## COVER SHEET FOR GRANT PROPOSALS

**State Board of Education**

<table>
<thead>
<tr>
<th>SBOE PROPOSAL NUMBER: (to be assigned by SBOE)</th>
<th>AMOUNT REQUESTED: $50,000</th>
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</thead>
</table>

**TITLE OF PROPOSED PROJECT:** SAVE: Self-organizing Air VEnt System

**SPECIFIC PROJECT FOCUS:**

Affordable and Smart Home Ventilation System: Automatic zone-to-zone temperature distribution

<table>
<thead>
<tr>
<th>PROJECT START DATE: 7/1/13</th>
<th>PROJECT END DATE: 6/30/14</th>
</tr>
</thead>
</table>

**NAME OF INSTITUTION:** Boise State University

**DEPARTMENT:** Office of Sponsored Programs

**ADDRESS:** 1910 University Dr., Boise, ID 83725

**E-MAIL ADDRESS:** osp@boisestate.edu

**PHONE NUMBER:** (208) 426-4420

<table>
<thead>
<tr>
<th>NAME:</th>
<th>TITLE:</th>
<th>SIGNATURE:</th>
</tr>
</thead>
</table>

**PROJECT DIRECTOR/PRINCIPAL INVESTIGATOR**

Dr. Gang-Ryung Uh

Associate Professor

Not required

**CO-PRINCIPAL INVESTIGATOR**


**NAME OF PARTNERING COMPANY:** Kinetic Engineering Group

**COMPANY REPRESENTATIVE NAME:** Nate Calvin

<table>
<thead>
<tr>
<th>NAME:</th>
<th>SIGNATURE:</th>
</tr>
</thead>
</table>

Nate Calvin

Authorized Organizational Representative

Karen Henry

Lisa Jordan, CRA
**SUMMARY PROPOSAL BUDGET**

Name of Institution: Boise State University  
Name of Project Director: Dr. Gang-Ryung Uh

### A. PERSONNEL COST (Faculty, Staff, Visiting Professors, Post-Doctoral Associates, Graduate/Undergraduate Students, Other)

<table>
<thead>
<tr>
<th>Name/ Title</th>
<th>Salary/Rate of Pay</th>
<th>Fringe</th>
<th>Dollar Amount Requested</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Gang-Ryung Uh, Associate Professor</td>
<td>1 month $88,754/year</td>
<td>32% of salary</td>
<td>$13,018</td>
</tr>
<tr>
<td>Graduate Research Assistant (4); to be hired</td>
<td>3 summer months or $6,000/year each @ $2,000/mo</td>
<td>10% of salary (summer rate)</td>
<td>$26,400</td>
</tr>
</tbody>
</table>

% OF TOTAL BUDGET: 79%  
SUBTOTAL: $39,418

### B. EQUIPMENT: (List each item with a cost in excess of $1000.00.)

<table>
<thead>
<tr>
<th>Item/Description</th>
<th>Dollar Amount Requested</th>
</tr>
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<tbody>
<tr>
<td>SUBTOTAL: $0</td>
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### G. TRAVEL:

<table>
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<tr>
<th>Dates of Travel (from/to)</th>
<th>No. of Persons</th>
<th>Total Days</th>
<th>Transportation</th>
<th>Lodging</th>
<th>Per Diem</th>
<th>Dollar Amount Requested</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel to 2 HVAC/Ventilation trade shows. Dates to be determined.</td>
<td>2</td>
<td>3</td>
<td>$300/each</td>
<td>$300/each</td>
<td>$150/per diem</td>
<td>$3,000</td>
</tr>
</tbody>
</table>

