

# E-Arogya

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## Open Health Care Information System

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## **What is E-Arogya?**

E-Arogya is a comprehensive health care solution, which covers the administrative as well as the functional part of a health care organization. It is designed for multispeciality hospitals, to cover a wide range of hospital administration and management processes. It is an integrated end-to-end Hospital Management System that provides relevant information across the hospital to support effective decision making for patient care, hospital administration and critical financial accounting, in a seamless flow.

Hospital Management Information System solves your day to day running of a health care organization.

The basic objective of E-Arogya is to cover every possible requirement of the health care sector on a functional domain. At the same time it would construct a consolidated DATABANK, and use its own data-mining tool to fish out relevant data to get the effective MIS and analysis reports as per WHO guideline.

**In short all legacy and isolated solutions would be replaced with a single window integrated solution.**

## **Background of E-Arogya**

As an Independent Software Vendor we have come across different types of requirements placed by different clients. At the same time, our self-funded encapsulated user/market surveys have revealed the need for an integrated solution in the healthcare sector for the benefit of both the customer/patient as well as the doctor/management. A properly designed software solution can actually put an end to much of the hassles encountered by both the aforementioned groups.

In most hospitals the need of the hour is an in depth study of the existing procedures to streamline them. The current procedures may have been effective when incorporated but since then, the business requirement has changed, the environment has changed, the doctor/patient ratio has changed, the investigating techniques have changed, the surgical procedures have changed and the patient population has exploded

## **Basic Differentiators**

### **Customization**

Every hospital is unique and has its own peculiar functioning procedures and methodologies. It is therefore necessary to develop a software to cater to these requirements. Accordingly a consulting team headed by a project manager will study the requirements, analyze them and then proceed to design an application specific to the organization.

### **Robust Design**

### **Totally Paperless Automation**

From the time the patient presents himself at the reception desk to the time he is discharged, every activity is recorded through a computer node on to the server. The same information about him, when needed is retrieved through a node from the server. There is no paper trail.

### **A Wizard For The Doctor**

The system is a complete wizard for a doctor. Anything that needs to be done for, or to a patient can be ordered, planned and executed

The application will be designed with JSP as front end, PostgreSQL as backend and Ajax as middle layer. This gives the most robust design. The entire data is stored and managed in one database. The above are all open source tools free of the burden of licensing charges. The end user shall have to pay only for the Solution and its utilities

### **Thin Clients: Most Economical & Secure Configuration**

With a browser as the front end the client is very thin. The entire data is stored on one server. The hospital can acquire the most economically priced computers for the front end as they don't need any drives or software to run. A minimal RAM is required. The savings are phenomenal. The system becomes absolutely secure as no data resides on the clients. The moment a user sign's off the node becomes a dud box.

### **Physical Security**

The system lends itself to physical security because there is only one server to protect.

### **Data Security**

All the data resides on the server. The client has only adequate software to run a browser. Each user has privileges granted to him/her by the administrator. He/She may use the system only after logging in and that too only to the extent that is needed by him/her and allowed to him/her. This ensures the information is available on a need to know basis. The software is so designed that it protects the system. Once a user has logged out that node cannot provide any information to anyone.

### **Automated Reception**

The reception is divided into two windows. One deals with registration of new patients and the other deals with providing help to the visitors.

from the desktop of the examining doctor, and from one browser window. No new windows are opened and closed. No complicated training is required to use the software. Everything is self explanatory.

### **At the click of a button a doctor can**

- Check the availability of blood in the blood bank for an operation.
- Book an OT with entire staff and equipment for an operation.
- Chat with a surgeon to ask him to execute a surgery.
- Admit and book a bed in a ward.
- Order any kind of investigation.
- Read the results of any kind of investigation.
- Read entire clinical history.
- Ask the opinion of another doctor on the case.
- Check availability of medicines.
- Prescribe medicines.
- Enter charges.

### **Reception is completely computerized and deals with**

- Inpatient and outpatient registration and admission.
- Online bed allocation.
- Provide complete information about a patient to authorized visitors.
- Provide information regarding package deals for a patient for a fixed cost including company sponsored packages.
- Provide ready information about doctors and staff regarding scheduling and appointments.
- Health Cards
- Insurance

**Benefits****Routine Operations Streamlined**

- Documentation procedures made easy.
- Duplication of records eliminated.
- Repetitive tasks reduced.
- Information redundancy brought down.
- Possible human errors avoided.

**Organizational Productivity Improved**

- Doctors enabled to see more patients.
- Medication errors avoided.
- Standards of documentation improved.
- Consistency of right decision making at the right time.
- Staff time saved in the administration and management of Clinical data.

