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Tele-Medical Aid System: A Virtual Bridge between Remote Villages and District/Taluk Hospitals

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Abstract: India is a vast country with more than half a million villages. Only a few of these villages are blessed with adequate medical facilities. Most of the villages do not have necessary amenities like roads, bridges, healthcare centres, etc. Most of the times, the villagers will have to travel about 50 kilometres to get proper medical assistance. In this paper, we propose a rural medical aid system wherein one can get immediate medical attention. A system named 'Rural medical aid' is deployed in the Anganwadi centres in each village and through wireless and distance/tele communication, the residents in these villages can be treated under the supervision of doctors in district/taluk hospitals, thereby saving many lives. Using this model, we can keep a track of compulsory vaccinations, malnutrition, communicable and non-communicable diseases. The system can virtually reduce the distance between remote villages and districts/taluks. As Mahatma Gandhi once quoted "The future of India lies in its villages". In this paper special attention is given to infants and women (during pregnancy and post-pregnancy).

Keywords: half a million villages, rural medical aid system, Anganwadi centres, district/taluk hospitals, wireless and distance/telecommunication.

I. INTRODUCTION

According to the 2011 census of India, 68.84% of Indians (around 833.1 million people) live in 640,867 villages. [1] The main question that arises is- "Are these villagers getting adequate medical assistance?" The answer is a huge resounding no. The second question that arises is "Why?" It may be due to

- Remote locations of some villages.
- Absence of well equipped hospitals in villages
- Few doctors who are unwilling to work in rural areas.
- Lack of awareness on modern medical facilities among villagers.
- The distance factor between villages and hospitals in districts or taluks.

To combat this, we are proposing a 'rural medical aid' system which can be deployed in Anganwadi centres present in each village (including remote villages). The employees at Anganwadi centres will take up the responsibility of acting as mediators between villagers and medical professionals. The word Anganwadi means "Courtyard shelter" in Indian languages. They were started by the Indian government in 1975 as a part of the Integrated Child Development Services to combat hunger and malnutrition among children.

Anganwadi centres provide a basic health care in Indian villages. It is a part of the Indian public health care system. Basic health care activities include contraceptive counselling and supply, nutrition education and supplementation, as well as pre-school activities. The centres may be used as depots for oral rehydration salts, basic medicines and contraceptives. As many as 13.3 lakh Anganwadi and mini-Anganwadi centres are operational out of 13.7 lakh are sanctioned as of 31st January, 2013. These centres provide supplementary nutrition, non-formal pre-school education, nutrition and health education, immunization, health check-up and referral services, of which the last eight services are provided in convergence with public health systems. [2]

II. ANGANWADIS- RURAL CARE

India is a country suffering from over population, malnourishment, poverty and high infant mortality rates. To counter the health and mortality issues there is a great need for medical and health care experts. Unfortunately India has a shortage of skilled professionals. Therefore, through the Anganwadi system, the country is trying to meet its goal of enhanced health facilities that are affordable and accessible for local populations.

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In many ways an Anganwadi worker is better equipped than a physician in reaching out to the rural population. Since the worker lives with the people she is in a better position to identify the cause of health problems and hence counter them. She has a very good insight of the health status in her region. Secondly though Anganwadi workers are not as skilled or qualified as professionals they have better social skills thus making it easier to interact with the people. Moreover, since these workers are from the village, they are trusted which makes it easier for them to help the people. Last but not the least, Anganwadi workers are well aware of the ways of the people, are comfortable with the language, know the rural folk personally etc. This makes it very easy for them to figure out the problems being faced by the people and ensure that they are solved.

A. Functions of Anganwadi Workers

The basic job of Anganwadi workers is extremely important and needs to be carried out in the most efficient manner possible. They need to provide care for newborn babies and ensure that all children below the age of 6 are immunized. They are expected to provide antenatal care for pregnant women and ensuring that they are immunized against tetanus. In addition to this they provide post-natal care to nursing mothers.

Since they primarily focus on poor and malnourished groups, they provide supplementary nutrition to children below the age of 6 and nursing and pregnant women. They ensure that regular health and medical check-ups for women 15- to 49-years-old take place and that all women and children have access to these check-ups. They work toward providing pre-school education to children who are between 3 and 5 years old.

