

# ECE 495M MOBILE COMMUNICATIONS PROJECT

## Application

**Overview:** This course is offered every semester. Space in the course is limited. Students will be accepted on a first come first served basis. However, priority will be given to students who are enrolled in Mobility projects during the current semester, and who wish to continue in the course during the subsequent semester. In addition, the student's level of preparation for the course will be considered. Each student who is enrolled in the course, will be given a handheld or pocket computer for their use during the semester. All computers and other hardware assigned to students must be returned at the end of the semester. Students are fully responsible for all equipment that has been signed out to them. This is a design course. As such, it will require extensive use of a subset of software tools (e.g. C, C++, Visual Basic, Java, SQL, or PHP) depending on the project, and also some work with hardware.

**For further information:** See the Mobile Communications Projects website at <http://shay.ecn.purdue.edu/~mobility> or contact Prof. Jan P. Allebach ([allebach@ecn.purdue.edu](mailto:allebach@ecn.purdue.edu)).

**Credits:** 2 Credits: Lec. 1, Lab. 1

**Prerequisites:** Senior standing and completion of BSEE or BSCmpE core curriculum

**Prerequisites By Topic:** C programming

**Format:** All students will meet together every Wednesday from 4:30p until 5:20p in MSEE 184. In addition, each student will be assigned to a lab section that will meet weekly for 1 hr. and 50 min.

**Course Description:** Mobile communications technologies and applications: interaction between different wireless protocols; mobile access, viewing, control, and printing of multimedia documents, databases, and video; security in mobile environments; mobile e-services. Students will work in teams to design and prototype new solutions that exploit mobile technologies to transform the way people communicate and process information. During the weekly lecture, students will learn about different aspects of wireless technologies, the relevant application areas, and the design process. The weekly scheduled lab period will facilitate project coordination and planning.

**Justification for the Course:** Mobile communication technologies are revolutionizing the way in which people carry out the tasks of their daily lives. The intersection of these technologies and the technologies associated with the applications of access, viewing, control, and printing of multimedia documents, databases, and video; security in mobile environments; and mobile e-services provides a rich environment within which students can apply what they have learned in other courses, as well as the specialized information learned during the lecture portion of this course to provide innovative solutions to real-world problems.

**Application Process:** To apply for the course, please complete the entire application form at the end of this document and submit it to either the ECE Undergraduate Counseling Office or to Bonnie Misner or Sherry Leuck in MSEE 330. The next part of this document contains a description of all the current projects. Please read these descriptions and visit the project web page for further information about any project. On the application form, you will be asked to rank your interest in working on each of the projects. While we will try to honor your preferences, we cannot guarantee that you will be assigned to the project that is your first choice.

## ECE495M PROJECT DESCRIPTIONS

### **Biometrics:**

Authentication is needed in many applications and most of the time this is done with user passwords. In a mobile setting, the user may lose connection with the system as he or she roams from access point to access point. The inconvenience of repeatedly logging on the system is compounded by the fact that text entry with mobile devices, such as PDAs, is cumbersome. Instead of simple text passwords, unique biological features such as fingerprint, eye iris and voice can be used for authentication. It is nearly impossible to forge fake identities and much simpler to gain access to a system.

This team is conducting research on the available technologies to authenticate users for access points using biometrics. In addition, biometric authentication hardware and software for mobile devices is being investigated. A long-term interest of the team is to also explore applications of biometrics other than authentication.

For more information: <http://shay.ecn.purdue.edu/~biometri>

### **eAct:**

One person out of every 100 experiences a serious mental illness, such as major depression, bipolar disorder, schizophrenia, or obsessive-compulsive disorder. These individuals live in a variety of situations, including their own apartments, group homes, or with their families. Their daily lives consist of the same kinds of activities in which we are all involved: work, school, buying groceries, paying bills, etc; but because their brains do not function normally, they need on-going assistance. They also need aggressive medical treatment to manage their illness as effectively as possible.

Assertive Community treatment is a new model in which a group of 10 care providers, typically consisting of one psychiatrist, two RNs, one employment specialist, a substance abuse specialist, an office manager/statistician, three case managers, and a team leader care for approximately 100 mentally ill clients. Assertive community treatment is an evidence-based practice that has been shown to yield much better outcomes than traditional treatment models.

