Current NVI Project Summaries

If you are interested in any of these unique technologies, please contact Nancy Saucier, Director of New Venture Development at Nancy_Saucier@uml.edu or 978-934-3212.

BUZSAW

Medical Device

Status: Proof of Concept; Prototype under development

Joel Therrien of UMass Lowell's Electrical & Computer Engineering department has developed a QCM/SAW based acoustic wave (AW) device that addresses the limitations of current commercial technology, the linear SAW, maximizing the surface area of the sensor and eliminating the need to phase match each sensor. This has been accomplished by eliminating the need for the large number of repeated electrode pairs and migrating from a linear to circular design to enable self-alignment.

QCM/SAW enables the use of cells as the sensor element to analyze mechanical as well as visco-elastic properties. Additionally, frequency dependent response of the oscillator can be used to obtain more detailed diagnostics of the status of the cell response.

NVI believes solving these two major hurdles to broad adoption of QCM/SAW technology combined with the sensing accuracy of QCM/SAW will enable the technology to be applied for use as a diagnostic for therapeutics, toxins, and pathogens.

New Venture Initiative is interested in this technology due to its sensing accuracy. NVI is currently working to further the commercial capability of this technology and assess potential market opportunities by:

- Awarding an internal translational grant of $24,000 further development of a stable sensor prototype
- Pairing mentors with the faculty inventor to drive to commercial milestones
- Exploring opportunity to integrate the technology into the existing laboratory technology suite
- Identification of a potential initial target market to focus the creation of a comprehensive database of frequency dependent responses

Ultrasound Optical Sensor

Medical Device

Status: Stable Prototype Available

This technology is a fiber optic photoacoustic ultrasound probe developed by Xingwei Wang from the Department of Electrical and Computer Engineering at UMass Lowell. This product can emit, steer, and detect ultrasound signals simultaneously on a single optical fiber tip. The probe is very compact equally about 125 µm in diameter. Due to the entire optical operation principle, there is no electromagnetic interference (EMI) generated from the probe. Furthermore, the phased array technique eliminates the necessity of the bulky mechanical structure for the scanning. Meanwhile, the principle of the probe allows the probe to generate a wide bandwidth as well as a high frequency (100 MHz) ultrasound signal. Therefore, the fiber optic photoacoustic ultrasound probe is extremely suitable for high resolution ultrasound imaging or testing applications where the access is very limited.

The unique features mentioned above allow the probe to be used in medical applications. The material of the optical fiber is silicon dioxide which is bio-compatible and has no EMI generation which makes the probe a perfect device for usage in emergency rooms and operating rooms. Moreover, due to its compact size, it can be guided into the blood vessel to perform ultrasound imaging to locate stenosis. The worldwide medical ultrasound market was valued at $2.99 billion in 2008 and is expected to reach a staggering $5.18 billion by 2015.

In addition, this technology holds several competitive advantages including:

- Greater sensitivity and larger detection range
- Low cost and good repeatability in batch
- All silica sensor—compatible with EMI technologies
- Miniature size and ease of use

This technology has been optioned to Endeavor Medical Inc. (see full description below) for start-up commercialization as a Phase II product under development.

NVI is actively assisting Xingwei Wang and EMI through:

- Early strategy development and customer assumption testing
- Pitch development and market research
- Funding strategy and initial angel introductions
- Mentor and Advisory Board development
- I-Corps funding, as well as other applicable grant sources

Endeavor Medical

Medical Device/Diagnostics

Status: Stable Prototype Available; Initial Animal Studies Complete; Sensor Fabrication Process Improvement On-Going

Endeavor Medical Technology, LLC (EMT) is a medical device consulting and development company founded by Steve Ferry. The UMass Lowell Optical Pressure Sensor technology has been optioned to EMT for purposes of enhancing the capability of medical devices designed for the purpose of monitoring, treating or imaging various processes within the human body. The first area of focus for EMT is to refine development of the sensor build process, which in turn could be sold as a finished component sensor assembly or be integrated by EMT into various interventional devices.

The Pressure Sensor (optioned technology by Endeavor Medical) was invented by UMass Lowell's electrical and computer engineering professor Dr. Xingwei Wang developed a miniature pressure sensor, which provides high fidelity blood pressure measurements in the catheterization laboratory. The sensor is half the diameter of the guide wire tube, therefore small enough to be inserted into it and be guided to and through the arteries. The sensor is based on the Fabry-Pérot (FP) principle of reflection.

