Relative-Identity Management Based on Context

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Abstract. Mobile devices nowadays are equipped with sensors and technologies that enable context evaluation. Those devices are not expensive in such a way that everyone can buy a smart phone easily. So, developing mobile context-awareness applications for helping dependent persons to deal with their everyday tasks is crucial. This paper aims to develop a new identities management system that runs on the dependent person's mobile device. This system will assist dependent persons by giving them information, advices, instructions and helps regarding their activities of daily living. The main idea is to use a simple communication way to identify objects and subjects in the surrounding context of the assisted person. In this paper, we propose efficient identification mechanisms that take benefits from our well understanding of the context. Our approach simplifies the use of the interaction between dependent persons and the system. Hence, unlike usual approaches, the identity of a given entity will not be universal by widely tailored it to the current person's context. In the case where the context is shared by many entities with the risk of identification ambiguity, our identification could use different means such as colors or locations towards others for identification of entities.

Keywords: identify, relative identity, context, context-awareness, profile.

1   Introduction

Holly Price is a five-year-old girl that has been saving her father's life when he fell into hypoglycemic coma by injecting him in the stomach with glucagon: a hormone that raises blood sugar [1]. This means that everyone can save life of other even he/she has limited capacities. The question is how can we inform a helper to do something for someone. Otherwise, how we can use profiles management and context awareness to communicate with a dependent person. A dependent person (e.g. deaf, blind and handicap.) is one who needs help and assistance to do common tasks.

Identity is a set of information that permits to identify an entity in a unique way. This entity may be a person or an object [2]. Identity management is a set of operations that can be applied on identities, like definition, verification, creation, deletion, modification, etc. [3].

Data characterizing an entity represent the profile of such entity [4]. An entity can be an object or a person. Generally, objects are characterized by the physical information such as the size, weight, color, etc. However, peoples are characterized by demographic information such as age, race, etc. Modeling profiles is organizing the data to be understandable and processable by computers [5].

Information that describes situations of an entity represents the context of such entity [6]. In the other hand, context can be defined as the change of the profile values. In general, the context can be constructed by answering the following five questions: *who*, *what*, *when*, *where*, *why*. the *who* is the identification of the person, the *what* is the identification of the object, the *why* is the identification of the intention, the *when* is the time and the *where* is the location [7]. Context-awareness is the ability of an application or a system to discover and react to changes in the context [8].

Change in context can be easily captured by handheld devices such as smart phones, tablets, etc. Nowadays, handheld devices are equipped with various sensors (GPS, camera, microphone, accelerometer, etc.) that allow the sensitivity to changes in the context [9]. Also, they are equipped with communication technologies (GSM, UMTS, Wi-Fi, etc.) to be connected to networks (Internet, private networks, telephony, etc.) [10]. Moreover, the price of these devices as well as the subscription price for services is reduced by such a fate everyone can purchase smart devices and profit of offered services.

In [11] an architecture for context based Identity Management System using smart phones is proposed. This system permits the use of multiple sensors to evaluate the context and based on that evaluation it authenticates users with accuracy. It can check the identity of persons based on the context, but it cannot identify this person to others in simple way.

This paper aims to develop a relative identity management system. This system will assist dependent persons by giving them information, advices, instructions and helps regarding their activities of daily living. The main idea is to use a simple communication way to identify objects and subjects in the surrounding context of the assisted person. This work that will be presented in this paper is a major part of the following previous works.

In [12] we have proposed an architecture for home automation system. The main objective was to adapt indoor context to the preference of inhabitants. The architecture is composed of: sensors to evaluate the environment, actuators to act on environmental parameters (temperature, lighting, etc.) and database containing the profile of each inhabitant. In addition, a decision support system is proposed to calculate new environmental parameters values based on the current context and inhabitants profiles.

In [13] we have proposed a new middleware called *tinyUPnP* to enables interoperability between home devices. Proposed middleware works in same way the UPnP architecture, except that data control used by underlying protocols (SSDP, HTTP, SAOP and GENA) were reduced. So, our new protocols called *tinyHTTP*, *tinySOAP*, *tniySSDP* and *tinyGENA* were proposed. [20:36:51] T. L.: Consequently, by reducing messages size, the processing time and the amount of exchanged data were optimized.

