Impact and Utilization of Wireless Sensor Network in Rural Area for Health Care

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Abstract— **It has been observed that in our rural society there is no proper awareness of Computer literacy. Literacy level in rural is also low compare to town or cities. In this paper Computer Literacy among the men and women in rural area shows impact and utilization of wireless sensor network have shown in different type of area covering like as health care, how health care cost reduced in rural area. How to utilize Mobihealth project and Mobile hospital/ Mobile health care faculties, ICT role and importance and Private and public sector hospitals. PRS/UMTS wireless communication technology for transferring data.**

Keywords— **BLUETOOTH, WI-FI, ICT, MOBILE HEALTH CARE, HEALTHCARE RESOURCES, MOBIHEALTH.**

I. INTRODUCTION

There are many types of devices uses for Internet connectivity in cities as well as rural area also. Internet connectivity can be access in the form of PC , Laptop, Mobile Phone etc. Information can be send and receive through Wi Fi , Wireless, wired connectivity, Broadband etc. Medicine order or Medical help can be placed through these types of Internet connectivity. Wired connectivity is typical in rural area and maintenance is also very high. Wireless network work so effective manner in remote or rural area. Our Indian in rural are so poor they can not afford the good medical treatment at the time of emergency as well as when they have needed. In this case they have provided medicine at manufacturing cost So, that they can utilize the medical benefits or treat at right time. To fulfill such requirement of rural area Mobile Hospital facility, Rural Healthcare delivery of Medicine and Medical related equipment so costly due to transportation cost, low requirement of medicine, low requirement of medical equipments. Our villages are distributed; they have small population and approximately 636K villages in India.

II. WIRELESS SENSOR NETWORK IN RURAL AREA FOR HEALTH CARE

There are so many applications of wireless sensor networks one of them is wireless sensor networks in rural area for health care by using different types of wireless devices, technologies and equipments those are very helpful for mobile hospital doctors and their staff as well as patients also.

A. BLUETOOTH

Bluetooth is the standard for wireless personal area networks or WPAN. It allows high speed transmission of data over very short distances. Bluetooth is normally used for transferring data between laptops, or in Internet Kiosk type applications where roaming is not needed [1].

B. WI-FI

Wi-Fi is an abbreviation for Wireless Fidelity and a catch all phrase for the several different standards and recommendations that comprise wireless networking.
Wi-Fi enables the user to deploy a computer network without needing to run cable throughout the facility [1].
Poverty is a greater problem in rural areas than in urban areas. The plantation (estate) sector in the central part of the island experiences more poverty than the rest of the country as measured by the higher poverty line [2].

C. GPRS/UMTS

GPRS and UMTS wireless technologies have also found their uses in the area of medical applications [7].
An application called MobiHealth, which we will discuss in a later section, had been designed by using BANs with GPRS/UMTS for Internet connectivity [7].
Lack of infrastructure and access to utilities in rural areas and the uneven nature of development have contributed to this situation. Underdeveloped road networks and transport services and limited access to basic utilities like safe drinking water and electricity deny opportunities in the rural sector [4].

In Fig. 1 wireless sensor networks for health care have shown with hospitals , village health care, individual doctors, clients.

Fig. 1 Wireless Sensor Networks for Health Care

Fig. 2 Pediatric nurse listening to child patients chest
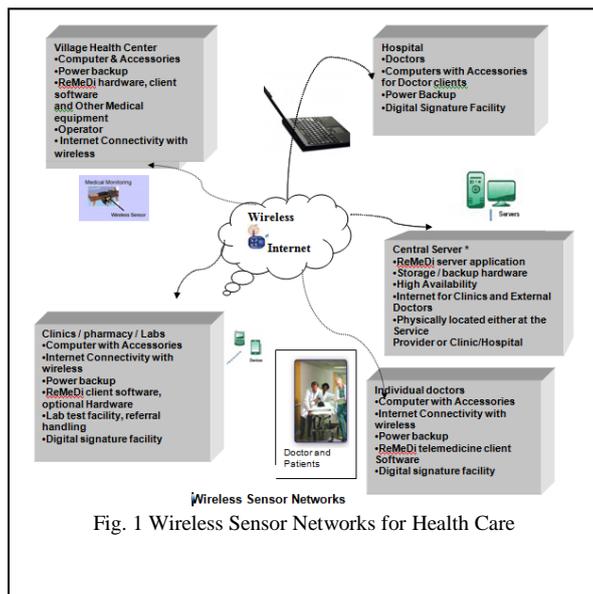
In Fig. 2 Pediatric nurse listening to child patients and examining his health problems and his mother seeing doctor. Child is also impressive from Pediatric nurse. A simple comparison illustrates this disparity – the time taken to reach the nearest bus stop in rural areas is more than twice that in urban areas, and over thrice that time in the estate sector [2].

