Smart Dentassist;

An Interactive System for Dental Support and Patient Management

(SRS Document)

Project ID : 15-085

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We are aware, that if we are found guilty for the above mentioned offences or any project related plagiarism, the SLIIT has right to suspend the project at any time and or to suspend us from the examination and or from the Institution for minimum period of one year".

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1. Introduction

1.1 Purpose

This document provides a detailed description of the "Smart Dentassist; An Interactive System for Dental Support and Patient Management". It will explain the purpose and features of the system, the interfaces of the system, what the system will do, the constraints under which it must operate and how the system will react to external stimuli. All parts are intended primarily for stakeholders of the application, but will also be of interest to software engineers building or maintaining the software. The intended audience of this document includes project supervisors, designers, developers, end users of the system and any other person interested in "Smart Dentassist".

1.2 Scope

"Smart Dentassist; An Interactive System for Dental Support and Patient Management" will be a web based system developed using Java, HTML, MySQL. This system will be used by dentists to manage patients and appointments, communicate (live stream videos and images) with other dentists, receive support to diagnose conditions, to make decisions, to decide on treatments, to simulate outcomes of a treatment, and maintain a knowledge base. The main objective of designing this system is to enhance oral health and maximize the dental care provided by dentists by assisting the dentist and educating the patient.

This system consists of 4 main components ;

1. Patient Management System
2. Teleconferencing System
3. Diagnosing, treating and simulating outcome
4. Dental Information Knowledge Base

Diagnosing, treating and simulating outcome :

The system will model a patient's lower and upper jaw and enable editing. Any modification to a tooth will be displayed on the 3D model. Standard tooth numbering system will be used. The system will enable the dentist to create prescriptions, save a copy in patient's folder, and print a copy. The system will maintain patients' history. The system will save images captured by intra oral camera in the particular patient's folder. The system will also allow the dentist to comment on images and will store them accordingly. The system will simulate the outcome of treatments using 3D modelling. These simulations will be shown to the patient during explanations. The system will suggest treatments based on the images captured and processed.

This component will benefit the dentist as follows :

- Summary of previously carried out treatments is graphically represented
- Convenient way of tracking treatments carried out

This component will benefit the patient as follows :

- Ability to view simulation of treatment and outcome.
- Enhanced dental care.
- Better dental education and understanding of dental conditions.

The main objectives of this components are ;

- To educate patients clearly on their dental conditions with the visual output of intra oral cameras.
- To educate children as well as adults on how to prevent oral diseases.
- To provide patients with a better understanding of the outcomes of treatments carried out.
- To educate children and adults the best practices of maintaining good oral health.
- To improve the technology of the dental medicine field

1.3 Definitions, Acronyms, and Abbreviations

SRS	Software Requirements Specification
Stakeholder	Any person with an interest in the project who is not a developer.
PC	Personal Computer
Knowledge Base	A store of information or data that is available to draw on.

1.4 References **(place this at the end of the document)**

[1] "Media Centre", *World Health Organization* , available: http://www.who.int/mediacentre/factsheets/fs318/en/ , [accessed : 28.01.2015]

[2] "What problems could my dental health cause", *British Dental Foundation,* available: http://www.dentalhealth.org/blog/blogdetails/104 [accessed : 28.01.2015]

[3] "Oral Health", *National Institute of Dental and Craniofacial Research,* available: http://www.nidcr.nih.gov/oralhealth/, [accessed : 28.01.2015]

[4] *Sri Lanka Annual Health Bulletin 2012,* Sri Lanka : [accessed: 06.02.2015]

[5] "A Healthy Mouth", *Sri Lanka Dental Association,* available: http://www.slda.lk/public/your-oral-health/ [accessed: 02.02.2015]

[6] *Oral Health Worldwide : A report by FDI World Dental Federation,* Switzerland : FDI World Dental Federation

[7] "Department of Health Services", *Ministry of Healthcare and Nutrition, Sri Lanka,* available: http://www.health.gov.lk/, [accessed: 02.02.2015]

