DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
AND COMPUTER SCIENCE
College of Engineering

SUMMER RESEARCH OPPORTUNITIES
FOR UNDERGRADUATE WOMEN

APPLICATION DEADLINE: MARCH 1, 2004

The Department of Electrical and Computer Engineering and Computer Science is pleased to offer the following research project(s) for the summer of 2004. Interested students are urged to contact the faculty member(s) directing the project that most interests them. By contacting the faculty member, you can discover more about the project, learn what your responsibilities will be, and if possible, develop a timetable for the twelve-week research period.

On Robust and Secure Mobile Ad Hoc and Sensor Networks
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The area of wireless and mobile networking is a new emerging area and many limitations are unknown. The field is so new that there are several prevailing wrong concepts. There is a need to have concentrated efforts to address many of the tools and techniques and we plan to have undergraduate students not only learn about the wireless technology but also do research in the area of ad hoc and sensor networks. Such a network is a collection of mobile systems that dynamically form wireless communication paths and do not rely on any underlying infrastructure for the formation and maintenance of the network. Communication between two nodes that are far apart and cannot have direct radio contact, takes places in a multi-hop fashion, i.e., mobile nodes that are located between these two nodes serve as routers and forward the data to the destination. The nodes are free to move randomly and organize themselves arbitrarily; thus, the network's wireless topology may change dynamically. Such a network may operate in a standalone fashion, or a few selected routers could communicate with an infrastructure network. For radio communication, only a single frequency is used in ad hoc networks so that all nodes in the neighborhood can listen to and communicate with rest of the nodes. The ad hoc and sensor networks have been shown to be useful for a number of civilian and military applications such as remote surveillance of a region, personal and institutional security, transport, agriculture, radiology and medicine, chemical plants, precise process control, national defense, toxic urban locations, and natural hazards.

Wireless sensor networks can be classified as one special class of ad hoc networks with very low mobility. They can be deployed without any installation costs or pre-planned organization. As these sensors are low powered, the protocols designed for these networks must efficiently utilize the limited power. To increase fault tolerance, hundreds or thousands of these sensors might be deployed. In addition, environments in which these nodes operate may have fast changing physical parameters. The position of the sensors, type of task (i.e., attributes the sensors need to operate on), etc., might change dynamically depending on the application. So, the routing protocol should be fault-tolerant in such a dynamic environment**.**

We plan to let the undergraduate students look at the usefulness of analytical models in analyzing wireless and sensor network routing protocols. Similar to other general subscribers of cell phones, undergraduate

students are exposed to the concept of hand off, but do not know how to avoid that, or at least minimize this kind of phenomenon in the wireless world. We will make the undergraduates understand the impact of scheduling algorithms on the performance of these networks performance and encourage the students to look at totally new and innovative algorithms. Application such as video-conferencing need multicasting and is currently common for Internet. Undergraduate students will be trained about different ways of achieving multicasting and then ask them to look at new and efficient mechanisms to achieve this. New protocols are being developed to optimize specific parameters in ad hoc networks and have introduced many new problems. The students will be asked to determine effectiveness of different optimizing techniques. Security is another aspect that needs to be studied extensively in this context, and innovative techniques and algorithms would help in solving such problems.