

CUSTOMER REQUIREMENT SPECIFICATION


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Customer Requirement Specification for a Hospital Information Management System (HIMS), focussed at the Hospital Patient Information Management Module (HPIMS)				
This document is aimed at eliciting the Customer Requirement Specifications corresponding to a Hospital Information Management System, primarily focussed at the Patient Information Management Module.				
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Definitions, Acronyms and Abbreviations

This section provides for definition of all terms, acronyms and abbreviations required for interpreting the CRS. Well known abbreviations need not be stated.

1. SMTP- Simple Mail Transfer Protocol
2. HIMS - Hospital Information Management System
3. HPIMS - Hospital Patient Information Management System
4. HTTPS- Hyper Text Transfer protocol secure
5. TLS- Transport Layer Security
6. OPD- Outpatient Department
7. IPD- In Patient Department
8. VPN- Virtual Private Network
9. SFTP- Secure File Transfer Protocol
10. NABH- National Accreditation Board for Hospitals & Healthcare Providers
11. JCI-Joint Commission International
12. HIPAA- Health Insurance Portability and Accountability Act
13. HL7- Health Level 7

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Change History

This section describes the details of changes that have resulted in the current CRS document.

#	Date	Document Version No.	Change Description	Reason For change
1.	10.10.19	v001	First Revision	Registration and Billing modules common to both in-patients and out-patients have been separated as independent modules for reusability
2.	13.10.19	v001.1	Final Revision	Removal of inconsistencies in CRS document
3.				

1.0 Introduction

This section provides a brief insight about the document as a whole, its purpose and the target audience relevant to this document. This document is aimed at eliciting the Customer Requirement Specifications corresponding to a Hospital Information Management System, primarily focussed at the Patient Information Management Module.

Components of the healthcare industry which are primarily dependent on paper based documentation, primarily for patient information management are plagued by the following menacing problems :

1. **Lack of immediate retrieval means:** In order to retrieve data related to a patient's history, the hospital staff has to go through heaps of files and registers which is not only inconvenient but results in wastage of time.
2. **Lack of means for immediate information storage :** The information generated by various transactions takes time and effort to be stored at an appropriate place.
3. **Lack of prompt updation methods :** Various updations pertaining to patient details are tedious to make as paperwork is involved.
4. **Error prone manual calculation :** Manual calculations involved in billing, etc. are error prone and take a lot of time this may result in incorrect information.
5. **Preparation of accurate and prompt reports :** This becomes a difficult task as information is difficult to collect from heaps of registers which may have been stored irregularly in an unorganized manner.

Therefore, in order to tackle these issues, our objective is to develop a world class patient information management suite comparable to the state-of-the-art systems, driven by Internationally recognized standards with a seamlessly integrated architecture with the motive of providing a one stop paperless solution for patient information management meeting meaningful standards for reducing errors creeping into data entry and storage and preventing data loss, enhancing efficiency and productivity of the processes involved using optimal resources. Our software system is also focussed at improving ease of communication between patients and the hospital staff, increasing transparency and credibility employing state-of-art customizable, scalable and flexible technology with robust backup and storage features and the ease of use is targeted towards facilitation of execution of day to day routines in a convenient and hassle free manner. The primary target audience of the system are the patients, whose convenience is critical to ensure customer satisfaction and a wide variety of hospital staff at various roles in the hierarchy, ranging from receptionists to doctors, nurses and administrators.

The customer specification requirements pertaining to such a system have been elicited, analysed, modelled and documented in detail in this document. The remaining part of this document has been organized as follows.

This document is to be read by the development team, the project managers, marketing staff, testers and documentation writers. Our stakeholders, company manufacturing associated hardware, company providing embedded operating system, shareholders, and distributors who markets the finished product, may review the document to learn about the project and to understand the requirements.

1.1 Scope

This section of the document vividly defines the coverage and limitations of the proposed software system.

The proposed software is the core part of a larger Hospital Management System as the scope of this project is limited and targeted primarily at Patient Information Management. However the proposed system can be conveniently integrated with the other participating components to form a complete HMS.

The HPIMS is targeted towards two broad classes of patients namely, in-patients and out-patients. The system is meant to keep track of all essential details of both in-patients and out-patients including Patient id, name, date of birth, gender, city name, state name, phone number, id of doctor assigned, etc. to name a few, more of which have been elaborately portrayed in further sections. The system should facilitate convenient entry, storage and future retrieval of relevant information and thereby minimize the usage of paperwork in order to speed up patient handling and other daily routines at a low cost and employing minimal resources in an optimal way.

The primary features to be incorporated in such a system and the scope of this software include but are not limited to the addition, removal or updation of relevant patient information, appointment scheduling and management, elaborate dashboards for patients, portraying various essential details such as appointment, schedule, bed and ward allocation details in case of in-patients, medication etc. The system should also provide dashboards for the administrators and front desk staff so that they can keep track of the day to day proceedings of the organization and might even conveniently perform analytics to detect inefficiencies and optimize them. The necessary requirements for the creation of such a robust software suiting the standards of the organization concerned and comparable to the state-of-the-art systems have been classified broadly into functional requirements, non functional requirements, etc. to facilitate smooth implementation and enhance ease of mapping of CRS to SRS and have been elaborated in great detail in the further sections.

2.0 Product Perspective

This section of the CRS puts the product into perspective with other related products or projects.

The modules involved in this product which have been extensively elaborated in the requirements section are a part of Hospital Patient Management System, which is an independent component of HMS . It manages some of the activities of the hospital i.e, patient registration, in-patient management, out-patient management. Our modules are totally independent of other modules and can work independently.

2.1 *User Characteristics*

The system will be used in the hospital. The administrators, doctors, nurses and front-desk staff will be the main users. Given the condition that not all the users are computer-literate. Some users may have to be trained on using the system. The system is also designed to be user-friendly. It uses a Graphical User Interface (GUI).

Front-desk staff: They all have general reception and secretarial duties. Every staff has some basic computer training. They are responsible for patient's registration , check-in.

Administrators: They all have post-secondary education relating to general business administration practices. Every administrator has basic computer training. They are responsible for all of the scheduling and updating day/night employee shifts. Administrators in the wards are responsible for assigning doctors and nurses to patients.

Nurses: All nurses have post-secondary education in nursing. Some nurses are computer literate. Consulting nurses to whom patients give short descriptions of their conditions are also responsible for assigning patients to appropriate wards if the beds are available, otherwise putting patients on the waiting list. Nurses in wards will use the system to check their patient list.

Doctors: All doctors have a medical degree. Some have further specialized training and are computer literate. Doctors will use the system to check their patient's list.

2.2 General Constraints, Assumptions and Dependencies

This section of the CRS shall provide a general description of any other item that will limit the developer's option for designing the system.

This section shall list each of the factors that affect the stated requirements. These factors are not design constraints on the software but changes to them can affect the requirements.

