Integrating Sensors in a Mobile Application Authoring Environment

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Authoring systems attempt to capitalize on the expertise of different domains towards in creating digital content to serve a determined demographic. Existing frameworks and systems enable non-expert programmers to create their own mobile applications with mild effort. Despite a certain range of diversity in this area, little relevance has been given towards capitalizing on all features of the targeted operating systems and / or devices. This paper presents the extension of DETACH – an authoring tool for Android mobile applications – with a set of features which enable non-expert programmers to access device sensor data with relative ease. Supported sensors encompass the chronometer, accelerometer, GPS and a set of third-party physiological sensors. In this report, we focus on the renewed system architecture, emphasizing the steps to add new sensors, the application deployment process and how sensor data is retrieved and evaluated to trigger behaviours in the developed applications.

1. MOTIVATION

Authoring tools have emerged as a valid alternative [Boujarwah 2011] to the stiffness of applications which fail to adapt to the constantly updated requirements of their stakeholders. This is particularly relevant in critical domains such as healthcare [Das 2002]. It can help domain specialists and IT experts in finding a commitment towards balancing the degree of intervention each of the involved parties is forced to partake in order to deliver appropriate applications for end-users. Existing solutions tackle a variety of devices, allowing for some flexibility as far as the richness of the created content is concerned. Little to no importance has been given towards the authoring of the device’s own sensors which may improve the quality of those applications [Hand 2012], a pivotal requirement in domains such as healthcare.

In this paper we present an extension carried out on the DETACH authoring environment. The goal consisted in imbuing it with the necessary components to harbour the usage of Android smart-phone sensors and / or other devices.

2. BACKGROUND

DETACH is an authoring environment initially created for the healthcare domain, but whose scope spans beyond it. Full details regarding the design process and initial architecture can be found in [Fernandes 2013 (a)] and early experimental periods in [Fernandes 2013 (b)]. DETACH allows non-expert programmers to compose mobile applications by selecting screen templates (e.g. screen with a label and textbox, screen with an image) and configure its contents. It also allows them to give the application some type of behaviour, by creating transitions from each screen to another based on different triggers (e.g. if the user types in a certain word, transition to screen 3).

As stated in both those articles, one of the most desired feature in this authoring environment was the ability to create applications which utilized data from external sensors, whether or not they were part of a smart-phone. The most sough-after requirements were:

- Sensors such as a heart rate monitor, time sensors / chronometer (e.g. time of day,) and GPS sensor access.
- Specialists expressed their wish to be able to easily configure sensors’ threshold values, in order to tailor them for each application and patient.
- Sensor data retrieval should be orthogonal to the mobile application. This means that the data should be collected and analysed at all times in order to trigger behaviours within the application.
3. AUTHORING ARCHITECTURE

The accommodation of the new features followed a similar development process as had been carried out in the original version of the authoring environment. We took special care in avoiding the disruption of the established application composition procedures for domain specialists, keeping most of the interaction workflows that we were able to extract from user testing in [Fernandes 2013 (b)] (Figure 1 – top-right). Likewise, IT experts were also taken into consideration, maintaining the requirement to create an XML file to specify screen triggers, a Javascript file containing each screen’s behaviour and a JPEG file for the screen template thumbnail in the authoring environment.

3.1 Updated Architecture

Figure 1 showcases the updated architecture. Significant differences encompass the inclusion of a new Event Manager component which runs on smartphones along with drivers for each sensor. These two components ensure that: i) applications are capable of collecting and interpreting sensor data; ii) applications are capable of using sensor data to trigger certain behaviours within them.

3.2 Adding Sensors to the System

Programming new sensors to the system follows the same requirements as adding a new screen. Some added effort is required to the development of the sensor drivers which need to be in accordance with the device’s characteristics or the manufacturer’s directives. The drivers are loaded once to the DETACH Mobile Application and can then be reutilized by different applications composed within the authoring environment.

3.3 Composing Applications with Sensors

The composition of applications including sensor data respects the directives found in the participatory design sessions, where subjects had already played with the possibility of including these components. Users indicate that an application uses determined sensors by activating them within the UI, and can then use that data when configuring screen transitions (e.g. when heart rate is above 75bpm transition to screen 2; when the user idles for 20 seconds at Trafalgar Square, switch to screen 4).

4. FUTURE WORK

We are currently performing usability and operability tests to the authoring platform. The first evaluation stage encompasses developers in order to assess the complexity of adding new sensors.

6. REFERENCES


