

A SMART SYSTEM CONNECTING E-HEALTH SENSORS AND CLOUD

K. Priya¹, S. Ranjana², R. Manimegala³

^{1,2,3}Assistant Professor, Faculties of Humanities Science, Meenakshi Academy of Higher Education Research Chennai, TamilNadu, India

E-mail: priyak@maherfhs.ac.in¹, ranjanas@maherfhs.ac.in², manimegalar@maherfhs.ac.in³

Abstract:

This paper discusses the concept as well as application of an adaptive networked e-health program. In particular after an incident or an disaster, the program is targeted at avoiding manual data entry and improving the capacity to have beds in hospitals, especially at mass occasions where a huge amount of people gather in one location. The device design is focused on medical devices that utilize wireless network sensor (WSNs) to calculate patients' physical parameters. Such sensors move information from the patient's devices to the cloud setting through the wireless network. The e-health smart network provides medical personnel with real-time data processing, reduces manual data collection and allows the tracking of vast quantities of patients, thus, doctors should be willing to access better quality care.

Keywords: Data mining; cloud computing; Raspberry Pi; Amazon Elastic Compute; Wireless Sensor Networks; Amazon Web Service;

1 Introduction:

WSNs rendered it easy to establish specific sensing facets. WSNs are used in different systems including military applications, temperature monitoring applications, applications in submarine networks and systemic environmental monitoring applications. WSN is faced with several problems, such as insufficient processing capacity, memory and storage functionality. Cloud computing should then be an effective way to increase the performance of sensors. Cloud storage is a general term of every Web networking service. Numerous computer tools such as networks, devices, software and utilities provide on-demand, open links to cloud computing. In comparison, cloud infrastructure utilizes new and scalable approaches for delivering, handling, and charging minimum achievable expense and commitment for information technology resources.

The benefits of cloud technologies are the simplicity, highly efficient, low expense, quick distribution of applications and a tremendous storage space. The capabilities of the Cloud enable clients to build, check and deploy their software on virtual servers with various operating systems and specific infrastructures. Cloud service companies provide three specific forms of offerings, Software as a Service (SaaS), Framework as a Service, and Infrastructure as a Service (IaaS) to create greater versatility for their users. SaaS provides direct access to and act as a Web-based infrastructure for software applications.

(PaaS) delivers database frameworks and operating systems, guarantees that the implementation costs are minimized and provides customers with multiple cloud services without adding frames or apps. (IaaS) offers a pool of cloud computing services, which includes equipment, software, network elements and a wide storage area.

There are five separate types of cloud machines operating social, public, group and hybrid cloud, according to the National Institute of Standards and Technology. Cloud Measurement also includes limitless storing of records. Therefore, cloud applications will not have to bother themselves with the file size of the organizations and the customers. Amazon's Web Service, one of the world-renowned software vendors, provides a variety of computing offerings such as the Amazon Elastic Compute Software (EC2). Amazon EC2 is a cloud service intended to promote web application applications and scalable cloud storage capabilities. In this article, we should concentrate on the notion that Wi-Fi and Cloud Storage will be combined. Following the acquisition and dissemination of cloud data through health sensors linked to the bodies of patients, resources provided in this system are responsible for collecting and preserving, analyzing and disseminating these results.

We believe that this approach proposals an suitable scenario for delivering a robust telemedicine program that automates the processes from information collection to reliable treatment decision centered on patients' present and historical medical records. The offerings of this paper are:

- A framework for incorporating WSN as well as cloud computing.
- A prototype employment using e-health sensors as well as the Raspberry Pi.
- Applying data analysis to make a conclusion on the basis of patient status and historical evidence.

The remainder of the paper is structured to this purpose. Section III describes the research relevant to the inspiration of the method. Section V defines a question regarding privacy and protection in Section IV. The alternative remedy is accepted. In the final segment, we addressed potential jobs.

