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Medical Image Archival and Analytics as-a-Service

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Abstract: Medical image is a good means that to spot medical abnormalities. Patients usually have medical pictures taken at completely different clinics throughout life, and that they usually want to possess second interpretation on medical pictures showing substantial diseases. With these 2 motivations, we tend to style MIaaS that may be a cloud service for archiving medical pictures and analysing medical pictures by software package and/or physicians. we tend to gift the planning and implementation of MIaaS and show its sensible worth as cheap personal health care service.

I. INTRODUCTION

A medical image could be a visual illustration of the inside of human bodies for clinical interpretation. It reveals the inner structures and practicality hidden by the skin and bones. Hence, medical pictures become a vital supply for identifying abnormalities of form. Medical Image repository and Analytics as-a-Service (MIaaS) could be a cloud service that provides 2 key functionalities; Archiving Medical pictures and Analysing the photographs. It is typical that patients become to go to totally different medical clinics throughout their lifespan for several reasons. Consequently, medical pictures for a patient are usually settled in multiple clinics, and also the patient doesn't have one and convenient access to his or her all medical pictures in one place. This becomes the key motivation for the repository service of MIaaS. A patient with medical pictures showing substantial medical abnormalities like cancer usually desires to hunt for second opinions on the photographs before deciding treatment actions like medical surgery. This becomes another key motivation for analysing uploaded medical pictures by software system or medical man.

Hence, the benefits of MIaaS will include:

1) Patients have a single place to store all their medical images in the lifetime.
2) Patients can retrieve and review their medical images anytime without visiting a clinic.
3) Patients have a convenient of getting second opinions on their medical pictures at inexpensive while not visiting a clinic.
4) Physicians like medical radiologists can be exposed to patients globally, charge for on-line interpretation fees, and acquire treatment opportunities.

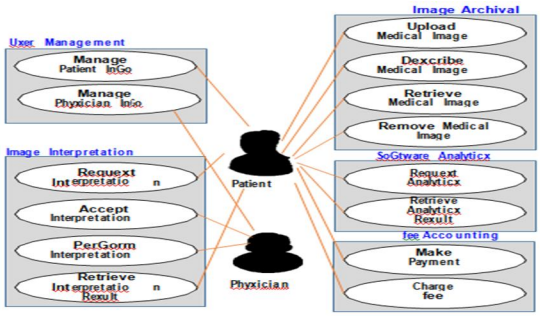
MIaaS may be a cloud-based attention resolution that permits patients to transfer their medical pictures and search for results of image analytics. The service conjointly promotes physicians' participation on decoding the medical pictures and treatment activities. That is, MIaaS provides a web market place between patients with medical pictures and physicians interpreting the pictures.

II. LITERATURE REVIEW

Lee's work proposes a hybrid cloud service for attention by victimization secure medical sensors like cardiogram and respiration sensors [l]. The service provides functionalities of grouping biological signals, sending the signals to mobile devices, and synchronizing patient diseases. This work contains a high-level description on its practicality and style, and additional focuses on supporting secure transmission of the signals. John's work proposes a SOA-based Healthcare-as-a- Service, that provides functionalities of storing, processing, and visualizing medical pictures [2]. The work focuses on presenting however the construct of the cloud service is well applied to the aid domain, with less explaining technical solutions to develop such a aid service.

III. FUNCTIONALITIES OF MIAAS

MIaaS consists of five functional groups and each group and each group consists of several use cases.



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A. User Management

1) Manage the information of two types of users; Patient and Physician. The functionality is mainly the collection of CRUD operations on patients and physicians.

2) MIaaS allows patients to leave reviews on physicians and feedbacks on the interpretation results.

B. Image Archival

1) MIaaS supports seven types of medical images that are commonly taken at medical clinics

2) Patients can write descriptions on their medical images and retrieve the images via a web browser in graphical or video forms.

C. Image Interpretation Service

1) The 'Basic' level -without any legal binding, which is only available when appropriate physicians participate in the service.

2) The 'Advanced' - legal responsibility of the provided interpretation, and hence more detailed interpretation can be expected at this level.

3) The 'Premium' level -high interpretation cost due to the additional medical data acquisition through interviews with patients.

