



An Efficient Emergency, Healthcare, and Medical Information System

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The call center of Emergency Management and Research Institute took up the case and identified the exact location where the patient had collapsed.

When attending a call, the user check for the similar calls and search for the ambulance which is located to that area and ambulance is staffed by:

- One driver
- One helper
- One experienced paramedic
- One trained medical officer, if required

For efficient medical monitoring of the patient's condition, the institute has qualified personnel with knowledge and skills sufficient to evaluate and stabilize patients with potentially lethal or disabling conditions.

Keywords : IEHMS, Emergency Service Manager (ESM), Helper.

GJCST-E Classification: J.3



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I. INTRODUCTION

Nowadays, Intranet plays a significant role in connecting all the participants in the health community. It is used to control remote medical equipments, communication between parties such as patients and doctors, search for needed information, transferring text, graphics, audio and video files as well as supporting collaboration in real-time.

Many of the current Indian healthcare, medical information and emergency systems are still paper-based and stand alone systems that do not fully utilize the Internet, multimedia, wireless and real time technologies. The system will revolutionize the delivery of emergency medical services, like ambulance, first aid etc, the call center of Emergency Management and Research Institute took up the case and identified the exact location where the patient had collapsed.

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II. EXISTING MEDICAL RELATED APPLICATIONS

Many of the current Indian healthcare, medical information and emergency systems are still paper-based and stand alone systems that do not fully utilize the Internet, multimedia, wireless and real time technologies.

We can summarize the drawbacks for such systems as:

- Lack of global shared system that is being used by all the emergency and healthcare centers
- Several of the medical centers that use electronic medical storage system for storing patients' information are window-based.
- Lack of utilizing open source software, which results in expensive to maintain systems.
- Lack of supporting multimedia environment, real-time and mobility technology
- Lack of integration between medical and emergency systems
- Lack of automatic generation for Plan of Care (the *Plan of Care* is a document created to finalize the treatment order)

An emergency system reduces the risk of an emergency case to the health and safety of persons and valuables by providing an effective means of communication with relevant authorities, safety guidelines and measures to be taken in an emergency situation. Several of these systems are normally rely on the existing telephone and other communications infrastructure via operators and service personnel; therefore they suffer from several drawbacks:

- Require prior knowledge on how to behave under each situation.

- Require effective description for the emergency case and location to the emergency personnel on duty.
- The person reporting the emergency has to wait for a response before passing on the message.
- Lack of usage for advanced capabilities of multimedia technology such as video, graphs and pictures.
- Lack of integration with medical information systems.

Many hospitals' emergency centers are not efficient enough because the big number of emergency cases, which is not easy to be handled. In an emergency department, most likely a nurse will determine the severity of the wound and check patient's vital signs such as temperature, blood pressure and heart rate. Additional personal information and

Medical history has to be obtained. In case patient's information is stored in another clinic or hospital they have to be obtained. Unless the patient has brought the personal file along, getting the required information will slow down the process. An emergency physician will have to examine the patient. In some cases, the patient needs great attention and sometimes the surgery room or other devices will be needed. All these will have to be arranged in timely manner, which in general is not the case. The lack or misunderstanding of ethical principles for people related to medical environment is another important problem that is reflected in the behavior of people as client or medical related staff, which affect the whole process.

III. INTEGRATED EMERGENCY, HEALTHCARE AND MEDICAL INFORMATION SYSTEM (IEHMS)

To overcome the weakness of the current Indian medical related system; we propose this project, which is an Integrated Emergency, Healthcare and Medical Information System (IEHMS). It provides an easy to use, efficient and non-expensive web-based system while making use of real time and open source technologies. The main features of this system can be summarized as:

- Creating a virtual local community
- Investigating and overcoming the weaknesses of the current medical emergency systems
- Offering real time communication between the client/patient and the emergency officer through:
 - ✓ Telephone Call
 - ✓ SMS (Short Message Service)
 - ✓ MMS (Multimedia Messaging Service)
 - ✓ Email
- Developing a real time agent based medical emergency system by using latest technology
- Offering User friendly web interface application:

- ✓ For the emergency center/hospital staff to interact with the client/patient.
- ✓ To provide doctors with up to date medical records for the patient(s)
- ✓ To provide patients with up to date personal medical related data as well as customized disease-related information.
- Offering guidance and address to the nearest emergency center or hospital.
- Arrange all the required equipments needed in emergency cases (emergency room, surgery room, special tools needed, assign a doctor to the case, automatically inform and call the doctor, etc.)
- Offering ethical principles for people related to medical environment.

