Experiment #12: Real Time Clock

ECE 367 – Microprocessor Design (Spring 2013)

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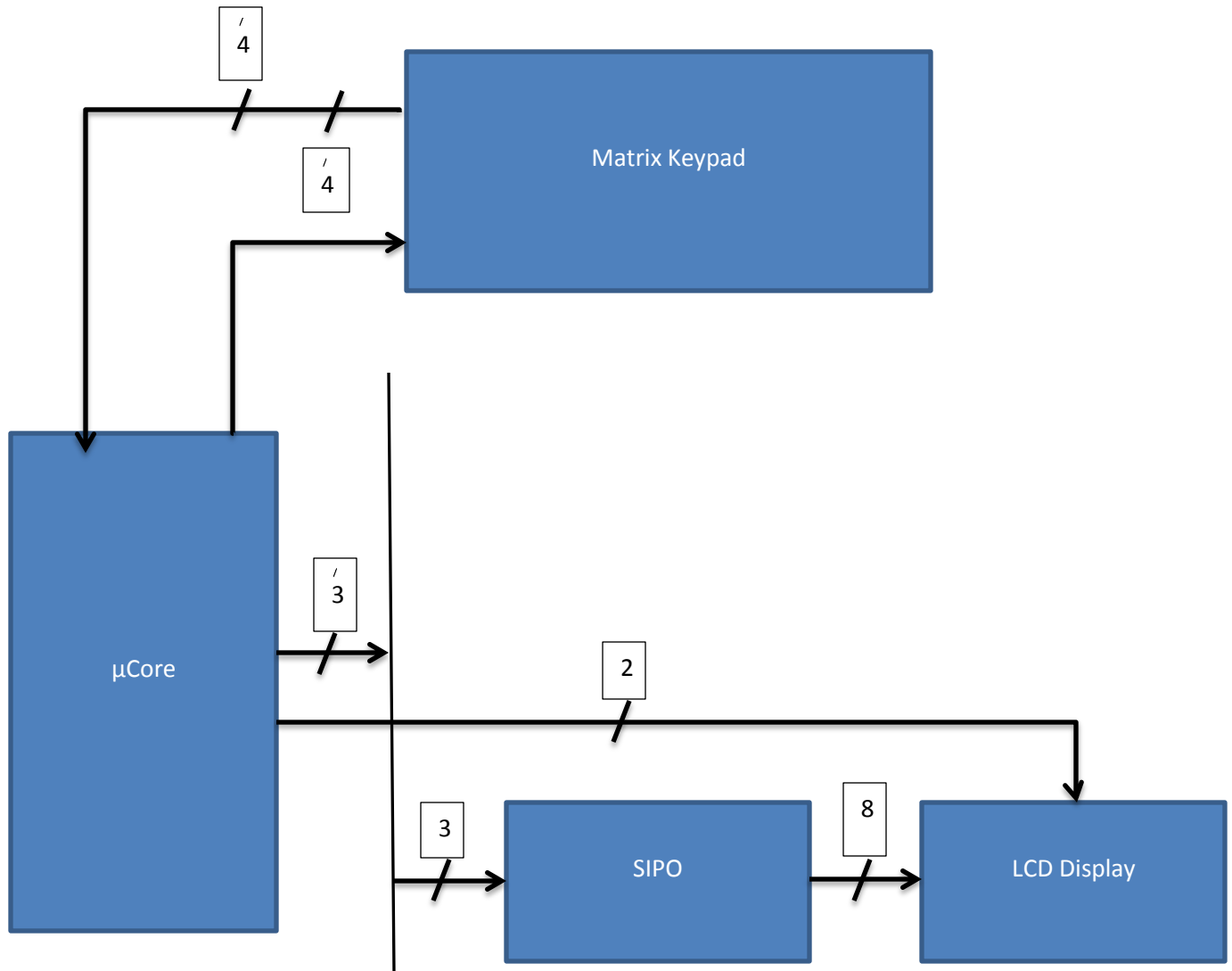MWF – 10:00AM – 11:50PM

T Lab: 8:00AM – 10:50AM

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I. Logic Diagram

II. Schematic Diagram
       I. See attached sheet following this page.

III. 9S12 Assembler Program

IV.   USER MANUAL
    I.   Start Up
        I.   To start this system, use the USB to miniUSB cable and connect to computer. If you have a USB-outlet adapter, power may be supplied this way as well.
        II.   Verify the system is in "Run" mode (the switch on the microcontroller board).
        III.   Press the reset button to begin (left-most black button).
    II.   Operation
        I.   After pressing the reset button, the system directions will be displayed on the screen.
        II.   The system will start up in "clock set" mode with the entire screen blinking and the clock blinking a "12:00."
        III.   Clock
            I.   To set the time:
                I.   Press and release the "A" key to place the system into "clock set" mode. Note: The system is automatically in "clock set" mode at start up/reset.
                II.   Simply press and release the "B" button to switch between hours and minutes.
                III.   Press the "C" button to increase the number until the desired value is reached.
                IV.   Press and release the "A" button to start the clock.
            II.   During clock run mode you can perform the following:
                I.   Press and release the "B" button to toggle between 12 and 24 hour clock time.
                II.   Press the "C" button to between normal and fast modes of clock operation.
        IV.   Stop-Watch
            I.   The stop watch can only be run after the clock has been set using the set time steps above.
            II.   Operation
                I.   Pressing and releasing the "F" key will start or stop the clock watch.
                II.   Pressing and releasing the "E" key will
                    I.   Stop and Reset the stop watch if it is currently running.
                    II.   Reset the stop watch if it is currently stopped.
        V.   The system can be restart/reinitialized at any time by simply pressing the reset button during operation.
    III.   Shut Down
        I.   To shut the system down, disconnect the power source (USB cable) from the breadboard.

V. Conclusion.
- I. How well does your project meet the specifications?
  - I. It meets project requirements as explained on the ECE 367 website for experiment #12.
- II. What were the most difficult issues in realizing the system?
  - I. Getting the interrupts to work correctly
  - II. Optimizing the delays for the LCD so that the stop watch worked correctly.
- III. Were you able to add extra features? If so, explain them.
  - I. I was able to add the extra credit stop watch feature listed in the experiment.
- IV. What would you have done differently if you were to do this project again?
  - I. I would have found a way to make the stop-watch more accurate. Due to some capacitive loading and long LCD delays the stop-watch is not as accurate as I had hoped it would be.
- V. What did you learn from working on this project?
  - I. How to implement interrupts using C code.
  - II. How to optimize timings for the LCD in C code.
  - III. A better understanding of direct translations from C to assembler.