IV. CHALLENGES IN DEVELOPING MIAAS

1) Providing High QoS: As a cloud service for potential an outsized variety of users globally, MIaaS must give prime quality of service (QOS). Two quality attributes square measure particularly essential in providing MIaaS operations. Availability: MIaaS should be offered relating to time and place, with an exact level of performance**.** Privacy: Medical pictures square measure sensitive info of each user, so MIaaS should guarantee a high privacy on the archived medical pictures and conjointly the results of code analytics and physicians' medical interpretation. Providing Reliable Software Analytics

2) Managing Heterogeneity of Medical Images: The seven forms of medical pictures supported by WaaS are all totally different for his or her media illustration, types of permanent storages (such as CD, DVD, and USB), software analytics strategies, interpretation services by physicians, and fee structure. MIaaS ought to be designed effectively to remedy the nonuniformity.

3) Providing Reliable Software Analytics: Some forms of medical pictures like graphical record and graph will be taken by package also as physicians. Interpretation by package yields edges of low value, timeliness, and automation. However, the results of package analytics needs to be reliable enough to be accepted by users. Current state-of- the-art medical analytics by package is being increased, but still mostly restricted. WaaS is realised solely with the tried and effective analytics strategies.

4) Providing Effective Market Place for Medical Image Interpretation: A key motivation in exploitation MIaaS would be to hunt for second opinions on patients' medical pictures. That is, a patient should be ready to effectively find the proper medical man World Health Organization would provide reliable interpretation at an affordable interpretation rate. MIaaS should use policies and supply a virtual market place for on-line contracts between patients and physicians. The business model for MIaaS on-line contracts and transactions would well be quite totally different from ones utilized on ecommerce sites.

A. Configuration of Clouds Servers

1) Amazon EC2 for deploying MIaaS components

2) Amazon RDS for maintaining application database

3) Amazon Glacier for maintaining a repository of medical images.

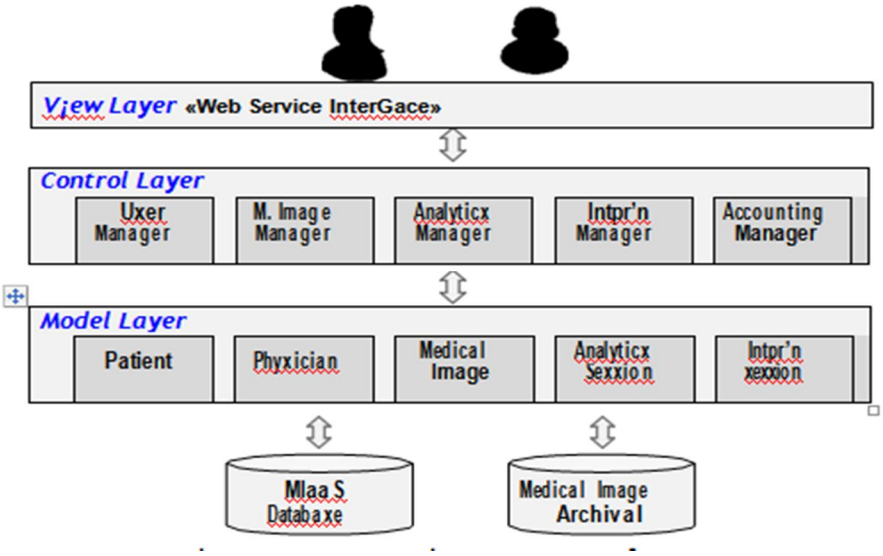
B. Configuration of Cloud Services

We deploy the implemented MIaaS by using three Amazon Cloud Services. Below table shows the Amazon Services which are used in MIaaS.

Device Instance	Instance Specification	Usage Description
Amazon EC2	Type: m4.2xlarge	To be used for MIaaS functional components deployment and static contents
	vCPU: 8	
	Memory: 16 GiB	
	Storage: 100GB SSD	
Amazon RDS	Class: db.m4.2xlarge	To be used for reserving structured data with MySQL for MIaaS data-base
	vCPU: 8	
	Memory: 32 GiB	
	Storage: 200GB SSD	
Amazon Glacier	Policy: No Retrieval Limit	To be used for archiving medical image files
	Notifications: Disabled	
	Storage: No Limit	

