Industry-University Partnerships for Undergraduate Engineering Internships

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Abstract

Cooperation between industry and academia is essential due to increasing global competition and rapid changes in technology. The establishment of undergraduate engineering internship programs can help strengthen industry-university partnerships. These programs enhance undergraduate engineering education, as students learn how to transform their theoretical technology background into practical design applications. In addition, a good internship program will encourage the company to pursue further projects with the university.

This paper describes an undergraduate internship partnership between The University of Tulsa and Geophysical Research Co. (GRC) that was funded by the Oklahoma Center for the Advancement of Science and Technology (OCAST). The results of the program have yielded research collaborations between the university and the company that will lead to future funded projects.

Introduction

A partnership between industry and academia is essential for all engineering fields. The resulting collaboration benefits both the participating companies and universities in projects that require the combination of research and education with practical commercial projects. An example is undergraduate engineering intern programs, which provide practical experience and developmental maturity for the participating students [1]. The exposure to a practical engineering environment teaches students how to apply their theoretical coursework background to actual product development. Also, students learn about the interaction of engineering design with corporate concerns such as project managements, finance, and manufacturing.

Employers are more likely to hire engineering students that have some experience and have acquired a basic knowledge of their specific industry. In additional, the internship experience will increase students' confidence in their engineering abilities, which will increase the likelihood of the students' success in their first years in industry [2].

In order for an internship program to be effective, the university must take an active role in the quality and administration of the intern's experience, and the intern's employer must take an active role in the management and mentoring of the student [3]. This includes identifying local companies that would be interested in hiring undergraduate engineering interns, and obtaining funding for these programs. This paper describes an undergraduate internship partnership

between The University of Tulsa and Geophysical Research Co. (GRC) that was funded by the Oklahoma Center for the Advancement of Science and Technology (OCAST) [4].

OCAST Intern Partnership with GRC

While many companies have budgets to cover student intern salaries, additional external funding will strengthen an internship program. This additional funding can supplement salaries and cover additional expenses such as supplies and travel. The authors obtained funding from OCAST through their R&D Student Intern Partnership program. This program was developed to improve Oklahoma's R&D base by supporting undergraduate student internships at Oklahoma R&D facilities. The goal is to encourage undergraduate students to prepare for scientific and technical fields that support high-tech companies in Oklahoma.

Each author received funding from OCAST to support internship collaborations between The University of Tulsa and Geophysical Research Co. LLC. (GRC). Dr. Manikas was the principal investigator (PI) for an OCAST grant to support one undergraduate electrical engineering student for the development of hybrid circuits for oil and gas well gauges. Dr. Ashenayi's OCAST grant supported one undergraduate electrical engineering student and one mechanical engineering student to develop crystal temperature sensors for these gauges. The students worked at GRC with full-time engineers, under the guidance of project mentors. As specified by OCAST requirements, the interns worked full-time (up to 40 hours/week) during the summer and part-time (up to 10 hours/week) during the regular academic year (fall and spring semesters). The students did not receive academic credit for this project, but were paid salaries for their work.

Intern Selection and Mentoring

A pool of intern candidates was identified by the PI's, with final selection of interns performed by the GRC mentors based on resumes and interviews. After the interns were hired, the mentors got the interns started on the research projects. The interns worked closely with the mentors and interacted with the regular engineering staff at GRC.

The mentors determined the project schedule, including milestones and deadlines. As the interns became more familiar with their duties, the mentors monitored their progress using regularly scheduled progress reports and meetings. Training and feedback was provided to the intern based on these reports, meetings, and personal interaction. In addition, the interns had bi-weekly meetings with the PI's to monitor their progress and get feedback on their internship experiences at GRC. The interns submitted a short progress report to the PI's during these meetings.

Interns were evaluated on their general performance, including work habits and professionalism, and on project performance, including meeting the project specifications and deadlines. As part of the evaluation process, the mentors provided feedback to the interns and consulted with the PI's as necessary to resolve any issues that arose. The PI's also monitored the interns' progress with periodic visits to GRC and discussions with the mentors.

Intern Projects

The student intern for Dr. Manikas' project designed and built a prototype hybrid oscillator circuit to be used in pressure gauges for oil and gas pipelines (Figure 1). An important component for pressure measurement is the quartz transducer. Producing this transducer requires the use of three crystal oscillators. A critical part of this design was to select components that would allow the circuit to operate reliably at the elevated temperatures. The intern's prototype circuit was proven to operate reliably at 200°C. GRC plans to incorporate this circuit into their future gauge designs.