1.5 Overview

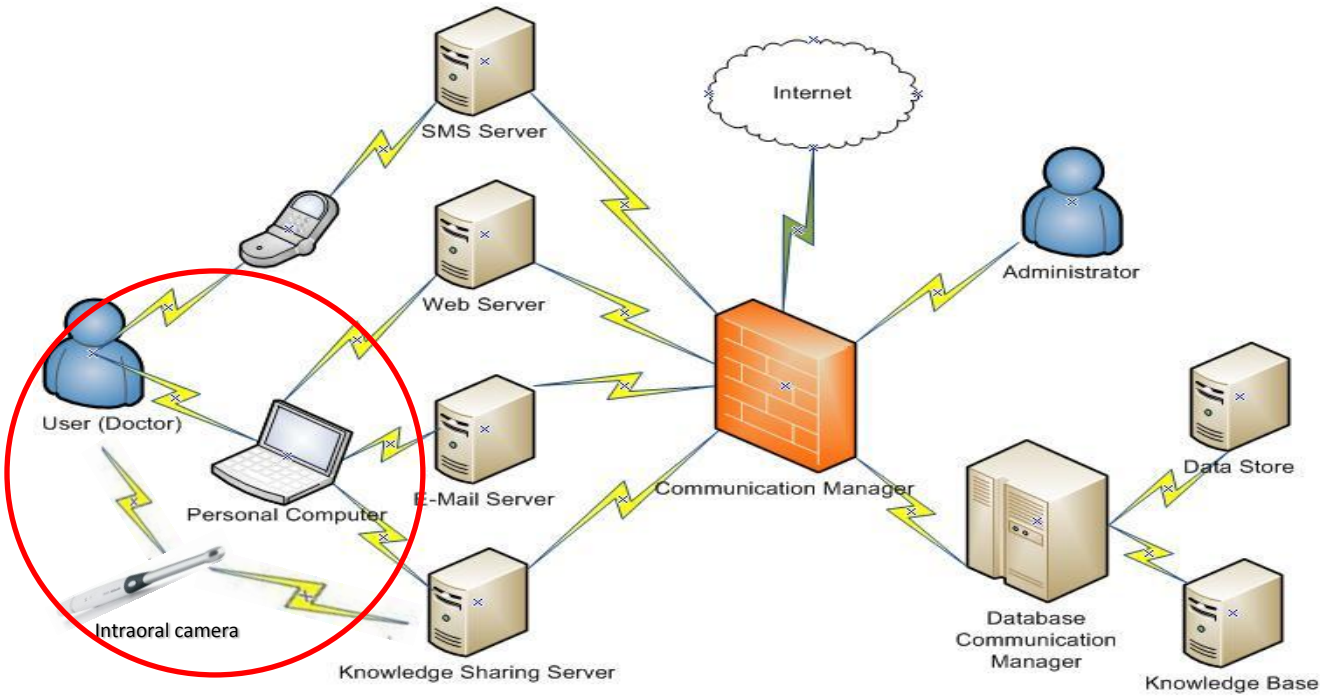


Figure 1 : component in the System diagram

The main goals of this research project are as follows,

- To provide a better dental health care service to patients, irrespective of where they live.
- To educate patients clearly on their dental conditions with the visual output of intra oral cameras.
- To educate children as well as adults on how to prevent oral diseases.
- To provide patients with a better understanding of the outcomes of treatments carried out.
- To educate children and adults the best practices of maintaining good oral health.
- To improve the technology of the dental medicine field
- For “knowledge balancing” among dentists
- To provide better communication facilities for dentists with specialists and consultants
- To create a “Knowledge Base” for dentists which helps in decision making.

The main tasks of the system are

- Providing a patient management system for dentists which could send updates and reminders to their patients.
- Providing a decision support system to the dentists.
- Emphasizing the need for bi-annual dental check-ups.
- Providing better education to patients on their dental conditions.
- Educating the common citizen about causes of oral diseases, impact of oral health on the human body.
- Educating children especially, as well as adults about the oral diseases can be prevented.
- Providing better means of communication to dentists with their consultants, as the geographic distribution and availability of dental personnel is low.

Document Overview

The next chapter, the Overall Description section, of this document gives an overview of the functionality of the product component **"Diagnosing, treating and simulating outcome"** . It describes the informal requirements and is used to establish a context for the technical requirements specification in the next chapter. This section is intended for the **customer**.

