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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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Revision History

Version	Date	Summary of Changes	Author

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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*, *php 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

1.2.1 Patient Management System

The system will register new patients by taking the essential details such as name, date of birth, gender, address, telephone numbers, email address, allergies and generate a unique barcode for each patient. When the barcode is scanned, the patient's details will be displayed. Images captured from intra oral cameras, medical history and all other relevant data will be stored in patient folder. The system will generate a virtual waiting list for the dentist. When patients arrive at the dental clinic, they will be entered into the system at the reception. The dentist will be able to view the patient being treated as well as the list of patients who are waiting for their turns. The system will maintain an independent timer for each person to track appointments and to send reminders.

This component will benefit the dentist as follows :

- Enhanced patient database.
- Better means of communication with patient through reminders

This component will benefit the patient as follows :

- Being reminded of upcoming appointments and treatments.
- Enhanced dental care.

The main objectives of this components are ;

- To provide a better dental health care service to patients, irrespective of where they live.
- To take measures to prevent oral diseases
- To encourage the common man to take preventative measures
- To improve the technology of the dental medicine field

1.2.2 Teleconferencing System

The system will allow the dentist to teleconference with other dentists to share images or to live stream video to get their opinions or support if needed. The system will also transmit images or video from the intra oral camera to a tablet so that the patient will be able to see and understand the condition of the disease as well as the treatment being performed.

This component will benefit the dentist as follows :

- Ease of access of enhanced technology and knowledge
- Easy communication among dentists for dental issues

This component will benefit the patient as follows :

- Enhanced dental care.
- Better dental education and understanding of dental conditions.
- Ability to receive necessary treatment even from rural areas

The main objectives of this components are ;

- To provide a better dental health care service to patients, irrespective of where they live.
- To improve the technology of the dental medicine field
- To provide better communication facilities for dentists with specialists and consultants

1.2.3 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

1.2.4 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

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. It describes the informal requirements and is used to establish a context for the technical requirements specification in the next chapter.

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.

Both sections of the document describe the same software product in its entirety, but are intended for different audiences and thus use different language.

2. User Requirements

2.1 Product Perspective

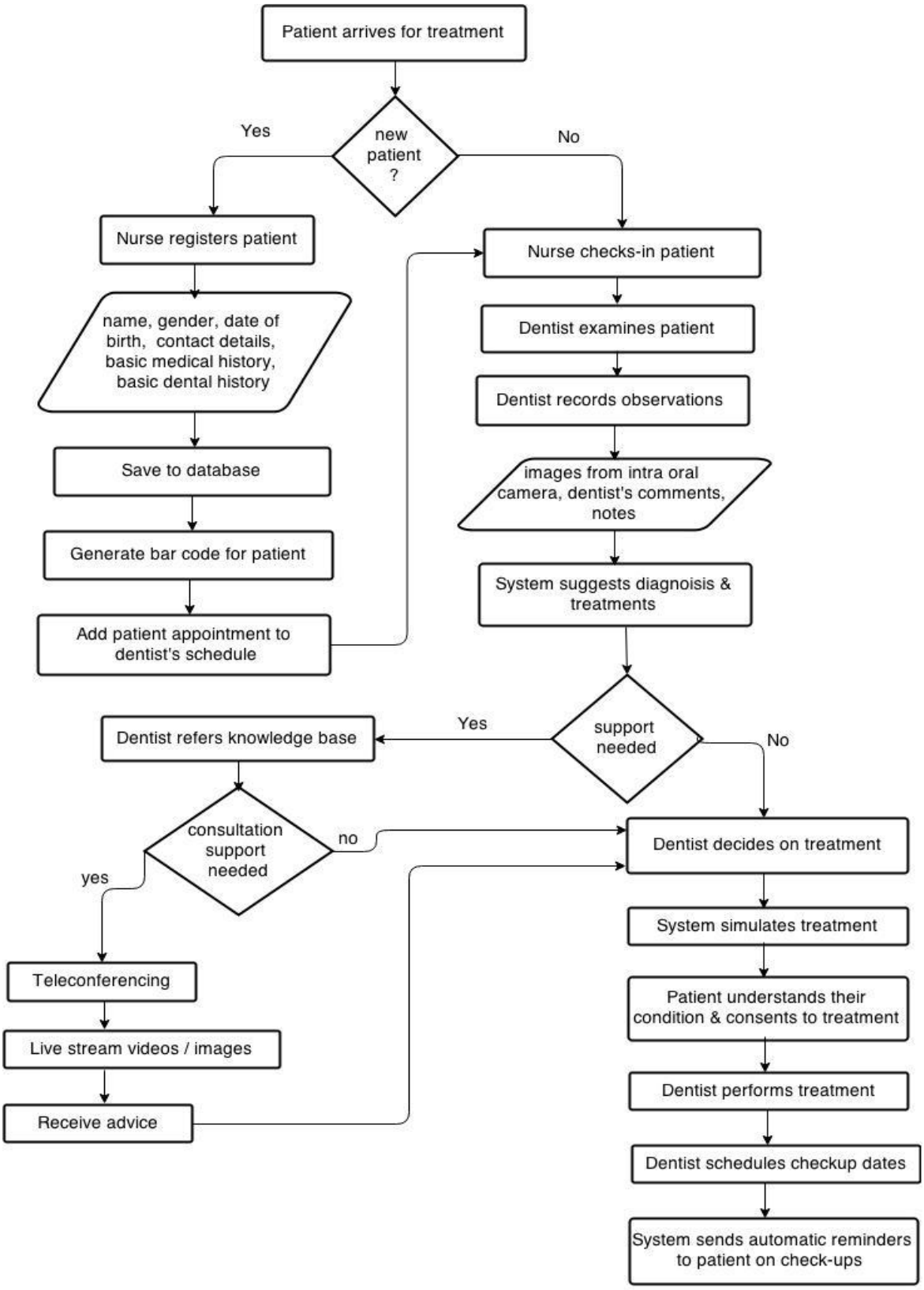


Figure 1 : Flowchart of the system

2.1.1 System Interfaces

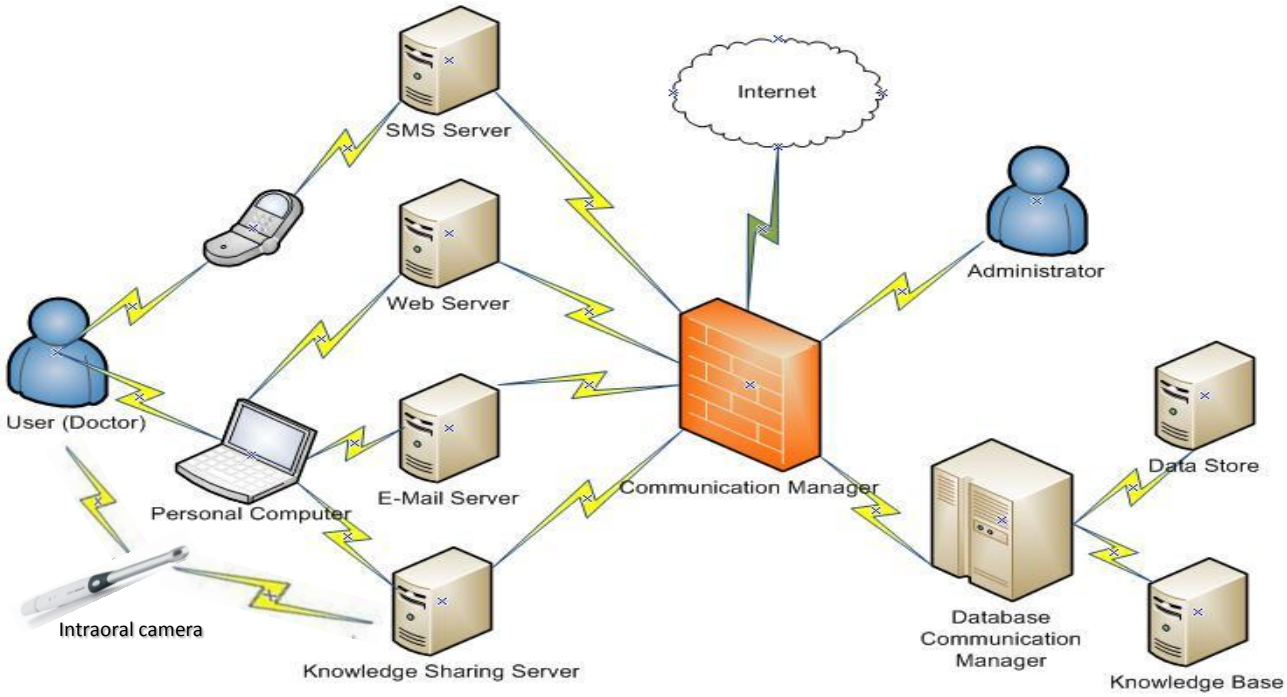
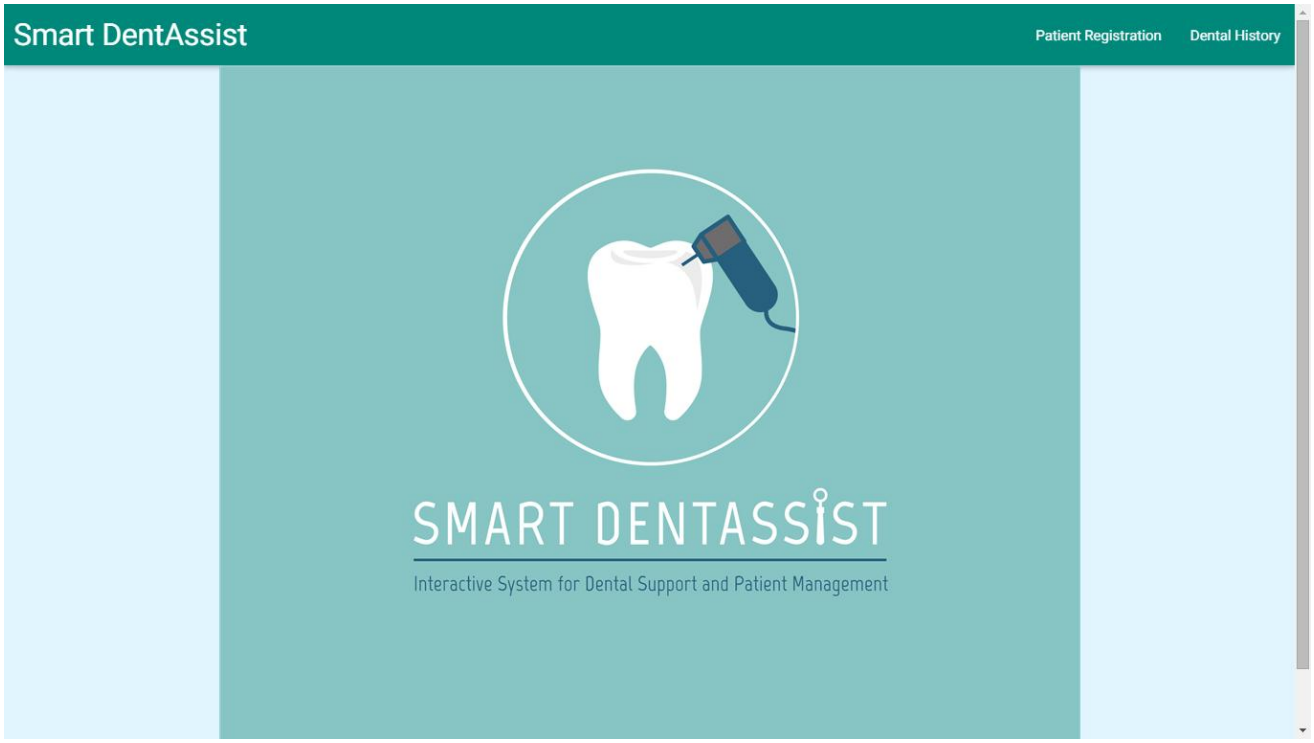


