

***IGEM***

***An Investment in Idaho's Future***

***2013-2014 Annual Report***



**BOISE STATE UNIVERSITY**

**IGEM**  
*An Investment in Idaho’s Future*  
2013-2014 Annual Report

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## IGEM – An Investment in Idaho's Future

### *Computer Science at Boise State University*

#### *2013-2014 Annual Progress Report*

#### **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 second year for the IGEM grant at Boise State.

#### **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** - Last year, the Computer Science Department was successful in hiring four new faculty members (one full professor, one associate professor, one assistant professor and one clinical professor) – Dianxiang Xu, Vijay Dialani, Elena Sherman and Jim Conrad. Three of the new faculty are in the area of software engineering while one is in the area of big data and databases. This year, the department was able to recruit another highly qualified faculty Dr. Steve Cutchin in the area of Visualization, another area of strong interest from local industry. We were able to do this by moving Dr. Jim Conrad to another line in the department. Dr. Cutchin's brief bio is given below.

#### *Steve Cutchin*

Dr. Steve Cutchin joined the faculty at Boise State University in August 2013. From 2008 to 2013 he was the manager of the KAUST Visualization Laboratory Core Facility and the Supercomputer Facility at King Abdullah's University of Science and Technology (KAUST) in Thuwal, Saudi Arabia. At KAUST he recruited a technical team of engineers and visualization scientists while managing the building of the state of the art scientific data visualization laboratory on the KAUST campus, forged relationships with international university and corporate partners, and continued to improve the laboratory and recruit new staff. Prior to his work in Saudi Arabia, Dr. Cutchin worked at the University of California, San Diego (UCSD) first as manager of Visualization Services at the San Diego Supercomputer Center and later at California

Institute for Telecommunications and Information Technology (Calit2). He has worked as a Sr. Software Engineer at Walt Disney Feature Animation developing software tools to improve animation production on feature films. He has published articles on Computer Graphics and Visualization, created animations for Discovery Channel and images for SIGGRAPH and Supercomputing conferences and journals. He received his doctorate from Purdue University in Computer Science.

These five new faculty members will lead 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. In a short period, they are already off to a good start as detailed later in this report.

**Strategy Two: Tighter Industry Integration** - The Industrial Advisory Board for the Computer Science Department was chaired last year by Jay Larsen, President of the Idaho Technology Council. The board has been expanded and revitalized and now meets regularly to provide direct feedback from industry to the department. This year, Alden Sutherland (CIO, MWI) is chairing the board.

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 2014 semester, 21 students enrolled in CS 481, the Senior Design course. The students were organized into five teams, each with one project. We had **11 industry sponsors** (*Balihoo, Clearwater Analytics, Cradlepoint, Department of the Interior, Hewlett-Packard, Idaho Digital Learning Academy, META, Micron, Sawtooth Ideas, Tripoli Idaho, and White Cloud Analytics*) that proposed 19 projects, of which students selected five projects. The selected sponsors include Baliaroo, Clearwater Analytics, the Idaho Digital Learning Academy, the United States Department of the Interior, and Cradlepoint. The projects include *Local Search Engine Optimization Audit, Security Price Correlation, Predicting Student Outcomes with Big Data, a Mobile Application for Pilots, and a Router API Solution*. 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 five teams completed the original objectives of their industry sponsored projects. Currently all five projects are at various stages along the path to production at respective companies.

Dr. Vijay Dialani made a presentation on Cassandra at Clearwater Analytics in Fall 2013. Dr. Vijay Dialani and Dr. Amit Jain met with Jim Gasaway at Keynetics for a potential joint research project. The legal paperwork is currently under negotiation. Dr. Dialani also consulted with IDLA on Data Science. He taught a class on Big Data that drew several industry people to it and received high praise from them. Dr. Elena Sherman offered a new class in software quality that also drew industry people to it. Dr. Dianxiang Xu is offering a new class in Secure Software Engineering this spring that is unique and of relevance to many industries. Dr. Steve Cutchin has created a 3-D Visualization lab and is working on research project with Idaho National Lab. The arrival of the new faculty has increased the interest in the department from prospective students, both in-state and out of state.