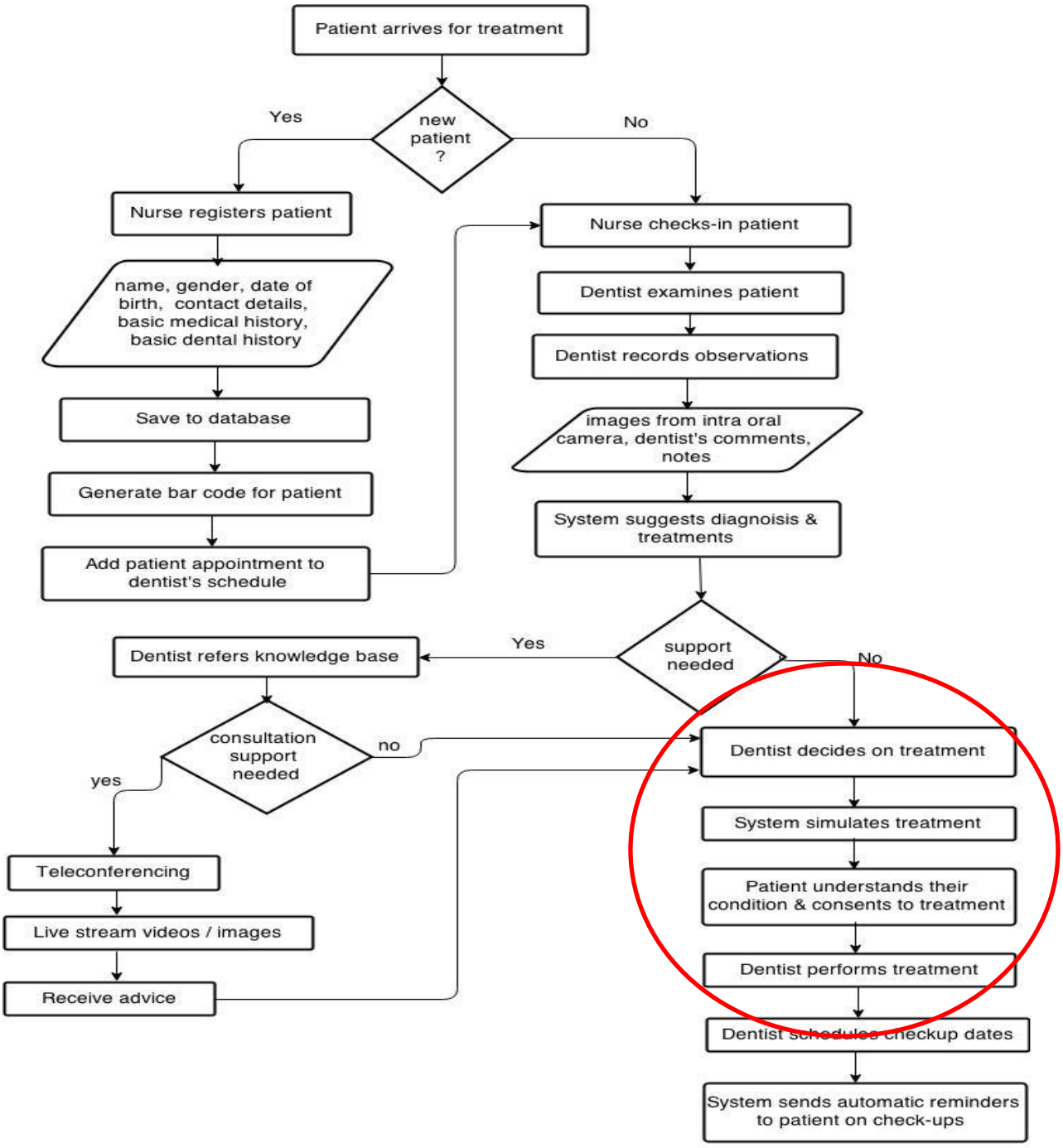
The third chapter, the Specific Requirements section, of this document is written primarily for the **developers** and describes in technical terms the details of the functionality of the product component.

Both sections of the document describe the same software product component **"Diagnosing, treating and simulating outcome"** but are intended for different audiences and thus use different language.

2. User Requirements

2.1 Product Perspective

Figure 2 : component in the flowchart of system



2.1.1 System Interfaces

- Web interfaces
- SMS gateway
- Teleconferencing interface
- Image capturing, processing and simulating interface

2.1.2 User interfaces

2.1.3 Hardware Interfaces

The hardware needed for this research project will be ;

- Laptop computer
- Intraoral camera
- Tablet PC
- Bar code reader

The **laptop computer** which will be used by the dentist, will contain the proposed software system and will perform the necessary processing activities.

The **intraoral camera** will capture images of the patient's oral cavity and transmit them to the laptop computer, where the processing will take place.

The **tablet PC** will serve as the education tool for the patient, on which images captured by the intra oral camera will be displayed and simulations of the treatments and outcomes will be displayed.

