

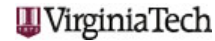
Finalists



A New Cellular-Phone Antenna to Solve the Cellular-Phone Hearing-Aid Interference Problem

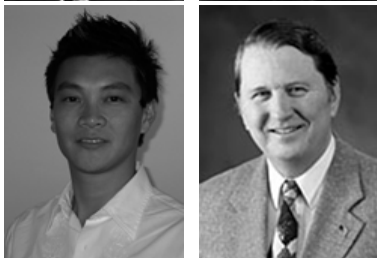
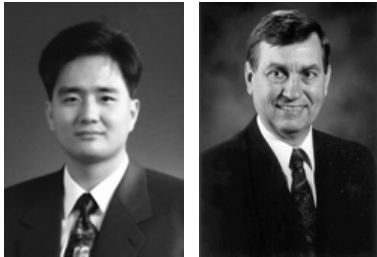
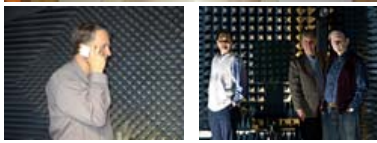
Team Members

Taeyoung Yang (lead); William A. Davis; Warren L. Stutzman; Minh-Chau Huynh



Demographers estimate that there are approximately 28 million people in the United States who suffer from hearing impairment that 5.6 million of them wear hearing aids. The total number of people wearing hearing aids worldwide is much larger, but no statistics are available. Unfortunately, these people are troubled by a buzzing noise in the hearing aid caused by interference from digital cellular phones. The resulting buzzing noise is overwhelming and effectively prevents the user from hearing the cell-phone audio. This is a near-field interaction/interference problem between the cellular phone and the hearing-aid. Similar interference problems have been reported for electric wheelchairs and pacemakers. Hearing-aid compatibility (HAC) has been regulated by the Federal Communications Commission (FCC) in the United States since 2008. A few solutions have been reported in the recent literature, but the solutions typically address the regulated specifications, not the fundamental cause of the interference.

Initially, we addressed this problem in a sponsored research project for a cell-phone manufacturer. While working on the project, we found many anecdotes from people, saying "My son has the exactly same problem.", "My grandma will be very happy if the problem can be solved.", etc. With this spark of hope, we have continued and extended our work beyond the initial sponsored project. Later, we realized that the same solution approach can be applied to other near-field interaction problems, and, thus, many more people can be helped.



Bedside Instrument for Pressure Ulcer Diagnosis – The Rubitect

Team Members

Sanna Gaspard



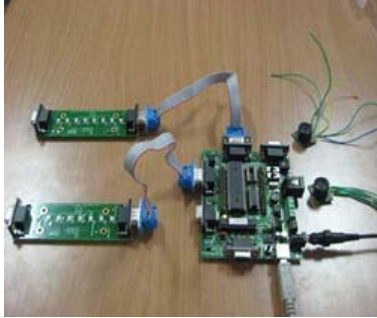
Pressure ulcers (PUs) are a health, and a quality of life problem that plagues the healthcare community and patients around the world. Pressure ulcer (PU) prevention is one of the greatest challenges faced by caregivers and long term care facilities. PUs appear primarily in hospitals, nursing homes, and among the elderly and in people with disabilities, paralysis, prosthetic limbs, peripheral nerve disorders, and those living with diabetes. PUs have an incidence rate ranging from 10-17% in acute care, 0-29% in home care, and 2.3-28% in institutional long-term care (LTC) [1]. The costs associated with healing PUs and worker productivity losses exceed \$2 billion a year in America. The cost to heal a complex, full-thickness PU in 2006 was as much as \$70,000; the cost for a less serious PU may range from \$2000 to \$30,000 [2]. Therefore PU management is focused on early detection and prevention. However, the subjective nature of the standard clinical diagnostic tools for PUs, tactile skin inspections and the visual observation of changes in skin make it difficult to accurately and reliably diagnosis early stage (stage -1) PUs. To address this problem I am developing a low cost easy to use point-of-care bedside instrument that can provide accurate and reliable layer by layer diagnosis of early stage PUs,



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independent of skin pigmentation, by acquiring visible and near IR light reflectance spectra from the skin at various depths as a function of applied pressure – providing a device-assisted quantitative PU diagnosis that will be reliable for all patients.



