

E- Health Care Management System

Abstract — In health care services , patient has to face lot of problems , due to lack of information they worried for the disease which create anxiety to them. To tackle this problem disease prediction system can be made so that they can check whether the disease is very serious based on certain symptoms. In this system patient has to enter the symptoms which he/she is facing which finally give the disease as the result. The algorithm that is used in the making the system is Random forest algorithm while some other algorithm can also be used like KNN or SVM depending on the accuracy. In addition to this patient also face difficulty in storing the various documents or medical certificates or reports which is very difficult to store them , hence to tackle this problem it stores the data or certificates in the database by keeping in mind of the 3LGM. This system is designed according to HIPAA. HL7 certifications is also required to apply for such critical jobs.

I. INTRODUCTION

Worldwide , many of the cases are left untreated because of poor health care support in local areas. For attaining this purpose , a centralised method is needed for the analysing or monitoring the medical records . Doctors usually starts treating the patient without knowing the medical history of the patient or the patient forgets the medical history like allergic as he/she didn't track the records . So it is very difficult to treat the patient accurately without any side-effect. A website based diagnosis for the patient is the ultimate platform to keep the medical records and can be helpful in predicting the possible illness or disease based on the symptoms that is experienced by a patient to ensure secure and faster analysis. Since we have all the medical history of the patients , we can use this data for the early prediction of the disease. It can also help the patients to undermine the severeness of that particular disease and accordingly the doctor or patient can take the particular measures on it.

It is far more important for the doctor or receptionist to properly document the medical records of the patient. This method is the most important as it will decide that whether the cure is going in right direction or not. Not only this, but this will also help in the scientific analysis of the

patient medical record and also the deep analysis into the disease and also review the problems of patients. Medical records form an important part of the management of a patient. There are two reasons for the doctor to maintain the records or data of the users or patients. One that is , it will help in the evaluation of the medical records of the user or patient , can help in the evaluation of the results of the patients. This one also help in making the strategies of the government for the medical purpose. Records of the medical of the patient is a very sensitive area in the hospitals and that too of the different medical examiner or doctor. It is very difficult to manage a large number of medical documents and is very difficult for those hospitals who does not have much resources which creates very much trouble in curing the disease of the patient. It is very much important to tackle this catastrophic problem by big and small hospitals. The primitive or old or widely used method is the manual method in which pen and paper was involved. In order to tackle the very catastrophic problem of recording the medical data of the patient manually , it includes or need the large storage areas and also it was very difficult in accessing the file efficiently. Talking in terms of legally, it is very obvious that the document form of the medical records is much more valuable and reliable because it cannot be easily tampered as that by the digital data , can be attained by any vulnerable attack without any detection. The era that we are living have seen the data to go for digital, medical records are being digitalised, they can be easily accessible and storage is also efficient. But it is not possible to accept. However it is still not universally acceptable until it can be proved that the record is not tampered. The use or the growth of digitisation is tremendously increasing and hence e-medical record is in the process of developing or evolution and is becoming the widely used. In the health care sector. Because of the avoidance of the hard records that is paper , there are many areas that require some changes to go through more convenient way in a transition from paper to digital world. The identity is the important problem in the digitalisation of the record. For the authentication purpose , electronic signature is required for the user , doctors or any other medical staff. This problem can be solved by using the fingerprints of the doctors or medical staff or even the staff.

When any of the disease is detected by the doctor then there must be a simple universal interface where he/she can put the data in the existing medical history . It must be widely used in the same way as we are using Aadhar-cards .

1.A Objectives :

- In determining the main performance metrics and standards for healthcare information systems and electronic hospital management systems (E-HMS) (HIS).
- To recognise the essential elements of E-Healthcare System.

1.B Requirement for E-healthcare— When the patient faced any accident , it takes much time to identify the blood group or knowing other details that are required to start the treatment of the patient.If we preprocess most of the information of the patient in advanced can reduce the danger in the life of the patient.By knowing the patient Id , doctor can read patient information can take quick action on it. Healthcare institutions are completely deserving of the necessity to blend their companies because of the need of the industry, such as the Healthcare Protection Portability and Responsibility Act (HIPAA) of the United States of America as a Global Average. Unfortunately the majority of health information sources still focus on curing diseases and frequently work with specific departments of the healthcare industry only. This is a tremendous barrier to a industry unification.

II. METHODOLOGY OF RESEARCH

The tremendous amount of the data that is available in the todays world for the study is either qualitative or descriptive in nature.These methodologies are being used because of the reason that that the subject of the research is quite broad and the sources of information are scattered around many regions of the world.By making a quicker

analysis on the survey data and the success of the healthcare management would create a perfect way to reach to the conclusion , would open another dimensions for the researcher to think in the direction of healthcare for the welfare of the people or patients , and would lead to the betterment of the world in the health sector III.

