© July 2015 | IJIRT | Volume 2 Issue 2 | ISSN: 2349-6002

AUTOMATED MEDICATION SUPPLY SYSTEM AT REMOTE AREAS USING GSM

Komal H. Nirala[1], Prof. Utkarsh Patel[2]
[1]*Students, M.E. Semester IV,* [2]*Assistant Professor*
Electronics & Communication, Silver Oak College of Engineering & Technology, Ahmedabad, India

Abstract **- Information technology and telecommunications are advancing rapidly, especially in the field of wireless and mobile communication, and are the reason behind the arrival of new forms of information infrastructure having the capability of serving many new services in healthcare. The implementation of Automated Medication Supply Systems (AMSS) using GSM, can serve weakly served or un-served parts of the country. Automatic Medical Dispense Devices are drug storage devices or cabinets that electronically dispense medications in a controlled fashion and track medication use. Telemedicine is another concept which can be defined as 'rapid access to remote medical expertise through telecommunication and information technology'. AMSS based on GSM will allow merging advantages of both concepts, and affordable and quick prescription can be made available when required. This kind of system can help the patients or person in emergency case with quick doctor's prescription & medication, and will make possible the availability of such services at rural places or remotely located places in India. Controlling of medication can be done by the available doctor remotely. At the time of emergency, the person can be able to talk directly with doctor located far away, with a single press of a button. This can be done by the GSM module over the cellular communication. After knowing the symptoms of the patient, the doctor will do a diagnosis and give proper prescription. Using an on-call provider client app running on a doctor's handheld; he will prescribe the medicines and will unlock the corresponding medicines' storage box on the AMSS device. Thus, it can be predicted that such kind of efforts and the combined advantages of developing mobile technologies will results in the development of further more applications, yielding necessary and better services to the citizen of India.**

Index Terms **Telematics, Telemedicine, GSM, Cellular communication, Automatic Medical Dispense Device, On-call service.**

I. INTRODUCTION

Reliable connectivity of sufficient data rate capability at affordable cost is a major requirement for low cost rural mobile telemedicine projects. In developing countries, the infrastructure which connects doctor and patients has not been developed properly, mainly in rural areas.

There is only one doctor per 1,700 citizens in India; the World Health Organization stipulates a minimum ratio of 1:1,000. Health ministry declares that there are about 6 to 6.5 lakh doctors available in India. But India would need about four lakh more by 2020 to maintain the required ratio of 1 doctor per 1,000 people. [1]

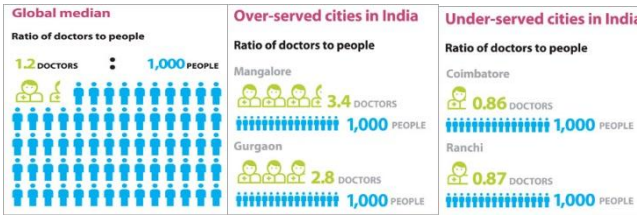

Fig 1: doctors/people ratio[6]

If shortage of doctors is one problem, while another problem is that they even don't prefer to work in the rural areas, creating artificial scarcity in the area and high concentration in another. Worse still, many doctors posted in the hospitals in the rural areas remain absent for long periods. And when the doctor is not present, patients visiting the healthcare centers are treated by stand-ins—pharmacists and even nurses. Surveys of rural healthcare facilities have revealed bad infrastructure, unavailability of medicines, equipment and even the basic needs.[2]

There are PHCs in villages, rural areas, they have to cover particular population, but if that much of population comes under large radius of about 50 km, then this much of distance in emergency will be of major problem. PHCs located near developed cities may at least have necessary equipment and facilities, but those located in rural areas, far away from the developed areas, lack even the general required facilities.

