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Case Study: The Condition of Ubiquitous Computing Application in Indonesia

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1. Introduction

Generally, people, especially in developing countries, does not realize that they are in third of computer revolution era. They are in the era of ubiquitous computing, which mean that they can interact with the computer everywhere and anytime, not just sitting in front of the PC (one person many computers). Furthermore, the social and political challenges of the ubiquitous computing era will be characterized by an increasing dependence on technology, control over the information to which everyday objects are linked, and the protection of privacy. In this paper, we present the study about the condition of ubiquitous computing application in Indonesia. We divide the application of ubiquitous computing in Indonesia into three parts, i.e. ubiquitous mobile application, ubiquitous web application, and ubiquitous payment system application.

Nowadays, the next generation of computers will be embossed by ubiquitous computing (Bagci & Petzold, 2003). The computer will disappear behind daily things and people will not know that they will be faced with the computer in their day-life activities. This will make the old paradigm, where people only sit in front of the PC if they want to interact with computer, will be eliminated gradually. Unfortunately, until now it is just happened in developed countries which the infrastructure and the environment has supported to implement the ubiquitous computing. How about developing countries? In developing countries, such as Indonesia, ubiquitous computing applications are still rarely because there are many problems will be faced if the application of ubiquitous computing is going to be implemented, start from governmental support, infrastructure, finance, technological, and the professional worker. Only a few of ubiquitous computing application, which we will be explained in the next section applied in Indonesia. We will explain a few explanations about ubiquitous computing in section 2. The science aspects of ubiquitous supporting development will be introduced in section 3. Next, the application of ubiquitous computing in Indonesia will be discussed in section 4. The issues in ubiquitous computing will be presented in section 5. The last section of this paper presents the conclusion and the challenges of the application of ubiquitous computing in Indonesia.

2. Ubiquitous computing

Ubiquitous computing (ubicomp) is the method of enhancing computer use by making many computers available throughout the physical environment, but making them effectively invisible to the user (Weiser, 1993). In its development as a new technology or as a branch of computer science, Ubicomp cannot be discharged from the other computer science aspects, such as natural interfaces, context aware computing, and micro-nano technology. At this time, ubicomp become the inspiration from the development of the new paradigm of computation (off the desktop), where the interaction between humankind and the computer was natural and slowly left the paradigm keyboard/ mouse/ display from the PC generation (Widhiarta, 2007). One of the positive effects from ubicomp is people who do not have skills use the computer and people with the physical lack (the defect) could continue to use the computer for all the needs.

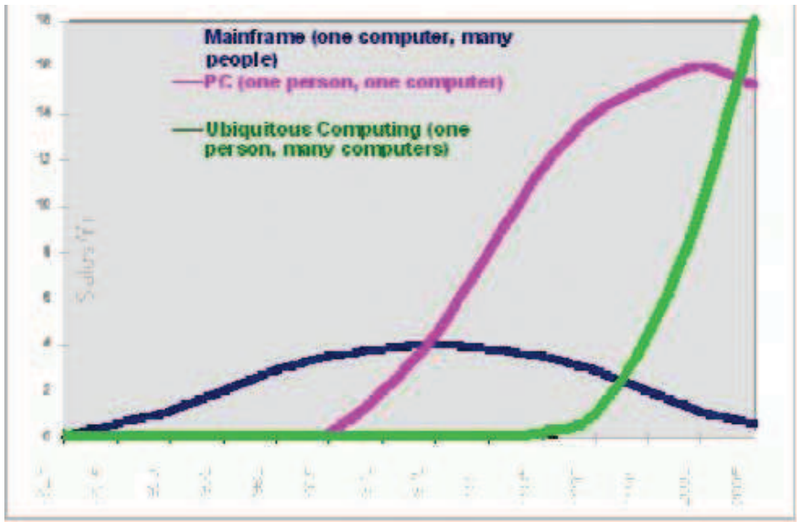

Fig. 1. The major trends of ubiquitous computing since introduced by Mark Weiser (1988) until year 2005 (*http://www.ubiq.com/hypertext/weiser/UbiHome.html*)

3. Support development aspects

As an applied technology or as a branch of computer science, ubicomp development can not be separated from other computer science aspects. Important aspects that support development of ubicomp research as follows.

