Monitoring, Discussing and Publishing Energy Consumption Data using EnergyUse

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Abstract. We introduce EnergyUse, a collaborative website designed for raising climate change awareness by offering users the ability to view and compare the actual energy consumption of various appliances, and to share and discuss energy conservation tips in an open and social environment. The platform collects data from smart plugs, and exports appliance consumption and community generated energy tips as linked data. EnergyUse is supported by multiples automatic processes that semantically link related contributions, generate appliances descriptions and publish consumption data using the EnergyUse ontology.

1 Introduction

Climate change and increasing energy prices have raised public awareness concerning the importance of reducing energy consumption. However, finding relevant information concerning typical home appliances usage, costs and energy reducing tips remains a complex task due to the current lack of system that allow the centralised access to such information.

In order to address the previous issue, we present EnergyUse,[1] a collective awareness platform that provides an online environment for people to discover, share, and discuss tips for conserving energy, and as a consequence, learn how to reduce carbon emission and help the environment [3]. With the help of electricity monitors, EnergyUse enables users to view and compare their average electricity consumption with others. Semantics are applied in EnergyUse for content augmentation from DBpedia,[2] for environment-related tag extraction, and for Linked Data exports [3].

The aim of the demonstration is to show how the EnergyUse platform can be used by different types of users (Section 3). We also show how the integrated semantic aspects of the platform help making the platform more engaging to users and more scalable (Section 4).

This paper only focus on the platform capabilities and how it can be used by different users. A full description and analysis of the EnergyUse platform can be found in [3].

[1] EnergyUse, `https://energyuse.eu`.
[2] DBpedia, `http://dbpedia.org`.

2 Background

The energy consumption of individual appliances is generally not very well understood [9]. Most people are unaware of the consumption of their appliances [10]. Energy monitors could ease these issues, and have shown to lead to energy savings of 5-15% [6]. However, studies showed that energy monitors rarely attract user's attention for more than a few weeks, unless combined with other interventions, such as providing tips, motivations, and social engagement [7]. Open access to information is also important in order to increase awareness about particular topics as it promotes information transparency and simplify information access [5]. In this context, linked open data can be used for publishing information in a reliable and standardised way over the web [1].

3 The EnergyUse Users

We propose the EnergyUse platform that is designed to answer different platform user requirements. In particular, we distinguish three different types of platform users that may be interested in using the EnergyUse platform.

- **Providing and Searching of Energy Related Information**: Users may be divided into two non mutually exclusive sub-user types: Information seekers and information providers. In this scenario, a user visits the platform for either posting energy related information or replaying questions (information provider); or for asking help concerning a particular issue (information seeker). When looking for particular energy issue, a user may first browse topics and appliances related to her interests. By doing so, she can access average energy consumption information for particular appliances and see existing discussions. If she cannot find relevant information, she can create a new post and associate it with relevant topics. Information providers can participate by contributing to existing discussions or creating new posts.

- **Personal Energy Consumption Insights**: A particularity of EnergyUse is to allow users to connect an energy monitoring device with the platform. Users that have smart plugs can visualise the consumption of their appliances directly in the platform and can compare their consumption with others in order to better understand their own energy consumption. The consumption data from the connected devices are also aggregated and anonymised in order to build a general consumption model of electric appliances [3].

- **Linked Data Consumption**: The EnergyUse platform publishes user contributions and anonymised aggregated energy consumption data as JSON-LD[3] so it can be used in third party applications. We designed the EnergyUse ontology[4] for representing both user generated content and summary information about the energy consumption of individual appliances. When looking

[3] JSON-LD, `http://json-ld.org`.
[4] EnergyUse Ontology, `http://socsem.open.ac.uk/ontologies/eu`.

for energy consumption data, third party websites can directly access the data as JSON-LD by looking at the corresponding appliances pages. Using the EnergyUse ontology, they can easily integrate their own semantic data as the ontology is mapped to existing ontologies such as the SIOC [2], PowerOnt, MUTO, DC Terms, FOAF and MUO models.

4 Platform Semantic Components

EnergyUse uses different semantic processes for both improving the user experience and the platform administration.

- **Semantic Tagging**: Besides the manual tagging of discussions, automatic semantic tagging is used in order to improve information discovery. The aim is to add additional tags relevant to particular discussions in order to improve the connections between contributions and related topics.
  EnergyUse automatically identifies relevant topics and appliances from the post content using DBpedia Spotlight[5] [4] and ClimaTerm [8].[6] With such annotation tools, EnergyUse is able to extracts concepts automatically from existing discussions and posts.

- **Semantic Descriptions**: Each topic and appliance on the platform gets its own page that contains a description, the list of related discussion, and a representative background image and icon. This page has different purposes: 1) Allow users to access posts and energy readings for an appliance or topic, and; 2) Obtain general information about a given topic. When such a page is first created, there is no description or image to describe it. This information is inserted manually by the EnergyUse administrators. As a result, such pages could remain relatively empty for a little while, especially when several of such pages are created in a short period of time. To populate such descriptive pages automatically, EnergyUse retrieves relevant such as background images and topic descriptions from DBpedia using DBpedia Spotlight.

- **Linked Open Data Publishing**: In order to cater for users and websites that need to reuse the data created by the platform, we designed the EnergyUse ontology. For avoiding any privacy issues concerning the energy consumption data, we only publish aggregated and anonymised energy consumption [3]. Relevant data is made available in JSON-LD on the appliance pages as well as on the post and user profile pages. On the appliance pages, consumption data and description information are published whereas post pages contain the post data in SIOC format. Similarly summary user profile information are made accessible on the profile pages.

[5] DBpedia Spotlight, `http://github.com/dbpedia-spotlight/dbpedia-spotlight`.
[6] ClimaTerm, `http://services.gate.ac.uk/decarbonet/term-recognition`.

5 Conclusions

We presented how the EnergyUse platform can be used for helping users to understand their own energy consumption and how it can be used for discussing energy related concepts. We also showed how the data produced by the platform can be accessed and reused in third party applications. In the near future, we are planning to improve the platform by: 1) Providing a method for users to upload energy reading information even when no smart plugs are available, and; 2) Adding additional methods for accessing consumption data and user contributions outside the platform (e.g. SPARQL endpoint).

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