SUBTOTAL: $3,000

### H. Participant Support Costs:

1. Stipends  
4. Other
I. Other Direct Costs:  

<table>
<thead>
<tr>
<th>Description</th>
<th>Dollar Amount Requested</th>
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</thead>
<tbody>
<tr>
<td>1. Materials and Supplies: Materials for prototyping (wires, registers, electrical components)</td>
<td>$7,582</td>
</tr>
<tr>
<td>2. Publication Costs/Page Charges</td>
<td></td>
</tr>
<tr>
<td>3. Consultant Services (Include Travel Expenses)</td>
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</tr>
<tr>
<td>4. Computer Services</td>
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<tr>
<td>5. Subcontracts</td>
<td></td>
</tr>
<tr>
<td>6. Other (specify nature &amp; breakdown if over $1000)</td>
<td></td>
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</tbody>
</table>

**SUBTOTAL:** $7,582

J. Total Costs: (Add subtotals, sections A through I)

**TOTAL:** $50,000

K. Amount Requested:

**TOTAL:** $50,000

---

### INSTITUTIONAL AND OTHER SECTOR SUPPORT

(add additional pages as necessary)

<table>
<thead>
<tr>
<th>Source / Description</th>
<th>Amount</th>
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<tbody>
<tr>
<td>Academic year support for the 4 GRAs working on the project. They will work as both Teaching Assistants and Research Assistants.</td>
<td>$96,000</td>
</tr>
<tr>
<td>Summer support for the 4 GRAs working on the project. They will work as both Teaching Assistants and Research Assistants.</td>
<td>$5,000</td>
</tr>
</tbody>
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### B. FACULTY / STAFF POSITIONS

<table>
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### C. CAPITAL EQUIPMENT

<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
</table>

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### D. FACILITIES & INSTRUMENTATION (Description)

<table>
<thead>
<tr>
<th>Description</th>
<th></th>
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</thead>
</table>
**SAVE: Self-organizing Air VEnt System**

1. Boise State University.

2. Principal Investigator (PI): Gang-Ryung Uh

3. This draft is original and was not submitted to any prior HERC RFPs

4. **Executive Summary:**

U.S. households rely primarily on electricity and natural gas for heating, ventilation, and air conditioning (HVAC). Even though the efficiency of the HVAC has improved over time, the Department of Energy (DOE) reports that air-conditioning and space heating are still responsible for the greatest share of each household utility bill. The DOE strongly recommends U.S. households to install central programmable thermostats that can save around 10% a year on cooling and heating bills by simply turning the thermostat back 7° -10°F for eight hours a day from its normal setting.

![Figure 1: The NEST Thermostat Controller](image)

A prime example of the programmable thermostats is the NEST product shown in Figure 1. Nevertheless, a critical drawback of these programmable thermostats is that they can only accurately control the temperature for a localized zone, and zone-to-zone temperatures can vary significantly. For instance, in a room/space that is poorly insulated, this programmable thermostat can make the room/space *too cold* (over-
cooling) or too hot (over-heating), which often results in an unexpected increase in the utility bills. Thus, the objective of the proposed Self-organizing Air VEnt (SAVE) system is to solve this critical drawback associated with the current programmable thermostats.

5. Project Objective and Total Amount Requested

To address the aforementioned over-cooling and over-heating problem, multi-zone HVAC systems have been used. The multi-zone HVAC system is part of the initial HVAC installation and consists of one or more central cooling/heating units, individual zone thermostats, a ductwork system, and dampers for controlling airflow to each zone as well as a central controller. These types of systems are exemplified by the Lennox HVAC Zone Control products. The over-cooling and over-heating problem can be mostly resolved since each zone is controlled by its own programmable thermostat. Yet, these systems require extremely high initial installation costs and expensive retro-fits in cases where a single zone system is converted into multi-zone systems (i.e. well beyond $10,000).

