Lab 4 Report
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4/18/17

LAB 4: Serial Communication

Current Lab Goals:

- Initialize the UART peripheral for communication with the ultrasonic sensor.
- Initialize the SPI to sync the display on LCD. Write device drivers using the basic SPI Tx function to make sure the LCD displays the correct values.

Steps Taken To Accomplish the Task:

- The first task was to interface the range finder with the UART, which involved initializing the peripheral and enabling the UART RX interrupt.
- We wrote an interrupt service routine in main that will print out the correct distance when it arrives.
- Most of the UART initialization was finished in Lab 2, so the main work in this lab was to edit lcd.c based on fonts.c
- This is the part that involves interfacing with LCD using SPIs. We configured the GPIOs connected to SPI_MOSI, SPI_CS, and SPI_CLK as digital pins with alternate functions.
- LCD_CD and N_RST_LCD are configured as normal output pins in the ece315_lcdInit() function.
- spiTx() enables us to interface using the spi's from the library.
- Next we set the current lcd page in ece315_lcdSetpage(). We change the tx_data being sent to 1011XXXX where XXXX is the page address. Then using the spiTx() function we send the data based on this new page addresses.
- We set the column address in the next function. This is the ece315_lcdsetColumn(). We first change the tx_data being sent to 0000YYYY where YYYY is the least significant 4 bits of the column number. We send the address of this data using spiTx(). Then similarly, we change the tx_data being sent to 0001YYYY where YYYY corresponds to the most significant bit 4 bits of the column number.
- The next function we wrote is the ece315_lcdWriteData(). This involved sending the address of data being passed in as the address for tx_data.
- The lcdClear() function simply writes a 0 to all bits in the screen. We went through each column by using two for loops, one that goes through the pages and the next that goes through all the columns.
- lcdWriteChar() is the function that uses the bitmaps found in fonts.c. First, we got the hexadecimal value of the character passed in by subtracting 32 and multiplying with 20.

Next , since requires two pages to be written to, we have wrote to different for loops after initializing each for loop.

- Lastly, the lcdWriteString() will print out 10 characters and terminate when it encounters a null character. This is a recursive function and repetitive calls are made to WriteString based on when 10 characters have been printed out.

Problems faced and how they were solved:

- We had difficulty initializing our board. It had various characters (or dots) as the start screen. There was an issue with the configuration of the lcdInit based on GPIO used.
- We also did not include UART Handlers for GPIOF which made the motors drive only in the forward direction and did not let it to move in any other direction. We realized this error after entering in debug mode and reaching the spio handler reset.

Ready References:

- All the defines in lcd.h were updated based on the robot schematics.
- LCD_CLK_PIN=PD0
- LCD_CS_PIN=PD1
- LCD_MOSI_PIN= PD3
- LCD_CD_PIN= PD7
- LCD_CD_PIN= PD7

