Secure Smart Healthcare Data with Data Aggregation

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ABSTRACT: The medical field deals with a lot of physical actions, reactions, and responses. Most of the communication between the doctor and the patient is not digital and is a time-consuming process. But, it would be easier, if it was. This framework allows the doctor to access the patient's data that have contact over a network. It also follows the security parameters, confidentiality, authentication, and integrity, encryption, Time access control policy and, key management. Only the authorized doctor will be able to access the patient data. This helps in time management for both the parties involved, as the doctor does not need to view every patient file and the patient need not worry about security.

KEYWORDS: Confidentiality, security, Encryption, Decryption, Key management, Time access control.

1. INTRODUCTION

Smart healthcare represents a groundbreaking shift in healthcare delivery, utilizing digital technologies to integrate diverse health data for personalized patient care. This transformation is not without its hurdles, notably balancing patient data access with robust security measures to prevent unauthorized access and data breaches, which can cause delays in transmitting critical access keys to healthcare providers. To tackle these challenges, innovative solutions like blockchain technology for secure data access, role-based access control mechanisms, encryption protocols, and real-time access management systems are being implemented. These solutions not only bolster data security but also enhance patient care and health monitoring, aligning with the core motivation of smart healthcare—improving healthcare efficiency and addressing system delays and fragmentation. The overarching objective is to shift from reactive to proactive healthcare, prioritizing personalized care, data security, streamlined processes, and empowering patients to actively engage in their healthcare journey. This vision is aligned with the broader goal of creating an accessible, effective, and adaptable healthcare system that meets evolving global healthcare needs.

2. LITERATURE REVIEW

M. I. Pramanik et al.'s study on 'Smart health: Big data enabled health paradigm within smart cities' [1] explores the integration of big data in smart health systems within smart cities. The paper discusses the potential of big data analytics to revolutionize healthcare delivery, particularly in

urban environments.. Q. Cai et al.'s survey on multimodal data-driven smart healthcare systems [2] provides a comprehensive overview of approaches and applications in this domain. R. Saha et al.'s "Internet-of-Things framework for oxygen saturation monitoring in COVID-19 environment [3]" focuses on enhancing healthcare monitoring in the context of the COVID-19 pandemic. The literature review of the paper explores various aspects related to IoT frameworks and their application in healthcare. N. Nasser et al.'s "Smart healthcare framework for detection and monitoring of COVID-19 using IoT and cloud computing" [4] introduces a comprehensive approach to leveraging IoT and cloud computing for COVID-19 detection and monitoring. This framework aims to enhance healthcare capabilities through real-time data collection and analysis, contributing significantly to public health management during pandemics. N. Mohammadzadeh, M. Gholamzadeh, S. Saeedi, and S. Rezayi's systematic literature review in "The application of wearable smart sensors for monitoring the vital signs of patients in epidemics" [5] explores the use of wearable smart sensors in monitoring patients' vital signs during epidemics.

3. PROPOSED METHOD

3.1 Registration and Login

The proposed method establishes a user-friendly interface or framework that enables smooth communication between patients and their designated doctors. Both patients and doctors must either register or log in to access this interface. The initial step involves the patient or doctor entering their email and password on the login page. If the patient or doctor is not registered yet, they can choose the If you are a new Patient click here option to begin the registration process. This simplified approach ensures convenient access and interaction within the healthcare system. as shown in Figure 3.1.1.

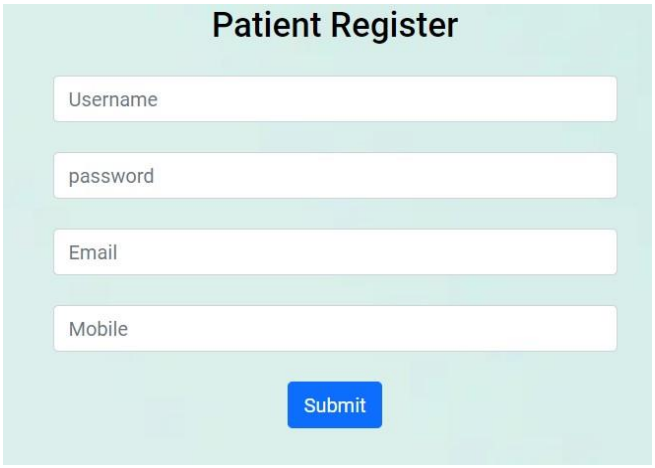


Figure 3.1.1 Patient Registration page

In this page, the details of the patient are to be filled in. They include username, password, email, and contact number. As shown in Figure 3.1.2, the patient fills up all the information and the login page opens up again. The patient can then put in the password that was previously created and gain access to the interface.