It provides an easy to use, efficient and non-expensive web-based system while making use of real time and open source technologies. The system provides an integrated medical database, which can provide stakeholders with related medical information. The registered users can log into the system to access or provide medical information based on their accessing privilege. The medical information can be stored in a variety of multimedia forms such as video, audio, pictures and text. For example, in addition to text description of patients' historical medical information, graphic images such as X-rays or video files of doctors' discussion about the disease can also be saved in patients' record.

The system will have the capabilities for finding the patient location based (in case of an emergency call) and suggest the nearest emergency center, arrange all necessary related patient information to be ready for the physician when the patient arrives, assigning a doctor to the patient based on the availability of the doctors and list all necessary requirements (if any) such as special devices or surgery room.

The system is an open real-time client-server environment with highly available capabilities. The client system is loaded with multi-form interfaces, database access functionalities, and manipulation tools.

The scripting language used to build the system is Java and the database utilized is Oracle10g. Oracle10g is a true multiuser, multi-threaded SQL database server. JavaScript is an HTML-embedded scripting language. The goal of Java script is to allow web developers to write dynamically generated pages. By implementing Oracle and Java technologies together, one can design a functional web-based database quickly.

IV. IEHMS SYSTEM DESIGN

Figure 1 shows the architecture of the overall system that consists of the following components:

Web Server: will listens for requests from Web browsers and upon receiving a request for a file sends it back to the browser. It will host the program and control information for the system.

In my project Apache Tomcat web server is used for this purpose.

Database: this is a fundamental part of the system. It stores all important and detailed information about the system stakeholder such as general users, emergency authorities, doctors, patients, hospitals and emergency centers, places or locations and events within the area of implementation. Beside that there is detail set of SMS, MMS, phone calls, and Emails which are suitable for different emergency and guidance cases. Hence it has both temporal validity and precise timing constraints, which allow it to store the most recent data and effect instant changes as soon as they occur.

Web Interface: The interface is simple, user friendly and requires little input from the user, mostly in the form of choices. It is based on Web 2.0 technology

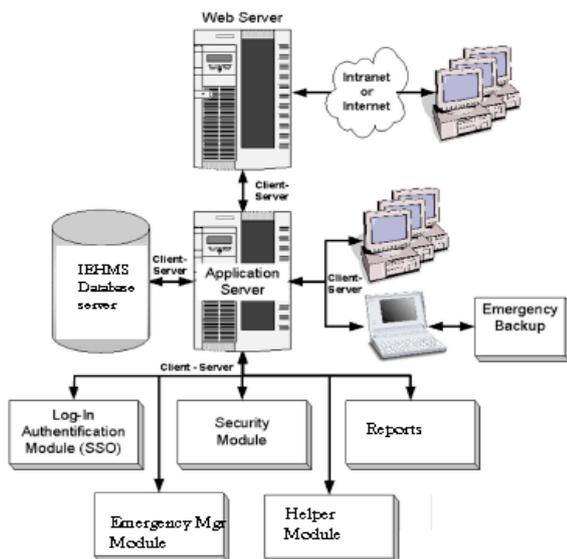


Figure 1 : Overall IEHMS architecture

a) Vision

This project deals with develop Health Services Booking System. The system will providing ambulances and staff to deal with medical emergencies services.

b) Project Specification

This system can be used as an application for the Medical service centers to manage the ambulance information as well as the immediate responses for needed people. The system also maintains the information of Patients.

c) Functional Components

Community-Based Planning: Ambulance services must be represented in the planning processes at the local, state and federal level.