General Constraints and Security consideration:-

- The system must be delivered by the deadline.
- The system must be user-friendly
- Only the administrator should be able to configure the software.
- The administrator should provide read and write access to all the staff
- There will be a 2 way authentication for the administrator - a login dashboard having a username and password field along with an OTP(one time password) generation sent to the registered email id of the administrator.
- The system must comply with Joint Commission International (JCI) standards define the performance expectations, structures, and functions that must be in place.
- The system must comply with NABH standards which provide a framework for quality assurance and quality improvement for hospitals. The standards focus on patient safety and quality of care. The standards call for continuous monitoring of sentinel events and comprehensive corrective action plan leading to building of quality culture at all levels and across all the functions.
- The system must comply with HIPAA, which is a series of regulatory standards that outline the lawful use and disclosure of protected health information (PHI). HIPAA compliance is regulated by the Department of Health and Human Services (HHS) and enforced by the Office for Civil Rights (OCR)

System Constraints :

The system must comply with at least the following requirement specifications :

CPU - Quad core (8 core)

Memory - 16GB

Hard disk - 500GB

Cache memory -

L1 D/I cache - 32KB per core

L2 cache - 256KB per core

L3 Cache - 16MB (could be shared across all cores or may)

Battery - APC Smart-UPS SMT1500

LAN Ethernet cables- Cat 6a

Assumptions and Dependencies :-

- It is assumed that compatible computers will be available before the system is installed and tested.
- It is assumed that the Hospital will have enough trained staff to take care of the system

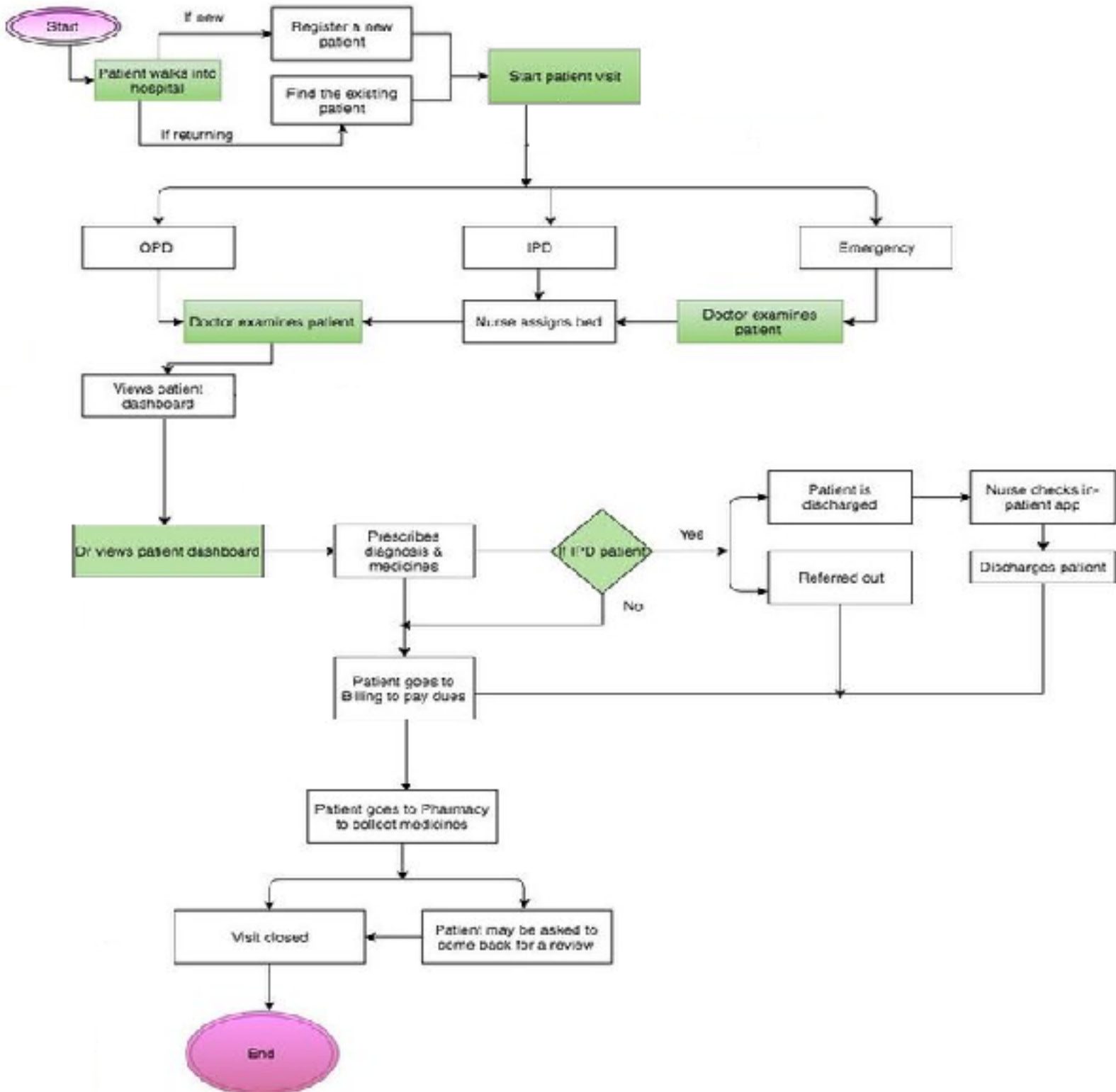
2.3 Risks

This section describes the risks that involved during this phase. Risks may be related to the resource requirements or functionality of the proposed system.

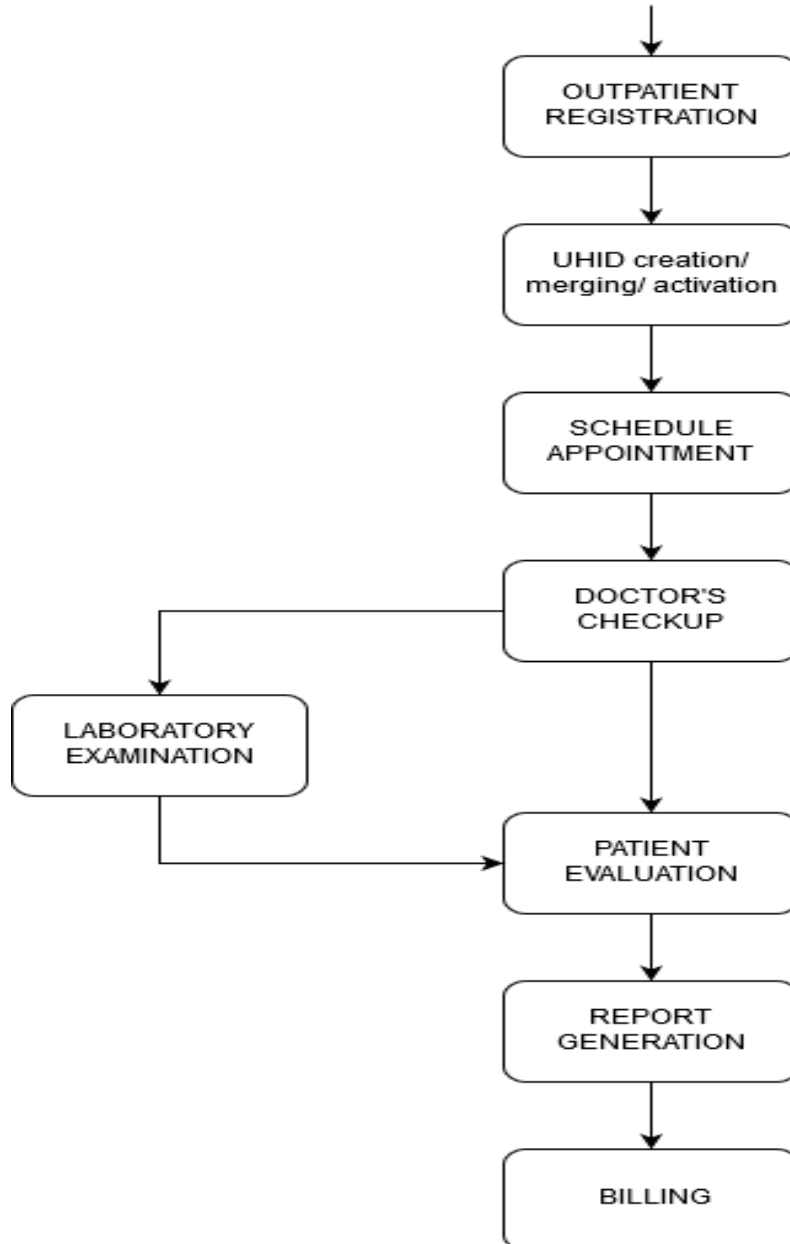
- Regulations and Standards are subject to changes which the existing system may fail to comply with
- Missing medical records of patients
- Wrong entry of medical records which may pose a potential threat to patient
- Any unanticipated event in the setting that results in death or serious physical or psychological injury to a patient or patients, not related to the natural course of the patient's illness
- Attackers may find vulnerabilities in system and gain unauthorized access to confidential patient information

