

Idaho Incubation Fund Program

Progress Report Form

Proposal No. IF14-008
Name: Gang-Ryung Uh
Name of Institution: Boise State University
Project Title: Self-organizing Air VEnt (SAVE) System
Reporting Period: July 1, 2013 - Dec 13, 2013

Information to be reported in your progress report is as follows (attach additional information as needed):

1. Summary of project accomplishments for the period just completed and plans for the coming reporting period:

Electrical/firmware advancements:

1. Created a new electrical board roughly the size of a credit card designed for debugging and prototyping our system.
2. Created a big loop PCB antenna for 433 MHz spectrum on first electrical board prototype.
3. Created a Xtapped loop PCB antenna on 915 MHz spectrum for second electrical board prototype.
4. Changed from 433 MHz spectrum to 915 MHz spectrum for PCB antenna communication distance. We have achieved communication over a 150 ft non line of sight.
5. Sourced method for electrical boards to be fully assembled to minimize construction errors (we no longer have to hand solder parts to our boards).
6. Switched to a task based firmware implementation as well as introducing more abstraction layers to help further decouple the firmware from the physical hardware.
7. Verified communication with all sensor and motor modules.
8. Changed to new micro-controller ATXMEGA64D4 to better align ourselves with system tuning. The large flash size will allow us to experiment with different radio stacks.
9. Changed from using an IR sensor in conjunction with a DC motor to using a servo-motor to determine louver open/close state.
10. Established basic algorithm for equalizing room-to-room temperatures.
11. Changed to a new radio controller MRF49XA to account for our original RFM12B radio coming to end of life.
12. Designed board and firmware to allow for lowest possible sleep states as an interrupt driven design.

Mechanical Prototype advancements:

1. Moved from simple design concept prototype (valve) to a design closer to the final product

2. Sourced a new method for creating prototypes using lasers (will use this source to build prototypes for collecting data)
3. Condensed prototype to fit within a 4"x10"x1" box. (Typical size for household register boxes)
4. Created a louver linkage system that operates 4 louvers to open and close off airflow through a vent.
5. Designed a compact space for electronics to be held securely (circuit board, battery, motor, etc...)
6. Experimented with collapsible prototype design that would fit multiple register sizes.
7. Designed a battery access hatch for easy replacement of batteries
8. Designed a wedge in system to easily install and remove the prototype.
9. Researched companies that provide plastic molding services for final product design.

Completed as the date of 12/13/2013 →

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

2. Summary of budget expenditures for the period just completed (include project burn rate):

Student Salary \$2,277.00
 Fringe \$15.50
 Other Expense \$933.31
 Travel \$1,798.40
 60 Custom Printed Circuit Boards (PCBs): \$2,297.77
 Total Expense as 12/13/13 = \$7,321.98
 The current burn rate is \$6,413.00

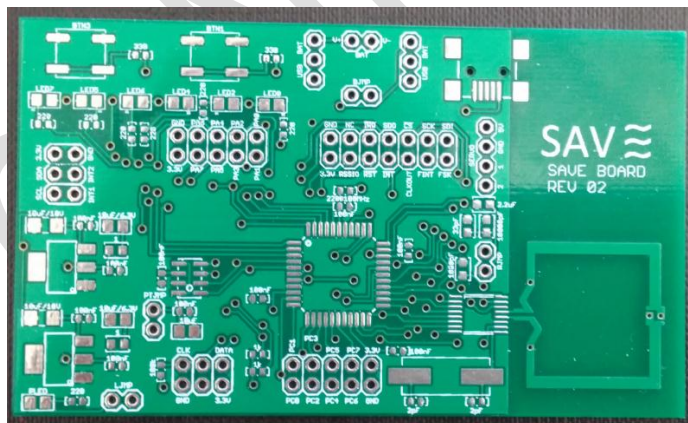
3. Numbers of faculty and student participation resulting from the funding, including internships: **5**

Gang-Ryung Uh (PI),
 Kyle Schwab (Graduate Research Assistant)
 Jared Law (Graduate Teaching Assistant) – Partially supported by HERC and CS
 Gregory Cook (Graduate Teaching Assistant) – Partially supported by HERC and CS
 Kyle Hoff (Undergraduate Research Assistant)

4. List patents, copyrights, plant variety protection certificates received or pending:

1. Provisional patent for “**SAVE**: Self Organizing Air Vent” is already filed - U.S. Patent Pending – 61/835,276.
2. Recognition of the Boise State University team for being selected as a runner-up for the Business Venture Challenge at UKC2013
5. List technology licenses signed and start-up businesses created:
Not Yet (We are preparing for this)
6. Status of private/industry partnerships (include enough information to judge level of engagement):
 1. For the SAVE’s mechanical prototype design and validation, we have been involving Nate Calvin (CEO Kinetic Engineering Group).
 2. The SAVE project just created additional partnerships with local software companies, IdeaRoom Technologies Inc (CEO Russ Whitney) and SMARTdwell Inc (CEO Steve Taylor) – we just submitted a proposal to IGEN 2014 to create a new venture and smart home service business.
7. Any other pertinent information that will indicate to the council that the project is meeting satisfactory progress.

- **SAVE’s Electrical/firmware advancements:
*Custom Printed Circuit Board (PCB)***



- **SAVE’s Mechanical Prototype Advancement:
*New prototype with the SAVE’s custom PCB***



- Planned future Project Diagram and IP ownership for a new venture with IdeaRoom, SMARTdwell, and Boise State University

