Demo Abstract: Disseminating WMSN Data by Using Social Network and Web

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Abstract. For smart cities applications, a key requirement is to disseminate data collected from both scalar and multimedia wireless sensor networks to thousands of end-users. Furthermore, the information must be delivered to non-specialist users in a simple, intuitive and transparent manner. In this context, we present Sensor4Cities, a user-friendly tool that enables data dissemination to large audiences, by using using social networks, or/and web pages. The user can request and receive monitored information by using social networks, e.g., Twitter and Facebook, due to their popularity, user-friendly interfaces and easy dissemination. Additionally, the user can collect or share information from smart cities services, by using web pages, which also include a mobile version for smartphones. Finally, the tool could be configured to periodically monitor the environmental conditions, specific behaviors or abnormal events, and notify users in an asynchronous manner. Sensor4Cities improves the data delivery for individuals or groups of users of smart cities applications and encourages the development of new user-friendly services.

1 Introduction

The popularization of wireless and sensor technologies, together with the demand for new audio/video services in Internet of Things (IoT) applications have fostered the development of Wireless Multimedia Sensor Networks (WMSNs) [1]. In this context, multimedia content provides more precise information about the monitored environment than simple scalar data, enables the end-user (or system) to visually identify the real impact of the event, and helps object/intruder detection. Thus, the users become aware of what is happening in the environment, and can plan actions [2].

Non-specialist users or civil safety organizations must have access to the monitored information to improve their actions. For instance, a rescue team can disseminate the potential risks of a certain area for users living or going there (save lives), users can access data about river flows (detect floods), or have information of available parking spaces (reduce time and fuel consumption). In

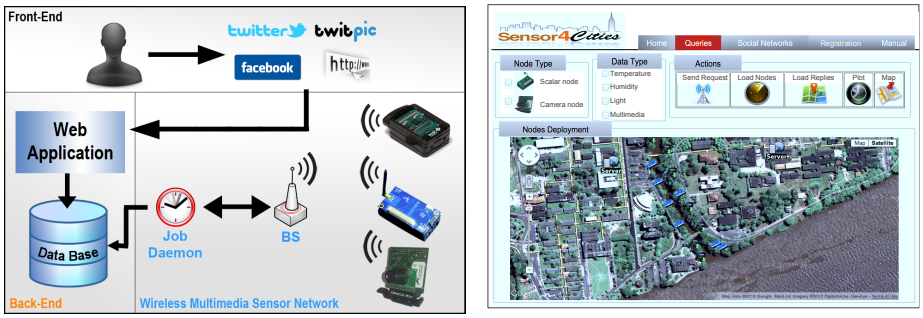
all smart cities applications and scenarios, users/authorities must receive/share scalar or multimedia data in a simple and efficient way, such as provided by social networks, and web pages.

This paper proposes the Sensor4Cities [3] tool to disseminate scalar/multimedia data for single or groups of users, to smart cities applications. Sensor4Cities allows users to access and share data in a simple, user-friendly and efficient manner through the use of social networks, web sites, including a mobile version of the web sites.

2 Sensors4cities

2.1 Sensors4cities architecture

Fig. 1(a) shows the Sensors4cities architecture, which consists of three components: front-end; back-end; and WMSNs. Front-end provides access to the system. The user can access the website (Fig. 1(b)) to request or schedule a query, view the history of monitored data, and see the node deployment in a map. Additionally, the users can request scalar/multimedia data using Twitter, due to its popularity and easy data dissemination. Finally, mobile devices, e.g. smartphones/tables, are very popular, and thus we include a mobile version of the Sensors4cities web site.



(a) Sensors4cities architecture (b) Sensors4cities Web page

Fig. 1. Sensors4cities

The back-end consists of two sub-components: database and web application. Both are running in a server. The web application has three Aplication Programming Interfaces (APIs) implemented in Java to provide a communication interface to a MySQL database, social networks, and website. The web application receives new queries from the front-end, inserts them into a database, checks for replies in the database, and sends responses to the front-end.

WMSNs have three sub-components: job daemon, Base Station (BS), and nodes. Job daemon is running on a server and implemented in Java. The BS is

connected to the server through an USB connection. The job daemon works as an interface between the database and the BS to forward the incoming queries to the BS, and to receive replies from the BS for inserting them into a database. The BS is used to broadcast the request message to the deployed nodes and receive replies.

2.2 Sensors4cities prototype

To exemplify how to use Sensor4Cities and show its features, we outline a prototype to collect scalar data using IRIS and SunSPOT nodes. The main purpose of this prototype is to test the communication and network response, rather than the monitored information. This is the reason for using the temperature and light sensors that are already embedded in IRIS and SunSPOT nodes. Moreover, to monitor specific data, sensors from different manufacturers can be easily included to allow Sensor4Cities to work with few changes on web application, database and job daemon to deal with the new data. For example, we use a CMUcam3 attached to a SunSPOT (camera node) to retrieve multimedia content.

Fig. 2 shows an overview of how to perform a scalar or multimedia data request from Twitter, which is conducted in the following stages: (1) the user sends a Tweet to Twitter of Sensor4Cities, i.e., @sensor4cities. The Tweet must contain the hashtag #sensor for requesting the scalar data, or #multimedia for a multimedia request. Thus, the web application can identify the requests by using these tags; (2) the BS broadcasts the request to WMSN nodes; (3) the nodes collect the multimedia/scalar data and send a reply; and (4) a Tweet is created to send to the user who initiated the request.

It is important to highlight that in most cases, the raw data is not useful information for a normal user. For example, a given temperature value does not provide intuitive information. However, information indicating the probability of fire, floods or rain are data that can be easily understood by a non-specialist user. Thus, Sensor4Cities creates responses based on a given scale (Fig. 2 in stage (4)) that should be deffined by a specialist.

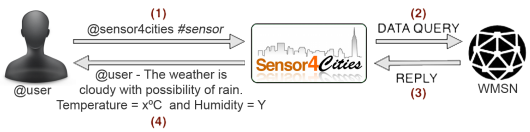


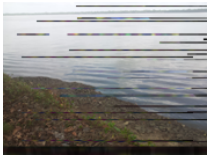
Fig. 2. Demo Scenario

In some cases it might be useful to have visual information from the monitored area, which could enable end users (or systems) to visually identify the real impact of an event, become aware of what is happening in the environment, take action and help to detect objects and intruders or analyse the scene. Sensor4Cities uses a camera node (Fig. 3(a)) to retrieve multimedia data from the

monitored area, such as streets and rivers. Currently, we provide only snapshots from the monitored area as shown Fig. 3(b).

As soon as a camera node receives the request, it should start to retrieve an image from the monitored area and send it to the BS. The BS receives the data and forwards it to the job daemon. Then, the job daemon reconstructs the image, saves it in a file, and inserts it into a database. As soon as the web application detects the image reply in a database, it uploads the image to Twitpic, and then creates a Tweet to the user who requested the multimedia data. It is important to highlight that the snapshot shown in Fig. 3(b) has some distortion due to packet loss during transmission between camera node and BS.

(a) Camera node



(b) Snapshot from monitored area

Fig. 3. Multimedia device and content

3 Conclusion

This paper has outlined Sensor4Cities, a tool which uses social networks and web pages to report monitored data from WMSNs. Sensor4Cities provides scalar/multimedia data dissemination to the end user by showing the results in a user-friendly and transparent way.

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