EEC 172 Lab 3 report

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Department of Electrical and Computer Engineering
EEC 172 Spring 2023

Team Member 1: Hualong Yu

Team Member 2: Zhongyu. Xu.

Section Number/TA:

Demonstrate IR decoding:		
Date	Signature	Comments
5,10,23	[illegible]	Done one day Late

Demonstrate Texting:		
Date	Signature	Comments
5/12	[illegible]	1 lab period late. System fully functional.

Implementati	/70	Report	/30	Total
Functionality	/55	Thoroughness	/10	
Robustness	/10	Clarity	/10	
Presentation	/5	Presentation	/5	
		Code Clarity\Commentary	/5	

Introduction:
In this lab, students will gain practical experience with infrared (IR) receiver modules. They will utilize a provided TV remote to transmit signals, and configure the CC3200 board to receive and interpret these signals. A crucial part of this lab involves using interrupts to discern whether the rising edge or falling edge should be used. We will then decode the received information to ascertain the button pressed on the remote. This hands-on experiment serves as a comprehensive introduction to the application of IR technology and signal interpretation, enhancing our understanding and skills in electronics and communications.

Equipment:

CC3200 LaunchPad
USB Micro-B plug to USB-A plug cable
Adafruit OLED Breakout Board
Saleae USB Logic Analyzer
Jumper wires
AT&T S10-S3 Remote Control
Vishay TSOP31336
100 ohm resistor
100 uF capacitor

Goal/Tasks:
In this lab, students commence by configuring their AT&T remote controllers following the guidelines provided in the lab manual. Each group is required to program their remote with the specified TV code. Subsequently, students construct the circuit and utilize a logic analyzer to capture and comprehend the signals transmitted from the remote. As evident in the screenshot, the signal commences with a low state for 9 ms, then transitions to a high state for 4.5 ms. This exercise helps students to recognize the signal pattern, paving the way for the next part of the lab.
After gaining a fundamental understanding of the received signals, students embark on the decoder program which leverages interrupts to identify the signal's falling edge. If a timer is set, the next rising edge interrupt will capture the elapsed time into a circular buffer. The final step involves connecting two CC3200 Launchpad boards via the asynchronous serial lines TX and RX of UART1, utilizing interrupts. Both OLED boards should be capable of simultaneous bi-directional message exchange. The lab also necessitates multi-tap texting, wherein the same button pressed repeatedly will display intermediate characters on the local OLED. This comprehensive lab thus offers hands-on experience in signal decoding, circuit building, and asynchronous communication.

Learning:
Through this lab, we've enhanced our understanding of interrupts, including their application in signal detection. Additionally, we've acquired knowledge on how to create a decoder program to translate raw information into usable data. An important aspect of this lab was understanding the mechanics of an Infrared (IR) remote, specifically how it transmits data and how the receiver

interprets these signals. Furthermore, we've explored the programming aspects of the CC3200 board, particularly its capacity for enabling text-based communication. This comprehensive lab experience has broadened our understanding of these key concepts, providing valuable insights for future applications.

Software Architecture:

The software architecture for this embedded system is designed to provide an efficient and interactive solution for UART and SPI communication, as well as handling input from an IR remote control. The architecture is divided into several distinct functions, each responsible for a particular task, thereby promoting modularity and maintainability. The board initialization sets up the hardware, clock, and initializes the peripherals like SPI, UART, GPIO, and timers to ensure the system operates correctly. SPI and UART communication are established through dedicated functions where SPI is used to control an OLED display and UART is responsible for sending and receiving messages. Remote control processing captures button presses from an IR remote, decodes the signals, and manages the input accordingly, handling the composition, sending, and display of messages based on the received input. The software includes several interrupt handlers to manage events like GPIO interrupts for IR remote input and UART interrupts for message reception. Timer interrupts are also implemented to handle consecutive button presses. Finally, the architecture incorporates display functions for rendering text and graphics on the OLED display, allowing for messages, characters, and other visual elements to be displayed. This architecture ensures a clear separation of concerns, facilitating better organization, easier debugging, and future modifications. It effectively manages communication over UART and SPI, processes input from an IR remote, and provides visual feedback via an OLED display.