On the sensor tip, there is a gap between the fiber core and the diaphragm. The optical light is launched into the optical fiber and part of the light is reflected back by the fibers end face. The other part of the light is transmitted to the diaphragm and reflected back. These two reflected beams interfere with each other and form the fringe. When the blood pressure is applied on the diaphragm, the gap distance changes and the fringe shifts accordingly. By demodulation of the spectrum, the applied blood pressure can be accurately measured. This novel technology has a variety of applications including:

- Fluidic pressure sensor
- Post evaluation of performance (artery opening)
- Monitor pressure during angioplasty
- Extremely useful during the initial blockage diagnosis

NVI has identified this technology because currently, there is no pressure sensor that can simultaneously achieve the minimum characteristics required for miniaturization to access tight spaces and be used in medical applications such as heart surgery or other procedures requiring blood vessel pressure measurements. As mentioned above, NVI is looking to assist Xingwei Wang and Steve Perry (founder of EMT) through:

- Early strategy development and customer assumption testing
- Pitch development and market research
- Funding strategy and initial angel introductions
- Mentor and Advisory Board development
- I-Corps funding, as well as other applicable grant sources

Additionally:

- Further market research
- Development of technical milestones and related coordination with the faculty inventor and lab
- IP Prosecution
- Initial business development where partnering opportunities are explored
- Investment and funding efforts

NonSpec

Medical Device

Engineering graduate students Jonathan DeAlderete a senior in mechanical engineering and Erin Keaney a senior in plastics engineering are the leaders of their new venture called *Nonspec*. *Nonspec* has designed prosthetic hands for children in emerging nations. This prosthetic differs from existing appliances because it was developed to be easily customizable while still being mass producible at a low cost.

Their product is an injection molded prosthetic with a ratcheting hand which allows expansion and contraction – depending upon the wearer. The linkages in the fingers and the design of the forearm are a novel approach and rated to allow double the normal lifting capacity. This is accomplished using a new approach to the design of the hand section of the prosthetic. The increased capacity is intended to make the appliance more durable and functional. Most importantly, the design allows for customization in the size of the hand and fingers. The device is designed with a child's overall wellbeing in mind. Instead of a hook (or a variation thereof) the full hand linkage provides an organic shape. The cavity of the arm components are weighted to approximate the weight of a natural arm to assist in symmetrical muscle development as the child grows. The hand design device is a natural "feel" which gives the user more autonomy. It puts less stress on the families and caretakers since it allows the wearer more independence. While the device can be provided to a child at a low cost, the prosthetic is sturdy and well made.

The New Venture Initiative is interested in this technology due to the strong engineering background of the company coupled with the low cost and extraordinarily high customizability of the device making it superior for its application over all other products on the market right now. NVI is currently working to further the commercial capability of this technology through patent filing, further research and development, and business strategy development.

E-Tongue

Health and Safety Monitoring

Status: Prototype expected by 1st QTR. 2014; multiple funding grants pending

The Electronic Tongue was invented for food safety applications and environmental monitoring. It is used to detect heavy metals and other inorganic contaminants in water. The founder of this innovative technology is Pradeep Kurup from the Department of Civil and Environmental Engineering at UMass Lowell. This technology is faster, more cost effective, less invasive, and easier to use when compared with traditional, current methods. In addition, this technology is part of a multi-billion dollar market and has significant commercialization potential in environmental sensing and monitoring, food industry, homeland security, medical diagnostics, pharmaceuticals, agriculture, biotechnology, and personal care.

The global environmental sensor and monitoring market alone has been valued at $11.1 billion in 2010 and is expected to reach $15.3 billion by 2016.

