

# **Mobile based Primary Health Care System for Rural India**

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## **Abstract**

Mobile technologies are increasingly growing in developing countries like India. There have been several new researches and developments in this space. Nowadays mobile is becoming an important ICT tool not only in urban regions but also in remote and rural areas. The rapid advancement in the technologies, ease of use and the falling costs of devices, make the mobile an appropriate and adaptable tool to bridge the digital divide. Mobile phone ownership in India is growing rapidly, six million new mobile subscriptions are added each month and one in five Indian's will own a phone by the end of 2007. By the end of 2008, three quarters of India's population will be covered by a mobile network. Many of these new "mobile citizens" live in poorer and more rural areas with scarce infrastructure and facilities, high illiteracy levels, low PC and internet penetration. The availability of low-cost mobile phones and the already broad coverage of GSM networks in India is a huge opportunity to provide services that would trigger development and improve people's lives. This paper explores the present status of Mobile based Health Care systems in different countries, shortfalls in Primary Health Care Management in rural India, and the potential solution to fill it with the enabling of Mobile Web technologies for Primary Health Care management.

## **Introduction**

1. According to the ITU, the total number of mobile users worldwide as of late 2006 was about 2.7 billion and the number of Internet users was just above 1.1 billion. This means that at least there is 23.6% of world population (and at least 22.2% of developing countries' population) who already have mobile phones but are not yet using the Internet. Mobile services are quickly emerging as the new frontier in transforming government and making it even more accessible and citizen-centric by extending the benefits of remote delivery of government services and information to those who are unable or unwilling to access public services through the Internet or who simply prefer to use mobile devices. In theory, many government services can be now made available on a 24x7x365 basis at any place in the world covered by mobile networks, which today means almost everywhere. Approximately 50%–60% of government

services including Primary Health Management can be delivered via mobile channel.

2. Primary Health Care Services using Mobile Devices ensures improved access to primary healthcare and its gate-keeping function leads to less hospitalisation, and less chance of patients being subjected to inappropriate health interventions.

### **Objective**

3. The objective of this paper is to bring out status of mobile devices based Health care management systems in the world particularly in India and present the details of Mobile based Primary Health Care Management System under development by CDAC, Electronics City for deployment in the PHCs in rural India.

### **Mobile technology for Health Care**

4. Amongst the many ICT options available to govt to improve the efficiency & effectiveness of its delivery process of primary health care, mobile & wireless technologies offer some exciting opportunities for a low cost, high reach service. There is strong evidence that mobile technologies could be instrumental in addressing slow response rates of govt to citizen requests, poor access to services, particularly for low-income and marginalised populations in under-served rural areas. In addition, mobile technologies offer significant opportunities for improving the back-office operations of govt. In addition, many primary healthcare clinics located in the rural areas do not have any electronic systems at all & continue to operate paper-based systems, resulting in patient records being kept by patients themselves. The impact of the use of multiple systems is that it is difficult & costly to develop a national overview of patient statistics. On a more basic level, it is extremely difficult for individual institutions within the healthcare sector to share information between each other. One of the clearest examples of this is to be found in the sharing of patient laboratory results. Currently in most instances, this only takes place through manual exchange. Many vendors of Cellular phones started to embed a variety of e-health services in Mobiles[1]

5. **Experience in South Africa.** The Dokoza system is an innovative cost-effective interactive real-time mobile system for fast-tracking & improving critical services to the broader majority. Components of the system have been patented (SA Patent#2002/1242), the system has been developed in SA for use initially in HIV/AIDS (specifically in respect of the roll-out of anti-retroviral therapy) and TB treatment, with the view to including other diseases. The system involves the use of SMS & cell phone technology for information management, transactional exchange & personal communication. The cell phone makes use of a regular

issue SIM card across any existing cell phone network. The system standard is normal SMS text messaging and therefore does not require special additional SIM software or downloading of templates for interacting. Dokoza back-end system is extensively rules based for intelligent interaction to build capacity for health workers with little knowledge. Furthermore, Dokoza back-end system is easily integrated with all existing hospital systems (such as the National Lab) and Dokoza can also be accessed in real-time via PC web, laptop, PDA, Smart phone, Palmtop and is able to interact with fax and email. Overall there are various levels of security measures, firewalls and encryption. Dokoza does not display HIV sensitive information on the web and further security is required to view these in a back-office environment.