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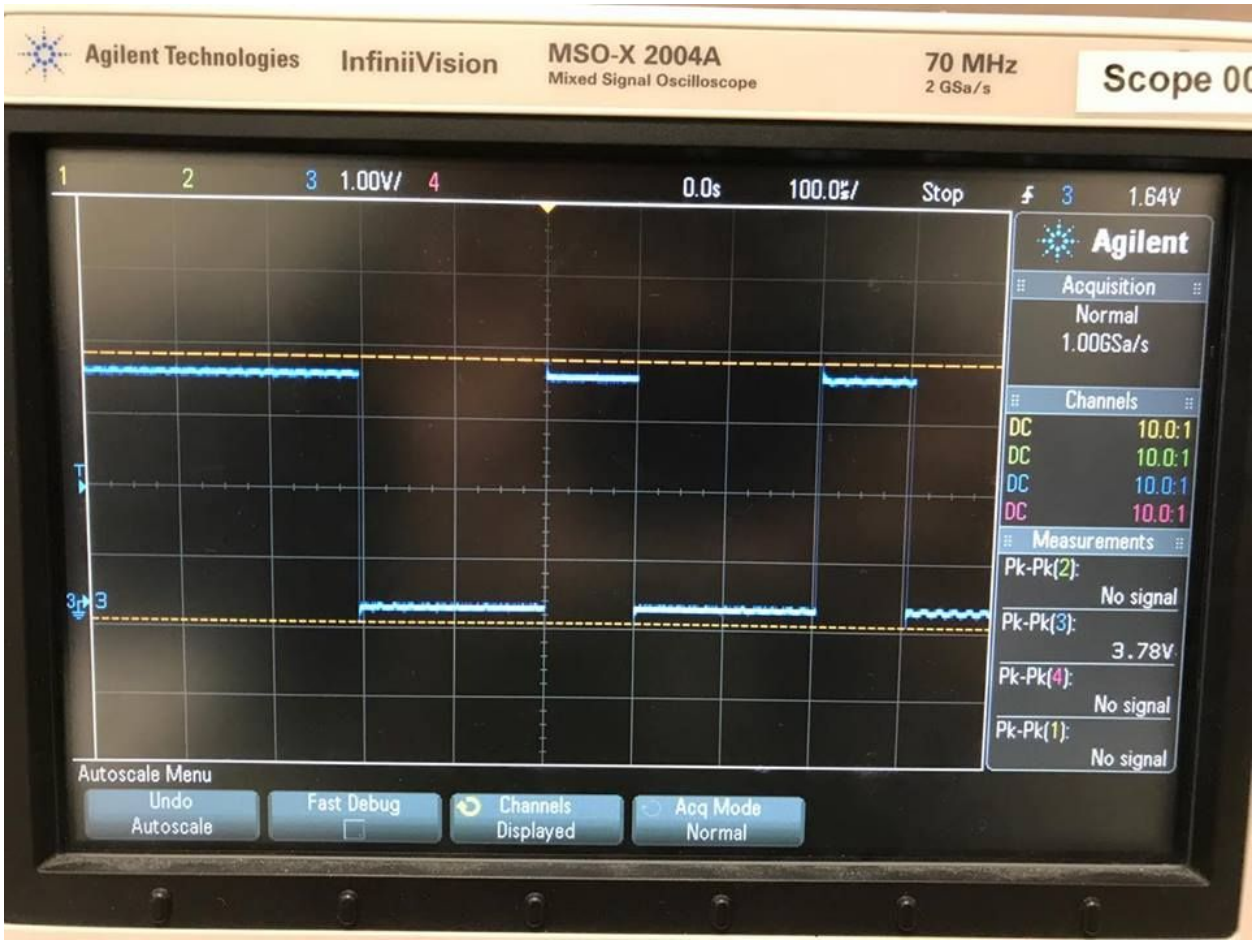

