Sensor Consortium: Consortium for Security and Medical Systems

Department of Electrical and Computer Engineering

College of Engineering and Applied Sciences, SUNY Stony Brook

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Six months have passed since the inception in June 2004 of the NSF PFI-funded **Sensor Consortium for Medical and Security Systems** at Stony Brook University. For the next two years the Consortium will promote entrepreneurship and technology transfer activities on Long Island, with a focus on medical and security sensor systems.

A unique component of the Sensor Consortium is our *Education Component*. For the first time, four of Long Island's campuses join forces to educate our students on technology entrepreneurship. The Sensor Consortium's Education Partners includes Stony Brook University, Hofstra University, SUNY Farmingdale and Suffolk Community College. We believe that by forming this partnership, the four education partners will be able to bring together a large and diverse student pool and could have a far reaching impact on Long Island's technology entrepreneurship education.

Besides the *Education Component*, the Sensor Consortium also has *Research and Technology Transfer* and an *Outreach and Dissemination* Components. These three components are interlinked together to provide an infrastructure and a community to support each other. The main goal of the Consortium activity is to make the faculty and students of the four Education Partners well aware of how a successful entrepreneur thinks and solves a problem. It is our vision that the consequence of such awareness will translate into more patents, more startup technology companies, and more research and development projects in national security and medical sensor systems on Long Island.

This newsletter, first in the history of the Consortium, is to document the progress in the Consortium program during the elapsed period.

Educational Component

1. Administrative.

Through a very selective process, we have successfully identified Dr. Nadia Lifshitz, a highly qualified scientist to be the Consortium's program manager. Dr. Lifshitz has more than 25 years of experience in electronics and sensor technologies. She will be instrumental in achieving the goals of the Consortium.

The core personnel of our Educational Partners (SUNY Stony Brook, Hofstra University, SUNY Farmingdale and Suffolk Community College) were amalgamated in an active group whose first task was to choose best undergraduate students for the Student Entrepreneurial Teams (E-Teams,

see below). With the help of faculty members from our educational partners, we have selected four E-Teams of students for developing projects that will generate economic and social benefits based on innovative technologies.

2. Creation of the E-Teams.

The **Technology E-Team (Entrepreneurial Team) Competition Program** is a unique activity proposed for the Education component. E-teams are groups of students, faculty, and mentoring professionals who join together to develop an idea, product, or invention that will generate economic and social benefits. A special feature of our Technology E-Team Competition Program is that each team consists of one undergraduate student from **each** of our four Education Partners. Students from each institution bring their unique experience and background to the teams. The selection process of these students was highly competitive and administered by the individual Education Partner. Each team of undergraduate students is led by a Stony Brook graduate student and supervised by a Stony Brook faculty. The Consortium supports four E-Teams each year. The E-team student body of this year is a typical cross-section of Long Island population with its racial, gender and social mix.

All students joining the Technology E-Team Programs are required to take a course on Entrepreneurship at Stony Brook**.**

3. Course on the Entrepreneurship.

The entrepreneurial course was read by Prof. Garret Wolf of the Harriman School of Management and Policy. This course met for an hour each Saturday during the fall semester with the entire body of all four E-teams present.

The course introduced the engineering student to the process of innovation and the business fundamentals necessary to plan, and potentially operate, a business from a technical or engineering standpoint. The topics covered include: Creativity, Innovation and Intellectual Property; Planning the Venture; Developing a Business Plan; Financing the Venture; and Launching the Venture.

Prof. Wolf' class during a discussion

One of the goals of the course was to teach the students write a project plan for technology research for the year and a business plan for the product. These two documents were discussed and outlined four each E-team. They will be completed at the end of the year when the specific technology for the product will be defined and the potential customers determined. During the discussion time the students dwelled on the topics of similarities and differences in applications of wireless sensor technologies, organizational problems in making the teams work well, and business markets for potential products in terms of customers and competitors.

Since the students of each E-Team come from different schools geographically located far from each other, they learned to communicate with each other and divide the tasks for a week ahead between themselves, without any pressure from their advisors. Each week they reported what they learned through trade associations and industry publications about many various factors and skills necessary to bring a product to market.