The department has now developed and made permanent a Web Development class and a Mobile Development class. The department is leveraging industry experts for these courses. Currently, we

have industry experts from Keynetics, Z Studio Labs, Cradlepoint, Clearwater Analytics, Micron and HP teaching courses and interacting with department faculty and students.

Boise State was recently awarded a grant from the National Science Foundation to purchase a GPU supercomputer with a visualization facility. The \$555,384 grant was awarded under NSF's Major Research Instrumentation (MRI) Program (Dr. Tim Andersen is a Co-PI on this grant). This new computing cluster significantly extends Boise State's ability to use advanced computing in science and engineering projects and substantially decrease the computational time required to generate results. The benefits of this grant will be felt far beyond Boise State University. The plan is for the parallel computing and visualization cluster to be housed at a facility open to university researchers, as well as local technology companies and partners. As part of the revised budget, IGEMs funds (\$91,375) were used in addition the MRI grant funds to enable the purchase of the latest hardware and a larger tiled display that will provide expanded capabilities for use by computational scientists throughout the region.

A primary outcome of the IGEM effort is to increase funded research activity and technology transfer in collaboration with industry partners. To achieve this goal, the new faculty hires will increase the research capacity of the department and existing faculty members.

For the first six months of the year, a total of **twenty two** new proposals were written and submitted to various institutions for a total amount of \$9,161,574. From these submissions, eight have been awarded, twelve are pending, and two were not awarded. The following table shows the proposals submitted in the current reporting year.

Submitted Proposals 7/1/2013 – 5/20/2014				
Faculty	PI/co-PI	Title	Agency	Amount
Xu, Dianxiang	PI	MRI: Acquisition of an Online Banking System for Information Assurance Research	NSF	\$145,000
Xu, Dianxiang	PI	TTP: Small: Automated Conformance Testing of Access Control and Obligation Policies	NSF	\$499,772
Xu, Dianxiang	PI	EDU: Developing a Software Artifact Repository for Software Assurance Education	NSF	\$299,892
Xu, Dianxiang Sherman, Elena Yeh, Jyh-haw	PI Co-PI Co-PI	Collaborative Research: Capacity Building: Faculty Development for Software Assurance Education	NSF	\$152,550
Jain, Amit	Co-PI	S-STEM: Idaho Scholars in Engineering and Computer Science	NSF	\$626,375
Jain, Amit	Co-PI	IBSS: Discovering the Tipping Point in Collaborative Decision Making: A Means to an End for the Wicked Problems in Regional Planning?	NSF	\$729,056

Joshi, Alark	PI	Developing an Ecosystem for In-class Preschool Teaching	Idaho SBOE	\$50,000
Andersen, Tim	PI	EXPAND CS Expand Computer Science Industry and University Partnerships to grow the Workforce and Idaho's Economy	Idaho Dept. of Labor	\$1,000,000
Andersen, Tim	PI	DockoMatic: A Fully Integrated Software Suite for High Throughput Virtual Screening	NSF	\$785,224
Buffenbarger, Jim	PI	Enhancing a Caching Software-Build Tool To Reduce Costs	Google Research	\$36,816
Dialani, Vijay	PI	CONCEPT: Creating On-line Content for Enhancing and Personalizing STEM Education	NSF	\$575,385
Uh, Gang-Ryung	PI	Self-organizing Air Vent (SAVE) System	Idaho Commerce	\$100,000
Uh, Gang-Ryung	PI	Self-organizing Air Vent (SAVE) System	Idaho SBOE	\$50,000
Uh, Gang-Ryung	PI	CSR: Medium: Collaborative Research: Portable Loop Acceleration Through an Efficient Accelerator Unit (PLATEAU)	NSF	\$300,000
Uh, Gang-Ryung	Co-PI	PFI:BIC: Smart Material Machine Medical Service Delivery	NSF	\$800,001
Yeh, Jyh-haw, Xu, Dianxiang	PI Co-PI	TWC: Small Enhancing Big Data Privacy in Clouds Using Semantic Hiding Approach	NSF	\$487,273
Sherman, Elena	PI	SHF: Small Collaborative: Mapping Software Analysis Problems to Efficient and Accurate Constraints	NSF	\$249,992
Sherman, Elena	Co-PI	SI2-SSE: GEM3D: Open-source Cartesian adaptive complex terrain atmospheric flow solver for GPU clusters	NSF	\$500,000
Cutchin, Steve	PI	Southeast Idaho Geothermal Play Fairway Analysis	UI	\$75,000
Cutchin, Steve	Co-PI	Simulating the Performance of Cellular Materials in Energy Systems: Multiscale Modeling, Visualization, and Experimental Imaging of Microstructural Evolution in Extreme Environments.	NSF	\$1,657,936
Cutchin, Steve	PI	Virtual Reality Volume Visualization of Micro-CT data	Battelle Energy Alliance	\$46,866