Personnel Protection & Safety: All medics, including those who have the potential to respond in a mutual aid capacity, must have appropriate access to personal protective equipment, training, exercises and vaccines and antidotes.

The call center of Emergency Management and Research Institute took up the case and Geographical Information System (GIS) identified the exact location where the patient had collapsed.

When attending a call, the user check for the similar calls and search for the ambulance which is located to that area and ambulance is staffed by:

- ✓ One driver
- ✓ One helper
- ✓ One experienced paramedic
- ✓ One trained medical officer, if required

In briefly the ambulance possesses all equipment standardized to enable a flawless transfer of patient during interruption of drug therapy or monitoring.

User Interface Requirements

Browser Based

Database Requirements

Centralized

Integration Requirements

Web/Pervasive enabled

Preferred Technologies

Solutions must be created using

- HTML, CSS (Web Presentation)
- JavaScript (Client-side Scripting)
- Java (as programming language)
- JDBC, JNDI, Servlets, JSP (for creating web applications)
- Eclipse with MyEclipse Plug-in (IDE/Workbench)
- Oracle/Ms-Access
- Windows XP/2003 or Linux/Solaris (Operating System)
- Tomcat5.0.

Other Details

The application should be highly secured and with different levels & categories of access control.

V. PRELIMINARY RESULT ANALYSIS

This research paper is work toward defining preliminary version of IEHMS system. A prototype as part of the suggested system has been build and some of the above mentioned features have been implemented. They include client application, administrator application, doctor application and mobility access system application. Client application is the interface between the user and the system. Figure 2 shows a simple diagram of the client application architecture. It uses the Data-Manager layer to access and modify the database. The users have to be

authenticated before they start using the system. The authorization function is global for all types of users, however the interface from where the users login is separated.

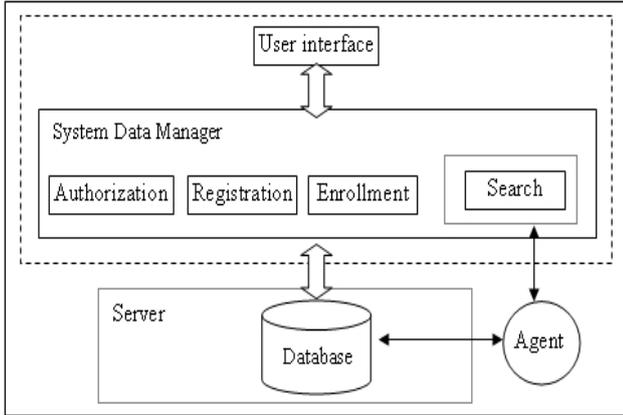


Figure 2: Client application architecture

Emergency service manager application is responsible for managing the system configuration, management of the system users, medical information, patients, doctors, hospital staff, etc. Figure 4 shows the interface for adding new doctor work schedule. Emergency service manager system is component based designed so that different components can be easily added at anytime to extend the functionality of the system.

The screenshot shows a web interface with a navigation bar containing 'Home page', 'Patient', 'Staff', 'Ambulance', and 'Reports'. Below the navigation bar is a 'WELCOME TO' message. The main content area is titled 'New Staff member Form' and contains several input fields: 'First Name' (Kishore), 'Last Name' (Kumar), 'Role of the Staff Member' (a dropdown menu set to 'Doctor'), 'Phone' (9898556325), 'Email Id' (kk@yahoo.com), 'Location' (Tirupati), 'Address' (100, TK street), 'Working Hours' (6-10), and 'Date of joining' (1-5-2012). A 'Submit' button is located at the bottom of the form.

