VIRTUAL PATIENT SIMULATOR FOR SKILL TRAINING IN DENTISTRY

Group 15

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INTRODUCTION

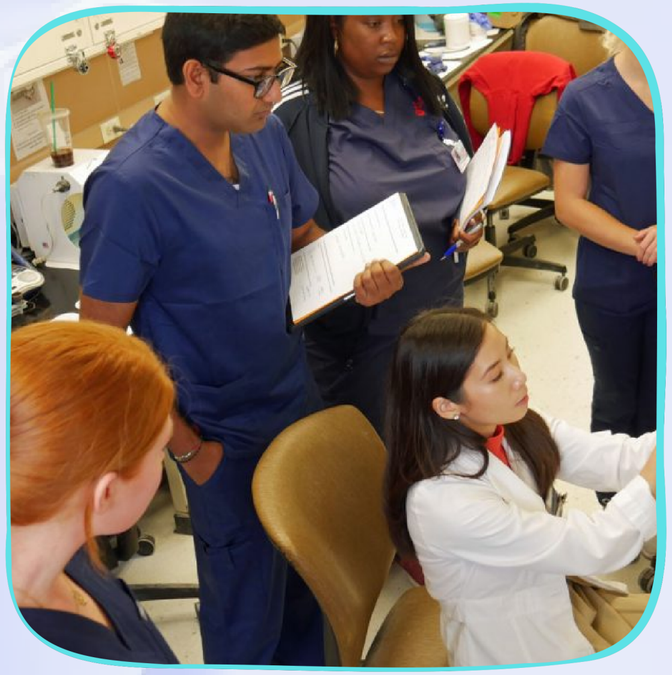
PROBLEM

Problems in traditional training method

- Clinical setting is time-consuming.
- Demands significant tutor guidance.
- Does not cover a broad spectrum of potential patient scenarios.