3.0 System Architecture

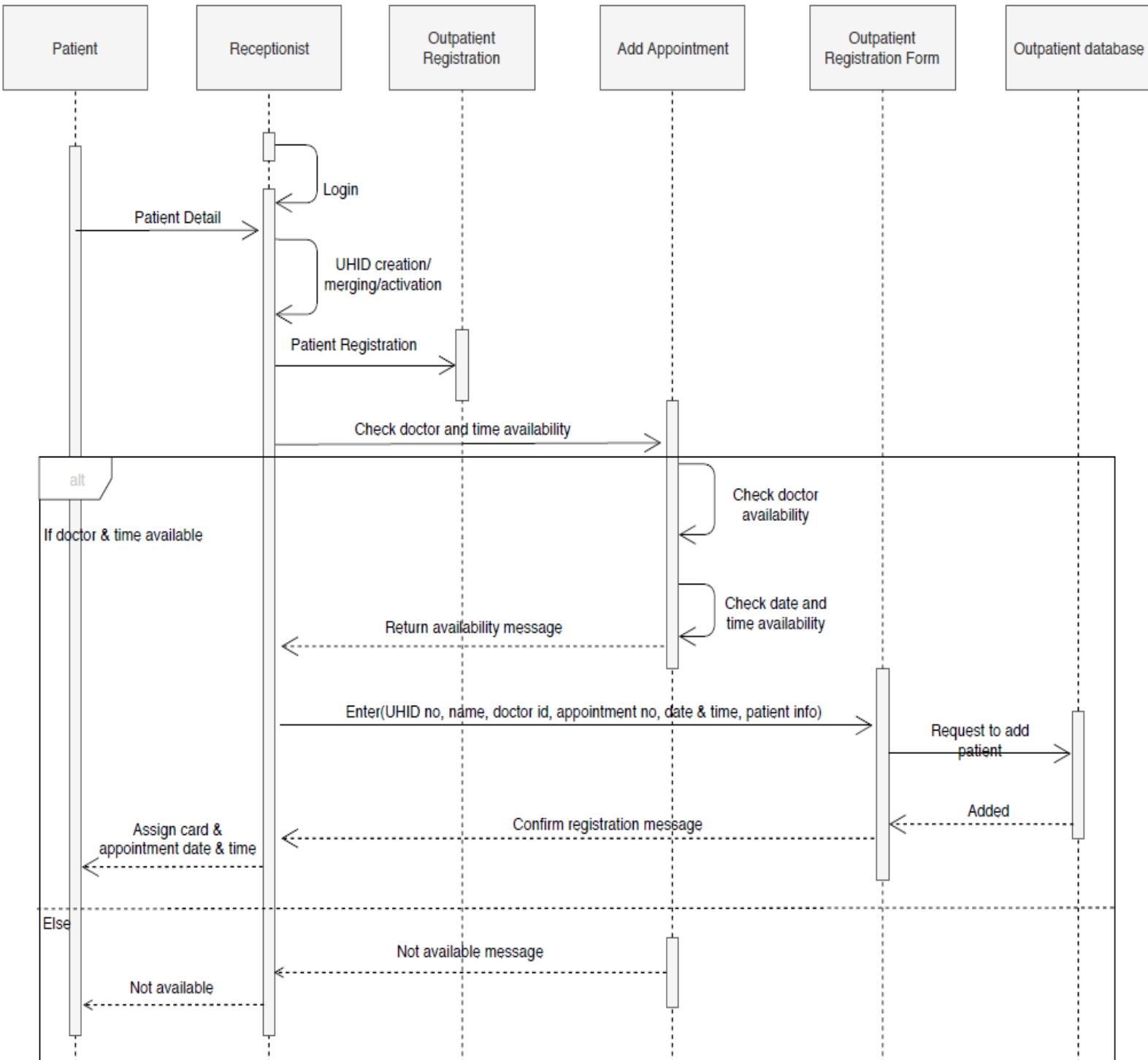
Workflow of the system :



