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Smart Dentassist;

An Interactive System for Dental Support and Patient Management

(SRS Document)

Project ID : 15-085

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Declaration

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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

Dental Information Knowledge Base :

The system will store images captured from intra oral camera along with their comments to create a knowledge base for the dentist. The diseases will be categorized and images will be saved according to the disease. This knowledge base should provide the dentist with treatment suggestions based on the data it stores. The system must allow the sharing of the content in knowledge base with other dentists in remote locations. If diagnosing is problematic, the dentist will be able to refer the knowledge base to check previously treated cases, treatments given, drugs used, and comments.

This component will benefit the dentist as follows :

- Ease of access of enhanced technology and knowledge
- Enhanced patient database.
- Constantly updating knowledge base

This component will benefit the patient as follows :

- Enhanced dental care
- All details, dental conditions, treatments carried out, treatments that need to be performed will be stored in the database and will not be missed out

The main objectives of this components are ;

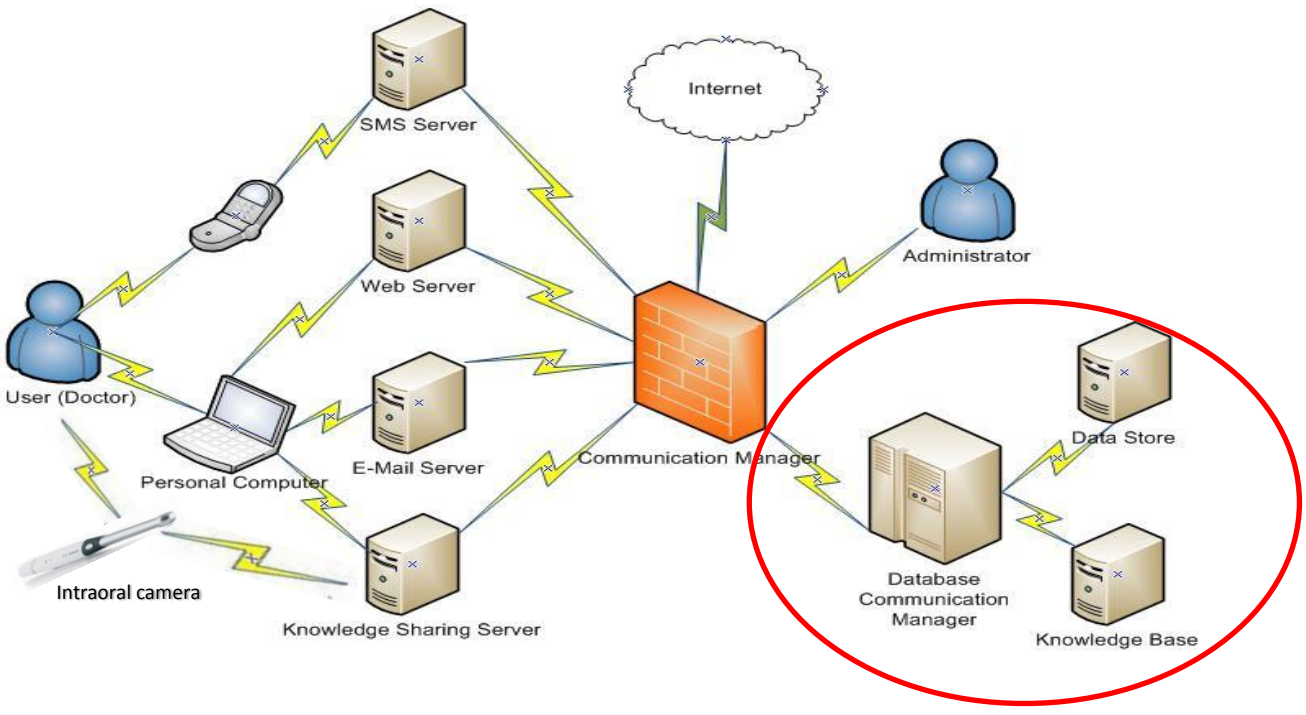
- To improve the technology of the dental medicine field
- For “knowledge balancing” among dentists
- To create a “Knowledge Base” for dentists which helps in decision making.

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 Overview

Figure 1 : Component in 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.

The next chapter, the Overall Description section, of this document gives an overview of the functionality of the product component "**Dental Information Knowledge Base**" . 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 "**Dental Information Knowledge Base**", but are intended for different audiences and thus use different language.