'India has 0.7 physicians per 1,000 people — BRIC peers Russia (5), Brazil (1.5) and China (1.5) have better ratios —'and most Indians travel about 20 kilometers to reach a hospital, according to a 2012 report by accounting firm PricewaterhouseCoopers" (PwC).[3]

The reasons for absence of complete rural health care can be listed as follows: 1) Rural backwardness; 2) Long duration of medical education; 3) High cost of medical education; 4) Offers and attractions of urban life.[4]

The shortage of healthcare workforce in rural India is evident from the above discussion, but we see this issue as a classic example of supply-demand mismatch, with operational inefficiencies in the supply chain caused by underutilization of capabilities.

II. PROBLEM STATEMENT

The shortage of infrastructure, shortage of doctors, and shortage of trained healthcare work lead to the main problem that was identified as the massive shortage of proper healthcare facilities in rural India.

While most research papers look at the shortage of such facilities in India as a whole, they fail to identify and address the fact that the real shortage lies in rural India, and not in urban India which is much better off. To improve the healthcare system in India as a whole, first we need to identify and resolve the problem in the rural India.

III. OBJECTIVE

Our Automated Medication Supply System- using GSM, tries to solve this issue: How do we provide greater access to primary healthcare services at a village level in rural India where there is an acute shortage of doctors, such that people do not have to directly visit hospitals, except only for higher-end services? The answer, according to us, had to exploit the widespread penetration of mobile technology.

In India, there is no such kind of dispense systems connecting city hospitals and doctors with rural ones for medication. Even there is a challenge for the establishment of telemedicine infrastructure in rural areas. This kind of system can help the patients or person in emergency case with quick doctor's prescription and medication. Increasing the chances of timely and appropriate actions. This system provides mobility to the doctor and the patient.

The operating algorithm will work as follows:

a) When emergency or medical need occurs
b) The patient or person will press the button on AMSS
c) Emergency service starts
d) The AMSS places the call to the doctor(GSM)
e) If call fails to connect, it again calls to another doctor. Here preference is given to the nearby doctor
f) When call connects, 2 way conference started
g) The doctor listens to the patient's symptoms and the kind of emergency and accordingly diagnose and prescribes the medicines
h) The Doctor unlocks the required medicine so that the person can take it
i) Doctor will release medicines by pressing DTMF on his mobile as per the requirement