III. INFORMATION AND COMMUNICATION TECHNOLOGIES(ICT) IN RURAL AND ITS IMPORTANCE

ICT is a tool to be used to improve health care service in cities and rural areas also and should not be considered as a means in itself. The educational aspect must be started early in the implementation phase and concentrated on the 'why' rather than 'how' the system works. If buy in from the end users of the system is obtained early on it will improve dramatically the chances of success.

Activities can include conducting awareness campaigns, induction activities as well as basic and advanced training. Education must also include computer literacy skills as the health care workers in the rural areas may not have been exposed to ICT before. If computer literacy levels are increased the effort of learning how to use Telemedicine will

be decreased which will increase user acceptance among the health care workers. The groups identified in this study as possible target groups include health care workers (only 13% of this group had received formal computer training) and health care workers in the rural areas (17,7% vs 73.9% in urban areas) [3] .

IV. IMPACT OF ICTS ON THE HEALTHCARE INDUSTRY

There is an enormous range of opportunities for significant cost reductions, service enhancements and behavioural change through what is often broadly referred to as 'ehealth'.

A. *Payers***:** The major impact of ICTs on payers will be the ability to manage the system in order to better account for expenditures, to manage the flow of funds and contain costs [2].

There will be strong motivation to adopt systems which enable payers to track expenditures and exercise control over the processes of referral and prescription – the initiators of health services. From the payers' perspective, ICTs are tools for demand management and cost containment [2].

B. *Providers:* It is clear that the entire healthcare system could reap significant gains from an integrated approach to supply chain management that includes the entire range of hospital and medical supplies and linkages to other players in the healthcare system. Electronic scheduling and patient management systems could improve scheduling of tests and procedures, and thereby reduce the length of hospital stays and reduce the need for multiple visits. Linking insurers, healthcare providers, financial institutions and consumers into claiming and payments systems also has the potential to reduce significantly administrative costs and improve quality of service [2].

C. *Practitioners:* From the perspective of individual medical practitioners, knowledge enrichment or education, practice administration, and clinical tools are among the most important ICT applications. Knowledge enrichment and practice administration systems are widely used, but the adoption of clinical tools has been relatively slow because of the complexity of such applications and a range of doctor concerns (eg. patient privacy and security of patient records, the possibility that the tools will generate activities that are not billable and/or reimbursable, the cost of integrating clinical tools with current systems, the difficulty of use and possible interruptions to workflow and doctor patient interactions, and the time needed for training to effectively use the new tools) [2].

V. HEALTH CARE IN RURAL

Populations in developing countries are becoming increasingly day by day and ill due to the double burden of HIV/AIDS/Diabetes , Arthritis, Blood pressure, Hart attack and lifestyle diseases (Kifle, Mbarika, Okoli, Tsuma, Wilkerson, and Tan, 2008).

In Fig. 3 Doctor and patients for rural India have shown. Lady doctor examining their patient. This means that health

care workers specifically in the rural areas are challenged to coordinate medical services with limited resources while case management is becoming increasingly more complex. The isolation of these health care workers is often cited as the reason for poor service delivery in rural areas [3].

Fig. 3 Rural doctors for rural Indian

In this type of diseases medicine are required immediately. So, ICT is very help full to order the medicine on mobile phone or through Internet. Through ordering the medical equipments or medicine receive in time.

VI. BLOCKING RURAL HEALTHCARE DELIVERY AND ITS SOLUTIONS

A. *Not attractive enough for private sector* [4]
- Distributed population
- Not enough money/ Facilities
- No of Villages in India are more but having less population
- Private sectors hospitals are not investing in rural

Solutions
- Private sector investment should be encouraged in rural
- New hospitals and medical colleges should be established in rural
- Doctor treatment policies and fees should be control
- Legal cost of treatment and medical tests

B. *Less efficient public sector* [4]
- Incentives missing
- No attraction in rural for doctors
- Doctors are not interested to work in rural
- Good doctors take transfer from rural to cities

Solutions
- Incentives to doctors should be increased
- Volunteers role for doctors
- Unemployed doctors should be appointed in rural areas

C. *Lack of skilled health workers on ground* [4]

- Some of the doctors have no medical related degree
- Some of the doctors are those persons who were compounders only
- Some of the doctors have degree or diploma like as BA or intermediate only. They some knowledge about medicine only.