**Patient Care Improved**

- Out patient waiting time reduced.
- Medical records made easily accessible.
- Accurate patient information provided.
- Content of reports improved.
- Diagnostic test results validated.
- Patient vital signs monitored on line.
- Quality of care audited.
- General productivity levels increased.

**Revenue Management Achieved**

- Chargeable services to patients computed online.
- Bed occupancy information optimized.
- Dead stock in pharmacies and main stores avoided.
- Record storage space and record access times reduced.
- Ongoing manual labor utilized for patient care.
- Department viability analyzed.

**The Technology behind E-Arogya**

## ENVIRONMENT

**Technical Details**

Front end developed with JSP as front end, PostgreSQL as backend and Ajax as middle layer.

**Future Software**

Smart Cards. Electronic Patient Records, portal service, tele medicine

**Future Hi-Tech Utility**

Introduction of web-enabled modules like E-Registration, E-Appointments, E-View Lab Reports...

## Technology Involved

As the total solution will be maintained from a centrally monitored server, we have to choose a solution based on web technology. More so because both front end and backend development tools will be based on open source technology.

The web server	:	Tomcat Apache Web Server
Solution Technology	:	JSP, Struts, AJAX
Language	:	Java
Database Usage	:	Postgre SQL
Middleware Technology	:	XML based layer..
Data tier	:	Stored Procedures
Report	:	Displayed in Internet Explorer and Excel based, PDF

## Key Technical Considerations

1. Based on open source technology and web architecture, hence OS independent.
2. Compatible with all open standards such as RDBMS, OODBMS, ORDBMS, ODBC, COM, DICOM III etc.
3. Comply with communication protocols and standards widely accepted within the European Union and internationally such as TCP/IP, SQL, HL7, EDIFACT etc.
4. Support of XML for export and import.
5. Capable of integration with other systems through stable and public interfaces.
6. Exploit its Object Relational Database Management System (ORDBMS) capability to facilitate the incorporation of new information subsystems, developed by the user or third parties, through the use of Rapid Application Development tools.
7. Allow the optional use of any available method for the capture of data such as keyboard, touch screen, stylus, voice recognition, voice transcription etc.
8. Allow the use of a wide variety of devices for the capture or access of data such as PC.s, notebooks, palmtops and mobile phones.
9. Interface with a wide variety of measuring instruments and equipment from which test results and image data may automatically be captured.
10. Allow for the possibility of introduction of mobile computing and wireless local Network systems to allow personnel to move freely in the hospital and have real time
11. Access to information without having to return to a fixed location to enter or view data.
12. Be capable of accepting image files from sources such as digital cameras, ultrasound, nuclear medicine and endoscopies.
13. Be capable of well-organised and indexed storage of information to allow efficient and reliable data retrieval for clinicians, researchers and other authorised health professionals.
14. Supports secure media archiving.
15. Be capable of maintaining an archive of scanned authentic report texts.
16. Provide easy and reliable procedures for backup and restore operations to be carried out at regular intervals.

## Why Open Source?

Motivations for using and developing open source software are mixed, ranging from philosophical and ethical to pure practical issues.

Usually, the first perceived advantage of open source models is the fact that open source software is made available gratis or at a low cost. But E-Arogya characteristic is not exclusive to open source software. Several proprietary software products are made available in similar ways (a prominent example is Microsoft's Internet Explorer). What really distinguishes open source software from software available with fee is the combination of effects due to the characteristics discussed in this section. All of them together produce a synergistic impact, which is the cause of the real advantages of the open source model. Let us provide some more detail on how these characteristics turn into advantages:

- *The availability of the source code and the right to modify it*
- *The right to redistribute modifications and improvements to the code*
- *The right to use the software in any way*
- *There is no one with the power to restrict in a unilateral way how the software is used*
- *There is no single entity on which the future of the software depends*
- *No "black boxes" are possible*
- *There is always the possibility of "forking"*
- *No per-copy fees can be asked for modified versions*
- *There are fewer conflicting priorities due to marketing pressures.*
- *It provides a new forum for democratic action*

## REQUIREMENTS

### Module Details of E-Arogya

#### **Front Desk Module**

*This module efficiently carries out all activities of the front desk, manages appointments for various consultants for various sessions, keep track of bookings for special investigations wards & surgical theaters etc..*

#### **Doctor's Console Module**

*This module records clinical notes of examination by date, Order Investigations, Record diagnosis, Prescribe medicines, Admit a patient etc.*

#### **Patient Module**

*This module captures patient data at time of registration, visit to the doctors, investigation and any other incident occurring in the line of diagnosis,*

#### **OT Module**

*This module helps to handle rescheduling and cancellation efficiently, manages operation theater activities effortlessly etc...*

#### **Dental Module**

*This module manages all activities of a Dental Clinic/ Poly Clinic. It helps build Dental Case Records with utmost ease, tracks patient referrals and cross referrals etc*