Figure 2 : System diagram

2.1.2 User interfaces

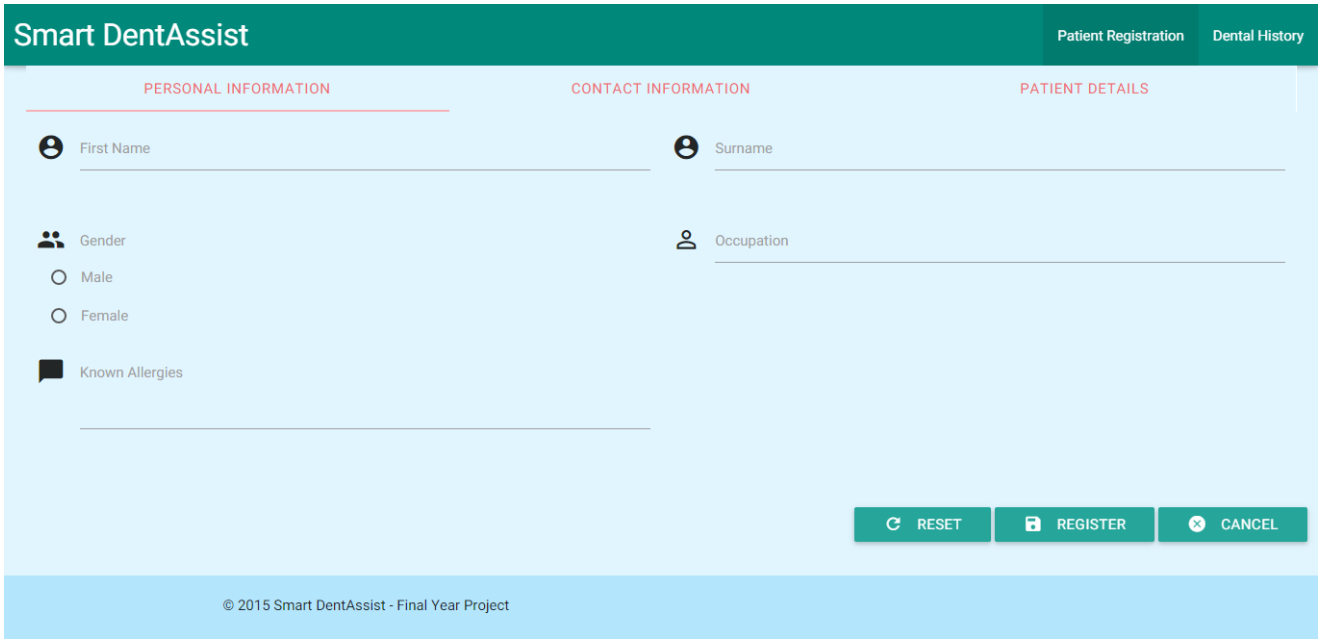
Figure 3 : Smart Dentassist Homepage



The home page of the Smart Dentassist system is displayed above. This will be displayed first to its users. Depending on the task the user needs to perform, they could select whether to navigate to “Patient Registration” section or “Dental History” section.

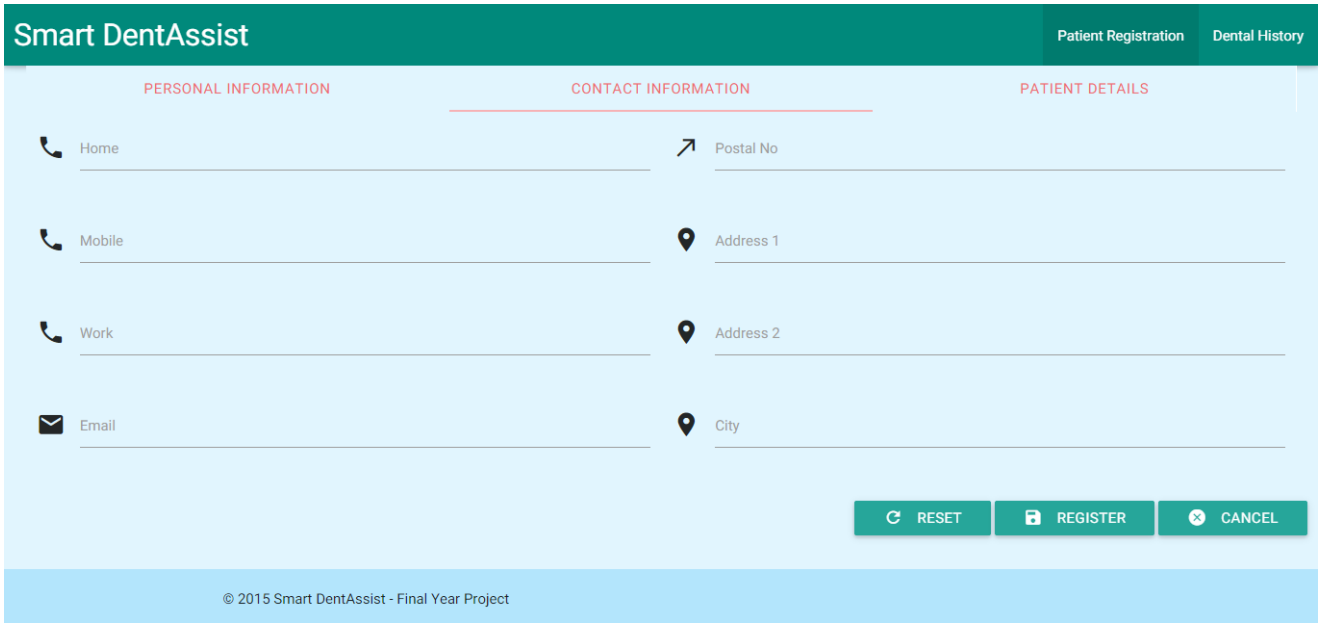
Users of the two sections Patient Registration and Dental Health could vary. Patient Registration section is intended for the use of the dentist’s assistant / nurse / receptionist. Dental health section is intended for the use of the dentist.

Figure 4 : Patient Registration - Personal Information



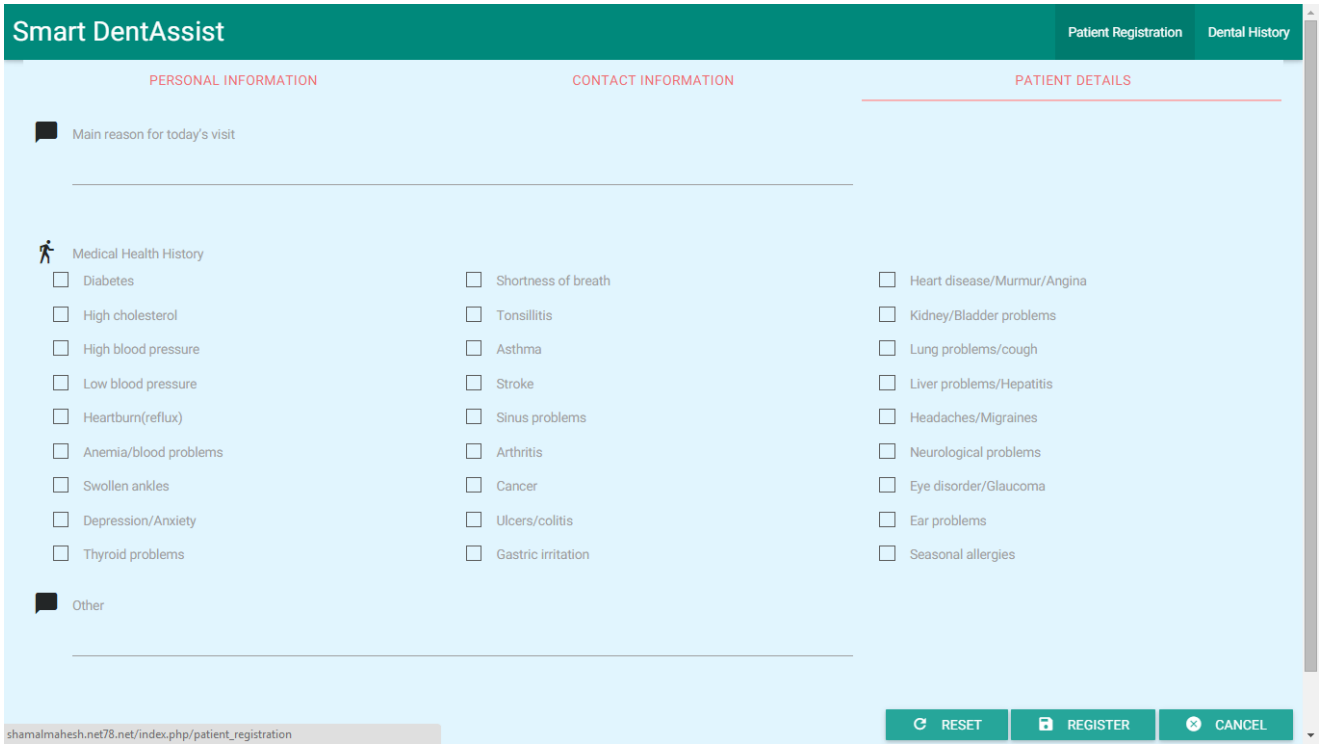
New patients who arrive for treatments must be registered in the system. The "*Personal Information*" tab of *Patient Registration* section is designed for the user to enter patients' basic personal information to the system.

Figure 5 : Patient Registration - Contact Information



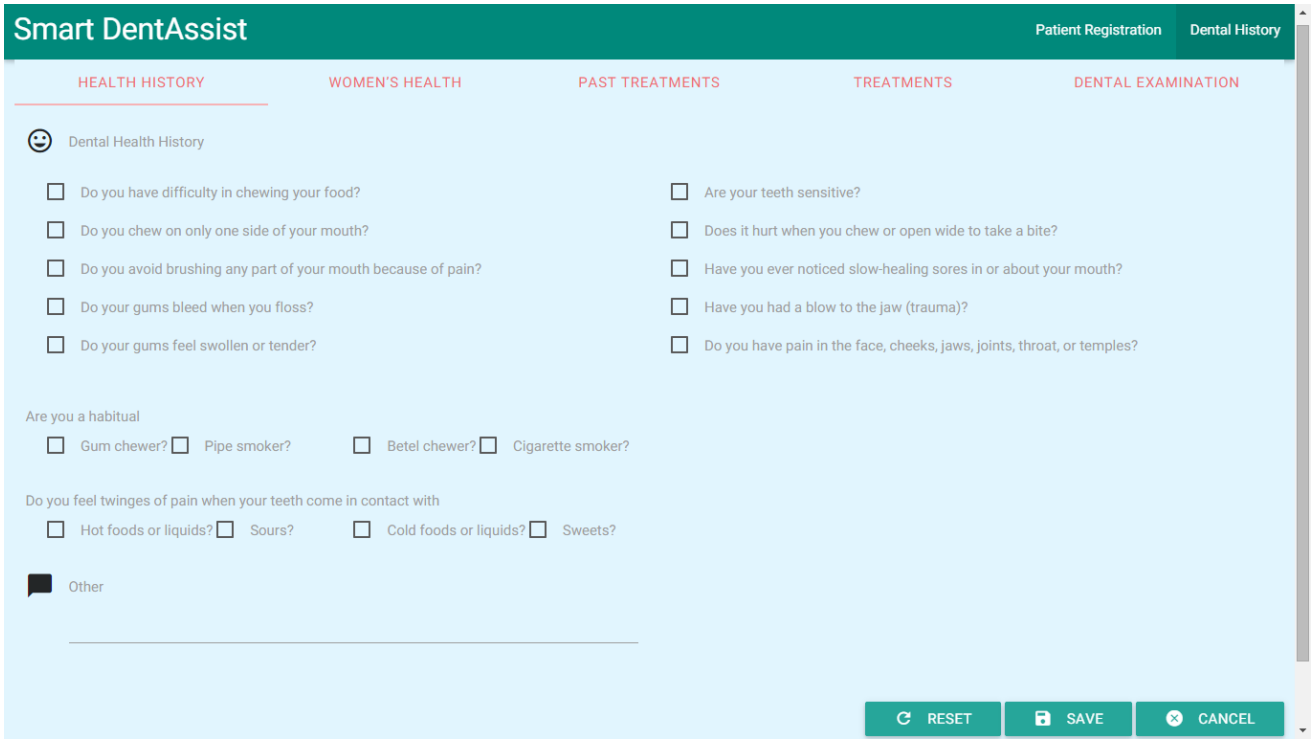
The "*Contact Information*" tab of *Patient Registration* section is designed for the user to enter the patients' contact information to the system.

