# CpE213 – Semester Project

Winter semester, 2002.

For your project, you will design a simple, self-contained 8051-based device which will repeatedly flash a pattern on a set of LEDs. The user will be able to set the device to flash 1 of 3 or more patterns and will be able to set the flash rate to an extent. I will let you decide how the user will control flash rate and patterns (switches, potentiometers, etc). You must have at least 2 speed settings – any more than that is up to you. You can use as many LEDs as you like. You may write your code in either C or ASM.

**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. Team member contribution will be evaluated in the final web-report and through a confidential evaluation the last day of the semester. Please do not share your team's solution with other teams.

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

- **Project demonstration** (50 points, due 4/15, 5:00). 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, I'll give you until Tuesday night for a loss of 10 points (approx. 1 letter grade). Grading criteria includes: does it work, is it packaged nicely, is it "cool". **START DEBUGGING YOUR WHOLE PROJECT (SOFTWARE WITH HARDWARE) AT LEAST A DAY AHEAD OF TIME OR YOU SERIOUSLY RISK MISSING YOUR DEADLINE.**
- **Project code** (10 points, due with project). During your project demonstration I will ask you to: show me your code, compile your code, email me a copy of your code, download the code to your device, show me your working device. Well designed code is worth more.
- **Short web-report** (40 points, due 4/22). If your project didn't work, explain how you might get it to work. Your report should also include:
  - **Title and team members**
  - **Summary.** Give a quick summary of what you did in your project, what problems you encountered, and how you got around them.
  - **Explanation.** If your code didn't work, explain what you might do to fix it. I would also like some explanation (maybe calculations) to explain the flash speeds you used, assuming project goal is a device you'd swing. Show the patterns you expect to see.
  - **Future work.** Explain what you might do to improve your project or the way your went about completing your project (timeline, etc).
  - **Project code.** It should be well documented so I can understand it.
  - **Work effort distribution.** List each person in your group. Tell what their job was and the total percentage effort they contributed to the completion of the project.

  Email me the link to the web site on 4/22.

**PARTS:** Unfortunately, I cannot buy parts for you, but the parts are not expensive. You'll need the following (at least):

- AT89C1051U – available from Eagle Electronics for about $5 (Eagle Electronics is located on HWY 63 about a block from Wal-Mart). You can find a datasheet for the part at http://www.atmel.com/atmel/acrobat/doc1045.pdf. Note that this is a VERY basic version of the 8051 and does not have all the bells and whistles of the 8051 we've been talking about in class. Eagle Electronics only has 11 of these things, so buy yours early. If you want to buy a fancier 8051, feel free.
- LEDs – either Eagle Electronics or Radio Shack (Radio Shack is off of 10th street in Forum Plaza). You can also buy some cool high-intensity ones from places like Digikey (http://www.digikey.com) or Mouser (www.mouser.com) or Jameco (http://www.jameco.com), though I think I've also seen good ones at Radio Shack.
- You may need an inverter or a PNP transistor to power the LEDs if you use high power ones (which are cool). The 8051 may not be able to drive them well directly from the I/O ports. Eagle Electronics or Radio Shack.
- A battery pack to power your device. You should not use power from an external power supply – your unit should be entirely self contained. The AT89C1051U can run from a 2.7V to 6V power supply, which you can create by putting 2, 3, or 4 1.5V batteries in series. You should be able to find a battery pack at either Eagle or Radio Shack.
- A quartz crystal and two 30pF capacitors to provide the clock… I *think* you can get the crystal from Radio Shack. I'm sure you can get the capacitors there (or probably from Eagle). Check the datasheets to decide what frequency the crystal should/can run at. If you run into trouble, let me know – we'll work something out.
- An input switch and 2.2k pullup resistor. Eagle or Radio Shack.

**DOWNLOADING YOUR CODE:** You can download your code to your chip using the chip programmer in G10 or in the Senior Design lab. I'll pass out/email instructions in the near future.

**EXTRA CREDIT:** (15 points max)

- (5 points) Solder it up and put it in a package ready for swingin'. (BTW, if you do this, I get to swing it ;-)
- (10 points) Make it *write* something while swinging! When swinging, the bar is moving pretty fast… much like the raster scan on your television. If you have a line of LEDs that flash portions of letters as it moves, you can make words during the swing! Mix words with the patterns to make it really cool. Include calculations of "flash" time in your report.
- (10 points) Add hardware + software that allows the 8051 to recognize *where* it is in the spin or spin rate (e.g. recognize when and how often the device hits the bottom of the circle, or whatever) and use that information to synchronize the pattern it shows with each spin (e.g. always flashes red at the top of the spin and then green at the bottom). Must be able to show that it works.