CpE5160 Fall 2019

Goals of the Class

- Build, Program and Debug an embedded system
  - Organize source code in a large project
- Introduce Communication Peripheral Devices and Interfacing
  - Read datasheets for peripheral devices
- State Machine Programming

Lecture Topics:

AT89C51RC2 overview	(2 Lectures)
Embedded C programming	(4 Lectures)
UART Interface	(3 Lectures)
General Purpose I/O and LCD Interface	(3 Lectures)
SPI Interface	(2 Lectures)
SD Card	(4 Lectures)
I2C Interface & MP3 Decoder initialization	(4 Lectures)
FAT File System	(8 Lectures)
State Machine Programming	(10 Lectures)

Contact Information:

Roger Younger
Office – 209 EECH
Lab – 210 EECH
Phone: 341-4885

Office Hours:

Monday, Wednesday & Friday 1:30pm to 5:00pm

Grading Policy:

Lab Experiments	30%
Homework, Attendance & Quizzes	20%
Mid-Term & Final Exam	50%

Attendance may be taken by signup sheet or by a quiz

Late Policy:

The experiments can be very time consuming and it is recommended that you do not wait until the day before the due date before starting. This class can take a lot of lab time and if you fall behind, it may be difficult to get caught up. Since this class is mainly seniors and graduate students, I know that you have important events such as interviews (hopefully) and projects. However, I will expect you to be able to manage your time. Late work will be accepted for up to three days late with a 10% penalty for each day late. No credit will be given for work more than three days late. If the policy is not abused by a student, an occasional grace period of a few days (no penalty) may be given for due dates with an acceptable reason. A test or assignment in another class is **not** an acceptable excuse for requesting a grace period.

Exams:
Mid-Term Exam: Wednesday, October 9, 11:00am to 11:50am
Final Exam: Thursday, December 12, 10:00am to noon
Anyone caught copying answers on an exam will receive a 0 for that exam.

Lab work:
The lab in room 210 is open from 9:00 am to 5:00 pm. Students who are working when I leave will be allowed to remain in the lab. The door should remain closed and locked after hours. If the student wishes to obtain a key to the lab for the semester, please send me an email. Keys can be picked up from Carol Lay when they are ready. Keys require a $10 deposit. Keys typically take two weeks to be made. Card access to the lab will hopefully be installed sometime this semester.

Lab Equipment:
Each station in the lab has a mixed signal oscilloscope, DMM and power supply. The cables can be found at the back of the room on the side of a couple of cabinets. Please return the cables to the proper rack when finished. (Note: The oscilloscope cables lock into place and a button must be pressed to release the cable.) If there is interest, I will have some training sessions for using the oscilloscope or I can answer questions one on one. There are also two logic analyzers that can also be used.

Group Work:
Each student is required to turn in homework assignments on an individual basis. Students may work on their own or with a partner to complete the experiments. I discourage students from working in groups of three or more, but I will allow it.

Experiments:
About five or six experiments are planned. The experiments are sections of a semester long project. The experiments may be combined or broken down into smaller parts as needed. The following list is the planned experiment titles, but this list is subject to change.

Experiment #1 – UART & LCD Module Interface
Experiment #2 – SPI Interface & SD Card Initialization
Experiment #3 – I2C Interface & MP3 Decoder
Experiment #4 – FAT File System
Experiment #5 – State Machine Programming
Experiment #6 – MP3 Player

Demonstrations of some of the experiments will be required.

Books:
The book for this class is Embedded C by Michael J. Pont, Addison-Wesley Professional, 2002. The book from CpE213, The 8051 Microcontroller & Embedded Systems by Muhammad Ali Mazidi, Prentice Hall, 2005, will be a good reference book. Another book on the topic of embedded microcontrollers is: Microcontrollers and Microcomputers: Principles of Software and Hardware Engineering by Fredrick M. Cady, Oxford University Press, 2010. It discusses microcontrollers in general and gives a good discussion of peripheral devices found in most microcontrollers. A lot of the topics will require datasheets and application notes from semiconductor manufacturers. These will be in pdf format and posted on Canvas.