Figure 6 : Patient Registration - Health Information



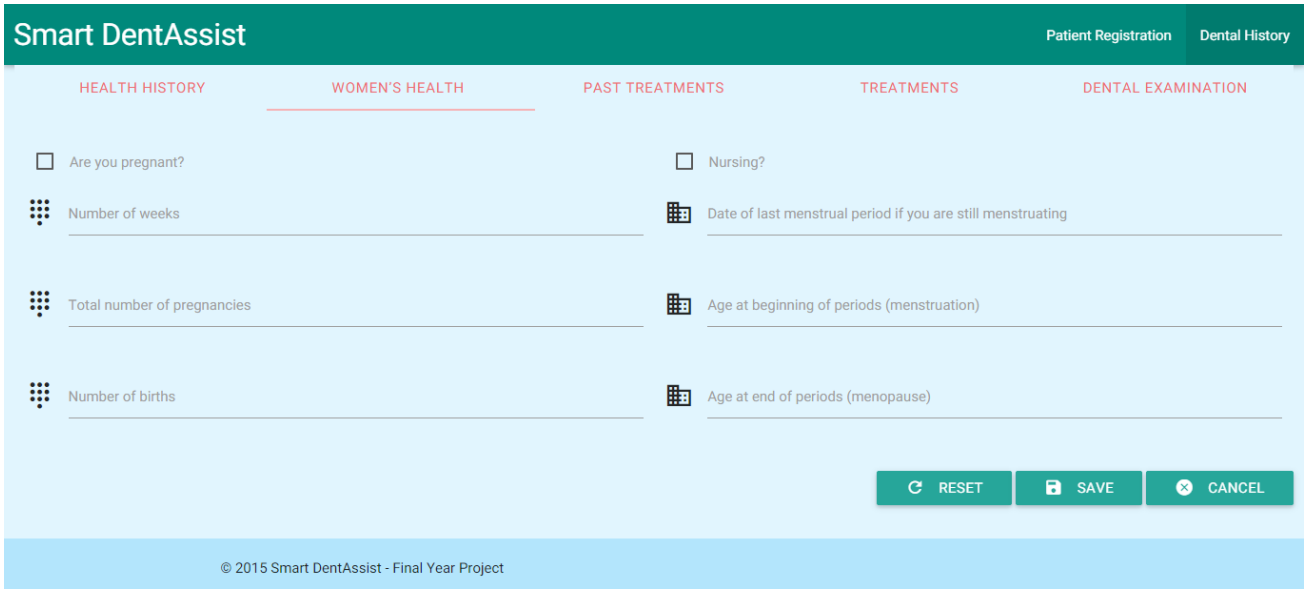
The "*Patient Details*" tab of *Patient Registration* section is designed for the user to enter patients' general health conditions to the system.

Figure 7 : Dental History - Health History



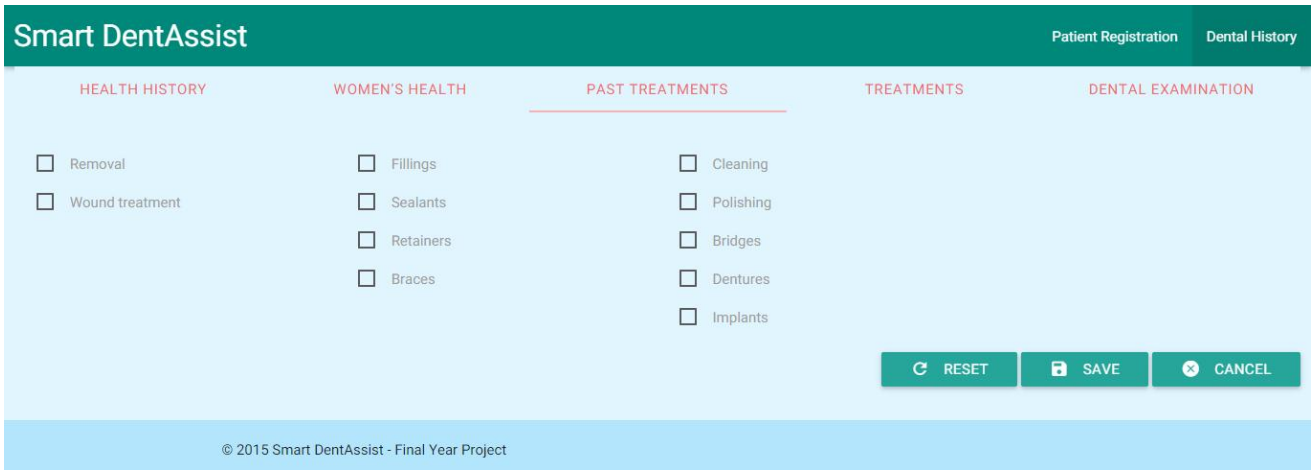
The section *Dental History* will be used mainly by the dentist to enter patient's medical history in detail when a new patient arrives for treatment. "*Health History*" tab is designed to store signs and symptoms as well as habits and practices related to dental issues.

Figure 8 : Dental History - Women's Health



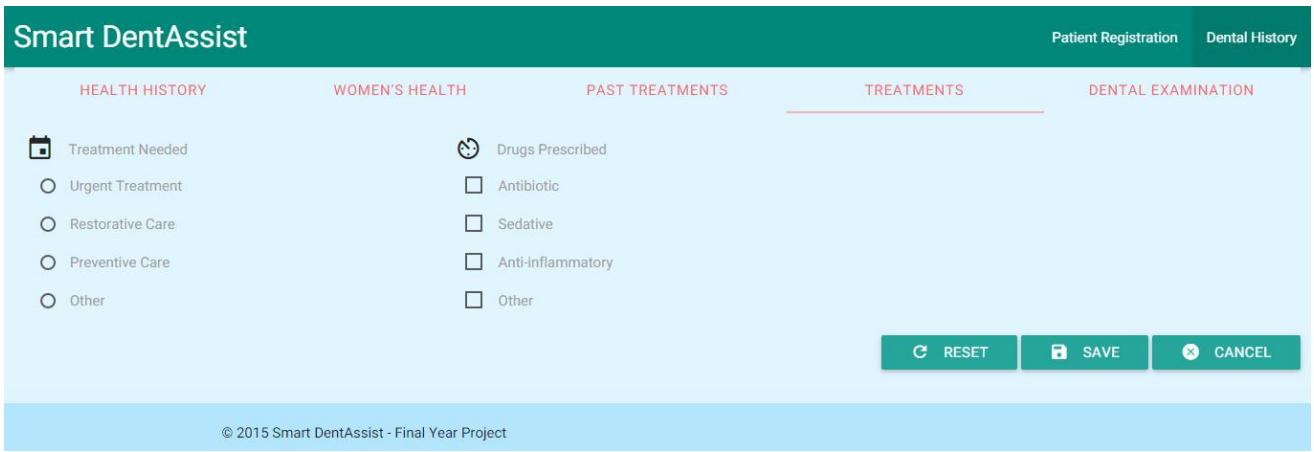
"*Women's Health*" tab (displayed above) is designed to store important health details of women that may have an impact on treatments.

Figure 9 : Dental History - Past Treatments



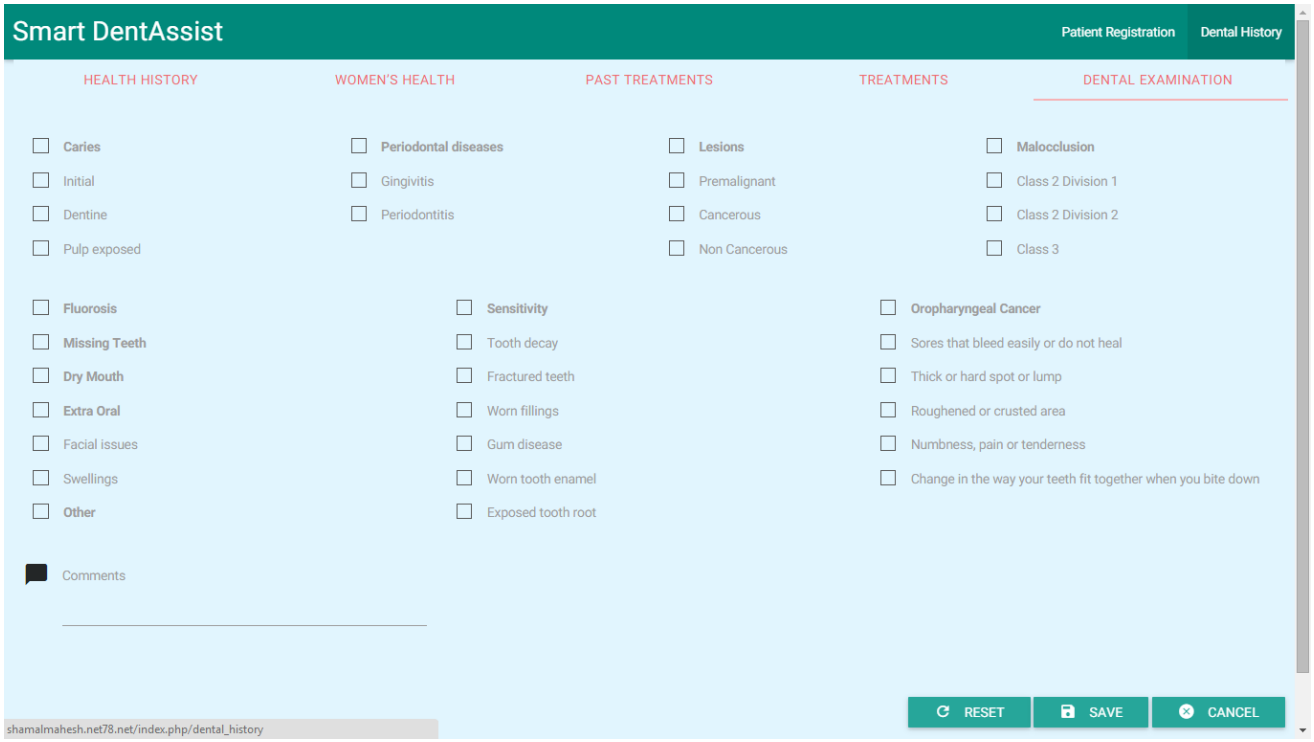
The "*Past Treatments*" tab (displayed above) of *Dental History* section is designed for the dentist to enter previously carried out dental treatments of the new patient, into the system.

Figure 10 : Dental History - Treatments



The "*Treatments*" tab (displayed above) of *Dental History* section is designed for the dentist to enter treatments required for the patients and the priority of the treatment into the system.