2. User Requirements

2.1 Product Perspective

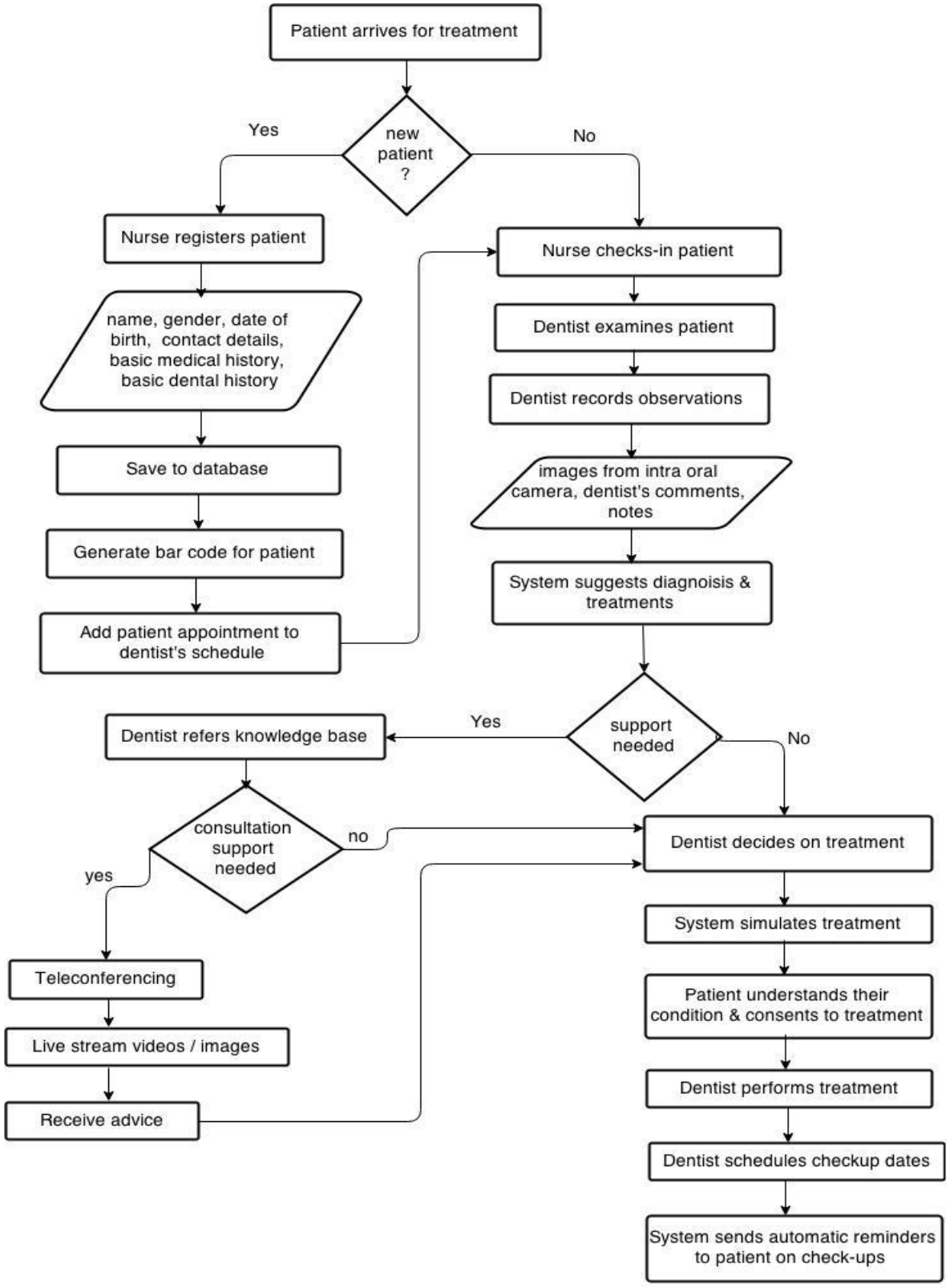
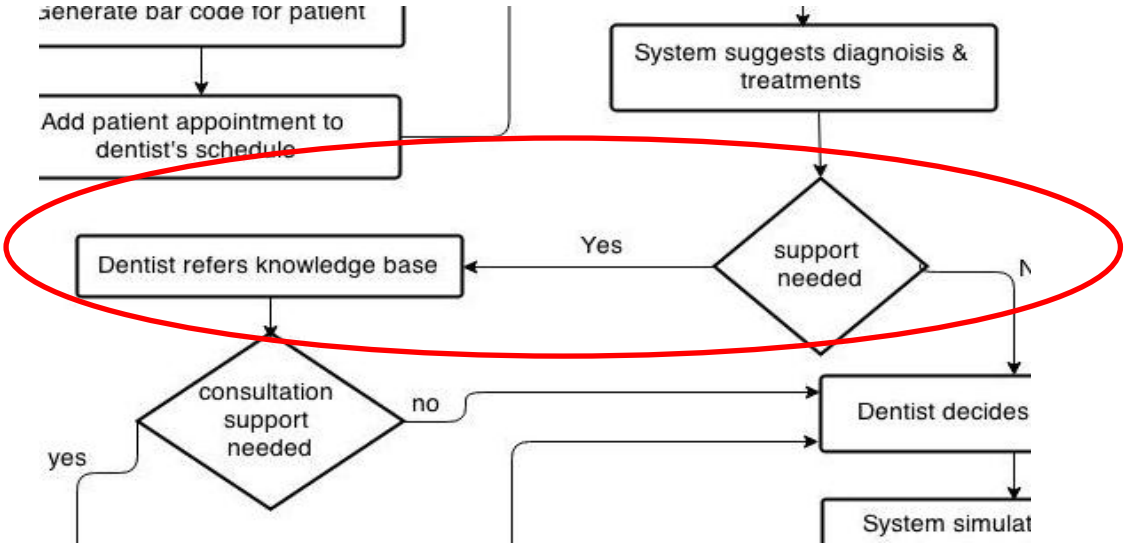


