Testing the Task Scheduling in Healthcare with CloudSun Tool using Emergency Resource Allocation

A.Sundar, B.Sankaragomathi

Abstract*: In recent years cloud computing impact all fields such an IT, industries etc...Hence researchers, organizations focus the cloud computing implementation in different sectors. The number of cloud-based services has amplified hastily and shaped desired outcome in the past years. The cloud computing also impact health care side because of its availability, security, portability, efficiency, and convenient low cost, dissimilar health care services (pay-as-you-go). Health care is vital part in human life so peoples must provide high priority for that. The cloud computing take care the health care carefully and gives the medical assistance whenever the peoples need that. Patients can get quality of health care services such a medical assistance anywhere and anytime with help of PC and other portable devices. Efforts are being made to shrink these costs, improving hospital service and quality outcomes for patients without any inconvenience. The ultimate aim of this paper is to testing the task scheduling in healthcare with help of our CloudSun tool. The emergency resource allocation policy is first process the critical patient's medical data and send the alert SMS to hospital uses and patient's care takers.

Keywords: Healthcare, CloudSun cloud, cloud computing, cloud computing in healthcare.

I. INTRODUCTION

As cloud services develop into the core of opposition in many IT market segments. It is significantly important for "traditional" IT providers to get more "cloud DNA" into their organizations and to gather speed the development of their cloud services platforms and customer bases [9]. Current developments seek towards getting information and other data all time, anyplace. It can be completed when fetching and retrieving healthcare data to the cloud with low effort. The introduction of cloud computing business models has rapidly become a widely adopted paradigm for delivering services over the Internet. It is impacting several others apart from computer industry due to a number of technical reasons. The cloud services are best opportunity if any organization wants to deploy their applications in required infrastructure and platforms. The consumers pay the money for what they use and how much they use with help of pay-as-you-go model. The consumers can create different operating system and platforms for create, test, and install their valuable applications in virtual servers. So consumers and organizations do not have to allocate lot of money, no need to maintain the hardware and software. They also don't be trouble in security, firewall, database backup etc. So their valuable data is safeguarded and the businesses are not affected by those problems. Presently in the hospital side they need to save the patient's life without waste a second so that they move cloud technology to resolve the problem. Hence utilize the Cloud technology with emergency resource allocation policy to save the patient's life and test the patient's ECG data in CloudSun tool.Cloud computing impact all fields such an IT, industries etc...Hence researchers, organizations focus the cloud computing implementation in different sectors. The number of cloud-based services has amplified hastily and shaped desired outcome in the past years. The cloud computing also impact health care side because of its availability, security, portability, efficiency, and convenient low cost, dissimilar health care services (pay-as-you-go). Health care is vital part in human life so peoples must provide high priority for that. The cloud computing take care the health care carefully and gives the medical assistance whenever the peoples need that. Patients can get quality of health care services such a medical assistance anywhere and anytime with help of PC and other portable devices. Efforts are being made to shrink these costs, improving hospital service and quality outcomes for patients without any inconvenience. The ultimate aim of this paper is to testing the task scheduling in healthcare with help of our CloudSun tool. The emergency resource allocation policy is first process the critical patient's medical data and send the alert SMS to hospital uses and patient's care takers ease of use.

II. RELATED WORKS

In [1] if the patient in critical condition then they are tracked and an alarm alert is sent to the emergency services and the doctor. In [15] they used remote monitoring technique to monitoring the urine output and analysis the kidney functionality from the device stored data. In [2] they proposed iMAGE using cloud computing SaaS (software as a service) method. This system provide different image processing function and features. In the medical EMR data and images accessed by physicians and surgeons in many departments.

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In [3] presented a survey about healthcare monitoring with cloud computing. They describe the healthcare monitoring techniques and security problems. In [4] they presented a Framework for healthcare system with cloud computing. This system accessed by the patient and hospital users anyplace and anytime. This Framework improve the quality of patient's treatment. In [5] created a platform with cloud computing for healthcare community and is used to store the whole country medical data. In [6] they presented a Framework with software as a serve and data as a service based cloud computing for remote, rural and urban area critical health care problems. In [10] they proposed an architectural design for managing and sorting healthcare recorder by Meta Data concepts to optimize the storage and improve the efficiency. In [13] they are discussed several reasons to utilization of cloud technologies in healthcare industry , the cloud computing solutions can help the doctors to keep in touch with them patients and scrutinize their health status efficiently at a low cost. In [12] they a solution with cloud computing for healthcare information sharing by the GAE (Google App Engine).They integrated the GAE (Google App Engine) with simulation environment and testing the healthcare data. In [8] authors talk about mass data storage, high-speed computing capabilities and effectively with less cost by using the available cloud-based applications presented by the cloud service providers. In [11] they developed E-Health System for monitoring the BP level. The patient upload their BP data to E-Health System then the healthcare provider contact patient if BP level in abnormal. In [7] they presented an automated monitoring system with help of heart rate measurement, temperature and acceleration sensors to monitor and prevent the neonates from the hypothermia. This system send alert to healthcare person's mobile device when abnormal temperature arises.