Solutions
- Health workers should be trained in rural
- Skills of doctors should be increased through training policies and certificate course should be provided
- Ladies who work for gynaecology should be trained give her latest tool kits and should work under the guidance of doctors

D. *Missing efficient distribution network* [4]
- No proper road in rural
- No proper transport facilities
- No proper ambulance facilities are available in rural.

Solutions
- Through the wireless connectivity rural area can be covered. Order can be processed with minimum
- Centre point should be made in 10 to 20 villages. So that medicine and doctors treatment should be provided.
- Population of village should be increasing through merging the population of 20 to 30 villages at same place. Facilities should be provided. Rest of land should be used for Agriculture with merging the land.

E. *Healthcare expenditure increasing rapidly in the rural areas* [4]
- Due to transportation cost
- Due to low requirement of medicine in rural. Supply of medicine in rural area are also low.
- Mostly company supplies medicine and medical equipments in cities only

Solutions
- Medicine and health care equipment should be supply at the manufacturing cost
- Excise duties and sale tax charges should exempted for rural supply so cost should be decreased
- Profit making strategies on medicine and health care equipments should be reduced and government control on price should be of government.

- *Why health care is required in rural [4]*
  - There are 700 million people living in 636K villages in India.
  - Preventable and curable diseases dominate the morbidity pattern; diarrhea, measles, typhoid.

- In Rural India 66% rural Indians patients do not have access to critical medicine.
- 31% of the population travel more than 30kms seeking health care in rural India.
- Third of symptoms presented at the primary health setting.
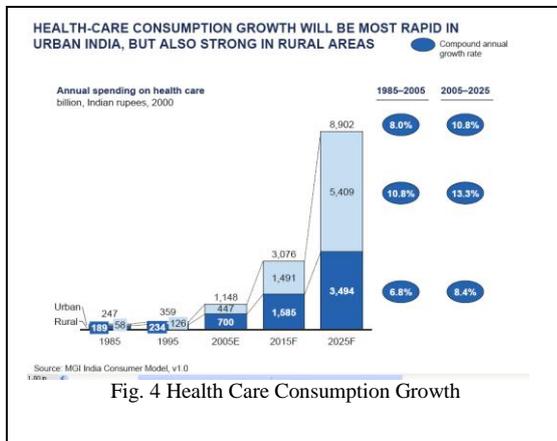- It might be psychosomatic in nature – "holistic approach is absent"

Fig. 4 Health Care Consumption Growth

VII.   HEAVILY URBAN BIASED HEALTHCARE RESOURCES

Rural Doctors to population ratio lower by 6 times. Patients in rural don't get required medicine in time. So, most of the patient damage their health through taking wrong medicine or incomplete dose with the prescription of unqualified doctors. In rural area there are many types of illegal degrees or diploma holder. They give the medicine according to their experiences without knowing the actual disease [4].

- In the hospital Rural Beds to population ratio lower by 15 times
- Villagers spend 1.5 times more compared to urban counterparts for same illness but economically villagers income are less compare to urban citizens.
- Spurious drugs: 7 of 10 medicines in rural areas substandard / counterfeit.
- Some of the medicine are also duplicate in rural area. Because in rural there is no proper labs and identification of medicine techniques.

VIII.   MOBILE DEVICES

In rural area there should be provided mobile to each doctor and mobile no. of doctor should be provided in each family [5].

- Facilitates the mobility of doctors in rural area, practitioners and caregivers.
- Mobile devices are helps to reduce paper.
- Allow to patient and Doctors talks through video conferencing in rural area.

- Allows access to patient information at any moment, everywhere and on real time.
- Improves automatic data gathering through barcode or RFID reading.
- Allows the immediate sharing of patient information and results.
- Improves the internal communication within the caregiver team and with the support staff.
- Through video conferencing patients tells everything about their illness or whatever treatment is required to the patient. If patients do not talk directly to the doctors. Doctors advise everything about him or her.

IX. MOBIHEALTH

Mobihealth is a project based on a European initiative to create a generic platform for home healthcare using BAN-based sensors and wireless telephony technology. They are using GPRS/UMTS wireless communication technology for transferring data[7]. Some of the capabilities include measurement and transmission of vital signs and other bio signals. IN This project they developed a Body Area Network (BAN) and a service platform for patients and healthcare professionals. Some benefits of the devices created in this project include [7]:

- Light-weight sensor system worn on the body
- Increases mobility and out of hospital care and monitoring
- Low interruption to daily life

Some of the challenges faced include [7]:

- Low bandwidth with GPRS/UMTS
- Power requirements
- Security and reliability

X. MOBILE HEALTHCARE

Three years ago, Dhandapany Raghavan, who heads Siemens Healthcare in India, had the idea of letting ASHAs record medical data via cell phones. "We soon realized that we need a competent and experienced partner for this, and we're proud to be working with the Christian Medical College," says Dr. Zubin Varghese of Siemens Corporate Technology (CT) in the Indian city of Bangalore. CMC has been active in this part of India for over 50 years and is very familiar with local conditions. The college has helped Siemens CT to develop a pilot project called the "Community Health Information System" (CHIS), which has already been tested in some villages. "During the first test phase, ASHAs tried out the cell phones," says Prof. George Kuryan, head of the Community Health Department at CMC in Vellore. "They're very excited about using them and the possibilities offered by the new technology." After the testing phase, 83 villages with a total population of about 100,000 people are expected to take part in the CHIS project [6]..