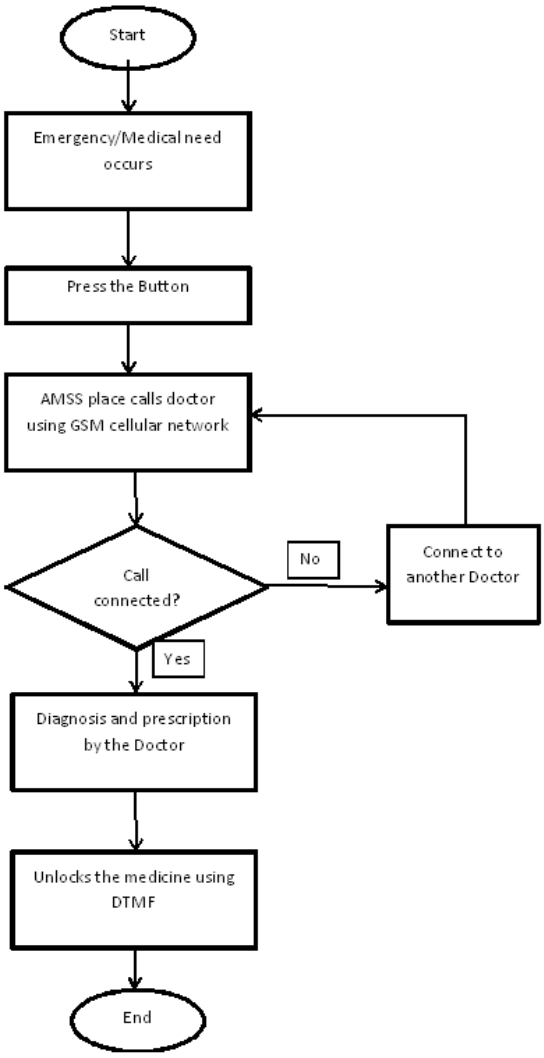

Fig. 2. Operating Algorithm

IV. BLOCK DIAGRAM

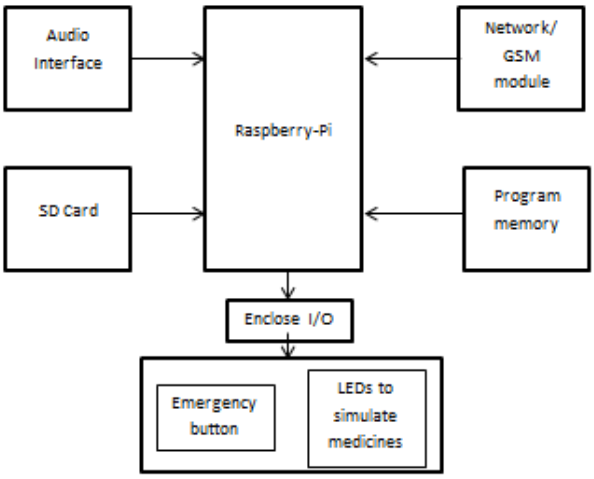

Fig. 3. Block Diagram

The block diagram shows the main unit of micro-processor, with supporting units like SD card, program memory, GSM module, audio interface, emergency button and LEDs to simulate the medicines.

The processor used here is ARM1176JZF-S, which is on the development board called Raspberry-pie. The processor is from the family ARM11. The ARM1176 applications processors deployed broadly in devices ranging from smart phones to digital TV's to eReaders, delivering media and browser performance, a secure computing environment, and performance up to 1GHz in low cost designs[5].

V. RESULTS AND SIMULATION

a) Things required for set-up:

- Raspberry-Pi B+ board
- 5V Power supply for RPi
- 4, 1-to-1 connecting wires
- 2 USB-serial convertors
- 1 Ethernet cable
- GSM modem
- 12V GSM supply
- MAX-232 circuit
- One SSH client such as Putty, Terminals, etc.

The simulation of the proposed solution requires many hardware and software tools as a team. It includes the initial setting of the Pi, installation of the required software along with the installation of the drivers required for the hardware to get detected by the PC or Pi.

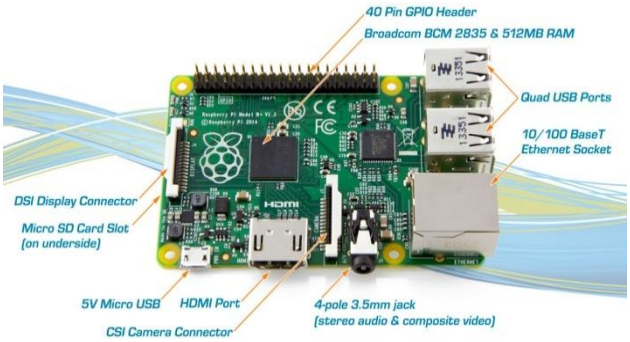

Fig 4: Raspberry- pi B+ board[7]

Fig 5: GSM Modem - RS232 - SIM900A[8]

b) Set-up and results:

- Raspberry-Pi is connected to the PC via max-232 circuit. The MAX232 is an IC that converts signals from an RS-232 serial port to signals suitable for use in TTL compatible digital logic circuits.In RS232 protocol, +12V indicates the Space state or Zero and -12V indicates the Mark state or 1. In TTL, +5V indicates the Mark state and 0 indicates Space state. Most importantly, TTL level is not accepting negative voltage levels. So for the RS232 to TTL interface translation is not only a task with 12V to 5V level shifting, and it includes a level inversion too. To do that, MAX232 is more often used in many applications.
- An SSH client is a software program which uses the secure shell protocol to connect to a remote computer.
- First of all, the board of raspberry-pi is made "up" by connecting it to the PC via max-232.
- An Ethernet cable is used to connect pi with PC and PC's internet is made available for pi to use by bridging the PC's net connection with its LAN connection.
- Using the command 'ifconfig' the details of pi-networks can be seen as shown in the Fig.5, so we can see the Ethernet ip of pi now.