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C. Architecture of MIaaS



1) View Layer

a) Web Service: Interface

2) Control Layer

a) User Manager: It manages the users account

b) Image Manager: It manages the Images which are stored

c) Analytics Manager: It manages the analytics which is done by Analyst

d) Interpretation Manager: It is used for managing the interpretation done by the physician

e) Accounting Manager: It is used to manage the finanacial matter

3) Model Layer

a) Patient: Who creates the account

b) Physician: Who diagnosis the patient

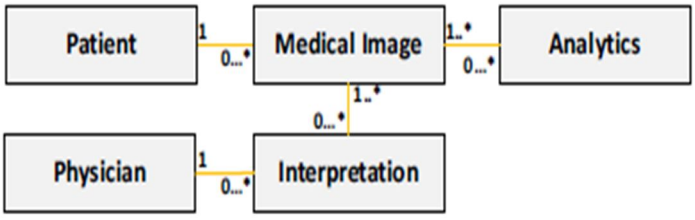
c) Medical Image: Medical image which is given by the physician

d) Analytic Session: Used for Analytics

e) Interpretation Session: Used for Interpretation

4) MIaaS Database: It stores the data

5) Medical Image Archival: Medical images are archived into small size to store lot of data

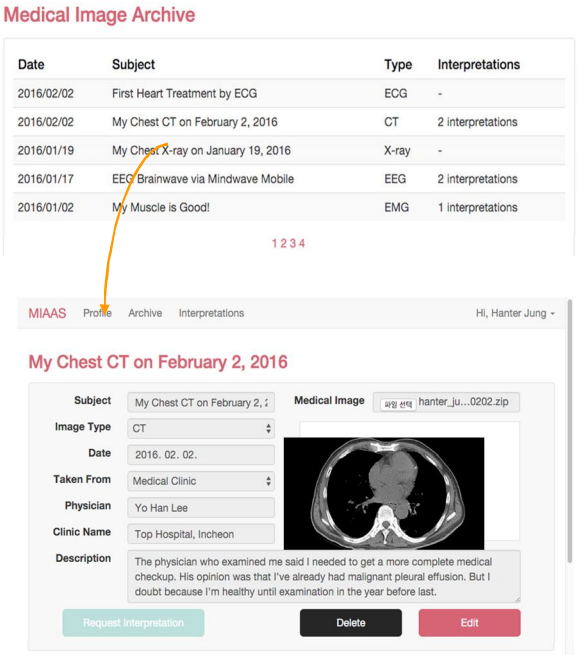


Patient and MD entities manage patient-specific and physician-specific info severally. Medical Image is an entity for storing pictures uploaded by patient associated consists of attributes like image sort, uploaded date, description, and its file location. Analytics is associate entity to store the analytics results created by computer code with the data of suspected disease, health standing, and attainable causes. And, Interpretation is used to store interpretation results created by physicians with the attributes like suspected illness, description, and recommendation.

As one answer to handle heterogeneousness of the medical images, Medical Image entity doesn't store the image as a blob, rather it's the knowledge of the particular file location. That is, every instance of Medical Image entity the info maintains a link to the situation of medical image file, which is maintained on Amazon ice mass.

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D. Summary And Detailed Page Of The Report



To meet the primary principle, we have a tendency to separate pages for patients from ones for physicians. The second principle is glad with coming up with the navigation 3 that depth is three. And the last principle is taken into account by permitting navigations between the connected page. Figure twelve shows 2 pages; a outline page showing all the medical pictures and an in depth page together with interpretation details.

V. EXPERIMENTS AND LESSONS LEARNED

With the model implementation of MIaaS, we conducted a series of experiments and discuss the leads to this section.