The screenshot shows a web interface with a navigation bar containing 'Home page', 'Patient', 'Staff', 'Ambulance', 'Reports', 'Security', and 'Logout'. Below the navigation bar is a 'WELCOME TO' message. The main content area is titled 'Staff Members' and displays a table with the following data:

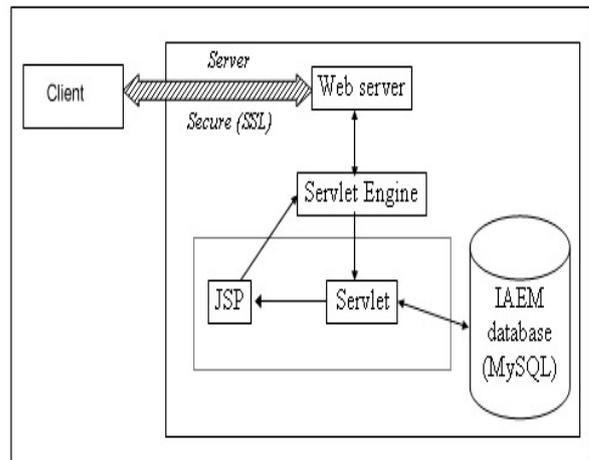
First Name	Last Name	Role of Staff Member	Phone	Email	Location	Address	Working Hours	Joining Date
Siva	kumar	Doctor	2502502525	siva@gmail.com	Tirupati	233, bhani nagar, tpt	9-12	2012-04-28
viji	kumar	Helper	1234567891	viji@gmail.com	puttur	123, sv nagar	6-10	2012-04-28
mad	hen	Driver	9876543211	mad@yahoo.com	chandragiri	2-3/1, Bazar Street	10	2012-04-28
chiru	raj	Doctor	1478523699	chiru@gmail.com	Tirupati	Tk Street, Tirupati.	6-12	2012-04-28
Jyothi	kumar	Helper	9290135896	jyothi@gmail.com	chittoor	3-2, dasari street	10	2012-04-28
Gyana	nanda	Driver	9638527411	gyana@yahoo.com	kadapa	69-2, kumar street	24	2012-04-28
Kishore	Kumar	Doctor	9898556325	kk@yahoo.com	Tirupati	100, TK street	6-10	2012-05-01

WELCOME TO

The screenshot shows a web interface with a navigation bar containing 'Patient Registration Form'. Below the navigation bar is a 'WELCOME TO' message. The main content area is titled 'Patient Registration Form' and contains several input fields: 'First Name' (Siva), 'Last Name' (kumar), 'Date of Birth' (16-5-2012), 'Location' (chandragiri), 'City' (chittoor), 'State' (ap), 'Address' (100,svnagar), 'Phone Number' (9966332214), 'Patient Height' (5.6), 'Patient Weight' (53), 'Date Of joining' (1-5-2012), and 'Type of Communication' (a dropdown menu with options: Phone, Phone, SMS, Email). A 'Submit' button is located at the bottom of the form. A thought bubble next to the form contains the text: 'Our proposed system can offer: SMS, MMS, Phone call, Email.'

Figure 4: Adding and viewing staff details

Emergency service manager application allows doctors to access past medical reports on patients as shown in Figure 5, summary of patient's records, record diseases and appropriate medicine after consulting a patient, record diseases and any related treatment, etc.



The screenshot shows a web interface with a navigation bar containing 'Patient Details'. Below the navigation bar is a table with the following data:

First Name	Last Name	Date Of Birth	Location	City	State	Address	Phone	Height	Weight	Join Date	Type of Message	Ambulance Status	Admission Status
Siva	kumar	17-1980	chandragiri	chittoor	ap	100,svnagar	9966332214	5.6	53	05-05-2012	Phone	Sent	Not Admitt

Figure 5: Registering and viewing the patient details

After this the application is used to admit the patient after releasing the ambulance. Figure6 show how to allocate the Doctors, Helpers and particulars of the patient will be maintained.

Figure 6 : Admitting the patient

a) Allocating staff members to an Ambulance

This screen is used to allocate the staff members to an ambulance and the ambulance is staffed by:

- ✓ One driver
- ✓ One helper
- ✓ One experienced paramedic
- ✓ One trained medical officer, if required

Figure 7 : Allocating staff members to an Ambulance

b) Acknowledgement for sending the ambulance

This figure will display the acknowledgement for sending the ambulance.