The advent of inexpensive low-power microprocessors and cheap IR sensors has led to the introduction of programmable battery powered air vent registers. Each battery-powered vent register can be programmed by its own programmable thermostat or from its IR remote temperature controller, which opens or closes the vent to regulate conditioned air according to a programmed setting. A prime example of these types is the Activent Vent-Miser ($20 per unit). Though, the disadvantages of the Activent products are threefold. First, the existing vent registers need to be removed and replaced by the Activent registers. Second, the Activent product does not come with any
central controller, and therefore, it can greatly damage a HVAC when all the vent registers happen to be closed while the HVAC unit is operating. Hence, the *Activent* manual strongly warns and recommends a limit of only one-third of the existing vents be replaced with their products. Finally, an individual within a household is required to program each Vent-Miser thermostat to avoid over-cooling and over-heating, which not only makes it difficult for the individual but also makes the programming more prone to errors (you can reword this but I think it’s can be quite difficult to be correct.

The **objective** of the proposed *SAVE* is to address the problem of over-cooling and over-heating via zone-to-zone automatic temperature distribution mechanism. The *SAVE* system will achieve a similar outcome of the *Lennox* types of multi-zone HVAC systems with a surprisingly affordable *Activent* Vent-Miser price. The following are notable features of the *SAVE* system compared to *Lennox* and *Activent* products.

- It does not require a retrofit of an existing HVAC system.
- It does not replace any existing vent registers.
- It does not require any stressful programming of zone controllers or air vent registers. Instead, it dynamically finds ideal vent controls that maintain zone-to-zone even temperature distributions throughout an entire house.
- It is safe to use and will not damage the HVAC unit.
- It is fault-tolerant; it can still operate even if one or more vent registers malfunction.
- It is extremely easy to maintain.

For this *SAVE* project, we are requesting **$50,000**, which covers four CS and ECE graduate research assistants summer assistantships, one month of PI Uh’s summer
salary, electronic parts and materials to build SAVE controllers, and travel costs to introduce the SAVE system during the annual HVAC trade show.

6. Resource Commitments that Reflect Boise State’s Priorities
Since 2005, the University has dedicated resources to the Office of Campus Sustainability led by Dr. John Gardner. In 2010, Boise State became the leading institution in the new Energy Efficiency Research Initiative at Center for Advanced Energy Studies (CAES). The mission of the new Initiative is to increase education and research in energy efficiency, which represents the ultimate objective of the SAVE System.

7. The SAVE System’s Potential Impact to the Economy of Idaho
There are several significant ways in which SAVE will positively affect the economy of Idaho. First, the SAVE system can be supported by the State Legislatures for energy efficiency, and it can be supported by Idaho local utility companies as a consumer commodity for the same reason. Second, as long as the SAVE system implementation, testing and market acceptance look promising, it can easily augment various HVAC products from the Nest, Lennox, Activent and other suppliers, which will help U.S households save cooling and heating bills. By approaching existing manufacturers with enhanced and working versions of their own products by the SAVE system, we can make it easy for them to visualize the SAVE system’s Intellectual Properties (IPs) in their product line. Third, a provisional patent for the SAVE system also gives us and Boise State University a sellable piece of IP.

8. The Market Opportunity for the SAVE Project
   I. SAVE System Architecture
Automatic zone-to-zone temperature distribution

The battery powered SAVE system consists of (1) multiple Zone Controllers (ZCs) (Figure 2.a) and (2) one or more registers (Figures 2.b and 2.c) which are wirelessly paired to each ZC (Figure 2.d). The ZC does not operate a HVAC; instead, it continuously repeats the following tasks while the HVAC unit is operating:

- Measuring the current zone temperature
- Wirelessly receiving temperature information from other ZCs
- Controlling the valves of the wirelessly paired SAVE registers

The wireless communication for the SAVE will be done using a low-power RFM12B (433Mhz) radio technology. The radio waves on 433Mhz frequency band, compared to 2GHz microwaves, travel significantly longer, penetrate walls, and leave much better at the same transmission power. Therefore, desired zone-to-zone communication among ZCs can be facilitated for the house size up to 4,000 square feet with RFM12B radio modules without any extra antenna or repeater.

