Course Information

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1 Overview

The Electronic Identification Lab (CS291E) will teach students how to build systems that use Radio Frequency Identification (RFID). The lab will be very hands-on and will involve (1) building RFID readers and tags, and (2) implementing modifications to a microcontroller-based RFID tag.

Much of the lab will rely on the “WISP” RFID tag from Intel Research. The WISP is a general-purpose RFID tag and sensor where most of the features are implemented in software rather than hard-coded in silicon. The tag communicates wirelessly with a reader that also provides wireless power (similar to how retail anti-theft tags work). With WISP, one can do remote sensing in buildings and bridges and perhaps even prototype the future of secure wireless medical records and drivers licenses.

Because this lab is experimental, students should expect that some assignments are still under development. By taking this lab as the first enrolled students, you should be on the look out for errors and other unexpected problems.

Intended audience. This 1-credit lab introduces undergraduates to the fundamentals of RFID for problem solving from a computer science perspective.

Prerequisites. Completed or concurrently taking CS201 (computer architecture/assembly).

Time and location. Lectures are held in Room 142 in the Computer Science Building on Mondays from 4:00PM to 5:00PM. The lab is located in LGRT room 224; we will post the lab hours shortly. Often the class will meet in the lab rather than the classroom for hands-on work rather than lectures. A schedule of topics is posted on the Web page.

Contact. Be sure to check your UMass email address regularly. If you check another email address, set up your UMass account to forward your mail appropriately.
2 Textbook and reading

There is no required textbook for this lab, but we highly recommend that you purchase the *RFID Handbook: Fundamentals and Applications in Contactless Smart Cards and Identification* by Klaus Finkenzeller. You may be able to find the same information with judicious use of Wikipedia and Google, but the book serves as compact repository of trusted knowledge. There are many Web pages that explain RFID, but not all Web pages are entirely accurate.

3 Lab materials

This lab involves some very delicate and often irreplaceable, custom-made equipment. While the equipment itself is inexpensive and virtually useless outside of research, we literally have to call up “a guy in Seattle” to resolder the parts if something breaks. A broken or missing part could delay a lab by weeks, so please treat the equipment with respect, do not allow outsiders in the lab, and obviously do not steal the equipment or allow others to steal equipment. Do not eat or drink in the lab. Violations will result in severe penalties.

Because of donations from Intel Research Seattle and ThingMagic, we have been able to avoid laboratory fees. However, if you lose or break any equipment, you will be responsible for purchasing a replacement. We will provide you with a bill of materials should you wish to purchase any of the parts for your own continued use.

4 Grades and methods of evaluation

Grading is weighted as follows:

- Five labs: 75%
- Final project: 20%
- Class participation: 5%

Passing the class is not possible without completing the final project, regardless of your other grades.

4.1 Labs

There will be five hands-on lab assignments. Lab assignments typically involve hands-on work and measurements/graphing. TAs will grade your labs during “check off” hours. Thus, most of your work will happen either during class or during posted lab hours. Due dates appear on the Web site. The expected labs include:

1. RFID fundamentals: the array of technology
2. RFID and energy: the battery or lack thereof
3. Solving problems with RFID: building a reader
4. Solving problems with RFID: programming a tag
5. RFID security and privacy: access control
4.2 Final project

A significant part of this lab is a team project. We will assign you team partner(s). Each team will have 2 or 3 members. One goal of this lab is to expose you to the joys and difficulties working in teams, which is the reality of 96.4% of all academic and industrial projects. You will be responsible for organizing team meetings around your many schedule constraints. Effective teamwork is essential. We will spend class time discussing how to be a good partner.

Each team will have the option to either (1) build an RFID system to enable contactless payments for an espresso machine, or (2) develop a creative project in consultation with the lab staff. There are three components to your project grade: a project proposal, a status report, and a poster/demonstration. The due dates for each of these milestones appear on the lab Web page. You cannot pass the project unless each is completed.

Communicate with your teammates! Lack of communication could result in a dysfunctional team that risks failing the class. If you have tried repeatedly to communicate

**Project proposal due October 29 (20%).** Pick either the task of building (1) a contactless payment system for an espresso machine, or (2) another creative project designed in consultation with the staff. Your proposal should explicitly state the problem your project will address, your project’s goal and motivation, the methodology and plan for your project, and the resources needed to carry out your project. Be sure to structure your plan as a set of incremental milestones and include a schedule for meeting them.

**Status report due November 19 (30%).** Your status report should contain enough information to show that your project is on the right track. You should append a copy of your original proposal with the comments from the staff, along with any surprising results or changes in direction, schedule, etc. You should also have a refined version of the problem statement and goals.

**Poster and demonstrations due December 10 (50%).** On the last day of class, you will demonstrate your projects to both your classmates and other visitors. You must create a large poster (details later) that we will print for you. Each student must also submit a paragraph by email to the lab staff that explains, for each team member, their contributions and duties in the project.

4.3 Class participation

Students can participate in class in several ways. At the beginning of each class, students will have the opportunity to report on the latest news in RFID. Intellectually stimulating questions also qualify. Students can also engage in discussion with the TAs and classmates in lab. Quality rather than quantity counts most in this subjective evaluation.

5 Policies

5.1 Lateness

Each team is granted one “penalty free” late pass for turning in the lab assignments. You need not provide any excuse. A free late means you may turn in the lab by the next class without penalty
(subject to the constraints of lab hours). Labs will be accepted either as emailed PDF files or documents handed to the TAs. The turn in date is when we receive the message, not when you send it. Any late labs beyond your team’s freebie will result in a zero grade. Late freebies may NOT be used for any of the term project assignments. A late final project assignment (i.e., the proposal, status report, or poster/demo) will have a 20% grade reduction for each late weekday (7:59AM).

5.2 Collaboration and plagiarism

You may discuss material with others, but your writing must be your own. When in doubt, contact the instructors about whether a potential action would be considered plagiarism.

When discussing problems with others, excluding projects, do not show any of your written solutions to others, including code. Do not show any books or papers used to discover the solution. Do not take notes about the solution other than to jot down publicly available references. Use only verbal communication.

Using someone else’s code or API is forbidden. You may use publicly available code (libraries and open source material) if code was published before we assigned the work. If you find code that trivially solves some problem we have assigned, we expect you’ll tell us where so that we learn the homework assignment is moot.

If you do discuss material with anyone besides the lab staff, acknowledge your collaborators in each write-up. If you obtain a key insight with help (e.g., through library work or a friend), acknowledge your source, briefly state the insight, and write up the solution on your own. In most of your write-ups, we expect to see citations.

We cannot emphasize enough that you MUST cite all your sources properly. You must remove any possibility of someone else’s work from being misconstrued as yours. We consider the facilitation of plagiarism (giving your work to someone else) as plagiarism as well.

Never misrepresent someone else’s work as your own. It must be absolutely clear what material is your original work. Plagiarism and other anti-intellectual behavior will be dealt with severely. Investigating plagiarism is a pleasant experience for neither instructor or student. Please help us by avoiding any questionable behavior.

Cheating is usually the result of other problems in school. Please come see us anytime if you are unable to keep up with the work for any reason and we will work something out. We want to see you succeed and will do everything we can to help you out!