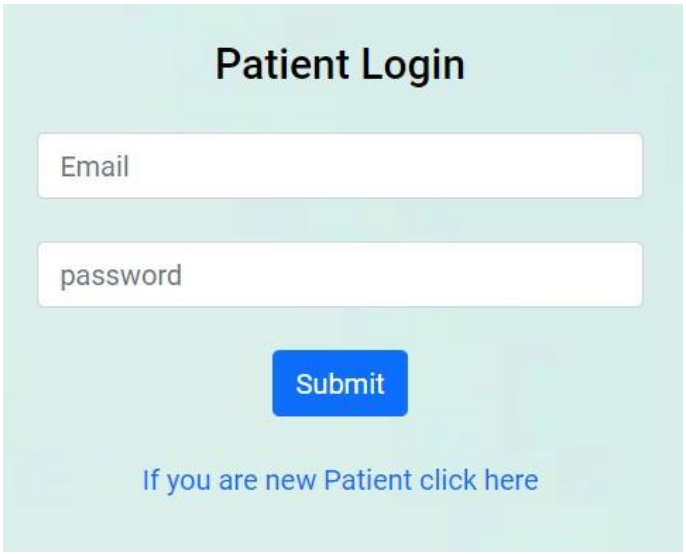


Figure 3.1.2 Patient Login page

Similarly, the Medical services provider login and registration takes place.

Figure 3.1.3 Doctor Registration page

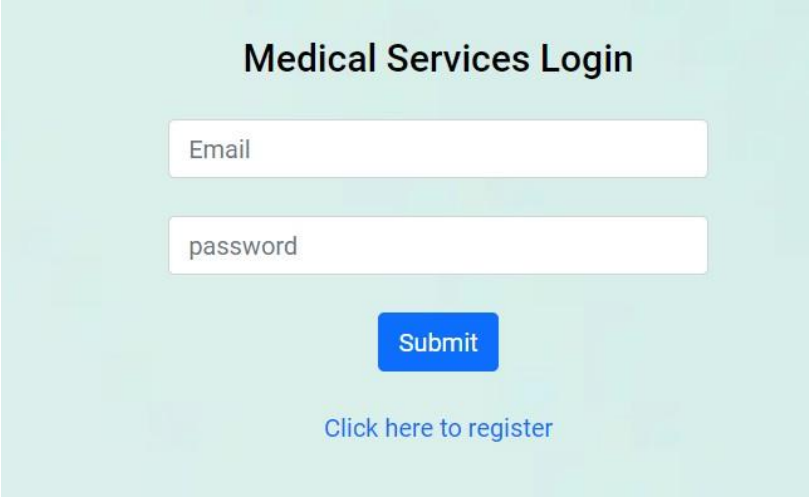


Figure 3.1.4 Medical Service provider Login page

3.2 Data Upload and Key Generation

After the patient registration and login page the patient will be able to upload a form in which he or she would fill in the details mentioned in the form. As shown in Figure 3.2.1, the patient will be able to upload a data file, while also entering The Time to access that is on what particular day the doctor can access the file.