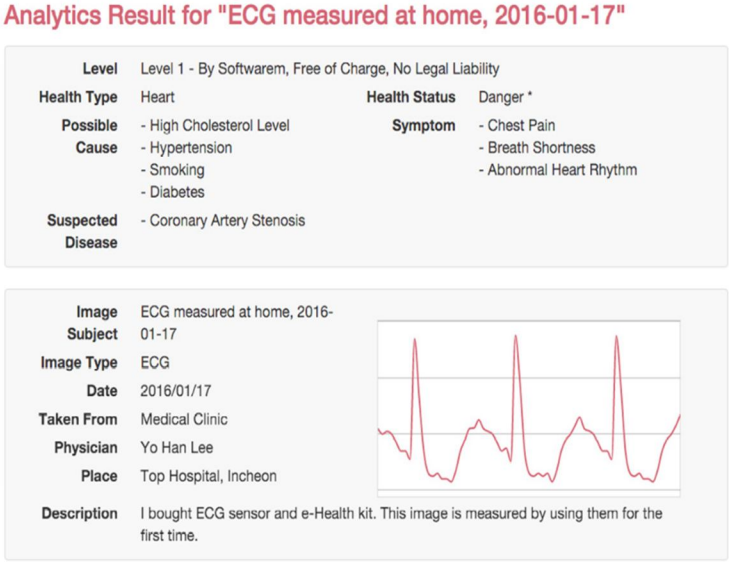
A. Analytics and Interpretations

1) Currently MIaaS only supports software analytics on ECG and EMG

B. Results and Lessons

1) Patients with software analytics gave positive feedback since they get analytics resources immediately.

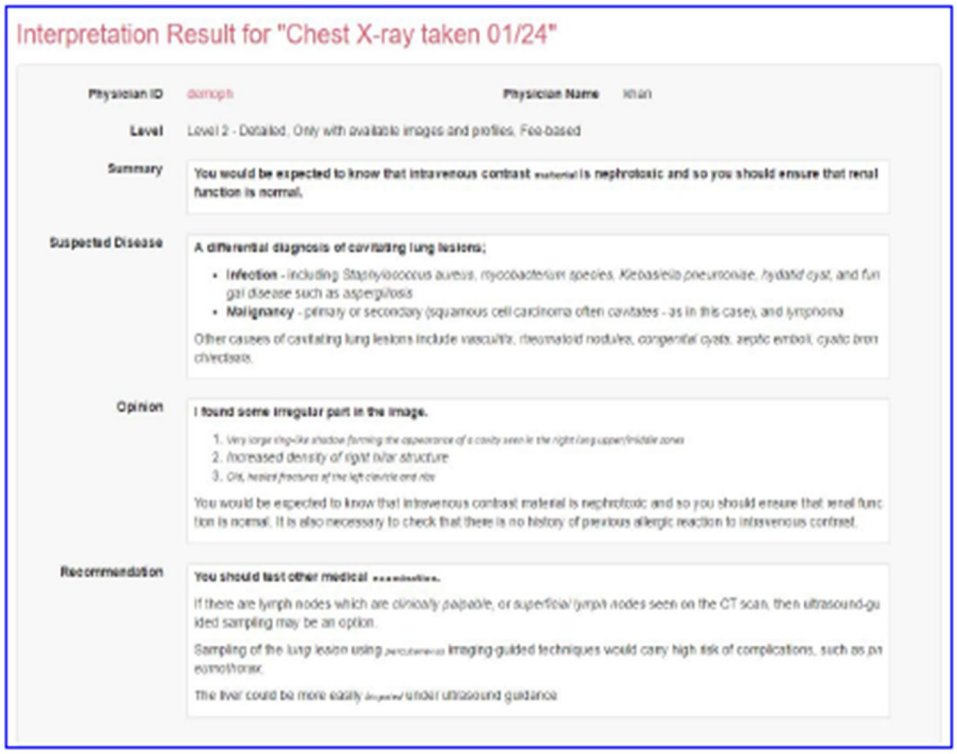
2) Below figure shows the analytics results of ECG image, indicating that patient is in danger with heart disease.



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Interpretations by the four physicians were provided within 2 days on the average once patents requests them. Drawing from the experiences of mistreatment the web contracts with physicians, patients according that the general method was fairly intuitive and that they may get affordable details of the interpretations.

3) Interpretation result posted by a physician which has the similar structure of the interpretation



4) After using the service, we ask the patients to give feedback for improvement in the services.

5) One of the major suggestion is to improve the accuracy of software analytics.

C. Survey Of Participants

	Accuracy of Analytics	Accuracy of Interp.	Function-ality	Practical Usability
hansol921	7	10	8	9
mkdmkk	6	9	7	9
kite1257	6	10	9	8
hhdd	8	8	8	9
rueru18	7	9	8	10
...	...		...	
Average	7.2	9.4	8.8	9.5

D. Based On The Survey

1) Accuracy of Software Analytics need to be improved.