Figure 11 : Dental History - Treatments



The "*Dental Examination*" tab (displayed above) of *Dental History* section is designed for the dentist to enter results and observations acquired after examining the patient, into the system.

Figure 12: Knowledge base – patient history interface

The above user interface displays a patient's history 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

Patient Management System :

The system must register new patients by taking the essential details such as name, date of birth, gender, address, telephone numbers, email address, allergies and generate a unique barcode for each patient. When the barcode is scanned, the patient's details will be displayed. Images captured from intra oral cameras, medical history and all other relevant data will be stored in patient folder. The system will generate a virtual waiting list for the dentist. When patients arrive at the dental clinic, they will be entered into the system at the reception. The dentist will be able to view the patient being treated as well as the list of patients who are waiting for their turns. The system will maintain an independent timer for each person to track appointments and to send reminders.

Figure 13 : Patient Management Use Case Diagram

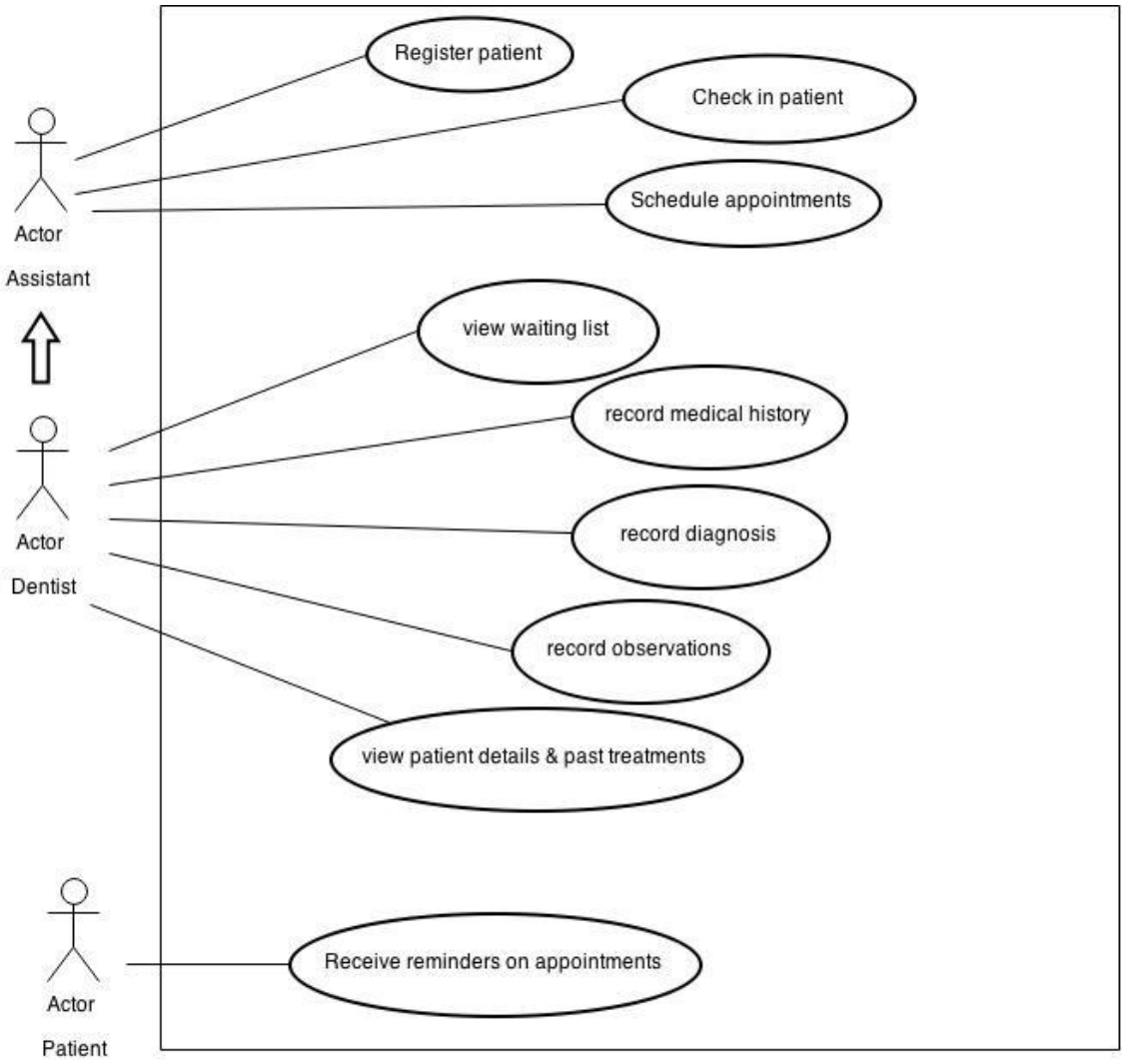


Table 1 : Use case - register patient

Use case	Register Patient
Pre-condition	1. Application is up and running 2. Database connection is active
Actor	Assistant / Nurse
Main Success Scenarios	1. Enter patient basic personal information 2. Enter patient contact details information 3. Enter patients' general medical history
Extension	

Table 2 : Use case - Check in patient

Use case	Check in Patient
Pre-condition	1. Application is up and running 2. Database connection is active 3. Patient must be already registered
Actor	Assistant / Nurse
Main Success Scenarios	1. Go to check in interface 2. Scan patient barcode with bar code reader 3. Doctor's waiting list & schedule are automatically updated
Extension	

Table 3 : Use case - Schedule appointments

Use case	Schedule appointment
Pre-condition	1. Application is up and running 2. Database connection is active 3. Patient must be already registered
Actor	Assistant / Nurse
Main Success Scenarios	1. Scan patient barcode / search patient 2. Select time and date 3. Enter reason for appointment / patient complaint 4. Add appointment

Extension	

Table 4 : Use case - view waiting list

Use case	View waiting list
Pre-condition	1. Application is up and running 2. Database connection is active
Actor	Dentist
Main Success Scenarios	1. Open daily schedule 2. View list of upcoming appointments
Extension	

Table 5 : Use case - Record medical history

Use case	Record medical history
Pre-condition	1. Application is up and running 2. Database connection is active 3. Patient is already registered
Actor	Dentist
Main Success Scenarios	1. Scan patient barcode / search patient 2. Open dental health history interface 3. Check/tick options and make comments if necessary 4. Save to the system
Extension	

Table 6 : Use case - Record diagnosis

Use case	Record diagnosis
Pre-condition	1. Application is up and running 2. Database connection is active 3. Patient is already registered 4. Patient history is saved
Actor	Dentist
Main Success Scenarios	1. Scan patient barcode / search patient

	2. Open treatment interface 3. Check/tick treatment types, drugs and treatment priority 4. Add comments 5. Save to the system
Extension	3a. if there are any other details to be stored, the dentist can store them as comments.

Table 7 : Use case - record observations

Use case	Record observations
Pre-condition	1. Application is up and running 2. Database connection is active 3. Patient is already registered 4. Patient history is saved
Actor	Dentist
Main Success Scenarios	1. Scan patient barcode / search patient 2. Open observations interface 3. Check/tick observations, signs, symptoms 4. Add comments 5. Save to the system
Extension	

Table 8 : Use case - View patient details & past treatments

Use case	View patient details & past treatments
Pre-condition	1. Application is up and running 2. Database connection is active 3. Patient is already registered 4. Patient history is saved 5. Patient diagnosis & observations are saved
Actor	Dentist
Main Success Scenarios	1. Scan patient barcode / search patient 2. Open patient profile interface 3. View past treatments, methods, drugs used, outcome

Extension	3a. If the patient is new, only the registration details will be displayed

Table 9 : Use case - Receive reminders on appointments

Use case	Receive reminders on appointments
Pre-condition	1. Application is up and running 2. Database connection is active 3. Patient is registered in the system
Actor	Patient
Main Success Scenarios	1. Receive text message / mail reminders of upcoming appointments
Extension	

Teleconferencing System :

The system will allow the dentist to teleconference with other dentists to share images or to live stream video to get their opinions or support if needed. The system will also transmit images or video from the intra oral camera to a tablet so that the patient will be able to see and understand the condition of the disease as well as the treatment being performed.

Figure 14 : Teleconferencing Use Case Diagram

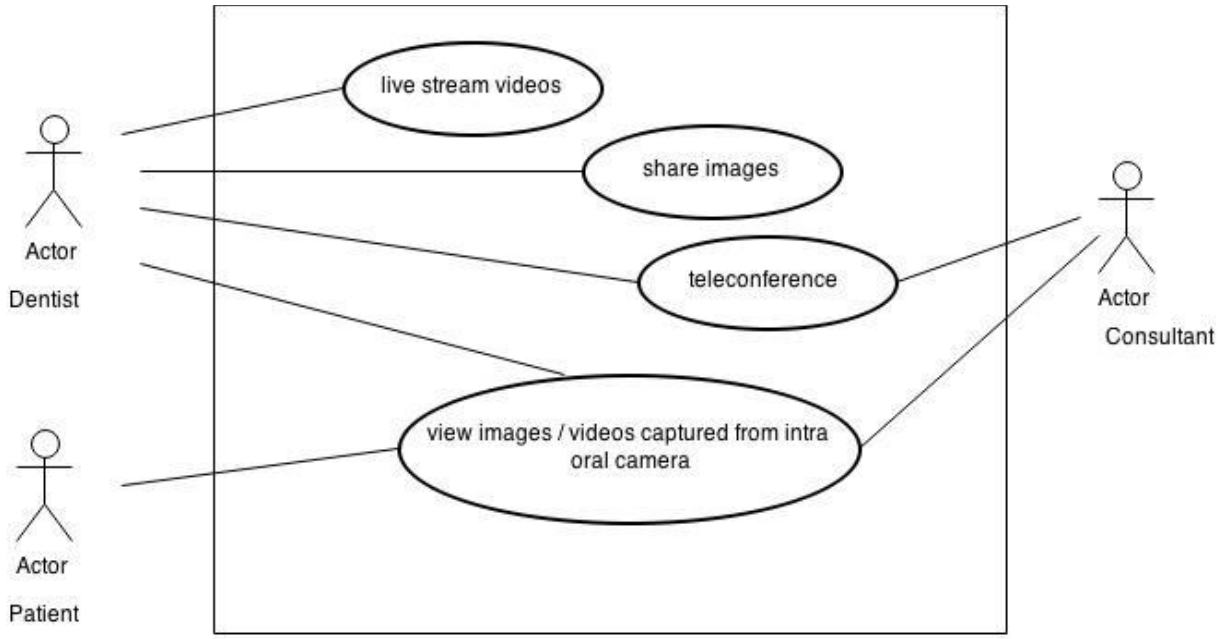


Table 100 : Use case - Live Stream videos

Use case 01	Live Stream videos
Pre-condition	3. Healthy internet connection 4. Application up and running and working hardware properly
Actor	Dentist
Main Success Scenarios	4. Get the list of online specialists/consultants 5. Send request to one or more specialists/consultants 6. Connect with people who accepted the request 7. Make online the video via the web application

Extension	1. a. No specialist/consultant available at the time

Table 11 : Use case - View images/videos captured from intra oral camera

Use case 02	View images/videos captured from intra oral camera
Pre-condition	1. Application is up and running 2. Hardware device is linked with the application
Actor	Dentist/Consultant
Main Success Scenarios	1. Select the patient profile 2. Connect device and get the inputs from it 3. View/save images/videos against the selected patient online 4. Share images/videos with other specialists/consultants
Extension	Inputs taken from the device is not recognixed =

Table 12 : Use case - Teleconference

Use case 03	Teleconference
Pre-condition	1. Application is up and running 2. Healthy internet connection
Actor	Dentist
Main Success Scenarios	1. Get the list of online specialists/consultants 2. Select one or more from the list to start teleconferencing with 3. Start the conference with the selected personnel.
Extension	3.a. share media with the participants if needed.

