

Smart Patient Health Monitoring System Using Raspberry Pi

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Abstract— “Health is not everything, but everything is after health”, no one will disagree with this statement. However, if we talk about the current scenario of Indian rural health care system, it is facing a crisis as compared to any other social sector. Nearly 86% of all the medical visit in India are made by remote area residence with majority still travelling more than 100 km to avail health care facility of which 70-80% is born out of pocket, landing them in poverty.

In India, around 27% of total population lives in urban areas where more than 75% of total health care infrastructure is available and rest is for more than 80% of the population of rural areas, with this figure we can easily predict that rural population is witnessing the lack of proper primary healthcare facilities. According to a KMPG report, “74% of Indian doctors are catering to the needs of the urban population.”

India is undergoing rapid epidemiological transition as a consequence of economic and social change. Due to the lack of basic health care infra in rural areas people are not aware of many diseases and they do not go through proper consultation. Some 2.4 million Indians die of treatable conditions every year, the worst situation among 136 nations studied for a report published in The Lancet. So, we come across a solution that how we can facilitate this problem in which we can connect the rural India about their basic health requirement using the technology.

I. INTRODUCTION

Healthcare is the right but lack of infrastructure, and non-access to basic medicines and medical facilities thwarts its reach to a major rural population in India. Around 800 million people lives in rural India where the condition of medical facilities is disgraceful. By taking the situation under a serious consideration, need of new practices and procedures is required to rebuild the health infrastructure to ensure that quality and timely healthcare reaches to the Indian villages. Even government is running multiple programs for rural health care system but it's success and effectiveness is questionable due to a lot of gaps. India also accounts for the most important number of maternity deaths. A majority of those are in rural areas where maternal health care is poor.

Rural areas have a lot of problems in health care systems, mostly people do not go under any consultation about their health and then it tends to some serious problems. At the initial stage if they go through a proper consultation the disease can be treated well at that initial stage. The office of the Census Commissioner served a warning in 2016: Lifestyle Diseases have emerged as the biggest cause of deaths in India.

According to new data, non-communicable diseases (NCDs) have emerged because the leading explanation for deaths in

India, accounting for as many as half the deaths between 2010 and 2013. However, for urban areas, NCDs account for nearly 60% death. Cardiovascular diseases are the most important killers within NCDs. Premature births and low birthweight have emerged because the main reasons for deaths of youngsters below the age of 29 days, the new data revealed.

In these all cases an awareness and proper consultation was required and with this the life expectancy may increase. So we come across a solution for rural India that how they can be get the same benefits at their sub centers or PHC (primary health center) within minimum cost with high accuracy.

We come out with a table top device which will be kept in PHC and another device like a tablet is kept on the other side in a hospital or a doctor both the devices will be connected with each other through a communication channel. When a person visits to PHC he/she to register for first time with some basic data which will be required on self or with the help of ANM or PHC staff. Then the patient can interact with the device about their symptoms and the problem they are facing and this device will work in their own language for better understanding after a pre assessment using artificial intelligence, the analyzed data will be transferred to the doctor/hospital who is sitting

outside the city and can easily recommend the required action.

Similar things can be done in case of repeated visit, suppose a patient is under consultation with a particular doctor and the doctor has schedule his/her visit after some time at this point, he/she doesn't have to present physically there he can get connected with the doctor virtually using the device/his mobile and the time a money will be saved for patient.

As we mentioned that life style is causing a major concern for death in rural areas this is all about the lack of consultation, with such device they can be consulted remotely about their lifestyle what to do not to do so. In case of maternity, it also requires extra care to avoid any complication at the time of birth, we are designing the algorithm in such a way that the lady can interact with the device and what measured to be taken can be suggested easily at the same time as in this digital world, everyone is using mobile phone so with the data gathered the device can send some updates on mobile at time-to-time basis and in final hours she can also update about the status. The device to arrange a smooth routing for hospital and will inform to the local administration to arrange the help and ambulance if required. Many other awareness sessions can be conducted remotely and the local demography can be analyzed with which we/govt. authority can easily understand the health demography and if something strange is happening the preventive majors can be taken out by keeping the time in hand. In rural areas still people are not aware of health insurance here we can promote it about the benefits from it and how it can help them.

At the same time, we can also introduce some basic tests at the PHC and test results can be come out in minutes and again these tests will be configured with the device so that doctor can better understand these tests will be done using the user ID of patient under the supervision of PHC staff.