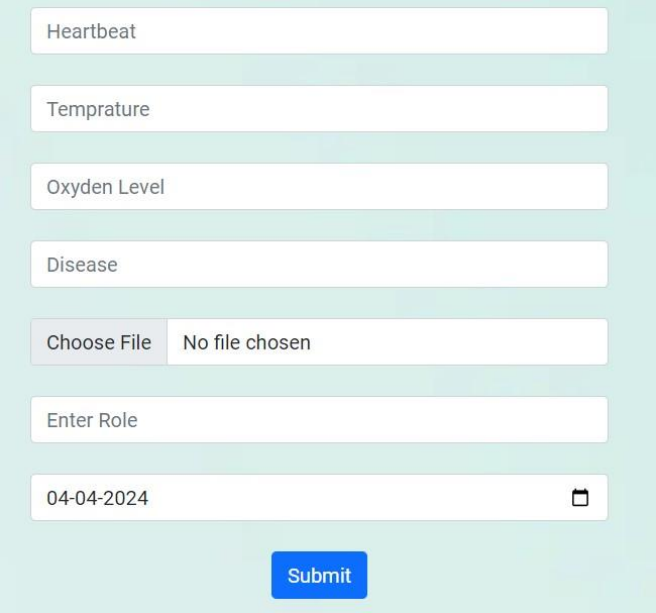


Figure 3.2.1 Patient Data Upload

After uploading the patient will be able to view data like it is shown in Figure 3.2.2

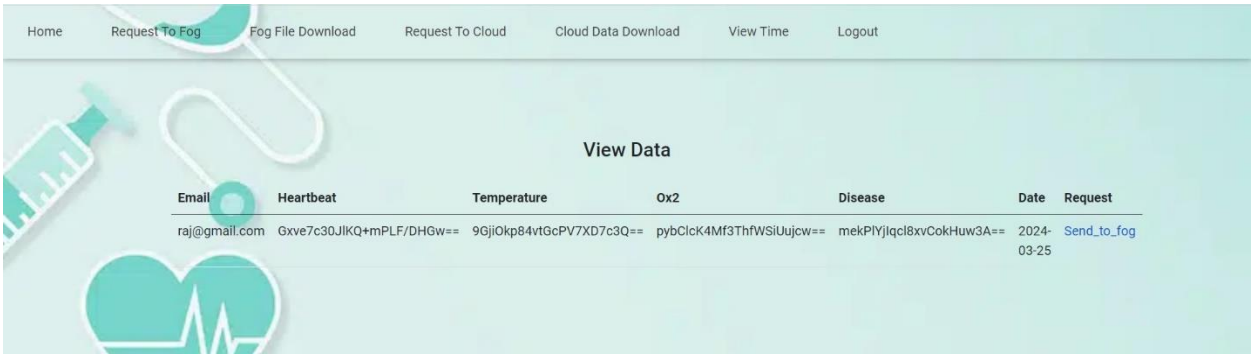


Figure 3.2.2 View Data

Then there is a Send to fog option that Sends the keys to fog framework where we can view the requests sent by the Doctor (Medical services provider).The Doctor can request for keys to the fog framework or cloud framework after activation of the doctor's registered account. After clicking on activated the doctor can acces the keys as it appears in Figure 3.2.3.

Figure 3.2.3 Doctor account activation

3.3 Key Requests and Receiving Files

In the doctor's side of the interface, he or she will be able to see a series of files in encrypted form. If the doctor wants to view a certain patient's Data, they can send a key request. Then the key request will be sent successfully as shown in the Figure 3.3.1

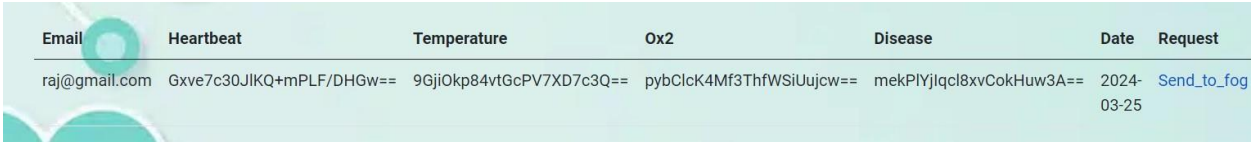
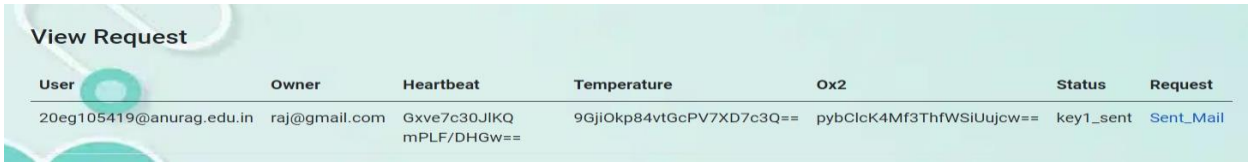