6. **Mobile Telemedicine System in Indonesia**. The project began by conducting several field surveys in the implementation area of Sukabumi, West Java. The target area covers about 4,248 square kilometres and has a population of about 2.3 million people. The altitude varies within the range of from sea level to nearly 3,000 metres. The topography consists of highlands, hills and coasts. Three hospitals and 71 community health centres serve the local population. The project has also completed field surveys on the quality of the existing communication signals in about 35 locations in Sukabumi area. To date the results of the project research activities have been presented in two national seminars, the National Biomedical Engineering Seminar, Yogyakarta, 25 February 2006 and the Symposium on Development of Emergency and Disaster Communication & Information System, Jakarta, 7 March 2006.

### **Systems in India.**

7. A number of Organisations have been working on various projects for enhancing the role of ICT in Health care. UK-based Loughborough University's engineers have entered upon a partnership with experts of India to develop a unique mobile phone health monitoring system. The system, which was first unveiled in 2005, uses a mobile phone to transmit a person's vital signs, including the complex electrocardiogram (ECG) heart signal, to a hospital or clinic anywhere in the world. Professor Bryan Woodward and Dr Fadlee Rasid from the Department of Electronic and Electrical Engineering at the Loughborough University have developed this mobile phone monitoring system. Presently the system can transfer the signals pertaining to the ECG, blood pressure, oxygen saturation and blood glucose level. Now the UK-India Education and Research Initiative (UKIERI) has awarded Professor Woodward a grant to further develop this mobile phone monitoring system. They have tied up with the Indian Institute of Technology Delhi (IIT Delhi), the All India Institute of Medical Sciences and Aligarh Muslim University and London's Kingston University, to further develop the system.

8. The research team is aiming to miniaturise the system, through designing sensors and mini-processors that are small enough to be carried by patients, and

at the same time procure biomedical data. The network of sensors would be linked through a modem to mobile networks and the Internet, and to a hospital computer. Then, doctors can use this device to remotely monitor patients suffering from chronic diseases, like heart disease and diabetes, which plagues millions across the world. The UK government will promote the device to improve the efficiency of healthcare delivery. In India, the project will link clinics and regional hospitals in remote areas to centres of excellence. The clinical trials of the system will take place in the UK and India in the next three years.

9. **Sehat Saathi**, a rural telemedicine system is being developed at Media Lab Asia research hub at IIT Kanpur. It can be used to extend medical care to patients in the remote parts of the country. The model provides for front-end contact through a suitably trained non-medical professional; back end support from doctors, pathologists and other health professionals for diagnosis and treatment; use of digital technology to achieve objects; and dissemination of information on health and disease through digital means. **MLAsia** has taken up a project with AIIMS for use of handheld computers (palm-tops) for healthcare data collection and planning.

### **Primary Health Care**

10. The Vancouver Island Health Authority defines Primary Health Care as the range of services individuals and communities receive on a regular, ongoing basis in order to stay healthy, get better, manage ongoing illness or disease, and cope with end of life. In India, Primary Health Centers (PHCs) are the cornerstone of rural healthcare; a first port of call for the sick and an effective referral system; in addition to being the main focus of social and economic development of the community. It forms the first level of contact and a link between individuals and the national health system; bringing healthcare delivery as close as possible to where people live and work.

11. Primary healthcare services substantially affects the general health of a population, however many factors undermine the quality and efficiency of primary healthcare services in developing countries. The World Health Organisation (WHO) specifically points out that to some extent, the deterioration in health status in developing countries is attributed to inadequacies in PHC implementation, neglecting the wider factors that have been responsible for this deterioration such as lack of commitment, inadequate allocation of financial resources to PHCs and community participation [2].

12. **Primary Health care in India.** In India, although there are many reasons for poor PHC performance, accessibility is one of the major obstacles. The public health system is managed and overseen by District Health Officers. Although there are qualified doctors, PHCs have barely able to utilize due to non-usage of IT and Mobile access. The rural primary public health Infrastructure has recorded an impressive development during the last 50 years of independence.

The network consists of 1,45,000 sub-centres, 23,109 primary health centres and 3222 community health centres, catering to a population of 5000, 30,000 and 1,00,000 respectively (and 3000, 20,000 and 80,000 population in tribal and desert areas)[3]. Each PHC is targeted to cover a population of approximately 25,000 and is charged with providing promotive, preventive, curative and rehabilitative care. This implies offering a wide range of services such as health education, promotion of nutrition, basic sanitation, the provision of mother and child family welfare services, immunisation, disease control and appropriate treatment for illness and injury. The PHCs are hubs for 5-6 sub-centres that cover 3-4 villages and are operated by an Auxiliary Nurse Midwife (ANM). These facilities are a part of the three tier healthcare system; the PHCs act as referral centers for the Community Health Centres (CHCs), 30-bed hospitals and higher order public hospitals at the taluka and district levels.

