Two undergraduate female/under-represented minorities will be selected to work during the Summer of 2005 on the on-going project titled "A New Energy-Efficient Broadcasting Scheme in Sensor Networks ". This proposal is intended for the Research Experiences for Undergraduates (REU) program aiming to provide appropriate and valuable educational experiences for undergraduate students through research participation.

The selected students will participate in the following activities:

1. **Learn the basic process of conducting research.**

   The selected students will learn the basic process of conducting research, including problem identification, literature survey, the method of attack, simulation, and report writing. Specifically, they will learn how to conduct literature searching using Web search engines. The selected students will also be invited to participate in regular meetings between the PI and his graduate students. In addition, they will work closely with the graduate student working under the grant.

2. **Get familiar with basic web and image design tools.**

   The selected students will learn to use HTML and image editors for basic web design. Specifically, the following tools will be used:

   HTML editors:

   - Microsoft Frontpage: easy to use, produce less efficient code.
   - Macromedia Dreamweaver: used by most professional web designers.

   Image editors:

   - Adobe Photoshop: powerful all-purpose image processing tool.
   - Macromedia Fireworks: focus on web image processing.
   - Macromedia Flash: popular web animation standard.

   The selected students will also assist the PI in updating the current web sites of three on-going NSF projects and in technical paper proofreading.

3. **Install and learn MatLab.** The Department of Computer Science and Engineering at FAU has several licensed basic MatLab and SimuLink in place. Recently, some internal

funds have been allocated to purchase more licenses for several special toolboxes, including Genetic Algorithm and Direct Search Toolbox, Symbolic Toolbox, Communications Toolbox, and Communications Blockset, and Statistics Toolbox. These special toolboxes are extremely useful tools for simulation of various algorithms/protocols related to the NSF project. The selected students will learn to install and use both the basic MatLab. and special toolboxes.

4. **Learn to install and use a network simulator.**

   The selected students will learn to install and use a network simulator, called ns-2, which is a discrete event simulator targeted at networking research. ns-2 has been widely used for simulation of TCP, routing, and multicast protocols over wired and wireless networks. The ad hoc network extension of ns-2 is provided by CMU's Monarch Project, supporting mobile node configuration, moving pattern and traffic generation, and several routing protocols including DSDV, TORA, DSR and AODV. Several simulations have been done to compare the performance of these routing protocols in terms of delivery ratio, end-to-end delay, and routing overhead. Currently, ns-2 has been installed at the Department of Computer Science and Engineering, Florida Atlantic University to carry out the on-going project on routing in ad hoc networks. The selected students will learn the process by re-installing the software package. They will get familiar with basic features of ns-2 and conduct some simple simulation.

5. **Assist PI to set up a research laboratory.**

   The selected students will assist the PI to set up a Wireless and Sensor Networking Laboratory. The network consists of several MICA motes which constitute a wireless sensor platform for developing powerful, tetherless, automated data collection, and monitoring systems. MICA motes run TinyOS/nesC [43] from UC Berkeley. The TinyOS operating system is open-source, extendable, and scalable. Code modules are wired together allowing C programmers to custom design systems quickly. The platform consists of Processor Radio boards (MPR500CA and MPR400CB) commonly referred to as motes. These battery-powered devices run TinyOS and support two-way radio networks. Sensor and data acquisition cards (MTS310CA and MDA500CA) plug into the mote processor radio boards. Sensor support includes both direct sensing as well as interfaces for external sensors. MTS310 MICA2 sensor board contains the following sensors: light, thermostat, acoustic sensor, acoustic actuator, accelerometer and magnetometer. Finally, a mote in-

terface board (MIB) is a gateway that allows customers to interface motes to PCs, palm computers, the WWW, and existing wired networks and protocols.

The selected students will also assist the PI to maintain a parallel/distributed processing laboratory (funded by an NSF research equipment grant last year). The laboratory consists of a 16-node Beowulf cluster and three general-purpose workstations. All hardware equipment has been purchased and installed. The selected students will help to install relevant software. They will also learn the basic parallel programming using MPI and PVM.