B. Responsibilities of Anganwadi Workers

The Ministry of Women and Child Development has laid down guidelines for the responsibilities of Anganwadi workers (AWW). These include showing community support and active participation in executing this programme, to conduct regular quick surveys of all families, organize pre-school activities, provide health and nutrition education to families especially pregnant women on how to breastfeed, etc., motivating families to adopt family planning, educating parents about child growth and development, assist in the implementation and execution of Kishori Shakti Yojana (KSY) to educate teenage girls and parents by organizing social awareness programmes etc., identify disabilities in children, and so on.

C. Supervision

Every 40 to 65 Anganwadi workers are supervised by one Mukhya Sevika. They provide on-the-job training.

In addition to performing the responsibilities with the Anganwadi workers, they have other duties such as keeping track of who are benefiting from the programme from low economic status — specifically those who belong to the malnourished category; guide the Anganwadi workers in assessing the age and weight of children and how to plot their weights; demonstrate effective methods, for example, in providing health and nutrition education to mothers; and maintain statistics of Anganwadis and the workers to determine what can be improved. The Mukhya Sevika then reports to the Child development Projects Officer (CDPO).

III.METHODOLOGY

A. Local clinic unit/ Anganwadi Unit

Figure 1 shows the block diagram of the Local clinic unit/ Anganwadi unit where the following parameters of a patient are recorded and sent to the district hospital unit or can be pushed to the server/ data acquisition unit.

- Pulse oximetry (person's oxygen saturation)

Pulse oximetry is a non-invasive method of monitoring a person's oxygen saturation. In its most common application mode, a sensor device is placed on a thin part of the patient's body usually a finger tip or ear lobe, or in case of an infant, across the foot. The device passes two wavelengths of light through the body part to a photo-detector. It measures the changing absorbance due to arterial blood alone, excluding venous blood, skin, bone, muscle, fat and nail polish.

- Heart beat and pulse monitor

Heart rate is the number of heart beats per unit of time, typically expressed as beats per minute. The heart rate can vary depending on the human activity or due to any health issue. The measurement of heartbeat is used by medical professionals to assist the diagnosis and tracking of medical conditions. The heartbeat sensor works on the principle of photo phlethysmography. It measures the change in volume of blood in any organ of body which causes a change in the light intensity through that organ (a vascular region). In case of applications where heart pulse rate is to be monitored, the timing of the pulse is more important. The flow of blood volume is decided by the rate of heart pulses and since light is absorbed by blood, the signal pulses are equivalent to the heart beat pulses.

- Chest sound recording microphone

In medicine, the respiratory examination is performed by as a part of a physical examination or when a patient presents with respiratory problems such as dyspnea, cough, chest pain or a history that suggests pathology of lungs. A chest sound recording microphone is placed on the chest of the patient and the sound patterns are recorded and sent to the district hospitals via RF/IP link. The audio clip is compressed before transmission.

- Camera to record eye and mouth visuals

A camera is used to take images of the eyes and visuals of the mouth as a part of medical examination of the patient. The input data is compressed before transmission by the image/video compressor. The eyes, throat and tongue are important sources in medical investigations.

