



Endless Possibilities

It wasn't that long ago that cell phones were used simply to make phone calls. Today, they're hand-held computers equipped with audio, video, Internet and GPS capabilities, touch screens and thousands of other applications. Users can even rotate their phones to show the screen in a portrait or landscape orientation.

One of the key technologies used to give the latest phones and many other electronic devices their impressive capabilities is called MEMS (Micro Electro Mechanical System). MEMS devices are very small signal transducers, that when integrated with electronic circuits, enable a system to interact with the surrounding environment. Such interaction is an essential component in most smart devices.

Dr. Reza Abdolvand, assistant professor of electrical and computer engineering, is leading a research project in OSU-Tulsa's Helmerich Research Center that focuses on MEMS sensors. He says that as technology continues to progress, researchers are continually looking for ways to develop smaller, cheaper and more advanced devices.

"The possibilities and applications for this type of sensor are endless," Abdolvand said. "It's the technology of today and if we can advance the level of resolution and sensitivity with our sensors at a lower price tag, then it's going to greatly impact the future generations of electronic systems."

Abdolvand and his colleague, Dr. Daryoosh Vashae, an assistant professor of electrical and computer engineering, supervise a team of four graduate students who currently work on a three-year project that includes the design, fabrication and testing of nano-engineered infrared sensors that can be used for multiple applications and devices, such as night vision goggles, medical diagnostics and thermal imagers for search and rescue missions.

The project is in collaboration with Amethyst Research, Inc., an Ardmore-based corporation specializing in materials and manufacturing processes for high-performance infrared imaging devices. The partnership was created through a more than \$1.5 million funding award from the Economic Development Generating Excellence (EDGE) initiative.

The EDGE initiative is dedicated to supporting applied research technology commercialization that will lead to more technology-based, high-paying jobs in Oklahoma. EDGE projects are designed specifically to increase the number and

growth of technology companies in the state, leverage funding into Oklahoma research intuitions and stimulate Oklahoma's economy.

"This innovative collaboration clearly demonstrates how university-industry partnerships can yield exciting new resources," said Howard Barnett, president of OSU-Tulsa and OSU's Center for Health Sciences. "Dr. Abdolvand's research has the potential to transform how infrared sensors are manufactured and used in applications from law enforcement to healthcare. It's a perfect example of the cutting-edge research our faculty and students are conducting at OSU-Tulsa."

Abdolvand says infrared sensors have been around for years, but in many cases the devices are very expensive to produce, in part because of the material cost and the very low temperatures of operation. His goal is to create smaller and more sensitive devices that operate at room temperature, which will enable the infrared cameras to be produced less expensively and operate more efficiently.

"We're trying to push this type of technology to the edge of sensitivity so we can get the best results and still keep the price in a range that is suitable for consumer devices," Abdolvand said. "If we can bring down the cost, there will be a lot more demand for this type of technology."

Abdolvand said applications could include a more streamlined and less expensive version of infrared goggles that would be used by fire and police rescue teams when searching for people in smoke-filled, burning buildings, dark rural areas and open water at night.

Infrared sensors can also be used for medical diagnostics, specifically in early breast and skin cancer detection. Abdolvand said, again, that this technology is already in place but it is not as popular as other testing procedures that are less expensive, but more invasive.

"We are developing this technology with the hope that it can be transferred to a company, like Amethyst, and they can hire local people who are going to build these devices and create revenue that stays in Oklahoma," he said. "It's these types of collaborations that can make economic growth happen."

Trish McBeath

Above: Dr. Reza Abdolvand in his lab in OSU-Tulsa's Helmerich Research Center. Jonathan Gonzales, a Ph.D. student and part of Dr. Abdolvand's research team, works in the background. Photo courtesy of OSU-Tulsa.