2   Concept of "Relative Identity"

We define the new concept of *Relative Identity* to identify objects or subjects uniquely in a well-defined context. This implies that the identity may change with the change of the context and the change of the person for whom entities will be identified. Thus, identity will not be universally unique.

As illustrated in Figure 1, the red pen can be identified in several ways depending on its context and on to whom it will be identified. In case (a), it can be identified as "*the pen*"; in case (b) there are two pens, so the red one can be identified by "*the red pen*"; in case (c) it can be identified by "*the red pen*" or "*the thin pen*". For a person who cannot see red colors, the pen can be identified as the "*longest pen*" (case c). For a blind person, the system can use a voice message. In general, the relative identity system will be based on the person's profile: it can use textual messages for a person who can read text, voice messages if the person is not able to read or a picture for a deaf person who cannot read (e.g. with an arrow as shown in Fig. 1 (b)). The relative identification can consider other dimensions from the person's profile such as the speaking language, color blindness, etc.
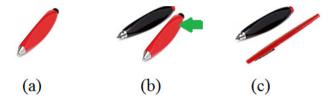

Fig. 1. Red pen relative identification in different contexts: (a) the pen is alone, (b) two pens with the same form but one is red and the other is black, (c) tow pen with different forms

3   Architecture of Relative Identity Management System

The objective of our Relative Identity architecture is the development of a management system for identifying people and things in a simple way. As illustrates figure 2, the architecture is composed of the following elements:

- **Profiles Manager:** permits the user to update the profiles structure and consequently the way in which they will be processed by the *Context Manager*.
- **Profiles Data Base:** contains the current profile instances.
- **Context Provider:** it is the responsible for acquiring information from the environment and to deliver it to the *Context Manager*.
- **Context Manager:** it processes data received from the Context Provider. It calculates profiles values and updates Profiles Data Base. Also, it detects anomalies and notifies the *Identity Manager*.
- **Identity Manger:** its main role is to translate notifications coming from the Context Manager into an understandable and processable format.
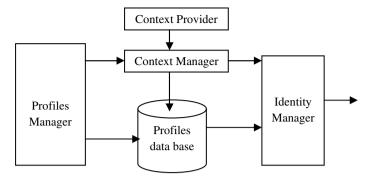
Fig. 2. Architecture of relative identity management system

4   Tests and Results

In order to test our solution we propose the following scenario. The system detects that the inhabitant (e.g. the father) is falling into a hypoglycemia coma and he needs a glucagon injection that is in the refrigerator. So, the system has to inform the nearest helper (e.g. the son/daughter) about the situation and what he/she has to do. It should send a message depending to the current context, such message could be "*your father needs a glucagon injection that is in the refrigerator, your father is in the bed room*".

Note that the system message and choice of the nearest or more appropriate helper is the result of the context processing (i.e. the answers of the five questions discussed previously in the Introduction). In our scenario, the considered questions and answers are the following couples: ("who is the subject needing help?", "universal identity of that person into hypoglycemia coma"), ("who is the helper?", "universal identity of a person based on the profiles of the available helpers"), ("what happens", "a person is in hypoglycemia coma"), ("where is the person", "he is in the bad room"), ("what we have to do?", "glucagon injection"), ("where are the glucagon?", "it is in the refrigerator").

In case where the helper is the son, and he is blind and he understands only English, the system has to use voice provide required assistance. However, in the case where the helper is the daughter and she is deaf and cannot read text messages, the system has to use picture like illustrated in figure 3.

Fig. 3. The interpretation of the message "your father needs a glucagon injection that is in the refrigerator, your father is in the bed room" using a picture

5   Conclusion

The objective of this work is to assist dependent persons by giving them required help regarding their activities of daily living. The main idea is to use a simple communication way to identify objects and subjects in the surrounding context of the assisted person.

In this work, we have presented a new concept that we called *Relative Identity*. Relative Identity consists in identifying object and subject based on theirs context. Also, we have proposed an architecture to enable that integrate our proposed concept. We tested the architecture using two scenarios. The first scenario illustrates how the context elements are identified using textual message. However, the next scenario illustrates that it is possible to identify context elements by using pictures.

Relative Identify proposes an efficient way to identify situations, persons and actions and allows to take into consideration the context and its changes over the time.

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