III. WHY CLOUD SYSTEM VITAL FOR HEALTHCARE

Some hospitals in India still they are using manual or paper-based form in their operations because they think that IT investment is expensive. This kind of paper system slows the healthcare process and patients retesting their medical

results, so the patient needs to repay for their medical test like EGC etc. If the medical record not gets in time means that may be injury the patient health. Many Healthcare organizations purchase and established the high quality IT systems then they pass this establishment and maintenance cost to their patients. The healthcare records are highly sensitive. Hence companies spend millions in protecting them and improve the quality of healthcare services by using the great features of Cloud computing. Private and government agencies provide funds for healthcare development and its enrichment. This type of funds used to improve healthcare delivery outcomes. A cloud based healthcare system can provide new potential, such as easy and ever-present access to medical data. Shared healthcare data to offer superior excellence of amenity and decrease prices and doctor can access his patient's records even if they are miles away. This type of healthcare system use "pay-as-you-go". Hence the patients and healthcare organizations can use the medical services at low cost. Patient saves huge money because healthcare organizations don't need to spend massive money so they collect actual fee of patient.

In the table 1 compared own healthcare system and cloud healthcare system. Server in own healthcare system the user don't enhance its hardware such a ram, hard drives, processors etc. but affix all type of supplementary features to cloud based healthcare system. There is no need of any maintenance in cloud healthcare system but the user need to maintain in own healthcare system's server and its infrastructure such a UPS, external hard drives, cooling units etc. In own healthcare system must to designate manpower to monitor that but cloud healthcare system doesn't need that. Always be bothered about EB bill, rent, salary and other investments due to hardware failures in own healthcare system but not in cloud established healthcare system. So cost wise cloud based healthcare system is forever better that own healthcare system.

Table- I: Own Healthcare and Cloud Healthcare

Details	Own Healthcare	Cloud Healthcare
Server	89.856	pay-as-you-go
Backup Server	89.856	pay-as-you-go
UPS & Generator	75,000	pay-as-you-go
Cooling Unit	45,000	pay-as-you-go
Server OS	307,776	pay-as-you-go
Dot Net Application	164,416	pay-as-you-go
SQL Server	173,888	pay-as-you-go
System Admin Salary * per year	240,000	pay-as-you-go
Technician Salary * per year	120,000	pay-as-you-go
EB Bill * per year	18,000	pay-as-you-go
Maintenance * per year	9000	pay-as-you-go
Server Room Rent * per year	24,000	pay-as-you-go
Web Hosting * per year	10,000	pay-as-you-go
Total	13,66,792	pay-as-you-go

IV. PROBLEM IDENTIFIED

The electronic health monitoring and personal health records are the electronic types of patient health datum. These vital electronic versions of medical data can be communicated with the healthcare providers or medical user (patient, *doctor*, nurse) and this data stored in secure manner. The hospital emergency care monitors and give assistance to critical patient .They are assisted by an extremely multidisciplinary medical squad. This kind of hospitals located within highly populated city areas with high quality medical specialists. In the rural and the remote areas side they have fewer number of specialties such a bed spaces and may not have specialists, medicines and medical equipments. Hence the patients need to travel number of

miles or kilometres to city from rural and remote areas. So the patients should be alert before the critical condition. New approaches are required to avoid critical situation for rural and remote areas patients.

V. PROBLEM SOLVED WITH PROPOSED SYSTEM WITH HELP OF CLOUDSUN

Now days there are number of wearable devices available with low cost to monitor the patient health status. The wearable sensors are used to collect Heart Beat, Hear Rate, Blood Sugar Level, Body Temperature and Blood Pressure. Hence rural and remote areas patients must have wearable devices and monitor then give the alert to patients, patient's care takers and hospital users it the patients in abnormal heath condition.