BLIND AID – providing thermal tactile information to the blind

Team Members

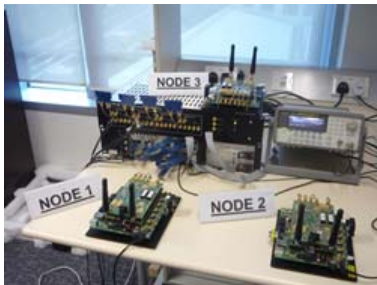
Vasavi Bhaviri Setty (lead); Harsha Ravi; Shruti Sridhar; Ramya Devarajan



There are many ETA [Electronic travelling aids] being developed for the blind presently. Most of the focus has been on using GPS in recent times. While this provides a great advantage in triangulating the position of the obstacle, it also increases the cost of the device. Another aspect of such aids is the use of auditory feedback to provide information to the blind. According to recent estimates, every fourth blind person is most likely to be deaf too. So these constraints propelled us to think for a novel solution which would help us invent a device whose cost is really affordable to the blind and also presents the tactile information to the blind apart from using vibrations. Thermal pinging is a novel way of providing tactile information. The other sensory organs of the blind are much quicker to respond to stimuli than that of an average human. We decided to use this to our advantage. Presenting auditory feedback also has a prominent disadvantage of preventing the blind from listening to their surroundings, while vibrations have the disadvantage of not quantizing the distance of obstacle from the position of the



blind. These were the main constraints in the present aids [ETAs] which propelled us to invent BLIND AID - A THERMAL TACTILE TO THE BLIND.



Cognizant Disaster Alarm System (CDAS)

Team Members

Vivek Bohara



The human race has evolved at a very fast pace over the last century, moreover so in the last decade. Information constitutes the core of this revolution. Businesses today can take faster and better decisions aided by technology. Social networking, Business intelligence, ERP solutions etc... have fundamentally changed the dynamics of business and the metrics of competitive advantage.



However, sadly in spite of these technological advances we cannot prevent loss to property and life caused due to natural disasters. To state some facts - 1.5 million (Source: "Reducing Disaster Risk: A Challenge for Development", United Nation Development Program Report, 2004) people were wiped out between 1980 and 2000 due to natural disasters such as earthquakes, volcanic eruptions, tropical storms, tsunamis and hurricanes. Additionally, the loss to property and financial setbacks to the economy are catastrophic.

We cannot challenge the forces of nature nor can we do anything to control it. The best that we can do is to reduce the impact of such disasters, by informing the right populace in a timely manner and in the most effective fashion. This article mainly focuses on an alarm system, henceforth referred to as Cognizant Disaster Alarm System (CDAS), which can detect a natural calamity in its nascent stage and further can transmit this information using GNSS [Global Navigation Satellite Systems] and cooperative networking between the mobile handsets.



Creating SMILES - building the nation

Team Members



Santosh Poudel (lead); Neelu Shrestha; Sibjan Chaulagain; Surya Thapa; Dharendra Kumar Chaudhary

During the past years of painful internal conflicts, people had to leave their homes, jobs and properties. Large number of students left their studies uncompleted and many families lost their earning members. The last decade pushed our country, Nepal, backwards into the darkness of doomed economy, increasing poverty and deteriorating human rights records. Moreover, due to uneven landscapes in the rural places the government has been facing serious challenges trying to meet the ever increasing needs for basic facilities. This situation is proving to be a serious threat to the development of the country

These kinds of predicaments have created many pressing national issues needing immediate addressing. SMILES has outlined these as poverty, illiteracy, deteriorating human rights records and public health as well as the global issue of climate change affecting Nepal immensely.

