march madness for the mind

2008

An exhibition of the work of some of the nation's most promising innovative and entrepreneurial student teams

NCIIA 12TH ANNUAL MEETING • MARCH 20–22, 2008
NASHER SCULPTURE CENTER • DALLAS, TEXAS

About the NCIIA

The National Collegiate Inventors and Innovators Alliance fosters invention, innovation, and entrepreneurship in higher education as a way of creating innovative, commercially viable, and socially beneficial businesses and employment opportunities in the United States.

The program was founded on the premise that invention, innovation, and entrepreneurship are essential components of the higher education curriculum and vital to the nation's economic future. The NCIIA works with colleges and universities to build collaborative experiential learning programs that help nurture a new generation of innovators and entrepreneurs with strong technical and business skills and the tools and intention to make the world a better place.

About The Lemelson Foundation

The NCIIA is supported by The Lemelson Foundation, established by Jerome Lemelson and his family. The Foundation uses its resources to inspire, encourage and recognize inventors, innovators and entrepreneurs, with a growing emphasis on those who harness invention for sustainable development where the needs are greatest. The Foundation supports several grantees whose programs inspire and develop inventiveness in young people and foster appreciation for the critical role of invention and innovation in American economic, social, and cultural development. Understanding that invention and innovation play a critical role in improving living standards around the globe, the Foundation also supports programs to address the challenges facing the nearly three billion people trapped in poverty in less-industrialized countries.

About the Nasher Sculpture Center

Open since October 2003, the Nasher Sculpture Center is home to one of the finest collections of modern and contemporary sculptures in the world. The Center is located on a 2.4 acre site adjacent to the Dallas Museum of Art in the heart of the Dallas Arts District.

The museum was a longtime dream of the late Raymond and Patsy Nasher, who together formed a comprehensive collection of masterpieces by Calder, de Kooning, di Suvero, Giacometti, Hepworth, Kelly, Matisse, Miro, Moore, Picasso, Rodin, and Serra, among others, which continues to grow and evolve.

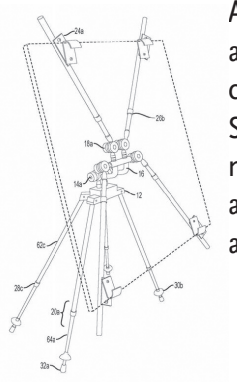
Renzo Piano, a world-renowned architect and winner of the prestigious Pritzker Prize in 1998, is the architect of the Center's 55,000 square foot building. Piano worked in collaboration with landscape architect Peter Walker on the design of the two-acre Garden. On display in the Galleries and Garden are rotating exhibitions of works from the Nasher Collection as well as special exhibitions drawn from other museums and private collections. In addition to indoor and outdoor gallery spaces, the Center contains an auditorium, education and research facilities, a café, and a store.

The Teams

The E-Teams represented at this year's March Madness for the Mind exhibition were selected through a competitive process from among the top-achieving teams in the NCIIA network.

Arachnovation

Marshall University



Arachnovation, a company coming out of Marshall University, has developed an adjustable, lightweight easel dubbed the Spider Easel. While many of today's easels cannot be adjusted, requiring different easels for each different type of artwork, the Spider Easel is customizable for the task at hand. It consists of four arms and four legs made from aluminum tubing, and the length of each individual arm and leg can be adjusted using compression fittings (much like a photographer's tripod). This allows artists to place a range of canvas shapes and sizes in a variety of positions and angles.

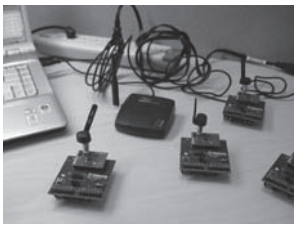
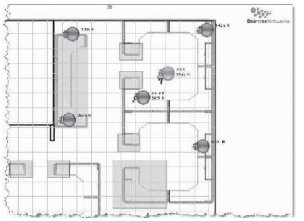
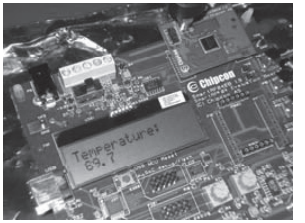
The Coconuts

Baylor University

Coconuts are an abundant, renewable resource in all coastal regions within twenty degrees latitude of the equator. These regions are generally economically underdeveloped and most are extremely poor. The purpose of this E-Team's project is to identify a variety of value-added products that can be manufactured from coconuts using simple, inexpensive technology. For now the team is focusing on two specific products: binderless particle board made from dried coconut husks, and filler for polymeric composites made from finely ground coconut shells. The team is developing a franchising business model created with Sustainable Rural Enterprises (SRE), a Philippine coconut co-op, and hopes that the technologies in development will allow farmers to increase the value of their coconuts from $0.05 to $0.50 each, increasing their annual income from $500 to $5,000.