The main purpose of this paper is to develop new emergency data access strategy and implement that in our CloudSun tool with real time electronic versions of medical data. The cloud established system to monitor and give alert to the patient's health status by using wearable body sensor and share this information to emergency care unit. Heart problem is the most common and danger disease in the world. We have taken the electrocardiogram (ECG) Hear Rate as the sample medical input data to solve the problem with help of CloudSun emergency resource allocation policy. The emergency resource allocation policy set first priority to the critical patient then allocate the VM to process the medical data and send the alert SMS to hospital uses and patient's care takers.

A. CloudSun

We developed CloudSun tool for task scheduling for our research work. The indigenous cloud tool used to analyze complex problems in the physical world. This tool decreases the cost of ownership and removes the IT support costs, luxurious hardware purchases and enhancement. The CloudSun no need to sustain the software license and no need pay the software upgrade costs and it is contain attractive GUI feature. It is used to set up repeatable simulations effortlessly and also provides various user friendly facilities that make CloudSun configurable and more flexible to use. CloudSun used to testing the large scaled Internet applications in a cloud environment. This CloudSun compared with CloudSim and it produced the same outputs of CloudSim.

B. ECG (electrocardiogram)

ECG biosensors are developed to measure the bio-potential that is produced by the electrical signals the heart utilizes to control the contraction and expansion of its chambers. These sensors give most accurate way of tracking heart activity. In this paper get the Heart Beat data for measure, monitor and give alert to the patient's hospital users and care takers.

C. Overall Functionality

The Figure.2 show the overall functionality flow chart of a Heart Beat monitoring and alert give system .It is contains the following phases:

1. A patient is wear wireless Heart Beat ECG sensor connected to his/her body and that is capable of sending the ECG data to the Internet.
2. The wireless Heart Beat ECG wearable sensor unit collects patient's ECG data and sends to cloud database.
3. If Heart Beat ECG once arrived then the CloudSun tool first process the most critical patient's data.
4. If heart Beat is abnormal then CloudSun Call Emergency service and SMS alert to patient and his/her relatives.

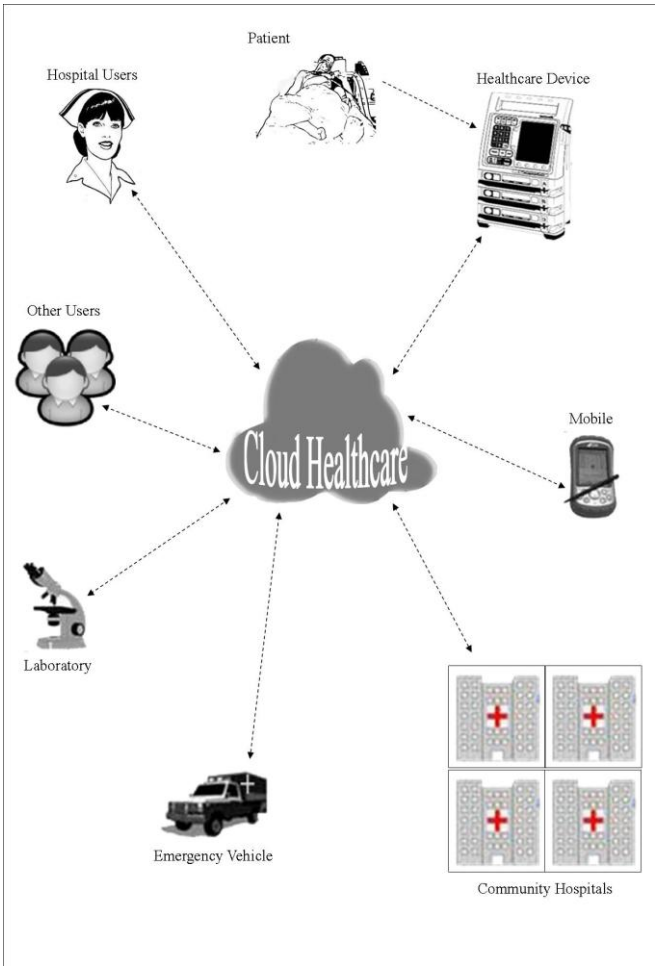

Fig. 1. Overall Functionality

Fig: 1 shows the overall functionality of our new approach. The cloud Healthcare connected with community hospitals, hospital users, laboratory, emergency vehicle and penitent's care taker. The patients connected with healthcare devices. If any emergency situation arise in patient's health then alert will be sent to hospital users, emergency vehicle and penitent's care taker.