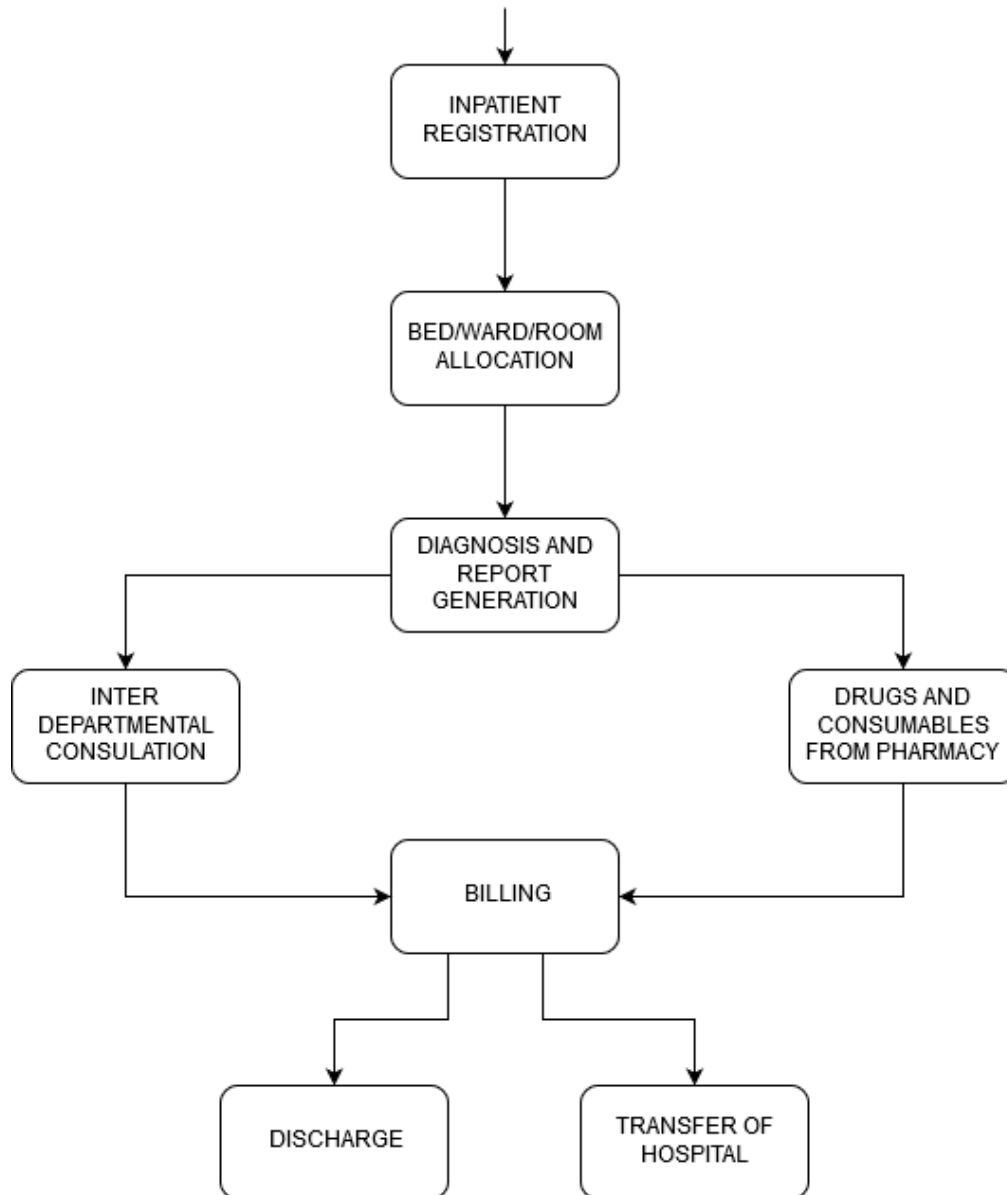
Modular Components for Out-patient management :



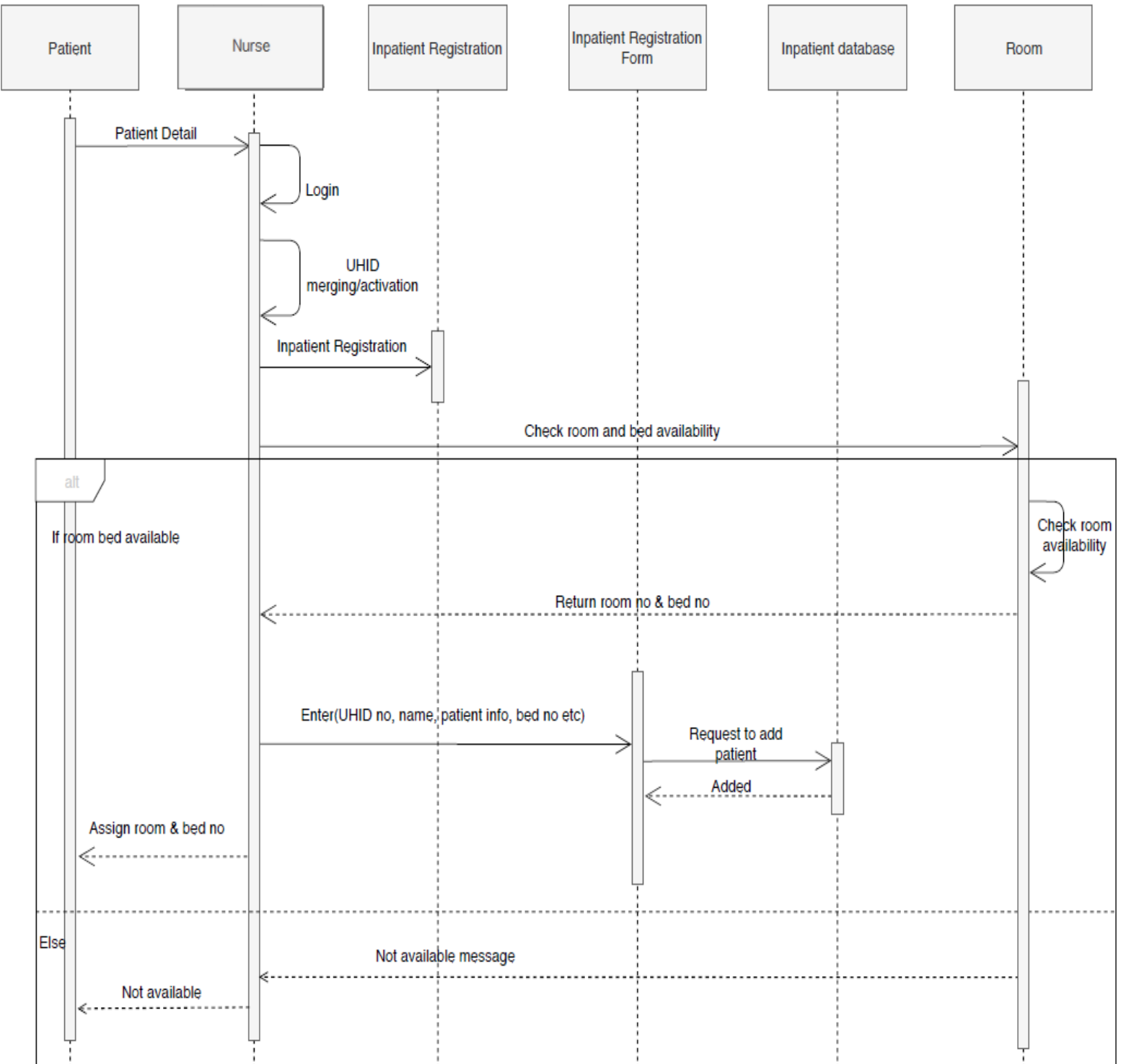
Sequence diagram for Out-patient management :



Modular Components for In-patient management :



Sequence diagram for In-patient management :



4.0 Requirements List

The Customer Requirement Specifications have been elaborated in this section :

4.1 In-Patient Management / View Patient List

Reqmt #	Requirement
CRS – 1	There should be 3 sections of patients sorted in alphabetical order of their names. The sections are "Patient to Admit" , "Current Admitted Patients" and "Discharge Patients" and the user of the module should be able to view the List of the patients under each section.

