

Using IoT to Transform Healthcare Analytics

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ABSTRACT

It can be seen that wireless communication devices and systems could have a major impact on the healthcare sector. The IoT based Healthcare system offers many advantages to the patients. They can be monitored continuously anywhere and anytime by the doctors, nurses as well as caregivers. This project surveys the advancements in IoT based health care technologies and develops a new approach towards personalized health care. It also leverages the use of wearables towards maintaining and living a healthy life. It also tries to automatise the diagnosis of health concerns.

Wireless system reduces the overhead associated with the system installation as well as the space required. It offers mobility and is also handy and easy to work with. It is also extensible. This project aims to create a Healthcare system that could be monitored and controlled continuously via the internet by many stakeholders. It would enable the doctors to get the patient history immediately. It would reduce the time required for diagnosis. Overall, it would Transform the Healthcare Analytics by Applying IoT.

Keyword: - Personalized Healthcare, Analytics, IoT, Remote Health Monitoring, Patient Monitoring, Sensor

1. INTRODUCTION

There are so many challenges in the healthcare sector. We have a constantly growing number of Chronic Disease Patients such as Asthma, Diabetes, and Cardiovascular etc. The financial burden on National Healthcare Systems is increasing day by day. Providing effective and reasonable healthcare is becoming next to impossible.

Nowadays, people want personalized & timely healthcare. They expect continuous monitoring of their health parameters. All this should be done in a cost effective way. There arises a need for an automatic health system that would make the task of collecting and measuring the vital parameters, processing and diagnosing as well as sending emergency alerts and necessary corrective actions automatic.

Patient monitoring using wireless sensor network has a greater potential in the future in order to achieve the best performance health care services and also to avoid from cost pressure in the hospital. It gives a new way to deliver health care services when the distance between the doctor and patient is significantly away. Rural area will get the benefit from this application. Patient monitoring is one of the telemedicine, which always needs improvement to make it better.

This paper surveys the advancements in IoT based health care technologies and develops a new approach towards personalized health care.

There is a dire need of the proposed healthcare system that would be reasonable, cost effective and flexible. At present, the IoT based healthcare is not in wider use. But in nearby future, a massive adoption of IoT based healthcare solutions could be seen.

2. LITERATURE REVIEW

David Metcalf et.al. has done some in making IoT based health care solutions better, faster and cheaper. [1] Phillip A. Laplante et.al. has reviewed some of the most promising applications for IoT in healthcare and the significant challenges ahead. [2]

V. Chan et.al. has proposed an agent based approach in mobile eHealth monitoring. [3] S.M.RiazulIslam et.al. surveys advances in IoT based healthcare technologies and reviews the state-of-the-network architecture, platforms, applications and industrial trends in IoT based healthcare solutions. They have also analyzed distinct IoT security & privacy features. [4]

Tejas P. Adhau and Dr. Mahendra A. Pund have viewed the privacy issues with respect to data mining in Big Data from a wider perspective and investigated different approaches to safeguard sensitive information. [5]

Syed Tanzeem, Dr. M.A.Pund and Surayya Syed have done some work in image retrieval and indexing based on Image Filtering & Similarity fusion using SVM classification & relevance feedback for biomedical images.[6]

Nusrat Jahan Farin et.al. proposed a web based human heart rate monitoring system. It is implemented as an embedded system with arduino and ear clip heart rate sensor. On the server side, the system ran the apache web server, PHP and mySql. They have demonstrated the performance of the proposed system. They have determined the idle heart rate for the monitoring body and make an alert in the abnormal situation. [7]

Wullianallur Raghupathi and Viju Raghupati discussed the use of Big Data in healthcare analytics. They have also highlighted several challenges that must be addressed such as fragmented rarely standardized data. [8]

Nidhi Mutha et.al. introduced a system consisting of a wearable device that will monitor the patient health. The device will send its data to the server through the android application of the nurse, wherein all the processing will take place. This data will be available to the doctor through his android application. [9]