More specifically, NVI believes initial market data demonstrates justification of demand, indicates potential competitive advantages and product fit:

- Demand for potable water outpaces population growth, particularly in emerging markets where delivery and storage can contaminate water because of outdated infrastructure
- According to Global Industry Analysis Inc. the water testing analysis instrumentation market is forecast to reach $1.86 billion by the year 2017
- Existing equipment is stationary, expensive and targeted for laboratory use—requiring highly-trained technicians
- Approximately 50% of all water testing is outsourced to commercial lab groups
- End-use industries are demanding a testing solution in response to quality and regulatory expectations of their products.
- According to Global Water Intelligence even the low-end water testing global market is $300-400 million and metal testing is currently cost prohibitive in this market

Dr. Kurup is currently working to achieve the following steps toward working prototype for heavy metal testing in water using a CVIP Translational Grant:

- Developing a modular sensor array configuration, to offer the flexibility of adding (or removing) different types of sensors based on the application
- Developing a compact electronic potentiostat for automated testing, data acquisition and analysis
- Incorporating new pattern recognition and analysis algorithms for more reliable and accurate predictions
- Designing a suite of algorithms based on the application and the ability of the user to choose the application
- Developing a user friendly interface that can be adapted or easily modified for different applications
- Mounting the sensing system in a small and light-weight, portable housing
- Testing, validation and demonstration

NVI has or is providing the following support:

- Assigned a New Venture Fellow with technology commercialization development experience to develop a technical action plan.
- Facilitated several mentor support meetings
- Worked with the internal founding team to socialize the idea of establishing a start-up around the technology
- Helped the team identify federal commercialization grants including I-Corp and SBIR for non-dilutive sourcing of financing
- Served as a co-PI for an additional commercialization grant that will drive prototype development
- IP prosecution, and management including FTO analysis
- Comprehensive business strategy development and market analysis

Wireless RF Passive Strain Sensor

Health and Safety Monitoring

Status: Prototype Development On-Going

Dr. Ramaswamy Nagarajan from the Department of Plastic Engineering at UMass Lowell has developed a new type of strain sensor suitable for wirelessly monitoring the mechanical deformation in tension, compression or bending using radio frequency based interrogation. It is a multi-layer structured wireless strain sensor that operates based on relative deformation of metallic sensing elements with potential for remote interrogation and substantial improvement of long-term performance. This technology is unlike any other due to both its wireless and passive capabilities which are used for monitoring structural integrity. In addition, it is cost effective and efficient by not requiring a clear line of sight, like most technologies do. This creates more accuracy and convenience when detecting tension, strain, compression, and more.

Strain sensing is one of the most critical aspects of structural health monitoring, which is the market being pursued by Dr. Nagarajan and his technology. The global market for non-destructive testing was estimated at $1.1 billion in 2008 with a growth rate of 3.2% over the period of 2008 to 2013. This means the industry is increasing at a steady rate. Typically, however, strain sensors are developed on spec and therefore the market is highly fragmented and no single technology has gained dominance in the market.

This technology was chosen for the New Venture Initiative due to its competitive advantages and capabilities:

- Robustness
- Easier way to detect (no man power needed after installation process)
- High value of applications in extremely challenging environments where neither line-of-sight nor the ability to constantly power up or maintain the sensors exists
- Replacement for conventional strain gauges

It differs strongly from what is on the market today and has the potential to make a great impact in the global market for non-destructive testing.

NVI will engage in the RFID Sensor technology by:

- Providing an internal grant of $12,000 for full prototype development including interrogator design and sensor design refinement
- Assignment of a NVI fellow for development of a technical plan of action
- Initial market analysis
- Pending internal grant results, development of an initial business strategy and early customer validation activities

Lidar Ground Satellite

Environmental Monitoring

Status: Beta Prototype Complete; Exploring Limited Production Opportunity

The faculty founder of Lidar Ground Satellite is Supriya Chakrabarti, from the department of Physics and Applied Physics at UMass Lowell. This Lidar Ground Satellite sits on the ground and sends out pulses of light that creates a 360-degree, 3-D picture. These pictures are used to measure the effects of radiation, erosion, and carbon in the environment. In addition, this device takes ground level scans which allow industrialists to detect how much radiation is making it down to the ground, how much carbon is in the surrounding area, how many gaps there are in a forest of trees, bushes and shrubs and how much biomass is in a certain spot.

Lidar Ground Satellite would revolutionize several industries including but not limited to science, environmental monitoring, lumber, and mining. Dr. Chakrabarti's colleague Professor Crystal Schaaf stated "when you're worrying about carbon and how much the trees are processing and how much they are holding in their timber, and realize that every time you cut down a forest, you are releasing that carbon into the Earths system, then it is important to figure out how much biomass is in that particular site."