4.2 In-Patient Management/ View Ward Details

Reqmt #	Requirement
CRS – 2	<p>The user should also be able to view different wards in the hospital namely "General Ward" , "Labor Ward" , "ICU(Intensive Care Unit" and the "Burn Unit".</p> <p>Each ward section should display the respective ward details - no.of beds in it , how many beds are free, which all beds are free(bed numbers) and which beds are occupied(bed numbers). On selecting an occupied bed the module should show the details of the patient who is admitted on that bed.</p> <p>The patient details include :-</p> <ul style="list-style-type: none"> • Name of the patient broken into "First Name" , "Middle Name" and "Last Name" • Gender of the patient as male or female or transgnerder • Date of Birth in Day-Month-Year • Patient's Age in years • Registration Id • Phone number • The name of the Ward in which the patient is admitted • Emergency Phone number • The name of the doctor who is consulting him/her • Admission Date in "Date-Month-Year" format • Diagnosis - Name of the disease or alignment the patient is suffering from • Allocated Bed Number. • Patient's Address broken down into 5 fields - House number,Line number , Pincode , City , State. • Any additional note for the patient - Should support at least 1000 characters.

4.3 ***In-Patient Management/ Admit Patient To a Ward***

Reqmt #	Requirement
CRS – 3	<p>Under the “To admit” section after selecting the patient , the user should be able to select the ward where the patient is to be admitted , along with selecting the bed for the patient. If no bed is available in that ward the user should not be allowed to select a bed and should go back to the “To Admit” section.</p> <p>After the successful completion of this scenario the patient details should get automatically updated with his/her bed number.</p>

4.4 ***In-Patient Management/ Transfer Patient from one bed to another in the same Ward***

Reqmt #	Requirement
CRS – 4	<p>The “Current Admitted Patients” section should also allow the user to transfer a patient from one bed to another..On selection a patient, along with his/her details , the module should also show an option to transfer the patient, which on selecting should allow the user to choose the bed(if available) to transfer the patient to.If the user while changing the bed finds that no bed is free then the operation stands cancelled and the user would not be allowed to transfer the patient.</p> <p>After the successful completion of this scenario the patient details should get automatically updated with his/her bed number.</p>

4.5 ***In-Patient Management/ Transfer Patient from one Ward to another***

Reqmt #	Requirement
CRS – 5	<p>The “Current Admitted Patients” section should also allow the user to transfer a patient from one ward to another.On selection a patient, along with his/her details , the module should also show an option to transfer the patient, which on selecting should allow the user to choose the ward and the bed(if available) to transfer the patient to.If the user while changing the ward finds that no bed is free in the ward then the operation stands cancelled and the user would not be allowed to transfer the patient.</p> <p>After the successful completion of this scenario the patient details should get automatically updated with his/her bed number along with the name of the ward.</p>

4.6 ***In-Patient Management/ Discharge a Patient***

Reqmt #	Requirement
CRS – 6	<p>Under the “Discharge Patients” section, the user should be able to see the list of patients who are approved by the doctor to be discharged. The user should be able to select a patient to be discharged and confirm his/her</p>

	<p>discharge. After discharge the patient should not show up in any of the 3 sections -“Patient to Admit” , “Current Admitted Patients” and “Discharge Patients”.</p> <p>After the successful completion of this scenario the patient details should get automatically updated with the discharge date.</p>
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4.7 **Registration/ Query Patient List**

Reqmt #	Requirement
CRS – 1	The user should be able to query the list of patients who have already registered before. The user should be able to query with respect to the “Registration ID” or by the name of the patient.

4.8 **Registration/ Enter Patient’s basic details**

Reqmt #	Requirement
CRS – 2	<p>The user should be able to enter the patient details into a form consisting of fields :-</p> <ul style="list-style-type: none"> • Name of the patient broken into “First Name” , “Middle Name” and “Last Name”. Each field length should be 50 characters and should only include alphabets. • Gender as male or female or transgender. • The Date of Birth in Day-Month-Year format • Age in years • Phone number • Emergency Contact number • Patient's Address broken down into 5 fields - House number,Line number , Pincode , City , State. Each field should support at least 50 characters • Smoking history checkbox • Father's/Husband name - Length should be 50 characters • An identification mark - Should support at least 500 characters. • Any additional note for the patient - Should support at least 1000 characters. <p>After the successful completion of this scenario the module will automatically generate a unique 20 digit registration id(consisting of digits from 1-9 as well as alphabets) for the patient.</p>

4.9 **Registration/ Selecting the Different types of OPD visits**

Reqmt #	Requirement
CRS – 3	<p>The user after entering the patient's details in the form for registration should be able to select the type of OPD visits for the patient. Multiple OPD visits selection are not allowed.</p> <p>Type of OPD visits which can be selected :-</p> <ol style="list-style-type: none"> (1) Emergency Visit (2) Lab test Visit (3) Doctor's consultation visit.

4.10 **Registration/ Uploading the photograph of the patient**

Reqmt #	Requirement
CRS – 4	<p>The user should be able to upload a picture of the patient by using a Webcam attached to the system.</p> <p>The resolution of the photograph should be 600*600 with size less than 5 MegaBytes and should be save in jpeg format.</p>

4.11 **Registration/ Assigning Doctor to the patient**

Reqmt #	Requirement
CRS – 5	<p>After entering the patient's details , opd visits, and uploading the photograph of the patient the user should be able to assign a doctor to the patient.</p> <p>The assignment of the doctor will be done either manually by the user or can be done by the module. If the user wants to select manually , the user will be shown a list of doctors to select from and the user can then choose any one out of them. If the user uses the module to make a selection , the module should assign a doctor to the patient based on the patient's count of each doctor. The doctor who has the least amount of patients will be preferred in assignment.</p>

4.12 **Registration / Generating Fee**

Reqmt #	Requirement
CRS – 6	<p>After assigning the doctor to the patient the system module generate the Fee for the registration which the user should collect from the patient.</p>

	The fee generated by the module should have been entered by the administrator while setting up the module/system with respect to the OPD visit type.
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4.13 Registration / Generating the Qr(Quick Response)- Code

Reqmt #	Requirement
CRS – 7	After generating the fee the user should be able to generate a Qr(Quick Response)-code for the patient encoding the patient's registration number and his/her name.

4.14 Registration / Printing the Patient Card

Reqmt #	Requirement
CRS – 8	After generating the QR(Quick Response) - Code the user should be able to print the details of the form along with the QR code and patient's photograph with the help of an attached printer to the system.

