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An Integrated Approach to Improve E-Healthcare System using Dynamic Cloud Computing Platform

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Abstract: **Cloud computing technology provides new opportunities for start-up,outsourcing individuals and corporations in health care outsourcing data and processing. The use of modern information technology can significantly improve the healthcare system. As ubiquitous computing for novel health-care systems, services, and applications became more closely linked to Cloud systems, the applications needed environments that were scalable, dependable, and secure, and containerized environments provided the right solutions.As the usage of,eHealth solutions advances new computer paradigms, such as cloud computing, have the potential to boost efficiency in storing medical health information while also lowering costs.In developing and underdeveloped nations, traditional analysis-based healthcare systems are still in use. Even though very few organisations use computer-based applications, doctors, and the government were unable to create a widespread network. A heterogeneous network can be built using the new technology of cloud computing to enhance the system. In this process,a cloud-based application with an integrated strategy and patients has been created to upgrade an antiquated healthcare system. Using this method, enormous numbers of Electronic Medical Records (EMR) will be saved every day.Furthermore, this way of developing an eHealth system ensures patient data privacy in the cloud.The platform presented here can be improve of a variety of cloud computing infrastructures that provide standardised, adaptive, and customised services for eHealth systems. The performance of this analysis is calculated on different aspects such as Accuracy, Precision, and Specificity. Though the outcomes for various methods are different,an integrated approach to improve eHealthcare System using dynamic Cloud Computing Platform will be the best results in this analysis.**

Keywords: **Dynamic Cloud Computing, e-health systems, Electronic Medical Record (EMR*).***

I. INTRODUCTION

Electronic health systems are advantageous to physicians, nurses, patients, insurers, pharmacies, medical supply companies, billing departments, and even law enforcement agencies. The information systems used in traditional healthcare are typically not connected to one another. Institutions like hospitals have their own servers, networks, and systems to meet their unique requirements. In such isolated platforms, user and organisational communication is challenging. Building data standards is required by these interactions as well as the technology trend, which enables transparent information sharing between various systems and agencies.

Users has more ability to access ,distribute and manage data over the Internet to cloud computing, often known as Internet computing. Systems in the cloud have also been made possible by new technology; cloud computing service providers host the systems and applications of their clients in order to serve their own consumers. As a result, there are now more platform options for contemporary electronic healthcare systems. It is not necessary for hospitals and other organisations to maintain on-site data centres and servers. Simply uploading their programmes to cloud computing service providers would allow them to direct clients to the cloud site. Based on these options, healthcare systems might be hybrid, centralised and integrated regional services with cloud-based services. The best option for patients is a comprehensive service that addresses all healthcare requirements but this is not likely to happen always This method describes a cloud computing system created to deal with this problem. It also improves user efficiency by allowing them to access their data at any time

and from any location, as well as reducing the load on both the patient and the doctor to analyse the data [1].

Poor and developing nations' healthcare systems have not yet fully embraced information technology. These nations' healthcare systems are poorly furnished and poorly integrated. While some private clinics and organisations employ computer-based information systems to keep track of their patients, there is currently no appropriate procedure in place for data sharing. There are several private practitioner doctors who offer therapy in addition to hospitals. As a result, this situation precludes the usage of current desktop-based technology."eHealth Cloud" model has been described in this analysis to build a shared platform for the enhancement of the healthcare system. The data is prepared for outsourcing into the Cloud due to the expansion of enormous data storage and increased protection of sensitive patient information [2].

Modern medical facilities cannot be provided by the existing method-based approach. The main problems are-There are no computerised medical records stored for later use. The past medical records of patients are not accessible to doctors. Choosing the right doctor and scheduling an appointment. Analysing a large amount of EMR data. Diverse contact among interested parties is not possible. (e.g., doctors, patients, pharmaceuticals, health insurance companies etc.). EMR systems are being used by many nations and healthcare organisations to maintain medical records in an effort to increase productivity, enhance patient care, increase patient safety, and cost. Basic patient data, diagnoses, laboratory results, images, medical histories and prescriptions could all be available .Cloud computing is a way through reliably storing enormous amounts of data while reducing administrative costs.