#### **Blood-Bank Module**

*This module comes with a vast library of Drugs, Non Drugs and Hospital consumables, follows international standardization of codes, Monitors and updates consignment registers etc...*

#### **Office Module**

*prescription, treatment, admission discharge and convalescence. It also manages patient records from Appointment to Discharge etc..*

**Investigation Module**

*It covers the entire gamut of invasive and non-invasive investigations. It also supports web based bookings and appointments for special investigations etc..*

**Pharmacy Module**

*This module manages all activities of a pharmacy from indent raising to dispensing, integrates data from all patient related modules on-line etc..*

**Billing Module**

*It completely automates Out-Patient and In-Patient billing procedure, updates services used by in patients instantly & dynamically. Generates quality reports depicting daily revenues, balance dues, department-wise revenues etc..*

**Inventory Module**

*It comes with a vast library of Drugs, Non Drugs and Hospital consumables, keeps track of suppliers and their quotes for future purchase, manages contract purchases, Ad-hoc purchases and cash purchases etc..*

**In-Patient Module**

*This module helps doctors to build clinical case records with minimal efforts and prescribe medicine. It also manages patient records from appointment to discharge.*

*This module manages all activities of the administrative department of a hospital, maintains employee records and their dependent details wherever necessary. It efficiently monitors Duty Rotor, Attendance Tracking leave register etc...*

**Occupation Module**

*Hospital Wizard efficiently manages the entire occupational health center. Provides ready access to medical checkups under various categories: Master Health Checkup and maintains the health record of all employees during their service etc...*

**Kitchen Module**

*Manages the hospital kitchen efficiently and completely. It schedules and updates In-Patient Diets on line and Has excellent control over dry and wet inventory. This module also Generates reports on daily consumption and requirement...*

**Insurance Module**

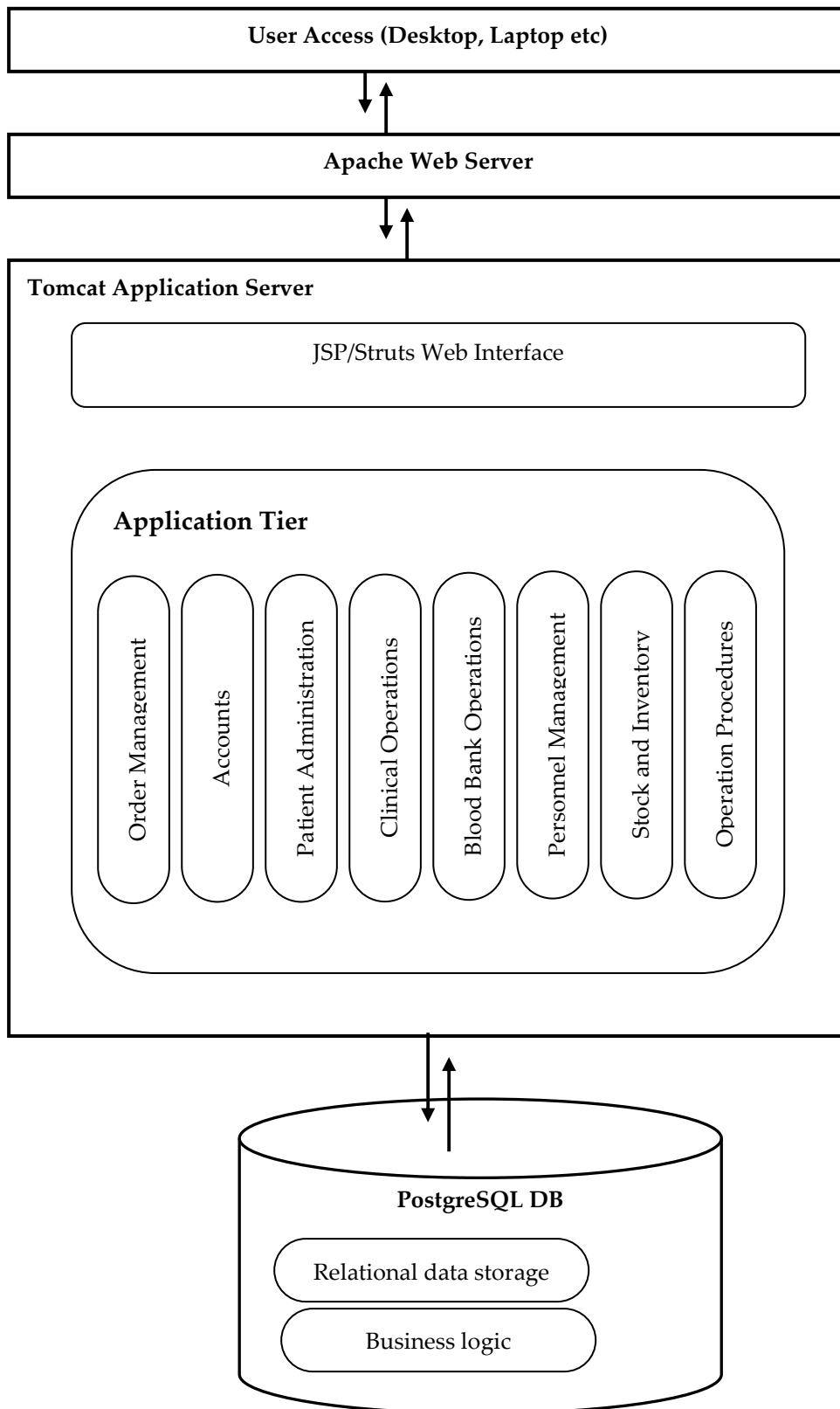
*This module Records patient demographics, insurance policy and payer details. It has modules built exclusively for generating, submitting and tracking of Insurance claims. It automatically generates all necessary supportive documents for claims..*