DEFINITION OF HEALTHCARE INFORMATION SYSTEM (HIS) :

Healthcare Information Systems (HIS) are discussed by Paul R. Vegoda (1987) as "an ultimate information system which increases user or patient care by increasing the user's knowledge and lowering ambiguity, allowing logical decisions to be made from the information presented.According to Haux, Schmücker, and Winter (1996), the sanitarium information system encompasses all of the sanitarium's information processing and storehouse subsystem.

IV E – HEALTHCARE MANAGEMENT / HIS STANDARDS & TECHNOLOGIES

With the inventions of technologies such as telephone and internet , it is possible to interact with doctors from a very large distance and can be prescribed from two apart location. This is the greatest advantage of the science and act ans boon for the emergency appearing patients who did not have enough time to get the prescription and medicine . It can save various lives of the patients who may require an urgency medicine.The delivery of medical treatments remotely is known as telemedicine. It covers disease detection, management, and prevention. Real-time or recorded telemedicine are two different subcategories of telemedicine. With the emergence of technology , healthcare sector can be more developed. Healthcare information systems (HIS) must have a very large storage and access to all the resources that are required for an efficient system in order to operate effectively, according to a report by Belgium's Federal Public Service (FPS) from 2002.

IV A : 3LGM² – Modelling tool for HIS

The 3LGM2 (Three-Layer Graph Based Meta Model) approach to modelling and analysing HISs is organised and

has received validation in several countries. 3LGM2 can be described by the Unified Modelling Language (UML) along with functional meta model with technical meta models. In a research by Bjorn Schreiwiese on HIS modelling, three layers that is - the domain layer, the logical tool layer, and the physical tool layer follows the 3LGM2 model. These layers show many perspectives on an HIS. According to Hübner-Bloder et al. (2005), the domain layer describes a hospital without regard to how its enterprise functions actually carry it out. The application components are visible in the logical tool layer. Application components process, store, and transport data in order to support medical or enterprise functions. A collection of physical data processing components that are "used to actualise the computer-based and the paper-based application components" are present on the physical tool layer.

IV B : HIPAA sequestration rules for user information

The U.S. Department of Health & Human Services provides a comprehensive guideline manual on de-identification techniques to be used for PHI content in hospital records and information systems management (Bradley Malin, 2010). De-identification, or the removal of identifiers from health information (see figure 1), reduces privacy risks for users and enables the other use of information for other purposes.

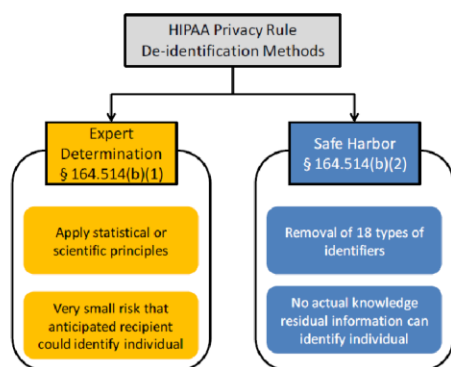


Fig. 1 – HIPAA sequestration rule De – identification Methods

4.3 HL7 / RIM Development Framework

Health Level Seven or HL7 indicates a collection of rules for the healthcare industry that is widely accepted by all over the world .All the softwares that can be made,by keeping these set of rules in mind ,i.e international

standards. Health Level Seven is discovered in 1987 is an ANSI-accredited non-profit framework or organisation that controls the world health data globally by creating some sort of rules and implementing them for the well being of the patients so that the patient can access the data from any where int the world and life can be saved. Health Level Seven dream search out develop a foundation for interoperability in the healthcare rule, claims Mauro Regio (2005).The administrators or staff in the healthcare sector industry are intended to make a certification valid and that is HL7 which will indicate the proficiency of the employee who are working in the it sector. The level of understanding that an employee must hold that even hospital must seek for it employee can be guaranteed by HL7 certification. There are many standards or versions of HL7 and the most popular among them is HL7 version3. The purpose of this standard is to help if all the healthcare workflows. It was in the year of 1995 when the process of developing version3 begins, which takes a quite long time to publish in the year go 2005. The HL7 -Version3 standard in contrast to version 2 is based on the latest technology and oops i.e object oriented which is quite efficient for the programming. One of the superior company in the software industry is also involved in the HL7 and is tremendously contributing to the organization for a decade so as to contribute in sector of health industry and help the patients. The latest version that is version 3 is continuously evolving and is creating some really important features that helps in interoperability between healthcare systems. The Border is an object oriented model created using some of Story3 approaches. But a rehashed view of the basic elements of Border / HL-7 is likely in figure 2.

