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Preparing for tomorrows challenges today, with automation in hospitals

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Abstract: ***In this paper we are introducing a new technique called IVR (Interactive Voice Response) for automation of hospital with decision making ability. Now a days we are using traditional communication media such as telephone or landline in hospital, but with the use of IVR (Interactive Voice Response) technology we are able to configure this traditional communication media with automated telephone, answering machine which gives instruction to the patient to book appointments, provide guidelines or help. This technique will provide 24/7 medical support or services to patient and their relatives. The system provides required service which is previously stored in database and response through application such as TTS (text to speech) and IVR. The system automatically sends alert massages about vaccination, upcoming medical camp and appointment to patients. Using this technique we can reduce paper works which are usually done in many hospitals which will reduce human error also some manual mistakes. In this system we focus on simple and effective methodology for medical diagnosis.***

Keywords: IVR(Interactive voice response), Data Mining, SMS, Naive Bayas algorithm, K-Means Clustering algorithm, Apriori Algorithm.

1. INTRODUCTION

Today's small scale clinics and hospitals are lacking in providing accurate information to the patient's because they based on manual appointment scheduling approach. As Today's Healthcare professionals are overwhelmed with a huge amount of information generated from different sources. In this context, preventable medical errors are estimated to be the cause of thousands of deaths and loss of billions of dollars per year in all over the world. To reduce the human related errors, clinical decision support systems have been developed to help physicians and caregivers in practicing medicine recent years, many studies in health informatics of the clinical decision support systems and concluded that these systems are indeed helpful.In this system we use Naive Bayas Algorithm and K- means Clustering algorithm. In Naive Bayas Algorithm classifier techniques is particularly suited when the dimensionality of the inputs is high. Despite its simplicity, Naive Bayas can often out perform more sophisticated classification methods. Naive Bayas model identifies the characteristics of patients with disease. It shows the probability of each input attribute for the predictable state. It is useful when data is high, the attributes are independent of each other and when we want more efficient output, as compared to other methods output. The K-means clustering algorithm accepts two inputs the data itself and "k" the number of clusters. The output is K clusters with input data partitioned among them. The aim of K means (or clustering) is this: we want to group the items into K clusters such that all items in same cluster are as similar to each other as possible. To perform effective data mining[2], system performs classification, clustering and association of data used to identify the decision, symptoms and the respective diagnostics. Best solution for the patient is selected by association rule [1].

2. RELATED WORK

Now a days the data related to the patients information, information related to the diseases, their corresponding prescriptions also the information of pharmaceutical elements

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required to cure that diseases and the doctors or hospital staffs information is stored in conventional manner that is stored in some papers. The hospital staff do the paperwork to store this databases. The huge files are maintained to store the data. Also the patient have to fix their appointment with the doctors by approaching to the respected hospitals.

The current record management system leads to misplacement of drug details, payment details, and late release of reports and insecurity to records. This research project is aimed at computerizing all the records about staff, patients and drug suppliers. In order to achieve this goal, a thorough System checking and Study was carried out and data was collected and analyzed about the current system using document and data flow diagrams. The report production concept has been computerized therefore, no more delay in report generation to the hospital manager.

3. LITERATURE SURVEY

We have studied and shown various existing system and relative work done in hospitals. Also written their pros and cons. towards the end of the chapter, we give the scope of our project, area of our study, and area of our research topic.

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Also The use of email, and other forms of electronic messaging, is recognized as an essential tool to support the administration and communication of patient information. However the ease of transmission of clinical information must be constrained by adequate security protocols and guidance.[6]

4. ARCHITECTURE

The current work focuses on building the system based on the application such as IVR (interactive voice response) and TTS (text to speech) techniques. The patients can obtain the information only by communication with the web server located at the particular hospital. The web server will store the entire record of the patients also the doctors. Whenever the patient will ask for the services provided by the hospitals the web server will fulfill the patient needs as the entire record is already present in the web server. Patient can fix their appointment with the corresponding doctor using the IVR or TTS techniques. Also the doctor can access the information of their appointments. In case doctor is unavailable the patient can request for the first aid to the web server then web server will be invoked and it will provide the prescription or first aid to the patient.Various component used in architecture are as follows:-

- Web server: Web server is specifically used to store the record. Database can contain information of doctors, information of patients and the information related to medical diagnosis. This server is used to store the large amount of data for a long time.
- GSM: Global system for mobile communication is used in this system. The GSM is used by the patients to set communication with web server. GSM is used for establishing the connection.
- Auto answering machine: After establishing the connection the patients may ask for the information which is essential for them at this time the auto answering machine reply for the request and provide the required information.