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 15 :Diagnosing, treating and simulating outcome - use case diagram

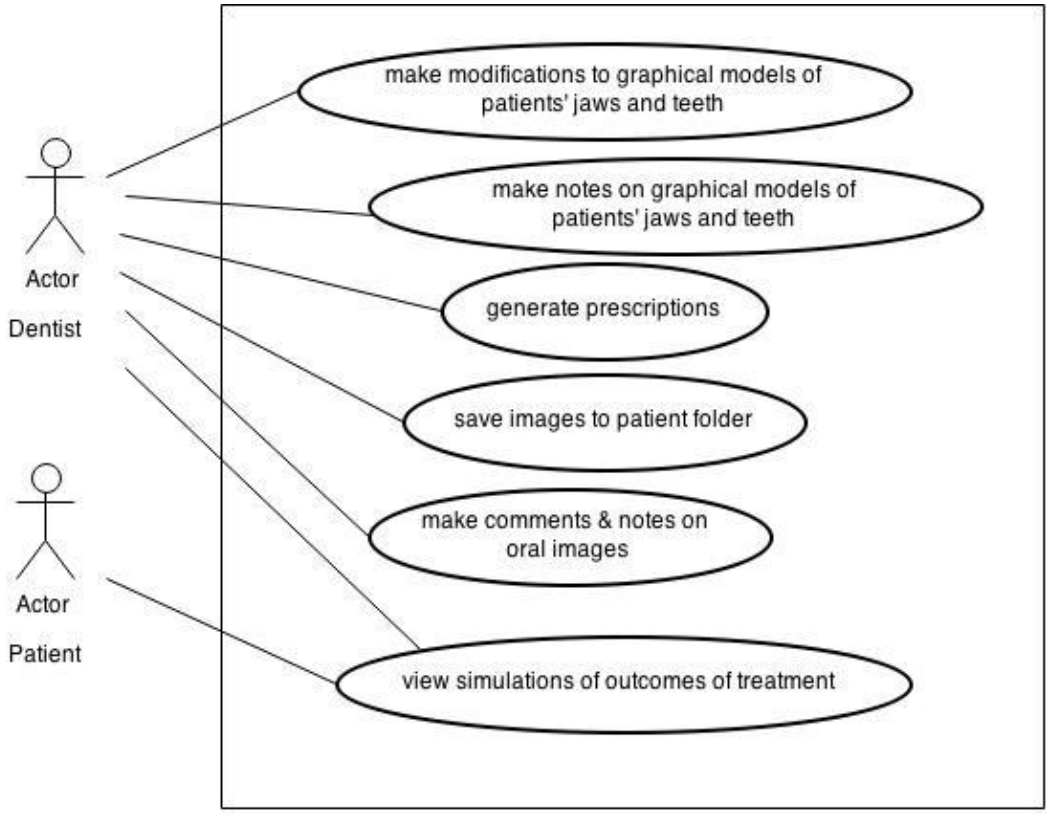


Table 113 : Use case - 3D modeling

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 14 : 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 15 : 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 16 : 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	

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 16 : Dental Information Knowledge Base - use case diagram

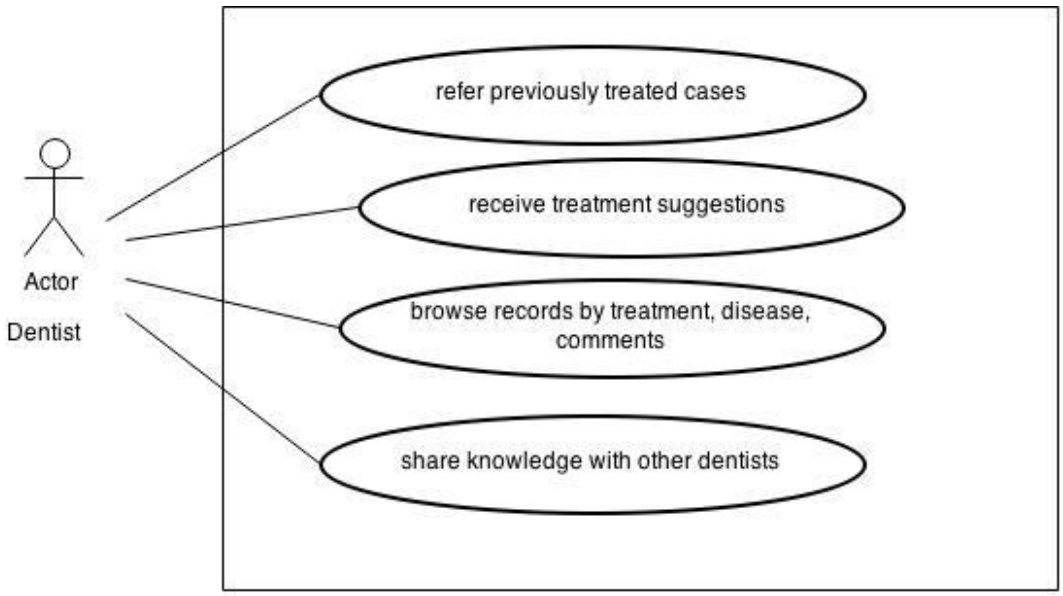


Table 127 : Use Case - Refer previous treatments

Use case 01	Refer previous treatments
Pre-condition	5. Application is up and running 6. Database connection is active
Actor	Dentist
Main Success Scenarios	8. Select the patient profile 9. Select the patient history 10. Patient's previous treatments will load in the web page
Extension	3.a. Previous treatments page not load for new patients

Table 18 : Use case - Table 2 : Use case - Receive treatment suggestions

Use case 02	Receive treatment suggestions
Pre-condition	3. Application is up and running 4. Database connection is active
Actor	Dentist
Main Success Scenarios	4. Select the patient profile 5. Add comments to the patient oral health 6. Click the ‘suggestions/help’ button 7. Popup suggestions for treatments and drugs
Extension	3.a. Comments must filled in the web page

Table 19 : Use case - Share knowledge base

Use case 03	Share knowledgebase
Pre-condition	3. Application is up and running 4. Database connection is active
Actor	Dentist
Main Success Scenarios	5. Select the patient profile 6. Click the ‘Share knowledgebase’ button 7. Popup knowledgebase details to select 8. Share details to central database
Extension	2.a. Knowledgebase can share with profile to profile and also with category wise.

Table 20 : 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 21 : 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.

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

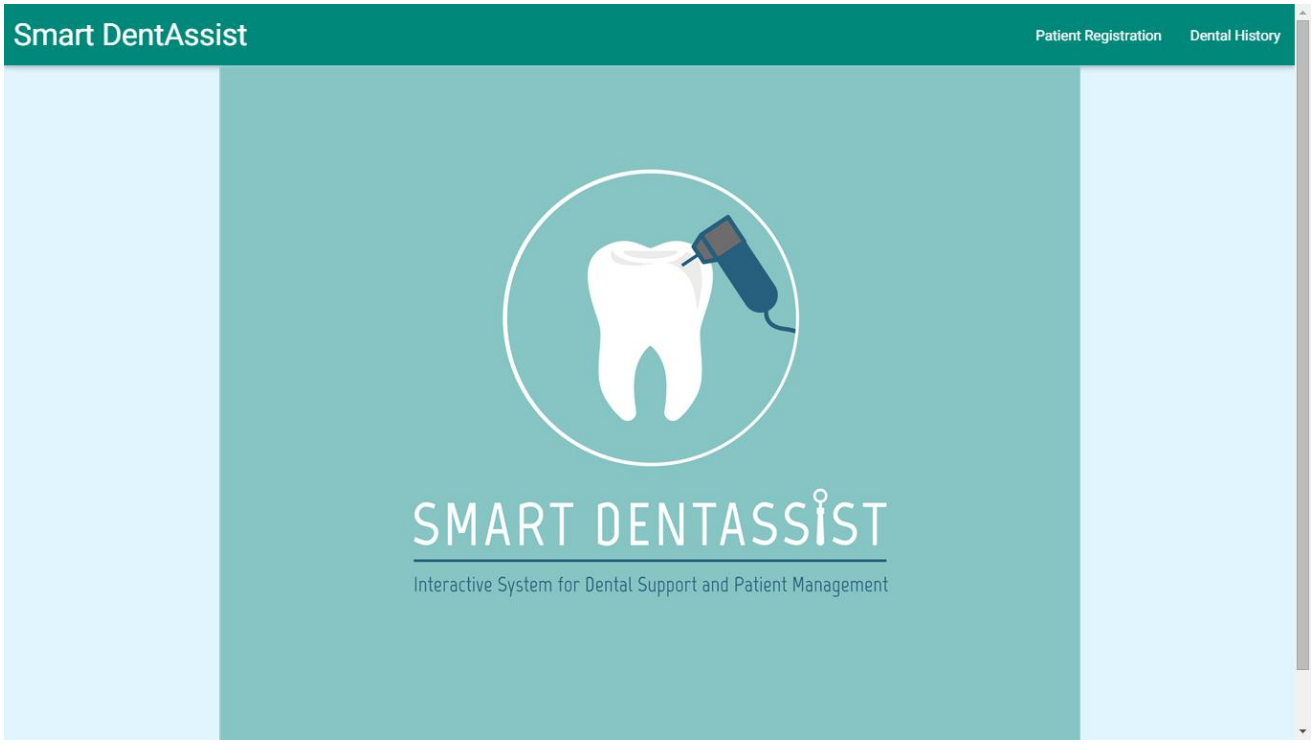
3.1.1 User Interfaces

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.

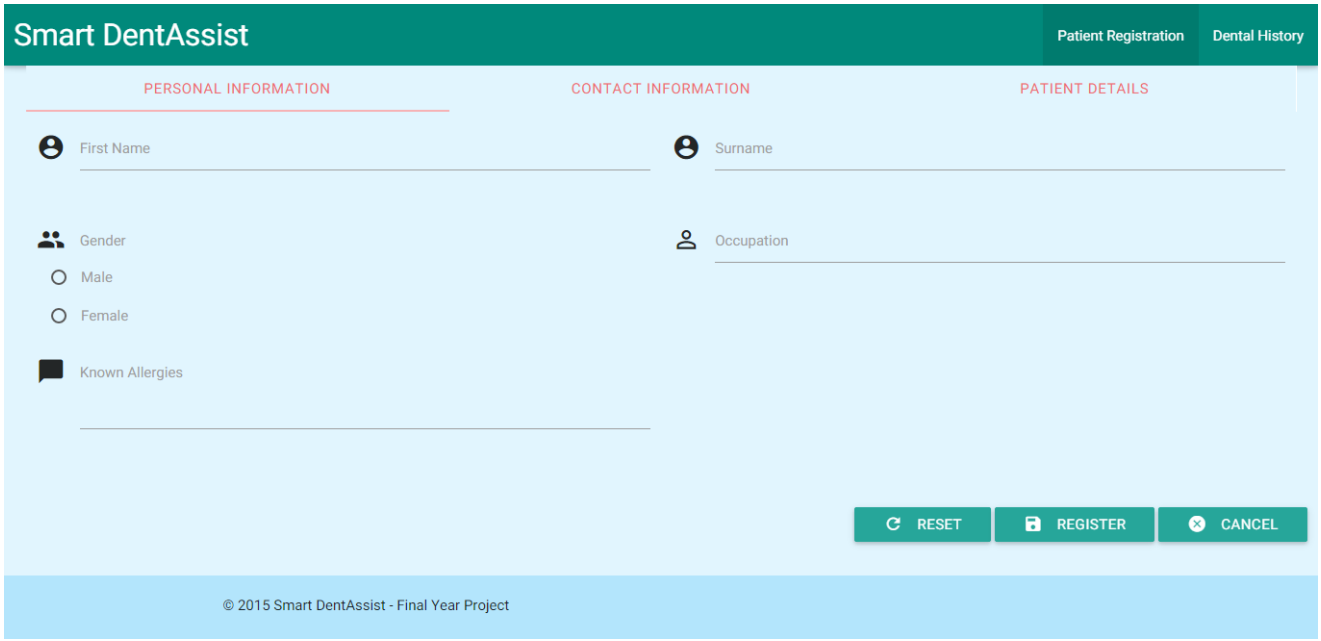
Figure 17 : Smart Dentassist homepage UI



The home page of the Smart Dentassist system is displayed above. This will be displayed first to its users. Depending on the task the user needs to perform, they could select whether to navigate to “Patient Registration” section or “Dental History” section.