### **Mobile based Primary Health Care Management System**

13. CDAC, Electronics City, Bangalore has initiated the development of “**Mobile based Primary Health Care Management System**” for deployment in the PHCs for betterment of management of Primary Health Care specifically in the rural and urban slums of India. The system will capture of complete information related to an individual patient treated by a PHC. The Software components under development are Patient Database management, Interaction between doctor and a patient, capture of Medical data acquisition- such as ECG, images of heart & lung, eye etc and Scheduling management. The project involves development of the following:

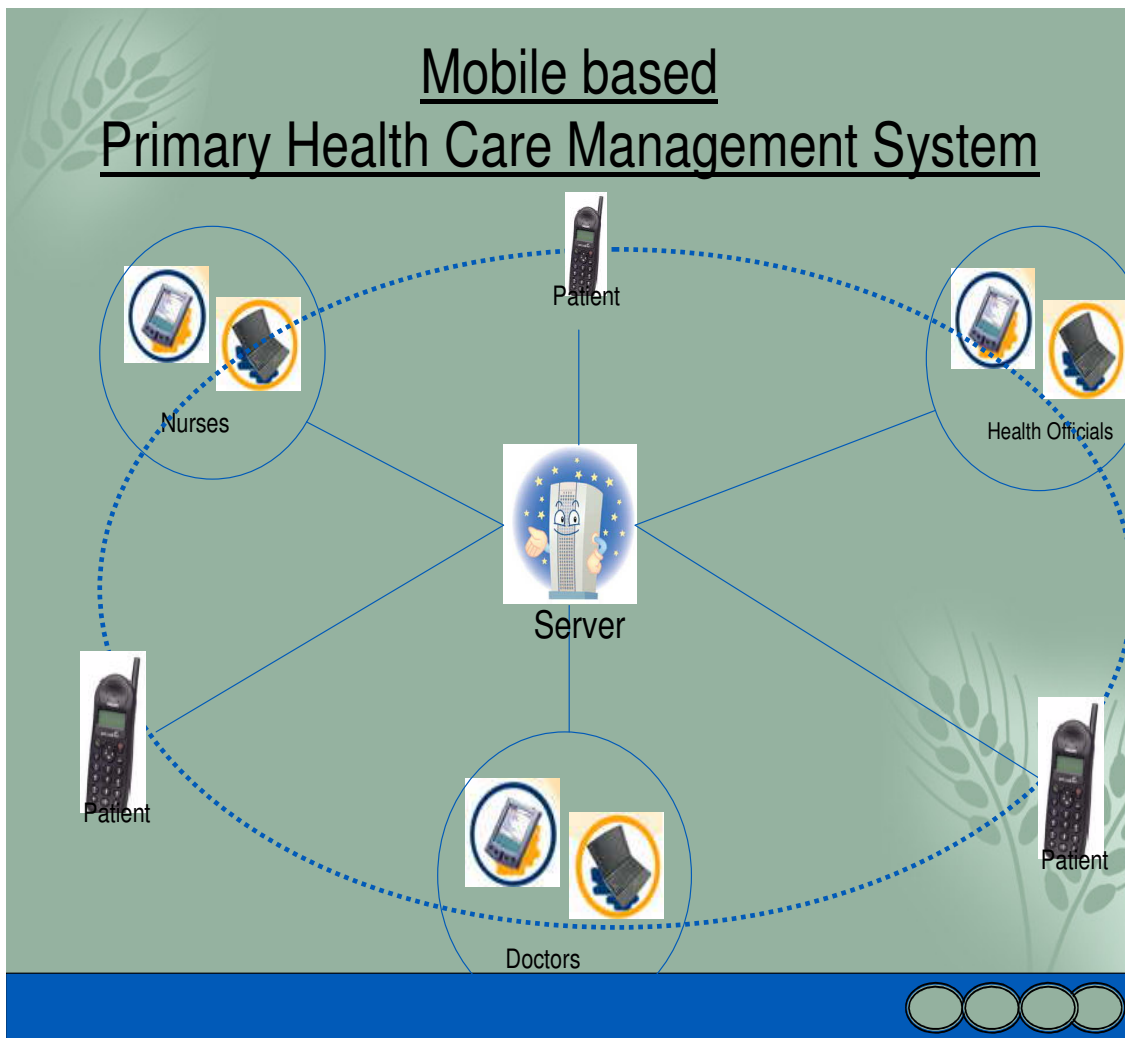
- (a) A Web based Information system for Management of Primary health care.
- (b) SMS interface for integrating SMS messages from the patients using 2<sup>nd</sup> Generation mobile systems (GSM/CDMA) with the Information system.
- ( c ) WAP Gateway for Web access Applications using WML for integrating GPRS/3G/4G Mobile devices of Doctors and Nurses with the Web server.
- (d) Development of Localization Support to National and other Indian languages in mobiles by providing interface for translation.