We, the members of the SMILES team, want to do something ourselves in order to improve the future of the country, and not just wait for the government to take actions against these major problems. We are all engineering students at Tribhuvan University. Hence the most intriguing aspect of the project is the way we have formulated it. Creating SMILES - building the nation is all about Science, Engineering, Technology, Humanity and Prosperity. What we believe is that science, engineering and technology combined with social and economic perspectives of human lives will indeed create smiles and build the nation.

Design & Fabrication of 3 Blade Vertical Axis Wind Turbine

Team Members

Gurpreet Singh Wallia

Major problem with Wind Turbines lie with the available wind speeds in a particular region. Low wind speed areas are not left with choices except solar panels which are quite expensive.

Another problem is yaw mechanisms which are needed to align conventional wind turbines with wind flow to tap maximum energy. So I've developed wind turbine which is capable of tapping low wind speeds, doesn't need any yaw mechanisms plus lot many other technical advantages mentioned in the solution part.

Digital agriculture and precision farming, modernized methods to improve an ancient lifestyle for the betterment of mankind and the land he inhabits.

Team Members

Shantanu Pal

Precision farming is an integrated agricultural management system incorporating several technologies which collect data, such as nitrogen, phosphorus, insect counts, and disease presence at precise locations in fields to optimize inputs, reduce waste, and generate higher yields. The technology often involves the use of GPS and remote sensing for data collection, GIS for data processing and analysis, and variable rate technology for implementing ideal models. In other words it is "Digital Agriculture" involving large scale farm level mapping, comprehensive data base creation on required resources generated through space based inputs and field observations as well as making a detailed plan for maximizing yield and reducing costs on inputs using the decision support system. The concept of precision farming is increasing in developed countries due to large farm holdings and fully mechanized agricultural operations. With the present technological developments and availability of higher resolution multi spectral sensor data, there is scope for adopting precision farming for cultivation of high value, commercial produce and flowers, etc., in developing countries including India. The "site-specific" information entered into the computer becomes a "spatial map". Using this map, farmers, growers, and researchers can draw links between soil characteristics, fertilizer application, plant health, and yield. Accurate spatial maps provide guidance for precise 'variable rate' application of pesticides and other agricultural chemicals. This decreases the amount of chemical inputs used. High resolution Digital Elevation Models (DEM) also forms a component of the database, which provides the appropriate description of the topography .



Dr. Algae: Bio-indicator for heavy metal pollution alert & a rapid test system



Team Members

Wendian Shi (lead); Cheng-hao Chien; Yu Zhao; Hongchao Zhou; Beth Stauffer



Do you trust what you are drinking? Is water as clean as it seems? We drink water every day. However, an invisible killer may be hiding in the innocent-looking liquid: heavy metal pollution. Excessive levels of heavy metals, such as Cadmium, Mercury and Lead, could severely damage human organs, bring unbearable pain, and cause serious diseases, even cancers.

Heavy metal pollution in water is a global health threat. In 2006, Haina, Dominican Republic, the waste water from a factory caused lead poisoning of almost the whole local population, 85,000 victims. In developing countries (China, India, African counties, etc), countless cases emerge every day due to the growing industrialization, impose huge threat to the health of millions.

One critical problem is the lack of the alert system when pollution happens, so that humanity accidents that people drink contaminated water without alarm happen frequently. In 2009, nearly 1000 children in Fengxiang, China, were severely poisoned because of drinking lead polluted water over a year. Similar case happened in Mae Ku, Thailand, where 7,000 farmers were cadmium poisoned. The current methods for monitoring the heavy metal pollution, such as WHAM and NICA, are costly, making large scale implementation unrealistic. A low-cost and real-time alert technology to monitor the pollution is urgently needed to avoid such tragedies.

