MOBILE PHONE BASED PREGNANCY SUPPORT SYSTEM

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ABSTRACT
Being pregnant can be very challenging to mothers especially if they are expecting for the first time. Many rely on information that is past down from one to another which may not be accurate as experience from each pregnancy can be different from one pregnancy to the other and from one person to another. Matters are made worse when information past down is mixed with cultutal taboo.

This paper presents the framework and prototype of mobile phone based pregnancy system based on preliminary study conducted among the pregnant mothers and their spouses in a local private hospital and few maternity clinics. This study provided the basis for the personalised and localised content development for mobile phone on the health care for pregnant mothers, due date calculation, calendar, growth of fetus, complications, medication, drug and health alerts.

Mobile phone based pregnancy support can position itself as a major breakthrough approach to educate women on pregnancy, monitor their own and child’s progress, follow up with medical checkups, critical updates and post delivery support through mobile phone. This will reduce the anxiety and stress among pregnant mothers. Women in rural area can benefit through this system greatly by preparing for child birth and post delivery.

1.0 INTRODUCTION
The rapid development of internet and communication technologies in the past twenty years had changed the lifestyle of human beings in the entire world. People who are leaving in urban and rural area can have equal access to quality lifestyles. The communication technologies using mobile devices can improve education, health and economics of people everywhere and anywhere.
In 2005, the number of mobile phone users in the world were 2.2 billion as compared to 1 billion internet users (ITU, 2006). This growth in mobile phone usage have created the opportunity for localised mobile content development to reach a wider public. With higher speed and affordable rate, mobile phone subscribers are able to get multimedia content such as movie clips and news. Availability of technology SmartFit to reduce the size of the content for mobile display (Access, 2007), accurate information about pregnancy can be easily delivered allows any possible time and place. This service can be easily accessed even from rural areas where transportation and medical services are limited.

Bringing a new life to the world is a wonder to everyone. Experience from each pregnancy can be different from one pregnancy to the other and from one person to another (Kelly Zantey, 2006). Matters are made worse when information past down is mixed with cultural taboos (Yvonne Bronner, 2000). There are lots of information widely available in printed form but usually these information is general, too lengthy and complicated. One of the many easy and fast way to access information about pregnancy is the Internet. However, the information is focused on pregnancy in western world setting. There are very few available pregnancy resources for population in different parts of the world. Other drawbacks of getting such information is that the lack of english language proficiency and computer literacy [InfoDev, 2006].

2.0 PREVIOUS WORK
Current trend in healthcare sector is to link patients, physicians and hospitals to provide optimized care to all patients (T.H. Britze, 2005; G.Dodero, V.Gianuzzi, E.Coscia and S.Virtuoso, 2001). Preventive care can be given to patients instead of curative medicine. This reduce cost, improves quality of treatment and promote knowledge sharing with physicians.

InfoDev (2006) in its framework paper has highlighted that health based web sites has improved knowledge, behaviour and slowed health decline among the users. Studies conducted in Peru, Egypt and Uganda show use of ICT has avoided
maternal deaths. Mobile phones were used in South Africa to provide timely reminders to patients with tuberculosis (Infodev, 2006).

Another approach is to provide tailored information based on individual characteristics of a person. This works well for different patients who have their unique need (Bental, Cawsey and Jones, 1999). For example for pregnant mothers during each stage of pregnancy the needs may be different and different types of health attention depending upon their health and physical condition may be needed (CenterSite, 1995-2007).

Patients can be educated to monitor their own health. For example in (JA Cafazzo, 2000-2004), diabetic patients are given device to measure blood pressure which is transmitted through mobile device to central data repository. Clinical rules engine receives the data from mobile device and notify the patient’s family physician if readings are not within the desired range.

Mobile devices can be used to provide health information based on geographical location of the person. These mobile devices are handy to use by travelers to be aware of illness in a particular location (Kamel Boulos MN, 2003).

In Malaysia, infant mortality is estimated as 250,000 in 2005 [Unicef]. According to the Malaysian Health Facts in 2005 (Ministry of Health Malaysia (MOH), 2006), there are 122 government hospitals, 6 Special Medical Institutions, 6 non government hospitals and 222 private hospitals for maternity and nursing homes in Malaysia. There are only 20,105 doctors in Malaysia with the doctor to population ratio is 1 to 1,300. Expecting mothers are usually referred to hospitals where more accurate and better advice are available. In urban areas, medical advice is quite easily available through clinics where most doctors are general practitioners and expert advise is expensive. Getting medical aid and advice in rural area is difficult.

To reduce infant mortality and morbidity issues, mobile phone based pregnancy support system can be an effective alternative to the Internet. This system is made possible with the rapid development of the local IT and telecommunication infrastructure as well as the competitiveness of mobile service providers. Though this
number is inclusive of those subscribers with multiple phones, which is only a small group, it is still the easiest and simplest way to communicate and deliver information.

3.0 METHODOLOGY
A survey was conducted as preminilinary fact finding method among the pregnant ladies and their spouses at a local private hospital and two maternity clinics in Petaling Jaya, Malaysia. Fifteen couples volunteered to participate in this survey. 30 questionnaires were given out. The objectives of this questionnaire were to find out the readiness of the pregnant ladies and their spouses to use mobile phone as a tool to receive support during the pregnancy and the types of support expected.