Sherlin Sebastian et.al. proposed an image based technique to acquire and analyze a constant streaming of ECG signal through digital camera for image capturing, information extraction and analysis performed using MATLAB tools as well as data sending system based on internet. [10]

Shivayogi Hiremath et.al. discussed the building blocks of wearable IoT(WIoT)-including wearable sensors, internet connected gateways and cloud and Big Data support. They have also presented a new system for WIoT that suggests future directions encompassing operational and clinical aspects. [11]. Mohammed Fezari et.al. implemented algorithms to analyze heart rate signals in real time, how to fusion data of different sensors mainly temperature & blood pressure and to transmit the data via radio frequency (Xbee Module). [12]

3. PROPOSED SYSTEM

The proposed system develops a new kind of approach towards individualized health care by making use of IoT. It also explores the use of IoT wearables in living and maintaining a healthy life. It also tries to make the diagnosis of health related issues automatic by making use of various sensors, mobile and cloud. It would consist of an electronic wearable device that could be worn on a finger/earlobe or chest. It would continuously measure the pulse rate and other physiological parameters. The data would be sent to the cloud via a mobile base station. The following figures 1 and 2 shows simple block diagram of the proposed system.

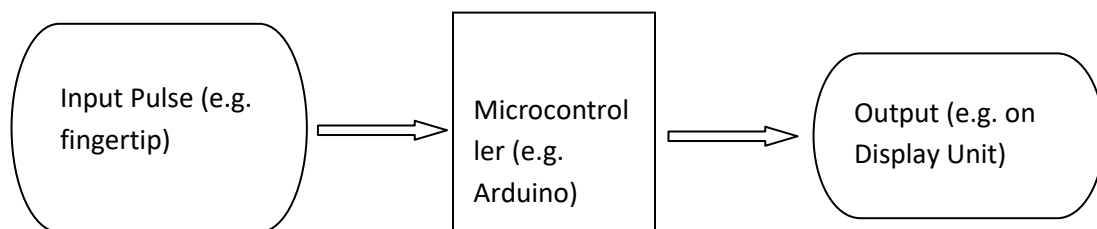


Fig -1: Simple Block Diagram (Module 1)

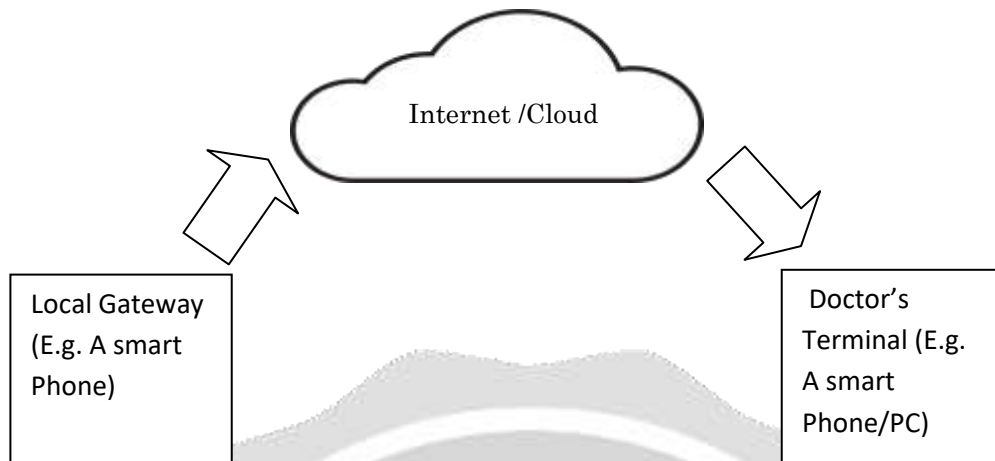


Fig -2: Simple Block Diagram (Module 2)

3.1 Architecture

The proposed system would have biosensors connected to the mobile base station which then would be connected to the central storage/cloud.