2 Related work:

This paper describes an e-health networked program planning and applying it. In particular in accident and emergency cases, the program aims at preventing delays in patient medical information's delivery to [1] healthcare professionals, at stopping manual data entry and at improving the ability for the hospital's beds, particularly in public activities where a large number of individuals gather in one location. The aim of this paper is to examine current data processing components and methods for the safely incorporation of cloud M2 M systems utilizing remote tele-medical tools, and to suggest a converged e-health [2] architecture focused on a search-oriented framework called Exalead Cloud View. Finally, we are reviewing the key conclusions and possible plans of the planned implementation.

In Healthcare IoT applications, we plan to leverage the idea of Fog Computing by establishing a geo-distributed intermediate information layer between the sensor

nodes as well as the cloud. Our Fog-based device design can face several challenges across all forms of healthcare systems, such as versatility, energy consumption, scalability and durability, by taking over responsibility for managing certain activities of the sensor network and a remote healthcare facility. A effective deployment of Smart e-Health Gateways makes the usage of universal patient tracking services in healthcare settings in a significant way. We provide a structure within this document for the processing of patient details in real time, effective, unintrusive surveillance and, where required and relevant, medically-or lifestyle commitments. With the Service focused architecture (SOA) and cloud-based framework [4], diverse systems, software, and resources may be combined in a consistent manner. It incorporates mobile technologies for the seamless processing and transmission of vital data through wearable biosensors, thus taking account, in addition to occasional network disconnections, of the restricted bandwidth and power depletion of mobile devices.

A wearable sensors-based experimental model for the surveillance of patients 'safety is defined. This device is based on a wearable sensor network, linking the data collected from[5] sensors to a cloud server. The sensors calculate different parameters such as body temperature and air humidity that are transmitted by a microprocessor via a cloud storage network gateway. In this method, a set of modules may be built to enable treatment by tele-monitoring patients. It also allows it possible for doctors to constantly monitor incidents investigated by volunteers and carers. To track the safety and environments of the patient, a combination of medical and environmental sensors[6] is used. Such sensor data is transmitted to the server in near proximity through an intelligent computer or a base station. The doctors and nurses track the patient in real time through the details provided from the application.

The framework will open web-based applications to users 'data collection and collected, management and billing, as well as healthcare resources from various third parties through a centralized cloud network. They present the illustration of a "home[7] framework" cloud-based database server that gathers information from a heterogeneous collection von Geräten, provides a high level overview of the proposed overall architecture model, market-driven possibilities and how it can be used by developers and service providers of health-care applications, including. This paper describes an experimental model built to track and control patients 'health status on the basis of sensors. The architecture relies on a cloud network that collects data from sensors. E-health sensor security. The sensors[8,12] calculate specific parameters, such as a glucometer, an airflow and a patient location, which can be forwarded on a cloud storage server through a microcontroller.

RF Identification (RFID) technology has now become mature, providing part of the IoT physical layer in smart environments with low cost, energy-specific and[9] units of disposable sensors for the personal healthcare system. A research on the state- - RFID is proposed for use in body- applications and for gathering details on the user's

living atmosphere (temperature, humidity and other gasses). This paper proposes an IoT and cloud storage methodology that increases clinical tracking by avoiding delays in the delivery of health information to hospitals by patients. It can be useful in case of injuries or incidents, because data can not be submitted manually [10] and is rendered accessible directly through the cloud service program (Dropbox) from e-health devices to emergency staff.

2 Proposed method:

In order to build a smart health system, the architecture of the solution provided is focused on integration between medical sensors which collect patients' physical parameters and the cloud setting.

