SmartFit: Lifelogging for Teams of non-Professional Athletes

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Abstract. In IoT domain, communities of domain experts, having different skills in specific areas of endeavor, need an effective and easy-to-use strategy for managing physical devices and their data streams. Specifically, in this paper we are interested in discussing a sociotechnical study aimed at designing an IoT ecosystem to be used by non-professional sport teams. Nowadays, coaches and trainers want to take advantage from the plethora of sensors and applications that can be used for monitoring the quality of their athletes' activities and behaviors, but they need an easy to use environment to perform proper policies, and the visualization and analysis of relevant events.

Starting from a definition of End-User Development (EUD) designed around the pervasive requirements of IoT applications, we describe a system able to provide coaches and trainers with a tool for monitoring, studying the flow of events to detect significant situations, and triggering proper actions through the use of filtering and temporal operators.

Keywords: Internet of Things, EUD, Rule Editor.

1 Introduction

The Internet of Things (IoT) concept is spreading thanks to the evolution of sensor technology and its use that is becoming more and more mobile and pervasive [1]. Tech-nology is part of everyday life, and some of this technology plays a role in sports prac-tice. New wearable trackers to place on wrists, ankles, or waistbands are driving the sport practice towards revolutionary changes together with other accessories or mobile applications that can be used for monitoring physical activities, quality of sleep, and diet. This type of integration is what characterizes the so-called lifelogging: keeping track of the collected data through all the everyday or occasional activities that may influence people's quality of life. Sports technology can exploit this Quantified-Self trend for helping people to adopt a healthy lifestyle or for supporting coachers to inves-tigate innovative strategies of training aimed at monitoring their athletes' physical ac-tivities and performances. The information this sport equipment can record — from steps taken to sleep hours — can be gathered and shared for tracking the quality of the sport activities or the quality of life itself of the athletes.

Proc. of Fourth International Workshop on Cultures of Participation in the Digital Age - CoPDA 2016
Gothenburg (Sweden), October 23, 2016 (published at http://ceur-ws.org).

One of the most exciting trends in the fitness industry is the emergence of the online fitness coach, web-based personal training services designed to give you the guidance you need to reach your goals; nevertheless, what we want to investigate in this paper is the problem seen from the opposite side. How coaches and trainers can use the data coming from the sport trackers or other tracking applications for monitoring their athletes. To connect in a network everyday devices and applications allows coaches and trainers to receive data, and at the same time to perform comparisons among athletes, but also understand when critical or interesting situation happen for each individual. Programming the behaviors of devices and applications is becoming suitable for everyone thanks to the design of interfaces that support customization, personalization, and to some extent also End-User Development (EUD) [2, 3]. To design and create new applications, it is less and less necessary to learn actual programming languages or to have previous software coding experiences. The peculiar structure of non-professional sport organizations is characterized by the existence of small teams with athletes who live different kind of lives, being professionals in different domains, and meeting only for some hours a week. Keeping track of their habits, in terms of physical activity, nutrition, sleep and so on, would help the coaches in understanding the variety of the team members and finding successful schemes of training. For managing such application domain, we need to define a EUD strategy for supporting domain experts in defining business polices and rules for detecting relevant and critical events.

2 Design Model

The knowledge associated with the design of the highly dynamic data processing that characterizes an IoT system is tacitly distributed among the various design communities. Specifically, in lifelogging and quantified-self applied to the management of non-professional sport teams, the communities are: IoT engineers, Coaches and Trainers, and Athletes. To perform their activities, coaches and trainers does not want to be bored by dealing with technical aspects that concern how to connect, maintain, and set up the devices and sensors to be used by the IoT ecosystem. These activities need to be carried out by IoT sensors/devices engineers whereas the role of coaches and trainers is to collaborate in guiding, instructing, and training the members of a sport team. To exploit at best, the potentials of IoT in their practice requires a specialized interactive system for designing rules for defining what actions have to be performed in response to specific events. They act as End-User Developers by designing the rules to be used to supervise athletes' performances and lifestyle and they also analyze the gathered data in their interactive system. Several solutions have been proposed to bridge the communication gap and to design usable interactive systems [4], [5]. Our design strategy stems from these works and aims at supporting multidisciplinary design teams' collaboration and to foster their situated innovation by means of several EUD methods. Our model follows a bottom-up approach that breaks down static social structures to support richer ecologies of participation. It offers three different levels of participation and design activities: i) Dataflow design level; ii) Rules design level; iii) Rules deployment, where the rules are deployed and end users use the environments and tools. At dataflow design

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level, IoT Engineers need to configure the network of sensors and services for managing the data-flow to be served at the rules design level. The outcome of this environment is the detection of a set of relevant events that coaches and trainers need to manipulate for monitoring the physical activities or daily behavior of their athletes. We identify an event with its temporal, spatial, and thematic dimensions that can be exploited both for the identification of the useful information needed to face a given event and for the analysis and forecast of useful activities to be notified to the users. In our architecture, the dataflow design environment is a Web environment where IoT engineers can drag and drop different sensor data sources and visually apply on them a set of operations. This application offers an engine and graphical environment for data transformation and mashup. Further details are reported in [6]. In what follows, we focus on the second environment, the Rules editor, which aim is to offer a graphical visual environment for supporting coaches and trainers to monitor a flow of events detected at the first level of our architecture, for analyzing actions and behaviors of their teams of non-professional athletes.

