

Boilermakers Announce Bearing Technology Breakthrough

Student research project at Purdue could revolutionize predictive bearing failure

Jack McGuinn, Senior Editor

Bob Griese. Len Dawson. Drew Brees. Anurag Garg. Anurag Garg?

No doubt about it—a mention of Purdue University typically elicits thoughts of All-American college quarterbacks going on to become NFL gun-slingers of renown. *Anurag Garg?*

No, you won't be seeing him on your friendly flat screen on fall Saturdays pitching the pigskin around. But remember that name — as well as the names of fellow student colleagues and co-inventors Lokesh Gupta, Andrew Kovacs and Christopher Ochynski — for they, along with Garg, are the Bearing Analytics team — a Purdue Boilermakers juggernaut of a different brew entirely. (Garg, Kovacs and Gupta are doctoral candidates in the school of electrical and computer engineering's adaptive radio electronics and sensors group; Ochynski is a senior in the school of electrical and computer engineering and a first-year student in the MBA program at the Krannert school of management.)

And no, they haven't helped the storied university in West Lafayette, Indiana win any Rose Bowls. But they did, for example, take the student Grand Prize at the prestigious Midwest Clean Energy Challenge in Chicago this past February (\$100,000 and \$10,000 worth of legal services); finished in the money (\$1,250) in the April Rice Business Plan Competition in Houston; and also took the Best Written Business Plan Award (\$3,000). The Rice success qualifies the team to compete in the national competition this month in Washington, D.C. But this should come as no surprise as, leaving college football aside, Purdue has long nurtured its well-deserved reputation as a top-flight engineering school.

The hard work that has gotten the Bearing Analytics team this far was in

their developing a patent-pending sensor — *fixed directly onto the bearing cage* — that monitors bearing performance with a predictive accuracy that, until now, was virtually impossible. While conventional bearing sensors that monitor real-time bearing performance are mounted outside the bearing, which limits the ability to determine internal conditions, “The Purdue-developed technology allows a sensor to be placed directly on the bearing cage, which is the source of temperature and vibration fluctuations,” explains Anurag Garg, a doctoral candidate in Purdue's School of Electrical and Computer Engineering. “As a result, (the sensor's positioning) provides a more reliable indicator of impending bearing failure and has a better response time than any commercial sensor available on the market.”

Like most things worth having, the new sensor technology took time to develop; no eureka moments here. Garg relates that “The technology was developed over numerous iterations

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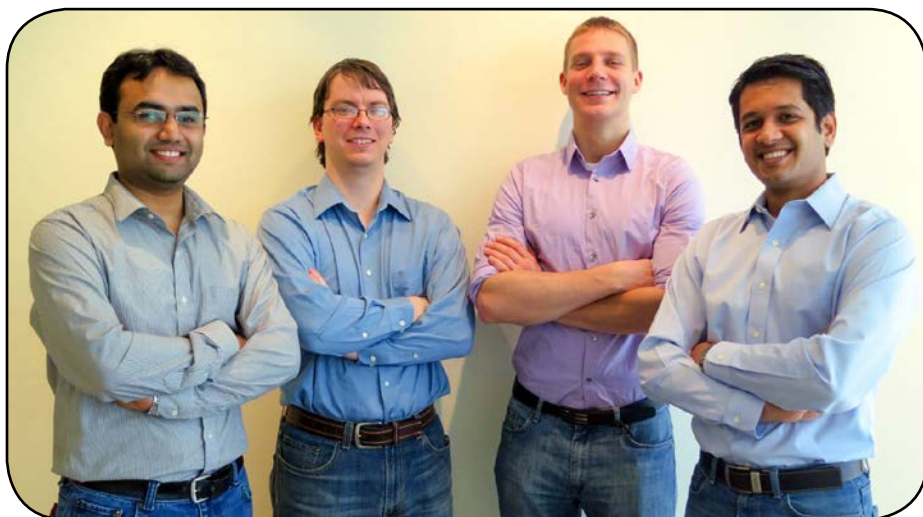
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and incremental developments (at Purdue) over seven years of research.

Also deserving recognition for their roles in the project are the team's “mentors,” who the team credits with “guiding the development of the technology”: Professor Dimitrios Peroulis, School of Electrical and Computer Engineering and School of Mechanical Engineering; and Professors Farshid Sadeghi and Douglas Adams of the School of Mechanical Engineering.

During that timeframe, Garg states that “The sensor has been reliably tested in high temperatures — up to 800°F — and in turbochargers with speeds up to 100 rpm. (These conditions) cover nearly all applications, at least as far as industrial machinery is concerned. Of course there are some applications (Dept. of Defense, etc.) where additional research and testing may be required.”

The sensor would appear to be a major breakthrough in the technical art of predicting bearing failure and a legitimate leap beyond existing manu-



The Purdue University Bearing Analytics Team (left to right): Lokesh Gupta, Andrew Kovacs, Chris Ochynski and Anurag Garg. The team's business plan is in support of a patent-pending, predictive bearing maintenance technology for a sensor that mounts—in unique fashion—directly onto the bearing cage, thus providing the ability to predict impending bearing failure sooner and more accurately than commercial sensors currently on the market (courtesy Bearing Analytics).

facturing technology. If it works as advertised, it will have a far-reaching impact on any number of industries and manufacturing processes, and for both OEM and downstream users. Right now, however, the Bearing Analytics team is focused on wind turbine gearboxes— already a singularly significant slice of the predictive maintenance market.

“Wind turbine gearboxes are our primary target market for (roll-out),” Garg says. “However, the applications for this technology permeate nearly every industrial segment (owing to the fact that bearings are a fundamental component to nearly all mechanical systems). Some of our potentially most profitable markets include bearings used in the manufacturing industry, and rotary systems (e.g., pumps and motors used in the oil and gas industry).”

And in case you were wondering, federal agencies have some skin in the game as well. Indeed, while the sensor has drawn the expected, considerable interest from (un-named for now) numerous companies across various industrial segments, Garg reveals that “The research was completed through grant funding (from) USAFR (U.S. Air Force Research Lab) and NAVAIR (U.S. Naval Air Systems Command).”

Garg also points out that an enhanced capability to forestall and/or prevent bearing breakdowns will alert workers to “take early corrective action (that) could improve safety conditions for (personnel) while “(reducing) operational downtime and increase bearing life.” (One can almost see the smiles on the faces of plant superintendents and QA managers, for example, once this new technology is in place. And the potential

And as every successful Broadway play has a deep-pocketed “angel” in the wings, the Bearing Analytics Team has the Purdue Office of Technology Commercialization. The office oversees one of the most extensive technology transfer programs of any premier research universities in the country. The services provided by this office support the economic development initiatives of Purdue University and benefit the university’s academic activities.

One last detail; mention counterfeit bearings to anyone in the industry and you will reap a wide range of — given their vehemence — not-for-publication responses. But keep hope alive— counterfeiters’ comeuppance might possibly be at hand. Garg makes no promises on whether the new sensor is up to the job of ferreting out illegal knock-offs, but allows that, “In theory, yes, this might be possible. However no tests have been conducted to vali-

date that hypothesis. It is something that can be explored in the future to create additional value.” **PTE**

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