Challenge:

This lab has certainly been the most challenging we've encountered thus far, with numerous segments to the program requiring our attention and a multitude of criteria that must be met. Particularly, the second part of the lab, involving the interface with the OLED display, proved to be the most demanding. The complexity of the tasks presented in this lab has undoubtedly pushed our limits, enhancing our problem-solving skills and providing a rich learning experience.

Contribution Breakdown:

We work the entire sections of this lab together.

Conclusion:

In conclusion, this lab combined the knowledge acquired from previous labs, necessitating the use of the Saleae logic analyzer, an IR receiver module, and the CC3200 Launchpad. We successfully designed a program that utilized interrupt techniques to monitor the signals from the IR receiver module and decode the unique patterns associated with each button press on the IR remote control. This lab further challenged us to use the multi-tap text entry system for composing text messages, a process that demanded a detailed understanding of the system and careful timing. We also facilitated communication between two CC3200 LaunchPad boards through asynchronous serial (UART) communication, demonstrating the practical application of data transmission over IR signals. Overall, this lab solidified our understanding of IR remote controls, signal analysis, and UART communication, and has equipped us with important practical skills for future exploration in the field of electronics and communications.

Part1 screenshots:

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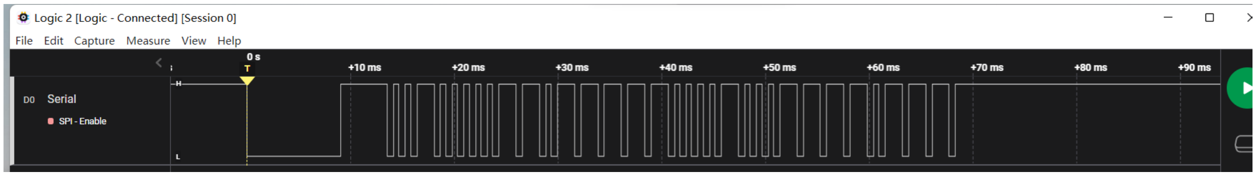

1

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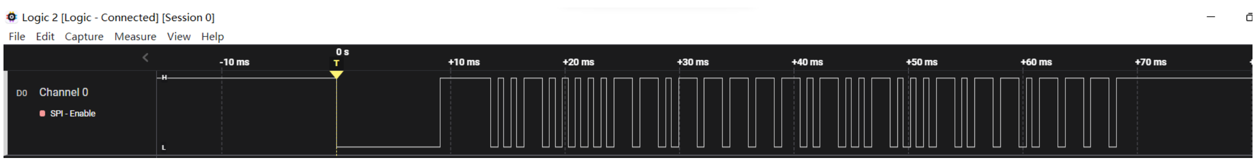

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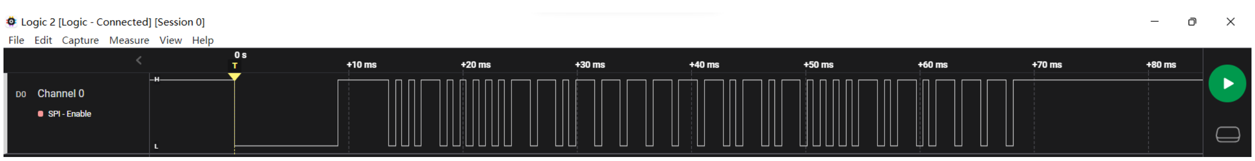

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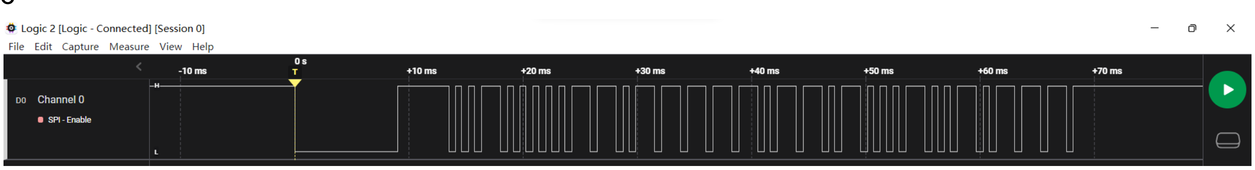