II. How SAVE System works

Automatic zone-to-zone temperature distribution

Suppose a house with the proposed SAVE system, which is configured with three ZCs and each ZC, is paired with two registers as shown in Figure 3.
Additionally assume that the sampled temperatures for ZCs $\alpha$, $\beta$ and $\gamma$ at time $t_0$ were 75 F, 70 F, and 80 F respectively when the central programmable thermostat turned on air conditioning with 72 F. There are many possible algorithms for automatic controls to achieve an even zone-to-zone temperature distribution. For this project, we will start with a simple algorithm. At any given point of time, the ZC which has the largest delta from the 72 F, opens the valves of its paired registers and all the other registers close their valves. Figure 4 shows the dynamics of the zone-to-zone temperature changes until 72 F.
The SAVE registers will be installed below existing air vent registers not to interfere with any existing vent fixtures. For easy installation and maintenance (i.e., annual or bi-annual battery replacement), the SAVE registers (Figure 5.b) will be designed with an expandable rubber insulator to fit securely in either the air duct interface (highlighted in RED in Figure 5.a) or the air vent register interface (highlighted in BLUE in Figure 5.a.). With this register placement, the SAVE can be exempt from many mandatory testing required by the Consumer Product Safety Improvement Act.

IV. Why SAVE System is Safe?

*Automatic zone-to-zone temperature distribution*

Each SAVE Register is equipped with both temperature and pressure sensors to detect airflow and temperature from an air duct. Each ZC will be able to detect the state of its paired SAVE Registers, i.e. open, close, or not responding. Each ZC also will be able to detect the health of all the other ZCs and will help prevent the catastrophic case, “*all registers happen to be closed while the HVAC unit is operating!*”

V. Responses to items a), b) and c): Please refer to Sections 5 and 7.

9. The Technology and Path to Commercialization

I. *What stage in the process SAVE project is currently at*
• January 2013: Kyle Schwab (ECE/CS graduate student) and PI Uh submitted Creation of Works Disclosure to Boise State University and Industry Ventures.

• February 2013: The University and Industry Ventures at Boise State University assigned the SAVE project Boise State File #130.

• Since January 2013: With the CS Department Support (Dr. Harold Blackman) and PI Uh's research grants, Kyle Schwab and PI Uh have been building required electronic components for SAVE Zone Controller (ZC) and Registers.

• March 2013: Jared Law (CS graduate student) and Nathan Riskey (CS graduate student) joined the SAVE project as graduate research assistants.

• March 2013: Nate Calvin, the head of Kinetic Engineering Group (http://www.kineticengineeringgroup.com/index.html) joined the SAVE project as a business partner and he is currently building the mechanical prototypes for SAVE Registers.

• April 2013: A patent agent examined the SAVE invention in prior art. He summarized three points of novelty and un-obviousness seen in the SAVE according to the Title 35 of the United States Code (numbers 101, 102 and 103).

• May 2013: Gregory Cook (CS graduate student) joined the SAVE project as a graduate research assistant.

II. What this funding will accomplish

• Support the research team to build hardware/software and build a deployable SAVE system for testing and benchmarking.

• Support the research team to develop SAVE ZC and Register with minimal cost.

• Support the research team to meet HVAC manufacturers
III. *What tasks are required to move the SAVE project to the next stage and the intended outcome*

- Task: Filing provisional patent for SAVE project.
- Task: Testing and benchmarking
- Task: Timing of action - Market strategy and planning

PI Uh submitted a proposal on a *Flexible Smart System for Lighting (FSS4L)* to HERC-2012, which was not selected for funding. Recently, we found that the LED investment company at the Silicon Valley successfully raised its funding $1.4M with the similar project and technology which we already have. [http://www.kickstarter.com/projects/limemouse/lifx-the-light-bulb-reinvented](http://www.kickstarter.com/projects/limemouse/lifx-the-light-bulb-reinvented)

- Task: Manufacturing plan
- Intended Outcomes: (1) completion of the provisional patent filing on the SAVE system invention and (2) production of SAVE systems that can be deployable at my neighbor’s houses.