Conceptual model for the content development and suitable network architecture are drawn to facilitate the personalised pregnancy support. A prototype application for mobile phone is developed and tested based on the initial findings.

4.0 RESULTS AND DISCUSSION
All the respondents use mobile phones and were interested in receiving pregnancy related health care information. All spouses have responded that they are interested in knowing more about their wife’s pregnancy and progress. 17 out of 30 respondents comprised of pregnant mothers and spouses used internet as the source to seek pregnancy related information. The respondents were interested in getting information about medication during pregnancy, due date calculator, diet, health, stages of pregnancy, prenatal care, doctor check up reminders and nearest maternity clinics or hospital location.

4.1 Content Model
A conceptual model is formulated based on the preminilary study conducted. The support system is divided into the following six modules as shown in the figure 1.

4.1.1 Health Care
This module provides general health care information to pregnant mothers. This is to help them on what they should or should not do if they have fever, headache, stomach ache, common cold and etc during pregnancy period. This is necessary as pregnant ladies should be careful of the common drugs that they take during
pregnancy which may harm the growing baby in the womb. In addition, they can key in any illnesses that they have such as ashma, diabetics, high blood pressure and etc to allow the system to send information related to these during pregnancy. Drug and disease alerts that are harmful to pregnant ladies based on their medical profile can be posted from time to time.

4.1.2 Emergency Care and Alerts
Sudden fall or accident can cause emergency situation during pregnancy. Emergency care information such as contact for hospital emergency unit or ambulance service is useful during panic state. The available clinics and hospitals that are located around the user’s place can be retrieved. System allows the user to key in the numbers of the spouse, close relatives or friends so that alert with special tone can be sent to them during emergency with just one click. Health alerts affecting pregnancy from Ministry of Health and World Health Organisation (WHO) can be sent through this mode to create awareness and for preventive care.

4.1.3 Stages of Pregnancy
Due date calculator provides the stage of the pregnancy information to the expecting mother and spouse at a set intervals selected by the users of this system. It tracks the countdown days to the due date and advises the pregnant mother on the progress and changes happening to the child and her self. The stages are shown with graphics of the growing fetus in the womb as shown in the figure 2.

4.1.4 Pregnancy Calendar and Diary
Pregnancy calendar and diary is to keep track of follow up appointments with doctor, reminders, record of weight gain during pregnancy and notes of events. This is also to assist the pregnant mother to take note of any abnormal changes and seek advise on time. In addition, ultrasound images captured through camera phone, music, tones and images related to pregnancy can be stored if there is enough storage space in the phone.
4.1.5 Nutrition and Exercise

This is important to mothers who normally have confusing statements from people stating certain food is good and certain others are harmful. General nutrition and hygiene information is provided for healthy pregnancy and details can be obtained through query or website. Illustrative graphics are shown for simple exercise positions during pregnancy.

4.1.6 Post Delivery Support

Post delivery support is very important to all mothers as they need to cope with the new born baby and their recovery after the delivery. Caring for the new born can be tiring and frustrating to first time mothers who are not sure on how to react or what to do when the baby cries.

4.2 Prototype

A prototype of pregnancy support system was developed for mobile phone based on the content model discussed above. Prototype tested on the following mobile phone models:

1. Nokia 6670 and Nokia 7210 mobile phone models run on symbian operating system (OS). The content display was good and details of the graphical content were clear to view. However, the users need to scroll up and down to see images.
2. Sony Ericsson K750i mobile phone model has smaller screen size that does not allow left to right to scrolling. Thus, the images could not be viewed fully.

Smart-Fit Rendering (Access, 2007) is one of the technologies available to adjust the contents and images according to the screen size. This is convenient and avoids unnecessary horizontal or vertical scrolling to see the full content for mobile phone models which has smaller screen size. Images which are larger than the screen width are adjusted according to the screen width. And also tables larger than the screen are breakdown into small sizes vertically (Access, 2004).

4.3 Network Architecture

This system is to access through phone primarily. The mobile application developed interact with Mobile Internet Platform (MIP) to send and receive short messages and
alerts as shown in the figure 3 above. Current mobile messaging gateways support
Enhanced Messaging Service (EMS), Multimedia Messaging Service (MMS) and
Wireless Application Protocol (WAP). A web portal is developed to support the
system with updates and provide more content rich information which can be
accessed through internet.

5.0 CONCLUSION
Pregnancy is not only challenging to mothers but it is equally stressful to fathers as
well. Mobile phone based pregnancy support can position itself as a personalised
approach to educate women on pregnancy, monitor their own and child’s progress,
follow up with medical checkups, critical updates and post delivery support through
mobile phone. With the availability of good mobile network infrastructure and mobile
phone technologies, a support system that is available anytime and anywhere will
help to reduce the stress and anxiety related to pregnancy and its complications. The
system will assist the pregnant mother and her spouse to be aware of changes
during pregnancy and take necessary actions to prevent the unforeseen. Women in
rural area can benefit through this system greatly by preparing for child birth and
post delivery.

6.0 FUTURE WORK
Future work will be focused to build on existing prototype and develop personalised
content for pregnancy and health care in Malaysia.

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**FIGURES**

![Figure 1: Mobile phone based Pregnancy Support System](image-url)
Figure 2: Mobile Phone Based Pregnancy System Support Model

Figure 3: The display of the baby’s development
Figure 4: The due date and calendar settings
Figure 5: Mobile Phone Based Pregnancy Support System Architecture