


CS486C – Senior Capstone Design in Computer Science

Project Description

Project Title: Engineering Career Builder (ECB)	
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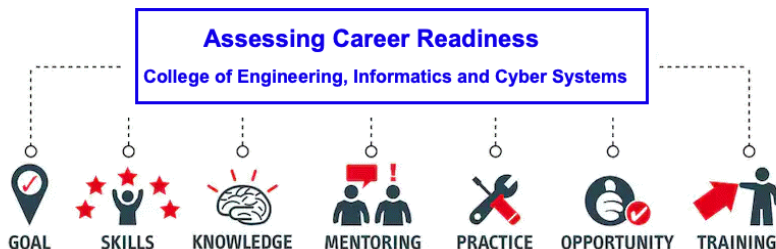
Project Overview:

High quality engineering education is vital to our society and nation's economy, and pursuing a postsecondary education is one of the most important investments a student can make. College graduates with a bachelor's degree typically earn 66 percent more than those with only a high school diploma; over the course of a lifetime, the average worker with a bachelor's degree will earn approximately \$1 million more than a worker without a postsecondary education. Engineering programs are especially important in this picture given that, in our advanced technological world, the majority of today's services and products have some element of engineering involved. But good engineering programs don't just happen, they must be carefully planned and updated to match the needs of our rapidly changing high tech economy.



The College of Engineering, Informatics, and Applied Sciences (CEIAS) houses some of the major high-tech degree programs at NAU, including engineering programs (Mechanical, Electrical, Computer, Civil and Environmental), Informatics and Computer Science; and Applied Physics and Materials Science. As a cornerstone for ensuring the quality of all programs, the College has developed a set of strategic goals, e.g., numbers of graduates doing internships, or how many graduates find jobs in their areas within six months of graduation. With over 2,800 students in CEIAS, however, monitoring the attainment status of these goals is a major challenge.

Tracking and reviewing progress on the strategic goals on a regular basis is absolutely critical to ensure the goals are realistic and that those executing the strategy are accountable. An effective tracking tool will tell us if we are on or off the roadmap described in the strategic plan, allowing us to take timely actions to support student career success. Unfortunately, the Dean's office does not currently have an effective tool to support this vital performance analysis task. Our current approach is centered around hanging folders with hardcopy student files and the use of various manually updated spreadsheets for various purposes; this highly conventional system is continually out of date, is difficult and arduous to merge into a holistic dashboard display or report, and cannot be effectively searched to retrieve critical information in a timely fashion. As a result, the only way to assess attainment of our strategic goals currently is via painstaking and manual collection and analysis of various sources of achievement data. This process is not only tedious and inefficient, but also error prone.



As an example of a specific shortcoming, we don't have an effective way to find out baseline data, such as: How many students in Mechanical Engineering had an internship or co-op experience in Spring 2020? What is the job placement rate for the College? With over 2,800 students in more than 20

academic disciplines, the College needs an automatic or semi-automatic tool that can effectively monitor student progress in their career building activities, such as internship, externship, co-op, and other practical experience outside of classroom learning, and help students to land a job in their profession. This tool will also support alumni for their professional development and continuing education. Considering the enrollment of STEM programs will increase in the future, this Engineering Career Builder tool should be able to scale up easily.

The Envisioned Product

What we need is an easy-to-use automatic or semi-automatic tool, which we'll call the Engineering Career Builder (ECB). Specifically, we envision a secure, modern web-based application that supports specification of strategic goals, collection of the needed data, and instant graphical analysis of where we stand on each goal. A dashboard should provide an overview of "active" goals and progress; clicking to "drill in" on any goal would provide a graphical analysis tool to explore progress on that goal in more detail. Although the system should be designed so that it is extensible to allow addition of further goals to monitor and editing of existing goals, this initial prototype should prove this concept by focusing on just two of our strategic goals to start with:

1. By 2025, 100% of CEIAS students will have at least one practical experience (such as internship, externship, co-op, R&D, startup, etc.) before their graduation; -- Goal 1
2. By 2025, 100% of CEIAS students will receive at least one job offer within 6 months of their graduation. -- Goal 2

We plan to require every CEIAS student establishing a LinkedIn professional account during their Freshman or Sophomore year. Students will update their LinkedIn accounts with their practical experience, such as projects in an internship job, or externship/co-op experience. Professional mentors, including academic instructors and professors, may endorse their students through the LinkedIn platform and network. Therefore, the progress tracking for Goal 1 and Goal 2 would turn into a data mining task on the LinkedIn social media networks. We envision three groups of users for this Engineering Career Builder tool, each of which will likely have different permissions; interfaces should be customized depending on which user role is being served:

1. **Administrative Users:** A department chair, school director, advisor, or Dean's office staff can find out how many students in a particular department/school/program have taken a professional practical experience at any time anywhere; what are the experiential learning opportunities available for students, how many students have received a job offer, etc.
2. **Student Users:** Each CEIAS student has a digital portfolio in the ECB (Engineering Career Builder) generated by the system. The initial portfolio data could be pulled from a local database, but the ongoing update of the portfolio should be implemented through data-mining of the LinkedIn social network. This portfolio is similar to an academic transcript, but it records all the activities and achievements outside of classroom. In particular, the digital portfolio is a collection of student extra-curricular projects including the following:
 - Internship / externship / Co-op / working experience
 - Extra-curriculum projects, such as student club activities, research and development experience, competition team activities, training certificates, etc.
 - Awards, scholarships, fellowships, and other recognitions.
3. **Industry Users:** Industry partners can post their jobs, intern/extern opportunities, project ideas, and answer questions from students.

Detailed features and requirements will be developed in conversations by the clients (Dr. Andy Wang and the Dean's office staff), as well as based on the team's evolving understanding of end user needs as the project progresses. The deliverable of this ECB project is a software prototype consisting of the following components:

- 1) A secure web application, including user authentication and role-based user permissions to serve as a cornerstone for the ECB system.
- 2) Must provide a searchable student career portfolio database. Database must be able to be easily updated and maintained by authorized (staff) users.
- 3) Ability for administrators to define Strategic Goals in some way. Would allow definition of data streams to be collected for each goal, either from our internal databases or from web sources.
- 4) Must provide a digital dashboard that gives instant overview of goals and achievement status; monitoring for at least goals (1) and (2) above must be implemented in this prototype, but extensibility must be considered.

Knowledge, skills, and expertise required for this project:

- Familiarity with DB design and data visualization.
- A solid knowledge about web design at both front end and back end.
- A good understanding of information security and their implementations, including access control and data security.
- A fundamental knowledge of GUI design and usability testing.

Equipment Requirements:

- Free/open-source software tools should be preferred, for easy installation on any computer or mobile phones.
- There should be no major equipment or software required other than a development platform and software/tools freely available online

Software and other Deliverables:

- A fully-functioning web application, as outlined above, installed and tested on a platform of the client's choice.
- A "system administrator's manual," which details step-by-step how the system can be installed on a platform of the client's choice, as well as how to perform basic configuration and maintenance.
- All the software engineering documents, including requirements specification, design, and implementation details. It should allow future team to easily pick up where left off.
- Complete professionally-documented codebase, delivered as a repository on GitHub. There should be special attention to the API usage documentation, which will be used by third-party.