The Internet of Things (IoT) offers good solutions for coping with the increase in computing intelligence and power in diverse devices. They are present in a number of e-health applications,The majority of them are in a patient survival area.The data is not only gathered and transmitted in real-time, but it is also modified to account for alterations in the environment. Typically, a mobile agent is a part of autonomous software that can move between network nodes in Multi Agent System (MAS).
By combining with IoT,theycan accomplish specific types of mobility that allow them to physically move the gadget. Multiagent systems have quickly become a study topic in the field of e-Health. Additionally, MAS was applied when the data was model-preprocessed on the client side before being sent to the server. In this situation, the client only needs to update the model.This plan combines computer and communication technologywith medical services on the one hand.The creation of a secure agent-based telemedicine system is the solution in this issue. The hardware component consists of numerous bio-sensors that are used to gather data from people (temperature, pulse oximetry, etc.). The information is gathered on the server side and forwarded to the relevant medical authorities.

Standard data transfer, emergency data transmission, and audio/video stream are the three different ways that the mobile component can transmit data. Many different biosensors make up the e-health platform. Real-time patient monitoring will be performed using the sensor data, or threshold values will be determined, which will then be carefully examined and interpreted as a pre-diagnosis in medicine. To store, gather, and process medical data, a cloud component was introduced and enabling access by medical staff.

Remaining analysis is arranged as follows: In Section II, it explains about liberature survey, Section III presents an integrated approach increase eHealthcare System using dynamic cloud computing Platform, section IV describes the results analysis and section V describes the conclusion.

II. LITERATURE SURVEY

S. Poorejbari and W. Mansoor et. al., [3]The affiliations with therapeutic administration are allowed by conveying registration to access the information from any area without concern on submitting a request. Information is also still accessible, as a renewal system in undermining gears.A suspicious arrangement of conveyed figure advancement is an absolute necessity to achieve the appropriate redesign of insurance and refuge.

P. E. Idoga, M. Toycan, H. Nadiri, and E. Çelebi et. al., [4] eHealthcare with cloud computing is referred to as circulated figuring as a development that inavoidably it is reasonable, transports on intrigue enter to the Storage framework to share preparing data, and it can be sent and increased quickly with the small organisation and without the cooperation of the authority community. It is quite significant to have recently discovered useful information in the field of medicine in such a short amount of time.

Mehdi Bahrami and Mukesh Singhal et. al., [5] They introduced a Dynamic Cloud Computing System based on Services-Oriented Architecture (DCCSOA). By establishing services, the concept adds a new layer to the cloud computing system

known as Template-as-a-Service (TaaS), allowing cloud vendors to standardise their cloud services. TaaS is separated into two sublayers:Front-end as a Service (FTaaS), which allows cloud vendors to create a generic and standardised cloud service, and Back-end as a Service (BTaaS), which allows cloud vendors to connect a preset generic cloud service to their cloud computing system.In other words, DCCSOA makes it possible for multiple cloud vendors to standardise their services through a standardised interface.

N. Paladi, A. Michalas, and C. Gehrmann et. al., [6] created a security architecture for data confidentiality and integrity for cloud-based eHealth systems leveraging Infrastructure as a Service (IaaS). To allow transparent storage segregation between IaaS clients, they had been employed trusted computing principles. Furthermore, the authors address the lack of reliable data sharing protocols by offering an XML-based language framework that enables IaaS cloud users to safely communicate data while precisely describing the access credentials offered to peers.

A. Michalas, N. Paladi, and C. Gehrmann et. al., [7] Extensive research has been conducted on the importance of developing secure eHealth services, the advantages of cloud computing, and the gain of pasing current healthcare systems to the cloud. To accomplish this, however, a variety of obstacles and issues must be addressed. In a typical eHealth scenario, numerous parties must be trusted to provide the appropriate security guarantees to the end-user, who is giving sensitive health data to a third party.

Lounis, Ahmed et. al., [8] developed a safe cloud architecture, however the study's architectural analysis is solely limited to wireless sensor networks. The analysis skips over architectural components like dynamic services or service modifications.

Fan, Lu et. al., [9] developed a system for gathering and cloud-based analysis of healthcare data. The authors do not express how the develop platform might be useful for any other architectures or customised services for heterogeneous clouds; the platform is based on its design. Administrators can build and move an eHealth system to various cloud computing systems customize a flexible and dynamic cloud platform, which was already mentioned.