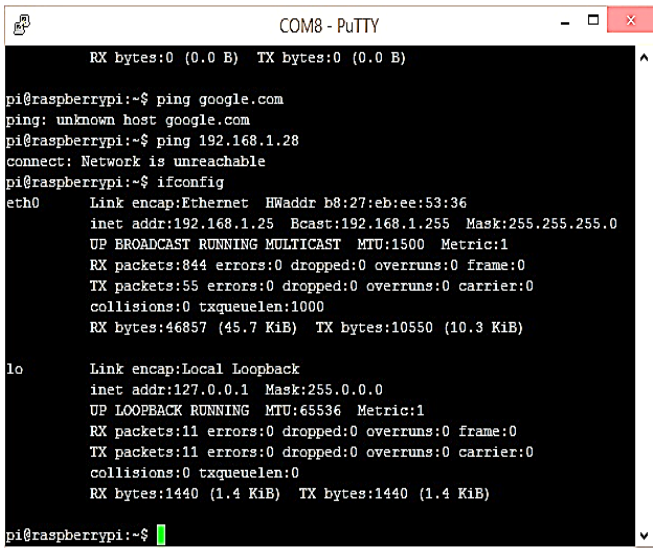

Fig 6: Pi static Ethernet IP

- To check if pi is connected to internet, pi to google ping is checked as shown in Fig.6.

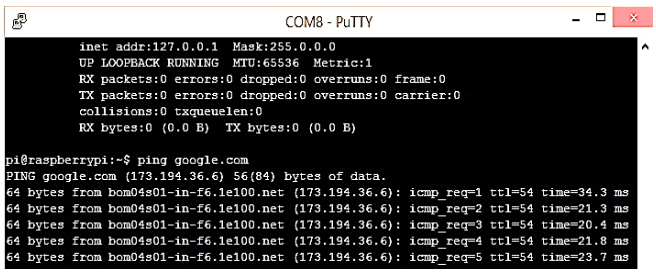

Fig 7: Pi to google ping

- The tool is installed now on pi to view and configure the serial ports on pi, called 'Minicom'.

- And then the setup is done as shown in the Fig. 8, by connecting the GSM module to pi through a usb to RS232 adapter.

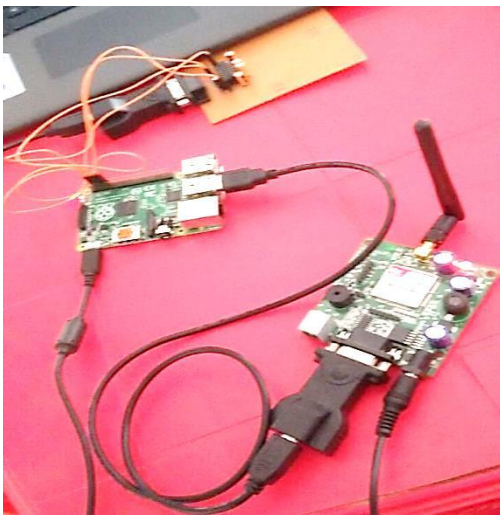

Fig 8: Set-up

- The configuration panel looks like the one shown in the Fig 8. and then the required configuration is done by setting the baud rate, port name, etc. In our case, it is done for the GSM module.

Fig 9: Pi port configuration

- Now, the GSM module becomes ready to place and receive calls, also to send and receive SMS using its AT commands.

- Call placing & receiving and SMS sending & receiving are shown in the Fig 9 & Fig 10.