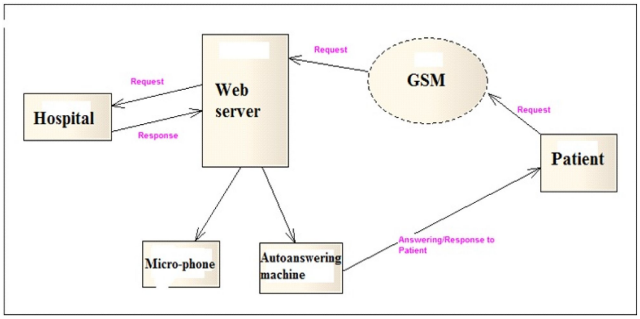

Figure 1 System Architecture

5. IMPLEMENTATION

The goal of the integration of the applications is to make the suitable accessing of the web services in short time and according to correct requirements. So that following components are important to implement ESB.

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1. Modules

2. Various Dataset And Their Implementation Using Algorithm.

3. Actual assembly.

5.1 Modules:

5.1.1 SMS Module:

Figure 2 SMS Structure

In respective project we are going to implement the SMS module which will help to take and fix appointment, update appointment and cancel appointment.

5.1.2 IVR Module:

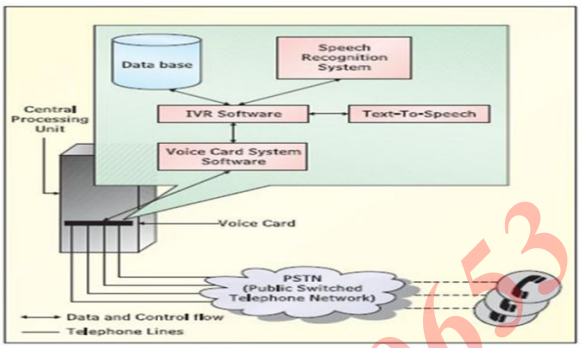

Figure 3 IVR Module

IVR module will help patients to ask about specific treatment is available or not and also to fix appointment or to cancel appointment. Patient can also get the information about various treatment available in hospital.

5.1.3 Web Portal:

In Web portal accessing the diagnosis reports and health awareness will be send to the patients email address. Patient and the doctor have to register themselves using this web portal.

5.1.4 Interface Module:

In Interface module the administrator will handle patient information, doctor information and he will have full access to the database, therefore he will be able to insert, update, or delete any data from database.

The interface module patient interface is also included using this interface patient can access detailed information about various services in hospital using hospital's web portal.

5.2 Various Dataset And Their Implementation Using Algorithm:

5.2.1 Patient Dataset:

Patient datasets are of various types. Patient dataset consist of some important medical information and the procedures carried out during the treatment of the patient. patient may have any type of diseases hence the hospital database can have collectively all patients data or medical history of patient saved differently.