Herein, we propose using algae as the bio-indicator for heavy metal pollutions. Our portable test system can make early alerts by monitoring the characteristic responses of algae to the heavy metal pollutants in real-time and with low-cost.

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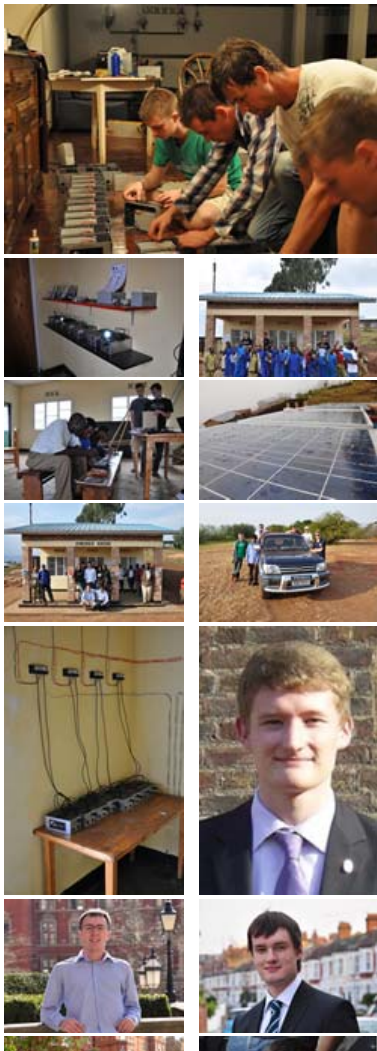
Team Members

Momammad Mansoor Hamayun (lead); Manuel Tragut; Alexander McLaren; Alexander Rybka; Christopher Baker-Brian; Christopher Hopper; Hemal Mehta; Laurent Van Houke; Matthew Dayton; Ndubuisi Kejeh; Thomas Luth; Varun Sharma

One of the major issues in developing countries is rural electrification. Due to socioeconomic reasons it is often not possible to implement a full-scale national electric grid. There is, however, a big demand for energy and electricity that needs to be met.

Currently many remote communities are without access to electrical power and enormous effort is undertaken in order to satisfy energy needs. Walks of several hours, multiple times per week are not uncommon to charge mobile phones or batteries.

Lighting is typically provided by kerosene lights and candles. Due to the long supply chain, the price of these goods has increased considerably by the time it reaches the end-user. Furthermore burning these substances indoors produces toxic smoke that is inhaled by the inhabitants. Because the dependence on sunlight the evening hours cannot be used for economic activities or education. In developing countries a significant amount of the family income is spent on its energy needs.





Energizing the community – thermoelectricity powered lighting using Seebeck effect

Team Members

Dileepa Karunaratna

Even though humankind has made remarkable technological achievements, still there are large number of students who use kerosene lamps to study, (fatal accidents caused due to

this aren't rare) and communities without access to electricity.

Meanwhile, expanding the grid is hard to some of these places due to the need of carrying out large scale projects which demand high capital costs. Such projects have to be initiated and implemented by governments in those countries which often suffer by unstable political situations and corruption. Although off grid solutions are preferred in this context, each of the existing off grid solutions have a number of constrains which hinders making breakthrough in rural electrification and lighting up remote areas.

Both photovoltaic solar systems and wind energy aren't readily available throughout the day and therefore needs an energy storage system of considerable capacity (deep cycling of batteries reduce battery lifetime). Other than that, photovoltaic generation suffers from poor efficiencies while requirement to use induction generators which requires capacitor banks and having mechanical parts prone to repair and maintenance, becomes disadvantages of wind energy.

Rural electrification is a prevailing challenge in many Asian and African countries which causes students and general public to undergo numerous hardships which intrigued us to ponder about a solution. And we were particularly motivated by couple of articles in ieee-spectrum, one about using organic photovoltaic lighting solution using white led to replace kerosene lamps, and the story of Dean Kamen going offgrid.



