National University of Singapore

Department of Electrical and Computer Engineering

CG2007 – Microprocessor Systems

AY2011/2012 Semester 2

Major Project 1: Memory and I/O Interfacing

1. Objectives

1) To construct a small microprocessor system using discrete hardware components on a PCB

2) To design an assembly program, which is to be burnt into an EEPROM in the microprocessor system, to achieve memory and I/O Interfacing applications

2. Components and Equipment Needed

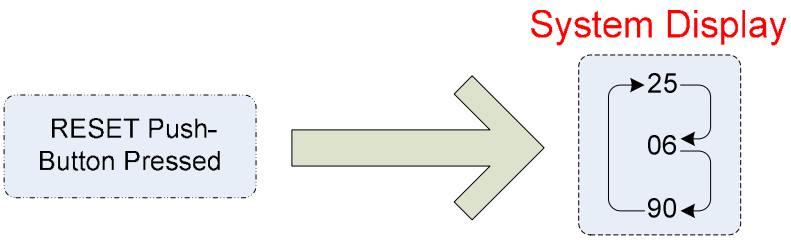
- ✓ All the tools, chips and hardware components distributed
- ✓ SuperPro500P EEPROM Programmer
- ✓ DC Power Supply

3. Project Requirements

In this project, you will design and implement a microprocessor system to display your birthday date from Port_A of 82'55 input-output interface. The system should consist of an 80C188 microprocessor, a 3-state transparent latch, an 8Kx8 EEPROM which owns your assembly program, an 8Kx8 RAM for memory interfacing, a peripheral input-output port chip 8255 for I/O interfacing, and other discrete components. The system should be powered by a +9V DC supply which is then regulated to +5V.

Task – Display Birthday Date

In this task, year, month and day need to be displayed **alternately**. Every display should have a period of around **1 second**. For example, if your birthday is 25th June, 1990 (25/06/90), then "25" should be displayed first for 1 second, followed by another second displaying "06", followed by "90" for the next second, then go back to "25" for the next second, so on and so forth. The system shall begin this operation after the "RESET" push button is pressed.



You may display your birthday date using **LEDs** that are directly connected to Port_A of 82'55. You will need all the 8 LEDs for the 2-number display, where 1 digit (0-9) is represented by 4 LEDs (4 bits). Alternatively, you can also make use of 2 pieces of 7-segment display components to complete this task. When using 7-segment display components, you will need to decode the numbers through 74'47 decoders for proper display.

4. Steps to complete the project

By now you should have completed soldering the component onto the PCB and tested its functionality. A general circuit schematic is also provided for your reference. Connections of data bus, address bus, as well as control bus for the peripheral devices are included in the schematic.

Design your assembly program to achieve the display purpose. A skeleton program is provided to help you initialize the EEPROM and RAM. You can use this skeleton program and fill in your code. Try to understand the code in skeleton on how the ROM and RAM are interfaced. The 8255 PPI device has not been initialized in the given skeleton program. You need to properly define the port addresses for proper I/O interfacing. Please refer to the 80C188 user manual.

Compile, Link, and covert your program to .BIN file. First, download the executable ASM86.EXE, LINK86.EXE, LOC86.EXE, OH86.EXE and HEXBIN2.EXE files from the workbin. Second, download RUN.BAT MS-DOS Batch file. This batch file can compile and link your code, and then convert it to .HEX file. Save all those files together with your own .ASM program file in the same folder (e.g. C:\EE2007). Open your MS-DOS window, and type the following instruction:

C:\EE2007>.*run project* (*assume "project.asm" is your program file name*)

If no error occurs, your program will be successfully converted into .HEX file. Then you need to convert it into .BIN file so that it can be burnt in to the EEPROM. Type the following instructions:

C:\EE2007>.*HEXBIN2*

Input HEX file name: *project.hex*
Output BIN file name[project.BIN]: *project.bin* ***(or just "enter")***
HEX file format
<I>ntel /<M>otorola [I] : *I*
Input CODE segment address [0000]: *FE000* ***(note that this number is fixed)***

Wait…
… …
Convert Complete

After you have the "project.BIN" file, you can burn it into the EEPROM, via the SuperPro500P programmer. A manual on how to use the programmer is also provided in the workbin.

Test your circuit to see its functionality. **Debugging such circuit may need plenty of time! You may approach your Graduate Assistant for difficulties in debugging. Please plan your schedule well so that you do not struggle till the last minute.**

5. Project Demonstration and Submission of report

Demonstration Date: Week 10 (starts from 19th March).
You need to demonstrate your system to your respective GA during the lab session in Week 10. In addition to verifying the functionality of your system, your GA will ask you several questions to test your understanding about the system.

Report Submission Date: Week 13 (starts from 9th April).
You will submit your report (hard copy) for major project 1 and 2 together (**ONE report in total**). Submit your report to your respective GA at the end of your demonstration for major project 2. (Details for major project 2 will be published later).

Note: Copying should be strictly avoided. If any circuit/report is found copied, then the candidate must face the disciplinary action from the Department/University.

The End