10. Commercialization Partners

Nate Calvin, the president of *Kinetic Engineering Group* ([http://www.kineticengineeringgroup.com/index.html](http://www.kineticengineeringgroup.com/index.html)) will be the SAVE system’s commercialization partner. In particular, Nate Calvin and his engineering team will build the mechanical prototypes of the SAVE system and help us commercialize the SAVE system as a consumer product.

11. Specific Project Plan and Detailed Use of Funds

For the tasks in Table 1, PI Uh will lead the research team of four graduate CS/ECE students – Kyle Schwab, Jared Law, Nathan Riskey and Gregory Cook. All the SAVE
team members have prior industry and academic experience in design and implementation of embedded systems. First, the research team will prepare the electronic and mechanical prototypes for the SAVE system described above by the 2nd quarter of the project, and we will deploy the prototypes to the houses of the project participants and do the testing and benchmarking the effectiveness of the system during the 3rd and 4th quarters. In addition, PI Uh will prepare the required document for provisional patent filing with the Boise State University. During the 4th quarter, we will begin public SAVE system demonstrations.

<table>
<thead>
<tr>
<th>Tasks</th>
<th>1st quarter</th>
<th>2nd quarter</th>
<th>3rd quarter</th>
<th>4th quarter</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>7/1/13 - 9/30/13</td>
<td>10/1/13 - 12/31/14</td>
<td>1/1/14 - 3/31/14</td>
<td>4/1/14 - 6/30/14</td>
</tr>
<tr>
<td>Electronic prototype</td>
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</tr>
<tr>
<td>firmware development</td>
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<tr>
<td>mechanical prototype</td>
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<td></td>
<td></td>
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<tr>
<td>testing and benchmarking</td>
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<tr>
<td>patent preparation &amp; filing</td>
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<td>project demonstration</td>
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<tr>
<td>HVAC trade show</td>
<td></td>
<td></td>
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</tbody>
</table>

Table 1. SAVE Project Plan

The requested $50,000 will be used to support (1) four CS and ECE graduate research assistants summer assistantships, (2) one month of PI Uh’s summer salary, (3) electronic parts and materials, and (4) travel costs to introduce the SAVE system during the annual HVAC trade show.

12. Institutional and Other Sector Support

Computer Science Department and PI Uh at Boise State University will support the participating graduate students for the SAVE project by providing research assistantships during the 2014 academic year.
FACILITIES, EQUIPMENT & OTHER RESOURCES

FACILITIES: Identify the facilities to be used at each performance site listed and, as appropriate, indicate their capacities, pertinent capabilities, relative proximity, and extent of availability to the project. Use “Other” to describe the facilities at any other performance sites listed and at sites for field studies. Use additional pages as necessary.

Laboratory:  Micron Engineering Center 302 - Computer Science Research Lab

Clinical:

Animal:

Computer: PI Uh has one 24-core Intel Xeon CPU (2.4Ghz) server and two Core i7 servers to manage the project development source code and report the progress of the proposed SAVE development. Two Windows 7 workstations and two Linux workstations for firmware development.

Office: Micron Engineering Center 302-N

Other: PI Uh has two floating licenses of IAR WorkBench to develop firmware on Atmel 8-bit microcontrollers

MAJOR EQUIPMENT: List the most important items available for this project and, as appropriate, identifying the location and pertinent capabilities of each.

20 Atmel XMEGA-B1 XPLAINED Evaluation Kits, 8 Atmel JTAGICE3, 5 BeagleBoardXM, 1 Pandaboard, and 3 Raspberry pi

OTHER RESOURCES: Provide any information describing the other resources available for the project. Identify support services such as consultant, secretarial, machine shop, and electronics shop, and the extent to which they will be available for the project. Include an explanation of any consortium/contractual arrangements with other organizations.