Figure 2 : Flowchart of the system

Figure 3 : Component in the flow chart



2.1.1 System Interfaces

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

2.1.2 User interfaces

Figure 4 : Knowledge Base - Patient Profile Interface

The above user interface displays a patient's profile, the drugs prescribed and treatments carried out. The system facilitates the dentist to store previously cases and refer them when in need.

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

Dental Information Knowledge Base :

The system will store images captured from intra oral camera along with their comments to create a knowledge base for the dentist. The diseases will be categorized and images will be saved according to the disease. This knowledge base should provide the dentist with treatment suggestions based on the data it stores. The system must allow the sharing of the content in knowledge base with other dentists in remote locations. If diagnosing is problematic, the dentist will be able to refer the knowledge base to check previously treated cases, treatments given, drugs used, and comments.

Figure 5 : Dental Information Knowledge Base - use case diagram

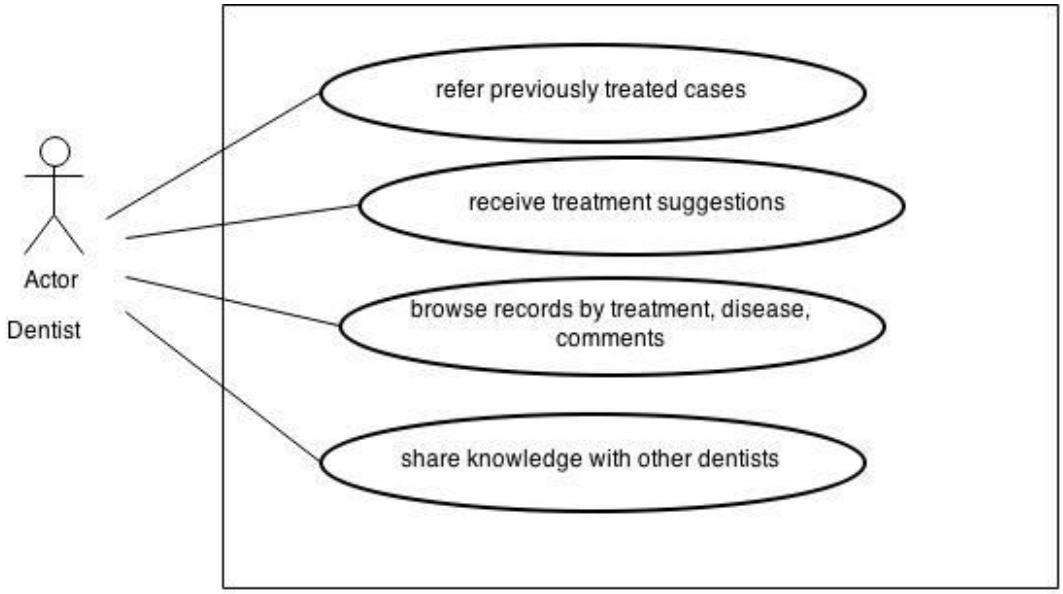


Table 1 : Use Case - Refer previous treatments

Use case 01	Refer previous treatments
Pre-condition	1. Application is up and running 2. Database connection is active