The entire device has used multiple technological platforms and multiple technologies ranging from AI, Robotics to IOT.

II. ABOUT SOLUTION

The six decades of Indian independence have witnessed too many plans, papers and proposals giving top priority to the health issues in India. Unfortunately, despite huge economic process, health continues to be the best predicament especially in rural areas. Rural areas has a lot of problems in their health care systems because of which most of the people over there do not go under any consultation about their health which sometimes results in to some serious health issues.

We conceptualize a table top solution for basic health requirement in which we can diagnose these health parameter as mentioned below:

1. Blood pressure
2. Asthma
3. Blood sugar
4. Eye sight
5. ECG

As we know these are the basic and required health parameter can be measured easily and will not require more precision to take the parameters for these tests.

So the question is that how we will manage and automate the entire process, as we all know that UIDAI/Aadhar is mandatory for every citizen in India. When a patient visits first time to our centre/PHC for diagnosis we make him register with us by doing the Aadhar authentication, and it will create a login id and password for that patient. If that person has not Aadhar we can register him/her manually too.

Once the patient has registered with us now the executive available at the centre can diagnose for the basic tests required to that patient.

As we mentioned that the entire process is automated, so the question is how these tests will be performed and how the data will be collected, So well we will have all the required gadgets and kits for the health parameter, we will make the user logged in to the system. E.g., the patient has to measure the BP, as we are using wearable devices with high accuracy. We will band the BP monitor machine on the patient wrist and it will measure the blood pressure and the data will be fed into the system using IoT, and similar other tests can be carried out in similar manner and data will be stored according to the patient visit to the centre.

This platform will also work as an intermediary between the patient and the doctor sitting in some other city through which they can consult the doctors. The profile of the individual will consist of a report section carrying all the reports of the previous as well as current diagnosis of the individual and their family members. This also helps in identifying the hereditary diseases. So, if in case they have to consult a doctor or are further referred to any other doctor, there is an ease of understanding of the issue. They can access all the necessary documents with just one click. Along with it he/she doesn't have to present physically for any further consultancy, they can carry on with the same software to connect with the doctor.

III. GENERAL IDEA

Vast population in our country is deprived of the basic ailments and are not aware of the health issues and health education. Medical support and educational mediums are a rare site to be seen. In more remote areas where the lack of

awareness leads to many of the fatal diseases healthcare fails badly.

In the light of these scenarios our idea revolves around connecting the modern healthcare facilities with the help of various engineering domains and technologies to facilitate and provide better knowledgeable guidance to medical staff at the primary health care centres and educating to create awareness about hygiene and to look after many of the treatable and curable diseases and injuries if worked upon at right time.

IV. FEATURES:

Wearable technology: We will use wearable technologies to minimize the human intervention and increase the accuracy. Using medical sensors to obtain medical parameters like respiratory system, blood sugar, oxygen saturation level for analysis.

Storing Blood pressure and other pyro data for medical analysing.

Medical Consultation based upon the data.

V. VIRTUAL ASSESSMENT

- a) Online medical record keeping
- b) Storing virtual test report, past medical records and previous ailments.
- c) Consultation with doctors and medical practitioner to ensure fast and vivid reach to immobile regions without hindrance.

VI. TELEMEDICINE SUPPORT

- a) Online 'prescription-based medicine being provided to local PHC facilities.
- b) After examination of data on available the device referring and connecting to nearest possible doctor for best outreach

VII. TECHNOLOGIES USED

Medical platform technology like Blood pressure, Asthma, ECG, Eye sight, Blood sugar.

1. Artificial Intelligence
2. IOT
3. Block-Chain
4. Bio- technologies
5. Networking

VIII. OUTCOMES

1. Cost effective medical facility in the extreme corridors.
2. Managing and analysing the data for tracing the root cause for better treatment.
3. Suspect tracking based upon symptoms and record matching by AI.

IX. PROPOSED SYSTEM

A health monitoring system consists of several sensors connected to a patient and that they communicate the info through the processing unit. In the project Raspberry Pi is used. Raspberry pi is device which is connected with sensors, sensors are connected with human bodies, and this raspberry pi3 is connected with software systems by using wireless connection. When all elements are connected together, sensor senses data from human body, then sends that data to server. after that these data is compares with standards values that are already stored in system. In this supervisor is there to regulate system, it can control new patient's entries and doctor's entries, when it'll get data from sensors and stores in database is displayed in separate UI page which periodically loaded and fetches data from database. A doctor or patient can access the data whenever required from the database. Useful for people in rural areas and no need of keeping records in paper. In this system, we should always need to connect system and hardware device and server centrally.in this we required two servers, one for system deployment and another for database which stores data.