Geared motors and drivers, temperature/pressure sensors, acceRFM12B (433Mhz) radio modules, accelerometers, Atmel Raven, and TI CC2530 ZigBee network processor development kits
Biographical Sketch of Gang-Ryung Uh
Associate Professor of Computer Science  U.S. resident
Dept. of Computer Science
Boise State University
1910 University Drive, Boise ID 83725  uh@cs.boisestate.edu
http://cs.boisestate.edu/~uh  Tel: (208) 426-5691

Professional Preparation
B.A.  1987  Economics
  *Hankuk University of Foreign Studies*, Seoul, Korea

M.S.  1992  Computer Science
  *Florida State University*, Tallahassee, FL

Ph.D.  1997  Computer Science
  *Florida State University*, Tallahassee, FL

Appointments
08/2008 - present  :  Associate Professor, Dept. of Computer Science, *Boise State University*.
08/2010 - 07/2011  :  Research Associate (sabbatical) for the NSF grant CNS-0964413,
  Static Pipelining, an Approach for Ultra-Low Power Embedded Processors
  Dept. of Computer Science, *Florida State University*, Tallahassee, FL.
08/2002 - 07/2008  :  Assistant Professor, Dept. of Computer Science, *Boise State University*.
  *Intel Performance, Analysis and Threading Lab*, Champaign, IL.
05/2005 - 08/2005  :  Research Associate,

Five most relevant publications (student author names shown in italic font)


Complete listing of current support

<table>
<thead>
<tr>
<th>PI/Co-PI</th>
<th>Grant/Research Fund</th>
<th>Amount</th>
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<tbody>
<tr>
<td>Google Faculty Research Award</td>
<td>$37,400</td>
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</tr>
<tr>
<td>Korea Evaluation Institute of Technology (KEIT) Grant NO. 10041725</td>
<td>$154,289</td>
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<tr>
<td>Small Medium Business Administration (SMBA) Grant NO. 0004537</td>
<td>$130,594</td>
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Synergistic Activities

• 2012 Google Faculty Research Award - Open-Source ARM Cortex A8 Compiler: An optimizing ARM Cortex A8 compiler development via streamlining LLVM and VPO compilers to generate high performing ARM Cortex A8 machine code, which can match the performance of Cortex A9 with significantly reduced power consumption.

• Ad-hoc Wireless Physical System Development: (1) Zigbee-based Wireless ad-hoc LED (Light Emitting Diode) network that can be accessed and controlled using smart phones and (2) Four-wheel Lego Mars Rover that can be wirelessly controlled over Bluetooth.

• Pin-based Dynamic Cache Simulator Development for Shared Address Space (SAS) Multiprocessor Architectures: On-line PIN cache simulation tool that reports cache performance for x86 multi-threaded applications with various cache coherence strategies, i.e., MSI, Dragon, and Directory-based.

• LeJOS Robotics Activities Development for Undergraduates and High School students: (1) Initiation of Computer Science Robotics Club (2009) and (2) creation of Robotics activities during e-Day (K12 under-represented students) and e-Girls (9th–10th grade female students) to broaden under-represented students’ participation into STEM.

• Conference: (1) Programming Committee members for INTERACT-15 and INTERACT-16, (2) Local chair ACM SIGPLAN Conference on Languages, and Compilers and Tools for Embedded Systems (LCTES 2005), and (3) Programming Committee members for ICPP’03, and LCTES’02–LCTES’05.

Collaborators & Other Affiliations

• Collaborators: Dan Connors (Colorado State University); Gary Tyson (Florida State University); Jae Ryu (University of Idaho); Robert Cohn (Intel); Ramesh Peri (Intel); Santosh Pande (Georgia Institute of Technology); Zhenghao Zhao (Florida State University).

• Graduate Advisors: David Whalley (Florida State University); Theodore Baker (Florida State University).