3 Rule Editor Interface

Visual strategies typically used in IoT field for modelling Event-Condition-Action rules can be described through the most famous systems that apply them: IFTTT[1] and Atooma[2]. These applications allow users to define sets of desired behaviors in response to specific events. This is made mainly through rules definition-wizards that rely on the sensors/devices states. The visual strategy aims at creating automated rules by using graphical notation for programming statements such as: “IF this DO That” or “WHEN trigger THEN action”. However, the language is not expressive enough for the specification of more sophisticated rules based on time and space conditions. For example, in a scenario where we want to monitor data related to health conditions and behavior of a group of athletes, apart from supporting logical combinations of conditions, we need to specify timing comparison between different events. For example that, the athlete has taken less calories of those burned in a physical activity that has been taken place after lunch. A second type of applications stems from another outstanding work done with Yahoo's Pipes[3]. Such applications offer solutions based on graphical environments for data transformation and mashup. The idea is to provide a visual pipeline generator for supporting end users in creating aggregation, filtering, and porting of data originated by sources. The visual strategies adopted by such Yahoos Pipes-compliant solutions are promising techniques but, in our opinion, they present some lacks. Some studies [7] also found that, although these strategies tried to simplify mashup development, they are still difficult to use by non-technical users, who encounter difficulties with the adopted composition languages [8].

Our Rule Editor user interface leverages the issues required for expressing complex conditions leading to a system that can be easily used by non-expert users. As depicted

[1] https://ifttt.com
[2] http://www.atooma.com
[3] https://pipes.yahoo.com/pipes

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in Figures 2 the interface is based on select widgets that are populated by using the attributes that characterize the JSON of the flow of events produced by the IoT Engineers. Through a visual notation, domain experts can specify conditions and temporal operations for implementing the business rules that characterize their activities.

An example of Composite Rule creation is given in Figure 2 where the user has defined four rules on the base of these conditions: (i) hours of sleep less than 7 (ii) calories intake at dinner greater than 1,500 (iii) number of steps less than 8,000 (iv) activity duration less than 45 (minutes). According to these conditions a set of four events are defined that can be built in this way: E1 AND E2 AND (E3 OR E4). The meaning of the Composite Rule created in this example is: “if the hours of sleep of the day before are less than 7 AND if the calories intake at dinner (before the sleep) is greater than 1,500 AND (if the number of steps is less than 8,000 at day OR the duration of physical activity is not less of 45 minutes at day THEN send the athlete a message that warns about the behavior and performances.

The Rule Editor aims at allowing non-technical people to specify rules by using simple drop-down menus. The conditions can be composed by combining groups of statements connected by using the AND/OR operators. The order of the conditions can be changed by the user just by dragging and dropping the statements into the right position. Domain experts can filter data on a certain period of time set by using the “validity interval” parameter (see Figure 2). Temporal conditions are defined using the automatically assigned names of the Rules as elements to be composed (e.g., E1, E2, E3). An example of complex temporal condition can be: E4 (activity duration less than 45 minutes) starts from 5 to 10 minutes before of the E2 (Calories intake at dinner greater than 1,500) and ends from 3 to 7 minutes after E2 ends. In other words, the trainer wants to check how much her/his athletes eat, if they eat seated at a table or when are on the move and in how much time. Once a rule is created, it is stored in a repository for further re-use or for sharing it among members of a community of trainers and coaches.

4 Ongoing Research

After a first evaluation performed involving HCI expersts, we are now setting up a user test evaluation for our eWellness system thanks to collaboration with the Centro Sportivo Italiano (Italian Sport Centre). A group of sport teams, all domain experts, will be involved in order to perform a set of activities concerning the design of data-flows and related rules from monitoring the athletes’ activities. What we want to study is how far our approach is able to offer new possibilities both at the design and use time and to understand how the idea to combine the design and end users’ environments appears to be successful and effective solution both for domain and technical experts.

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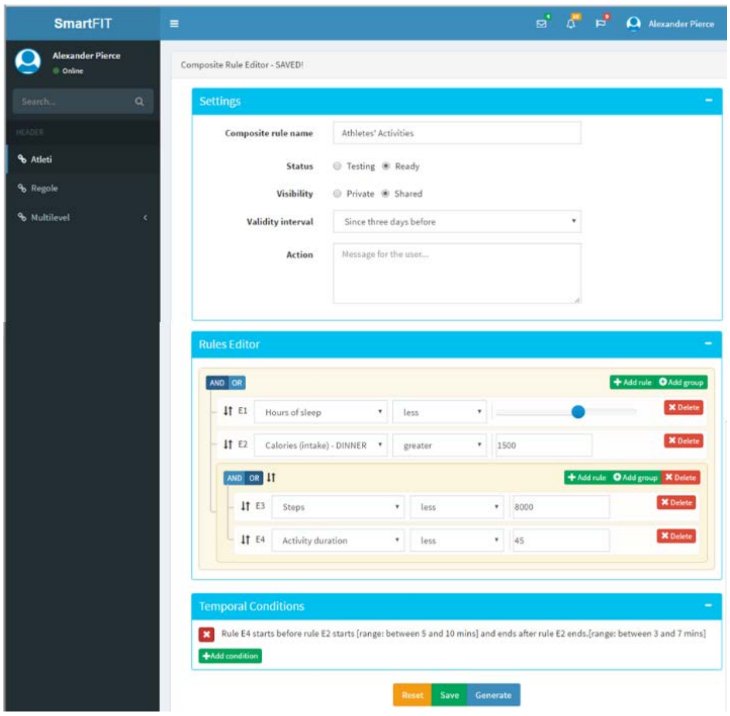

Fig. 1. Example of the composition of a set of rules.

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