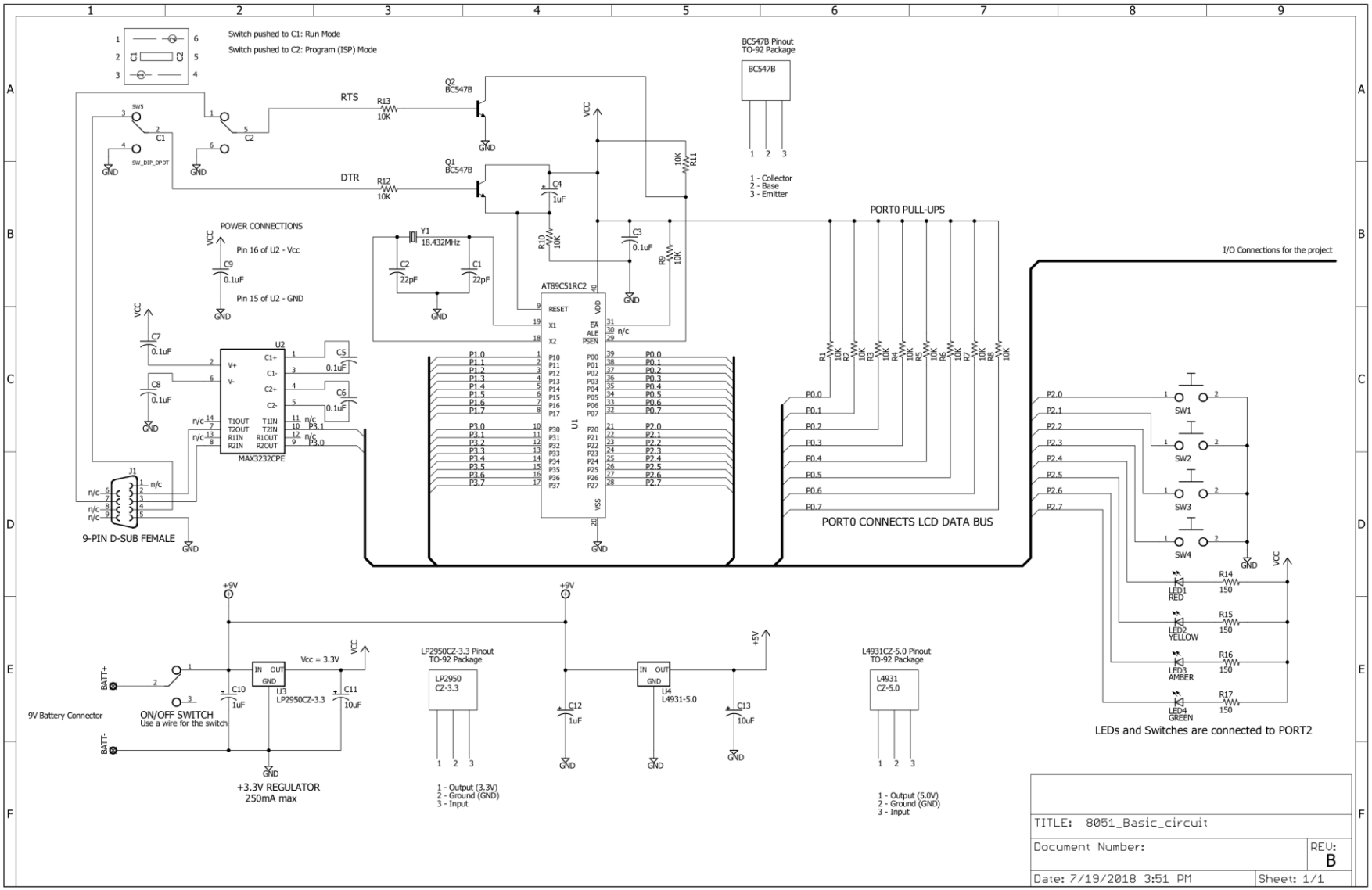
Canvas:
I will put datasheets, application notes and other documentation along with any Power Point lectures on Canvas for students to view. Some of the assignments will be placed on Canvas. I will also put some source code and project files that you need to work with the microprocessor experiments as part of the assignments placed on Canvas. I also reserve the right to place quizzes on Canvas to test your comprehension on topics discussed in the lectures. I will place grades in the Canvas grading center for students to view.

Office Hours:
My office hours are from 1:30pm to 5:00pm MWF or by appointment. If my door is open, I am available. If it is closed, I am not available and please do not disturb.

Project Parts:
The parts for this project will be supplied in a kit. The kit requires a deposit of $70. If the kit is returned undamaged at the end of the semester, then the deposit will be returned. The student may keep the kit at the end of the semester instead of having the deposit returned. If a student does not have a large breadboard to build the project on, then some are available from me with a deposit of $30 or for purchase through HKN. A partial parts list with approximate costs is given below:

Device	Quantity	Cost	Total
3.3V and 5V regulators	2	0.50	1.00
IC, MAX3232	1	2.50	2.50
IC, AT89C51RC2	1	7.00	7.00
Crystal, 18.432MHz	1	0.50	0.50
SD Card and socket	1	19.00	19.00
IC, STA013	1	16.00	16.00
Crystal, 14.7456MHz	1	0.50	0.50
IC, CS4334	1	6.00	6.00
Conn., 3.5mm Stereo Jack	1	1.50	1.50
LCD Module	1	7.00	7.00
Serial Cable	1	5.00	5.00
Serial Adapter	1	2.00	2.00
Misc Parts			2.00
		Total	70.00

There are several resistors, capacitors and other parts that are not listed, but are included in the kit.


Switch pushed to C1: Run Mode
Switch pushed to C2: Program (ISP) Mode
RTS
DTR
Q2 BC547B
Q1 BC547B
BC547B Pinout TO-92 Package
1 - Collector
2 - Base
3 - Emitter
POWER CONNECTIONS
Pin 16 of U2 - Vcc
Pin 15 of U2 - GND
Y1 18.432MHz
AT89C51RC2
MAX3232CPE
9-PIN D-SUB FEMALE
PORT0 PULL-UPS
PORT0 CONNECTS LCD DATA BUS
I/O Connections for the project
LEDs and Switches are connected to PORT2
9V Battery Connector
ON/OFF SWITCH
Use a wire for the switch
+3.3V REGULATOR
250mA max
LP2950CZ-3.3 Pinout TO-92 Package
1 - Output (3.3V)
2 - Ground (GND)
3 - Input
L4931CZ-5.0 Pinout TO-92 Package
1 - Output (5.0V)
2 - Ground (GND)
3 - Input
TITLE: 8051_Basic_circuit
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