The **bar code reader** serves as a tool for patient management, where a unique bar code will be generated for each patient, and once the bar code is scanned patient profile will be displayed on computer.

2.1.4 Software Interfaces

- The system will be developed using Java version 1.7
- The webpages will be developed using HTML, CSS, JavaScript and jQuery.
- The database will be created using MySQL version 5.5

2.1.5 Communication Interfaces

- Intra oral camera software will provide wireless access to the laptop and tablet PC. Images and videos captured by the intra oral camera will be transmitted to the laptop and tablet PC to be viewed by dentist and patient.
- A Modem or a dongle will provide access to Internet when necessary Internet access will be required for Teleconferencing and live streaming videos and images captured by the intra oral camera.

2.1.6 Memory Constraint

"Smart Dentassist" is expected to use no more than 4 GB of Ram and 250 GB of external storage.

2.1.7 Operations

- Dentist's assistant / Nurse is able to register new patients to the system, by entering patients' personal information and basic medical history.
- Dentist's assistant / Nurse is able to enter to the system patient's reason for the visit, signs and symptoms faced by the patient and other oral health related information.
- Dentist is able to save observations and conclusions of examining the patient.
- Dentist and patient are able to view the video and images captured by the intraoral camera on the laptop / tablet PC
- The system models the patients teeth graphically
- The system makes suggestions of possible treatments and displays similar previously treated cases
- The system simulates graphically the outcomes of treatments selected by the dentist
- The system automatically reminds patients of their upcoming appointments
- Dentists is able to teleconference with colleagues or consultants and live stream the images / videos captured by the intraoral camera

2.1.8 Site Adaptation Requirements

The system will be compatible with mobiles, tablet, desktop and laptop computers.

2.2 Product Functions

Diagnosing, treating and simulating outcome :

The system will model a patient's lower and upper jaw and enable editing. Any modification of a tooth will be displayed on the 3D model. Standard tooth numbering system will be used. The system will enable the dentist to create prescriptions, save a copy in patient's folder, and print a copy. The system will maintain patients' history. The system will save images captured by intra oral camera in the particular patient's folder. The system will also allow the dentist to comment on images and will store them accordingly. The system will simulate the outcome of treatments using 3D modelling. These simulations will be shown to the patient during explanations. The system will suggest treatments based on the images captured and processed.

