Supporting User Interaction of Social Network Mobile Application with Multimodal Interaction

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***Abstract* -- Developing commercial multimodal interfaces to date has been accommodation of the practical aspect of usability of the application. The advent of advanced mobile devices in combination with new interaction modalities and methods, opens new possibilities in user interface adaptation. In this paper we propose a framework to enhance the user interaction of a social network mobile application with multimodal adaptation. Our approach integrates the multimodality adaptation for both input and output modality interaction according to user needs.**

Keywords: *Multimodality, Multimodal Interaction, Ubiquitous computing*

I. INTRODUCTION

Social Networks (SNs) have been a facilitator to share common interests and information while building communication and interactions among group of users. Users join, establish social links to friends, and leverage their social links to share content, organize events, and search for specific users or shared resources. Among user activities; post contents to the application, share personal news, accomplishments, interests etc. are popular. This content can be in the form of simple text status updates, videos or photos.

In the interaction techniques context, use of multimodal interfaces allowing users to interact with the system by a combination of several input modalities, has played the key role. Multimodality in mobile computing appears as an important trend, but a very few applications allow a real synergic multimodality. The researchers are studying models, frameworks, infrastructure and multimodal architecture allowing relevant use of the multimodality, especially in mobile situations [1].

The interaction modalities are not limited to only tactile, voice or gesture-based interaction, but also more implicit information, which is gathered from e.g. multitude of sensors. The requirements for choosing a certain modality often depend on the context, e.g., time, location, social setting, or security demands. [2]

Enhancement of user Interaction still plays an important role in any of the application design and development. As well, SNs are the most popular context in the internet where thousands of applications are attracted. In order to attract users to social networks enhancing users' interactions is really important.

Novel interaction modalities have shown superior performance in e.g. task completion time than traditional methods or enable novel scenarios in different domains such as indoor navigation, health and fitness, or education and entertainment. However, the adoption of multimodality in the real world is still cautious, both from user and development side.

Smart environments challenge user interfaces with a variety of available mobile interaction resources supporting diverse modalities, and heterogeneous users with different capabilities and preferences. A user interface which is supporting smart environments features requires a high degree of adaptability to innumerable contexts of use. Unfortunately, today's user interfaces do not sufficiently support the creation of ubiquitous systems and smart environments and a significant improvement of the communication, interaction and adaptation capabilities is required. At the same time the user must be given the power of understanding and controlling her/his smart environment in a flexible and comprehensible way [1].

Therefore the need for Ubiquitous User Interfaces (UUIs) addressing the challenges of the ubiquitous computing paradigm is more useful for SNs applications. We propose a novel interaction framework that enhances the user interactions in SNs application to support real time adaptation.

Currently smartphones are with variety of input/output modalities but according to our questionnaire conducted towards the smart phone users to gather the information regarding the user experience of different input/output modalities, most of the users have shown moderate level of experience with provided modalities or they have not known about controlling the applications or they are not aware about the existing modalities embedded into smartphones.

The paper is organized as follows. Section II discusses the related work. Section III presents the requirement analysis. Section IV discusses the proposed MM framework followed by conclusion and future work in Section V.

II. STATE OF THE ART

Multimodality is seen as the combination of multiple input and/or output modalities in the same user interface, together with additional software components such as fusion, fission, and synchronization engines [1]. Multimodal interactions play an important role in current mobile applications with the help of number of sensors which are natively embedded in smartphones/tablets to support applications with input modalities: tactile, voice, styles, gestures etc. and output modalities: voice, text, graphic, video, ringing etc. According to Elouali et. al 2013, **Table 1** represents some examples of interaction modalities [3].

Table 1: Examples of interaction modalities

Modality	**Mode**	**Interaction language**	**Device**
Acceleration	Gesture	Direct manipulation	Accelerometer
Location	Gesture	GPS positioning data	GPS
Speech	Voice	Natural language	Microphone
Pointing gestures	Tactile	Direct manipulation	Touch screen
Orientation	Gesture	Direct manipulation	Compass
Speech synthesis	Audio	Natural language	Speakers
Displaying image	Visual	Widgets	Screen

Multimodal interfaces are being commercialized smart phone and other applications, as illustrated by multimodal interfaces created Speech Work sand Ford at the 2003 North American International Auto Show [4]. Most of the research approaches focus on each interaction modalities independently and then fuse information at the application level, such as processing two input modalities (i.e. facial expressions and vocal emotions) respectively to analyse emotions [5].

The goal of research in multimodal interaction is to develop technologies, interaction methods, and interfaces that remove existing constraints on what is possible in human–computer interaction perception, towards the full use of human communication and interaction capabilities [6].

CenseMe is another SNs application, which represents the first system that combined the inference of the presence of individuals using off-the-shelf, sensor-enabled mobile phones by sharing information through SNs applications such as Facebook and Myspace [7]. But they did not consider MMI in their application development.

In considering the applicability of MMI in SN applications, Kong J et.al 2010 stated that their approach supports human-centric adaptation where a user can report the preference of a modality so that selected modalities fit user's personal needs. An optimal solution and a heuristic algorithm have been developed to automatically select an appropriate set of modality combinations under a specific situation [4]. However their approach did not consider about information presentation such as what information/how to present. Additionally several studies have reported that multimodal interfaces is becoming a way to achieve more efficient, pleasant and adapted interaction for mobile applications [8].