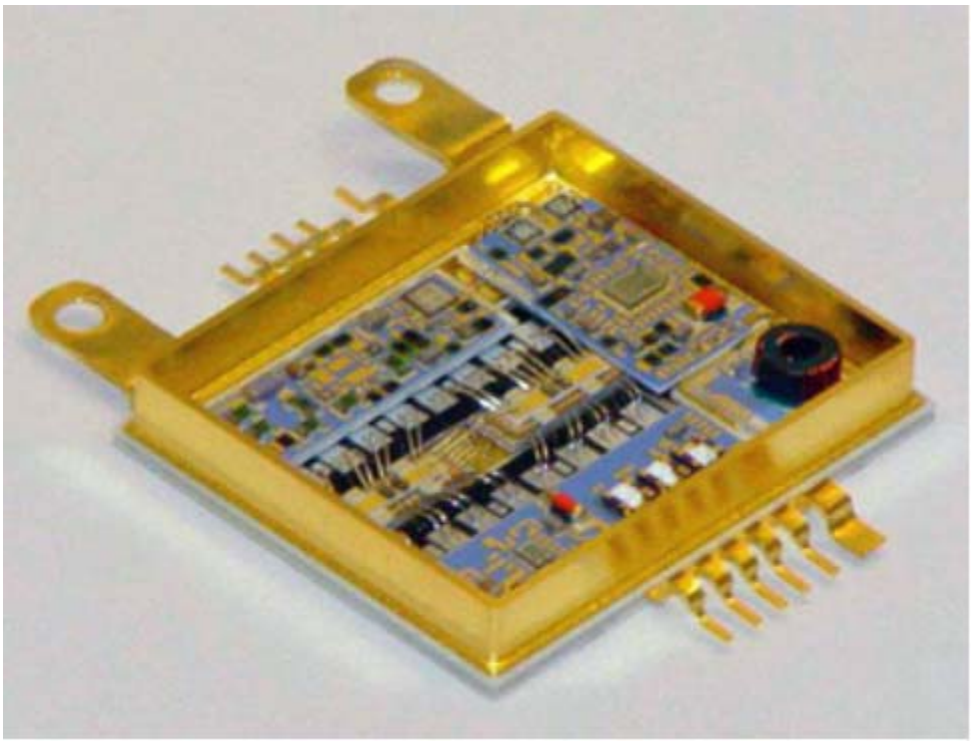

Figure 1. Hybrid oscillator circuit developed by student intern.

The student interns working on Dr. Ashenayi's project designed (the first year, 2007-2008) and are building and testing (second year, 2008-2009) a prototype RTD circuit to be used in quartz crystal based gauges for oil and gas wells. Crystal temperature is an important parameter affecting accuracy of the measurements. Producing this transducer requires the knowledge and ability to vapor deposit platinum on a substrate in close proximity to the crystal. A critical part of this design was to select the design and develop the deposition process. A major component of this process is design of the mask to be use in the deposition process. The intern's prototype by GRC and a mask has been produced based on that design. GRC plans to use the mask and create the RTD in house using their vapor deposition system.

Intern Partnership Outcomes

Many benefits resulted from the OCAST-funded intern partnerships between The University of Tulsa and GRC. The student interns gained valuable experience on the practical applications of their engineering coursework and how engineering design and development is performed in an industrial environment. GRC has benefitted through the design contributions of the interns, and has also evaluated the students as possible full-time engineering employees. For The University of Tulsa, these projects have provided additional educational opportunities for their engineering students and have also resulted in research collaborations between the university and company that will lead to future funded projects.

Bibliographic Information

1. D. J. Bayless, "Using Industrial Summer Intern Programs as a Tool for Engineering Education," ASEE Journal of Engineering Education, vol. 88, pp. 465-469, 1999.
2. A. Lozano-Nieto, "Internship programs in engineering technology: Some personal thoughts," in ASEE Ann. Conf. Proc., St. Louis, MO, June 18 - 21, 2000, pp. 3743-3749.
3. R. K. Tener, M. T. Winstead, and E. J. Smaglik, "Experiential learning from internships in construction engineering," in ASEE Ann. Conf. Proc., Albuquerque, NM, June 24 - 27, 2001, pp. 4889-4920.
4. Oklahoma Center for the Advancement of Science and Technology (OCAST), Oklahoma City, OK, http://www.ocast.state.ok.us.

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