Makahiki: An Open Source Game Engine for Energy Education and Conservation

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ABSTRACT
The rising cost, increasing scarcity, and climate impact of using fossil fuels as an energy source makes a transition to cleaner, renewable energy sources an international imperative. This paper presents Makahiki, an open source game engine for energy education and conservation. Makahiki facilitates the implementation of "serious games" that motivate players to learn about energy issues, improve their intuition about the energy impact of appliances and behaviors, and enable them to discover how to use energy more efficiently in their normal life. Makahiki has been used to implement "The Quest for the Kukui Cup", a three week energy challenge for over 1,000 first year students living in residence halls at the University of Hawaii in Fall, 2011. Evaluation of this initial deployment of Makahiki has revealed useful insights into its game mechanics, ways to improve the next Kukui Cup challenge, and the challenges when adapting it to other energy contexts.

Categories and Subject Descriptors
L.5.1 [**Game-based Learning**]: Gaming

General Terms
Human Factors, Games, Education, Motivation

Keywords
Serious Games, Education, Gamification

1. INTRODUCTION (PHILIP)
The rising cost, increasing scarcity, and climate impact of using fossil fuels as an energy source makes a transition to cleaner, renewable energy sources an international imperative. One barrier to this transition is the relatively inexpensive cost of current energy, making financial incentives less effective. Another barrier is the success that electrical utilities have had in making energy ubiquitous, reliable, and easy to access, thus enabling widespread ignorance in the general population about basic energy principles and trade-offs.

2. RELATED WORK (YONGWEN)
Our research draws on work we've done previously [2, 3, 4, 1], and well as from work done by others [5]. But mostly we just make stuff up.

3. SYSTEM DESIGN (GEORGE)
3.1 Requirements
The requirement is ....

3.2 Architecture
The architecture is ...

3.3 Game Mechanics
The game mechanics is ...

4. EVALUATION (?)
In Kukuicup.....

5. CONCLUSIONS AND FUTURE DIRECTIONS (PHILIP)
From the above .....

6. ACKNOWLEDGMENTS
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