• Thesis Advisor and Postgraduate-Scholar Sponsor: Christopher Healy (Furman University); Frank Mueller (North Carolina State University); Prasad Kulkarni (University of Kansas); Steve Hines (Google);
GANG-RYUNG UH, Ph.D. – CURRICULUM VITAE

A  Contact Information

Department of Computer Science, Boise State University,
1910 University Drive, Boise, Idaho 83725
E-mail: uh@cs.boisestate.edu,
Home page: http://cs.boisestate.edu/~uh,
Phone: 208.426.5691

B  Research and Teaching Interests


C  Formal Higher Education

      Dissertation: “Effectively Exploiting Indirect Jumps”
1993  M.S.  Major: Computer Science. Florida State University, Tallahassee, Florida. Thesis:
      “Predicting Consumer Expenditure Behavior with Neural Nets”

D  Professional Employment

2008 – present  Associate Professor, Computer Science Department, Boise State University.
2010 – 2011  Research Associate (sabbatical) for the NSF grant CNS-0964413, Static Pipelining, an Approach for Ultra-low Power Embedded Processors, Dept. of Computer Science, Florida State University, Tallahassee, FL.
2002 – 2008  Assistant Professor, Computer Science Department, Boise State University.
2007 (Jun–December)  Consultant, Intel Performance, Analysis and Threading Lab, Champaign, USA.
2006 (May–August)  Consultant, Intel System Software Lab, Hillsboro, USA.
2005 (Dec)  Research Faculty, Seoul National University, Korea.
2005 (May–August)  Research Faculty, Seoul National University, Korea.
1990 – 1997  Research/Teaching Assistant, Department of Computer Science, Florida State University, USA.
E University Level Teaching

E.1 Courses taught

1. Quantitative Computer Architecture (grad) Boise State University, Boise, Idaho
2. Advanced Topics in Compilation (grad) Boise State University, Boise, Idaho
3. Introduction to Computer Science I (undergrad) Boise State University, Boise, Idaho
4. Introduction to Computer Science II (undergrad) Boise State University, Boise, Idaho
5. Embedded Systems Design in C (grad) Boise State University, Boise, Idaho
6. Programming Language & Translation (undergrad) Boise State University, Boise, Idaho
7. Problem Solving in C (undergrad) Florida State University, Tallahassee, Florida

E.2 Courses created

1. Quantitative Computer Architecture (grad) Boise State University, Boise, Idaho
2. Advanced Topics in Compilation (grad) Boise State University, Boise, Idaho
3. Embedded Systems Design in C (grad) Boise State University, Boise, Idaho
4. Problem Solving in C (undergrad) Florida State University, Tallahassee, Florida

E.3 Courses revised in large

1. Introduction to Computer Science I (undergrad) Boise State University, Boise, Idaho
2. Introduction to Computer Science II (undergrad) Boise State University, Boise, Idaho
3. Programming Language & Translation (undergrad) Boise State University, Boise, Idaho

F Publications

F.1 Refereed Journals

1. I. Finlayson, Gang-Ryung Uh, D. Whalley and G. Tyson. "An Overview of Static Pipelining." IEEE Computer Architecture Letter (CAL), ISSN:1556-6056, Volume 11, No. 1, Jan 2012. The paper was selected as the BEST paper and presented during the 19th IEEE International Symposium on HPCA.


F.2 Refereed Conferences


F.3 Refereed Workshops


F.4 Patent


G Invited Talks/Presentations


**H Funding**

1. Principle Investigator, Google Faculty Research Award, “Preprocessing for Modulo Scheduling within Open-Source ARM Cortex-A8 Compiler,” $37,400, August 2012 –.


H.1 Equipments awarded

1. INTEL Corporation, 2x Intel Itanium IA64 MP 1.3Ghz Rackmount server, $11,655.00, Mar 2007.
2. INTEL Corporation, 4x Intel Xeon MP 2.7Ghz Rackmount Server, $28,159.00, Oct 2006.
3. AGERE SYSTEMS Corporation, DSP16000 software tools and DSP16410 development boards, $36,000.00, Dec 2005.
4. CYPRESS SEMICONDUCTOR Corporation, PSoC development kits, $10,000.00, Oct 2005.