Problems in existing simulators

- Limited in availability

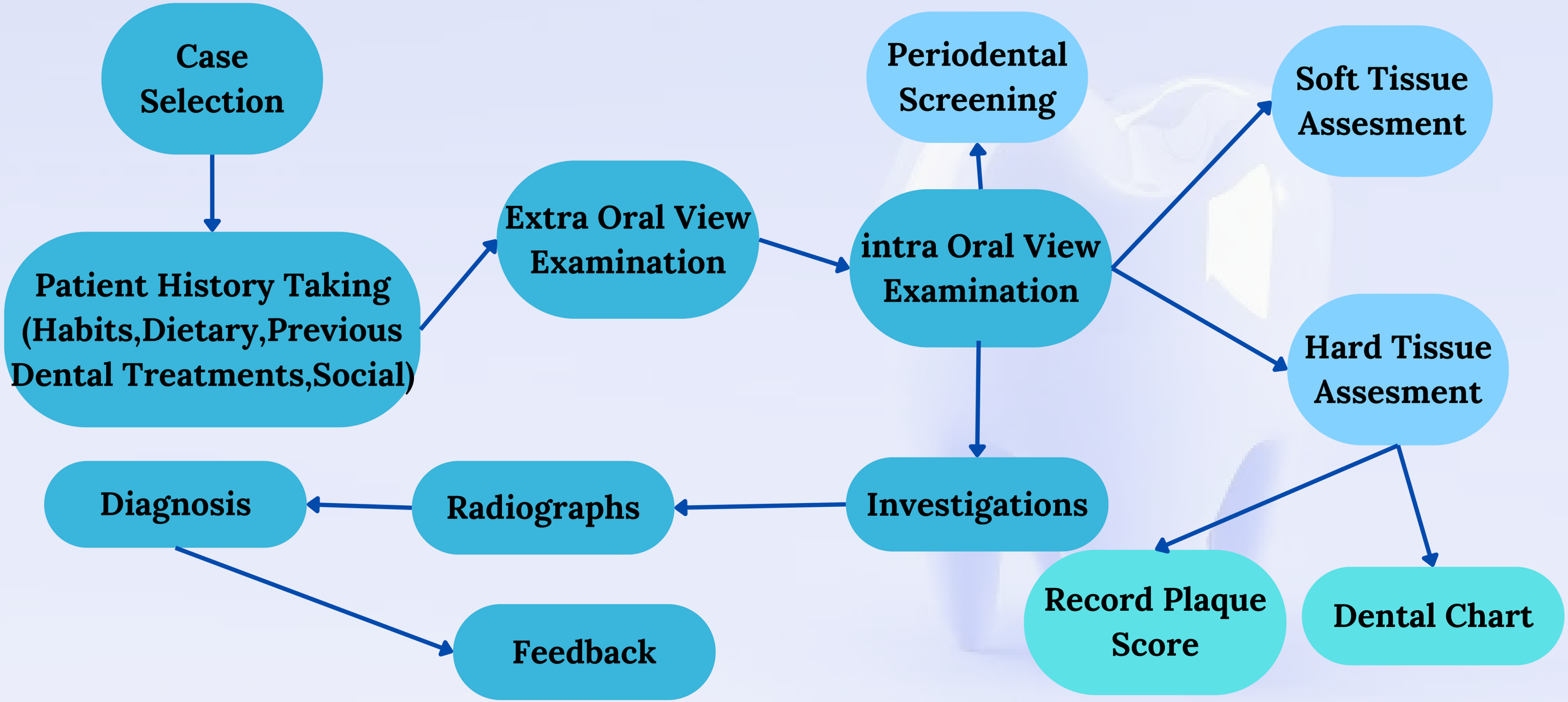


MOTIVATION

Need for realistic training simulators for dental students.

METHODOLOGY

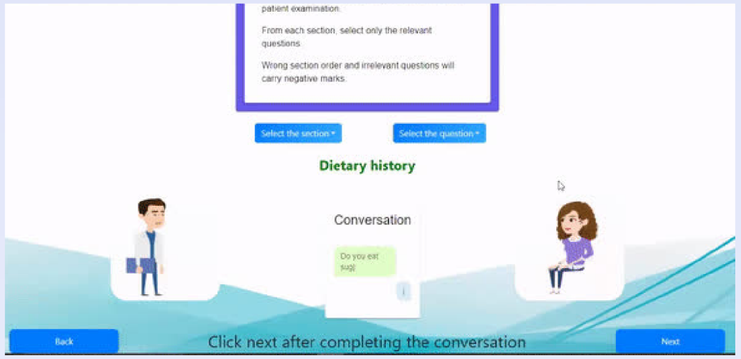
SYSTEM OUTLINE



SIMULATOR DEVELOPMENT METHODOLOGY

Design Aspect

Questioning patients



Using visual aids

Technical Aspect

Unity,Blender - 3D Modelling

Unity Web GL -Hosting the simulator

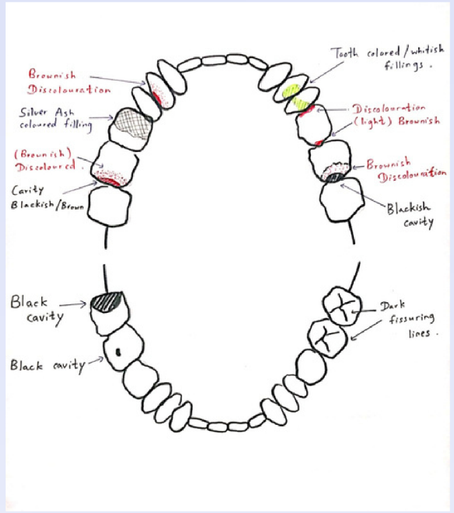
React -Web Application

Firebase - Database

Unity

blender

CONTENT DEVELOPMENT METHODOLOGY



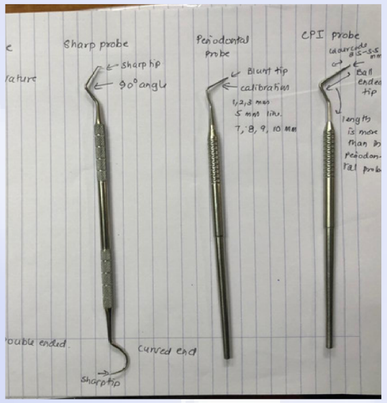
Formulating questions and answers for clinical cases