### **System Overview**

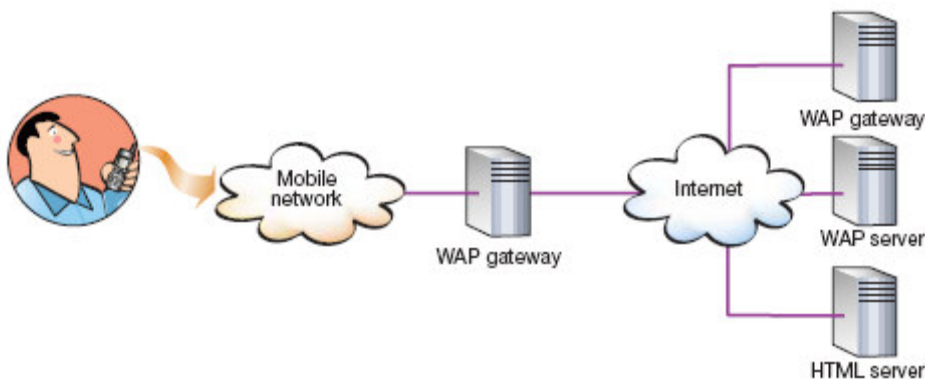
14. A Central repository of Primary Health Center management System with a Web interface is proposed to be developed in an Open source database. An

SMS based interface to the Web is planned to be added for integrating with 2G (GSM/CDMA) telephones, since Mobiles have penetrated overwhelmingly in rural India. A WAP web Gate way will be developed for integrating with a GPRS/3G mobile devices, which are expected to be used by Doctors and Health Assistants. In case of GPRS/3G systems, the Web request from the phone is first served by the WAP Gateway Server. The gateway server translates mobile phone requests (WAP) into HTTP requests and sends them to Web server. The Web server processes the request, and sends WML to gateway server, which in turn sends the WML to phone in the binary compressed WML format.

15. The pictorial representation is depicted below:



16. The Primary Health Care Server, having the information System can be accessed through Mobiles with GPRS connectivity [4] as shown below:



### Sub Systems

17. The sub-systems under development are

(a) A **Central Information Repository** with database of the Patient information and other resources/services

(b) **Web server**

© **SMS interface** for receiving/sending SMS to 2G Mobile systems, which receives the SMS, converts the SMS into a query and executes the query. The results are then sent as an SMS reply.

(d) **WAP Gateway** for linkage with a GPRS/3G mobile. The gateway server translates mobile phone requests (WAP) into HTTP requests and sends them to Web server. The Web server processes the request, and sends WML to gateway server, which in turn sends the WML to phone in the binary compressed WML format

(e) **Localization Module** for providing interface for translation.

## **Highlights**

18. Health Information system in which each family has an up-to-date family folder is a valuable tool for maintaining, analyzing and interpreting the enormous data [5]. The **Mobile based Primary health Care Management System** will seek to achieve:

- (a) Increased quality of primary healthcare (PHC) services.
- (b) Increased efficiency of service care with an adequate referral and remote consultation system.
- (c) Improved epidemiological surveillance and control.
- (d) Better pregnancy case registration and management.
- (e) Reduction of maternal and perinatal mortality and morbidity.

## **Conclusion**

19. The Primary Health Care strategy seems to be a right intervention in terms of basic preventive methods but it needs to be supported by other strategies as well to close the gaps. Primary health care is presented by the Alma-Ata declaration as essential health care based on practical, scientifically sound and socially acceptable methods and technology, which is universally accessible to individuals, family and the community through their full participation and at the cost they can afford. The Primary Health Care can be made transparent and easily accessible by the implementation of "Mobile based Primary Health Care Management System". In this paper, the subsystems of the proposed system have been brought out.

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