Buzby Networks

Pennsylvania State University

The Buzby Networks team is developing wireless sensor network technologies for healthcare environments such as hospitals and nursing homes. A number of problems occur in healthcare facilities due to a lack of timely information; for example, locating patients and basic medical equipment in an emergency in nursing homes can be a challenge. In response, Buzby is developing a system that allows accurate, real time location tracking of both patients and equipment with small, low-power devices. The team has begun to develop relationships with local Pennsylvania nursing homes and health care facilities to help develop this and other wireless sensor solutions. The team is developing these prototypes using ZigBee®, the rapidly developing suite of wireless communication protocols that facilitate low-power, simple, and reliable wireless communication.

Extremely Low Frequency Seismic Detector (ELF SD)

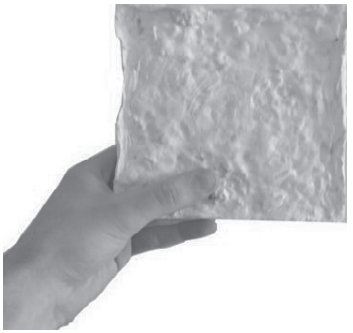
Virginia Military Institute

This E-Team is developing the Extremely Low Frequency Seismic Detector (ELF SD), a device designed to allow miners to communicate with rescuers on the surface in the event of a mine collapse. The device consists of an underground, battery-powered transmitter, a portable receiver, and custom software installed on a laptop. When a disaster occurs, ELF SD transmitters located in predetermined "safe rooms" within the mines will send low frequency signals through the earth. By correlating the signals from these transmitters with specific safe rooms, rescue officials will get precise data on the location and condition of the workers, making rescue easier and possibly saving lives.

Various mine communication products are on the market, but all depend in some way on a wired electronic network, which a mine collapse would obstruct and likely disable. The team believes its competitive advantage lies in the fact that the ELF SD system would continue to function in the event of a collapse. The team has successfully tested its first generation prototype in underground caverns to the depth of 300'; a second-generation prototype is being built that would extend the capability to the depth of 1000'.

Ecovative Design

Rensselaer Polytechnic Institute



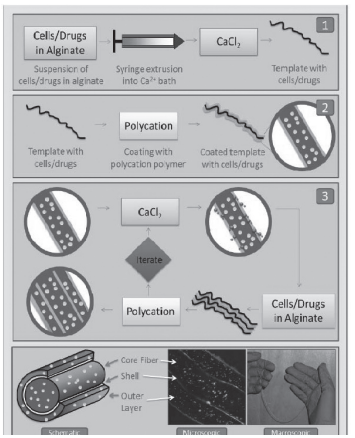
Household energy use accounts for one-fifth of the total energy consumed annually in the US. Better insulation would lead to a reduction in energy consumption, but today's most popular forms of insulation have significant drawbacks in the form of health risks, high cost, and large environmental footprints.

This E-Team, incorporated as Ecovative Design, is developing Greensulate, an environmentally friendly home insulation material made from mushrooms. Greensulate is a composite board made up of insulating particles suspended in a matrix of mycelium-growth-stage mushroom cells; this mushroom-based insulation is biodegradable, low cost, produces no pollution in the manufacturing process, and insulates as well as competing products.

The team has begun small-scale manufacturing of Greensulate in the Rensselaer Technology Park, producing wall batt panels for a series of pilot projects throughout the northeast.

Multilayered Hydrogel Microfibers for Cell and Tissue Engineering

Johns Hopkins University



Every year more than 500,000 coronary artery bypass surgeries are performed worldwide. While autografting (taking tissue from one part of the body and moving it to another) is the preferred technique, there are limitations to it: autografts cannot be obtained multiple times from one patient, and they fail when the patient lacks healthy blood vessels. Synthetic polymers are used when the patient has weak blood vessels, but not when making small diameter vascular grafts (less than five mm) due to risks of stenosis (abnormal narrowing of a bodily canal or passageway), and thrombosis (a clot of coagulated blood attached at the site of formation in a blood vessel).