4.15 Patient Lists

Reqmt #	Requirement
CRS – 1	<p>This module enables the user to view the list of patients registered at the facility. The module must be equipped with filtering capabilities. The system must enable the user to navigate to the Patient Dashboard to view and add clinical information for the patient by selecting the corresponding patient info as displayed in the patient list.</p> <p>Patient Lists must provide the following functionalities :</p> <ol style="list-style-type: none"> 1. A snapshot of patients belonging to various categories, must be rendered by the system either as a tile or list view based on the user's preferences.. 2. In case of tile view mode for the patient snapshot, the patient picture is also displayed, provided that the patient's image has been captured during the registration phase. For in-patients, the tile view mode also indicates that the patient is admitted at the facility. 3. In the list view, a configurable set of information for each patient must be displayed. 4. The filter to be applied in order to display the patient list must be configurable. The variety of filters provided by the functionality include : <ol style="list-style-type: none"> A. list of all patients who have an active visit B. all patients who have been sent to a particular department C. list of in-patients D. list of out-patients E. list of patients who have visited the facility for consultation between a certain range of dates F. list of patients who have been admitted between a certain date range G. list of patients who have been discharged within a certain timeframe

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4.16 **Patient Dashboard**

Reqmt #	Requirement
CRS – 1	<p>This functionality associates a dashboard to each patient which displays an overview of a patient's crucial clinical and personal information. to enable quick and efficient care. The information to be displayed on the Patient Dashboard must include patient personal information (nam, address, email id, phone number, blood group, medical history), diagnosis history, lab results, nutritional values, vitals, treatments, radiology documents.</p> <p>The software must facilitate the user to create and configure multiple dashboards per patient, which in turn enables users to conveniently view information which can be filtered and organized based on their needs.</p> <p>The dashboard must also portray graphical trends of numeric observations and a department specific view of patient clinical data.</p>

4.17 **Out-Patient Management / Capturing Consultation Data**

Reqmt #	Requirement
CRS – 1	<p>This module enables clinicians to record and view clinical notes for general patients, emergency admissions, surgeries, delivery, gynecology, and basically every disease or condition for which elaborate forms have been defined.</p> <p>Users of the system should be provided the following functionalities :</p> <ol style="list-style-type: none"> 1. Enter Patient data retrospectively or on behalf of another provider. 2. View Patient Dashboard including Patient Details, Active and Past Programs. 3. View the summary of a Patient's visit along with graphs and trend mapping. 4. Capture specific clinical observations for the patient such as Obstetrics, Gynecology, etc. 5. Autocompletes available data fields for easier data entry. 6. Capture various diagnoses for the patient. 7. Capture Consultation notes for the patient. 8. Prescribe treatment orders for medications. 9. Place orders for radiology tests via PACS (Picture Archiving and Communication System) integration. 10. Place orders for Laboratory tests. 11. View the consultation history of the patient. 12. View scanned documents and results of tests. 13. Capture Bacteriology test results for the patient (different from laboratory tests). Bacteriology includes smear test results, culture test results and drug-sensitivity test results.

	14. View Patient Lists with support for sorting by filters.
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4.18 Out-Patient Management/ Visit Dashboard

Reqmt #	Requirement
CRS – 1	Visit dashboards are similar to patient dashboards, except that they display data for a single visit. Multiple visit dashboards can also be created. Each visit dashboard has a printable view, optimized for paper.

4.19 Out-Patient Management/ Appointment Scheduling

Reqmt #	Requirement
CRS – 1	<p>Patients appointments must be scheduled in order to access the requisite health-care and medical services. By scheduling appointments, this module should manage schedules of various health care service providers and medical services offered and also in streamlining of patient load.</p> <p>The Appointment Scheduling module must behave as a generic component across different departments within a healthcare setting and must cover the following scenarios :</p> <ol style="list-style-type: none"> 1. General OPDs or Specialised OPD services like a Diabetic Clinic or a Dental clinic 2. Particular providers coming only on specific days and times of the week 3. Medical services including X-ray, Ultrasound scan 4. Surgery slots in Operation theaters

4.20 Out-Patient Management/ Appointment Scheduling/ User Roles and Privileges

Reqmt #	Requirement
CRS – 2	<p>The system must facilitate its Users to be assigned different privileges so as to provide different levels of access to the appointment scheduling module for the purpose of viewing or Creating appointments or services.</p> <p>There are three different user roles which should be made available in Appointment Scheduling which are mentioned below,</p> <ul style="list-style-type: none"> • Read Only Access • Manage Appointments • Full Access <p>Users can have either a "Read only" role, "Manage Appointments" role and "Full Access" for the App.</p>

	<p>Read Only: Can only view Manage Appointments Tab. No actions can be performed. Any effort for action will give an error message.</p> <p>Manage Appointments: This user will have access only to "Manage appointments." Can perform all actions in the app. Admin tab will be hidden.</p> <p>Full Access: This user will have access to Both the tabs of "Manage appointments" and "Admin". The user will be able to create, edit appointments and services.</p>
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4.21 ***Out-Patient Management/ Appointment Scheduling/ View Appointments***

Reqmt #	Requirement
CRS – 3	<p>Viewing of Appointment schedule must be facilitated by the following means :</p> <p>Calendar View</p> <p>This view provides the user the ability to view appointments for different providers in a given day, in a calendar. Users can further filter appointments using a filter panel available on this view.</p> <p>Weekly Summary View</p> <p>The summary view is a weekly view. Users can configure the view to begin with either Sunday or Monday</p> <p>Default List View</p> <p>The appointments scheduled are displayed as a list by default unless the user opts for a different view</p>

4.22 ***Out-Patient Management/ Manage Appointments***

Reqmt #	Requirement
CRS – 4	<p>Create Appointments - Patient search Field</p> <p>Appointments are booked against a service for a patient. The web API that searches for the patient is configurable.</p> <p>Edit Appointments - Allow Services to Edit</p> <p>Appointments are created against a service for a patient. Sometimes it is required of the user to edit this service at a later point in time. While in some cases, the user might choose to not allow this. In the latter case it is expected of the patient to cancel the appointment and create a new one.</p> <p>Users should be able to turn on the ability to edit services in previously created appointments.</p> <p>Appointment Status Change Validation</p> <p>A given appointment can have the following statuses:</p>

	<ol style="list-style-type: none"> 1. Scheduled: Appointment is scheduled for a patient. 2. CheckedIn: Patient with the appointment has checkedIn to the hospital/clinic. 3. Missed: Patient has missed the appointment. 4. Completed: Patient has completed the appointment with the care provider. 5. Cancelled: Appointment has been cancelled. <p>The change of appointment status from one status to another can be controlled</p> <p>Scheduler for Complete or Missed Appointments:</p> <p>Depending on the implementation, user should be able to mark appointments either with missed or complete status manually or the user may configure the scheduler to do so.</p>
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4.23 *Patient Billing and Accounting*

Reqmt #	Requirement
CRS – 1	<p>Doctors may prescribe medicines or drugs for patients or may additionally place orders for patients to undergo prescribed medical tests for patients using the consultation feature of the clinical module which is beyond the scope of this software. The patient would then proceed to the Pharmacy or to a Billing Counter in order to make the payment. This module describes the usage of the Billing and Accounting feature.</p> <p>The following features must be supported by this module :</p> <ul style="list-style-type: none"> • View Sale Orders • Add Discounts or Pay in Instalments • Confirm Order <p>Once an order for a pharmacy product or medical test is confirmed, the system should not allow further editing of order information.</p>

4.24 *Patient Billing and Accounting/ Print Bill*

Reqmt #	Requirement
CRS – 2	<p>The module must follow the following workflow for printing bills/prescriptions of patients :</p> <p>The system screen should display the patient in the list for whom medications or medical test orders were placed</p> <p>The user would then select the patient from the patient list in order to view the invoice.</p> <p>The subsequent screen should then allow the user to select the "Print Invoice" option in order to print the bill for the customer.</p>

5.0 External Interface Requirements

5.1 *Hardware Requirements*

This section specifies the logical characteristics of each interface between the software product and the hardware components of the system. It also covers such as what devices are to be supported, how they are to be supported, and protocols.