3.1 Natural interfaces

Natural interface is the common parlance used by designers and developers of computer interfaces to refer to a user interface that is effectively invisible, or becomes invisible with successive learned interactions, to its users. The word natural is used because most computer interfaces use artificial control devices whose operation has to be learned. It relies on a user being able to quickly transition from novice to expert. While the interface requires learning, that learning is eased through design which gives the user the feeling that they are instantly and continuously successful. This can be aided by technology which allows users to carry out relatively natural motions, movements or gestures that they quickly discover

control the computer application or manipulate the on-screen content. A common misunderstanding is that it is somehow mimicry of nature or that some inputs to a computer are somehow more 'natural' than others. In truth, the goal is to make the user feel like a *natural*.

Prior to the concept of ubicomp, we have become witnesses of various researches on natural interfaces for years, namely the use of natural aspects as a way to manipulate data. For example, voice recognizer technology or pen computing. Currently, implementation of various researches on natural inputs along with its tools became the most important aspects of ubicomp development.

The main difficulty in natural interfaces development is error prone. In natural interfaces, inputs have a wider area of form, for example the pronunciation of vowel "O" by someone can be very different from other people though with the same intent. Writing letter "A" with a pen computing can generate thousands of possible writing style that can cause computer can not recognize the input as letter "A".

Various research and new technologies in artificial intelligence is very helpful in finding a breakthrough to reduce error level. Genetic algorithm, neural networks and fuzzy logic makes into stepping technology to natural interfaces more "clever" in recognizing natural forms of input.

3.2 Context aware computing

Context aware computing is a branch of computer science who views a computing process not only focuses attention on one object to be main focus but also on its surrounding aspects. For example, if conventional computing is designed to identify who person was standing in a certain coordinate point, computer will look at that person as a single object with various attributes, such as employee number, height, weight, eye color, and so forth.

On the other hand context aware computing is not only directed its focus on human object, but also on what he was doing, where he is, what time he arrived at that position, and the reason why he was in that place.

In the simple examples above, it appears that in carrying out those instructions, conventional computing focuses only on the aspect of "who". On the other side, context aware computing is not just focusing on "who" but also "when", "what", "where" and "why".

Context Aware Computing makes a significant contribution to ubicomp. The increasing ability of a device context, the more input can be processed. This assumed for more data processed into information provided by the device.

Context aware mobile agents are a best suited host implementing any context aware applications. Modern integrated voice and data communications equips the hospital staff with smart phones to communicate vocally with each other, but preferably to look-up the next task to be executed and to capture the next report to be noted. However, all attempts to support staff with such approaches are hampered till failure of acceptance with the need to look-up upon a new event for patient identities, order lists and work schedules. Hence a well suited solution has to get rid of such manual interaction with a tiny screen and therefore serves the user with:

- automated identifying actual patient and local environment upon approach,
- automated recording the events with coming to and leaving off the actual patient,
- automated presentation of the orders or service due on the current location and with
- supported documenting the required information keying in a minimum of data into prepared form entries.

Basically such contextually well formed approach requires scheduled workflows, as all necessary preparation must refer to given orders and set schedules. Working *free hand* or *ex tempore* does not provide such qualities.
While context-aware computing aims to facilitate a smooth interaction between humans and technology, few studies of how users perceive context-aware interaction have been performed (Barkhuus & Dey, 2003). Most research focuses on the development of technologies for context-awareness as well as the design of context-aware applications.
Example applications are numerous and the level of interactivity within these varies greatly, ranging from letting the user manually define parameters on how an application should behave, to automatically providing the user with services and information that the developer finds relevant.

3.3 Micro-nano technology

The development of micro and nano technology, which led to a smaller size of microchip, becomes a major driving factor for the development of ubicomp devices now. The smaller a device will cause the smaller user focus on instrument. This is according to concept "off the desktop" from ubicomp.
Technology utilizes a variety of microchips in a kind of extremely small size of T-Engine or Radio Frequency Identification (RFID) applied in everyday life in the form of smart cards or tags, such super mini microchip illustrated in figure 2. For example someone who has a subscription bus ticket in the form of card uses this by swiping it through sensor and the balance will be directly debited according to the distance he traveled.

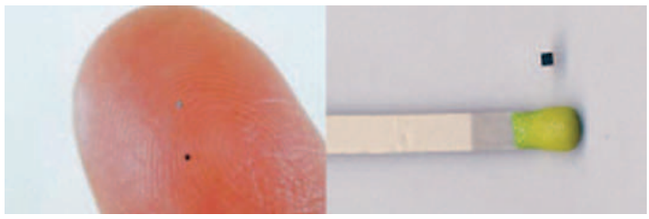

Fig. 2. Super mini microchip from Toshiba (IEEE Pervasive Computing)

In developed countries such as Japan, the current micro and nano technology has been applied to everyday life through a variety of sensors. The size of data processing tools are not seen by humans in public places as shown in figure 3.