**A. GENERAL REQUIREMENTS**

1. The required Integrated Health Care Information System is expected to include the following modules in order to support the clinical, administrative and financial activities of a modern hospital.
  - a. Patient Administration

- b. Queue Management System for Day Care/OPD
- c. Hospital Order Entry and Management System
- d. Personnel Management
- e. Finance and Accounting
- f. Doctor's Pharmacy Prescription
- g. Logistics
- h. Stock Control/Inventory (Supply Chain Management)
- i. Software Administration
  
- j. Clinical Laboratory
- k. E-Arogyatopathology
- l. Blood Bank
- m. Coding of Diseases / Operations / Procedures
- n. Radiology/PACS
- o. Patient Data Archival System
  
- p. Health Smart Card
- q. Electronic Health Record and Reporting
- r. Laundry Management
- s. Canteen Management





**Non-functional Features of E-Arogya:**

1. The required system shall be a ready-made package with no or minimal modifications and is expected to meet the requirements of the Document.
2. Based on a friendly graphical user interface (GUI).
3. Web enabled via a secure Internet connection.
4. Remote use of the system.
5. Provide on-line enquiry facilities about information held in the system.
6. Support a multilingual user interface and data entry
7. Support concurrent use of other software such as word processing, databases, spreadsheets and graphics.
8. Have no limitation as to the number of users it is able to support concurrently.
9. Provide extensive, context sensitive on-line help.
10. Facilitate the introduction of an Electronic Health Record
11. Allow for the possibility of eventual conversion of hospitals and clinics into paperless & film less organizations.
12. Support the introduction of a Smart Card.
13. Allow for the provision of remote medical services (internet, telemedicine, robotics)
14. Provide access to external and internal data banks.
15. Be available 24 hours a day/365 days a year.
16. Allow up to 15% workload increased per annum.
17. Be capable of stepwise and modular implementation in order to give personnel reasonable time to adjust to the new procedures and practices that the system will introduce.
18. Provide Database and application software system mapping (Tables, DR Sets etc.)
19. Ability to communicate through any interface and standard to machines and applications.
20. Utilization of legacy systems
21. Make the fullest possible use of the existing hardware and software.
22. Allow any subsystem or module to be replaced or added independently of the other subsystems.
23. Capable of employing any connectivity system such as PSTN, ISDN, Radio, GSM, and GPRS etc.
24. Export or publish reports in other software programmes such as word processors, spreadsheets, databases and statistical tools.

**Security Features of E Arogya:**

1. Support an automatic log-off after a certain time period. e.g. 2 minutes or system administrator configurable time period.
2. Allow the sharing of information between all healthcare professionals.
3. Provide constant monitoring and troubleshooting of security system function.
4. Support active smart card system management.
5. Support host-based system security and card-based system security Standards
6. Support a formalised Systems Administration for the management of:
  - a. Backups
  - b. Anti-virus
  - c. Standards of clinical practice and hospital management
  - d. Software upgrades
  - e. Network management

- f. Database administration
- g. Security issues
- h. Data processing and management control

**Misc Features of E-Arogya:**

1. Support the framework and the set of health indicators in the WHO Health for All Database
2. Be capable of generating data compatible with the definitions of the health indicators Included in the above-mentioned frameworks in order to ensure alignment and Compatibility with the EU/US format
3. Specialties Patient Information Systems (including primary care)
4. Dental Patient Information System
5. Mental Health Services Module
6. Thalassaemia Files
7. Health Inspection
8. Immunisation Control
9. Intensive Care Units
10. Telemedicine/ Telematics etc.