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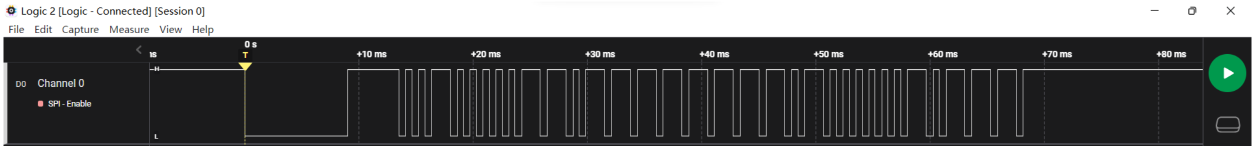
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File Edit Capture Measure View Help
0 s
+10 ms
+20 ms
+30 ms
+40 ms
+50 ms
+60 ms
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+80 ms
D0 Channel 0
SPI - Enable

8


Logic 2 [Logic - Connected] [Session 0]
File Edit Capture Measure View Help
0 s
+10 ms
+20 ms
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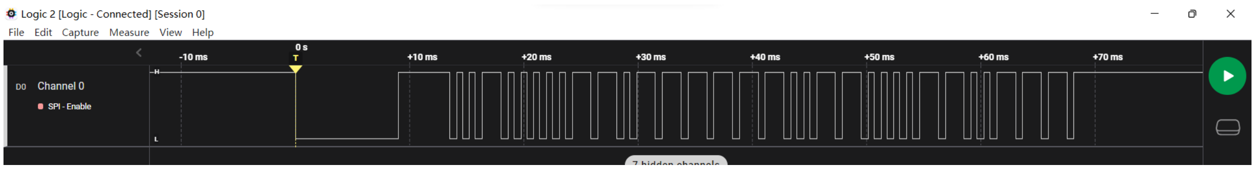
+80 ms
D0 Channel 0
SPI - Enable

9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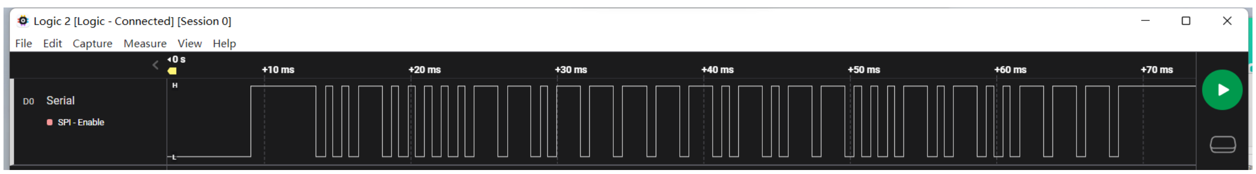
File Edit Capture Measure View Help
-10 ms
0 s
+10 ms
+20 ms
+30 ms
+40 ms
+50 ms
+60 ms
+70 ms
D0 Channel 0
SPI - Enable

Last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+20 ms
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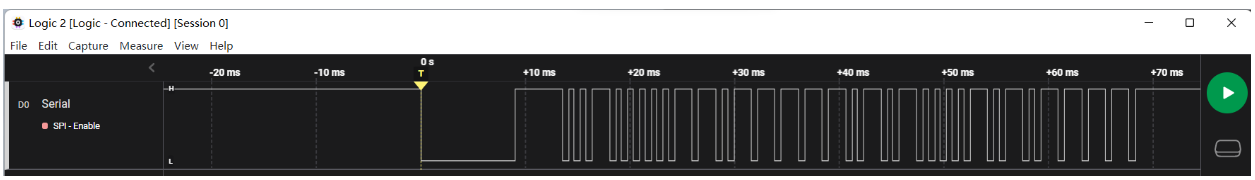
D0 Serial
SPI - Enable

Mute


Logic 2 [Logic - Connected] [Session 0]
File Edit Capture Measure View Help
-20 ms
-10 ms
0 s
+10 ms
+20 ms
+30 ms
+40 ms
+50 ms
+60 ms
+70 ms
D0 Serial
SPI - Enable