4. Case study

How about the development and the application of ubiquitous computing in Indonesia ? As one of the developing countries, Indonesia is still developing the ICT environment, including ubiquitous computing.
Our research showed that the application of ubicomp still in the development stage. And based on our research too, we divide the use of ubiquitous computing application into three parts and will be explained as follows.

4.1 Ubiquitous mobile application

We restricted our study to the usage of mobile phones technology for Ubiquitous mobile application. And according to our observation, the amount of user of mobile phones

Fig. 3. Installed sensors in public places are very helpful for disabilities people and tourists. (IEEE Pervasive Computing)

technology have reached more than 40 million people, as shown in figure 4 *(http://www.pemberdayaan-telematika.info/wartelnet/index.php).* Figure 4 shows graph of mobile phone user according to cellular operator usage that exists in Indonesia).

The number of mobile phone users is still continuing to improve considering that the needs of this technology are no longer become luxury requirement, but become the mandatory requirement for the Indonesia people. The new technology which is offered by the manufacturer of the mobile phone also could make the number of users of the mobile phone continue to improve.

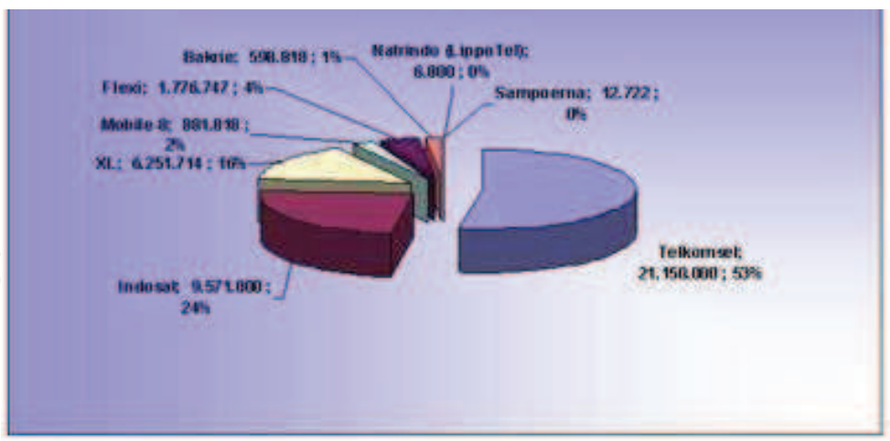

Fig. 4. Trends of mobile phone user in Indonesia

3G mobile concept has been implemented in Indonesia since 16 Aug 2006 after Singapore and Malaysia. However, 3G technology does not provide Indonesian users perfectly, because Indonesia does not have good backbone network architecture to support this technology.

Owned by PT Telekomunikasi Indonesia (Telkom) (65 percent), the largest full-service telecommunications operator in Indonesia and SingTel (35 percent), one of Asia's leading telecommunications service operators, Telkomsel provides GSM cellular services in

Indonesia through its own nationwide dual-band 900/ 1800MHz GSM network, and internationally through 244 international roaming partners in 148 countries.
The 3G phenomenon in Indonesia, especially W-CDMA-based technology, is quite interesting to observe. In comparison, its northern neighbors Singapore and Malaysia – especially since both countries launched 3G services at about the same time–have had seen starkly different uptakes in these services.

4.2 Ubiquitous web application

Web sites are evolving from repositories of (mainly) passive information to become complex applications, with operations and, sometimes, transactions available. In addition it is becoming more and more necessary to develop ”families of applications”, presenting the same content-services to different categories of users in different contexts.
So, what is a ubiquitous web application? A ubiquitous web application is a Web application that suffers from the anytime/ anywhere/ any media syndrome. This means that an ubiquitous web application should be designed from the start taking into account not only its hypermedia nature, but also the fact that it must run as is on a variety of platforms, including mobile phones, Personal Digital Assistants (PDAs), full-fledged desktop computers, and so on.
This implies that a ubiquitous web application must take into account the different capabilities of devices comprising display size, local storage size, method of input, network capacity, etc. New opportunities are offered in terms of location-based, time-based, and personalized services taking into account the needs and preferences of particular users. Consequently, a ubiquitous web application must be, on the one hand, context-aware i.e., aware of the environment it is running in, and on the other hand it must support personalization.
According to our study, we find that Indonesia has implemented ubiquitous web application. And we restrict our study for this ubiquitous application to the usage of internet application in Indonesia. We present the graphic of internet users in Indonesia which we have been studied at figure 5.
Figure 5 shows that the development of internet user in Indonesia is developing from year-to-year. It also shows that the people in Indonesia are aware about the benefit of Internet; know how to use the internet. Unfortunately, the use of internet at the village are still lowest than use of internet at the city. These become homework for the governance how to cast the balance of the use of internet in all area in Indonesia.

