

CpE213 – Semester Project

Fall semester, 2000.

Your semester project will be a project of your own choosing. The only restrictions will be that it must use an 8051 microcontroller and some special external hardware in some way. It should generally contain both inputs and outputs but does not have to. Points will be given for creativity and the difficulty of the project you complete (assuming you get it done ;-).

TEAMS: Projects will be done in teams of my choosing. Teams will be formed so that each team has at least one member from CpE214 and so that each team has approximately the same average grade on our first test.

DELIVERABLES AND DEADLINES: Points are given for the following deliverables. In general, if it is late it is worthless.

- **Project idea** (5 points, due 10/24). Approximately ½ page description of the project you would like to do, to be turned in in class. I will look it over and make recommendations
- **Parts list** (5 points, due 11/2). List any parts your project will need, along with price and source. Your final project part list should match this one fairly closely, though some revision is allowed.
- **Project demonstration** (20 points, due week of 11/20). Prove to me that your project works. I'll post an appointment sheet around the due date to allow you to do so. If you can't get on my appointment list and demo to me by 5:00 11/24, I'll give you until Monday morning for a loss of 8 points.
- **Web page** (30 points, due 11/30). With the exception of the project status reports, which has special due dates, the completed web page is due 11/30. You may either a) hand in your self-contained web pages on a disk (self-contained in the sense that they will work from a computer not hooked to the web), or b) serve your web-pages entirely from your ece account and just give me a URL. I prefer option b). I will be archiving your web pages to a central location where future CpE213 students can view them. Your web pages should contain:
 - **Project summary.** A brief overview of the project, perhaps with a picture or two.
 - **Status report** (5 points each, **1st report due 11/13. 2nd report due 11/20**). A short report documenting how far along your project is. You must be able to back up what is shown in your status reports. I will give you points for getting more work done early.
 - **Project goals.** The goals you began your project with.
 - **Background.** An explanation why you are pursuing this particular project, why this project is worth doing. Might be incorporated into the project summary.

- **Code.** All code you used in your project should be put on the web page. It should be well documented (commented), so that others may use it in the future and so that I can understand it easily.
- **Schematics.** Any hardware schematics used in your project.
- **Parts list.** The final version.
- **Summary of simulation techniques.** Be brief. I'd like to know what you did both for hardware and for software.
- **Explanation** of how your project works. Must be comprehensive enough that another CpE213 student could read and understand your project.
- **Work Distribution.** A table or bulleted list explaining precisely what was done by each team member. Be honest.
- **Project Results.** Did you meet your original goals? What changes did you have to make along the way and why? Did the final project work? If not, why not? What major successes did you have? What would you do differently if you had to do it over? What work still needs to be done in the future? Do you have any ideas for a cool extension of this project? If you did not get your project done, you need to defend your project as best you can here – that's how you'll get partial credit.
- **References.** If you built on someone else's project, you must specify here exactly what you took from their project and what you added yourself.
- **Cool pictures.** If you want – not required. No nudity.

Your web page will be graded on content (approximately 60%), on appearance (approximately 20%), and on readability (approximately 20%), which includes grammar and spelling.

- **A short talk** (20 points, due 12/5). Your team (everyone must talk) will give a short 7-8 minute talk describing their project on the last week of classes. Demonstrations of your project to the class are encouraged. I will be very strict about time limits, so you may want to practice it first. You may either bring your presentation to class on a disk (zip/floppy/CD), make it available from the web, or bring it on transparencies. I don't believe students can actually log onto the cart computer used in class. Your talk will be graded on content (approximately 70%) and the overall quality of the talk (approximately 30%).

In addition to the points given above, you will be given 5 points for the creativity of your idea, 10 points for the quality and sophistication of the hardware used in your project, 10 points for the quality and sophistication of the software used in your project, and 5 points for using simulation in a reasonable way to expedite completion of your project. Getting the project done will help with all of these. If your project is extra cool, I may even give some extra credit points.

PARTS: Unfortunately, I cannot buy parts for you. If you are poor, I suggest you choose a project that requires a minimum of hardware. Feel free to use the XS40 boards, though you cannot take them from the lab. I recommend you get parts either from Digikey (www.digikey.com) or from Radioshack. Digikey is generally better, but Radioshack is quicker. I have a hardcopy of the Digikey catalog you can borrow if you like. I would suggest that after everyone turns in their parts list, that several of you get

together and order from Digikey as a group, to make sure you meet the minimum order and to distribute the shipping costs among you. The following is a list of parts we've worked with or that you might need, but feel free to get others. The numbers shown below are generally Digikey part numbers, the names are brands sold by Digikey (list courtesy of Kyle Mitchell):

- push button - get in town (these need to be debounced – either with a one-shot or in software)
- 12/16 key keypads - Grayhill \$10-15 GH500x-ND (need 8 resistors)
- 74373 8 bit latch - get in town
- 7404 hex inverter - get in town
- 16x1(2) LCD display - Optrex \$10-20 (get a data book too)
- 7-segment display - get in town (need 7 resistors, possibly drive circuit)
- LEDs - get in town (need resistor)
- buzzer/speaker - get TTL drivable (requires a 7404 or an external transistor like the 2N2222). In town or through Digikey
- max232/233 serial port transceiver/level shifter- \$5-10 (need 1-5 caps, 9 pin d-shell connector)
- 9-pin d-shell - get in town
- 5-pin keyboard plug - get in town
- 8-bit D/A (parallel) - (parallel makes this a much easier device to access)
- 8-bit A/D (parallel) - (parallel makes this a much easier device to access)
- track 2 credit card reader - we have one of these
- 7805 5V voltage regulator - (need 2 capacitors, 9 volt battery)
- capacitors
- resistors
- 8051-family microcontroller. A must. Feel free to use the XS40 board. I also have quite a few 89C51RC2s, which have a generous supply of on board flash programmable ROM and RAM and can be programmed through a standard serial port. Will require that you get a crystal to clock it with.
- quartz crystal - ECS brand with 4.8mm pin pitch \$1 (pick correct speed) (also requires 2 capacitors)
- bread board wire - \$8 per100' (get several colors)
- 9 volt battery connector -
- joystick, analog pc - (need 2 capacitors, 4 resistors) We have some in G10
- joystick, analog atari - (need 4 resistors) Used to have one in G10
- joystick, digital – We have some in G10

MISC:

- Past 214 projects can be found at www.ece.umn.edu/courses/ee214. These projects are a little different than the one you will be doing. All the code and schematics are available. You are free to build on these projects, but you must specify precisely what code/schematics/information you used from someone else's project and what you did on your own. For example, if you use a function that someone else wrote, you should clearly give credit in a comment in your program and you should also note this in the references on your web page. **ALL**

PROJECTS MUST BE ORIGINAL – NOT A COPY OF A PAST PROJECT.

- If you use multiple seven-segment LEDs, I recommend you use time-division multiplexing between them.
- Projects should be stand alone, not requiring additional power supplies or function generators (except to supply an “example” input – not for signals like the clock).
- A simple clock or timer is not sufficient in and of itself for a project, unless it uses an input in a unique way or uses the clock to control an output in a unique way.
- A “calculator” is an OK project only if it uses external hardware in some unique way.
- There will be a **confidential evaluation** of your teammates at the end of the semester. Grades will be weighted accordingly.