Figure 3 :Diagnosing, treating and simulating outcome - use case diagram

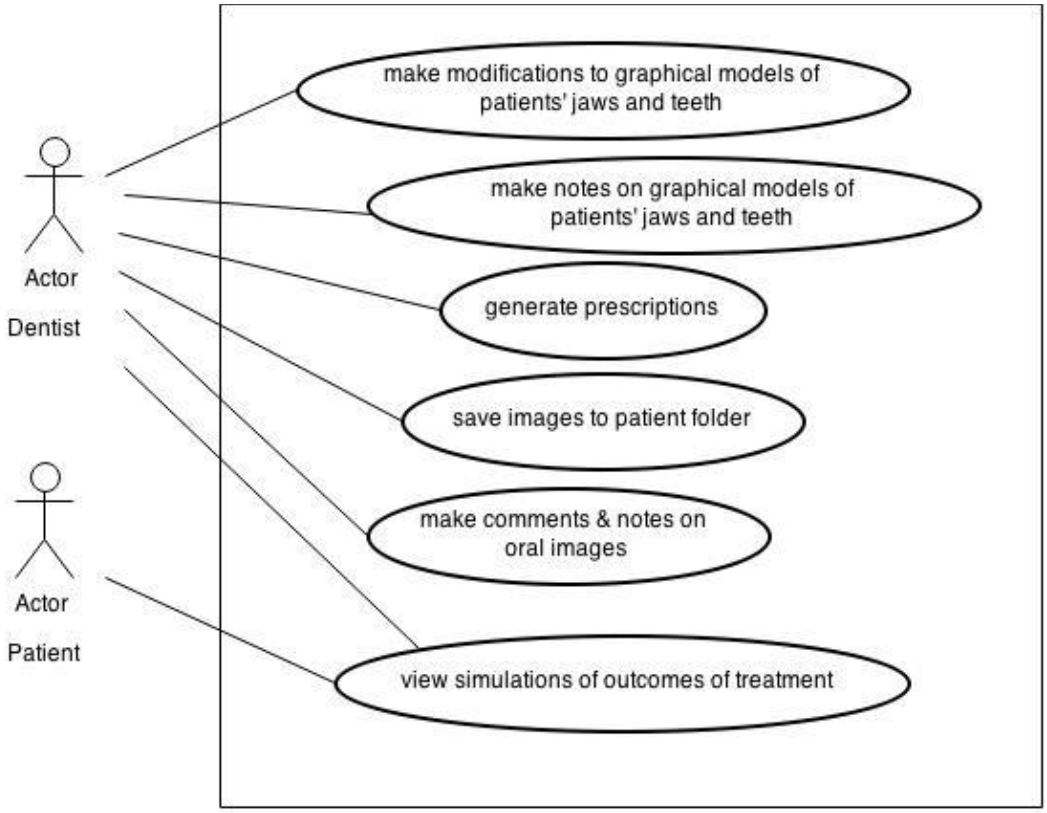


Table 1 : Use case - 3D modeling

Use case Name	3D modeling
Pre –Condition	Capture 2D images
Actor	Doctor
Main Succes Scenarios	1. Capture images 2. Select 2D images 3. Select output type 4. Click “Modeling/Convert”.
Extension	1a. Captured images are not clear 2a. Select a valid source images

Table 2 : Use case - Simulating outcome

Use case Name	Simulating outcome
Pre –Condition	3D model
Actor	Doctor
Main Success Scenarios	1.Select 3D model. 2. Select treatment type. 3. Select treatment period 4. Click “Simulate”.
Extension	1a. Selected model not compatible

Table 3 : Use case - 3D model editing

Use case Name	3D model editing(Manual 3d modeling)
Pre –Condition	Simple model
Actor	Doctor
Main Success Scenarios	1. Select 3D model. 2. Edit 3D model. 3. Click “View”.
Extension	1a. Selected model not compatible

Table 4 : Use case - Create prescriptions

Use case Name	Create prescriptions
Pre –Condition	
Actor	Doctor
Main Success Scenarios	1 Select patient’s teeth images. 2. Select treatment. 3. Comments images 3. Click “Create Prescription”.
Extension	

2.3 User Characteristics

Users of this system are ;

- Dentist
- Dentists' assistant / nurse / receptionist

The dentist has full access to the system, while the assistant / nurse / receptionist has access only to the patient registration component.

Therefore, this component will be used by the **Dentist**

2.4 Constraints

- Java will be the implementation language
- MySQL will be used to create the database
- A storage devise of 100 GB the least will be required to store images
- A daily backup will be required to free storage space on the device

2.5 Assumptions and Dependencies

- Future versions will use cloud technology for the knowledge base.

2.6 Apportioning of Requirements

The requirements described in sections 1 and 2 of this document are referred to as primary specifications; those in section 3 are referred to as requirements (or functional) specifications. The two levels of requirements are intended to be consistent. Inconsistencies are to be logged as defects. In the event that a requirement is stated within both primary and functional specifications, the application will be built from functional specification since it is more detailed.

3. System Requirements

3.1 External Interface Requirements

3.1.1 User Interfaces

Users of this system will not be experts, hence user friendliness will be crucial. Users of this system will be the dentist and the dentist's assistant / nurse.

User interfaces will be simple, clear and easy to use. Font on these interfaces must be greater than 12 pt.

System interfaces will be designed to ensure highest usability and efficiency. Text fields will be used only where necessary. The interfaces will be designed to contain check boxes and radio buttons predominantly, to ensure the data entry process easy and efficient.

The system is expected to be used at least 8 hours a day. Hence its interfaces will have suitable colours to avoid inconvenience and discomfort to its user.

3.1.2 Hardware Interfaces

The hardware needed for this research project will be ;

- Laptop computer
- Intraoral camera
- Tablet PC
- Bar code reader

The **laptop computer** which will be used by the dentist, will contain the proposed software system and will perform the necessary processing activities.

The **tablet PC** will serve as the education tool for the patient, on which images captured by the intra oral camera will be displayed and simulations of the treatments and outcomes will be displayed.

The intraoral camera

The intraoral camera will capture images of the patient's oral cavity and transmit them to the laptop computer, where the processing will take place. Device specifications are listed below.