First Name	Last Name	Date Of Birth	Location	City	State	Address	Phone	Height	Weight	Join Date	Type of Message	Ambulance Status	Admission Status
Siva	kumar	17-1980	chandragiri	chittoor	ap	100,svnagar	996632214	5.6	53	01-2012	Phone	Sent	Not Admitt.
Venkatesh	p	29-1987	puttur	Chittoor	ap	25,tankbund	9999634612	5.7	75	05-2012	SMS	Not Send	Not Admitt.

Figure 8 : Acknowledgement for sending the ambulance

c) Releasing the Ambulance

This screen is used to release the ambulance which is sent by the helper to the location, where the patient has been collapsed. After releasing the ambulance, the status of the ambulance will be available

at particular location or the ambulance will be hospitalized.

Figure 9 : Releasing the Ambulance

It will display the acknowledgement of the releasing the ambulance.

First Name	Last Name	Date Of Birth	Location	City	State	Address	Phone	Height	Weight	Join Date	Type of Message	Ambulance Status	Admission Status
Siva	kumar	17-1980	chandragiri	chittoor	ap	100,svnagar	996632214	5.6	53	01-2012	Phone	Hospitalized	Not Admitt.
Venkatesh	p	29-1987	puttur	Chittoor	ap	25,tankbund	9999634612	5.7	75	05-2012	SMS	Not Send	Not Admitt.

Figure 10 : Releasing the Ambulance

d) Admitting the patient

This page is used to admit the patient after releasing the ambulance. This page will also allocate the Doctors, Helpers and particulars of the patient will be maintained.

Figure 11: Admitting the patient

e) Acknowledgement for admitting the patient

This page will display the acknowledgement for admitting the patient.

First Name	Last Name	Date Of Birth	Location	City	State	Address	Phone	Height	Weight	Join Date	Type of Message	Ambulance Status	Admission Status
Siva	kumar	17-1980	chandragiri	chittoor	ap	100,svnagar	996632214	5.6	53	01-2012	Phone	Hospitalized	Admitted
Venkatesh	p	29-1987	puttur	Chittoor	ap	25,tankbund	9999634612	5.7	75	05-2012	SMS	Not Send	Not Admitt.

Figure 12 : Acknowledgement for admitting the patient

f) Discharging the patient

This page is used to discharge the admitted patient after he/she will be recovered.



Figure 13 : Discharging the patient



Figure 14 : Discharging the patient

g) Acknowledgement for discharging the patient

This page will display the acknowledgement for discharging the patient.



Figure 15 : Acknowledgement for discharging the patient

Once user generates a search request, the web server transfers further requests to the Servlet engine. The Servlet communicates with the database to obtain the required data. The request is forwarded to a Java Server Page, which then reads the data and forms the response HTML document. This document is sent to the client by the Servlet engine through the web server. Figure 7 shows the architecture of the data access system.

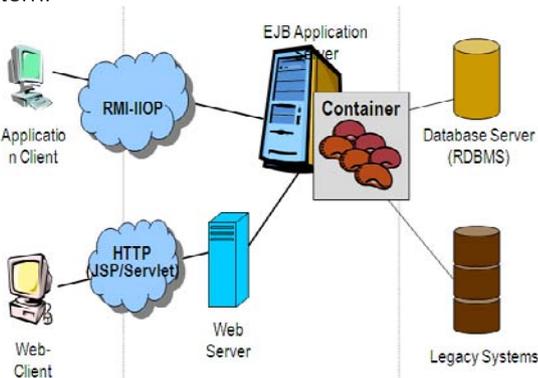
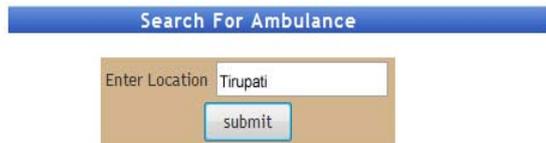


Figure 16 : Data access system architecture and JSP processing

The system offers advance search capabilities for finding the geographical location of the patient where he/she collapsed. Figure 8 shows the graphical user interface of the searching. Users can enter search criteria such as location of the patient collapsed. In this particular example, the user is searching for "Tirupati" as location. The search results will be shown in friendly interface. The paging capability allows the user to easily navigate between the returned results. The user will also be able to specify the number of records that is to be displayed at a time in the screen. Figure 8 also shows some sample results returned from the system.