As the 10 members of the treatment team work throughout each day with their 100 clients, they must be in constant communication with each other, be able to access information about the client's treatment history, and be able to add new information to the database from which the team works. The team does not work in a single location, as is the case with traditional medical care. Instead the team is dispersed. They are out in the community working directly with their clients, helping them in a variety of ways throughout the day.

The eAct team is developing a database that can be securely accessed from mobile devices, such as PDAs or cell phones. They are also developing the user interface to this database, which is web-based.

For more information: <http://shay.ecn.purdue.edu/~eact>

### **ePrint:**

The goal of this team is to use mobile technologies to solve various problems associated with printing on the Purdue campus, which surveys have shown to be one of the major areas of dissatisfaction of students with campus IT services. Recently produced printers are quite smart. They have built-in processors, memory, storage, and networking devices. Therefore, they are capable of much more than just printing. For the last two semesters, this team has focused on solving the following problems:

- **Print notification:** If a user sends a job to a printer, it will typically be entered in a queue. The user would like to know when their job has finished printing; so they can go pick it up. The ePrint team is researching available mobile technologies to notify users via their mobile devices when their jobs are ready to be picked up.

- Fault notification: Printers require routine maintenance to refill paper trays, clear paper jams, and replace consumable supplies. At Purdue, ITaP manages over 100 printers. This current solution to routine maintenance is for an employee to visit each printer at regularly intervals to assure that it is functioning properly. The ePrint team is developing solutions that will allow the printer to send notification to a management point that it needs attention.

For more information: <http://shay.ecn.purdue.edu/~eprint>

#### **GPS-DVI:**

GPS-DVI stands for *Global Positioning System - Device for the Visually Impaired*. The goal of this project is to design and develop a portable GPS device that aids members of the Purdue campus who are visually impaired to navigate around campus. The device will have three primary functions:

1. A *where-am-I?* button to give the user's current position on campus, 2. A mode to provide audio directions to the user for a desired destination, and 3. A schedule mode to tell the user his/her next class and its location on campus. A GPS receiver will be used to gather position information of the user. Input will be from a custom HCI overlay on the touch screen and synthesized speech via an earphone will be the output.

Students working in this project will work with the Office of the Dean of Students EPICS team.

For more information: <http://shay.ecn.purdue.edu/~gpsdvi>

#### **Multimedia:**

The projects include JPEG2000, watermarking for content authentication, video compression and streaming, cryptography, and multimedia security.

The team will combine wireless technologies (802.11b), multimedia applications (MPEG) and portable devices (PDA) in order to learn about communications standards and thus develop applications to be deployed for a mobile environment.

In the Fall of 2002, the projects consisted of two applications for implementation on the Jornada: the JPEG image compression standard and image watermarking for security. In the Spring 2003 the team worked on two goals. The first goal was to create a wireless connection to a server and send an encrypted, watermarked image, taken by the mobile device, to the server and receive a reply from that server. The second goal was to achieve a high definition video feed over an 802.11b wireless network.

For more information: <http://shay.ecn.purdue.edu/~multimed>

#### **RFID:**

Radio Frequency Identification (RFID) is the wave of the future for Automatic Identification and Data Collection applications. RFID comprises a base radio transmitter/receiver, or reader, which can interrogate, display, and sometimes rewrite, an electronic code held in a remote device, transponder, and thus identify any item with which the transponder is associated. Some of the growing RFID application segments are point-of-sale, access control, package tracking, electronic ticketing, baggage handling, real-time location tracking systems, and manufacturing process control.

The goal of this project is to become familiar with the RFID technology, do research on the latest RFID equipment available in the market, compare RFID with other technologies such as 802.11b focusing on system recommendations for different scenarios, and implementing an RFID application that will be used for the betterment of student life at Purdue University.

In the Spring of 2003, the team developed a Library Book Finder application, and also worked on the process of building an RFID tag.

For more information: <http://shay.ecn.purdue.edu/~rfid>