Figure 3.3.1 Send Request

The cloud or fog Frame work will immediately receive a request. If the request is sent by the trusted Doctor the Fog or cloud framework will be able to verify and send the key(Figure 3.3.2) The key will be sent to the doctor's mail from which he or she can copy the key together in a single mail sent by Fog framework to access all keys at once or by cloud framework to access the keys one by one to access single attributes for further process as shown in Figure 3.3.3

User	Owner	Heartbeat	Temperature	Ox2	Disease	Date	Request
20eg105419@anurag.edu.in	raj@gmail.com	Gxve7c30JlKQ mPLF/DHGw==	9GjiOkp84vtGcPV7XD7c3Q==	pybClcK4Mf3ThfWSiUujcw==	mekPlYjlqcl8xvCokHuw3A==	2024-03-25	Verify & Send mail

Figure 3.3.2 Send Key by Fog Framework



View Request

User	Owner	Heartbeat	Temperature	Ox2	Status	Request
20eg105419@anurag.edu.in	raj@gmail.com	Gxve7c30JlKQ mPLF/DHGw==	9GjiOkp84vtGcPV7XD7c3Q==	pybClcK4Mf3ThfWSiUujcw==	key1_sent	Sent_Mail

Figure 3.3.3. Send Key by Cloud Framework

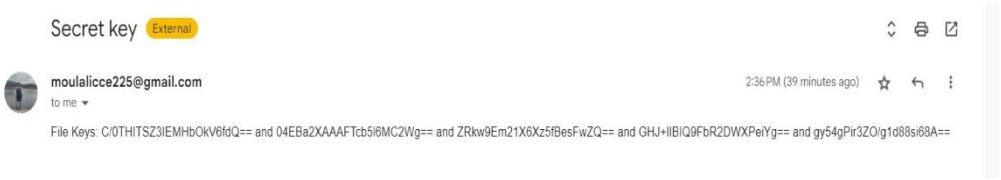


Figure 3.3.4 Mail (all Keys)

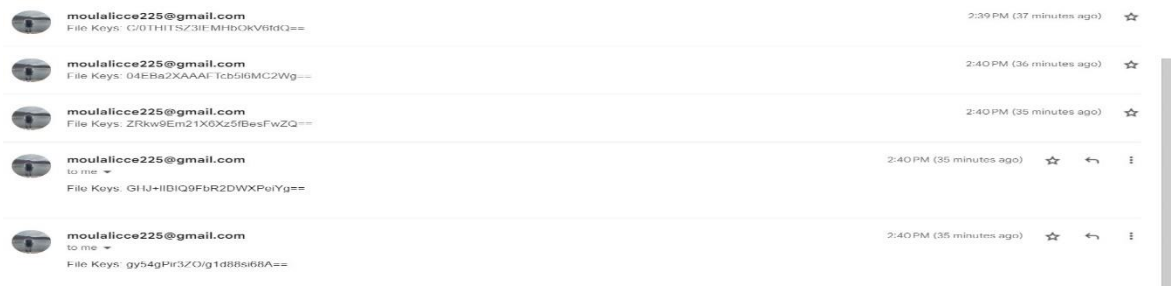


Figure 3.3.5 Mail (Single Key)

The file can be downloaded by the doctor after the correct key is given all at once or by single Parameter Key (figure 3.3.6 and figure 3.3.7).