2) Accuracy of physician interpretation Is similar to the interpretation given in the clinic.

3) MIaaS provides functionality needed for archiving and analysing medical images.

4) MIaaS has high potential to be practically used by many users.

IV. CONCLUSION

A. Medical image is an effective means to identity medical abnormalities.

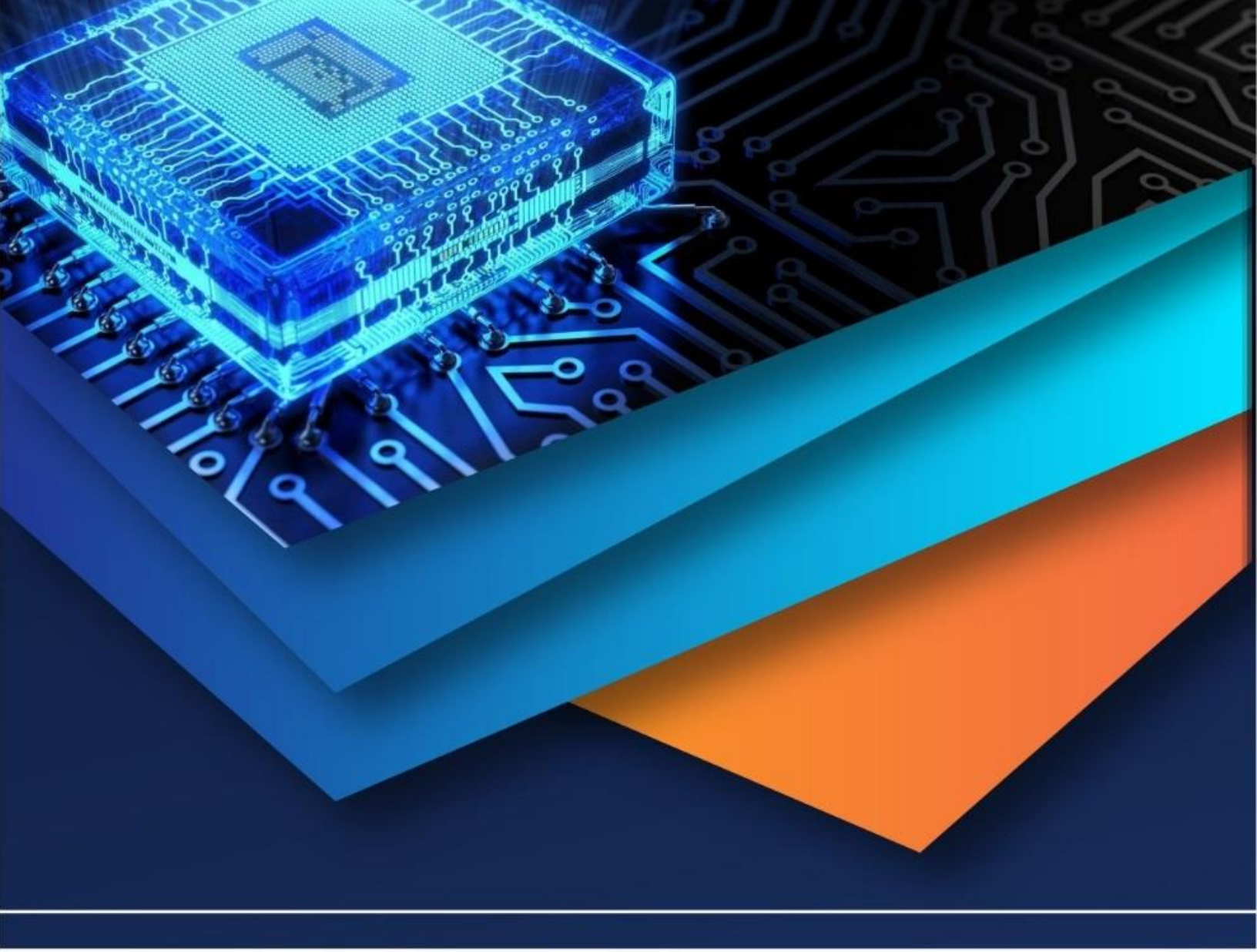
B. MIaaS is a cloud service which reflects the two demands. It provides a single space for archiving medical images and analysing medical images by software and/or physicians.

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