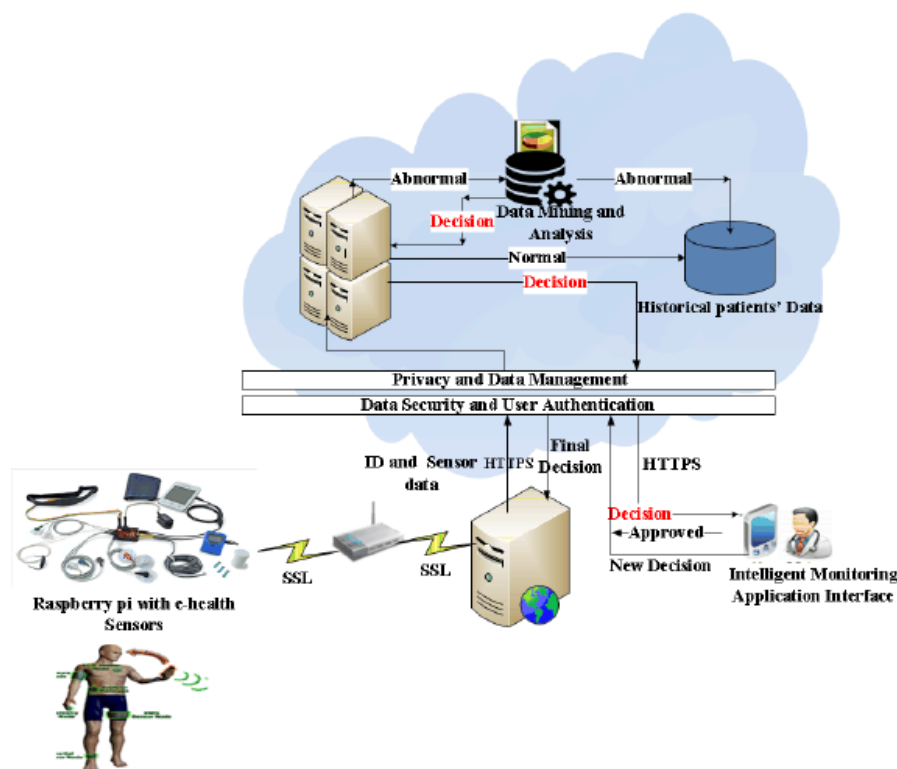


Figure 1. System Architecture

The wireless sensors of safety are connected to a Raspberry Pi, as seen in Figure 1. The Raspberry Pi gathers data from sensors and transmits this data to cloud-hosted network resources through wireless communication channels. There are various resources on this platform: (1) the collection of sensor-related data; (2) the data mining service that supports professional decision-making focused on past patient care details; and (3) the monitoring service to monitor, review and check patient information used by medical personnel. The program from various smartphone and stationary Internet related systems may be utilized by medical personnel and patients. The main considerations in the cloud world are stability and privacy. The cloud infrastructure system offers several pooled infrastructure services. Therefore, intruder and/or outsider attacks threaten sharing of hardware and cloud storage data fields. To protect and safeguard data in our framework. We use two methods, i.e.

1) Socket Secure Layer (SSL), a common approach for creating a connection to a Raspberry Pi web server to transfer patient data via protected channels to the cloud device. The AES algorithm would be the data processed in the cloud in encrypted format.

A. Data Collection

Health sensors attached to the raspberry pi are used to calculate physical parameters of patients. The raspberry pi captures and passes information from the sensors to the cloud atmosphere by means of the SSL. The sensors continuously pass real-time data to the cloud server on the basis of the latency defined in the configuration system.

B. Decision Making

In order to construct our algorithm, we use data mining methods. Three parameters, which are patient name, sensor form and current sensor details, are responsible for making correct medical determinations. The algorithm should verify whether the application receives the sensor data, based on the standard ranges of laboratory test medical as well as patient safety policies specified within the program, if the sensor data is usual or abnormal. Standard laboratory health assessments typically identify improvements in measures or values of safe individuals across a variety of fields relevant to safety. The number of references is usually calculated by taking either the lowermost or the uppermost results (index) from the general population.

C. Decision Approver

After the program makes the measures, the professional staff responsible for the treatment of the individual should be submitted for approval. Health workers may be informed individually, through SMS and e-mail. You may use a web browser on any platform to test as well as change decisions when appropriate. When evaluating the background records of patients, health care workers may determine whether or not the latest judgment taken by the program relates to the situation of the individual. The program should inform the patient of the directions required for coping with the case or illness until medical professionals accept decisions.

There are some benefits for the proposed system, including:

- 1) Providing real-time statistics gathering.
- 2) Elimination of the cycle of manual collection of data which includes errors in data entry.
- 3) Enables the monitoring of large numbers of patients that rely on a limited number of medical staff.
- 4) Making sure the bedtime is just for people who require it in hospitals.