Furthermore, multimodal interfaces potentially support adaptation at the input level as well as the output level. The automatic adaptations have been explored separately by various researches [9]. But there is a growing necessity of exploring the applicability of adaptation in both input and output side in development trend in software development. As well different APIs have been developed to implement applications and some studies have proposed frameworks to facilitate the software engineering life cycle for multimodal interfaces in Android [10].

In this study we proposed a framework for SNs which support users with all the possible interaction modalities, find most suitable input and output modalities depend on the user expectations while considering possible interaction context factors (E.g. time, location etc.) and create automatic user preferred *Settings Profile* for each users in SNs application.

III. REQUIREMENT ANALYSIS

Initially, the questionnaire was conducted on a focused group and smartphone users to identify the requirement of applying multimodalities with SNs application from both user's and developer's perspectives.

The focus group was conducted with fifteen participants (9 males, 6 female) between 24 and 35 years. All participants rated their smartphone expertise as high or very high. In a questionnaire, we investigated current usage and adoption of multimodality, and elicited unsatisfied needs and expectations. In the following, we summarize the most important results and design implications.

In order to consider the developer's perspective, we interviewed five software developers involved in mobile application development and asked how they were satisfied with the smartphone SNs and wishes for future SNs applications regarding their programming needs.

IV. PROPOSED MULTIMODAL ARCHITECTURE

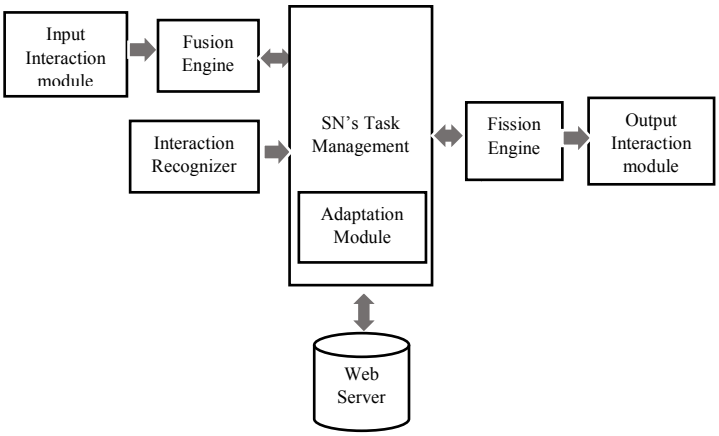

Figure 1: Proposed framework for user interaction enhancement in social network applications

Figure 1 shows the proposed framework to deal with SN's tasks: user registration, users' feeds, internal messaging, user search, personal profiles views, Text/ File/ Audio/ Video sharing (Timeline) etc. while creating the user interactions with multimodality and adaptation concepts.

The proposed framework for SN itself provides users all the possible interaction modalities, by finding most suitable input and output modalities depend on the user expectations in the fusion and fission engines. The Interaction Recognizer recognizes possible interaction context factors (E.g. time, location etc.) to support for the automatic adaptation of the social network activities and send the information SN's Task Manager.

Interaction context describes the state under which a person uses a device. User plays a central role in the human–computer interaction. The delivery and rendering of information to a user must fit the user's personalized features, such as the user's personal experiences, motion, physiological and mental states and abilities (E.g. mood), current activity, etc. Input/output modalities must adapt to these types of user requirements. The environment in which the user interacts with the device is another important entity in the human–computer interaction. The environment is not directly related to the user, but rather sensed through advice. It continuously affects the interaction of a communication mode. For example, a high noise level could significantly reduce an auditory effect. According to interaction factors identified, the task fission engine select possible output modalities to select for the assigned tasks. The automatic user preferred Settings Profile for each users in SN application.

We have implemented our SN by allowing users to upload status with their feelings, current activities engaged current locations, maintain a profile messaging etc. The tasks can be controlled with the input modalities; Virtual keyboard, Voice, Styles, Head shake and the output modalities: Graphic, Text, Voice and Video. The system's tasks are mainly consist with an input modality interaction, evaluation phase, output interaction and adaptation process as shown in figure 2.

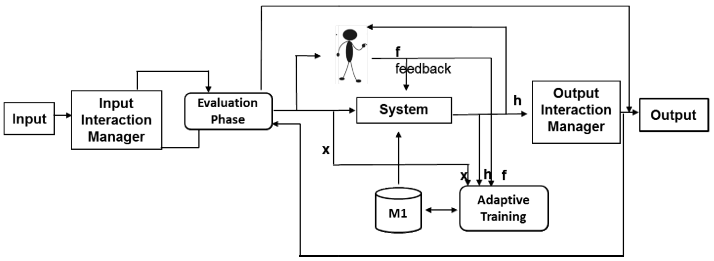

Figure 2: System task model (x - Input to the system, h - Output of the system, f - Feedback of users)

V. CONCLUSIONS AND FUTURE WORK

Our research study is conducted to show that multimodality can truly enhance SN mobile applications, particularly in mobile contexts: our test users appreciated the freedom to use alternative modalities in the social network application.

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