To fill the need for small diameter vascular grafts for people with weak blood vessels, this E-Team is developing the Hydrogel Microfiber, a hollow, polymeric cylinder in which living endothelial cells can be encapsulated. Concentric layers can be added to this fiber, each containing its own cell population. Once implanted in the patient, the cells in the fiber grow over time and eventually become fully integrated with the vessel wall.

Flexible Prosthetic Vein Valve

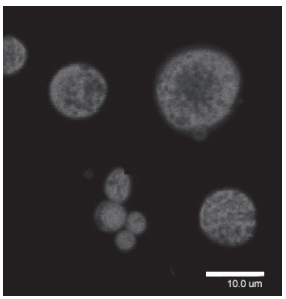
Georgia Institute of Technology

Over seven million Americans suffer from Chronic Venous Insufficiency (CVI), a painful and debilitating disease that affects veins in the lower extremities. Veins in the legs have one-way valves that usually function to prevent blood from pooling at the feet, but malfunctioning valves can cause leg swelling, ulcerations, varicose veins, deep vein thrombosis, and pulmonary embolism, which can be fatal. Current treatments for CVI include anti-coagulant drugs, bed-rest and compressive legwear, but these target the symptoms of the disease rather than the cause. The standard surgical treatment is valve transplantation, but it's difficult to find suitable donor valves, and the surgery is highly invasive.

This E-Team has fabricated a prosthetic vein valve that can be implanted in a lower-risk, minimally invasive procedure. The valve is flexible, biocompatible, does not form blood clots, and can be manufactured cheaply. The team has shown that the valve is operationally functional, and they are now performing animal trials, the results of which will be used to design a larger pre-clinical animal trial and eventual human clinical trial.

Rotavirus Vaccination via Oral Thin Film Delivery

Johns Hopkins University

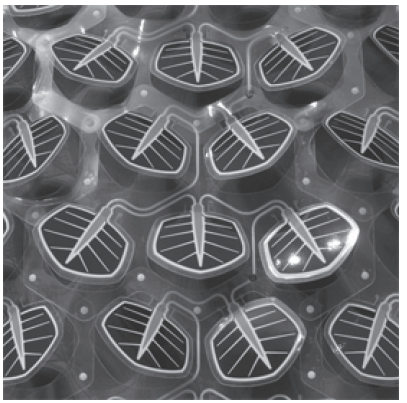


Rotavirus, a disease affecting children age five and younger, kills 600,000 people each year in the developing world. The virus infects the villi of the small intestines and leads to structural changes in the surrounding epithelium, leading to severe diarrhea, vomiting, high fever and dehydration. The mortality rate is relatively low in developed countries such as the US, but in third world countries where treatment options are significantly more limited, the mortality rates are much higher.

While rotavirus vaccines exist, they are currently delivered only in liquid form in a syringe, making the vaccine difficult to administer to infants and requiring expensive refrigeration to maintain. Building on thin film technology such as the popular Listerine Breath Strips, this E-Team is developing a method of delivering a rotavirus vaccine orally, on thin film. The team believes this design will have many advantages over current syringe-based methods, including simplifying storage and distribution due to the film's light weight and ability to be stored without refrigeration, and easier delivery to infants.

SMIT Design Group

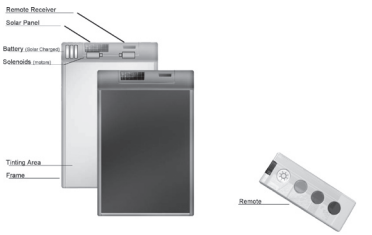
Pratt Institute



This E-Team is developing GROW, a hybrid solar and wind panel designed to resemble ivy vines. GROW consists of flexible photovoltaic foil molded to look like ivy and piezoelectric generators acting as "leaves"; the foil produces solar energy while the fluttering of leaves flicks the piezoelectric devices, generating wind energy. The team, the first to come out of Pratt Institute's Sustainably Minded Interactive Technology (SMIT) group, has partnered with a solar foil manufacturer, DayStar Technologies, and a piezoelectric manufacturer, Face International. The team intends the product to be an aesthetically pleasing alternative to standard solar panels and wind turbines, and plans to target multiple markets, including commercial, residential, and the developed and developing worlds.