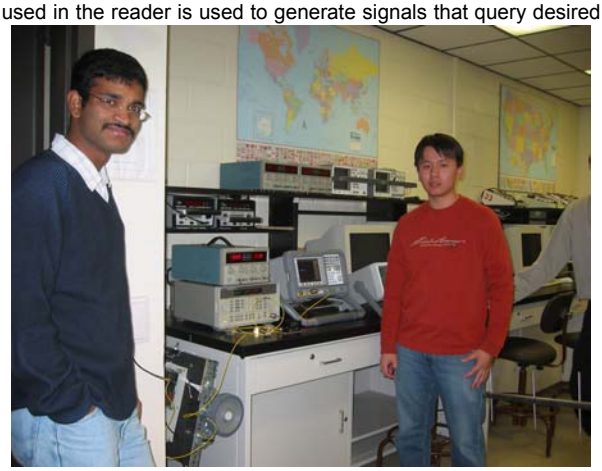
After each lecture/discussion session the students met with their faculty advisors to discuss the progress of the project and the assignment for the week.

4. E-Teams Projects defined and initiated.

As a part of the educational component, each E-Team is developing an innovative project that will potentially generate economic and social benefits. Each project is led by a graduate student and supervised by a faculty member from the Electrical and Computer Engineering Department at Stony Brook. Each project was selected on the merit of its commercial and societal potentials. Below we give a short synopsis for each project.

- Title: RFID Sensor Networks; Advisors: Profs. Petar M. Djuric and Mónica Bugallo

Radio frequency identification (RFID) is a new technology that provides automatic object identification and/or tracking by using electromagnetic radiation at radio frequencies. A basic RFID system is composed of RFID readers and RFID tags. The circuitry used in the reader is used to generate signals that query desired tags and to "power" the RFID tags. In turn, if necessary, the RFID tags reflect the reader signals and send information that is processed by the reader. Based on the received signals from several readers, the system can locate or track the desired tag. Typically, the information used for location of the tag is in the distances of the tag from three or more readers.



Members of Prof. Bugallo's E-Team working on their project

The location and tracking of tags can be accomplished by adding sensors to the RFID system and thereby, building a wireless sensor network. The idea is to allow the sensors to sense only tags in their vicinity and report the detected tags to nearby readers. From the response of the sensors, the readers would be able to locate or track the desired tag.

The aim of this project is to explore the feasibility of building an RFID sensor network. The objective is to use readers and tags available from the current market and build a sensor that will become an essential component of the sensor network. In the design of this sensor, currently available protocol standards for RFID communication will be used. The project will also include work on issues related to sensor deployment and investigation of challenges for achieving a robust realization of a large and complex sensor network.

The School of Health Technology and Management at Stony Brook University, expressed its interest in the proposed product.

- Title: ANGEL: embedded platform for improving on-campus security; Advisor: Prof. Alex Doboli

Our goal is to develop an embedded system that will aid the physically challenged. The device will use a set of sensors interfaced with a microcontroller. The sensors will gather information that may be useful to help the challenged individual navigate through obstacles in a campus environment or a residential area. The microcontroller shall process this information and provide it in an output comprehendible by the user. This device will be light and portable and will greatly improve the ability of physically challenged individuals to not just move with ease but also to be safe in an environment with moving objects.

Potential customers for this device would be Old Age homes, Assisted Living centers and On Campus Disability Support Centers. In order to find out what are the exact requirements of these customers would be we have set up a short survey and disseminated it to them. The survey is to be filled in by the physically challenged individuals. The responses to the survey are still pending and an effort is being made to speak to personnel at Disability Support Centers and Assisted Living Centers to learn directly from support personnel what needs and requirements of the challenged individuals could be met by this device.

- Title: Wireless Biopotential Recording for the Treatment of Sleep Apnea Disorders Advisor: Prof. Ridha Kamoua

Sleep apnea is very common disorder that affects more than twelve million Americans, according to the National Institutes of Health. It is a breathing disorder characterized by brief interruptions of breathing during sleep. Risk factors include being male, overweight, and over the age of forty. There are two types of sleep apnea: central and obstructive. Central sleep apnea occurs

when the brain fails to send the signals to the breathing muscles to initiate respirations. Obstructive sleep apnea (OSA) is caused by blockage of the airway.

Current approaches for the diagnosis of sleep apnea include recording and tracking the body surface potential associated with brain waves (EEG), eye movements (EOG), muscle tone (EMG), and heart rate (ECG). The diagnosis system consists of metal electrodes attached to the patient and connected with wires to external electronics for signal amplification, filtering, and processing. Such a system limits the free movement and comfort level of the patient.