Pixels : 1MP
6 LED Lights (5600K)
Bright Adjustment: 4 Levels of different brightness
Focus Range: 10 to 50mm
Field Angel: 105 Degrees Celsius
Magnification: 5 xs
Connection: Wi-Fi
Terminal Connection: 4 Terminals (At the same time)
Available Distance: Up to 30 Meters
Battery: 3.7V 2100 mAh
Charging Time: About 1 Hour
Usage Time: 3 Hours

Smartphone Compatibility: iOS ,Android, Windows System

Button: Photo/ Video button, Brightness Adjusting button, On/Off button

Micro USB port

Toothpick socket

Main Product Dimensions: 233x34x36 mm (L x W x D)

The bar code reader

The bar code reader serves as a tool for patient management, where a unique bar code will be generated for each patient, and once the bar code is scanned patient profile will be displayed on computer. Device specifications are listed below

Interfaces Supported: USB

Scanning Type :Automatic scanning or manual

Depth of Field : 15-800mm PCS0.9

Scan Rate: 85 scans per second

Reading Preciseness : 0.40-0.825mm

Reading Distanc : 10-520mm

Print Contrast : 30% minimum reflective difference

Scanning Angle : Inclination angle 45°, Elevation angle 60°

Operating Temperature : 0°C - 50°C / 32°F to 122°F

Storage Temperature : -40°C - 70°C / -40°F to 158°F

Operating Humidity : 5% - 95% (non condensing)

Storage Humidity: 5% - 95% (non condensing)

Power Voltage ;5V

Static Current : 36mA

Ambient Light Immunity : Immune to direct exposure of normal office and factory lighting conditions, as well as direct exposure to sunlight

Electrostatic Discharge: Conforms to ±15KV air discharge and ±8KV of contact discharge

EMI/EMS : En50081, par1 criteria

3.1.3 Software Interfaces

- The system will be developed using Java version 1.7
- The webpages will be developed using HTML, CSS, JavaScript and jQuery.
- The database will be created using MySQL version 5.5

3.1.4 Communication Interfaces

- Intra oral camera software will provide wireless access to the laptop and tablet PC. Images and videos captured by the intra oral camera will be transmitted to the laptop and tablet PC to be viewed by dentist and patient.
- A Modem or a dongle will provide access to Internet when necessary Internet access will be required for Teleconferencing and live streaming videos and images captured by the intra oral camera.

3.2 Classes / Objects

Classes required by the system are shown below in class diagrams.

The class diagrams below represent the system in different perspectives.