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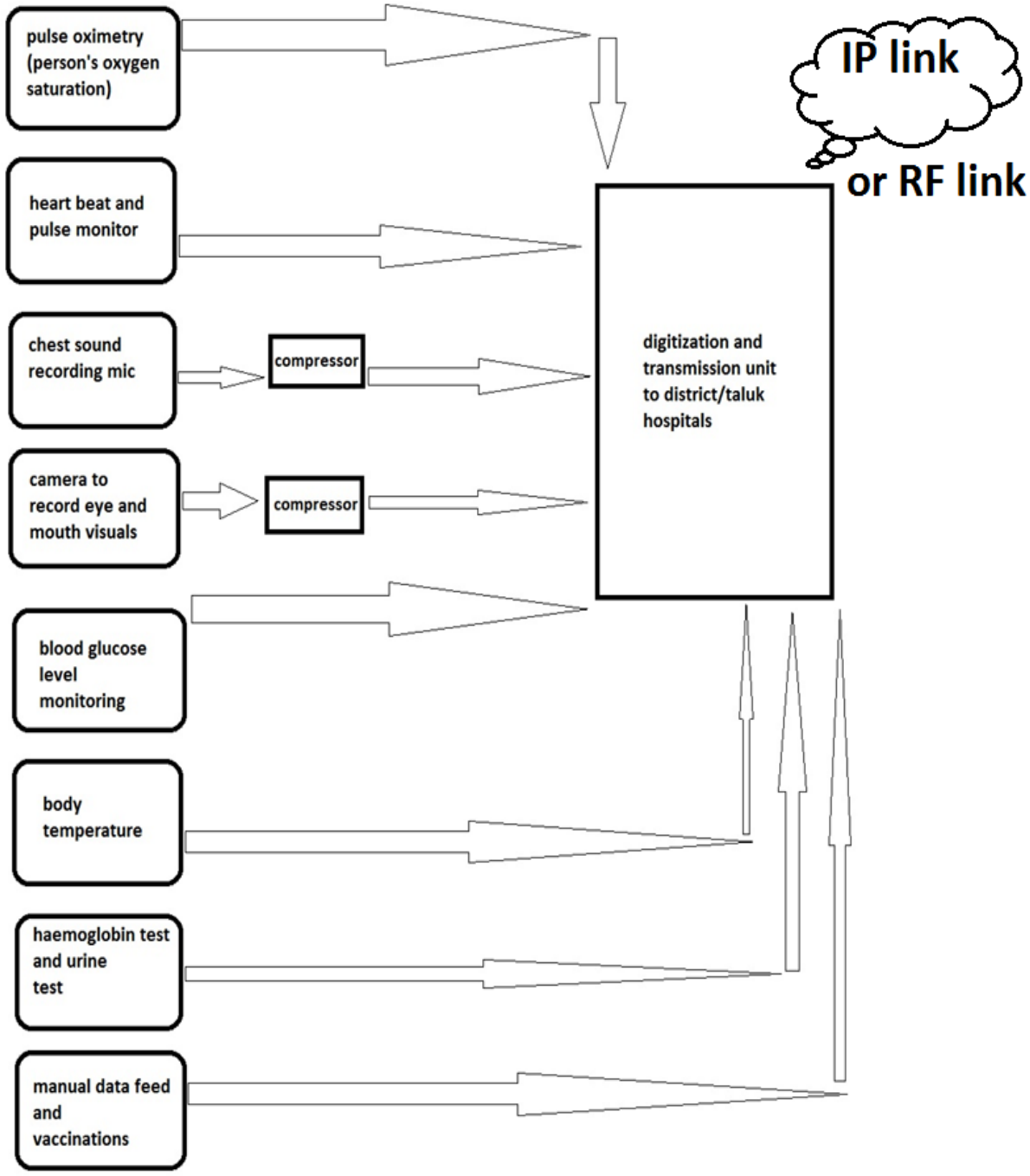

Figure 1 block diagram of the Local clinic unit/Anganwadi unit

• Blood glucose level

Diabetes Mellitus is quickly gaining the status of a potential epidemic in India. [3] Diabetes Mellitus is a condition where there are high blood glucose sugar levels over a prolonged period. If left untreated, it can cause many complications such as diabetic ketoacidosis, nonketoic hyperosmolar coma or death. Serious long term include heart diseases, stroke, chronic kidney failure, foot ulcers and damage of the eyes. A blood glucose meter or glucometer can be used to measure the blood glucose level in mg/dL [4] in Anganwadi centres.

• Body temperature

Normal body temperature, also known as normothermia or euthermia is a narrow temperature range indicating optimal health and thermoregulation. Typical range is 98.2 +/- 0.72 degrees Fahrenheit. [5] The body temperature changes when a person is hungry, sleepy, sick or cold. A thermometer can be used to measure the body temperature.

• Haemoglobin test and urine test

Haemoglobin in the protein molecule in red blood cells that carry oxygen from the lungs to the body tissues and returns CO_2 from the tissues back to the lungs. [6]

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Haemoglobin test is often used to check anemia. Several methods exist for measuring haemoglobin, most of which are done currently by automated machines designed to perform different tests on blood. Within the machine, the red blood cells are broken down to get the haemoglobin into a solution. The free haemoglobin is exposed to chemical containing cyanide that binds tightly with the haemoglobin to form cyanomethhemoglobin. By shining light through the solution and measuring how much light is absorbed at a wavelength of 540nm, [7] the amount of haemoglobin can be determined.