HIGH SPEED BIO-GAS ENGINE GENERATOR SET FOR RURAL AREAS

Team Members

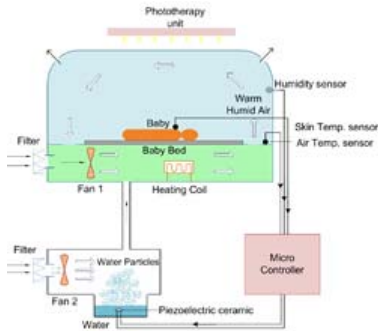
Karthikeyan Ramasamy (lead); Japaprakash

In remote rural areas where the electricity board cannot give electricity due to high transmission cost. But there are lot of decomposable solid and liquid wastes available that can be decomposed into Bio-gas that contain about 50-75% of Methane (depending on the type of waste). Methane has high heating value of 44-50Mj/Kg and it has a high Octane number of 107. Now it is used only for cooking and producing steam in boilers. This can be used as a fuel for IC engines but when it is used at atmospheric pressure the power generated is low and the speed of the engine is low. When the Bio-gas is compressed and ignited in an IC engine the output power is equal to a petrol engine.

But a separate compressor is not available in rural areas where electricity is not available and also it makes the system costly. When a latest IC engine is started in petrol the normal piston speed (without any acceleration) is about 2500-3000 rpm. When an axial flow compressor is connected to the crank shaft and rotates at this high speed it will compress the bio-gas to about 1.7-1.85 bar. Then the petrol can be turned OFF and Bio-gas is turned ON then the Bio-gas is ignited by spark plug and power is generated. Then a part of the power is used by the compressor to compress the Bio-gas and the rest is used by the generator to generate electricity.

When Bio-gas is combusted the emission contains only carbon-di-oxide and water in vapour form. The carbonmonoxide is eliminated about 90%. Thus the emission is pollution free and ecofriendly. The remaining products after decomposition is rich in nitrogen contents which can be used as a fertilizers for

agriculture. The organic decomposable waste is available throughout the year.
 An 100cc IC engine can able to produce 3bhp(2.2Kw) of power while running at a speed of 3000rpm.



Low cost Neonatal Incubator : An optimum solution for premature newborn babies in third world countries

Team Members

Dihan Md. Nuruddin Hasan (lead); Md. Nadim Ferdous Hoque; Md. Abdul Kader Sagar; S.M. Shahrear Tanzil

A major problem in third world countries is high mortality rate of premature babies which is the direct outcome of lack of adequate number of Neonatal Incubators. This mortality rate is again a major cause of population increase since parents feel insecure due to neonatal death and are used to take more children. Statistics show that in Bangladesh 65 out of 1000 babies are died within 1 month among which about 40% are died within 24 hours. The main causes of neonatal death recorded were birth asphyxia (38.6%), low birth weight (27.8%) and infectious diseases (14.7%), including acute respiratory infection (6.8%), jaundice (3.4%), diarrhea (1.6%), sepsis (1.6%) and tetanus (1.3%). Premature babies lack the body fat necessary to maintain their body temperature, even when swaddled with blankets. Therefore, incubators or radiant warmers are used to keep the babies warm. Again, about 80% of premature babies have jaundice during the first few days of life. Even those who are not born prematurely will have jaundice for at least a few days or weeks after birth. These two major problems namely low birth weight and jaundice can be solved only by using neonatal incubator having photo therapy unit. In spite of such necessity Neonatal incubator is not sufficient in the Health centers and Hospitals of Bangladesh due to high cost namely US \$2000 at least. Though some expensive clinics and some urban hospitals can give support regarding this, a vast part of the village people are lacking from the benefit of costly neonatal incubator. Very recent news on this burning issue



intrigued us most which says that even the govt. hospitals in Dhaka, capital of Bangladesh, don't have active incubators for various reasons among which high cost is a major concern (<http://tinyurl.com/thedailystarnews>) and thus we were convinced to make an easy solution which will be simultaneously cost effective and low power consuming and thus working for the welfare of mankind.