WELCOME TO



Ambulance Number	Ambulance Type	Ambulance Location	Ambulance Equipment	Ambulance Status
100	Big Ambulance	Tirupati	medicine	Available
104	Small Ambulance	Tirupati	oximtr,FAB	Available

Figure 17 : Searching and Returning search results

This page will ask from and to date of patient registered.



Report 1: Patient Report

This page will display the details of the patient between requested from and to dates in the same webpage and there is an option called "xls" to export the result into Microsoft Excel sheet.

1	First Name	Last Name	Date Of Birth	Location	City	State	Address	Phone	Height	Weight	JOin Date	Type of Message
2	girl	babu	10/1/2008	SanathNagar	hyd	ap	ssoddd	332211	5	20	1/5/2009	Phone
3	girl	babu	10/1/2008	SanathNagar	hyd	ap	ssoddd	332211	5	20	1/5/2009	Phone
4	girl	babu	10/1/2008	SanathNagar	hyd	ap	ssoddd	332211	5	20	1/5/2009	Phone
5	girl	babu	10/1/2008	SanathNagar	hyd	ap	ssoddd	332211	5	20	1/5/2009	Phone
6	girl	babu	10/1/2008	SanathNagar	hyd	ap	ssoddd	332211	5	20	1/5/2009	Phone
7	girl	babu	10/1/2008	SanathNagar	hyd	ap	ssoddd	332211	5	20	1/5/2009	Phone
8	girl	babu	10/1/2008	SanathNagar	hyd	ap	ssoddd	332211	5	20	1/5/2009	Phone
9	girl	babu	10/1/2008	SanathNagar	hyd	ap	ssoddd	332211	5	20	1/5/2009	Phone

Report 2 : Patient Report

This Microsoft Excel sheet denotes the result of the patient those who are registered between from and to dates.

h) Report of Discharged patients

This report will display the details of discharged patients those who are discharged between from date and to date.

Welcome to

Discharged Patient

From Date:

To date:

Report 3 : Discharged patients Report

The RDBMS used to host the data is Oracle which is open source software. The system database consists of a number of tables. A short list of tables and their description is included in the Table 1. Each of the tables consists of a certain number of related fields.

Table name	Description
Ambulance_Det	Details of the Ambulance
Ambulance_Inf	Information of an ambulance
Patient_Info	Patient information of ambulance
Patient_Discharge_info	Patient discharge information
Patient_det	Patient personal information
Login_audit	Audit details of logged user
Login_det	For user Authentication
Login_profile	To maintain the profile of the user

Column Name	Data Type	Nullable	Default	Primary Key
SID	NUMBER	No	-	1
FIRSTNAME	VARCHAR2(20)	Yes	-	-
LASTNAME	VARCHAR2(20)	Yes	-	-
STAFFTYPE	VARCHAR2(20)	Yes	-	-
PHONE	VARCHAR2(20)	Yes	-	-
EMAIL	VARCHAR2(20)	Yes	-	-
LOCATION	VARCHAR2(20)	Yes	-	-
ADDRESS	VARCHAR2(20)	Yes	-	-
WORKINGHOURS	VARCHAR2(20)	Yes	-	-
JOININGDATE	DATE	Yes	-	-
STATUS	VARCHAR2(20)	Yes	-	-

T 1: Partial list of database tables
Figure 18 : Staff_det table details

VI. CONCLUSION

The study of the current Indian emergency, healthcare and medical information systems shows that they have several drawbacks such as lack of sharing between hospitals, no integration between emergency, healthcare and medical information systems, lack of utilizing real-time and open source technologies, still some parts are paper-based and stand alone systems. Thus, this paper is to develop an integrated Emergency, Healthcare, and Medical Information System (IEHMS) that can overcome many of the above problems. The proposed system contrast with the traditional approach in which, health professionals would need to gather information from many different devices or locations in the medical center to obtain a complete picture of a patient's status.

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