Users of the two sections Patient Registration and Dental Health could vary. Patient Registration section is intended for the use of the dentist’s assistant / nurse / receptionist. Dental health section is intended for the use of the dentist.

Figure 18 : Patient Registration - Personal Information UI

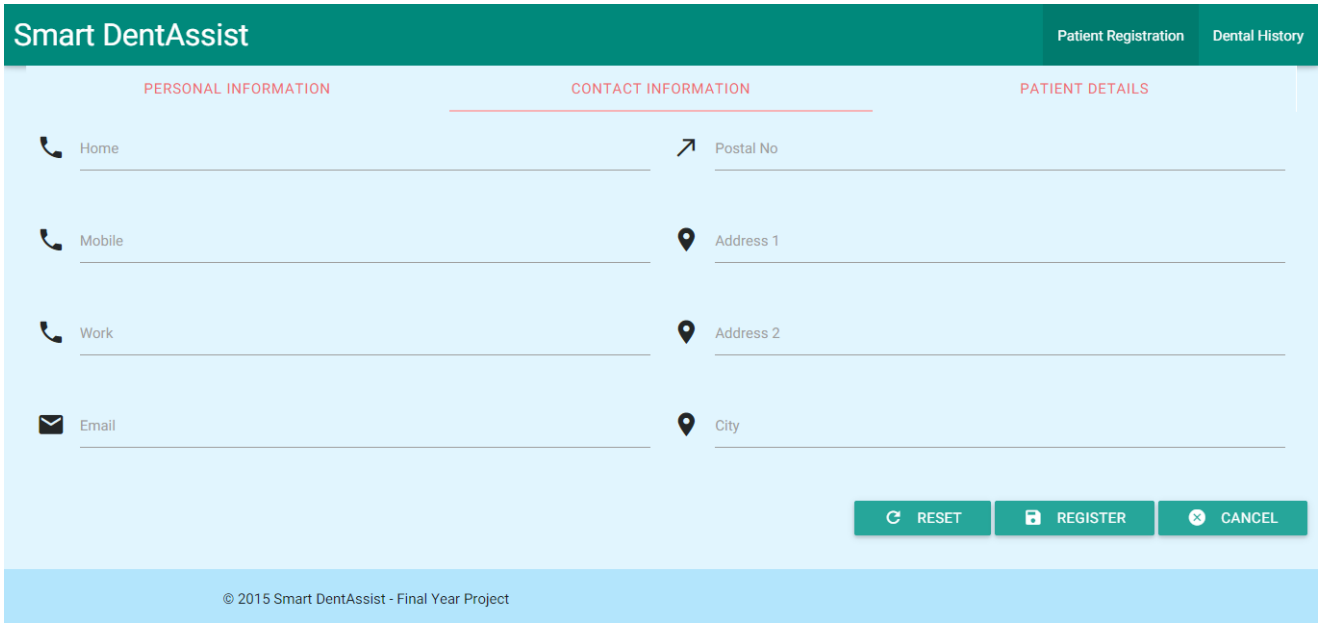


The "*Personal Information*" tab of *Patient Registration* section is designed for the user to enter patients' basic personal information to the system as new patients who arrive for treatments must be registered in the system. The user of this interface will be the nurse / dentists' assistant.

First name, *Surname*, *Occupation* and *Known Allergies* will be text fields for the user to type in necessary details. *Male* or *Female* options will be radio buttons for the user to simply click and select.

Reset button will clear the details in the text fields and selected radio button. *Register* button will save the data into the database. *Cancel* button will terminate the registration.

Figure 19 : Patient Registration - Contact Information UI

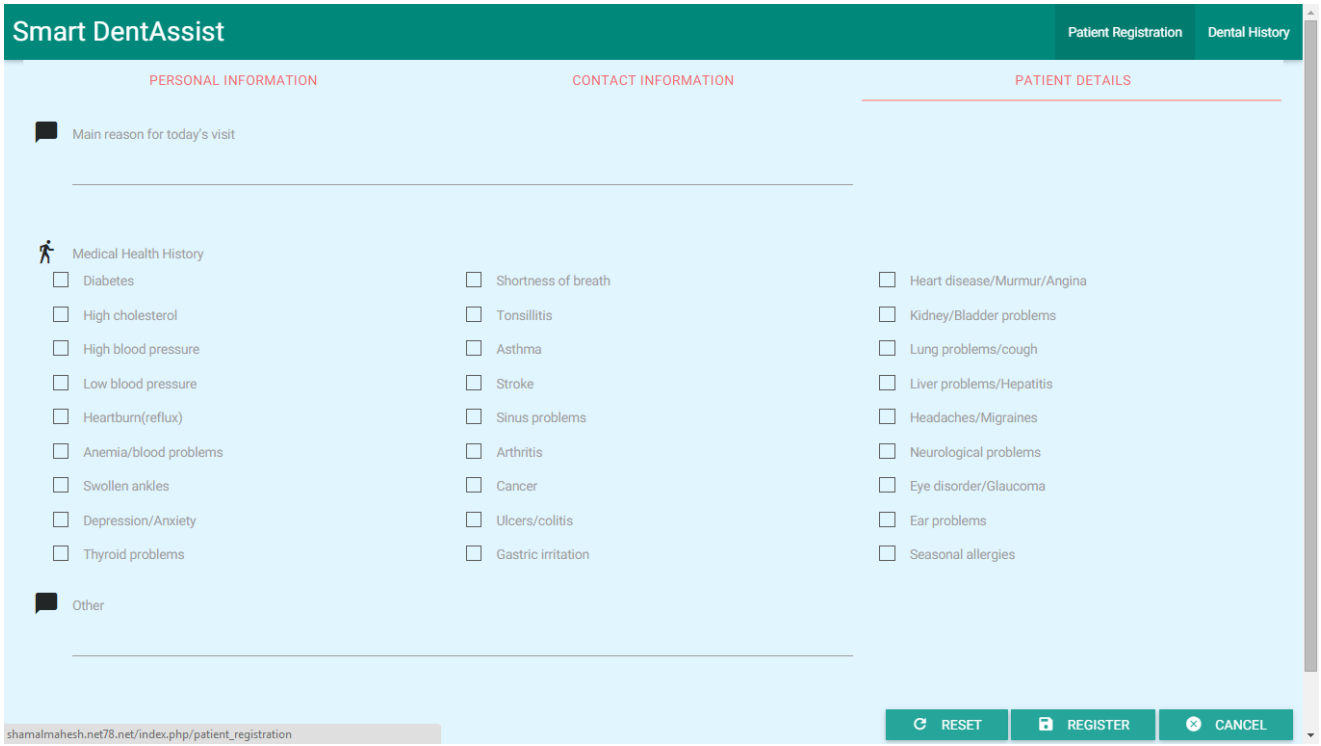


The "*Contact Information*" tab of *Patient Registration* section is designed for the user to enter the patients' contact information to the system. The user of this interface will be the nurse / dentists' assistant.

Home, Mobile, Work, Email, Postal No., Address 1 , Addresss 2, City will be text fields for the user to type in necessary details. The fields *Home, Mobile, Work* will be validated for 10 digit numbers, while *Email* too will be validated for its correctness.

Reset button will clear the details in the text fields. *Register* button will save the data into the database. *Cancel* button will terminate the registration.

Figure 20 : Patient Registration – Patient Details UI

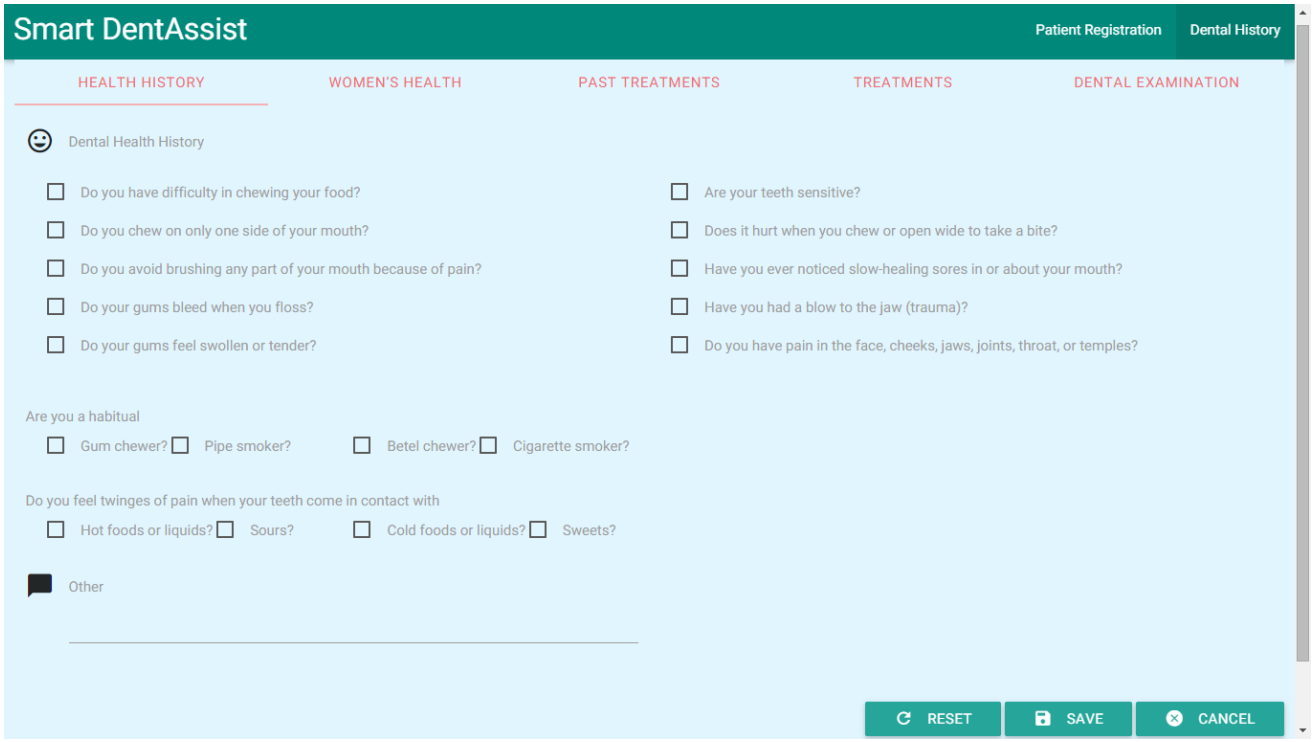


The "*Patient Details*" tab of *Patient Registration* section is designed for the user to enter patients' general health conditions to the system. The user of this interface will be the nurse / dentists' assistant.