III. An Integrated Approach To Improve Ehealthcare System Using Dynamic Cloud Computing Platform

The block diagram of an integrated approach to improve eHealthcare System using dynamic cloud computing Platform is shown in fig.1. In this section presented an integrated approach to increase eHealthcare System using dynamic cloud computing Platform discussed in detailed.

Both user and sensor inputs are used in tbhis study. Three agents were developed to gather information from users or sensors and build the mobile client. To decide which method to use to transmit the data, these agents among themselves. The architecture's periodic analyzer is a crucial element. If it is deemed pertinent, the periodic analyzer agent will regularly gather data from sensors and send it to the cloud. The periodic analyzer agent's basic idea is to use a pattern recognition method to find anomalies in medical sensor data. The emergency agent's main job is to gather data from sensors and check for the presence of vital parameters.

The manual handling agent has the authority to override the conclusions reached by the first two agents and start the audio/video call to the medical specialists. Next the decision logic is done which is used to take decision. There were two modes of transmission.In the first instance, MLLP is used to gather and upload the patient's recurring medical data to the cloud (minimal lower layer protocol). The HL7 is used for serialisation. In the second case, the audio/video stream is used to send the data to the cloud. The architecture is built on top of the cloud module. Data from the user and sensors must be gathered by it. However, the dependability and manageability of cloud computing are two of its main advantages. These qualities are essential for platforms that are service specific since cloud computing is far more reliable and consistent than internal IT infrastructure. The vast amount of data that was stored in the cloud as a result of user input and sensor data is used and monitored by the hospitals.

Additionally, patients can use their patient ID at hospitals or healthcare facilities to get prescription drugs or other medical services. They can access the EMR and check the medication list, medical history, lab results, and other information if the medical facility has got the government approval.The patient medical history generated from the EMR system. This central EMR has the potential to become a widely used application database, fundamentally altering the healthcare industry. A dynamic layer called FTaaSeH enables cloud service providers to utilise it as a model for customising their cloud offerings. First, cloud providers employ FTaaSeH to connect their value-added services via BtaaSeH to defined generic and uniform services. On the one hand, FTaaS defined

services are dynamic and can be updated by a cloud vendor to provide a variety of services to consumers.. An eHealth system can access services across heterogeneous cloud services because cloud vendors tie BTaaS services to their value-added cloud services. eHealth applications, on the other hand, can be moved to a different cloud provider with little client-side modification. Furthermore, because altering the software on these devices can be costly and occasionally necessitates upgrading the hardware, offering a broad and consistent service is crucial. With the provided technology, end users can access an Electronic Medical Record (EMR) with general data access throughFTaaS.To preserve patients' privacy, they deployed two strategies on the platform

. EMR is used to sharing electronic information with patients and other clinicians securely. Helping providers more effectively diagnose patients, reduce medical errors, and provide safer care. Improving patient and provider interaction and communication, as well as health care convenience. Enabling safer, more reliable prescribing.

AES encryption is one choice, while a light-weight Data Privacy Method (DPM) is another. From FTaaS, the customer receives a uniform and generic function. From FTaaS to BTaaS, the request will be forwarded. Two user-data protection techniques DPM and AES encryption are used to each retrieved answer. The task of putting BTaaS into practise belongs to Windows Communication Foundation (WCF).