From cloud, the Clinician/Doctor would be able to observe the collected vital parameters and the associated measurements. The Doctor could then suggest the appropriate medication to the patient or ask him to take the corrective steps.

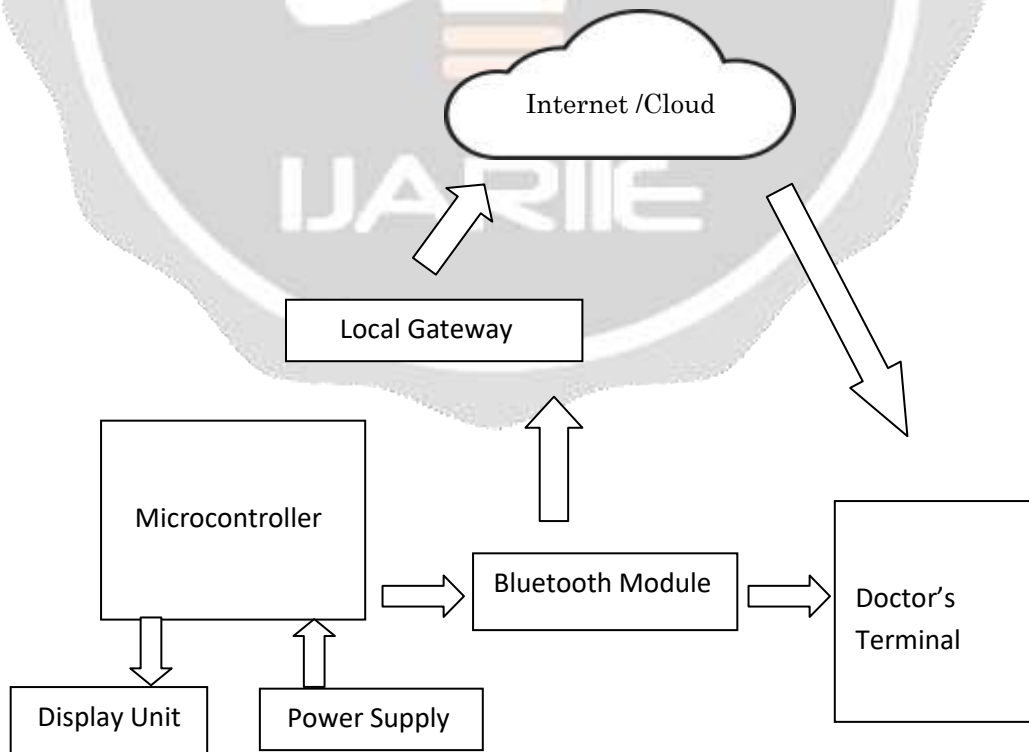


Fig -3: System Architecture

3.2 System Components

The various components that are required for the proposed system are:

- Input Devices
- Processing Unit
- Local Data Storage
- Transmission
- Central Data Storage
- Application Software etc.

Input Devices: These consist of various sensors and wearable devices. The other input devices may be smart phones, computers etc. These are used for capturing or entering data. They may also be used as a local data storage.

Processing Unit: It is a device/unit that collects and processes the data gathered from the input devices. The processing unit will send the data to local storage or will send it to the cloud for further processing, analysis and storage. It consists of a microcontroller and other associated devices.

Local Data Storage: It is used to store the data locally. This data may be held by the patient or as per requirement may be submitted to a Central Data Storage. Telecommunications is required to transmit the data from the input device or the local data storage to the Central Data Storage.

Transmission: It includes different kinds of home hub devices/mobiles that capture the short-range signals and move them over a cellular network to the Cloud or Central Data Storage.

Central Data Storage: It includes Electronic Health Record, Patient Health Record or other registries, e-prescribing system, laboratory information system etc. depending on the kind and nature of the data that is being monitored.

