

Demo: Using Industrial Engagement to Create and Develop Research Ties within Academia

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Abstract—Cardiff University has developed a new software engineering degree that is influenced by, and works directly with, industry. Through this degree scheme, dedicated staff members have been used to interact with and source industrial partners. From these interactions, new research opportunities have been identified and one has been funded.

Cardiff University introduced a new industry-focused degree, BSc Applied Software Engineering (ASE) in September 2015. The course aims to address the digital skills gap [2] and provide students with skills, knowledge and experience to be effective work-ready software engineers.

The course provides three key benefits: the first is that engagement with industry allows students to learn through live projects with real-world applications; the second is that the course provides an entry point for industry to engage with the university, making collaboration with the School of Computer Science more accessible and developing a network of contacts that connects industrial partners with Cardiff University, as well as each other. Thirdly, these collaborations do not simply provide projects and employment opportunities for students, but they allow the School of Computer Science & Informatics (CS&I) to identify potential opportunities for new research projects and collaborators.

This paper details an example of an industrial collaboration that has resulted in initial funding for a research project.

The first benefit detailed is allowing students to learn through live projects. While their career path is not fixed to research software engineers, this allows them to gain a mix of both academia and industrial experience. Projects in the past have been provided by Cardiff University, hardware manufacturers and local government.

The projects are taught using the Agile development cycle [4] and encourages ‘learning through practice’, teaching students large concepts in small chunks and giving them the opportunity to implement using a step by step process. When enough concepts have been taught to give students a foundation knowledge, a live project is introduced and students must gather requirements from the client, work in 2 week ‘sprints’ and hand over a finished project at the end of the semester. These projects range from a simple web site and server that runs for half a semester to an enterprise project that runs for a full academic year. Not only does this method encourage teamwork and give exposure to some leading tools, the Agile approach allows the course content to be informed

by the latest research and the tools used to be informed by industrial partners.

Students understand version control as soon as they are introduced to programming on the course, building on that knowledge as the degree progresses to deal with merging multiple versions of a project and ensuring the integrity of a repository by ignoring configuration files and not embedding passwords directly into their code. As with any project, it is not simply about writing code that works for a single use case and, very early on in the course, students are introduced to many different forms of testing and taught how to use popular industrial tools to automate the building, testing and deploying of their projects. These tools do not just benefit their learning and prepare them better for work but enables marking of work to be automated.

Industrial partners need only commit their ideas and time in order to have the students create a project for them, but companies have also been involved with presenting to students about the technology they use, skills they are looking for and some have simply provided an overview of their career and experiences thus far. The course is reviewed regularly and each module is updated to keep up to date with the tools most commonly used in industry and this review does not simply involve members of the academic team but industrial partners provide their input as to skills/tools that they believe are crucial for new graduates and, providing that these suggestions are supported by a majority, those changes are implemented for the next iteration of the module. This means that students do not simply learn about fundamental computer science or software engineering concepts but also cover areas such as DevOps and security.

Summer placements allow students to try different work opportunities, either in industry or in research. These placements are available for ever year, as opposed to a year in industry only being available to those between second and third year, this allows students to try research based placements one summer or even two different streams of industry-based work, such as: security and mobile development. The students can then bring their industrial skills to their placements and feed back what they are taught in their placement, through the group work in their modules. For example, Git is taught as a version control system (VCS) to students but they may be exposed to a particular methodology of using Git (i.e. Git Flow [1]) that they can encourage the team to use in the next academic year; this means that learning is not limited

to just the lecturer-student relationship but it is more of a collaborative effort.

Further details on the pedagogic focus of the course, teaching methods and collaborative learning processes will be presented at the 7th Annual International Conference on Computer Science Education: Innovation & Technology (CSEIT 2016).

Since the Applied Software Engineering degree started, more than sixty companies have met with academic staff to discuss providing and supervising projects, giving talks and assisting with practical sessions. Of those sixty, six have provided student projects, ranging from a simple tracking website to a mobile application that utilises indoor localisation and Bluetooth Low Energy (BLE) devices. Some of the projects that were pitched by potential industrial partners were far beyond the scope of first year undergraduate students and one such project was related to current research interests within the School.

The example used in this paper is with the newly-formed cyber-crime unit within the Dyfed-Powys Police force. A student project was proposed that would, given some personal information, identify the social media accounts of an individual. The initial belief was that the project would be trivial and primarily require building a Web-based dashboard. To investigate criminal activity, the tool could identify suspicious activity, such as each account reporting a different age or regularly adding underage children as friends. For victims, it could be used to prove claims of cyber-bullying or warn potential victims of adults posing as users within their age group.

Existing research has shown that identifying users across multiple social media sites is not a simple task and there are multiple methods for doing so [3]. Some involve the matching of usernames across sites [5], others involve identifying behavioural patterns [6]. Each of these approaches have varying degrees of accuracy but are far beyond the scope of a six week undergraduate project.

The research interest of this was quickly identified and funding for an initial proof of concept was provided by Cardiff University, through the Cardiff University Research Opportunities Program (CUROP). CUROP provides funding for Cardiff University undergraduates to undertake 4–8 weeks of supervised research work during the summer. Dyfed-Powys cyber-crime unit agreed to assist with the supervision of a staff and student project over a two month period in the summer of 2016.

Because of the industrial links with this project, it is not simply a case of implementing a proof of concept and publishing findings. The tool that is created is intended to be developed further and used regularly. Using the industrial best practices taught in the ASE degree scheme, the tool needs to be modular, tested and well-documented. While this is a research project first and foremost, the industrial link and real-world application of the intended outcome requires that practices are used so that the software is sustainable beyond the scope of the initial project. If the findings of the project prove to be positive,

we hope to be able to use similar funding opportunities to explore more industrial research partnerships.

We hope to continue to cultivate these new industrial links and to develop research ties that benefit both industry and academia. The key point to note here is that the client was unaware of any research relevance within their proposed project and were merely looking for implementation, being able to initiate these links with the University allowed industry to utilise research expertise within the School of CS&I.

The School previously found its industrial partners through research ties within the School, social ties of academic staff or connections made at events. ASE has a dedicated team of staff tasked with industrial outreach and engagement that makes the School of CS&I much more accessible to industry and also allows the University to develop a network with both local and national companies. These ties with industry allow new research collaborations, as well as allowing students to apply skills to real-world projects and follow sustainable practices, such as version control, testing and managing deployment.

However, there are drawbacks with this approach in that sourcing and establishing new ties in industry is often time consuming. On top of this, the staff members must have a high-level overview of all of the existing research projects, links and skills within the School. This could be assisted with the implementation of a directory of active projects and existing collaborations with industry.

After one year of existence, the industrial outreach of the Applied Software Engineering degree has allowed the School of CS&I to meet with over sixty companies and receive funding for a research project with the Cyber-crime unit of Dyfed-Powys police. We believe that these opportunities will only grow as our network grows to further research collaboration.

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APPENDIX



Fig. 1. Students meeting with an industrial client



Fig. 2. Students working in teams on client projects



Fig. 3. Students presenting and handing over to an industrial client