Main reason for today's visit , Other will be text fields for the user to type in necessary details. *Medical Health History* section will consist of a list of common diseases and conditions along with check boxes, so the user only needs to click on diseases to save the patient's health conditions to the system.

Reset button will clear the details in the text fields, and the checked check boxes. *Register* button will save the data into the database. *Cancel* button will terminate the registration.

Figure 21 : Dental History : Health History UI

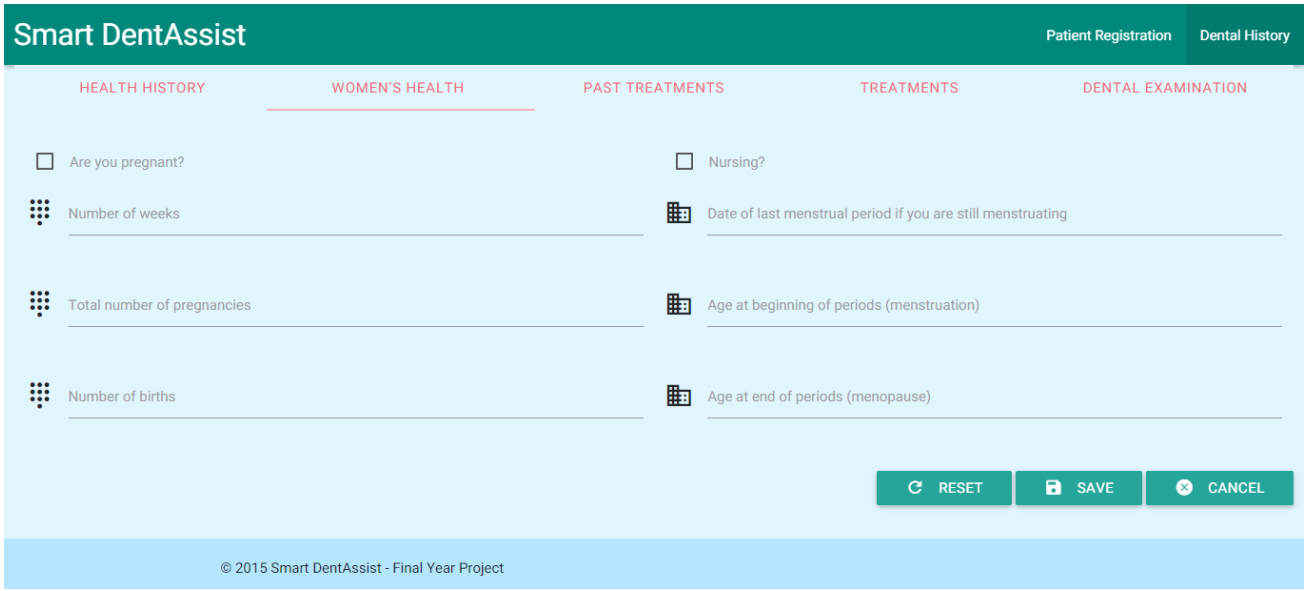


The section *Dental History* will be used mainly by the dentist to enter patient's medical history in detail when a new patient arrives for treatment. "*Health History*" tab is designed to store signs and symptoms as well as habits and practices related to dental issues. The user of this interface will be the dentist.

This interface will consist of lists the questions the dentist will ask the patient. Each question will have a check box, for the user to mark questions for which the patient gives positive answers. The text field *Other* will be used when any comments are needed to be made or details other than the given list items must be saved.

Reset button will clear the details in the text fields, and the checked check boxes. *Register* button will save the data into the database. *Cancel* button will terminate the registration.

Figure 22 : Dental History - Women's Health UI

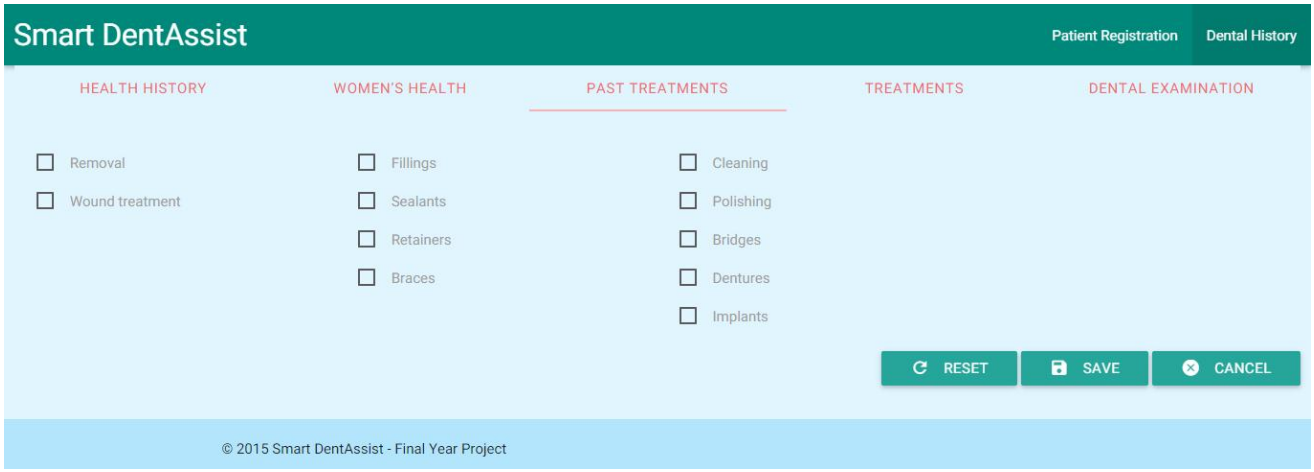


"*Women's Health*" tab (displayed above) is designed to store important health details of women that may have an impact on treatments. The user of this interface will be the dentist.

This interface will consist of two subheadings with check boxes. Once a particular check box is checked, the text fields below it will be enabled for data entry.

Reset button will clear the details in the text fields, and the checked check boxes. *Register* button will save the data into the database. *Cancel* button will terminate the registration.

Figure 23 : Dental History - Past Treatments UI

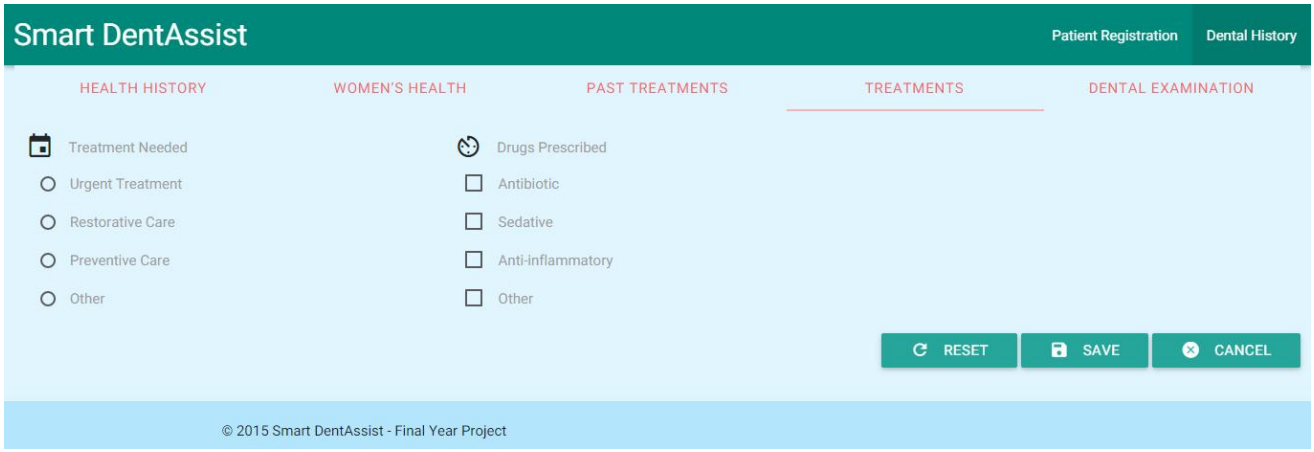


The "*Past Treatments*" tab (displayed above) of *Dental History* section is designed for the dentist to enter previously carried out dental treatments of the new patient, into the system. The user of this interface will be the dentist

This interface will consist of a list of dental treatments, each list item with a check box. The dentist will check the check boxes corresponding to the treatments the patient has undergone previously.

Reset button will undo the checked check boxes. *Register* button will save the data into the database. *Cancel* button will terminate the registration.

Figure 24 : Dental History - Treatments UI

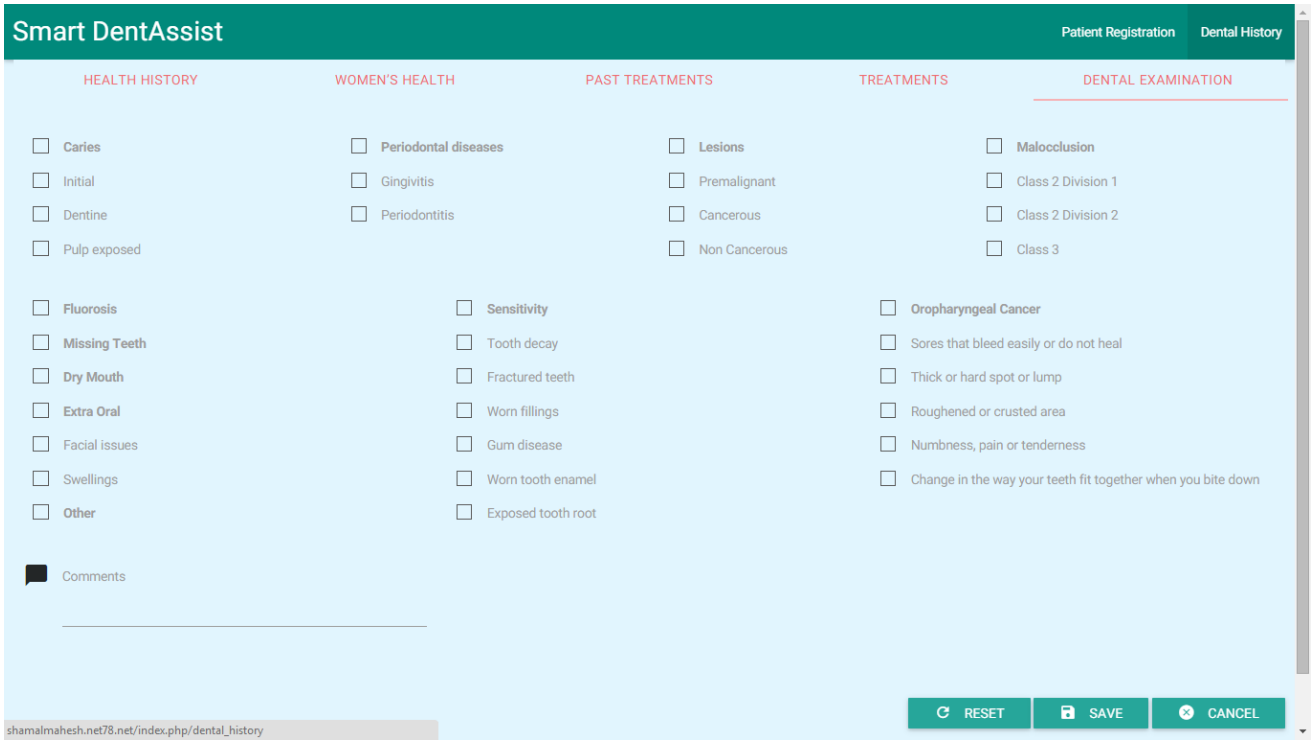


The "*Treatments*" tab (displayed above) of *Dental History* section is designed for the dentist to enter treatments required for the patients and the priority of the treatment into the system. The user of this interface will be the dentist

This interface will contain mainly 2 sections. One section contains a list with radio buttons to save the type of treatment needed. The other section contains a list with check boxes to save the types of drugs needed. In both cases the dentist will only need to click on the required list items to save data into the system.