Neonatal Automated Physiotherapy (NAP)

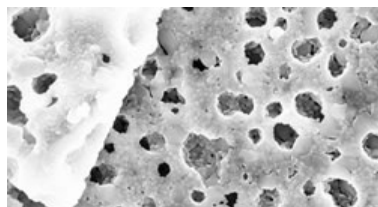
Team Members

Sanna Gaspard

My technology, the automated infant physiotherapy (NAP), addresses the problem of preterm infant weight gain. Four million infants are born in the US yearly; 12% or 500 thousand of these infants are born premature (1). Yet preterm infants comprise 68% of the total US infant mortality rate (1). Preterm infants are at increased risk for complications and death due to their low birth weight and additional complications. The seriousness of premature births was brought into sharp focus by the Institute of Medicine which estimates that preterm birth costs the US more than \$26.2 billion in 2005, and by the PREEMIE Bill

(S. 707/H.R. 2861) signed by the US senate in 2006 to expand research into prematurity.

Scientific research has shown that a 15 minute massage 3 times a day for 10 days leads to increase weight gain and improved overall health- increasing an infant's survival rate by up to 30%, yielding a 6 day (on average) early discharge from the hospital (2). Despite its many benefits infant massage is not widely used in hospitals, where a certified trained nurse is required, due to the current nursing shortage, which is projected to grow to 260,000 nurses by 2025 (3). To address this problem to make this potentially lifesaving therapy more accessible to hospitals, I have designed a patent pending technology, an automated instrument to deliver infant massage. I became a champion of this therapy and ideated the technology after completing a summer research internship on infant massage at Jackson Memorial Hospital.



nLung: Novel nanoporous coatings to reduce harmful effects of toxic gases

Team Members

Pradyumna



Ayyalasomayajula (lead); Harsha Kasi;

Prabitha Urwyler

UNI
BASEL

Eco balance is severely disturbed by the extent of existing air pollution. Toxic gases and volatile organic compounds (VOCs) are recognized as dangerous pollutant compounds. Besides being carcinogen agents and contribute to ozone production in the troposphere, the major problem arises from their high resistance to physical, chemical or biological treatments. Levels of NOx (oxides of nitrogen), SO2 (sulphur dioxide) and CO (carbon monoxide) are increasing along with industrialization. There is an urgent need for a remedy to these continuously mounting toxic gas emissions all around the world for a healthy environment for our future generations.



PALAPA : Development of an Energy, Economy and Health Independent Region in Indonesia

Team Members

Mohammad Ikhsan (lead); Ramadhani Wahono; Giri Kuncoro; Ferdaus Ario Nurman

It was the generosity, the kindness, and the spirit from one man that sparked the beginning of this unforgettable journey. This man, the man we called Pak (Mr.) Mamo, sold noodles in our campus. Everyday, he would come to our student organization with the weight of his stove, ingredients, and, of course his noodles, all, carried on his shoulder. But, everyday he would come with his spirit and his smile. It was Pak Mamo who showed us that outside our campus wall, there were still thousands of villages who did not enjoy the basic infrastructures as those in our city. A two hour drive followed by two more hours on foot took us to his village in Garut, Indonesia. A village whose children still slept by candle light at night, whose sick had to travel the whole four hours to get proper health care, and did not have proper access to books and educational facility.

After our first visit there, we were determined to return for another visit. Next time, we would bring a change in the form of our project, PALAPA. Our project focused on solving the problems that many villages faced in Indonesia, poor infrastructures that include electricity, health care, sanitation and education. Overall, these problems affected the general welfare of the village and in Pak Mamo's village the welfare was very low. Through the implementation of multiple engineering disciplines, we were determined to increase the welfare of the village and the region around it.