Actor	Dentist
Main Success Scenarios	1. Select the patient profile 2. Select the patient history 3. Patient's previous treatments will load in the web page
Extension	3.a. Previous treatments page not load for new patients

Table 2 : Use case - Table 2 : Use case - Receive treatment suggestions

Use case 02	Receive treatment suggestions
Pre-condition	1. Application is up and running 2. Database connection is active
Actor	Dentist
Main Success Scenarios	1. Select the patient profile 2. Add comments to the patient oral health 3. Click the 'suggestions/help' button 4. Popup suggestions for treatments and drugs
Extension	3.a. Comments must filled in the web page

Table 3 : Use case - Share knowledge base

Use case 03	Share knowledgebase
Pre-condition	1. Application is up and running 2. Database connection is active
Actor	Dentist
Main Success Scenarios	1. Select the patient profile 2. Click the 'Share knowledgebase' button 3. Popup knowledgebase details to select 4. Share details to central database
Extension	2.a. Knowledgebase can share with profile to profile and also with category wise.

Table 4 : Use case - Make comments on oral images

Use case 04	Make comments on oral images
Pre-condition	1. Application is up and running 2. Database connection is active
Actor	Dentist
Main Success Scenarios	1. Select the patient profile 2. Click the 'Add Image' button 3. Load the intra-oral camera images 4. Select relevant image 5. Click 'Add Comment' button 6. Popup the editor panel 7. Add comments to the image 8. Save the image
Extension	3.a. Images are not loaded if the location is empty

Table 5 : Use case - Make notes on oral images

Use case 05	Make notes on oral images
Pre-condition	1. Application is up and running 2. Database connection is active
Actor	Dentist
Main Success Scenarios	1. Select the patient profile 2. Click the 'Add Image' button 3. Load the intra-oral camera images 4. Select relevant image 5. Click 'Add Note' button 6. Popup the image editing panel 7. Add notes on the image 8. Save the image
Extension	3.a. Images are not loaded if the location is empty 8.a. Notes are empty image will not saved

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.

Figure 6 : Knowledge Base - Patient Profile Interface

The above user interface displays a patient's profile, the drugs prescribed and treatments carried out. The system facilitates the dentist to store previously cases and refer them when in need.

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 7 : Class diagram of system - Patient Perspective

