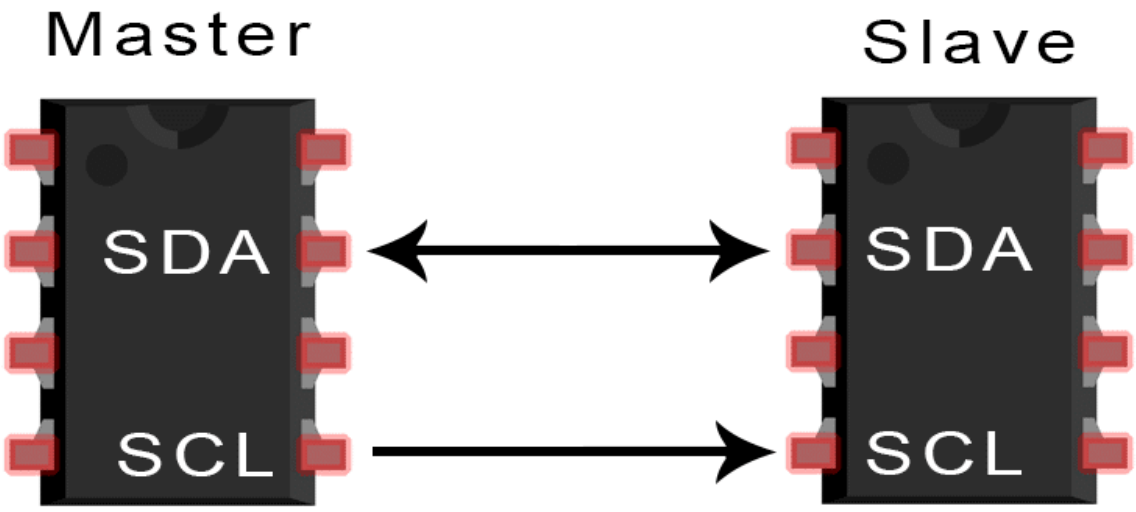
CECS 447 Fall 2023
Project 4: I2C Bus Communication



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11/27/2023

Use I2C bus communication to configure and retrieve data

Introduction:

In this project, we utilized I2C bus communication to set up and obtain information from separate external elements. This allows us to recognize colors, control the position of a servo motor, and showcase the identified color and angle. Both the servo motor and the LCD display are optional which we opted out to not do. The main goal of this project is to develop a hands-on comprehension of I2C bus communication, an extensively employed serial communication protocol across diverse industries, thereby making it an essential skill to acquire.

Operation:

In order for the system to work, the .c and .h files would have to be downloaded. Once all the files are downloaded, run the files on Keil V5 with the board connected to the color sensor; TCS34725. For this demo, you will need:

- LaunchPad
- Jumper wires
- Tera Term
- TCS34725 RGB color sensor
- Breadboard

Lab Demo Link:
Demo Link

Theory:

This project will consist of two parts: the initial phase involves creating and implementing tests for each hardware component. In the second phase, we will be conducting a comprehensive system test. Below are the peripherals for this project:

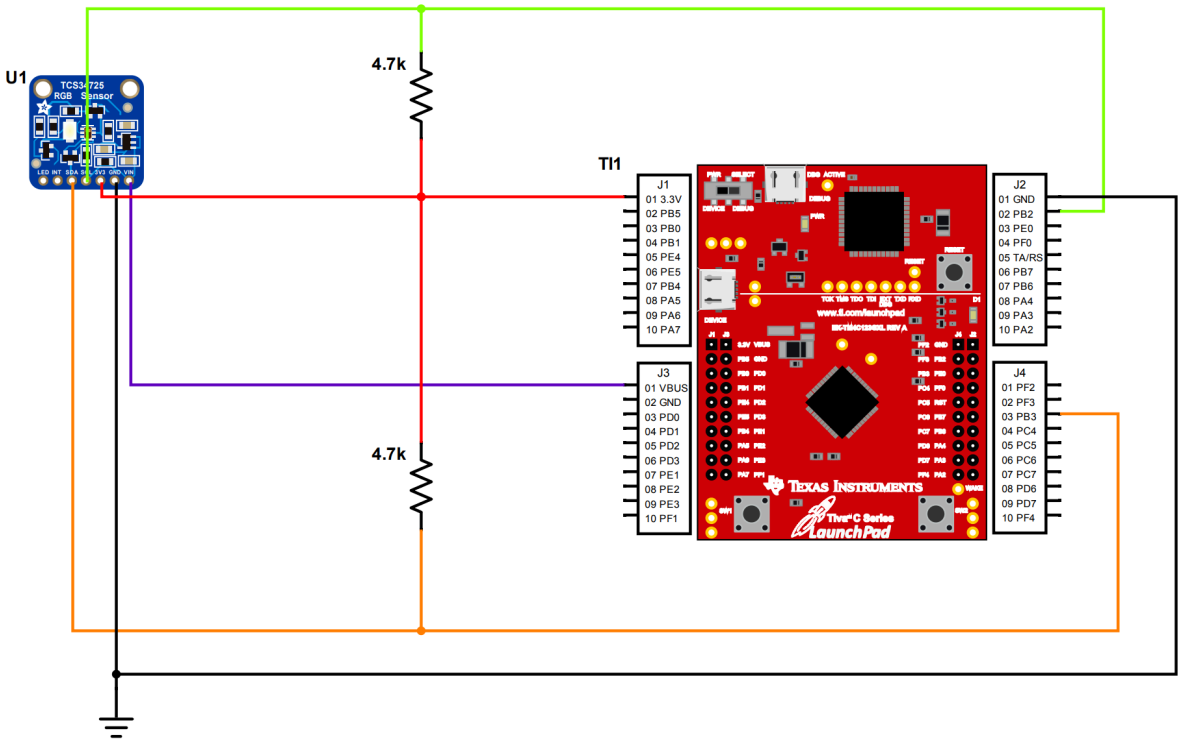
1. UART0 for microcontroller to PC serial terminal communication.
2. I2C0 at Standard-Mode speed
3. Hardware PWM M0PWM0
4. WTIMER0 for delay functions

In this project, it is necessary for us to fill in macros and meet specified conditions. Using the datasheets provided to us, we were able to replace the macros labeled "DUMMY_FILL" and replace them with appropriate values.