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	Sample set A dataset		Sample set B dataset		Sample set C (Population) dataset	
	Controls N=266	Cases N=235	Controls N=415	Cases N=336	Controls (Cancer-free) N=811	Cases N=36
Tumor type, n (%)						
NSCLC	n/a	179 (76%)	n/a	301 (89%)	n/a	32 (88%)
Stage I		79 (34%)		170 (51%)		16 (44%)
Stage II		48 (20%)		45 (13%)		5 (13%)
Stage III		14 (6%)		44 (13%)		8 (22%)
Stage IV		3 (1%)		21 (6%)		2 (6%)
Stage unknown		35 (15%)		21 (6%)		1 (3%)
SCLC	n/a	53 (23%)	n/a	35 (11%)	n/a	2 (6%)
Limited SCLC		23 (10%)		6 (2%)		1 (3%)
Extensive SCLC		7 (3%)		26 (8%)		1 (3%)
Stage unknown		23 (10%)		3 (1%)		0 (0%)
Type unknown	n/a	3 (1%)	n/a	0 (0%)	n/a	2 (6%)
Gender, n (%)						
Male	185 (70%)	171 (73%)	265 (64%)[a]	218 (65%)	290 (36%)	15 (42%)
Female	81 (30%)	64 (27%)	148 (36%)	118 (35%)	521 (64%)	21 (58%)
Age						
Age, median [min-max]	65 [38-86]	65 [42-85]	62 [23-87]	67 [23-90]	60 [35-85]	70 [49-85]
Age, mean +/- sem	64 +/- 0.6	65 +/- 0.6	62 +/- 0.5	65 +/- 0.6	61 +/- 0.4	70 +/- 1.4
Race, n (% of known)						
Caucasian	n/r	n/r	n/r	n/r	721 (91%, n=789)	29 (85%, n=34)
African-American	n/r	n/r	n/r	n/r	37 (5%, n=789)	4 (12%, n=34)
Smoker						
Yes, n (%)	93 (35%)	108 (46%)	78 (19%)	175 (52%)	361 (45%)	18 (50%)
Pk-yrs, mean +/- sem	36 +/- 2 (n=92)	31 +/- 2 (n=86)	31 +/- 3 (n=69)	32 +/- 2 (n=147)	41 +/- 1 (n=346)	45 +/- 6 (n=18)
Risk (Modified Spitz)	3.0 (0.3)	3.3 (0.3)	3.1 (0.3)	3.4 (0.2)	2.4 (0.1)	5.9 (0.6)
Ex, n (%)	144 (54%)	67 (29%)	237 (57%)	112 (33%)	331 (41%)	16 (44%)
Pk-yrs, mean +/- sem	32 +/- 3 (n=105)	38 +/- 4 (n=37)	31 +/- 2 (n=223)	39 +/- 2 (n=72)	40 +/- 2 (n=315)	52 +/- 9 (n=16)
Risk (Modified Spitz)	3.8 (0.2)	3.7 (0.3)	3.4 (0.1)	5.1 (0.3)	3.7 (0.1)	5.8 (0.4)
No, n (%)	29 (11%)	24 (10%)	99 (24%)	43 (13%)	117 (14%)	2 (6%)
Risk (Modified Spitz)	0.2 (0.02)	0.1 (0.02)	0.1 (0.01)	0.2 (0.01)	0.1 (0.01)	0.1 (0.02)
Unknown	0 (0%)	36 (15%)	1 (0%)	6 (2%)	2 (0%)	0 (0%)

[a]Gender unknown for two subjects. n/a, not applicable; n/r, information not recorded; NSCLC, non-small-cell lung carcinoma; SCLC, small-cell lung carcinoma; sem, standard error of the mean; Pk-yrs, Pack-years. Rounding applied to percentages to ensure 100% totals.

Figure 4 Standard Dataset

Above figure shows the standard dataset of the cancer patient cases and the control measures. The dataset is stored in database using various algorithms which are as follows:

5.2.1.1 k-means algorithm:

K-mean clustering is the process of portioning or grouping given set of pattern. K-mean method has been shown to effective in producing good clustering results for many practical applications. As shown in figure it is used to finding the various tumor types [3].

5.2.1.2 Apriori Algorithm:

Apriori algorithm is an influential algorithm for finding frequent data set. It is used to finding the medicine frequent items and finding the male and female patient suffering from various symptoms of tumor. It helps to make a frequent dataset of the controls and cases as shown in figure [4].

5.2.1.3 Naive bayes:

Naïve bayes is the classification algorithm for finding the probability of diseases or tumors according to symptoms. It also identifies the characteristics of patients with diseases[5].

5.3 Actual assembly:

Figure 5 Actual System

Figure 5 shows the Actual System of a system which is being used in automation of hospital.

For the purpose of analyzing incoming calls and requests the system responds using microcontroller and DTMF assembly.

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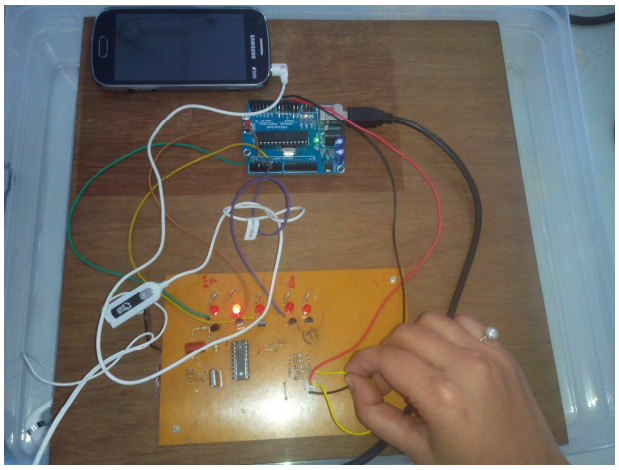

Figure 6 Microcontroller and DTMF assembly

Figure 6 shows Microcontroller and DTMF assembly. DTMF card sense the different inputs and forward it to microcontroller and microcontroller forwards it to the main system from where the required request is served.

6. ADVANTAGES

To reduce human related error.

To maintain large amount of data.

It allows SMS that is short message service.

It provides services 24/7.

