**BaranC: A Service-oriented Cloud-based User Interaction Monitoring and Analysis Framework**

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**Abstract**

A comprehensive user model, built by monitoring a user’s current use of a digital device (e.g., smartphone), and also collecting all available context data from the user (e.g., from sensors on a physical device itself: a smart watch, or in smart appliances) in order to build a full model of a user’s application behavior. The model built from the collected data, called the UDI (User Digital Imprint), is further augmented by analysis services. For example, a service to produce activity profiles from smartphone sensor data. The enhanced UDI model can then be used to guide and support various types of adaptive applications that take advantage of a user’s control as it is on an individual user model. BaranC supports continuous user monitoring, an application can be dynamically adaptive in real-time to the current context (e.g., time, location or activity). Furthermore, once BaranC’s core model is created, it can adapt over time to changes to the user’s behavior patterns. Since BaranC is continuously augmenting the user model with more monitored data, over time the user model changes, and the adaptive application can adapt gradually over time to changing user behavior patterns. BaranC has been implemented as an service-oriented framework where the collection of data for the UDI is all sharing the data of the UDI are kept strictly under the user’s control. In addition, being service-oriented allows (with the user’s permission) its monitoring and analysis services to be easily used by 3rd parties in order to provide 3rd party adaptive assistant services. An example, but party service developer, built on top of BaranC, proactively assists a user by dynamic prediction. Based on the current context, what app or content is the user likely to need. BaranC introduces an innovative user-controlled unified service model of monitoring and use of personal digital activity data in order to provide adaptive user-controlled applications. This aims to improve on current situation where the diversity of adaptive applications results in a proliferation of applications monitoring and using personal data, resulting in a lack of clarity, a dispersion of data, and a diminution of user control.

**Introduction**

Increasingly users are interacting with a wide variety of digital devices. This extends beyond using apps on smartphones to using various devices such as watches, activity monitors, and cameras. Increasingly users are interacting with a wide variety of digital devices. This extends beyond using apps on smartphones to using various devices such as watches, activity monitors, and cameras.

**BaranC Framework**

BaranC [2, 3] is a service-oriented user monitoring and analysis framework with various supporting services that reimplments and expands the scope of a previous interaction monitoring system [1, 2]. BaranC has a data management service to keep the data in containers for further usage. The data analysis service contains several software agents that process the data in order to analyse and extract useful information and knowledge out of the data. The data analysis is not limited to the framework analysis services. BaranC lets 3rd party services contribute to data analysis. As the framework is responsible for collecting the data and delivering it securely to 3rd parties, there is a security service that takes care of de/encryption.

**User Digital Imprint (UDI)**

The User Digital Imprint (UDI) is the user model that underlies BaranC. It is a model with a manageable, flexible, and scalable data structure that holds various types of data and information. The main focus of the UDI is to record the user’s digital imprint and by that we mean to record dynamic user interaction with digital devices. The UDI also contains dynamic information from any relevant sensors both in user devices (e.g., smartphone accelerometers) and in the environment (e.g. smart coffee-maker or a door sensor). The UDI model hierarchy contains at least three levels, Data, Information, and Knowledge (Figure 5).

**References**

[1] Mohammad Hashemi and John Herbert. User Digital Imprint. To be presented at requesting the user’s data from BaranC. The user’s data is granted by user. The service then analyses the data and the product can proactively service the user based on the user’s habits. For instance, if you’re at work, it’s morning, and Bob is home, then the tea maker service would command the tea maker to prepare a cup of tea for Bob.

**Interaction Profile**

The Interaction Profile is an innovative comparison scheme. It is based on three major metrics (Frequency, Duration, and Interaction) that can be used to characterize an activity where the user interacts with a digital device such as a smartphone. We also introduce two metrics derived from the main metrics (Engagement and Intensity) that emphasise other aspects of the activity profile. Figure 7 shows the interaction profiles of two of our users.

**Conclusions**

An interaction-centred user monitoring framework, BaranC, based on a comprehensive dynamic user model, the User Digital Imprint (UDI), has been presented. The UDI is a record of the user’s digital activities and associated context, and can be used to better understand a user for user-centered design, and can provide a basis for adaptive personalized user services. BaranC is implemented as an open cloud-based service-oriented framework that supports 3rd party services. The collecting, storing and sharing of the UDI data is kept strictly under the user’s control. Implementing the framework as a service-oriented system allows its services to be used in a very simple, direct and transparent way. We also present the Interaction Profile as a new way of computing two subjects that provides an informative summary of interaction based on five useful metrics. Frequency, Duration, Interaction, Intensity, and Engagement. The approach taken to user-centered design is based on finding out precisely (in an unambiguous way) how different users of technology are making use of existing applications, and using this is the starting point and reference point for subsequent design activities.

**Acknowledgements**

This work is supported by the Telecommunications Graduate Initiative (TGI) program which is funded by the Higher Education Authority (HEA).