Port table	**Connection**	**Description**
LED	No connect	
INT	No connect	Interrupt- open drain
SDA	PB3	I2C serial data I/O terminal - serial data I/O for I2C
SCL	PB2	I2C serial clock terminal - clock signal for I2C serial data
3V3	Positive Voltage	Voltage supply

GND	Ground	Power supply ground
VIN	VBUS	Voltage supply

Hardware Design:



Schematic of hardware design

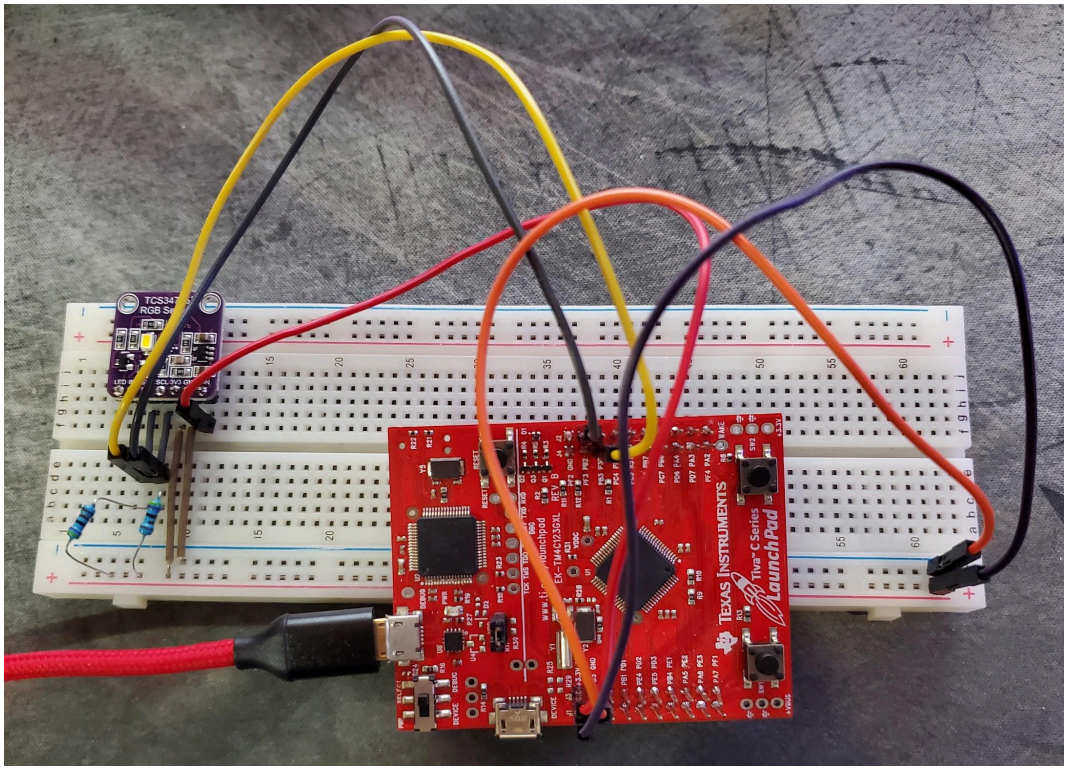


Photo of hardware

Software Design:

For the first part of the process, we had to modify UART and delay. Modifying the UART will make it so Tera Term will be able to print functions using a baud rate of 57600. In this project, we had to set the delay to 2.4 ms and a red LED was used in order to test it out. After UART and delay was implemented, using the data sheets again, we made sure to replace the DUMMY_FILL portion with the proper register values and initialization. When flashing the program onto the board, the white LED on the TCS34727 will be white. This LED will help read the RGB value of the object in front of the sensor and display the RGB value on Tera Term.

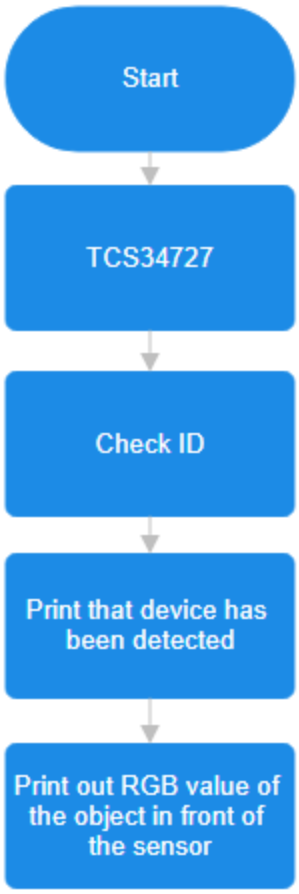


Diagram of design

Conclusion:

We were able to create an I2C bus communication to configure and retrieve data from the TCS34727 RGB color sensor. This type of communication protocol is widely used in various industries. There wasn't really a big challenge to this project but the most time consuming part of this project was looking through the TCS34727 datasheets and lecture slides to find the right registers. We did have a single issue where our value when reading to Tera Term only displayed a single color always at 255 depending on what color was most dominant in the sampled color. This was resolved once we typecast the values to float. If we had more time on this project overall, we would've liked to implement the 16x2 LCD display to display the color of the RGB value instead of using Tera Term.