PROTOTYPE

We also used consumer wireless safety sensors that attach to the eHealth Sensor Shield[10] to calculate patient physical parameters. It enables Raspberry Pi production to conduct biometric and medical applications. In our implementation, we have used two instruments, the pulse and oxygen in the blood sensor (SPO2), the body temperature and a screen display or TV. It contains two USB ports, an HDMI cable, and an Ethernet port, a slot for SD card and an audio / video channel, and memory. In order to read and transmit data to the cloud from the sensors, we used C++ to execute the code (on a raspberry pi). In order to

link the Pi to the cloud server, we have used TCP sockets. C # was installed in the server software. Amazon Web Services (AWS) were selected in the cloud. An internet manufacturer known as Amazon Elastic Compute Cloud (AC2), AWS is one of the commonly deployed computing services. Amazon EC2 is a web service designed to promote production online computing and provide scalable cloud storage power. We installed the 2008 Windows Server as an operating system for the EC2 case. We used a C # language and a Microsoft SQL database on which we designed the framework to construct a stable, knowledgeable network that collects, handles and processes patient information.

3 Result and discussion:

We checked our system using a monitor, pulse and oxygen so the costs of the procedure were minimized. As a research study, we've used seven hypothetical people, all of them have the same body temperature of about 37 Celsius. Thus, we've been focusing on incorporating some training details to our target to allow the machine to take decisions based on increasing body temperature. Table 1 reveals that, from 12 April 2020 to 18 April 2020, one patient has had body temperature reported at various periods. When seen in Figure 3, medical staff can also conveniently track the patient throughout the day. The care staff can may be willing to rely about the status of the patient whether the individual experiences an emergency.

Sensor Id	Patient Id	Insert date	Sensor Data
TEMP	1001	April 12, 2020	38.5
TEMP	1001	April 13, 2020	39
TEMP	1001	April 14, 2020	37
TEMP	1001	April 15, 2020	37.5
TEMP	1001	April 16, 2020	39
TEMP	1001	April 17, 2020	37
TEMP	1001	April 18, 2020	40

