IGEM

An Investment in Idaho's Future
2012-2015 Final End-of-Project Report

BOISE STATE UNIVERSITY

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TABLE OF CONTENTS

BOISE STATE UNIVERSITY

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Computer Science at Boise State University

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Project Summary:

The Idaho Global Entrepreneurial Mission (IGEM) and State Board of Education Higher Education Research Council (HERC) have provided three years of funding to expand and restructure the Boise State University Computer Science Department to help meet compelling state economic development, research, and workforce needs. The five-year Idaho Strategic Research Plan for Higher Education identifies Information Management and Software Development as a strategic research area that has tremendous potential to drive future economic growth within the state. Responding to this need, Boise State identified the expansion of the Computer Science Department as an institutional priority. This is the completion of the third and final year for the IGEM grant at Boise State. This report details the activities of the third year of the project and also provides an overall summary of the project in various categories.

Task Performance Summaries:

The project plan identified three primary strategies to achieve this goal:

1) *Hiring Faculty;*
2) *Tighter Industry Integration;*
3) *Enhancing the Student Pipeline*.

Progress to date toward implementing these strategies is detailed in this report.

Strategy One: Hiring Faculty - The Computer Science Department was successful in hiring and retaining five new faculty members (one full professor, two associate professors, one assistant professor and one clinical professor) – Dianxiang Xu, Vijay Dialani, Steve Cutchin, Elena Sherman and Jim Conrad. Three of the faculty are in the area of software engineering while one is in the area of big data and databases and another in visualization. Dr. Jim Conrad has been moved to another line and the others are being supported by the IGM grant.

These five new faculty members have led to an increase in computer science research as well as bring expertise that will help prepare our students for careers in software engineering, big data, databases and visualization. They have also been successful in getting grants from industry and agencies to work on projects that enhance Idaho's competitiveness. In a short period, they are already off to a good start as detailed later in this report. In addition, the grant supported twelve different graduate students to help the faculty with their research.

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BOISE STATE UNIVERSITY

Strategy Two: Tighter Industry Integration - The Industrial Advisory Board for the Computer Science Department was chaired last year by Alden Sutherland (CIO, MWI), who will continue being the chair for the upcoming year. The board has been expanded and revitalized and now meets regularly to provide direct feedback from industry to the department. The board has taken on several initiatives to benefit and improve the department in the last three years.

A second effort to increase industry integration has been the creation of a senior design class, CS 481. This class, taught by Dr. Jim Conrad, engages students in a fast-paced software development team project with industry partners, applying knowledge acquired throughout the undergraduate Computer Science curriculum. This two semester project provides a "real world" project-based environment to the students and aids in their transition from the classroom to a career in industry. In Spring 2015 semester, 36 students (up from 21 last year) enrolled in CS 481. The students were organized into ten teams, each with one project. There were a total of **twenty one** projects proposed by sponsors. Out of these **ten** projects were chosen and completed. We had **eight sponsors** (*Clearwater Analytics, Healthcast, Cradlepoint, National InterAgency Fire Center, Winco, Khamu, AIR Confort Zone, Boise State University*). All of the projects employed an agile lifecycle incorporating scrum and software engineering practices. Each student had an opportunity to serve in each of the scrum roles including Developer, Product Owner and Scrum Master. All eight teams completed the original objectives of their industry sponsored projects. Currently all but one of the project are at various stages along the path to production at respective companies.

Over the last three years, **seventeen** companies and over 60 students have participated in senior design projects. We expect these numbers to go up as the number of students in the program goes up.

The department has a regular industry seminar series that now runs in both semesters. The spots in the seminar are highly sought after by industry and student attendance in the seminar is high. The department has introduced courses in Web Development, Mobile Development, Data Modeling, GPU Computing. The department is leveraging industry experts for these and other courses that provide breadth to our students that would be hard to do with only the regular faculty. Currently, we have industry experts from Clearwater Analytics, Cradlepoint, Intelliscience, HP, Kount, Micron and Z Studio Labs teaching courses and interacting with department faculty and students.

A primary outcome of the IGEM effort is to increase funded research activity and technology transfer in collaboration with industry partners. For the last year of the project, a total of **twenty nine** new proposals were written and submitted to various institutions for a total amount of $17,496,644, about double of the year above. From these submissions, seven have been awarded while most of the others are pending or were not awarded. The following table shows the proposals submitted in the current reporting year.

The following **eight** proposals were awarded to Computer Science faculty members, totaling $1,343,062. Note that this doesn't include the IGEM grant itself nor does it include continuing grants from before the current reporting time period.

Proposals Awarded 7/1/2014 – 6/25/2015				
Faculty	PI/co-PI	Title	Agency	Amount
Elena Sherman	Co-PI	SI2-SSE: GEM3D: Open-source Cartesian adaptive complex terrain atmospheric flow solver for GPU clusters	National Science Foundation	$500,000
Gang-Ryung Uh	Co-PI	SAVE: Self-Organizing Air Vent System	Idaho SBOE	$50,000
Elena Sherman	PI	SHF: EAGER: Collaborative Research: Mapping Software Analysis Problems to Efficient and Accurate Constraints	National Science Foundation	$75,001
Dianxiang Xu	PI	REU Site: Software Security	National Science Foundation	$88,373
Dianxiang Xu	PI	REU Site: Software Security (Supplement)	National Science Foundation	$235,627
Vijay Dialani	PI	Precision Ag–Increasing Crop Yields Using Internet of Things & Data Science. (with Simplot)	Idaho Dept. of Commerce	$343,072
Vijay Dialani	PI	ARC: Automata Processor for Research in Computing (with Micron)	Idaho SBOE	$50,898

All but one of the funded proposals were from the new faculty supported by the IGEM grant.