An ASHA starts her work by downloading villagers' up-to-date demographic data, including some health information from a hospital server, to her Smartphone One of the ASHAs'

focus areas is on supporting women during pregnancy, preparing for birth, and providing postnatal and postpartum care. Most women in India give birth at home, usually under poor hygienic conditions. According to the World Health Organization, 37 of every 1,000 Indian newborns died within the first four weeks of life in 2008. By comparison, Germany had a mortality rate of three in 1,000 newborns that year. After a delivery, an ASHA therefore records data such as the baby's weight and heart rate. If an emergency occurs, she can call a doctor on her cell phone. Siemens CT India also hopes to provide better support to doctors by developing inexpensive medical devices that are usable by trained laypersons, such as the ASHAs, provide reliable results, and are robust enough to operate dependably in adverse conditions. The top priority in this regard is to provide support for pregnant women. The device currently at the most advanced stage of development is the Fetal Heart Rate Monitor (see Pictures of the Future, fall 2010, Catching Up, and Emerging Markets: Amazing Growth Ahead), a sort of stethoscope that automatically measures and displays the heart rate of an unborn child. Production of this device will soon begin at a Siemens plant in Goa. After the test phase of the project has been completed, the ASHAs in 83 villages in Tamil Nadu will be equipped with cell phones and, later on, with Fetal Heart Rate Monitors [6].

XI. TECHNOLOGY FOR EMERGING ECONOMIES

Increasingly, the typical diseases of modern civilization are spreading in India. For instance, there are already over 40 million diabetics on the subcontinent, and each year about two million people suffer a heart attack. Indian authorities estimate that by 2020 over seven million Indians will die of chronic illnesses each year. The reasons for this include population growth as well as the country's rising prosperity. CT developments are therefore also focusing on simple devices for investigating cardiovascular illnesses, such as mobile ECG devices. Also in planning are easy-to-use systems for remote patient monitoring. "These devices we're developing are tailored to the needs of emerging countries like India," says Varghese. "Since we need a great quantity of devices for our large population, we have to supply them at the lowest possible price. These devices also have to be as easy as possible to use and they must be virtually maintenance-free." [6].

Another challenge faced by Indian society is infectious diseases. There so many of diseases those affect to patients different manner. India accounts for a fifth of the world's cases of tuberculosis — and a large proportion of these occur in rural areas. The biggest problem in this context is contaminated water, which is also partly to blame for the high child mortality rate: Every day, over 1,000 children in India die of diarrheal illnesses. ASHAs therefore keep a record of all cases of diarrhea in their villages. Using analytical software, CT researchers can evaluate the database of its project partner in the hospital and pinpoint those villages in which cases of diarrhea occur very frequently. Now that tests

have been completed, the first mobile water treatment systems from Siemens Water Technology will soon be delivered to those villages most affected by diarrheal illnesses [6]..

For Dr. Varghese it is already clear that the CHIS project is a successful model that can be carried over to other Indian states and to other countries. In its next phase, the project could be extended to a million people in the neighboring state of Andhra Pradesh. But as Varghese knows, there is still a long way to go before that happens.

Annapurna Verma, has just finished transferring her data from a cell phone to a laptop. She and her fellow ASHAs are done with their examinations for the day, and the bus starts moving again [6].

In Fig. 7 Village hospital has shown and Fig. 5 And Fig. 6 Mobile Hospital/ health care have shown.

Fig. 5 Lady doctor enquary / records of patients

Fig. 6 Lady Doctor examinig the health of rural patient

Fig. 7 Hospital of a Village

XII. CONCLUTION

This paper describes rural health care problem and its solutions using wireless sensor networks. Roll of ICT, reduction of costs of medicine and medical equipments according to technological enhancement. Mobile health care solution provided by Siemens South India. Mobihealth project of European initiative to create a generic platform for home healthcare using BAN-based sensors and wireless telephony technology. They are using GPRS/UMTS wireless communication technology for transferring data. Public sector and private sector hospitals role in rural India will improve the health care strategies of rural India.

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