

Capturing and Linking Human Sensor Observations with YouSense

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Abstract. Semantic technologies are prominent for gathering human sensor observations. Linked Data supports sharing and accessing of not just data but also vocabularies describing the data. Human sensor observations are often a combination of natural language and categorizable entries, thus calling for semantic treatment. Space and time serve as natural integrators of data in addition to concepts. In this paper we demonstrate YouSense tool which supports gathering of experiences about spaces (like generic buildings or office spaces). Our contribution is also a vocabulary for describing the experiences as RDF and tools for visualizing and making sense of the gathered user experiences.

1 Introduction

Understanding how people experience surroundings (like office spaces or conference venues) supports to further develop spaces and to modify them to meet user needs. This *Human Sensor Web* approach is rather different from monitoring just technical parameters such as the indoor temperature, humidity, or CO2 concentration, typically in use to assess the performance of buildings.

The promise of Linked Data and semantic technologies in this setting is that they can offer ways to share and access these human sensor observations in a radically novel ways. The crucial tasks are to figure out how to describe the experiences of people in a processable way, and also how to gather the observations. Finally, Information Visualization is a useful step in understanding if the gathered data has a story to tell [1,2].

In this paper we demonstrate and present YouSense, a mobile and web application for supporting sensing of the spaces by people. We also present the EXPERIENCE vocabulary, a Linked Data compatible collection of terms to enable creation of RDF about the gathered experiences. The resulting history data provides evidences about comfortable and problematic spaces for both users of buildings and building managers. Our contribution includes also a set of visualization tools to make sense of the human sensor observations, and their thematic, spatial and temporal characteristics.

The paper is structured as follows. Section 2 presents the tool for gathering the user experiences and discusses the vocabulary for encoding them. Section 3 demonstrates the use of the gathered data and outlines questions one can ask with the system. Section 4 provides future work research agenda and concluding remarks.

2 Gathering Observations for Semantic Descriptions

YouSense³ is a web application that can be used from both mobile and desktop browsers. In YouSense, a user makes a sentence to describe how he/she feels in the space (see Figure 1 for an example). The structure of the sentence is defined with the help of the EXPERIENCE⁴ Vocabulary. EXPERIENCE is a lightweight vocabulary providing terms for creating descriptions of experiences (as instances of *Experience*) about the environment, for example how cold or warm one feels in a particular context created by the location, time and activities an *Experiencer* is involved with. It thus supports for describing user experiences and feelings.

The image shows two side-by-side screenshots of the YouSense web application. The left screenshot, titled "HOW DO YOU FEEL?", displays a form with the following fields: "When?" with the value "NOW", "Where?" with the value "in ROOM 3156", "What?" with the value "I feel _____", "Why?" with the value "because of _____", "Activity" with the value "I'm _____", and "Then..." with the value "I will _____". A large orange button labeled "SUBMIT FEEDBACK!" is at the bottom. The right screenshot, titled "WHAT?", shows a "Back" button and a text input area containing the sentence: "Now in the room 3156 I feel VERY COLD, FRESH AIR because of ____, I'm ____, I will ____". Below this are several buttons for selecting terms: "OK", "EXCELLENT", "HOT", "COLD", "CHILLY", "SMELLY", "TOO BRIGHT", "TOO DARK", "STUFFED AIR", "FRESH AIR", "COZY", and "ANNOYED". At the bottom is a grey button labeled "ENTER OWN".

Fig. 1. YouSense in action.

The structure of EXPERIENCE was designed to include things people generally use when they describe situations in spaces. We conducted a diary study, where people were asked to report about their experience about spaces in a free form. By analyzing the results of the user study we designed the set of terms to be included in EXPERIENCE. For instance, while we supposed people would

³ Demonstration also available online at <http://yousense.aalto.fi>

⁴ <http://linkedearth.org/experience/ns/>

like to relate the experiences to spaces, and times, it was rather surprising that they also wanted to guess about the reason for the experience.

Below is a simple example use of the EXPERIENCE Vocabulary, in line with Figure 1 but a completed one. In this example there is a person (*Laura*) who has experience (*VeryCold*) and (*FreshAir*) in her office (*Room3156*) in June 2014 while performing certain activity (*Sitting*). The observer has also communicated about the (possible) reason (“*Window is open*”) for the experience (*VeryCold*). We also gather the action that the experiencer plans to do next (*Work*).

```
@prefix experience:<http://linkedearth.org/experience/ns#> .

example:exampleExperience_34
  a experience:Experience ;
  experience:hasExperiencer feelingdata:Laura ;
  experience:hasEventExperience feelingdata:VeryCold, feelingdata:FreshAir ;
  experience:hasLocation feelingdata:Room3156 ;
  experience:hasTime "2014-06-20T10:00+02:00" ;
  experience:hasActivity dbpedia:Sitting ;
  experience:hasReason "Window is open" ;
  experience:hasFollowingAction dbpedia:Work .
```

3 Experimenting with YouSense in Concrete Use Cases

The sensemaking part of the YouSense creates diagrams for each of the message parts (reasons, locations, times, people, spaces, activities) with reasoning support (partonomy, concept hierarchy, temporal abstraction). For instance, the adjectives people reported about the certain experiences (such as cold or warm) about spaces support understanding of spaces.

Figure 2 depicts the approach by presenting a set of experiences about spaces as a bubble visualization. The experiences are aggregated to positive (green) and negative (red) ones. The floor plan visualization on the right shows a heat map of these aggregated experiences by rooms. Zooming closer to a room allows to see more detailed information about collected experiences and the spatial configuration of the room. The idea is to retrieve patterns like “rooms facing the sea generally have more positive experiences than ones facing the inner yard” thus supporting to reveal the causes of the experiences.

We have experimented YouSense with selected spaces at the Aalto University to evaluate its usefulness. These spaces include the Design Factory⁵, Media Factory⁶ and the spaces of the Department of Media Technology and Department of Automation and Systems Technology. According to the experiments and discussions with building managers the following types questions arose as the ones needing to be answered by making sense of the gathered data.

- what is the air quality of this space?
- do people feel comfortable in this space?
- do people stay in this space to work and study?

⁵ <http://www.aaltodesignfactory.fi>

⁶ <http://mediafactory.aalto.fi>