It reduces paper works.

7. CONCLUSION

The goal of this project is making small scale clinics and hospital atomized. Server works 24/7 without any human involvement. It is well proven that IVRS controls damages and waste due to careless human error and poor management up to 30 percent. This adds value in terms of direct cut in cost and better utilization of resources. When the data is high, when the attributes are independent of each other, When we want more efficient output, as compared to other methods output the system is useful. The system is mainly used to store huge amount of data/information. To extract this data mining is used in automated way which is useful for saving time that is usually required to extract data manually. Also the Human errors, manual mistakes are overcome. As the time required for extraction data is less patient and also the hospital staff consume their time and obtain the information which only important to them rather than whole information associated with requested terms.

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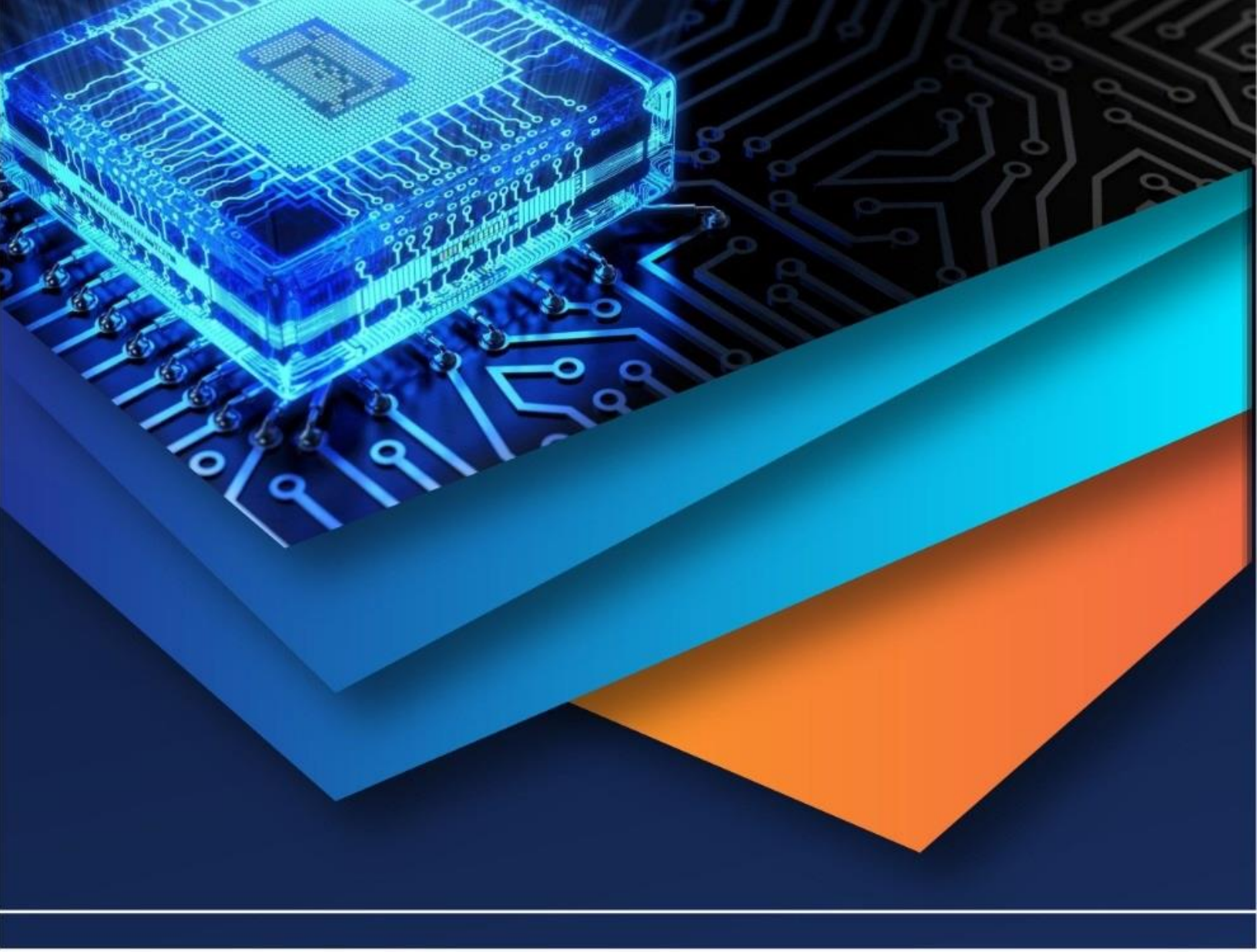

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