Reset button will undo the checked check boxes. *Register* button will save the data into the database. *Cancel* button will terminate the registration.

Figure 25 : Dental History - Dental Examination UI



The "*Dental Examination*" tab (displayed above) of *Dental History* section is designed for the dentist to enter results and observations acquired after examining the patient, into the system. The user of this interface will be the dentist

This interface will consist of list of possible observations and conclusions of the dental examination carried out. The dentist will only need to click on the required list items to save data into the system. The text field *Comments* is designed to store additional remarks, comments, or information to the database.

Reset button will undo the checked check boxes and clear text fields. *Register* button will save the data into the database. *Cancel* button will terminate the registration.

Figure 26 : Knowledge base – patient history profile

The above user interface displays a patient's history 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 **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.

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 27 : Class diagram of system - Patient Perspective

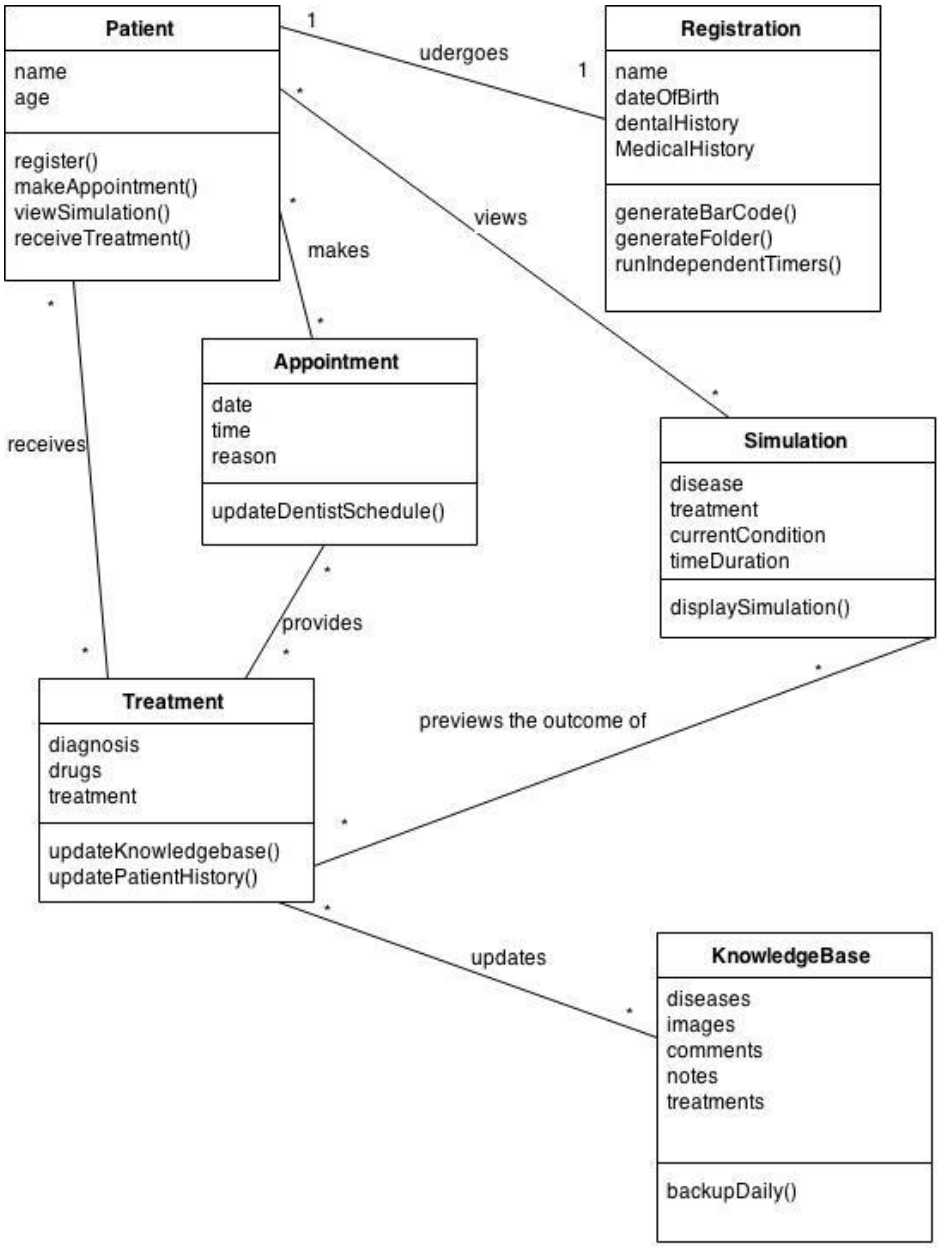


Figure 28 : Class diagram of system - Nurse Perspective

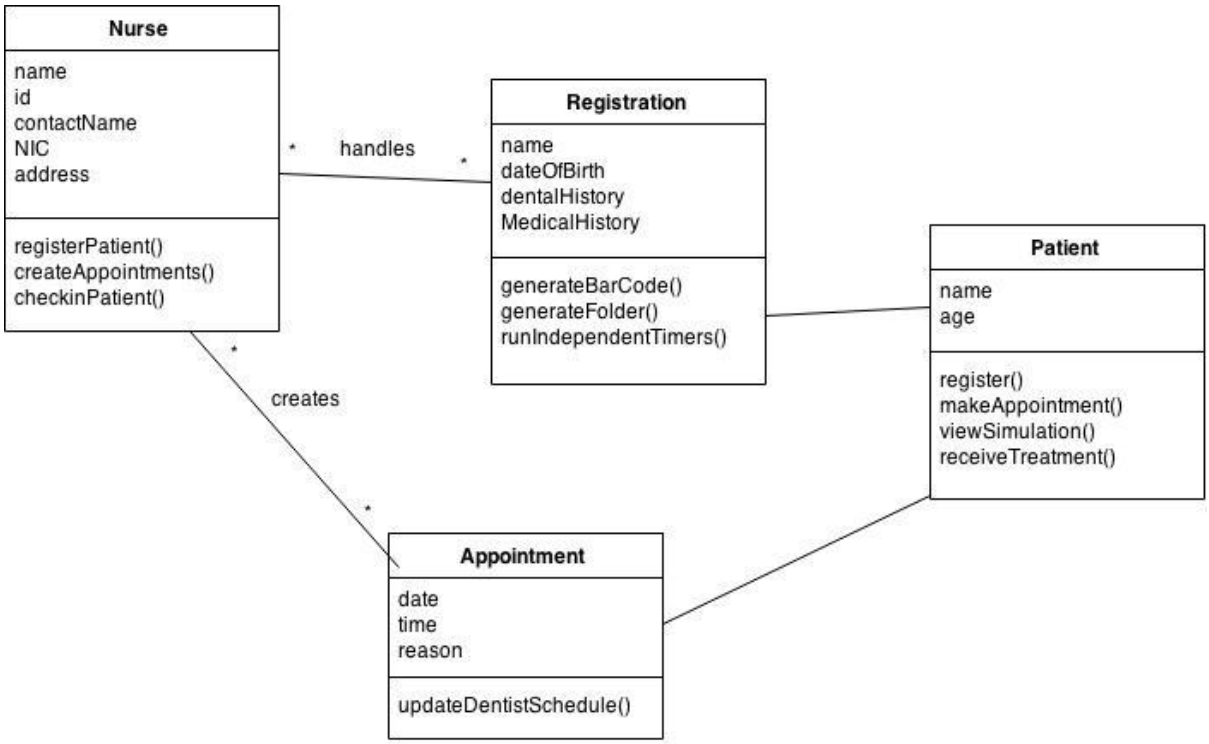
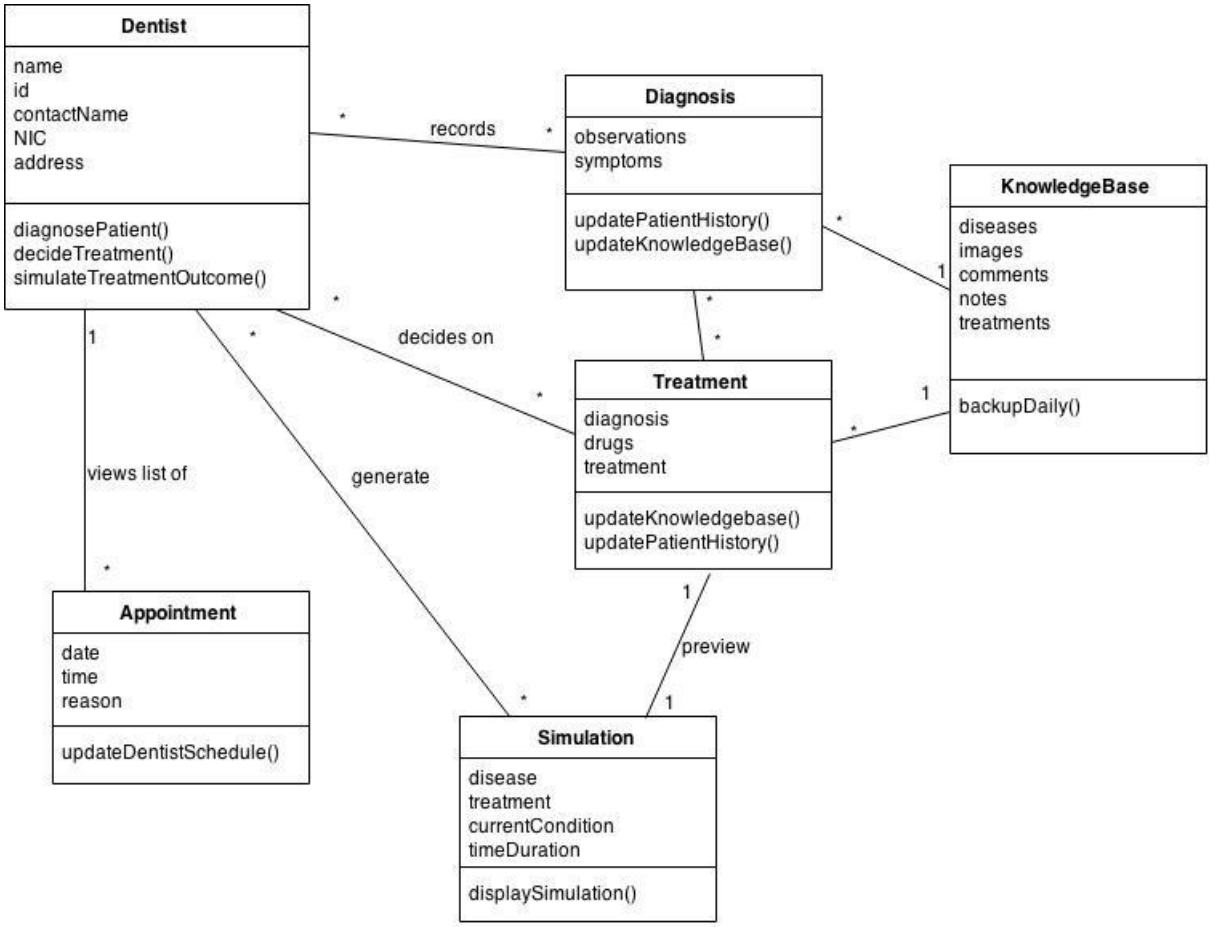


Figure 29 : Class diagram of system - Dentist Perspective



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 always.
- **Accuracy** – The accuracy of treatment and diagnosis suggestions should be 100% accurate.
- **Availability** - The dentist can access any data in the database at any time and the dentist should be able to use teleconferencing 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 difference access levels to its users.

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