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Raspberry PI 3:

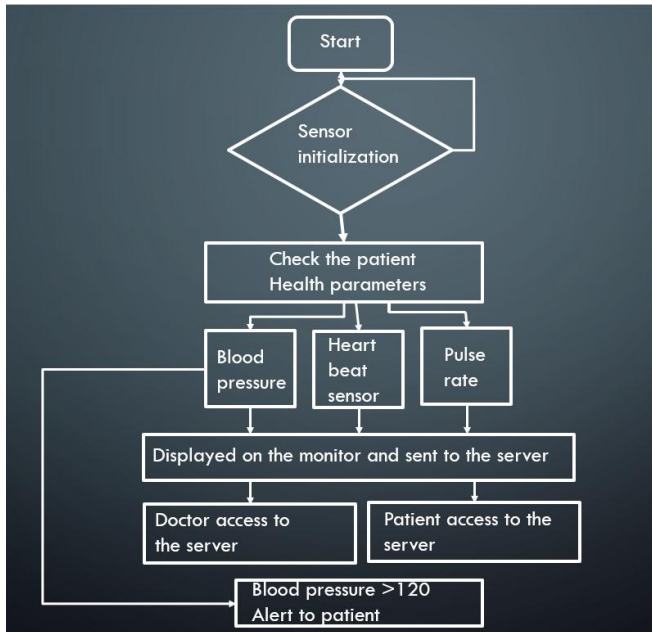
Raspberry Pi 3 is that the third generation of Raspberry Pi and it packs quite formidable clock in its credit card-sized package. Most notably, additionally to the quality features of the Raspberry Pi (such as four USB 2.0 ports and built-in Ethernet), it has:

- A 1.2GHz 64-bit quad-core ARMv8 CPU
- 802.11n Wireless LAN
- Bluetooth 4.1 Low Energy (BLE)

The powerful CPU including Wireless LAN and Bluetooth 4.1 radio makes it a perfect candidate for IoT projects, because multiple sensors are often connected thereto simultaneously. In addition, the Raspberry Pi has a 40-pin GPIO (General Purpose I/O) connector for interfacing with external sensors.

The Raspberry Pi Zero is the smallest Raspberry Pi ever made, and although it doesn't have a processor that's as powerful as the Pi 3, its small size is especially suited for embedded projects (such as wearables, etc.), where space may be a premium.

X. FLOW CHART



XI. CONCLUSION

What we conclude from this paper is : IOT can proved to be a great help for health monitoring in remote. The compact sensors with IoT will make an enormous impact on every patient's life, that albeit they're far away from home and physician, this helps them to scale back the fear of danger. The sensory data are often acquired in home or work environments. Also, the challenges in sensing, analytics and prediction of the disease also are highlighted and people are often addressed to supply a seamless integration into the medical field

The outcome of project shows us that the hardware works successfully and gives result in real time and ready to use from anywhere, message alert goes to registered number. Hence, number of critical cases can be reduced and more no. of people can be saved.

XII. MAJOR KEY ISSUES AND CHALLENGES OF IOT

The involvement of IoT based systems altogether aspects of human lives and various technologies involved in data transfer between embedded devices made it complex and gave rise to many issues and challenges. These issues also are a challenge for the IoT developers within the advanced smart tech society. As technology is growing, challenges and wish for advanced IoT system is additionally growing. Therefore, IoT developers got to consider new issues arising and will provide solutions for them.

1. Security and Privacy issue

One of the foremost important and challenging issues within the IoT is that the security and privacy thanks to several threats, cyber-attacks, risks and vulnerabilities. the problems that produce to device level privacy are insufficient authorization and authentication, insecure software, firmware, web interface and poor transport layer encryption. Security and privacy issues are vital parameters to develop confidence in IoT Systems with reference to various aspects. Security mechanisms must be embedded at every layer of IoT architecture to stop security threats and attacks.

On the other hand privacy is the biggest concern, an user should be able to use the IOT without feeling insecure and dubious. Therefore, it's required to take care of the authorization and authentication over a secure network to determine the communication between trusted parties.