Figure 3.3.6 Download all at once

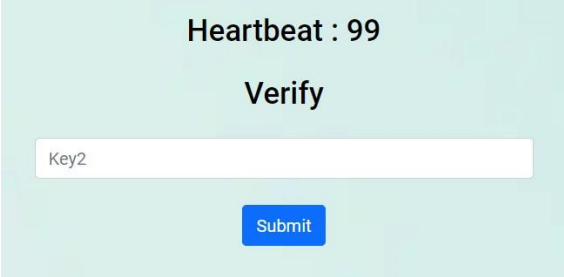


Figure 3.3.7 Download One By one

The doctor is now able to view the patient's Details. In a short amount of time one can access the details all together or one by one and in the last step we calculate the time taken for the whole process for both cloud framework and fog framework as mentioned in Figure 3.3.8

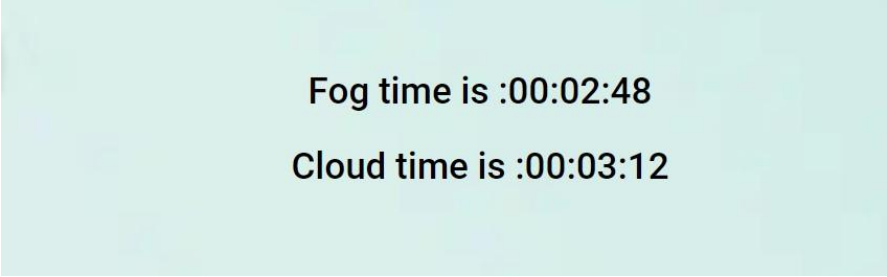


Figure 3.3.8 Time calculation

4. RESULTS

The total process Time for data of different types and sizes. Parameters like key lengths and modes of operation will be varied to analyze their impact on speed. Total Process time for existing methods and proposed methods is compared

based on the values of Table 4.1 and Figure 4.1 shows the graph of Total process times.

Input	Existing Method	Proposed Method
1	3 min 10 s	2 min 35 s
2	3 min 43 s	2 min 06 s
3	3 min 21 s	2 min 97 s
4	3 min 09 s	3 min 01 s
5	2 min 85 s	1 min 71 s

Table 4.1

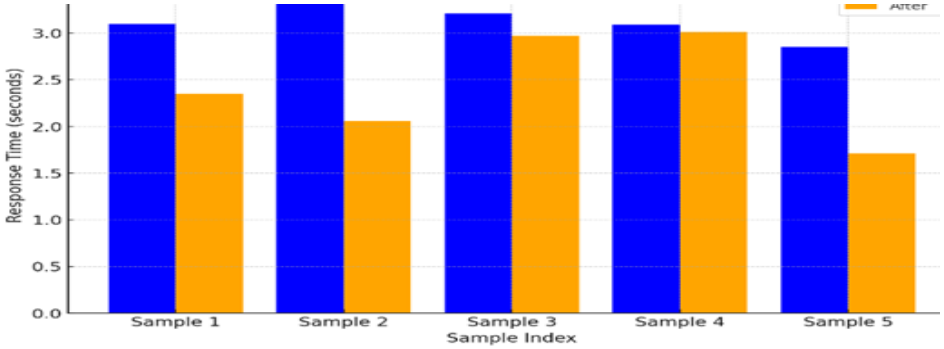


Figure 4.1

The comparison of the total time taken process of cloud framework and fog Framework. The comparison is based on Table 4.2 and the graph is shown accordingly in Figure 4.2.

Input	Fog based framework	Cloud-based framework
1	2.3	1.35
2	1.2	0.35
3	3.7	2.3
4	5.6	2.5
5	6.2	2.3

Table 4.2

Figure 4.2

5. CONCLUSION

The proposed fog-based framework for healthcare data processing marks a substantial step forward in managing and safeguarding health data. Its edge processing capabilities notably reduce data processing times compared to traditional cloud-based systems, thereby improving healthcare delivery efficiency and accessibility. Time-based access control implementation ensures data security while enabling timely access within set timeframes, vital for protecting patient privacy. The encryption and key management techniques employed effectively address the challenge of securing sensitive health parameters, contributing to enhanced data security and operational efficiency. The comparative analysis underscores the fog framework's clear advantages over cloud-based alternatives, advocating for its adoption to bolster healthcare systems' data management, security protocols, and adaptability to evolving healthcare demands.

6. REFERENCES

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