CPU - Quad core (8 core)

Memory - 16GB

Hard disk - 500GB

Cache memory -

L1 D/I cache - 32KB per core

L2 cache - 256KB per core

L3 Cache - 16MB (could be shared across all cores or may)

Battery - APC Smart-UPS SMT1500

LAN Ethernet cables- Cat 6a

Due to security concerns and the ease of hackers cracking WiFi hotspots, WiFi internet support will be prohibited by the software

5.2 *Software Requirements*

This section shall specify the use of other required software products, and interface with other application systems .

- FRONT END

- o Html(HyperText Markup Language) Version 5.2

It is the standard markup language for documents designed to be displayed in a web browser. It can be assisted by technologies such as Cascading Style Sheets (CSS) and scripting languages such as JavaScript.

- o CSS(Cascading Style Sheets) Version 4

It is a style sheet language used for describing the presentation of a document written in an HTML like markup language.

- o JavaScript Version Version 1.8.5

It is a high-level, interpreted scripting language that conforms to the ECMAScript specification. JavaScript enables interactive web pages and is an essential part of web applications.

- SERVER SIDE SCRIPT

- A. Php(Hypertext Preprocessor) Version 7.3.10

It is a general-purpose programming language originally designed for web development. It is a server scripting language, and a powerful tool for making dynamic and interactive Web pages.

III. DATABASE

A. Mysql Version 8.0.17

It's an open source Relational Database Management System (RDBMS) that uses Structured Query Language (SQL). SQL is the most popular language for adding, accessing and managing content in a database.

IV. OPERATING SYSTEM

A. Ubuntu Version 16.04

It's a free and open-source operating system (OS) based on the Debian GNU/Linux distribution. Ubuntu incorporates all the features of a Unix OS with an added customizable GUI.

V. WEB BROWSER

A. Google Chrome Version 77

It is a free web browser developed by Google, used for accessing web pages on the internet.

5.3 *Communication Interfaces*

This should specify the various interfaces to communications such as local area network protocols, serial ports, parallel ports, etc., and also line speed, buffer size and any other communication standards requirements if applicable

Communication interfaces will use TCP/IP for data transmission and SMTP/HTTPS for generating emails of reports from the software over the internet. SFTP is used in securely pushing generated document reports to a hospital's SFTP server. All communication interfaces should have high baud data Tx and Rx rates of 10 Gbps over 100 meters (330 feet) of cable. TLS or higher encryption standards are a must-have, high priority requirement. All offline and online access will be monitored, for transparency purposes, and in order to reduce abuse and unauthorized access of the system. It shall utilize USB support for importing photos directly from the devices into the HIMS, but before importing the photos it shall thoroughly scan the USB device to check if the USB device is free from malware or any other malicious programs. The HIMS subsystem shall enter patient information with a secure VPN for communicating with the database.

6.0 **User Interfaces**

The inpatient module will have user interfaces for the below operations -

- View patient list based on different status - To Admit, Admitted, To Discharge etc.
- Admit a patient and assign a bed
- Discharge a patient
- Transfer a patient from one bed to another
- View a summary of patient information

If you click on In-Patient module, you will be landed on patient queue page where you can see the WardLists, patients to be admitted, patients who are already admitted and patients who are ready to be discharged.

On the WardList page you can see the list of wards in hospital and patients admitted in those wards.

By Clicking on any patient's ID in ward list you will land on patient movement page where you can transfer patient from one bed to another bed or one ward to other or discharge a patient.

By Clicking on any patient on "To Admit" tab, you will go to patient movement page where you can admit a patient

By clicking on admit button, you will see a popup where you can close the OPD visit and open a new IPD visit if needed.

On admit you will be landed on ward list page where you can choose a bed on which the patient will be admitted. By clicking on any bed icon you will see a popup where you can assign a bed to a patient.

The beds which are already assigned to patients will be shown in yellow color. Empty beds will be shown in green color.

By clicking on any patient in Admitted tab you will land on patient movement page where you can transfer patient from one bed to another or one ward to other or discharge a patient.

By clicking on any patient in To Discharge tab you will land on patient movement page where you can discharge a patient.

The inpatient module will have user interfaces for the below operations -

- Enter Patient data retrospectively or on behalf of another provider.
- View Patient Dashboard including Patient Details, Active and Past Programs, etc.
- View the summary of a Patient's visit along with graphs and trend mapping.
- Auto-completes most data fields for easier data entry.
- Capture various diagnoses for the patient.
- Capture Dispositions for the patient with Disposition notes.
- Capture Consultation notes for the patient.
- Prescribe treatment orders for medications.
- Place orders for Laboratory and Radiology tests.
- View the consultation history of the patient.
- View scanned documents and results of tests.
- View Patient Lists with support for sorting by filters.

Patient Lists feature gives quick snapshot of patients in various categories, either as a tile or list view. The tile view displays the patient picture, if the patient image has been captured in the registration module. If the patient is admitted, the tile view also displays an icon indicating the patient is admitted. In the list view, a configurable set of information for each patient can be displayed.

Patient dashboard allows to View patient information using display control widgets. It also allows to view a complete snapshot of patient clinical information either at the level of a patient or a visit. It also contains widgets for configuring patient graphs and trends for convenient metrics and monitoring.

Search functionality in the search fields of the queues we can search by either name or partial identifier of the patient. If the partial identifier can uniquely find the patient, it will automatically open the clinical dashboard of that patient.

Capturing observations tab plays a key role in capturing patient's clinical information. The information is entered in forms that are exclusively set up for various diseases or conditions that a patient may have. For example, a facility can define a form for diabetes. This form would contain a list of all the questions that a doctor would need to ask a patient suffering from diabetes. Some questions can be populated with a predefined list of possible answers. This helps the doctors ensure that they have covered all the core questions that they need to ask the patient.

Ordering Laboratory and Radiology tests feature allows medical practitioner who wants to place an order to go to the tab "Orders" under Clinical Consultation. The Orders tab lists all the possible types of orders. Once an Order type is selected, all the concepts that are needed to specify that particular type of order are listed in a hierarchical manner from where they can be selected for specifying the order. This Order then resides in a queue which contains all the orders. The orders will be fulfilled through different views of this queue. The Orders fulfillment is set up as a separate module in the application. Clicking on the icon for this module will take the user to a page where all the pending orders are listed in different queues based on their order types.

The Diagnosis tab provides the history of diagnosis of a patient at one place. If the diagnosis being entered has not been saved as part of the coded set of diagnoses in the database, the clinician can save the diagnosis as a "non coded" diagnosis by Accepting it as a new diagnosis being entered. Along with the diagnosis, the clinicians can also indicate whether a diagnosis is primary or secondary and if it is presumed or confirmed. In addition to this, they can also rule out or mark a diagnosis as inactive if applicable. Additional notes can also be entered against each diagnosis. Clinicians can also delete or edit past diagnoses on this tab.