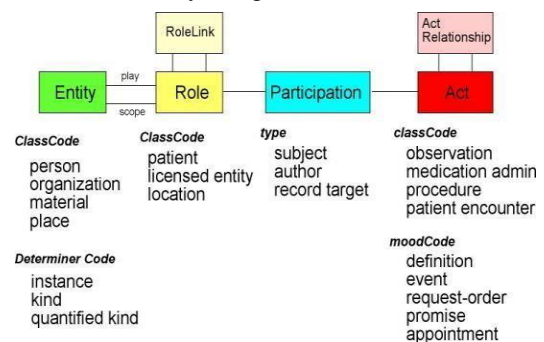
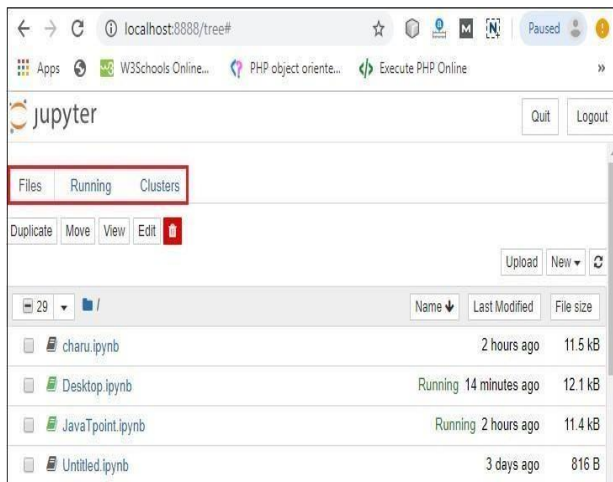


Fig. 2 — RIM / HL-7 model

V. E – HEALTHCARE MANAGEMENT SYSTEM AND ITS FEATURES

There are various activities that are analysed and discussed in E health care management system so that the



system become effective for the patient to tackle the problem in a much more convenient way.

The tasks that are critical in healthcare information systems are as follows :

(1) Storage of the user data and its monitoring :

- Accurate and electronically stored medical records of cases like medicines disinclination are handed.

(2) Disease Prediction Aspects :

- Based on the Symptoms that are provided by the user, it can predict the disease .
- This model can also predict the disease with an accuracy of greater than 97%.

Few of the positive e-healthcare management solutions across all divisional domains include the Social Sciences concerned with information Center, India's e-Hospital resolution (NIC, 2013). It is a Hospital Administration Order for nursing homes with a workflow-based ICT resolution that is meant for the wards in the government area. This is a typical spreadsheet that manages important hospital operations like user health etc. It is either succession of increase to an economic system or a patient-principal strategy.

For multispecialty emergency rooms, the E Healthcare Administration Resolution is produced to address different types of nursing facility presidency and administration processes. In order to enable efficient resolution compensate patient care, nursing home administration, and

detracting financial book keeping, in a fluid flow, it is a linked end-to-end healthcare management system.

Fig.3 Jupyter Notebook - For training the model

Table-1st : NIC, E- Healthcare Management Solution Special Features

Ser.No	Features
1	ISO / IEC 9126 Certified
2	It is based on HL7
3	Multiple language support
4	Language such as ICD-9 etc.
5	Report on customisable issue
6	Supports access control and Security
7	Provides security of data and its privacy
8	Logs
10	Abstraction of user history
11	Interface of Touch Screen
12	Available on all platform such as Mac

VI. CASE: FUJISOFT – HIS

A leading provider of software products, Fuji Soft is based in Japan. It offers one of the top hospital administration solutions on the planet with a long heritage of proprietary software that has been evolving since the 1970s. Fuji delicate(2012) asserts that wards administrative environments are undergoing a significant transformation. For instance, new hospital accounting regulations have simplified financial reports bureaucracy (by removing charges for available funds), and clinics are implementing a medical inclusive payment system based on DPC (Diagnosis Procedure Combination). Additionally ,a new method of raising money for administration (which includes some of the securing medical facility salaries and the distribution of clinic bonds) are used.

VI.A Fuji soft HIS functions

The various functions of Fuji soft sanitarium solutions can be epitomized as below table2.