Figure 4 : Class diagram of system - Patient Perspective

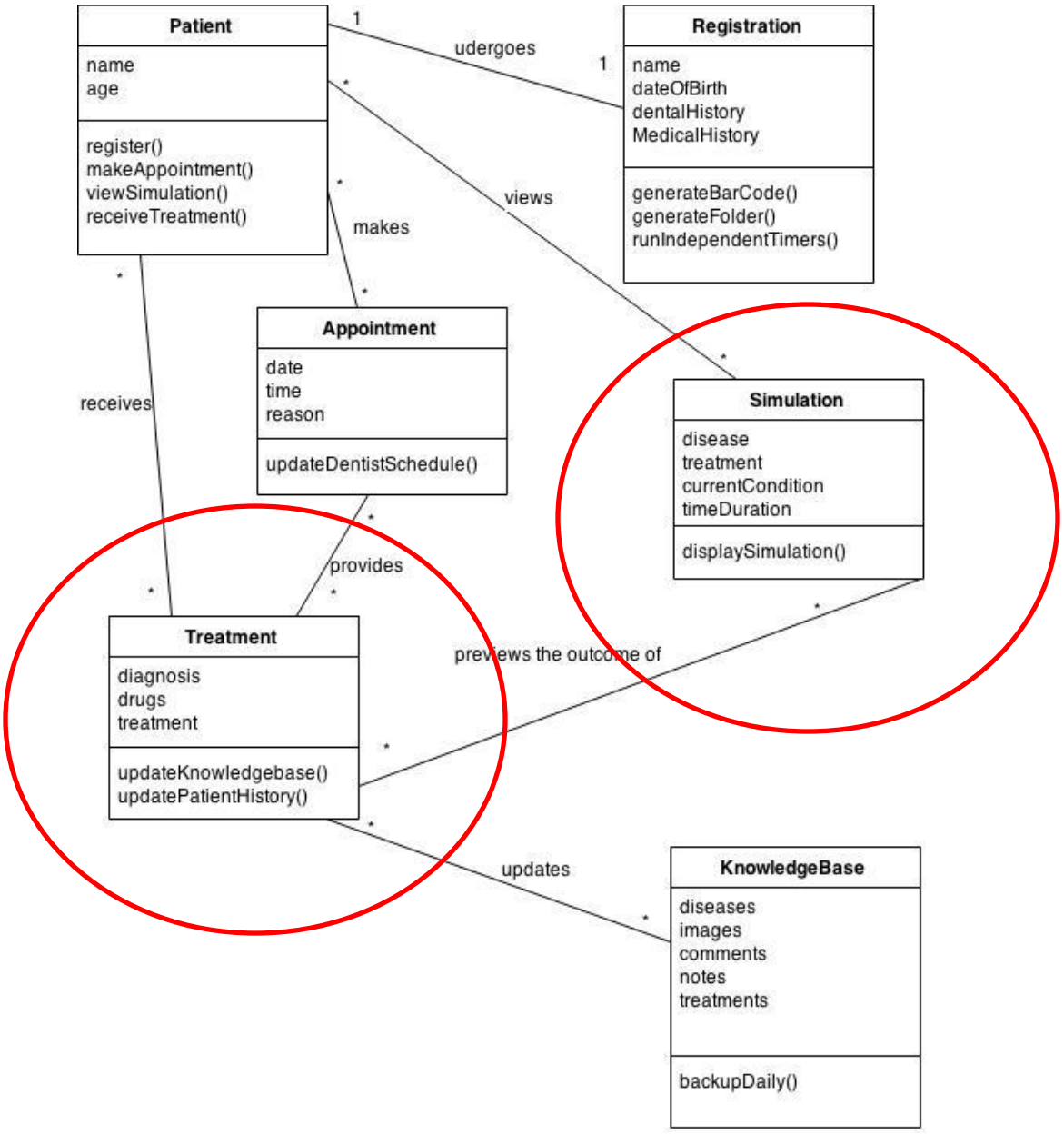


Figure 5 : Class diagram of system - Nurse Perspective

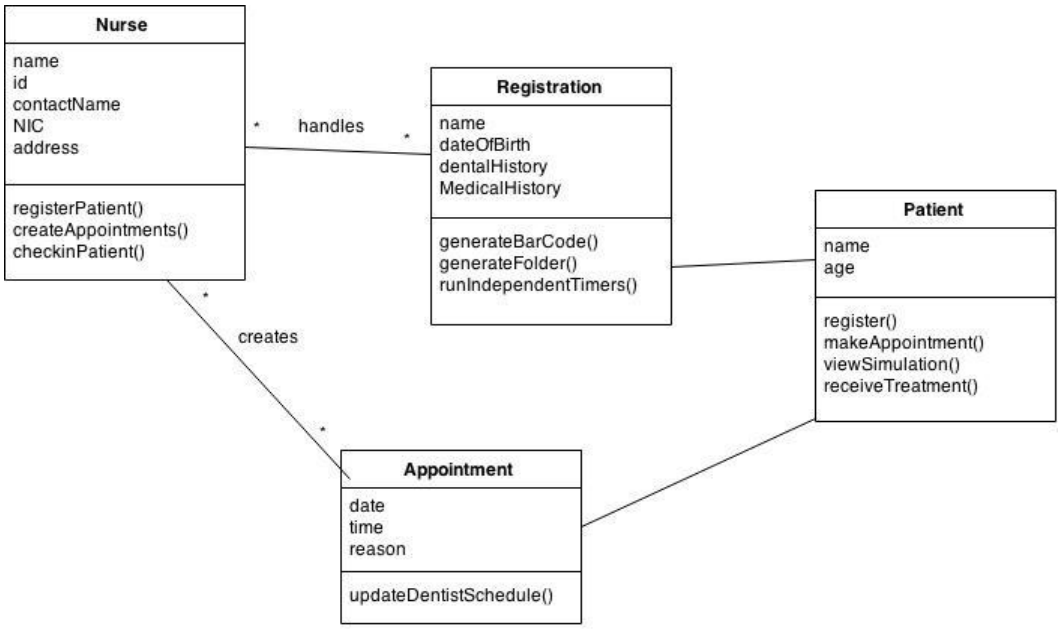
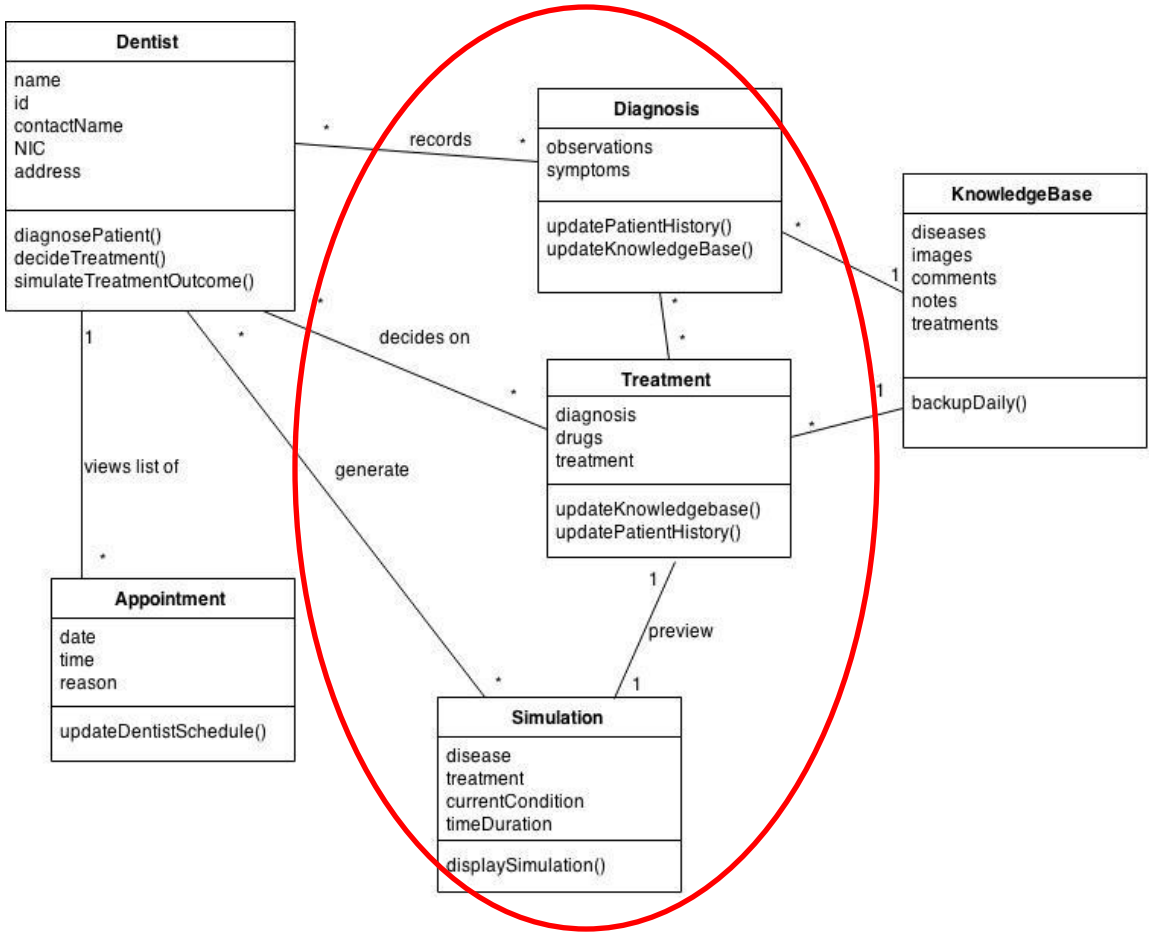


Figure 6 : Class diagram of system - Dentist Perspective



3.3 Performance Requirements

The laptop used for this system must be no less than the following

- Core i5 CPU
- 4 GB RAM
- 250 HD

3.4 Design Constraints

Since the web application is used by doctors and nurse who are fairly computer illiterate, the GUIs will be designed as very simple and self-evident interfaces. Light colors, mind relaxing images will be used in designing the GUIs.

3.5 Software System Attributes

- **Correctness** - The correctness of the details which is in data base should be 100% correct when taking the assumptions and the constraints together.
- **Availability** - The administrative officer can access any data in the database at any time.
- **Confidentiality** – Information must be kept private from the outside world.
- **User friendly** – The system's user interfaces must be kept simple and easy to handle.
- **Safety** - Database backup is required in case of a database crash or an operating system failure. A backup shall consist of a complete reproduction of every file on the server.
- **Security** - The system shall implement authentication via a secure login scheme.

References

[1] “Media Centre”, *World Health Organization* , available: http://www.who.int/mediacentre/factsheets/fs318/en/ , [accessed : 28.01.2015]

[2] “What problems could my dental health cause”, *British Dental Foundation,* available: http://www.dentalhealth.org/blog/blogdetails/104 [accessed : 28.01.2015]

[3] “Oral Health”, *National Institute of Dental and Craniofacial Research,* available: http://www.nidcr.nih.gov/oralhealth/, [accessed : 28.01.2015]

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