I Mentoring

I.1 Graduate Students

• MS student: Kyle Schwab: SAVE: Self Organizing VEnt Control.
• MS student: Jared Law: SAVE: Self Organizing VEnt Control.
• MS student: Nathan Riskey: SAVE: Self Organizing VEnt Control.
• MS student: Gregory Cook: SAVE: Self Organizing VEnt Control.
• Ph.D committee: Doosan Cho, Dept of ECE, Seoul National University.
• MS Chair: Jaremy Creechley, Topic: LAZYCAt: A Lazy XMLPL Compiler and Runtime System, October 2012.
• MS student: Pallayya Sarma Karra, Tentative topic: Visualization of Dynamic Loop Profiling Information.
• MS committee: Kevin Nuss, Topic: A Tool to Aid in the Parallelization of C and Fortran Programs.
• MS Chair: Ravi Ayyagari, Topic: A Dynamic Loop Profiling, Optimization and Detection Tool, August 2007.

I.2 Undergraduate Students

• Ryan Baird (CS), Topic: LLVM-VPO Compiler for ARM Cortex A8
• Jason Wall (CS), Topic: 3D NBody Gravitational Simulation
• Mark Stewart (CS), Topic: 3D NBody Gravitational Simulation
• Paul Turner (Physics), Topic: 3D NBody Gravitational Simulation
• Dan Crow (CS), Topic: Visual Interactive Assembly Level Optimizer for DSP16000, August 2005
• Steve Mathie (CS), Topic: Visual Interactive Assembly Level Optimizer for DSP16000, August 2005
• David Zuercher (CS), Topic: Automatic Code Generator for Embedded Processors, Dec 2004
• Charles Paulson (CS), Topic: Automatic Code Generator for Embedded Processors, April 2004

J Professional Service

2010-2011 Program Committee Member, Workshop on Interaction between Compilers and Computer Architectures (INTERACT)
2004– Chair of Board of Directors, Idaho Korean Community Association
2002– Reviewer of numerous journal and conference articles, approx. 40.
2003 Program Committee Member, International Conference on Parallel Processing (ICPP).
Tenure period.

K References

References available upon request.
May 10, 2013

Boise State University
Attn: Dr. Gang-Ryung Uh

Dear Dr. Uh,

We are writing to express our support for your proposal for funding under the HERC Idaho Incubation Fund program towards developing Self-Organizing VEnt (SAVE) System.

The purpose of your proposed scope of work is important to the industry and we are interested in research and development opportunities that will assist in moving this technology to a stage that can be commercially marketed.

Kinetic Engineering Group is comprised of a team of forward-thinking, degreed engineers focused on bringing innovative projects and designs to market. Although the majority of our prior projects involve the process of development starting from the ‘ground up’; we have also successfully improved several existing processes and products using the same approach. In particular, we will provide the expertise, technology and experience is researching and designing the mechanical components of the SAVE Registers that best suits the intended market and meets the performance expectations. We have over 40+ yrs of manufacturing and design of electrical/mechanical components, which provided the basis for bridging the gap between R&D and full-scale manufacturing. We are prepared to provide the following support towards the SAVE project. Specific experience/expertise include:

1) Full Mechanical Design of components;
   a.  Simulation of System (FEA, CFD and Dynamic Motion Studies);
   b.  DFC/DFM criteria;
   c.  Life Test Analysis (simulated and empirically tested);
   d.  Prototype and model verification;
   e.  Beta Test Articles/Case-study implementation;
2) Electrical PCA Design:
   a.  CM selection;
   b.  DFM/DFC;
   c.  PSpice Analysis;
3) Business Model Development
   a.  Production Tooling/Options/Selection;
   b.  NRE Identification;
   c.  Cost Projections;
   d.  Business Model Development

We are committed to providing industry with the most current technology and see the opportunity to partner with Dr. Uh’s research at Boise State University to be extremely valuable.

Kinetic Engineering Group looks forward to our involvement and potential for interaction leading to the development and commercialization of Dr. Uh’s SAVE system as a consumer product.

Best regards,

Nate Calvin (Nate@kineticengineeringgroup.com)
Kinetic Engineering Group