Fig 10: SMS & Call receiving

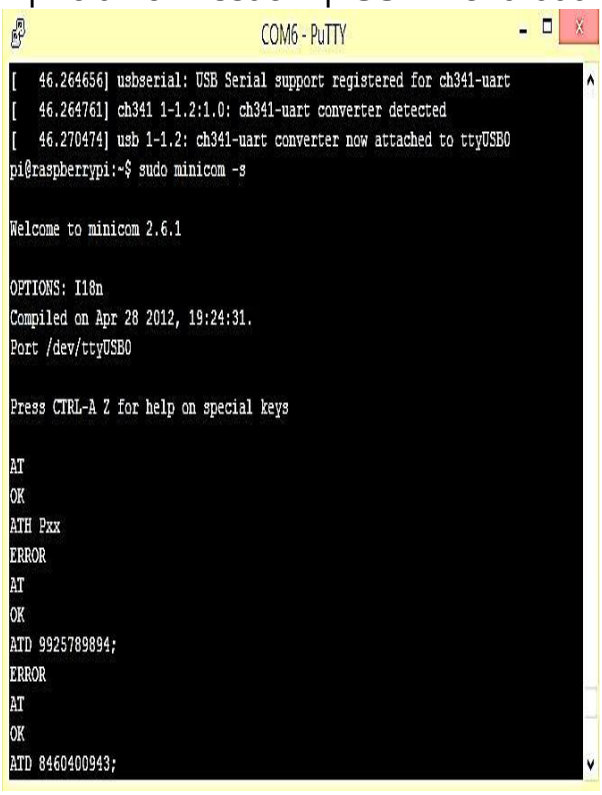

Fig 11: Calling from GSM modem

c) Problem faced and troubleshooted:

While trying to use and enable the DTMF functionality of the GSM modem, I found that the firmware in my GSM modem does not support the DTMF function.

Following is the problem I was facing in my GSM modem sim900a:

1. I checked the firmwares using command AT+CGMR,
   - My modem's firmware was: 1137B09SIM900M64_ST
   - Modem with DTMF should have: 1137B10SIM900A64_ST_ENHANCE
2. The command for DTMF function enabling is AT+DDET=1, given different results in both modems
   - My modem's result was: error
   - Modem with DTMF functionality should yield: OK (means DTMF functionality is enabled and working properly)

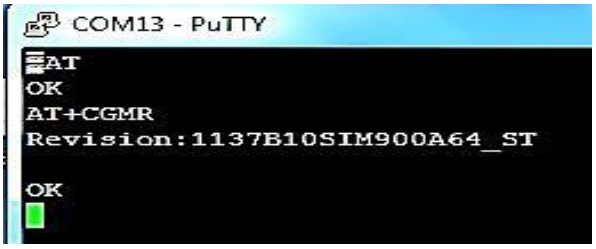

Fig 12: My modem's original firmware

Then tried to change the firmware of the modem so that DTMF can be enabled, using the following:

1) Customer flash loader V1.01
2) The required firmware, i.e. 1137B10SIM900A64_ST_ENHANCE.cla

But other errors occurred during upgradation of the firmware, shown in the figure below:

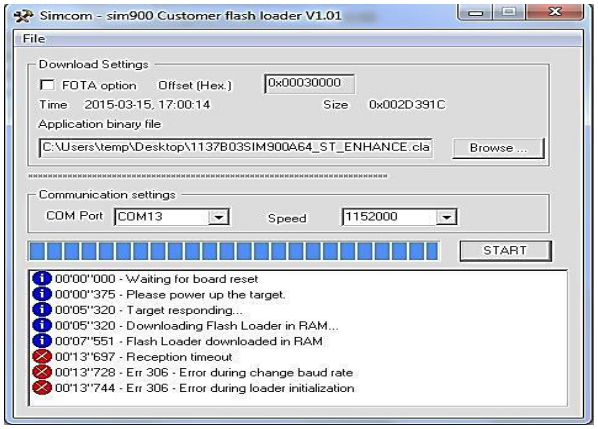

Fig 13:First error encountered during firmware upgradation

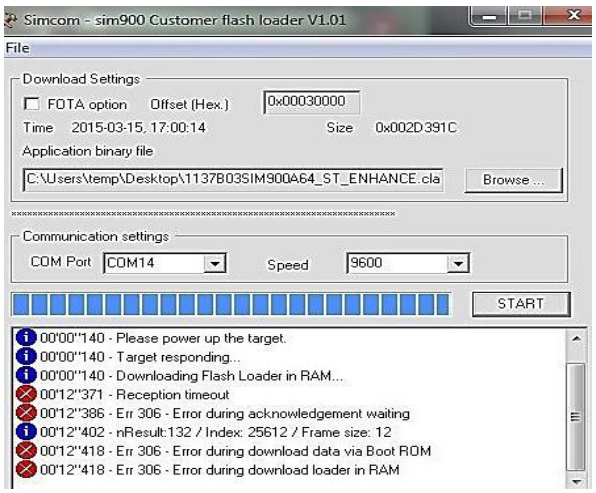

Fig 14:Second error encountered during firmware upgradation

After troubleshooting so many times with different set-up changes and trial-and-error technique with the help of experts from different forums, I finally succeeded in changing the modem firmware as shown in below figure.

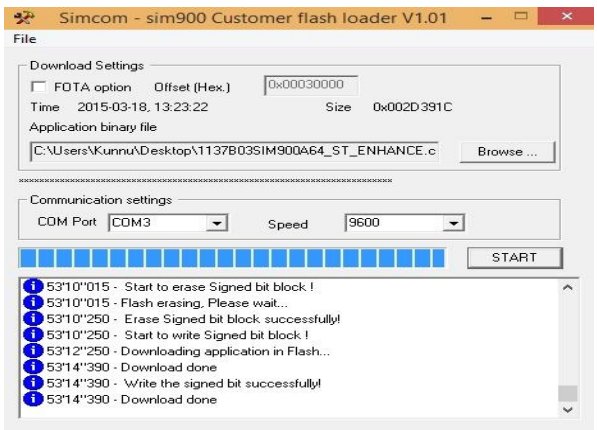

Fig 15: Successfully changed the firmware

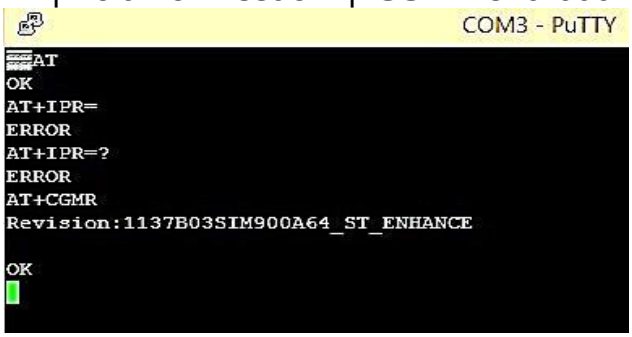

Fig 16: My modem's upgraded firmware

Now, I am able to enable the DTMF functionality in my modem and able to receive the DTMF from another person's cell or land-line, in this case, from the Doctor's cell or land-line.

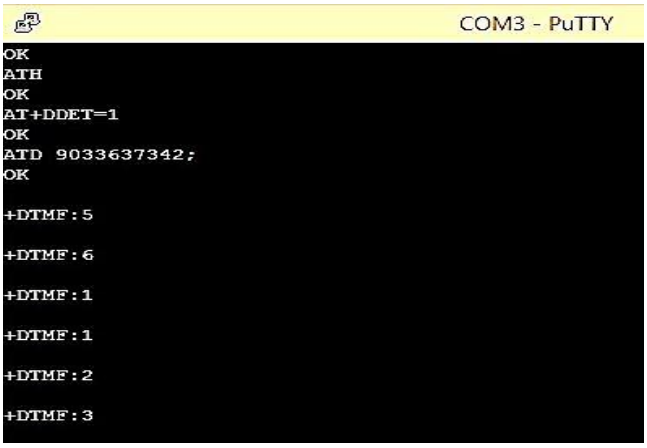

Fig 17: Enabling and successful reception of DTMF

VI. ADVANTAGES & APPLICATIONS

AMSS based on GSM will allow merging advantages of both concepts of telemedicine and AMDS. Hence, affordable and quick prescription can be made available when required. It will serve the areas as follows:

a) Schools and other populated bodies located at rural areas.
b) Clinics, in case doctor are unavailable.
c) To assist the compounder at village clinic.
d) To assist the nurses in village hospitals and PHCs.
e) Agencies, groups, organizations that are providing services to the rural population in healthcare. A trained person who serves there, can manage AMSS with large amount of medicines. PHC doctors can get assistance to serve rare medicines.

VII. CHALLENGES

There arise many obvious challenges that comes in the path of the desired solution:

a) **Perspective of the doctors:** Doctors are not fully familiar and with the technology of electronic-medicine.

b) **Rate of literacy rate and languages diversity:** Only 65.38% population in India is educated with only 2% being well-comfortable in English.
c) **Support of Government:** The government has its own limitations and also there are limitations in private enterprises. Every new technology in its primary stages needs support & care. Only the government has the required power and the resources with the help of which it can survive and grow.
d) **Unfamiliarity and fear of patients:** The patients have very low confidence about the results of telemedicine and also this AMSS proposal is new to them.
e) **Lack of basic necessities:** In India, nearly 40% of population lives below the poverty level. Basic amenities like transportation, electricity, telecommunication, safe drinking water, primary health services, etc. are missing. No technological advancement can change anything when a person has nothing to change.
f) **Training related to AMSS:** If the system is required to be put in very populated area, it should also require to be managed by a trained person to prevent misuse or errors. '
g) **Quality:** Quality aspect is the essential and everybody wants it, but this can sometimes also create issues. In case of healthcare, there is no proper governing body to provide guidelines regarding medication quality and motivate the organizations to follow that thing. The organizations are fully responsible for how they take it.
h) **Maintenance:** To maintain the system properly at environment of rural areas.
i) **Financial issues:** Sometimes, high cost of the technology and communication make Telemedicine, financially not feasible.

VIII. FUTURE SCOPE

The continuous evolution of telemedicine and healthcare system in India is trying to cope with the problems in both the urban and rural India. The rural India need to be focused more. One must start with the very weak side to successfully remove the main difficulty. The root cause must be improved first.

Automated Medication Supply System using GSM in rural areas can be proved as a new hope and a way to contribute to the rural India to solve the major healthcare problem. This will allow public access of rare medicine in weakly served. If appreciated, it can be used in PHCs, rural schools, small clinics, rural hospitals.

IX. CONCLUSION

This paper has suggested the evolution of health related services in remote areas with the help of telemedicine using widespread GSM network technology. This will lead to the access of rare medicines and general medicines, along with the consultation of doctor where there is large concentration of people, kids, and adults alike, like colleges & universities, hotels, restaurants, large day care facilities, theme parks, airports, shopping malls etc. This will solve the medication availability problem in rural areas to many extents.

REFERENCES

[1]https://ideas.sap.com/ct/ct_a_view_idea.bix?c=7EE5732E-EE93-48ECA125ED0146A776&idea_id=BC988606-8511-466F-BBD9-7809147E55A7
[2]http://www.gramvaani.org/?p=1629 "Rural Health Care: Towards a Healthy Rural India"
[3]http://www.newindianexpress.com/magazine/India-has-just-one-doctor-for-every-1700-people/2013/09/22/article1792010.ece
[4]http://pharmabiz.com/ArticleDetails.aspx?aid=71113&sid=9
[5]https://www.modmypi.com/raspberry-pi-model-b-plus
[6]http://www.newindianexpress.com/magazine/India-has-just-one-doctor-for-every-1700-people/2013/09/22/article1792010.ece
[7]http://element571.rssing.com/chan-5145677/all_p225.html
[8]http://www.sunrom.com/159