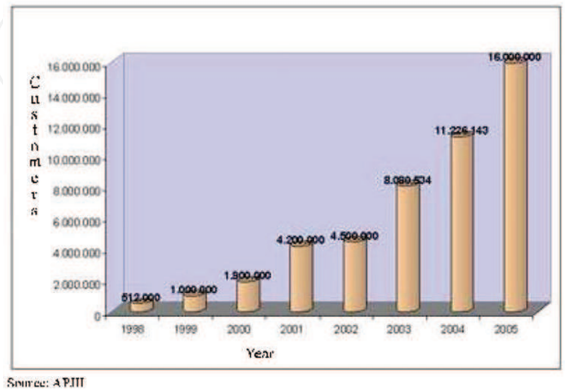

Fig. 5. The development of internet users in Indonesia (http://www.pemberdayaan-telematika.info/wartelnet/index.php)

4.3 Ubiquitous payment system application

The last part of our study about the application of ubiquitous computing in Indonesia is the use of Ubicomp for the payment system. M-payment market is in a constantly flux due to a wide variety of payment solutions, technologies, scenarios, consumer expectations, and penetration strategies of payment service providers. The systems change and are subject to a high or low market penetration according to the parties' requirements: customers, financial institutes, and merchants alike want a convenient way to perform payments, even though they have different motivations. For instance, the customer wants a convenient and trustworthy way to pay; the financial institute needs automatic and economic settlement of the payment. Based on these considerations, it would be desirable to handle different payment methods with a standardized architecture.

The customer should be able to choose his preferred device, his mobile phone or PDA, and choose the appropriate financial service (e.g. financial information or payment). Today, these services are rendered by mobile payment (m-payment) systems (Gross et. al, 2008).

M-payment can be understood as any access to payments, where at least one participant uses a mobile device. This is often a mobile phone (Krueger, 2001). Other devices are for instance personal digital assistants (PDA), or items in which transponders are integrated. This could be an identity card. The data stored on the transponder is transmitted via radio communication to a reader and passed through to a financial network.

Frost and Sullivan extracted several application areas for m-payment in a study (Legard, 2002):

- Automated point-of-sale payments (vending machines, parking meters and ticket machines)
- Attended point-of-sale payments (shop counters, taxis)
- Mobile-accessed Internet payments (merchant WAP sites)
- Mobile-assisted Internet payments (fixed Internet sites using phone instead of credit card)
- Peer-to-peer payments between individuals.

The technology of ubicomp which available in Indonesia for the payment system are RFID technology and Barcode technology. We will explain the use of both technologies in separately.

(a) Barcode Application

Barcode is an optical machine-readable representation of data. Originally, bar codes represented data in the widths (lines) and the spacing of parallel lines and may be referred to as linear or 1D (1 dimensional) barcodes or symbologies. But they also come in patterns of squares, dots, hexagons and other geometric patterns within images termed 2D (2 dimensional) matrix codes or symbologies. In spite of there being no bars, 2D systems are generally referred to as barcodes as well.

Based on our study about application of barcode, the use of this technology has been used for long time. The application of this technology could be seen at supermarket, university, library, office, etc. We can't explain when the first penetration of barcode come to Indonesia because we can't get the resource, but the usage of this technology has been developed from until now during our observation.

(b) RFID Application

The development of RFID was spurred by the need to enhance tracking and access applications in the 1980s in manufacturing and other hostile environments. This no contact

means of gathering and tracking information proved to be resilient. RFID is now an established part of specific busi- ness processes in a variety of markets.
RFID has a set of frequencies which are classified by their range which described as follows:

- Low, covering from 100 KHz to 500 KHz, has a short reading range, and Lower system costs,
- High, covering from 850 MHz to 950 MHz, has a long reading range, and High reading speeds,
- Ultra High, covering from 2.4 GHz to 2.5 GHz.