Urine test can also be carried out to measure the levels of a substance called urobilinogen. Higher-than-expected levels of urobilinogen in the urine may suggest pre-hepatic jaundice or intra-hepatic jaundice. Lower levels could suggest post-hepatic jaundice.

• Vaccinations and manual data feed

Vaccinations is the administration of antigenic material to stimulate an individual's immune system to develop adaptive immunity to a pathogen when a sufficiently large percentage of has been vaccinated, this results in herd immunity. There are many compulsory vaccinations like polio vaccine, influenza vaccine [8], HPV vaccine [9] and chicken pox vaccine. [10] Anganwadi workers can keep track of these vaccinations in rural areas.

Many manual parameters exist which have to be input or entered manually. Figure 2 shows those parameters.

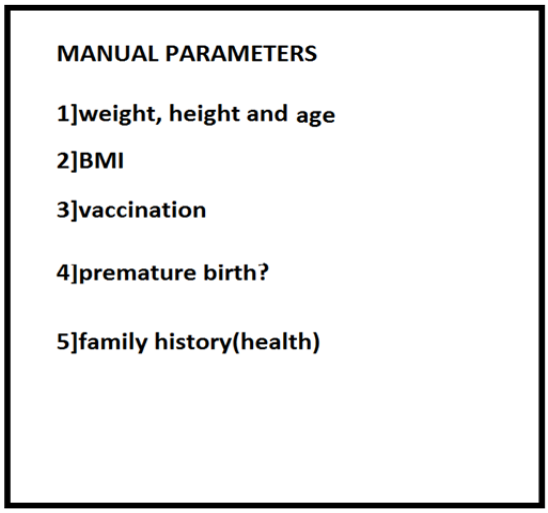

Figure 2 Manual parameters

B. State Web Server/Data Acquisition Unit

Digital data from the local clinic or Anganwadi centres is sent to the web server or data acquisition unit before it is received by the district hospital unit. Each state in India will be deployed with centrally located state servers. All the district or taluk servers will be ultimately connected to their respective state servers in a star topology. Doctors in the district hospitals can retrieve the data at any time from the web server to remotely treat the patients of rural areas. Doctors can go for real time or live monitoring of patients in case of an emergency. Figure 3 shows the state web server or data acquisition unit.