Table 2 –Fujisoft HIS Modules

S · N o	Module Name	Function
1	Home page	Healthcare Management System - Daily data handling and management
2	Hospital Comprehensive Physical distribution Management System	Total goods physical distribution management – purchase costs management
3	FS - Incident	Hospital Specific incident reporting system
4	Cash Collection Solution	Complete Sales / Cash collection management

6.2 Problems in Implementing of E – Healthcare System / HIS

To meet the requirements of the E-Healthcare Management system, a multi-dealer administration system or integrated structure is required. This system must be able to choose and combine the suitable result from those of many producers (clients). The successful implementation of contemporary E-Hospital management resolutions depends on the addition, exclusion, and composite integration of technology. Only via ongoing involvement in system design and construction in the healing region may establish talent and technical superiority increase to such an exact and effective decision in the choice of science and E-emergency room resolution management.

VII. PROPOSED ALGORITHM

One of the most important machine learning algorithm i.e random forest is a type of the supervised learning. It can be used in machine learning issues including both bracket and retrogression. It is founded on the idea of cluster learning which is the process of integrating various classifiers to address a complicated issue and hence enhances the trained model performance.

Random forest as the name suggests is a classifier that uses a number of decision trees on different subsets on the handed dataset and parse them to increase the dataset accuracy.

VIII. RESULT

After testing and training using a machine learning approach, we discovered that Random Forest's accuracy was far more effective than that of other algorithms. The confusion matrix for each algorithm should be used to determine accuracy. Using the accuracy comparison, we can say that random forest is the best among them, having an accuracy of 100% and having less training time compared to another algorithm, as shown in TABLE 3.

Random Forest

```
In [16]: from sklearn.ensemble import RandomForestClassifier

In [17]: random = RandomForestClassifier().fit(X_train,y_train)

In [18]: random.score(X_test,y_test)

Out[18]: 1.0
```

Fig 4: Score of Random Forest

SVM

```
In [22]: from sklearn.svm import SVC

In [23]: svm = SVC().fit(X_train,y_train)

In [24]: svm.score(X_test,y_test)

Out[24]: 1.0
```

Fig : 5 Score of SVM

Decision Tree Model

```
In [13]: from sklearn.tree import DecisionTreeClassifier
```

```
In [14]: decision = DecisionTreeClassifier().fit(X_train,y_train)
```

```
In [15]: decision.score(X_test,y_test)
```

```
Out[15]: 1.0
```

K-nearest Neighbour :

The score of SVM is 1 which indicates the accuracy is 100%.

The F1 score is also 1 which is same for other algorithm.

The time to train is 275 seconds.

Fig :6 Score of Decision Tree

```
In [26]: f1_score(svm.predict(X_test),y_test,average='micro')
Out[26]: 1.0

In [27]: f1_score(random.predict(X_test),y_test,average='micro')
Out[27]: 1.0
```

Fig 7 : F1 Score of SVM and Random forest

```
In [29]: f1_score(decision.predict(X_test),y_test,average='micro')
Out[29]: 1.0
```

Fig 8 : F1 score of decision tree

Since the F1 score is same for all the models , but for training the model the time to train the model is minimum for Random forest.

Table 3 : COMPARISON OF THE ALGORITHM:

Algorithm	Accuracy	F1 Score	Training Time(in sec.)
SVM	100	1	300
KNN	100	1	275
Decision Tree	100	1	185
Random Forest	100	1	150

Decision Tree Model :

The score of SVM is 1 which indicates the accuracy is 100%.

The F1 score is also 1 which is same for other algorithm. The time for training the model is 185 second as shown in figure 6 and 8

Support Vector Machine :

The score of SVM is 1 which indicates the accuracy is 100%.

The F1 score is also 1 which is same for other algorithm. The deciding factor in determining the best fit for the problem is the time to train the model , in this case it is 300 seconds as shown in figure 5 and 7.

Random forest algorithm is best among all other algorithm because:

- 1.The accuracy found in the random forest algorithm is high .This is because of the multiple decision trees and aggregates their predictions and also the factor of risk is minimum in this case. Hence the overall accuracy increases.
- 2.Apart from this the F1 score is also 1 for this algorithm and time to train the model is 150 seconds which is minimum among all the algorithms as shown in fig 4 and 7. and in the table 3.