Overall, the department has received total external funding for $5,544,079 (which doesn't include IGEM) in the past three years. This is orders of magnitude higher than before the IGEM grant.

Strategy Three: Enhancing the Student Pipeline - The third strategy of the IGEM proposal is to focus on the student pipeline to attract, retain, and graduate a larger number of high-quality students. The Computer Science curriculum in the primary, lower-division courses is challenging, resulting in retention issues. One strategy to improve retention is to allow students more time to absorb the material. The core sequence of COMPSCI 125, 225 and 342 (each a four credit class) was restructured into CS 121, 221, 321 and 421 (one four credit and the rest are three credits). The new CS 121 (Computer Science I) course also has an associated structured laboratory component. The new courses started in fall of 2013 and were in their second to third iteration in 2015 spring.

A second retention strategy was to develop a Computer Science Tutoring Center that will employ graduate assistants to aid undergraduate students in a one-on-one instructional environment. The tutoring center has been extremely popular. As a result, we are retaining higher percentage of students.

The critical senior-level 453 course has gone from 27 to 74 students over the last three years, critical junior-level 354 course has gone from 35 to 91 students over the last three years while critical

BOISE STATE UNIVERSITY

sophomore-level 253 course has gone from 41 to 102 students over the last three years.

The IGEM funds have also supported graduate students in their research efforts. As a result, the number of Masters degrees in Computer Science went up from 4 per year to a total of 28 over the last three years, **more than double the annual rate** we had before.

The number of bachelors in Computer Science has almost doubled from 27 to 47 over three years. Out of these graduates 86% accepted jobs in Idaho (out of students who accepted jobs instead of going on to graduate school). The demand for our graduates remains high with most students landing offers well before graduation. See the graphs on page 7 for trends in the number of graduates.

The overall enrollment in the department has also doubled over the last three years (see graph on page 7). Combined with better retention, the enrollment trends in critical junior/senior-level courses point to 70+ students graduating next year, which would be a three–fold increase from three years ago.

Demonstrated Economic Development

As previously mentioned, external funding is strong with a total awards of $1,343,062 thus far this year. This is significantly higher activity than the department had prior to the IGEM award. Note that the faculty hired under the IGEM grant were responsible for 85% of the grants funded last year. Overall, the department has received $5,544,079 of external funding (which doesn't include IGEM grant) in the past three years. This is orders of magnitude higher than before the IGEM grant.

Future Plans

The department is well on its way to further sustained growth in all three of the areas. We expect the number of graduates to triple in the next two years, research activity to stay at a high level and the interaction with industry to also continue to increase.
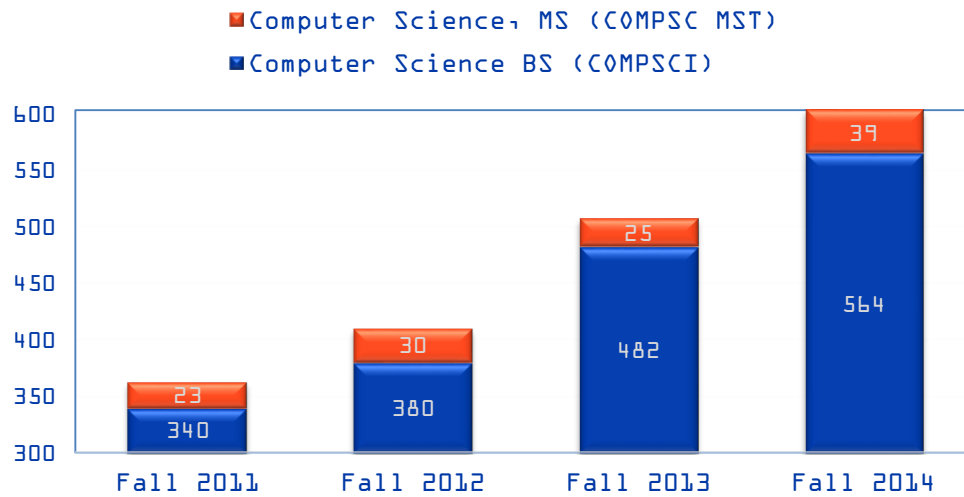
Commercialization Report

There is no commercialization revenue to report at this time.

Expenditure Report

The following table shows the expenditures for the third year. Note that the amounts are rounded to nearest dollar amount.

Category	Salary	Fringe	Tuition	Total
Faculty	$ 425,827	$ 122,158	-	$ 547,985
Graduate Students	$ 128,671	$ 2,210	$ 21,132	$ 152,013
	$ 554,499	**$154,369**	**$ 21,132**	**$ 700,000**

BOISE STATE UNIVERSITY

CS Program Enrollment

■ Computer Science, MS (COMPSC MST)
■ Computer Science BS (COMPSCI)

Fall 2011	Fall 2012	Fall 2013	Fall 2014
23	30	25	39
340	380	482	564

CS Graduates

■ B.S. Computer Science   ■ M.S. Computer Science

2011-2012	2012-2013	2013-2014	2014-2015
4	16	4	8
27	26	27	47

BOISE STATE UNIVERSITY