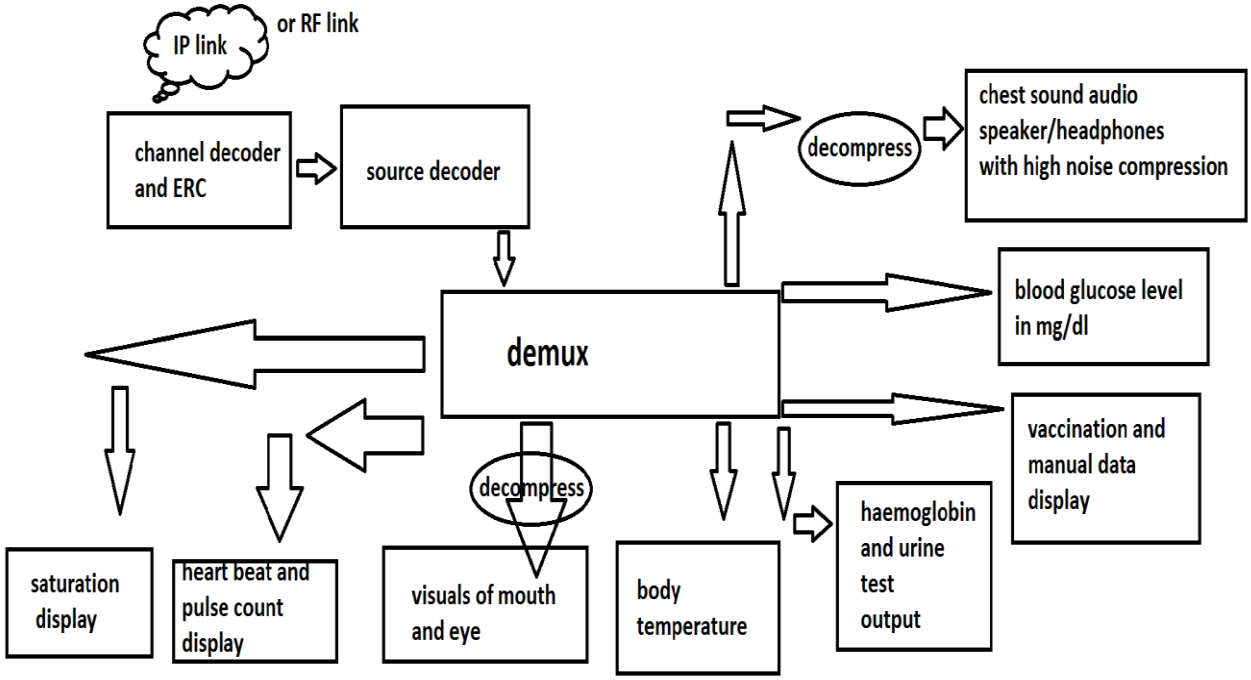

Figure 3 State web server or data acquisition unit

C. District Hospital Unit

Figure 4 shows the district hospital unit. Real time digitized data or recorded data is channel decoded before feeding it to the source decoder. The output of the decoder is demultiplexed according to the following parameters as shown in figure 4:

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- Saturation display
- Heart beat and pulse count display
- Visuals of mouth and eye (after decompression by a decompressor)
- Body temperature
- Haemoglobin and urine test output
- Blood glucose level in mg/dL
- Chest sound audio speaker/headphones with high noise compression (after decompression by a decompressor)
- Vaccination and manual data display

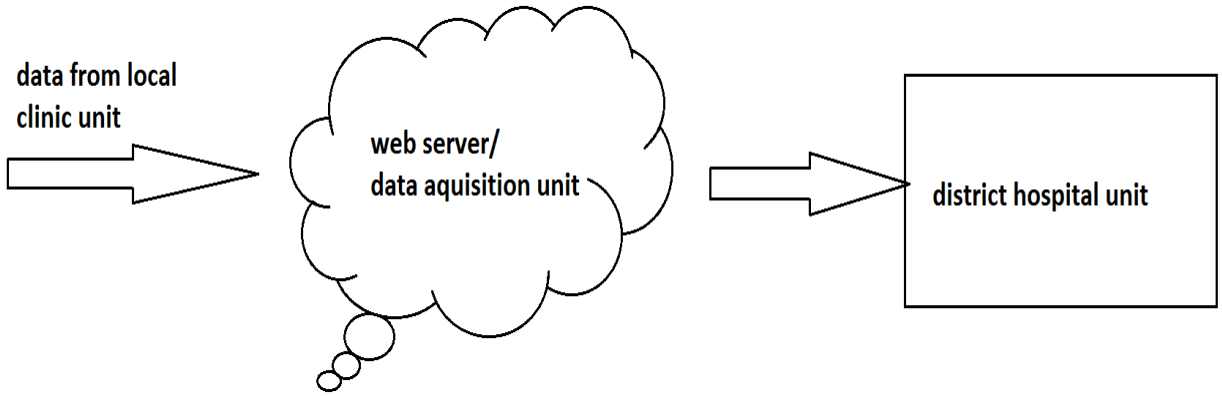

Figure 4 District hospital unit

IV. CONCLUSION

68.84% of Indians live in 640,867 villages (as per 2011 census of India). As Mahatma Gandhi once quoted "The future of India lies in its villages". These figures reveal how important it is to provide proper health care and medicines to villagers. Also most of these villages are remotely located and are deprived of basic facilities and are haunted by deadly diseases. Moreover, these people have very less knowledge/awareness of such diseases. The question is "what is the solution?" Deploying a 'rural medical aid system' in Anganwadi centres, where the Anganwadi workers act as mediators between the patients and the doctors of District/taluk hospitals. Also the Anganwadi workers can provide the first line of treatment: which is lifesaving.

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BIOGRAPHIES

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