Application Software: It helps the patients, care providers, or other persons analyze and interpret the data captured through the input devices. It may be an app on a smart phone that compares the captured data against the standard values and gives an alert to the provider or take the appropriate actions in case of abnormal situations.

4. CONCLUSION

As a conclusion, a prototype of patient monitoring system using wireless sensor network has been successfully developed. The pulse signal can be monitored through laptop or personal computer wirelessly. The patients' ECG signal can be monitored remotely anywhere and anytime.

This method automatically helps patients to get more attention if they faced a complexion regarding their health. Thus, the health performance of patients will improve better by using patient monitoring wireless sensor network. Finally, the current status of patient can be uploaded in the internet and doctors, nurses or caregivers can monitored patients easily even though they stayed a far from them.

So, this project have a good improvement here by adding monitoring and controlling using internet compared than previous researches. A part from that, the device is designed to build as a low cost equipment.

In order to commercialize the device to the public usage, some improvements need to be considered. Therefore, for the future works, more vitals parameters should be added to make it more valuable to the patients.

5. ACKNOWLEDGEMENT

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6. REFERENCES

- [1] David Metcalf, Sharlin T.J. Milliard, Melinda Gomez, Michael Schwartz, "Wearables and the Internet of Things for Health: Wearable, Interconnected Devices Promise More Efficient and Comprehensive Health Care" IEEE Pulse (Volume: 7, Issue: 5, Sept.-Oct. 2016) P: 35-39.
- [2] Phillip A. Laplante, Nancy Laplante, "The Internet of Things in Healthcare: Potential Applications and Challenges", IEEE IT Professional (Volume: 18, Issue: 3, May-June 2016) P: 2-4.
- [3] V. Chan, P. Ray, N. Parameswaran, "Mobile e-Health monitoring: an agent-based approach" IET Communications (Volume: 2, Issue: 2) P: 223-230.
- [4] S.M.RiazulIslam, Daehan Kwak, M.D.Humaun Kabir, Mahmud Hossain, Kyung-sup kwak, "The Internet of Things for Health Care, A Comprehensive Survey", IEEE Access (Vol:3,P:678-708), 2015.
- [5] Tejas P. Adhau and Dr. Mahendra A. Pund, "Information Security and Data Mining in Big Data", International Journal of Scientific Research in Science, Engineering and Technology, (IJSRSET) Volume: 03, Issue: 02, 2017.
- [6] Syed Tanzeem, Dr. M.A.Pund and Surayya Syed, "Image Retrieval based on Image Filtering & Similarity fusion using Classification & Relevance Feedback", International Journal of Advanced Research in Computer Science and Software Engineering, ISSN: 2277 128X, Volume-5, Issue-5, 2015
- [7] Nusrat Jahan Farin, S.M.A.Sharif, Iftekharul Mobin, "An Intelligent Sensor Based System for Real Time Heart Rate Monitoring [HRM]", Scientific Research Publishing, 2016.
- [8] Wullianallur Raghupathi and Viju Raghupati, "Big Data Analytics in healthcare: promise and potential", Health Information Science and System, 2014.
- [9] Nidhi Mutha, Ekta Meel, Ruchira Rokade, Prof.Ganesh Deshmukh, "Patient Health Monitoring Using Android Application", IJRCCE, 2016.
- [10] Sherin Sebastian, Neethu Rachel Jacob, Yedu V.R., M.J.Jayashree, "Remote Patient Monitoring System", IJDPS, 2012.
- [11] Shivayogi Hiremath, Geng Yang, Kunal Mankodiya, "Wearable Internet of Things", MOBIHEALTH, 2014.
- [12] Mohammed Fezari, Rachad Rasras, Ibrahiem M.M., El Emary, "Ambulatory Health Monitoring System Using Wireless Sensors Node", ICCMIT, ScienceDirect, ELSEVIER, 2015.