New Venture Initiative is supporting and assisting the Lidar Ground Satellite through:

- Identification of early adopter markets and commercial applications
- Pricing and small scale manufacturing facilitation for market testing
- Forming an institutional partnership
- Defining an early test market strategy utilizing an early adopter research market for product testing and user feedback for follow-on commercial product development
- Further market analysis is required

Health Mobile Application

Software

Status: Provisional Patent Application Filed, Testing in Process

Professor Guanling Chen from the Computer Science department at UMass Lowell invented an energy-efficient continuous location tracking system that works with Android smartphones. This technology will be utilized to develop two mobile applications that target location-based behavior health markets. One of these mobile applications will be for monitoring the behavior of mental health patients and the other will be for weight management. This technology differentiates itself from other current technologies because:

- It is more accurate than current GPS trackers
- It requires low energy compared to other GPS trackers that are extremely power hungry
- Rather than using WiFi scan as the primary place entrance and departure detection, this technology uses accelerometer to determine when to turn on WiFi or GPS for recognition of a current place
- The benefits of using accelerometer are tremendous, as it is the most power-efficient sensor, often several magnitudes less than WiFi scan or GPS on modern smartphones
- It focuses on preventive care rather than acute care

New Venture Initiative (NVI) identified this technology as one with great market and commercialization potential in the growing mHealth market, which is projected to reach $23 billion in revenues by 2018. NVI will assist Professor Chen in:

- Market research
- Funding for further application development
- Conducting small scale user studies

Passive Software Testing

Software

Status: Technology Identified; Alpha Available for Customer Exploration

This passive software testing technology was developed by Guanling Chen, a computer science professor at UMass Lowell. It is a coarse-grained modeling method for automated GUI testing of contest-aware android applications. This technology offers a fast delivery mode (produces values in a very short time), lack of cost-effective testing solutions (extent of automation, ability to find bugs), and unique characteristics of mobile applications (context-based execution behaviors). This technology differentiates itself from other current technologies such as:

- Random GUI testing (Monkey)
- Record-and-Replay
- Script-based (Robotium framework, Monkeyrunner and many other tools)
- Model-based testing (construction of GUI model takes a long time)

The passive software testing competitive advantages include:

- It describes the GUI state from an interaction perspective, considering only the group constitution of a given GUI
- It can handle scaling issues when constructing the GUI model, so it is fast to run and scale
- It creates the possibility for further model aggregation processes

These advantages differ greatly from current sources of software testing. NVI will assist Guanling Chen and Jing Xu in:

- Furthering market research
- Identification of testing partners
- Funding further testing
- Identification of potential operations and market mentors

Weave

Software

Status: Project Identified; Existing Customer base; approx. $200k current revenue

Weave (Web-based Analysis and Visualization Environment) is an open source software service that already has active users and generates revenue. This powerful, interactive software platform developed by Professor Gorges Grinstein helps anyone explore, analyze, visualize and disseminate data online for any purpose, from any location and at any time. It allows the user to work on a project with hundreds of individuals in multiple locations simultaneously. It also allows data collection from different sources and integrates them into a bigger, more collaborative and connected encyclopedia of data for visualization purposes. In summary, this product is designed to:

- Provide meaningful visualizations of measures and indicators with an open-source, web-based system
- Support multiple types of users (from novice to expert, analyst to developer)
- Provide high degrees of interactivity, performance, usability and security

Weave is currently being used by 30 large scale organizations, 17 consortium members, and by a number of cities including Boston, San Antonio, Kansas City, Atlanta, Chicago, Seattle, Portland and Grand Rapids, as well as states including Massachusetts, Arizona, Ohio, Michigan, Connecticut, Rhode Island and Florida. The current focus of Weave is to enable non-profits and other small groups to use the technology in order to share and disseminate data, visualizations, and stories on their own web pages, in grant writing, and most importantly to help them affect social change.

New Venture Initiative (NVI) identified Weave as a technology with great market and commercialization potential beyond the non-profit sector. NVI supports this technology due to its unique offerings, proof of concept in the marketplace, and revenue generation. This initiative will assist Dr. Grinstein in:

- Further researching the market potential
- Forming a substantial founding team outside of the University with experience in open-source software and customization models
- Creating an independent spin-out company with the Weave technology focused on training, services, and customizations for mid-sized data sets