LAB 4-1

COMMUNICATE WITH SERIAL PORT, EEPROM, RTC

OBJECTIVE:

- Understand and use UART, I2C, SPI peripherals.

- Understand how to communicate with RTC and EEPROM.

REFERENCES:

- Lab manual chapter 7, 9, 11

- Atmel-2505-Setup-and-Use-of-AVR-Timers_ApplicationNote_AVR130.pdf

EXPERIMENT 1:

a) Connect the TxD and RxD pins of UART0 to UART_TxD0 and UART_RxD0 signals on header J85 in the UART block.

b) Connect a USB-Serial cable to the experimentation kit.

c) Set up the Hercules program with a baud rate of 9600, 8-bit data, no parity, 1 stop bit, and no handshake.

d) Use sample programs from the experiment guide to write a program that initializes UART0 with the specified parameters, waits to receive one byte from UART0, and then sends it back to UART0.

e) Use Hercules to send a character to the kit and observe the received data to check the program's functionality. (Note: The CPU clock frequency on the kit is 8 MHz.)

EXPERIMENT 2:

a) Connect the SDA and SCL signals of AVR to the corresponding signals on the RTC module. Connect one port pin to the MFP signal. Connect a 16x2 LCD to one port of AVR.

b) Write a subprogram to initialize the RTC with the current time, configure the MFP signal to have a 1Hz frequency, and read the date, month, year, hour, minute, and second values from the RTC. Then, update these values on the LCD.

c) Compile the program and observe the LCD to verify its functionality.

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Time:10:42:12
Date:01/01/16
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EXPERIMENT 3:

a) Connect the MOSI and SCK signals from the SPI port of AVR to the SDI and CLK signals of the shift register. Connect two port pins to the nCLR and LATCH signals. Connect the output of the shift register to the Bar LED.

b) Connect the UART signals as in exercise 1.

c) Write a program that receives one value from UART and outputs it to the Bar LED using SPI.

EXPERIMENT 4:

a) Connect the MOSI, MISO, and SCK signals from the SPI port of AVR to the corresponding signals on header J80. Connect one port pin to the nCS signal.

b) Connect the UART signals as in exercise 1.

c) Connect one port to the Bar LED.

d) Write a program to count the number of characters received from UART and display them on the Bar LED. Every time a byte is received, increment the count and write it to EEPROM. When the microcontroller loses power and then regains it, read the count from EEPROM and use it as the starting value.

EXPERIMENT 5:

a) Connect the UART signals as in exercise 1.

b) Connect one port to the Bar LED.

c) Write a program to count the number of characters received from UART and display them on the Bar LED. Every time a byte is received, increment the count and write it to the AVR's internal EEPROM. When the microcontroller loses power and then regains it, read the count from the internal EEPROM and use it as the starting value.

LAB REPORT

Class group:

Group:
Subject:

EXPERIMENT 1:

1. Answer the following questions:

    a. With a clock frequency of 8 MHz, how much will the actual baud rate deviate from the desired 9600 baud?

    b. What is the purpose of the UDRE flag?

    c. Explain the difference between hardware UART and software UART (bit-banging UART).

    d. Which port pins correspond to the TxD0 and RxD0 pins of UART0?

    e. How many hardware UARTs does the Atmega324 have?

2. Provide the source code with comments.

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EXPERIMENT 2:

1. Answer the following questions:

    a. Which pins are the SCL and SDA pins on the AVR?

    b. Draw a diagram illustrating the connections in the experiment.

2. Provide the source code with comments.

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EXPERIMENT 3:

1. Answer the following questions:

    a. According to the datasheet of the 74HC595, what is the highest clock frequency it can accept?

    b. With a clock of 8 MHz, what is the maximum SPI speed for the Atmega328?

2. Provide the source code with comments.

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EXPERIMENT 4:

1. Answer the following questions:

    a. What is the EEPROM size of the 25AA1024?

b. According to the datasheet, what is the fastest clock frequency that can be provided to this EEPROM?

2. Provide the source code with comments.

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EXPERIMENT 5:

1. Answer the following questions:

    a. What is the EEPROM size of the Atmega324PA?

    b. List the differences between SRAM and EEPROM.

    c. List the differences between Flash and EEPROM.

2. Provide the source code with comments.

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