The following proposals were awarded to Computer Science faculty members, totaling \$3,383,340. 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 7/1/2013 – 5/20/2014				
Faculty	PI/co-PI	Title	Agency	Amount
Uh, Gang-Ryung	PI	Development of Virtual Sensor Terminal Environment that Assists Personalized Mobile Application Development	Moneual, Inc.	\$71,417
Uh, Gang-Ryung	PI	Self-organizing Air Vent (SAVE) System	State of Idaho	\$45,800
Xu, Dianxiang	PI	TTP: Small: Automated Conformance Testing of Access Control and Obligation Policies	NSF	\$499,772
Xu, Dianxiang	PI	MRI: Acquisition of an Online Banking System for Information Assurance Research	NSF	\$145,000
Jain, Amit	PI	CS10K: IDoCode: A Sustainable Model for Computer Science in Idaho High Schools	NSF	\$992,067
Jain, Amit	Co-PI	S-STEM: Idaho Scholars in Engineering and Computer Science	NSF	\$626,375
Joshi, Alark	PI	Development of a Mobile Application for Early Literacy and Early Numeracy	Lee Pesky Learning Center	\$2,910
Andersen, Tim	PI	EXPAND CS Expand Computer Science Industry and University Partnerships to grow the Workforce and Idaho's Economy	NSF	\$1,000,000

**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) has been 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 are in their second iteration this spring. While it is too early to see the full impact of the change in the curriculum, other changes are already having a significant impact as noted below.

A second retention strategy was to develop a Computer Science Tutoring Center that will employ graduate-level teaching assistants (TAs) to aid undergraduate students in a one-on-one instructional environment. The tutoring center has been extremely popular last year with freshmen and

sophomores. As a result, we are retaining higher numbers of students. Please see the figures on pages 9 and 10 for increases in enrollment in critical sophomore, junior and senior-level courses and recent graduation rates. The critical senior-level 453 course has gone from 27 to 58 students over the last two years, critical junior-level 354 course has gone from 35 to 82 students over the last three years while critical sophomore-level 253 course has gone from 41 to 107 students over the last three years. Since we are only in the second year of the grant, this data is still preliminary and we would have more data in another year.

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 20 over the last two years. We expect the number of bachelors in Computer Science to also go up significantly over the next two years as the data from critical courses shows. Especially, since the department has very recently received a \$1.28 million grant from Idaho Department of Labor to build up the teaching capacity to allow doubling of the number of Bachelor's degrees in computer science. As part of that grant, the department received \$280,000 in matching money from eight local software companies. We feel that this was a result of the focus on the department due to the IGEM grant and shows a high degree of integration with local tech industry.

### **Demonstrated Economic Development**

As previously mentioned, external funding is strong with a total awards of \$3,383,340 thus far this year from a total of \$9,161,574 applied for. 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 over half (\$4.6 million) of the grants submitted last year.

### **Future Plans**

Work will continue on the planned tasks while focusing on mentoring the new hires for the department, managing the growth in the enrollment to keep improving retention and graduation and continued integration with industry.

### **Commercialization Report**

There is no commercialization revenue to report at this time.



## Expenditure Report

The table below reflects the modified budget approved earlier this year. Note that the total exceeds \$700,000 because of carry forward from last year.

Category	Salary	Fringe	Tuition	Computer Equipment	Total
Faculty	\$ 444,477	\$ 132,595	-	-	\$ 577,072
Graduate Students	\$ 121,576	\$2,436	\$ 54,374	-	\$ 178,386
Other Expenses	-	-	-	\$ 91,381	\$ 91,381
	<b>\$ 566,053</b>	<b>\$135,031</b>	<b>\$ 54,374</b>	<b>\$ 91,381</b>	<b>\$ 846,839</b>



