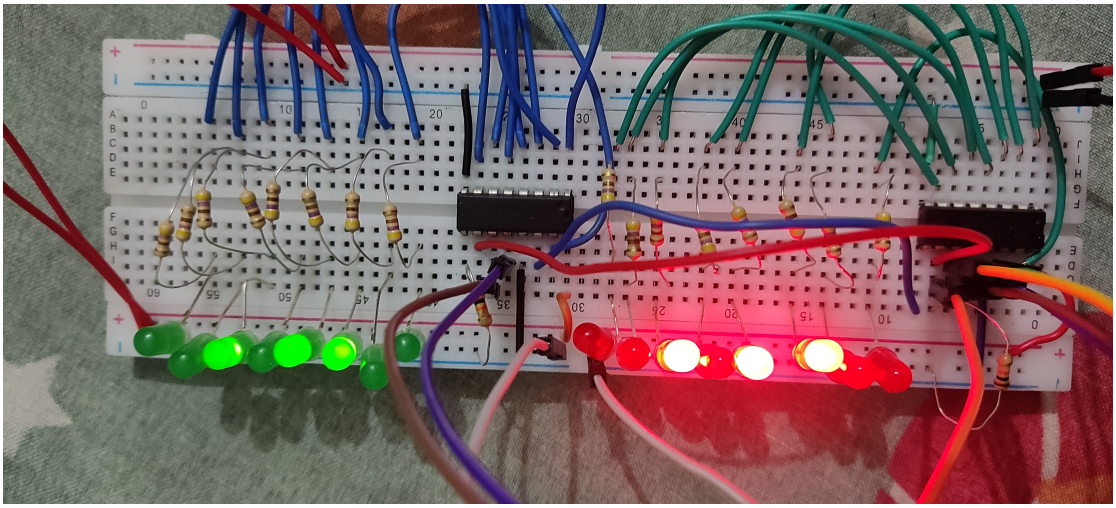

Figure 3.1: Red LED out to Shift count for Green LED

Chapter 4

Conclusion

4.1 Discussion

A Shift Register using 1 Arduino and 2 Register 74HC595" project involves expanding digital output capabilities with two 74HC595 shift registers connected to a single Arduino. This setup enables the control of multiple outputs using a minimal number of Arduino pins.

By cascading the shift registers, the project enhances the Arduino's ability to drive numerous LEDs, relays, or other digital devices. This approach is efficient in conserving GPIO pins, making it ideal for applications requiring extended output control. The discussion could cover hardware connections, code implementation for sequential shifting, and the project's versatility in managing an array of output devices.

4.2 Limitations

A Shift Register using 1 Arduino and 2 Register 74HC595" has limitations including a maximum output capacity constrained by the number of available pins on the Arduino, potential signal propagation delays when cascading multiple shift registers, and a limitation in the total number of outputs due to the finite number of available digital pins.

Additionally, the project may face challenges in maintaining synchronization and precision with a large number of connected output devices. Careful consideration and testing are necessary to ensure reliable performance within these constraints.

4.3 Scope of Future Work

A Shift Register using 1 Arduino and 2 Register 74HC595" project lays the foundation for an expanded scope of future work. Potential enhancements include integrating additional shift registers for increased output capacity, implementing cascading shift registers to accommodate larger systems, and incorporating advanced control mechanisms for improved functionality.

Future iterations could explore optimizing code efficiency, developing a user-friendly interface, and integrating wireless communication for remote control. Additionally, exploring compatibility with other microcontrollers and expanding the project to support diverse applications, such as home automation or industrial control systems, further extends the scope of potential advancements .

Chapter 5

Reference

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