The goal of this project is to develop a wireless system capable of recording from a large number of electrodes that map the body's biopotentials. A small battery powered unit, that can be easily attached to the patient, will perform the analog signal processing, digital conversion, and wireless transmission of the measured biopotentials. The measurements could then be accessed remotely by the patient's doctor or care provider.

The Center for the Study of Sleep and Waking at Stony Brook University Medical school has expressed interest in this project. Prof. Lehman and Prof. Rozensky from the Sleep Apnea Center have agreed to collaborate and provide access to their facility for the development and testing of the proposed wireless system.

- Title: Wireless Health Monitoring System; Advisor: Profs. Wendy Tang, Ridha Kamoua

With the aging of the baby boomers, it is predicted that the US population over age 65 will grow from its 1999 level of 34.6 million persons to approximately 82 million in 2050, a 137% increase. The most rapid surge in our senior population will take place between 2011 and 2030. During this 19-year interval, seniors will expand from 13% of our population to 22% of our population. (Source: US Census Bureau).

In this project, our goal is to design a wireless sensor system, the Health Tracker 2000, that can monitors users vital signs and notifies relatives and medical personnel of their location during life threatening situations.

The Health Tracker 2000 combines wireless sensor networks, existing RFID (Radio Frequency Identification) and Vital Sign Monitoring technology to simultaneously monitor vital signs while keeping track of the users' location. The use of wireless technology makes it possible to install the system in all types of homes and facilities. Radio frequency waves can travel through walls and fabric, sending the vital sign and location information to a central monitoring computer via a miniature transmitter network. Such information can easily be accessed from any location over the Internet.

Currently, we have identified several vital sign sensors and begun building the wireless sensor networks. We have also contacted several Assisted Living Communities and doctors who will provide testbeds for our system and act as medical advisors.

Research and Technology Transfer

The goal of the Research and Technology Transfer (R&TT) component is to provide a permanent infrastructure to promote research and technology transfer in security and medical sensor systems.

1. Databases.

The major proposed activity in this component is the establishment of searchable, web-based, **Research and Funding Databases** to serve the partners of the Sensor Consortium; Funding database has been established at our Website (http://www.ece.sunysb.edu/~sensorconsortium), in the Research and Technology Transfer page. The database is constantly broadening its scope; new funding sites are added to the database as soon as we learn about them. We are currently working on the format for The Research Database that will be developed later in the year.

2. Finding new partners and potential customers

Another R&TT activity is finding potential customers for the products developed by the E-Teams. Most of the teams have been successful in this search. For example, the School of Health Technology and Management at Stony Brook is very much interested in the RFID Sensor Networks project. Another proposed product (project ANGEL: embedded platform for improving on-campus security) found its customers at the Assisted Living Centers and On-Campus Disability Support Center. In order to find out what are the exact requirements for these products a short survey was created and disseminated among physically challenged individuals. The Center for the Study of Sleep and Waking at Stony Brook University Medical School has expressed interest yet in another product (project Wireless Biopotential Recording for the

Treatment of Sleep Apnea Disorders). Several assisted living communities and doctors on Long Island also expressed interest in advising the Wireless Health Monitoring System project.

Outreach and Dissemination.

The goal of the outreach and dissemination component is to promote the Sensor Consortium's achievements and to obtain entrepreneur-mentors and speakers.

1. Consortium Website

Important development in our Outreach and Dissemination program is creation of the Consortium Website (http://www.ece.sunysb.edu/~sensorconsortium/). The site contains all information about the Consortium, its goals, programs, people and current events.

2. Seminars and workshop series.

Our series of seminars and workshops feature entrepreneurs, venture capitalists and other industry professionals as guest speakers. The first three seminars of the series have been a great success. Descriptions of our past and future seminars can be found on our website, in the Schedule of Events page.

3. Publications

We have sent out short report letters to our sponsors about our progress. Our seminar announcements are placed in all announcement board on the Stony Brook campus and sent to campuses of our educational partners. This Newsletter will also be disseminated among our sponsors and partners as well as past and future speakers at our seminars.

4. Obtaining entrepreneur-mentors.

We are actively looking for new entrepreneur-mentors and speakers via a network of our educational and outreach partners, Sensor CAT partners, former speakers, industrial sponsors and Small Business Development Center.