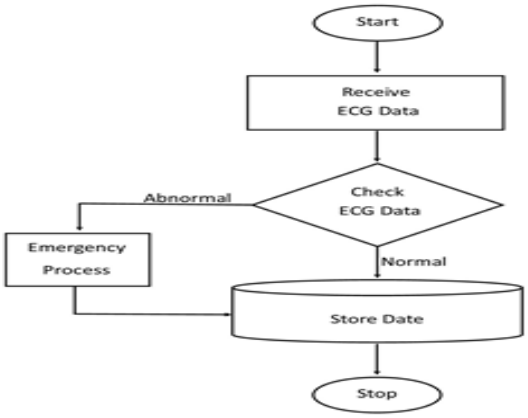

Fig. 2. Overall Functionality Flow Chart

D. Emergency Resource Allocation Policy (ERAP)

Healthcare sectors use mixture of IT applications and infrastructures. It is always need to be updated as a result of the speedy development in health care services. Why we go "Emergency Resource Allocation Policy" because fraction of a second save the patient's life.so we should give more importance to healthcare side by using cloud technology. Regular resource allocation policy not suite for healthcare unit. Hence we have to go for the new policy called ERAP (Emergency Resource Allocation Policy).This policy help to process the most critical patient's data then process the ordinary patient's data.

E. Implementation

As mentioned earlier, we used CloudSun simulation tool to build the result. Utilize the ECG parameters table [14] to determine whether patient's ECG data are normal or abnormal. Here use two VMs (D1_H4_VM1 ,D1_H2_VM1) and use 4 patients ECE data for simulation input. CIS: The cloud registry get the information of available resources such a data centre, VMs, patients, patient's priority and task details. In ERAP the Task Scheduler get information from cloud registry (CIS) then allocate the task to virtual machines. The Task Scheduler set high priority for most critical heart rate based patients. It is first process the high priority patient's data and send Emergency SMS alert to the hospital users and patient's care takers. If the patient in normal priority the Task Scheduler following regular task allocation technique. All processed patient's data store to database.

Pseudo Code:

1. Find critical_heart_rate
2. Find task_count
3. Find vm_count
4. Find ptft
5. If critical_heart_rate=true
6. set_priority=high
7. else
8. set_priority=normal
9. if vm_count = < ptft
10. Assign task i to index virtual machines
11. Remove task i from Queue
12. Update vmcount
13. else
14. Call RESCHEDULE minimum completion time
15. end if
16. return

Illustration:

The task_count calculate the total task and vm_count check the total availability of virtual machines and total. The ptft is the Predictable Task Finish Time and set_priority is set priority for most critical heart rate patients.

Result:

Table2 contain id, age and heart rate, gender of the patient and type is denote the patient's health condition.

Table- II: Patient's Heart Rate Parameters

PID	AGE	HEART_RATE	GENDER	TYPE
1	20	65	M	Normal
2	20	48	M	Normal
3	20	106	M	Critical
4	20	109	M	Critical

Table 3 input parameters such a patient's id task id, task length and size. The task length and size both are scanned images or digital data of the patient's record.

Table- III: Task Parameters

PID	TASK_ID	TASK_LENGTH	TASK_FILE_SIZE
3	3	1000	100
4	4	4000	100
1	1	1000	100
2	2	2000	100

Table4 produce the output from the corresponding input parameters (table2 and table3). Where D1_H2_VM1 is Data center1_Host2_Virtual Machine1 and D1_H4_VM1 is Data center1_Host4_Virtual Machine1.The start time is task start time and finish time is task finish time. The SMS alert sent to the hospital uses and patient's care takers. The patient id 3 and 4 are in critical heart rate condition (Table2). Hence that both patient's data processed first by using emergency resource allocation policy

Table- IV: Output

PID	TASK ID	VM_ID	START TIME	FINISH TIME	Alert
3	3	D1_H2_VM1	0	1	SMS Sent
4	4	D1_H4_VM1	0	2	SMS Sent
1	1	D1_H4_VM1	3	3.5	------
2	2	D1_H4_VM1	4.5	5.5	------

Fig: 3 overall functionality flow chart show the overall result from the bird eye view.