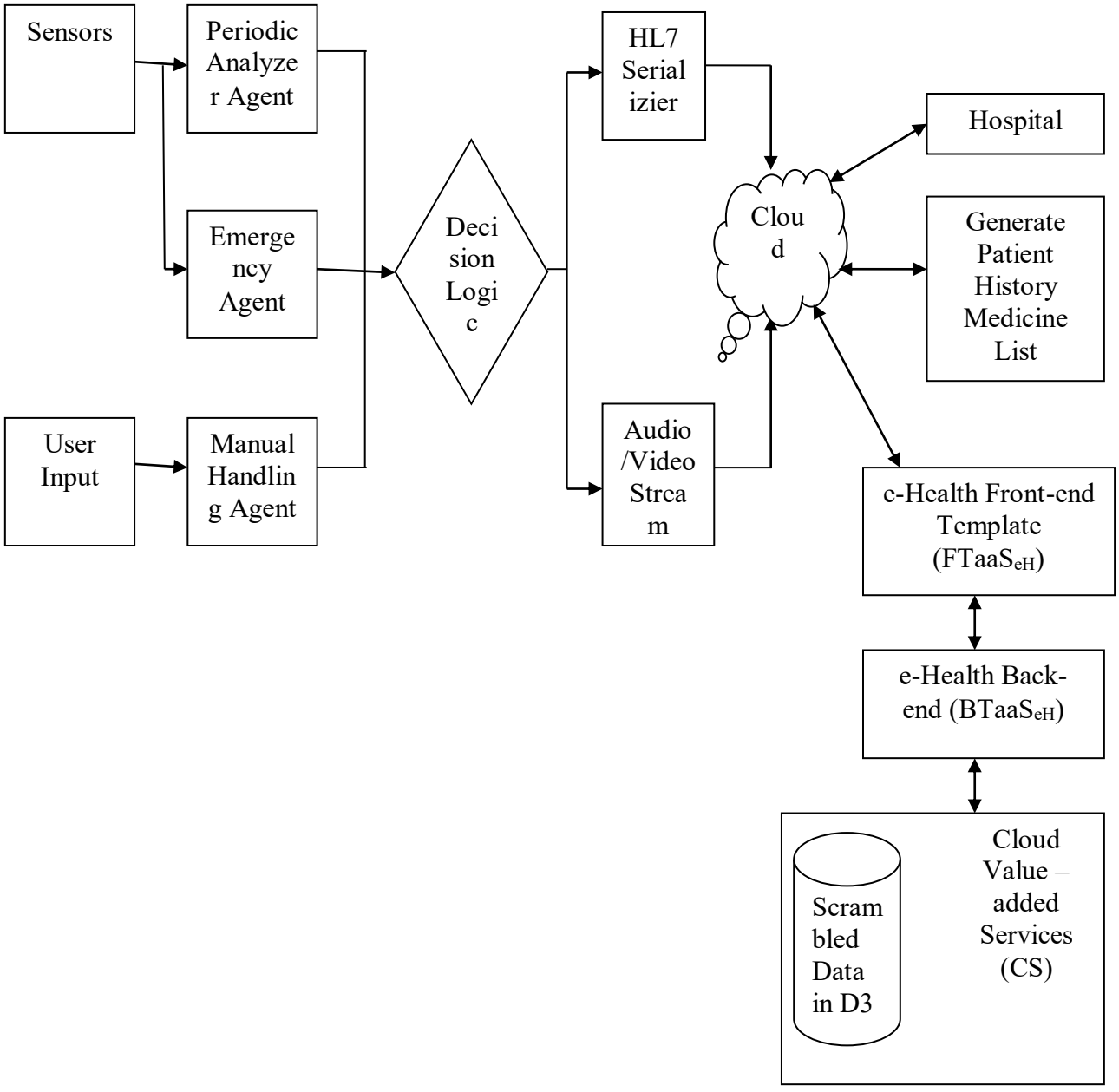

Fig. 1 The Block Diagram Of An Integrated Approach To Improve E-Healthcare System Using Dynamic Cloud Computing Platform

IV. RESULT ANALYSIS

The result analysis of an integrated approach to improve eHealthcare System using dynamic cloud computing Platform is demonstrated in this section. Using the following definitions for True Positive (TP), True Negative (TN), False Negative (FN), and False Positive (FP), the performance of the presented model is assessed:

True Positive (TP): TP is the total number of accurately classified, factually positive predictive episode.
True Negative (TN): TN is the total number of correctly categorized ,negative predictive episode and factually negative. False Positive (FP): FP is the total amount of positive prediction instances that are regarded to be inaccurate and not factually positive.
False Negative (FN):The total number of factually negative but incorrect negative predictive instances is referred to as FN.

Accuracy: It is described as being the proportion of correctly identified occurrences to all instances, and it is provided as

$$Accuracy = \frac{TP + TN}{TP + FP + TN + FN} \times 100 \quad (1)$$

The proportion of data items that a model correctly classifies as relevant is known as precision. That means classification models return only relevant instances in precision and expressed as

$$Precision = \frac{TP}{(TP + FP)} \times 100 \quad (2)$$

Specificity: It is described as the ratio of true negative instances to the actual negative instances (i.e. FP + TN) and is expressed as

$$Specificity = \frac{TN}{TN+FP} \times 100 (3)$$

The table 1 describes the performance analysis of presented integrated approach to improve eHealth System using dynamic cloud computing Platform.