Description: UART Rx of the left sonar sensor: Oscilloscope Capture

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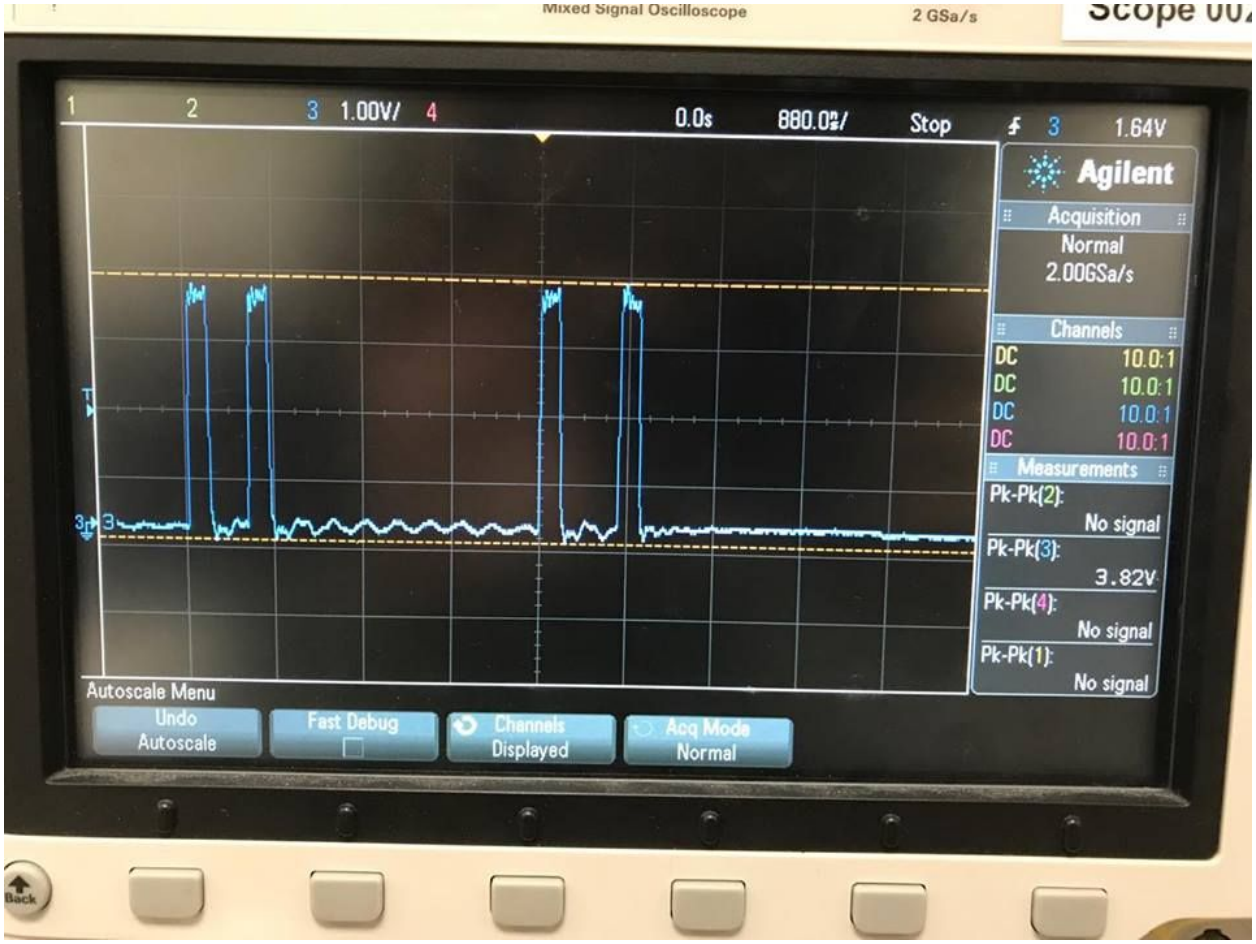

Description: MOSI capture

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Description: The top one is MOSI and the bottom one is SCK

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ECE315: Introductory Microprocessor Laboratory

1.5 LCD Work Sheet

Make sure that you examine page 6 of the data sheet to properly initialize the LCD before writing any data to the display.

Bringing the LCD Out of Reset

What logic value does N_RST_LCD need to be set to bring the LCD out of reset?

1

Entering Command Mode

What logic value does CD need to be set to in order to enter command mode?

0

What GPIO pin is connected to CD?

PD7

Setting the Active Page

What is the logic value of CD when you set the active page?

0

If you wanted to set the page address to page 0, what would be the packet(s) that you would send over the SPI interface?

0x B0

Setting Active Column

What is the logic value of CD when you set the active column?

0

If you wanted to set the column address to column 10, what would be the packet(s) that you would send over the SPI interface?

0x0A , 0x10

Writing Pixels to the LCD

What is the logic value of CD when you are writing data (pixels) to the LCD?

1

Write the code necessary to turn on all of the pixels for page 0, column 10. Assume that you have completed the functions `lcdSetPage` and `lcdSetColumn`.

```
lcdSetPage(0x00);
lcdSetColumn(0x10);
PD7 = 1;
tx_data = 0xAA;
```

SPI_Tx(LCD_Config.SPI_base, &tx_data, 1, &rx_data);

When testing your LCD code, verify that you can turn on all of the pixels for page 0, column 10 before trying to implement writing entire characters to the LCD.

Worksheet