Solar Shade

University of Notre Dame



This E-Team is developing the SolarShade, a solar-powered aftermarket window treatment solution designed to selectably tint a window at the push of a button. Using a remote control, the customer can adjust the level of tinting from clear to opaque. SolarShade itself is a lightweight, semi-rigid sheet of plastic made from offset planes of polarized material. The sheet can be manufactured to fit into any existing window track or frame, right over the window itself.

The team's first target market is the RV industry. Current RV skylights are shaded using remote-controlled blinds, a system that costs about $200. The team estimates that SolarShade can be sold for a quarter of the price. After RVs, the team will target the home skylighting industry, as well as home construction and office products. The team has developed two prototypes and filed a provisional patent.

TinyFi

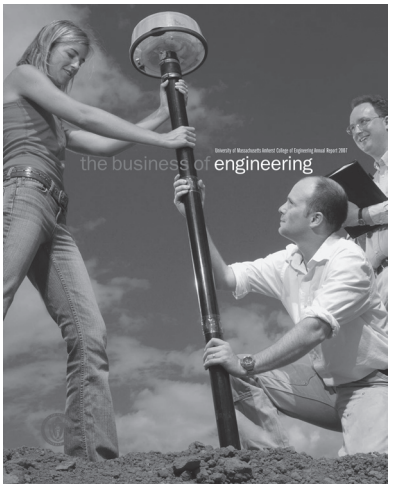
Johns Hopkins University

During mass casualty disasters, one of the urgent problems at the scene is the overwhelming number of casualties that must be monitored and tracked by the responders. For years, this task was conducted by medical providers through manual measurement of patient vital signs and then documentation of the information onto paper triage tags. This has proven to be overly labor intensive and prone to human error, especially when the medical providers become overwhelmed with patients.

This team has developed wearable patient sensors that detect patient heart rate and blood oxygenation level and wirelessly transmit the data to the healthcare providers. These sensors communicate using an infrastructure independent, wireless, ad-hoc mesh networking scheme; they can be instantly deployed at a disaster scene, even when all pre-existing channels of communication have failed. The team has developed multiple prototypes, encompassing the patient sensors and the software for storing, analyzing, and displaying the patient data to care providers.

Intelligent Ground and Structural Monitoring System

University of Massachusetts Amherst



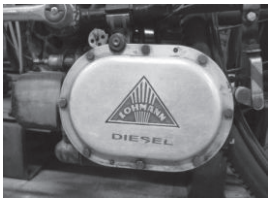
The best way to monitor the condition of load-bearing structures (bridges, tunnels, earthen dams, and levees) is to install sensors to measure things like movement, vibration, and water saturation. A typical instrumentation set-up uses a number of individual sensors to monitor each different parameter at each different location. This can become costly and inefficient, however, if many parameters need to be measured at once.

This E-Team proposes a solution with the Intelligent Ground Condition Monitoring System (IGCMS), a sensor technology that can assess multiple parameters simultaneously. The IGCMS provides detailed information regarding structural stability while reducing the number overall number of sensors. The device consists of a sensor driver attached to a sensor rope. The rope is flexible like a garden hose and takes measurements all along its length. Sold by the foot, the rope could be used as a stand-alone device or in groups of tens, hundreds or thousands to provide a widespread, comprehensive monitoring system.

The sensing technology has been successfully demonstrated in a laboratory environment. The beta prototype is currently under development, and should see field-testing soon.

Small Engines: A Technology Alternative for BOP Farmers

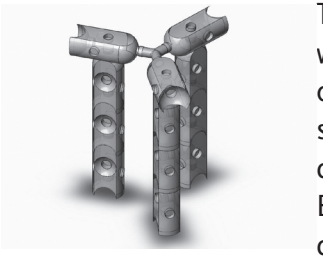
Colorado State University



This team is developing a small engine (SE) that meets the water pumping and electricity generation requirements of small and marginal farmers in the developing world. The team, partnered with two groups developing two different types of SEs, is focused on developing a fuel-efficient engine that runs various fuel-types, including biodiesel and straight vegetable oil. The team's engine would be used to power treadle pumps, which bring up water for farmers to irrigate their land.

H.DuO

Rensselaer Polytechnic Institute



This team is developing connectable plastic bottles that can be used to build whatever a person desires, from furniture to housing. By encouraging reuse of the bottles, fewer will be discarded into the trash, decreasing pollution, and since the bottles are not only a means of transporting water but also a means of construction, they can be used for housing as needed in the developing world. Beyond housing, the bottles can be used for various applications at home, from chairs to bookshelves.