TABLE 1: PERFORMANCE ANALYSIS

Performance Metrics	An integrated approach for eHealthcare System using dynamic cloud computing Platform	An integrated approach for eHealthcare System
Accuracy (%)	97	84.2
Precision (%)	95.4	81.6
Specificity (%)	93.8	80.7

The above table shows that an integrated approach to improve eHealthcare System using dynamic cloud computing platform gives the high accuracy, precision and specificity which is used to improve the ehealthcare system.

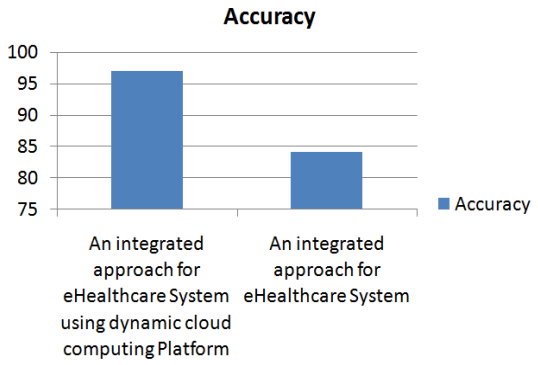

Fig. 2: Accuracy Performance Comparison Between Methods

Therefore an integrated approach to improve eHealthcare System using dynamic cloud computing Platform has better accuracy. Better acchuracy is achieved by retriving the patients history by using this framework.

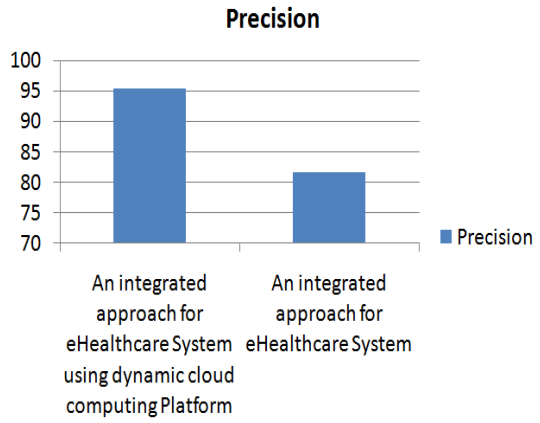

Fig. 3: precision performance comparison between methods

In this comparision the above graph shows that an integrated approach to improve eHealthcare System using dynamic cloud computing Platform has higher precsion.

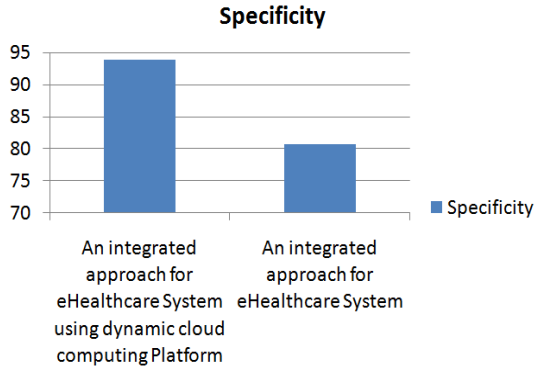

Fig. 4: specificity performance comparison between methods

V. CONCLUSION

In this analysis, they described an integrated approach to improve eHealthcare System using dynamic cloud computing platform. With the platform presented here is a cloud vendor can easily customise and standardise services on top of a variety of cloud computing platforms. The current healthcare system can be improved upon with the help of the eHealth cloud. Cloud computing, can connect every doctor and patient in our network.The improvement in automation and connection will make it possible for the government to provide the required healthcare. By examining the EMR in a Broad framework,conventional therapeutic thinking can be drastically altered .Their position will be strengthened by giving the general public access to healthcare. The performance of this analysis is calculated on different aspects such as Accuracy,Precision,and specificity. Depending on the calculated performance metrics of the approach, an integrated approach to improve eHealthcare System using dynamic cloud computing Platform has given the better results.

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