Based on our study, the implementation of the RFID technology is improved although the finance is common problem for this new technology. The implementation does not just in one place (usually at supermarket), but it has implemented in other places too, such as bus way station, KAI (Indonesia Railway Company), gas station, offices, etc. (*http://ekowahyudin.wordpress.com/tag/rfid*).
Various benefits of RFID we can feel almost in a variety of access control applications. RFID short-range has been quite widely used in Indonesia. Door access control technology is quite powerful but still it depends on the design of the security plan. Taking the example of E-toll, payments automation and highway access toll. We can learn when RFID is implemented, we do not have to worry about the queues at toll booth because all cars already automatically "pay" without waiting for officers to give receipts, less returns, money and so forth.
Further, for RFID technology, Indonesia uses RFID ISO-14443, one of RFID technology, with the frequency 13.56 MHz, in implementation of this ubicomp technology. But it is still illegal application because there is no regulation from Indonesia government and still being study by DIRJEN POSTEL Indonesia. But later, this technology will replace barcode technology because of it has more advantages than barcode technology.

5. Ubicomp issues

5.1 Security

Ubicomp increased risks to security. The use of bearer, infrared, or other wireless communication media form between input devices and data processing devices opens opportunities for other parties in hacking data. The hacker can use it for their interests. Currently, various researches on secure data transmission, including research on new protocols, became one of main focus of research on ubicomp.

5.2 Privacy

The use of devices in human causes the narrowed space on privacy. By reasons of employees time efficiency, a supervisor can ask all employees to use their tags so that it can be monitored their presence in the office. This causes the employee get no longer privacy, their rights. Their existence can be monitored at any time and accompanying data by supervisor. He can know how many his employees went to the toilet that day. In few science fiction films we have seen how government is paranoid attempt to provide citizen tags in obtaining data of national security.

5.3 Wireless speed

With a variety of ubicomp devices, the demand for speed wireless communications technology into something is absolute. Today's technology ensures this speed for one person

or a group. Ubicomp is not just talking about one device for one person. Ubicomp makes someone can bring some ubicomp devices and also must be used in such a large area. This technology is not currently able to guarantee the pace for such situations because it can be ineffective if not supported with wireless technology development that can provide the required speed.

6. Conclusion

Our study shows that the application of ubiquitous computing are identified in three parts, first is ubiquitous mobile application, second is ubiquitous web application, and third is ubiquitous payment system application. For each explanation of that application, we conclude that the uses of Ubiquitous Computing technology in Indonesia are still in development stage. Further, the challenges to improve the use of ubiquitous computing in Indonesia is to provide the infrastructure and the environment of ubiquitous computing so that many application of ubiquitous computing can be available and identify in Indonesia. We also hope the research of ubicomp technology in Indonesia will improve for the next year because it is still rarely to find the paper which discuss about this technology.

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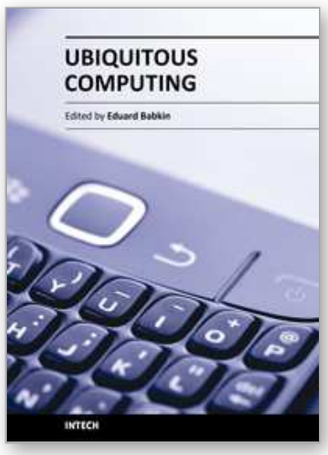

Ubiquitous Computing

Edited by Prof. Eduard Babkin

ISBN 978-953-307-409-2
Hard cover, 248 pages
Publisher InTech
Published online 10, February, 2011
Published in print edition February, 2011

The aim of this book is to give a treatment of the actively developed domain of Ubiquitous computing. Originally proposed by Mark D. Weiser, the concept of Ubiquitous computing enables a real-time global sensing, context-aware informational retrieval, multi-modal interaction with the user and enhanced visualization capabilities. In effect, Ubiquitous computing environments give extremely new and futuristic abilities to look at and interact with our habitat at any time and from anywhere. In that domain, researchers are confronted with many foundational, technological and engineering issues which were not known before. Detailed cross-disciplinary coverage of these issues is really needed today for further progress and widening of application range. This book collects twelve original works of researchers from eleven countries, which are clustered into four sections: Foundations, Security and Privacy, Integration and Middleware, Practical Applications.

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