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CONTEXT-AWARE MOBILE APPLICATION WITH PROXEMIC: DESIGN DISCUSSION

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Abstract

This paper tries to discuss possible problems and their solutions in designing context aware mobile application that does not use location (physical proximity) but using proxemic (logical proximity). Logical proximity is not bound to location, but, as context area which constrained logically, it can be defined through activities or tasks people are engaged in. We illustrate these concepts through the prototype of a mobile application to help students to find friends in similar interests and in their proximity.

Keywords: *context-aware, location, logical proximity, mobile application, proxemic.*

1. Introduction

The development of wireless communication and ubiquitous computing technology has enabled a novel adaptive and pervasive interaction in social environment. A university campus, a social environment where students, faculty staff, and other campus entities make lots of social interactions between them, can benefit that technology to provide proactive services in campus environment.

With the fact that many students come from different city of origins with different backgrounds, these students may encounter social problems such as loneliness and adjustibility to different culture environment. The university can extend the use of computing and communication service from academic-centric to more social aspects of daily life. It can be done by designing a system which adopts social context such as proximity, communication history, activity, location and user profiles to support social interaction.

This paper paper will discuss about the possible problems and possible solutions while designing a context-aware mobile application system with proximity. The system would assist students to find partners who are in their proximity and interested in same activities. The range of proximity can be in their classes, accomodation, or anywhere they stay to do things together.

The rest of paper is organized as follow. A brief overview of context and proxemic is explained followed by mentioning some existing research from previous works straightaway after this paragraph. Section 2 details application design including basic system architecture followed by application diagram. Later, the discussion about possible problems and their solution is described. Finally, conclussions and some possible future improvements are provided in section 3.

In [1], Dey and Abowd defined a context as:

Context is any information that can be used to characterize the situation of an entity. An entity is a person, place, or object that is considered relevant to the interaction between the users and application, including the user and application themselves [1].

From that definition, it is reasonable to accept location, identity, activity and time as important elements of context [1] [2]. In [3], context is characterized as dynamic, relational, and imperfect.

The term of proxemic is first coined by Edward T. Hall in 1966. It is a theory of people's understanding and use of interpersonal distances to mediate their interactions with other people. There are four distance zones that suggest certain types of interactions: intimate distance (6-18 inches), personal distance (1.5-4.5 feet), social distance (4-12 feet), and public distance (12-25 feet) [4].

In addition, Greenberg et al identified five essential dimensions of proxemic relationship as a first-order approximation of key proxemic measures. They are:

1. Orientation: the relative angles between entities.
2. Distance: the distance between object, people, and digital devices.
3. Motion: changes of distance and orientation.
4. Identity: knowledge of identity of a person or a device.
5. Location: the setup of environmental features [5].

The notion of context and proxemic are such an interesting topic in ubicomp. Several research in those fields have been conducted. The following paragraphs will point out some of those notable works.

In [6], Prante et al introduced the notion of distance-dependent semantics in the form "Hello Wall"

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application, where the distance of an individual to the display (the wall) defined the possible interactions and then the information will be shown on the display. The more advanced concept was conducted by Vogel and Balakrishnan in [7]. They created public ambient display that relates people's presence in four discrete zones around the display to how they can interact with the digital information content. In another occasion, Lochtefeld et al proposed the adoption of interaction techniques that relay on spatial relationship to enrich mobile projection interfaces [8].

In terms of controlling device to device connectivity, two different works published by Want and Rekimoto considered as powerful techniques for connecting devices that are in very close proximity. Want's [9] technique was using an attached RFID tag to detect nearby objects and device, while Rekimoto [10] used a combination of RFID and infrared to establish device connectivity.

An approach to detect interaction group in intelligent environment was proposed by Maisonnasse et al in [11]. The model was derived from gravitational model and cognitive psychology approach as well as exploited contextual elements like position, speed, and saliency of object to estimate shared attention.

Pichler in [12] introduced a wireless context area networks (WCANs) as enabler of ubicomp information access. His vision is to see communities built by human, who come together in the same context area which can be limited physically or logically (physical proximity or similar situation).

Yu in [13] designed a mobile client-server based application to support social interaction in campus environment. The server will agregate and analyse social context collected by the client such as proximity and communication history to provide social services. Some basic functions of this system consist of 7 (seven) modules existed in mobilesocial networking including semantic extraction, pattern mining, ubiquitous search, location management, scalability, lightweigth, and Connectivity.

The eyeJOT project proposed by Bashar from the University of Lubeck Germany is another example of incorporating context-awareness in campus-wide environment. It combined the ambient giant-size display with location-aware and context-sensitive information sharing on mobile devices to provide a ubiquitous context-aware campus information system. The system can provide functions and detail information to the user by mean of user's proximity and proximity-location-tracking [14].

Another work issuing the social interaction and communication change following the emerging technologies is described in [15]. Closely similiar to the work in [13] and [14], Benjamin and his colleague developed a system that implemented in a campus environment. However, while the former focusing on engaging social interaction the later come with more holistic approach and implementation. It included a new perspective in embedding mobile cloud-learning educationand mobile-learning domains to form intelligent campus environment.

2. Discussion

This section will provide the basic system architecture of context-aware mobile application followed by the discussion of some possible problems and solutions in respect with the pre-designed system architectureand application.

The basic system system architecture is illustrated in figure 1. There are three main entities. The first entity is students with mobile phones. This entity represents the user of the system. System entity comprises of mobile phone with RFID and the designed application. The last entity is medium. It serves as a connection media between systems. In this design, Wireless Ad Hoc Network was used as a medium, since the mobile nodes in the network can establish routing among themselves dynamically to create their own network on the fly [16].

