

Title

Long title: Increasing motivation for energy-efficient behaviour based on smart metering data and serious gaming methods

Short title: SmartER Game (Smart Energy Ranking Game)

Background

About a quarter of German final energy consumption is caused solely by the residential sector. Aside from improving building insulation and HVAC systems, the improvement and optimization of tenants' consumption behaviour is considered a significant factor to reduce energy consumption within the residential sector. In this context serious gaming methods and gamification approaches can offer a chance to motivate tenants and encourage a more energy efficient behavior.

Research Approach

The research project "SmartER Game" aims on raising awareness for the way we consume energy, encouraging a more energy efficient behaviour and pointing out the benefits of smart metering technology to German consumers. To accomplish this, a web application has been designed that offers visualization and analysis of the consumed energy (electricity) and supplements these evaluations with gaming elements like rankings, avatars and competitions. Within the application users will be able to monitor and analyze their energy consumption and, in particular, to compare their energy consumption to other participants.

Residential living areas represent an inhomogeneous metering environment. Most German consumers still rely on analog meters, so-called Ferraris meters. Thus, one of the vital goals of the research project is to provide customers with an economical feasible, flexible and easy-to-use data logger that can be connected to common metering devices (analog and digital). According to these requirements the "SmartER-Box" was developed. The SmartER-Box is a single-board computer Odroid-C1 type that is equipped with a customized data logging software provided by our industry partner WiriTec GmbH. It is therefore capable of supporting common metering interfaces and protocols. For the purpose of digitalizing analog Ferraris meters we use an open source sensor made available by the volkszaehler.org community (www.volskzaehler.org). The sensor provides the capability to optically track the mark on the spinning metal disc of the analog meter and transforms this information into a digital signal which is transferred to the SmartER-Box via USB or via WiFi if available. The measurements then are either automatically transferred to a data server via a secure OpenVPN connection or can be manually read from the data logger by using a certified USB drive and later be imported within the web application.

The main goal of the gamification concept is, firstly, to inform about possible energy saving behaviours, secondly, to make energy saving a joyful experience, and, thirdly, to link the users' consumption pattern to a playful environment. Thus, in addition to monitoring and consulting components, the web application offers various active game elements. The main game concept is based on the idea of a management game. Therefore, each user is represented by an avatar which virtually represents the users' consumption behavior. The avatar appears in the shape of a camel, because the shape of the humps of a camel remind of the characteristic shape of a daily electricity consumption pattern, with higher consumption in the morning and evening hours. Competitive elements were implemented by a household ranking and an "energy race" (camel race). The ranking is based on a special scoring system which does not evaluate the total consumption of each household but assesses the success of energy saving efforts made by the player. Due to this approach it is possible to compare different households. The energy race is a weekly competition where up to five households, represented by their avatars (camels), compete against each other in a race. As most of the avatars' attributes are directly linked to the consumption pattern of a household, the probability to win a race is predominantly determined by the amount of saved energy. Additional game elements are "energy challenges", badges and an "energy quiz".

Conclusion

Over the course of the research project a web application (www.smartergame.de) has been developed which offers not only monitoring and visualization components but also gamified elements to support energy saving and efficiency measures of tenants. A flexible and low cost data logger was developed that is capable of digitalizing analog Ferraris meters. The data logger as well as the various game elements have been tested and proved to be practically feasible. A three-year operational phase adjoins the funding period of the project. The operational phase will be used to further investigate the impact of the gamified elements on tenants' consumption behaviour and to optimize the web application.

Key Information

Short title: SmartER Game (Smart Energy Ranking Game)

Researcher / Project Leader: Univ.-Prof. Dr.-Ing. Uwe Rüppel (Project Leader), Dipl.-Ing. Robert Irmeler

Total cost: 238.469,63€

Share of federal grant: 154.736,91€

Project Duration: 24 Months

Figures:

Figure 1: SmartERGame01.jpg

Optical Ferraris sensor

Figure 2: SmartERGame02.jpg

Data logger "SmartER-Box" based on Odroid-C1

Figure 3: SmartERGame03.pdf

Process model of the game (BPM Notation)

Figure 4: SmartERGame04.png

Screenshot of the web application: home page

Figure 5: SmartERGame05.png

Screenshot of the web application: monitoring components

Figure 6: SmartERGame06.png

Screenshot of the web application: energy-camel

Figure 7: SmartERGame07.png

Screenshot of the web application: energy race