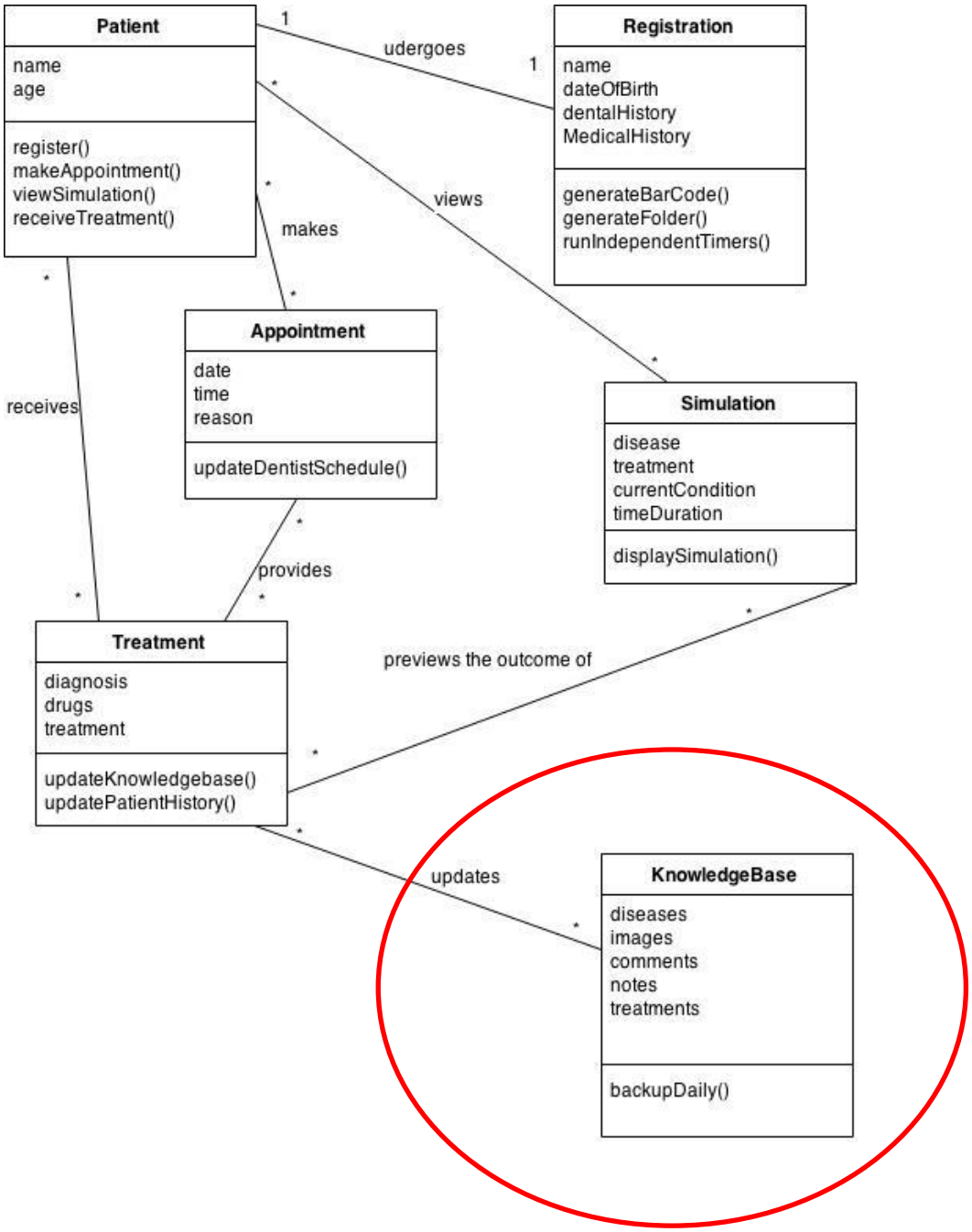


Figure 8 : Class diagram of system - Nurse Perspective

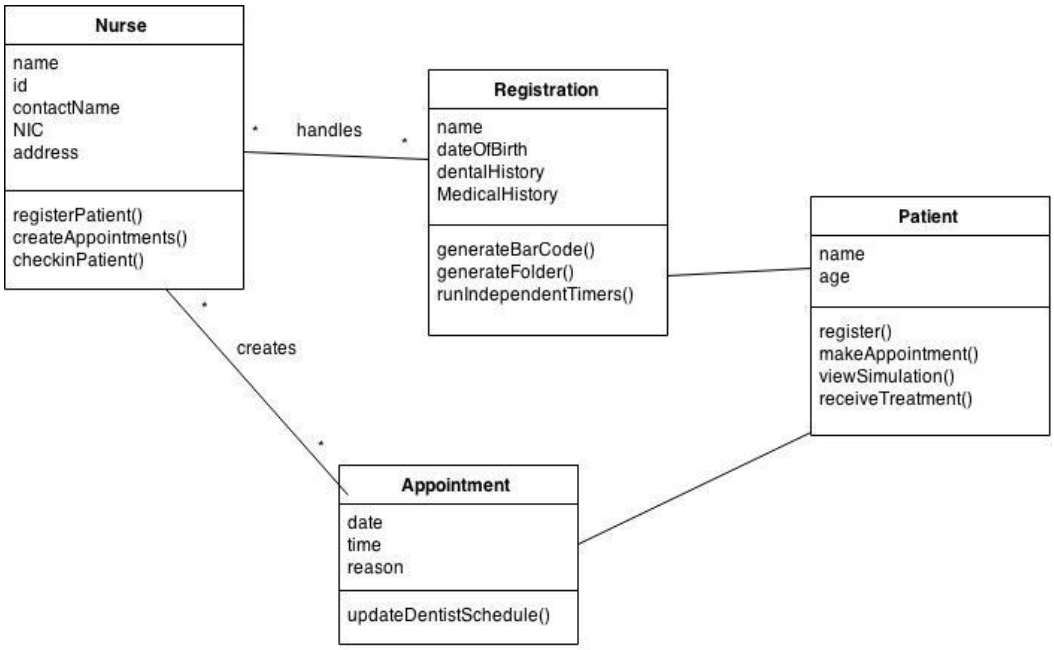
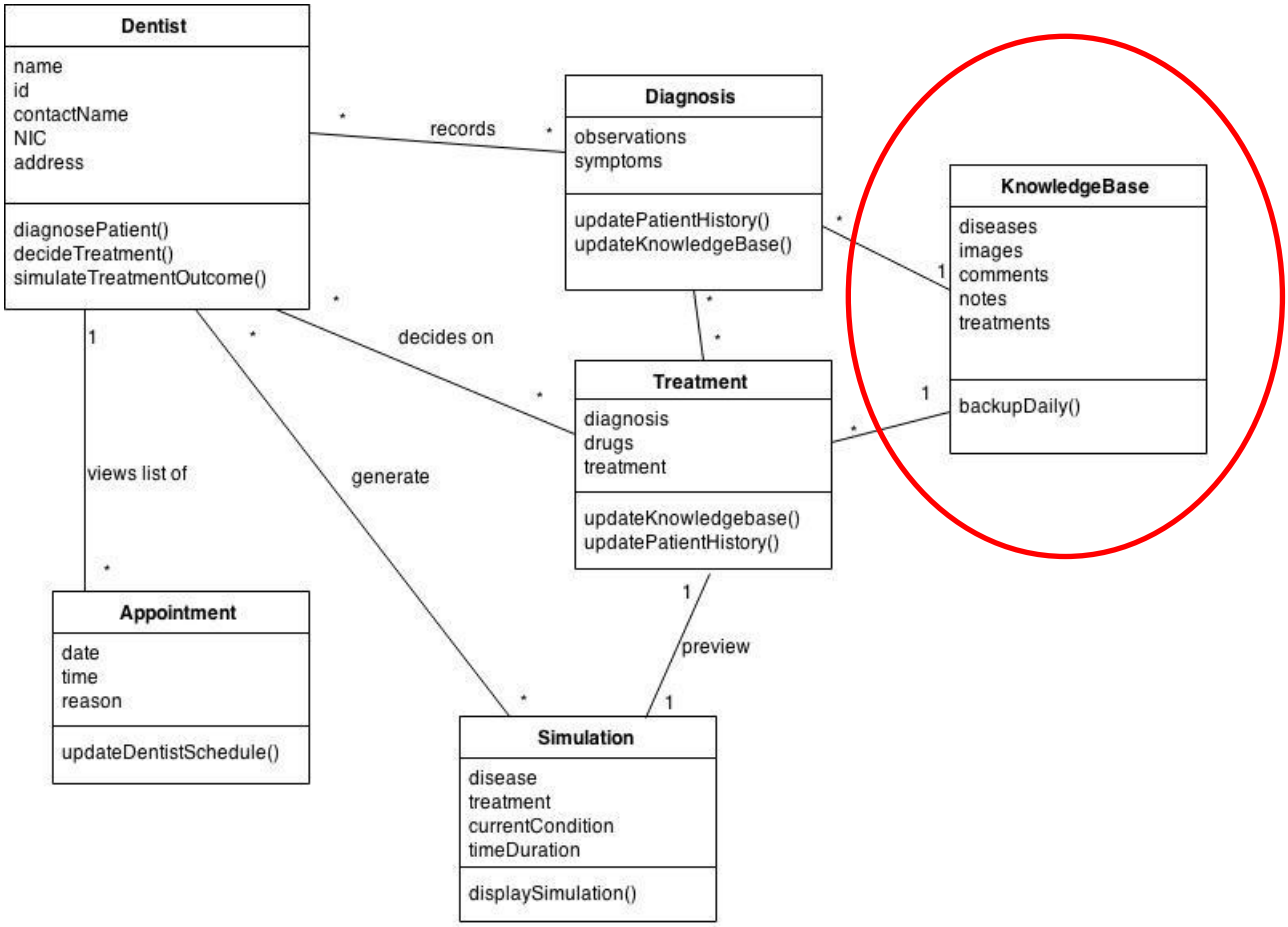


Figure 9 : Class diagram of system - Dentist Perspective



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.

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