A Prototype Implementation of the Open Geospatial Consortium (OGC) Sensor Web for Internet of Things (SWIoT) Service

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Introduction

Very soon billions to trillions of small sensors and actuators will be embedded in everyday objects and connected to the Internet forming a concept called the Internet of Things (IoT). IoT-enabled objects can sense their environment, collect information, and communicate and interact with each other. As defined by ITU (Telecommunication Standardization Sector of ITU, 2012), Internet of Things refers to “a global infrastructure for the information society, enabling advanced services by interconnecting (physical and virtual) things based on existing and evolving interoperable information and communication technologies.” In the context of IoT, the “things” in the physical world are identifiable and capable to be integrated into communication networks. By populating our environment with real-world sensor-based devices, the IoT is opening the door to a variety of application domains, such as environmental monitoring, transportation and logistics, urban informatics, smart cities, as well as personal and social applications.

Motivation

Similar to the Web 2.0, the real value of IoT is creating innovative applications by repurposing and assembling the IoT sensing and controlling capabilities from different sources in novel or effective ways. However, today’s IoT service providers are developing and using their own proprietary software interfaces. That means the number of proprietary interfaces are growing as the number of IoT devices increases. Consequently the efforts required to interconnect different IoT devices for innovative applications is growing exponentially. Standardized interfaces for sensors in IoT can solve this problem. There is a need for a standard Web Application Programming Interface (API) that can be used by all IoT sensing devices and applications.

To this end, a group named Sensor Web interface for the Internet of Things (SWIoT) Standards Working Group (SWG) formed in Open Geospatial Consortium (OGC). The SWIoT SWG is working on the above-mentioned IoT interoperability issues. The goal is to capture the observations and controlling capabilities from IoT devices and makes them easily available through data aggregation portals (e.g., cloud services for IoT devices). OGC has established a complete suite of standards for sensors, called Sensor Web Enablement (SWE). SWE has been implemented as the standard web service framework to interconnect sensors around the world. Examples range from international buoy network (National Oceanic and Atmospheric Administration, 2013), debris flow monitoring (Open Geospatial Consortium Inc., 2009), weather and soil moisture monitoring (Geosensor Web Lab, 2013), to citizen sensors [1] (Geosensor Web Lab, 2013). And OGC's new IoT standard will be based on the OGC SWE framework.

Implementation

We have developed a prototype implementing the OGC SW-IoT RESTful API. IoT devices can simply connect to our service prototype. IoT sensing devices can upload their observations to the service simply using HTTP POST request. Moreover, IoT controlling devices also can be controlled and tasked by users through our service implementation. Our prototype has the flexibility of updating and deleting the uploaded data using simple HTTP PUT and DELETE requests. The implemented service accepts JSON format for the input data and also GeoJSON for uploading location information. In addition, the retrieved data from the service also use the IoT data model encoded in JSON encodings.

Our prototype service is capable of demonstrating the following use case. The use case starts with some IoT devices register themselves to the service. For the sensing devices, registration information contains the phenomenon that is observed by one or many sensors. For the IoT devices that can accept tasks and be controlled, they can also register and publish their tasking capabilities to the service. After registration, sensing devices can start uploading their observations to the service. Then, users can access those observations and also send controlling tasks to the controlling devices through the service. All the scenario functionalities are following the RESTful architecture, *i.e.*, using the HTTP verbs (i.e., GET, POST, UPDATE, and DELETE).

In this presentation we will demonstrate our implementation of the SW-IoT service. Our implementation is world's first OGC SWIoT service implementation. In the demonstration, we will connect multiple air quality sensors to our prototype service, and demonstrate how different components working together. In addition, we will discuss our future work on IoT and Big Data. Several Big Data challenges in the context of IoT will be discussed and a future road map will be presented.

References

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[1] http://www.mdpi.com/1424-8220/13/10/13402