2. Interoperability/standard issues

Interoperability is that the feasibility to exchange the knowledge among different IoT devices and systems. This exchange of data doesn't believe the deployed software and hardware. The interoperability issue arises thanks to the heterogeneous nature of various technology and solutions used for IoT development. There are four levels in interoperability:

1. Technical,
2. Semantic,
3. Syntactic,
4. Organizational

Various functionalities are being provided by IoT systems to enhance the interoperability that ensures communication between different objects during a heterogeneous environment.

3. Ethics, law and regulatory rights

Other issues arise here are ethics, law and regularity rights, here are certain rules and regulations to take care of the quality, moral values and to stop the people from violating them. Ethics and law are very similar term with the sole difference is that ethics are standards that folks believes and laws are certain restrictions decided by the govt . However, both ethics and laws are designed to take care of the quality , quality and stop people from illegal use. With the event of IoT, several real-life problems are solved but it's also given rise to critical ethical and legal challenges.

4. Scalability, availability and reliability

A system is scalable if it's possible to feature new services, equipment and devices without degrading its performance, the most common issue in IOT is to support and connect an outsized number of devices having different memory, processor, storage power and bandwidth. Another important issue that has got to be taken into consideration is that the availability. Scalability and availability both should be

deployed together within the layered framework of IoT. an excellent example of scalability is cloud based IoT systems which give sufficient support to scale the IoT network by adding up new devices, storage and processing power as needed.

5. Quality of Service (QoS)

Quality of Service (QoS) is an important factor in IoT. QoS are often defined as a measure to gauge the standard, efficiency and performance of IoT devices, systems and architecture. Some important and required QoS metrics in IoT applications are reliability, cost, energy consumption, security, availability and repair time. A smarter IoT ecosystem must fulfil the requirements of QoS standards. Also, to make sure the reliability of any IoT service and device, its QoS metrics must be defined first. Further, users may also be able to specify their needs and requirements accordingly.

REFERENCES

- [1] Sullivan, H.T., Sahasrabudhe, S.: Envisioning inclusive futures: technology-based assistive sensory and action substitution. *Futur. J.* 87, 140–148 (2017)
- [2] Yin, Y., Zeng, Y., Chen, X., Fan, Y.: The Internet of Things in healthcare: an overview. *J. Ind. Inf. Integr.* 1, 3–13 (2016)
- [3] Himadri Nath Saha, Supratim Auddy, Subrata Pal: IEEE Journal: Health Monitoring using Internet of Things (IoT)
- [4] Kolic, V., Spaho, E., Matsuo, K., Caballe, S., Barolli, L., Xhafa, F.: Implementation of a medical support system considering P2P and IoT technologies. pp. 101–106 (2014): Eighth International Conference on Complex, Intelligent, Software Intensive Systems, Birmingham.
- [5] Mohan, A.: Cyber security for personal medical devices Internet of Things. pp. 372–374 (2014): IEEE International Conference on Distributed Computing in Sensor Systems, Marina Del Rey, CA.
- [6] Por ambage, P., Bracken, A., Gurtov, A., Ylianttila, M., Spinsante, S.: Secure end-to-end communication for constrained devices in IoT-enabled ambient assisted living systems. pp. 711–714 (2015): IEEE 2nd World Forum on Internet of Things, Milan,
- [7] Labuan, K., Trent, M., Root, B., Abdel Gawad, A., Yelamarthi, K.: A wearable portable electronic travel aid for the blind. (2016) In: IEEE International Conference on Electrical, Electronics, and Optimization
- [8] (2014) [18] C. T. Chou, R. Rana, and W. Hu, “Energy efficient information collection in wireless sensor networks using adaptive compressive sensing,” in IEEE 34th Confront Local Computer Networks, LCN 2009., Oct 2009, pp. 443–450
- [9] N. Bui and M. Zori, “Health care applications: A solution based on the internet of things,” in Proc. of the 4th Int. Symposium on Applied Sciences in Biomed. and Com. Tech., ser. ISABEL '11. New York, NY, USA: ACM, 2011, pp. 131:1–131:5
- [10] C. Bishop, *Pattern recognition and machine learning*. New York, NY: Springer, 2006.
- [11] M. Li, S. Yu, Y. Zheng, K. Ren, and W. Lou, “Scalable and secure sharing of personal health records in cloud computing using attribute-based encryption,” *IEEE Trans. Parallel Distribute. Syst.*, vol. 24, no. 1, pp. 131–143, Jan. 2013.