rusty_sputum	:	YES <input type="radio"/>	NO <input checked="" type="radio"/>
lack_of_concentration	:	YES <input type="radio"/>	NO <input checked="" type="radio"/>
visual_disturbances	:	YES <input type="radio"/>	NO <input checked="" type="radio"/>
receiving_blood_transfusion	:	YES <input type="radio"/>	NO <input checked="" type="radio"/>
receiving_unsterile_injections	:	YES <input type="radio"/>	NO <input checked="" type="radio"/>
coma	:	YES <input type="radio"/>	NO <input checked="" type="radio"/>
stomach_bleeding	:	YES <input type="radio"/>	NO <input checked="" type="radio"/>
distention_of_abdomen	:	YES <input type="radio"/>	NO <input checked="" type="radio"/>
history_of_alcohol_consumption	:	YES <input type="radio"/>	NO <input checked="" type="radio"/>
fluid_overload.1	:	YES <input checked="" type="radio"/>	NO <input type="radio"/>
blood_in_sputum	:	YES <input checked="" type="radio"/>	NO <input type="radio"/>
prominent_veins_on_calf	:	YES <input checked="" type="radio"/>	NO <input type="radio"/>
palpitations	:	YES <input checked="" type="radio"/>	NO <input type="radio"/>
painful_walking	:	YES <input checked="" type="radio"/>	NO <input type="radio"/>
pus_filled_pimples	:	YES <input checked="" type="radio"/>	NO <input type="radio"/>
blackheads	:	YES <input checked="" type="radio"/>	NO <input type="radio"/>
scurring	:	YES <input checked="" type="radio"/>	NO <input type="radio"/>
skin_peeling	:	YES <input type="radio"/>	NO <input checked="" type="radio"/>
silver_like_dusting	:	YES <input type="radio"/>	NO <input checked="" type="radio"/>
small_dents_in_nails	:	YES <input type="radio"/>	NO <input checked="" type="radio"/>
inflammatory_nails	:	YES <input type="radio"/>	NO <input checked="" type="radio"/>
blister	:	YES <input type="radio"/>	NO <input checked="" type="radio"/>
red_sore_around_nose	:	YES <input checked="" type="radio"/>	NO <input type="radio"/>
yellow_crust_ooze	:	YES <input type="radio"/>	NO <input checked="" type="radio"/>

Submit Reset

Fig 9 : Input of Symptoms

visual_disturbances	:	YES	<input type="radio"/>	NO	<input type="radio"/>
receiving_blood_transfusion	:	YES	<input type="radio"/>	NO	<input type="radio"/>
receiving_unsterile_injections	:	YES	<input type="radio"/>	NO	<input type="radio"/>
coma	:	YES	<input type="radio"/>	NO	<input type="radio"/>
stomach_bleeding	:	YES	<input type="radio"/>	NO	<input type="radio"/>
distention_of_abdomen	:	YES	<input type="radio"/>	NO	<input type="radio"/>
history_of_alcohol_consumption	:	YES	<input type="radio"/>	NO	<input type="radio"/>
fluid_overload.1	:	YES	<input type="radio"/>	NO	<input type="radio"/>
blood_in_sputum	:	YES	<input type="radio"/>	NO	<input type="radio"/>
prominent_veins_on_calf	:	YES	<input type="radio"/>	NO	<input type="radio"/>
palpitations	:	YES	<input type="radio"/>	NO	<input type="radio"/>
painful_walking	:	YES	<input type="radio"/>	NO	<input type="radio"/>
pus_filled_pimples	:	YES	<input type="radio"/>	NO	<input type="radio"/>
blackheads	:	YES	<input type="radio"/>	NO	<input type="radio"/>
scurring	:	YES	<input type="radio"/>	NO	<input type="radio"/>
skin_peeling	:	YES	<input type="radio"/>	NO	<input type="radio"/>
silver_like_dusting	:	YES	<input type="radio"/>	NO	<input type="radio"/>
small_dents_in_nails	:	YES	<input type="radio"/>	NO	<input type="radio"/>
inflammatory_nails	:	YES	<input type="radio"/>	NO	<input type="radio"/>
blister	:	YES	<input type="radio"/>	NO	<input type="radio"/>
red_sore_around_nose	:	YES	<input type="radio"/>	NO	<input type="radio"/>
yellow_crust_ooze	:	YES	<input type="radio"/>	NO	<input type="radio"/>

You are diagnosed with ['Tuberculosis']

Fig 10 : Shows Output of the symptoms

Figure 9 shows the input taking of the symptoms given by the patient by checking one of the the option as “YES” and “NO” and figure 10 shows the output of the symptoms – In this case it is showing tuberculosis.

IX SUMMARY

Various advantages, disadvantages, and features of the E healthcare management system are described in their respective sections. The Healthcare management system highly depends on the management and training to use the software and the user-friendly environment. Its success depends on these factors. HIPAA privacy guidelines and HL7 / RIM framework are identified as the main determinants and metrics of Global compliance in producing and implementing a successful E - healthcare management system. Many studies show that the insights on the broader framework of the E–healthcare management system/HIS pave the way for future research on enhancements in the E-Healthcare Management domain.

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