

IPRO 323 Project Plan

**Developing a Next-Generation Occupant Engagement
System**

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1.0 Abstract

Education of the public on sustainable development is a necessity if the technology and deployment of green design and construction is to succeed. Facing sustainable challenges in all aspects of energy and natural resource consumption, IPRO group 323 is looking to implement education of the consumer at their foundation-the home. Translating the sustainable terminology used in the media into a language found in residential life; our group proposes that if resource consumption is made into an understandable, built-in aspect of the home then education also becomes “built-in” to the public’s psyche. Green technology is becoming a common thing in buildings today but without a green consciousness in the public who would utilize these ideals, the technology will not be used to its fullest potential.

GOAL-to design a user interface that makes energy consumption a live, chartable and ongoing process that resident can track. This information when compared with current trends, prices or even equivalent energy consumption by neighbors becomes a powerful tool in illustrating just how important resources in energy are tracked in the individual realm of residential use.

2.0 Background

The IPRO is pending to be sponsored by ComEd in order to research possible methods of energy conservation. The focus of this project is to design a system that encourages energy conserving behavior in residents by use of an interface that displays real time energy use of a residence. For this system to encourage conservation on a significant scale it is necessary that it can be installed in both new and existing buildings. The

interface needs to give detailed enough data about the building's energy consumption for the user to make well informed decisions of how to save energy, but at the same time the data must be presented in an easy to understand format. Also, the unit or units that provide the data must be accessible enough so that the user can at any time be aware of the impact that activating a certain device will have on energy consumption in their home.

The technology to implement such a system as this is already made and on the market. Devices that measure power consumption are already widely used. The information gathered by these devices can be transmitted to a central hub by low bandwidth wireless devices, such as Zigbee. The information could be displayed for the user on televisions, personal computers, wall mounted displays, or cell phones. The software for displaying real time energy use has already been made. However, what is currently on the market is catered more so to businesses, not residences. It is a good example to begin with, but the IPRO's interface will need not only to tell the resident how much energy is being used, but provide encouragement for energy saving behavior as well.

This system is not the first attempt to reduce excess power consumption at home. New designs of appliances and light bulbs use less power than those before them, and The Museum of Science and Industry's Smart Home exhibit is a life size example of an energy efficient home. Where this IPRO differs though is that whether someone lives in the most energy efficient or energy wasting house in the country our system can help. The way that the system monitors a residence empowers the user to single out items that are wasting power and shut them off. This practice will save users money every month on their energy bills, which will in turn pay for the initial cost of the monitoring system.

3.0 Objectives

The main objectives for this IPRO stem from the need for ComEd to reduce energy consumption through altering consumer behavior. To this end we require a system that will monitor energy consumption, provide occupant's with information that will help them to make more efficient use of their energy resources, and at the same time be energy efficient itself.

4.0 Methodology

For most of this semester our primary goal will be to brainstorm and come up with possible ideas/implementations of a way to monitor energy use and give constructive feedback to the users of the system about their energy usage.

Our first concern is how to gather data from the user's use of the system, we will choose a method of collecting the data from individual devices. We then need to find a way to networking the devices together, along with methods of delivery to the user. We also need to decide which way (or ways, if more than one would be appropriate) that the

product can convey information to the user, and which ways will be most likely to cause the user to think more about their energy consumption. We will try to find the most important information to the user, and allow the user to more efficiently access that data, rather than the current system of waiting till the customer receives their bill.

Depending on what our research into products that already exist yields, we may be able to use a pre-existing product for the monitoring, and just add additional methods of communication to the user.

Since our project will mostly be research into the possible paths we can take in this field, we will be relying heavily on sources outside the group, possibly from professionals in the field if possible. We should be able to get a rough plan for the product done in the given time, but it is likely that a working prototype will be out of the scope of our team's goals, so we will work with that in mind. We do want to try to get a specific idea that could be expanded, possibly by further IPRO semesters, and transformed into a working product.

5.0 Project Budget

Due to the fact that our project is still in the very early stages of the concept phase of production it is difficult to give an accurate budget. While the need for research equipment may arise in the future we see no current need for funding.

6.0 Team Structure

NAME	Major	Skills & Strengths	Experience and Academic Interests	Team
Phillip Sirk	CS/CPE	Software	Embedded Systems/Software Development	
Kevin Ventullo	Math	Critical Thinking	Mathematical Research; previous IPRO	Human Condition and Marketing
Brian Parkes	Aerospace Eng.	Writing, brainstorming	Hardware retail	Global/Environmental concerns
Joshua Shaffer	Computer Science	Programming	Coding/Software Development	
Howard Clark	Architecture	Critical	Architecture	Existing Products

		Thinking		
Adrien Binet	Architecture	Brainstorming, Critical Thinking	Architecture	Existing Products
Marco Veneziano				
Ewa Guzek				

Members of our IPRO were split into two main groups, hardware and human behavior. The hardware group was tasked to research existing hardware with a focus on determining what benefits each implementation provided as well as determining which types of devices were feasible for our group to attempt to implement. The human behavior group was tasked to do research on various means of altering human behavior.

7.0 Code of Ethics

(see ethics iNugget)

8.0 Results

Our research determined that there is in a fact a need for a product like the one we have described, though not in the form that we originally assumed. Devices that monitor energy are not new and are at best novelty items in the current market. However, a simple software product, with possible hardware expansions, would have the benefit of being affordable and effective. Our team was able to identify many of the best qualities of existing implementations and tie them together in an affordable package. As far as objectives met go however we did experience a few setbacks. While the performance criteria was eventually defined we were never able properly document it. Also, the virtual prototype proved to be an unrealistic goal and was soon dropped for a simple energy use simulator. There were also many interesting ethical dilemmas in the area of information sharing and government control. One in particular was very difficult to come to an agreement on. The question of whether it would be ethical to distribute citizens energy

consumption statistics to their neighbors. It had been showed that such a practice could bring about a sprit of competition and drive down energy consumption without any sort of monetary cost. As beneficial as this sounded though, we could not get passed the fact that this information is still private and should not be disseminated to the public.

9.0 Obstacles

Our IPRO experienced more than its fair share of obstacles this semester. First, we were given basically nothing to build from. Aside from the IPRO description, which was vague at best, we had only our imaginations to bound our goals. This made the early stages of the IPRO very difficult since we had to go through the extra steps of defining our goals and even our motivation. We did our best to push through this however and I believe did a satisfactory job. A possible resolution to problems such as this would have been for the IPRO office to both describe their IPROs in more detail as well as screening potential IPROs that they deem not feasible. This is actually a continuing obstacle as several judges determined that our main objective was already being pursued by companies who would far exceed us in speed an quality. While we do not agree and believe that said judges were simply hearing what they wanted to hear and not our actual description it would still be best for such feelings to be shared before an IPRO is introduced.

10. Recommendations

It is the recommendation of our group that this IPRO be allowed to continue, however that it have either a more tangible challenge/motivation from the IPRO office, or that it be defined as searching for a non-product based solution.

11-12. References & Resources (See hardware compendium iNugget)

13. Acknowledgements

Our IPRO would like to acknowledge the following people/groups who aided us in our endeavors. First off we acknowledge Dirk Dennison, our advisor, who continually gave us new insight and motivation. We'd also like to thank our other advisors Jeremy Alexis and Jeremy Alexis for their unwavering support and valued advice. Last but certainly not least we'd like to acknowledge ComEd for giving us the motivation and the challenge that came to define our IPRO as well as for the guidance they provided throughout the semester.