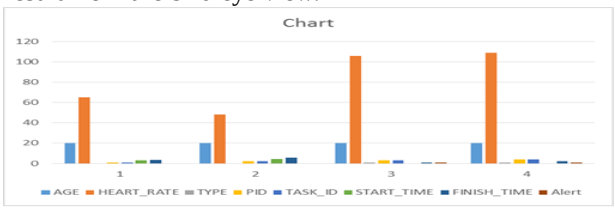

Fig. 3. Overall Functionality Flow Chart

Screenshots:

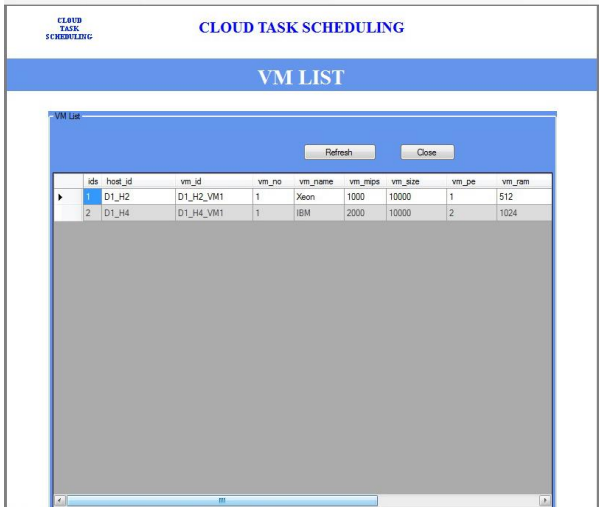

Fig. 4. VM List

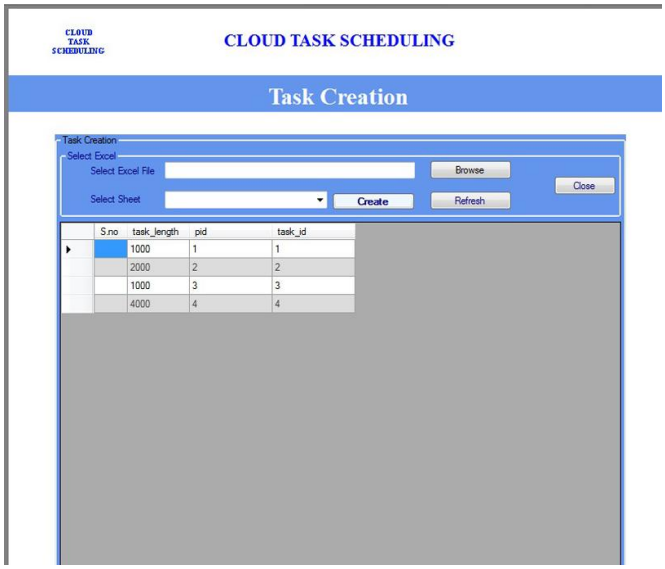

Fig. 5. Task List

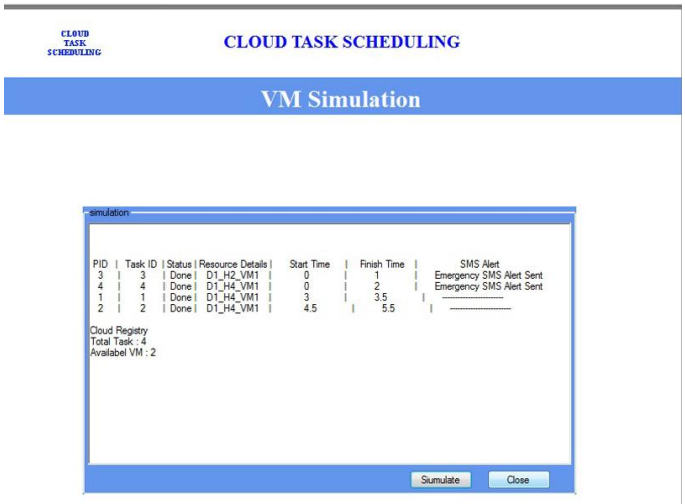

Fig. 6. Result

Figure4shows the created VM configuration details such a processor speed, ram size… etc. Figure5 shows the task list with patient's id and data.Figure6 shows the simulation result's output with VM, VM's Start and finish time, SMS alert and cloud registry details… etc.

VI. CONCLUSION

The Patient's ECG data successfully tested in the CloudSun tool. The combination of Cloud Technology and emergency resource allocation policy fulfil the requirements. From the medical history a single second save patient's life hence combine the Cloud Technology and emergency resource allocation policy to process the medical data and give the alert to hospital users and patient's care takes. This kind approach save the patient's life. The heart patients often get stress due to them heart problem. But this system provide the fear free life and confident to patients. This system absolutely save and increase the patient's life. In the feature this system implement in Hospital to save the patient's life.

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