Proxemics in terms of logical area is not bound to location. If the students wherever they might be have similar interest would be listed, and communication would mainly be using an Internet connection. Context areas that are constrained logically can be defined through activities or tasks people are engaged in [17].

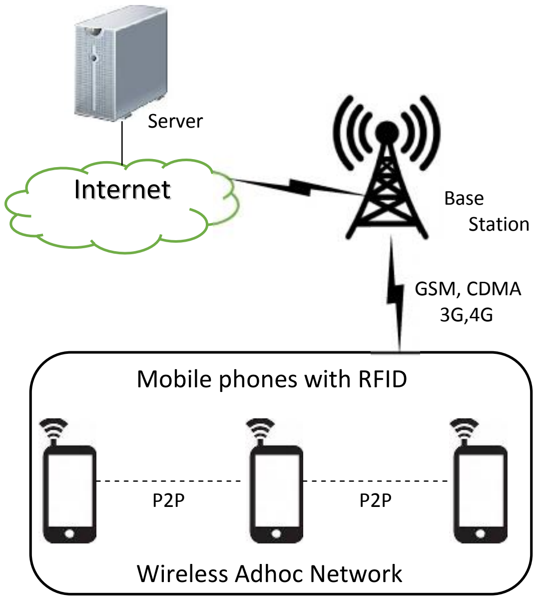

Figure 1. Basic System Architecture

In this application, the proxemics term is applied in computing user's self-interest. When the application is launched, it will compute user's self-interest either automatically or manually. Automatic self-interest computation means that the self-interest is formulated based on installed applications, viewed web pages, music, and movies that exist in the user mobile phones. While manual self-interest computation allows the user to define his interests which will then be used to get appropriate results. The complete picture about the application flow diagram is depicted on figure. 2.

There are mainly 9 (nine) features of this application including share your plans, join other person's plan, chat with available person, manage plans, file sharing service, video service, voice communication service, update privacy features, and block the person.

There are some possible problems and solutions in accordance with the design. The implementation of that design requires one to answer these questions.

A. How will the system detect and identify other student?.

The first step of the system requires detection and identification of students. A RFID tag is a drive with Radio Frequency Identification (RFID) technology. This allows the mobile object to be tracked in a real time [16]. RFID tags in mobile phones can be used to detect and identify people in the proximity, as RFID reader would read only tags within a certain distance. Cell phones with RFID would be available in the near future. For instance, Nokia already releases a RFID kit to enable phones to use RFID technology; however, the range of these RFID readers are very low currently [17] [19]. RFID technology is not the only solution to the system. Proximity sensors are another solution to this problem. These sensors are able to detect objects in its proximity. Depending on the use, the range can vary [20]. For example, a low range proximity sensor is currently available in iPhone. This is able to detect whether the phone is near to ear during a call or not and turns off the display accordingly to save battery power.

B. How can other students prevent them from being detected?

The users are given a freewill whether to open the signal to public or not depending on technology they use.. If using RFID tags, they can be disabled to allow others to stop from being detected. If proximity sensor is used, it is likely that device will be detected but not identified by the system if student has chosen so.

C. How can the system allow them to communicate if both parties agree?

There are many possible ways to communicate between two devices. Communication tools can be a WiFi hostspot, a server, and Bluetooth. A WiFi hotspot allows other phones to connect to the phone which creates the WiFi hostpot [21]. A server can also be used to communicate by the setup between the two or more parties. In addition, if both parties have Bluetooth enabled, then the communication between them can be established. However, to ensure communication can be established between the devices, student can also enable his mobile phone to use all possible means to communicate. Once communication has been established with one of the methods, other methods can be turned off.

Figure 2. Application flow diagram

D. How can the student share his plan with others?

After the communication method is selected and the two or more parties are connected. Student may enter a plan in a few words which will be visible to all.

E. How user friendly it will be?

A plan from a student is likely to change again, even probably changes many times a day. Thus, the system is required to make the student feels very easy to do that. The system will allow the user to change to a plan on a single click.

F. Would it require technical knowledge to start the communication?

One of the most common problems for system users is the knowledge to use. The system will not require the user to have any detailed technical knowledge. However, basic knowledge to manipulate the device is essential.

G. How much would it cost?

If communication is established without using the server, it is likely that the system would cost nothing when used. Unless the cost of the system if sold.

H. What information will be communicated to the other party?

It is no doubt that the privacy has been an issue in new technology. The information being transferred would be only allowed by the user him/herself. In the system, plan will be allowed by default. If the user is willing to share any extra information, he/she must select it from several displays options. The contact information is an example. To ensure that the user gets only the desired results, the system should filter out the detected students according to the interest/plan of users.

I. Is the system robust?

Making a robust system is one of the most important things in any system. To ensure that the system is robust and gives the most appropriate results, the use of mixture of sensors like RFID and proximity both together is recommended. Moreover, it can improve the system reliability rather than depending on one sensor for all data which is very risky and even lead to incorrect results.

J. How can we explore similar people?

Most people you are interested in have something in common with you. How can we seek similar people and integrate into a society quickly just using a mobile phone? Strategies based on similarity of shared files such us UIM model [22] and matching index and algorithm between users profile [23] can be used to explore similar people. Data mining algorithm [24] and behavior-based model can also be an excellent option. Any similarities can be used to identify common people even from your preference setting to your mobile desktop or from your time spending on website to the frequency of phone calls.

3. Conclussion

Through the student's interaction case scenario, we have shown how we can design an effective context aware mobile application with logical proximity. The discussion about some possible problems along with their solution can be used as a framework and consideration for designing such a similar context aware application.

In the future, hopefully, we can make a collaboration with any institution such as education based institution (school and higher education), education and cultural office, Ministry of Education, Directorate General ofHigher Education, or commercial industries to improve and implement this design.

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