Table 1. Body Temperature for one patient

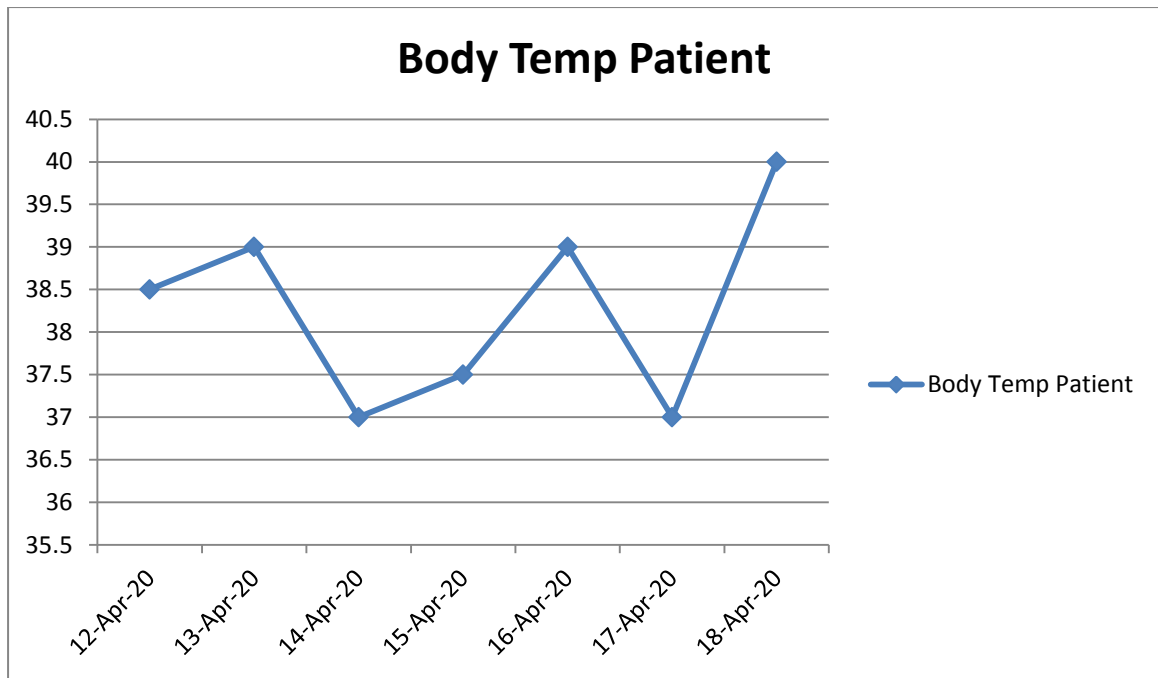


Figure 2. Body Temperature for one patient

Patient Id	Name	Insert date	Sensor data
1001	A1	1:06:00 PM	38
1002	A2	1:05:00 PM	37.5
1003	A3	1:07:00 PM	39.5
1004	A4	12:06:00 PM	38.5
1005	A5	12:03:00 PM	40
1006	A6	12:09:00 PM	39
1007	A7	12:012:00 PM	37

Table 2. Body temp for seven patient

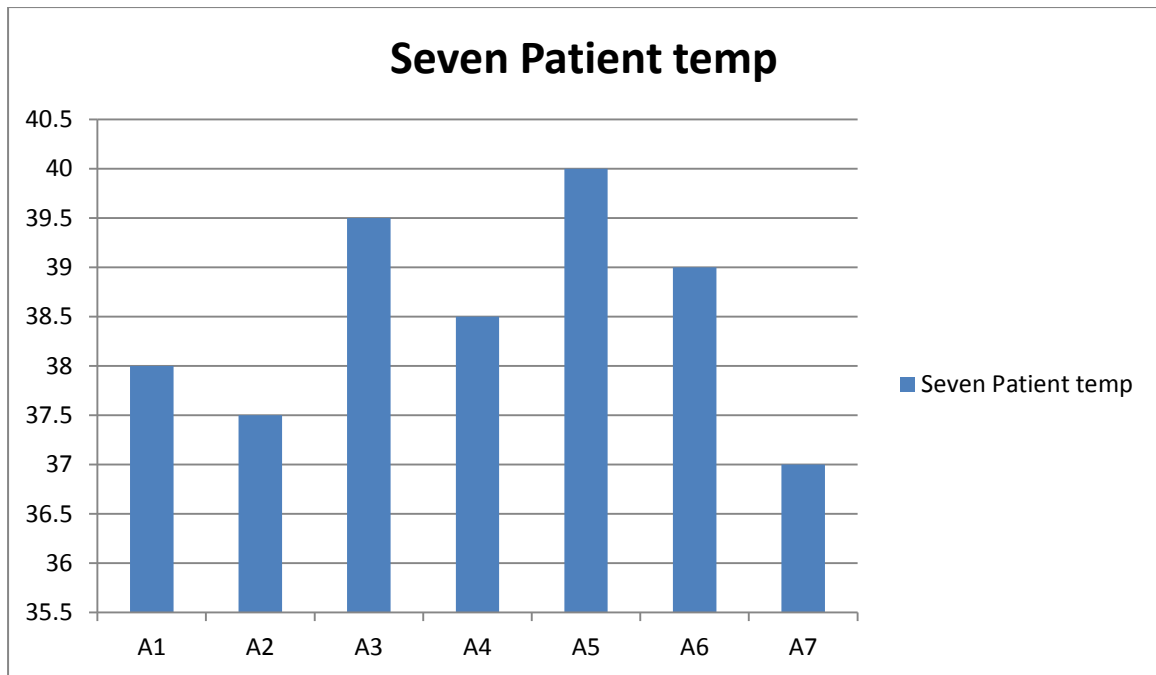


Figure 3.body temp for seven patient

We obtained data on body temperatures from seven patients as seen in Table 2. The goal is to equate the effectiveness of body temperature monitors with the conventional method of calculating the temperature of the body manually. In contrast to the conventional approach, we found that everybody requires a minute to interpret the body temperature. We have often used the waiting method as the temperature sensor we have worked with requires time to produce the appropriate body temperature and reach a high degree of body accuracy. We thus find that a wait of 30 seconds to obtain the body temperature allows to maintain a high degree of precision.