The Medications tab provides an easy way to order drugs for a patient. It has key features like edit, stop and refill a drug order, all of which simplify management of drug orders. The tab provides a clear visual distinction of the current active, scheduled and past drugs. The drug orders with a green tag are scheduled, the ones with an orange tag are those that are currently active and the ones without any tag are the past drug orders of that patient. It can also be configured to group drug orders into subsections if desired by the hospital/clinicians.

Visit dashboard tab lets the hospital generate discharge summary, birth and death certificates and any other document that requires a patient's visit level data without writing any code.

7.0 Performance Requirements

This section shall specify both static and dynamic numerical requirements placed on the software or on human interactions with the software, as a whole.

Static numerical requirements may include:-

- The number of terminals to be supported
- The number of simultaneous users to be supported
- Number of files and records to be handled
- Sizes of tables and files

- Dynamic numerical requirements may include:-
- The number of locations to which the system caters
- The number of transactions
- Tasks and the amount of data to be processed within certain time periods for both normal and peak workload conditions
- Compatibility between heterogeneous environments (for e.g. Open Systems, Mainframes, Mid-range systems, etc.)
- Interconnection between various networks (LAN, WAN, Internet, etc.)
- All the requirements should be stated in measurable terms.

8.0 Special Characteristics

This section shall specify the factors that would protect the software from accidental or malicious access, use, modifications, destruction, or disclosure. Specific requirements in this area could include the following :

- The system needs to record specific logs or error reports when an anomalous flow of control leading to an unexpected result is observed, so that these may be used subsequently for debugging purposes and maintainability.
- The system needs to facilitate backup of data at a regular interval of 72 hours.
- In the event that any data corruption or loss should occur, the system should automatically detect the last most recently stored backup and restore it.
- Any access to critical or sensitive patient information should be accompanied by a two factor authentication to prevent intrusion by unauthorized personnel.
- The system should have at least 95% availability and must be reliable simultaneously as both these criteria go hand in hand.
- The average time it takes to accomplish a user's goals through the provided interface must be not more than 5 seconds.
- Low perceived workload: The percentage of total tasks a user may be able to complete without the usage of any help should be at least 95%.
- The percentage of total transactions completed without errors or without triggering unexpected sequence of actions should be not more than 5%.
- The system must be interoperable, i.e., must be able to exchange data and subsequently present that data such that it can be understood by a user.
- The system must comply with three levels of interoperability: foundational, structural, and semantic

Foundational interoperability

One system to send data to another system. The receiving system does not necessarily need to be able to interpret the exchanged data — it must simply be able to acknowledge receipt of the data payload.

Structural interoperability

To achieve structural interoperability, the recipient system should be able to interpret information at the data field level.

Semantic Interoperability

The system must be able to exchange and interpret information — then actively use the information that has been exchanged.

9.0 Help

This section shall describe the help planned for the system like, online / context sensitive help and other documentation (e.g. User Manual, Technical Manual) planned, to aid in the usage of the system.

- 1) It will contain HIMS videos catalogue module to assist customers and end users for better usage of software. The following useful videos will be available in this catalogue:
 - a) Overview of HIMS setup and installation
 - b) An overview of configuring the HIMS UI
 - c) A video playlist of short demos of HIMS
 - d) A playlist which contains multiple videos showing how to configure the Registration screen for HIMS
- 2) It shall consist of a FAQ section which is mainly used to help the end user solve some common problems of the system. It supports managing questions and answers in category, supports searching by keyword in questions or answers with category and supports browsing by category.
- 3) The User guide shall describe the detailed user workflows and documentation from an end-user's perspective of HIMS.
- 4) The Feature Guide will be provided for a high-level overview of HIMS functionality.
- 5) The Implementer's guide shall describes various steps and configurations required to setup and implement HIMS.

10.0 Other Requirements

Certain requirements may, due to the nature of the software and the user organization, be placed in separate categories as indicated below:

10.1 Site Adaptation Requirements

- Each system should be equipped with 600VA UPS(Uninterruptible Power Supply) system.
- There should be at least 3 power plugs for each system.
- The room in which the system is operated must maintain a temperature between 15 - 30 degree Celsius for proper working of the system. Adequate air coolers should be provided for cooling the room.

10.2 **Safety Requirements**

The safety requirements that have to be addressed in the software are as follows :

- All physical systems must be used solely for the operation of the software as dedicated workstations, and must have all recent updates installed, an active firewall instance, and have solid anti-virus software, in order to protect the patient's private and confidential medical information from unauthorized access
- All offline and online access to patient information should be monitored, for transparency purposes, and in order to reduce abuse and unauthorized access to the system. Any access to sensitive data should be accompanied by a two phase authentication before it can be granted.
- The connections shall be of a secure means: VPN, HTTPS, or SFTP. The secure connections shall prevent patient information from getting into not authorized users/viewers. This is of high priority for the Information System for patient confidentiality.
- If there is extensive damage to a wide portion of the database due to catastrophic failure, such as a disk crash, the recovery method restores a past copy of the database that was backed up to archival storage and reconstructs a more current state by reapplying or redoing the operations of committed transactions from the backed up log, up to the time of failure.
- The system needs to comply with Healthcare Insurance Portability and Accountability Act (HIPAA) standards of the US which is the norm of the Healthcare industry when it comes to medical records management and patient information privacy.
- The system must comply with NABH standards which provide a framework for quality assurance and quality improvement for hospitals. The standards focus on patient safety and quality of care. The standards call for continuous monitoring of sentinel events and comprehensive corrective action plan leading to building of quality culture at all levels and across all the functions.
- The software should not be involved in any copyright or patent infringement whatsoever.
- The system must comply with the HL7 standards Version 2, which is the most widely used messaging standard for exchange of patient care and clinical information.

11.0 **Packaging**

This section shall describe the software product to be packaged by considering the following: -

The HIMS product is going to be made up of one package(since many small packages take longer time to install) which shall be archived and compressed with the help of Linux tools such as tar and gzip respectively.

The Process of Building a Package includes:

1. Create a pkginfo File

Create the pkginfo file to describe the characteristics of package. The pkginfo file is an ASCII file that describes the characteristics of a package along with information that helps control the flow of installation.

2. Organize Package Contents

Arrange package components into a hierarchical directory structure that mimics how they will be present in the target system after installation. The components of package includes *package objects*, the application files to be installed, and *control files*, which control how, where, and if the package is installed.

3. Create Installation Scripts

Automated script to install dependencies.

4. Build the Package

5. Verify and Transfer the Package

Verify the integrity of a package before copying it to a distribution medium.

12.0 Traceability Matrix

URS Reference Section No. and Name	CRS Reference Section No. and Name
URS Section 1 : Patient Registration	CRS Section 4.7-4.14
URS Section 2 : In-Patient Management	CRS Section 4.1-4.6
URS Section 3 : Patient List	CRS Section 4.15
URS Section 4 : Patient Dashboard	CRS Section 4.16
URS Section 5 : Outpatient Management	CRS Section 4.17-4.22
URS Section 6 :Patient Billing and Accounting	CRS Section 4.23-4.24