Patient id	Gender	Age	Decision Description	Sensor Id	Sensor Data
1008	F	27	You will quickly come to the clinic	TEMP	38.5
1009	M	31	Three times regular you should take Tylenol.	TEMP	37
1010	M	34	Enter your opinion. Please enter your opinion. History details was not valid	TEMP	38

Table 3 shows system decisions

The machine choices are displayed in Table 3. It tests whether or not this data is regular any time the device receives sensor data. This procedure is based on standard set of medical laboratory tests [9] and professional recommendations for the individual. When the data is incorrect, then this knowledge (patient name, sensor sort, and current sensor details) will be submitted to the data mining algorithm, so that a patient will make correct medical decisions as seen in Table 3. Such recommendations are referred to the healthcare professionals who are responsible for approving the patient's chart

.Conclusion:

The convergence of wireless and cloud sensor networks would create a revolutionary development in many ways, such as low-cost patient tracking, decreased utilization of hospital beds and increased efficiency of medical personnel. The usage of complex data processing methods also helps in the retrieval and interpretation of data from patients. The program proposed in this paper provides judgments focused on patient history evidence, data collection in real time and the elimination of manual information processing. For future research we expect to enhance the system's performance by incorporating new sensors and gathering data from a larger variety of patients.

Reference:

1. Altaf, F., Aditia, M., Saini, E., Rakshit, B. and Maity, S., 2019, March. Privacy Preserving Lightweight Searchable Encryption for Cloud Assisted e-Health System. In 2019 International Conference on Wireless Communications Signal Processing and Networking (WiSPNET) (pp. 310-314). IEEE.
2. Ghosh, S., Das, J., Ghosh, S.K. and Buyya, R., 2020, May. CLAWER: Context-aware Cloud-Fog based Workflow Management Framework for Health Emergency Services. In 2020 20th IEEE/ACM International Symposium on Cluster, Cloud and Internet Computing (CCGRID) (pp. 810-817). IEEE.
3. Okikiola, F.M., Mustapha, A.M., Akinsola, A.F. and Sokunbi, M.A., 2020, March. A New Framework for Detecting Insider Attacks in Cloud-Based E-Health Care System. In 2020 International Conference in Mathematics, Computer Engineering and Computer Science (ICMCECS) (pp. 1-6). IEEE.
4. Kanehanadevi, P., Selvapandian, D., Raja, L. and Dhanapal, R., 2020, October. Cloud-based Protection and Performance Improvement in the E-Health Management Framework. In 2020 Fourth International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud)(I-SMAC) (pp. 268-270). IEEE.
5. Sadok, D., Kelner, J. and Endo, P.T., Modeling the availability of an e-health system integrated with edge, fog and cloud infrastructures.
6. Pop, M. and Dragomir, G., 2019, November. Cloud Improvement of an Emergency Management System (SMURD+). In 2019 E-Health and Bioengineering Conference (EHB) (pp. 1-4). IEEE.
7. B., 2019, October. Leader Election and Blockchain Algorithm in Cloud Environment for E-Health. In 2019 2nd International Conference on new Trends in Computing Sciences (ICTCS) (pp. 1-6). IEEE.

- 8.** Elsayed, M.S. and Azer, M.A., 2018, April. Health Records Privacy Issues in Cloud Computing. In 2018 1st International Conference on Computer Applications & Information Security (ICCAIS) (pp. 1-6). IEEE.
- 9.** Mante, R.V. and Bajad, N.R., 2020, June. A Study of Searchable and Auditable Attribute Based Encryption in Cloud. In 2020 5th International Conference on Communication and Electronics Systems (ICCES) (pp. 1411-1415). IEEE.
- 10.** Aburukba, R., Sagahyoon, A., Aloul, F. and Thodika, N., 2018, September. Brokering Services for Integrating Health Cloud Platforms for Remote Patient Monitoring. In 2018 IEEE 20th International Conference on e-Health Networking, Applications and Services (Healthcom) (pp. 1-6). IEEE..