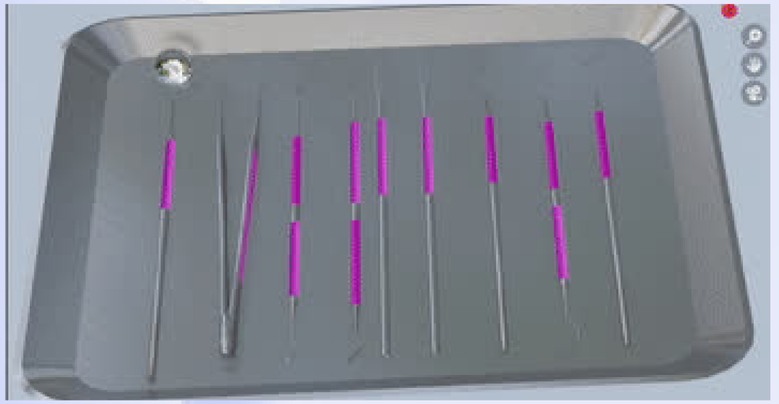
Modelling teeth set with defects

Modelling dental tray tools

Designing the dental chart

Developing an evaluation criteria to assess the student's performance





SYSTEM EVALUATION METHODOLOGY

Evaluation	Objective	Method	Outcome
Formative Evaluation	Continuous improvement of the simulator and tutoring system	Getting regular feedback from dental experts during the development phase.	Adjustments made to increase realism and usability based on feedback.
Usability Testing	Ensure an intuitive and user-friendly experience.	Task-based testing with a group of dental students	Planning to do at the last phase
Effectiveness Assessment	Measure the educational impact of the system.	Pre- and post-tests with students who used the system versus a control group.	Planning to do at the last phase

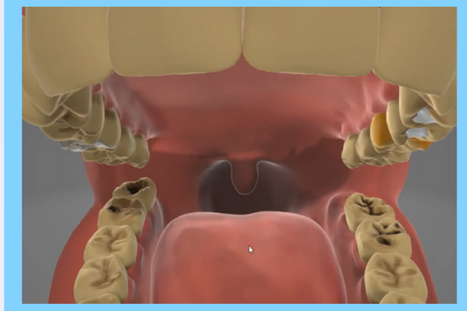
PROGRESS

CURRENT WORK DONE

1. Developed patient history-taking content.
2. Modeled the mouth showcasing defects.
3. Modeled the dental tool tray design.
4. Implemented tool selection functionality.
5. Enabled precise tool movement within the patient's mouth.
6. Enabled closer mouth inspection using the dental mirror
7. Enhanced the dental chart to allow students to draw and highlight defects.

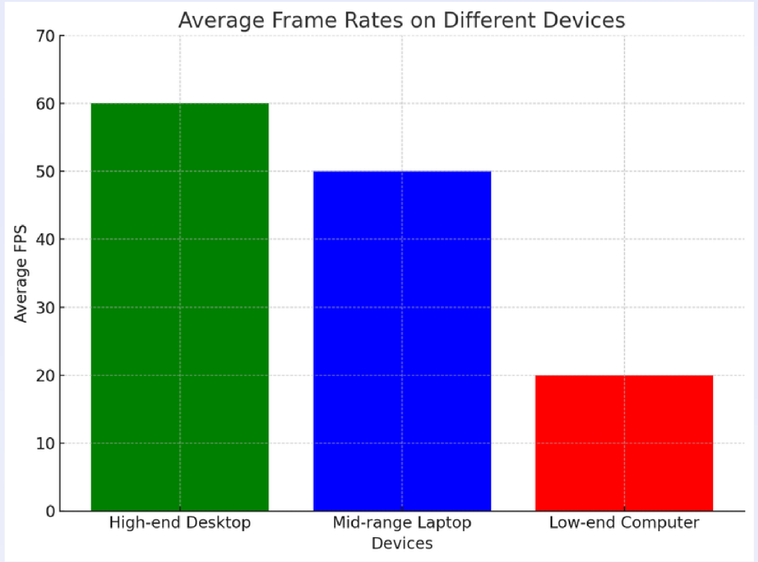
EXPERIMENTS & FINDINGS

EXPERIMENTS & FINDINGS

Test	Objective	Procedure	Findings
1 **Tool Movement and Rotation**	To evaluate the ease and realism of tool selection, movement, and rotation.	Ask participants to select different tools and manipulate them in the virtual environment.	**Received feedback to make the tool movement more smoother.**
2 **Visual Clarity and Detailing** 	To assess the visual quality and clarity of the teeth model and defects.	Ask them to identify and list the defects they can observe.	**Received a feedback on improving the realism of defects such as fillings, gum color, and cavities**

Test	Objective	Procedure
3 **System Performance and Stability**	To evaluate the performance, loading times, and stability of the simulator.	• Run the simulator on different devices with varying specifications. • Monitor frame rates, loading times, and any glitches or crashes.

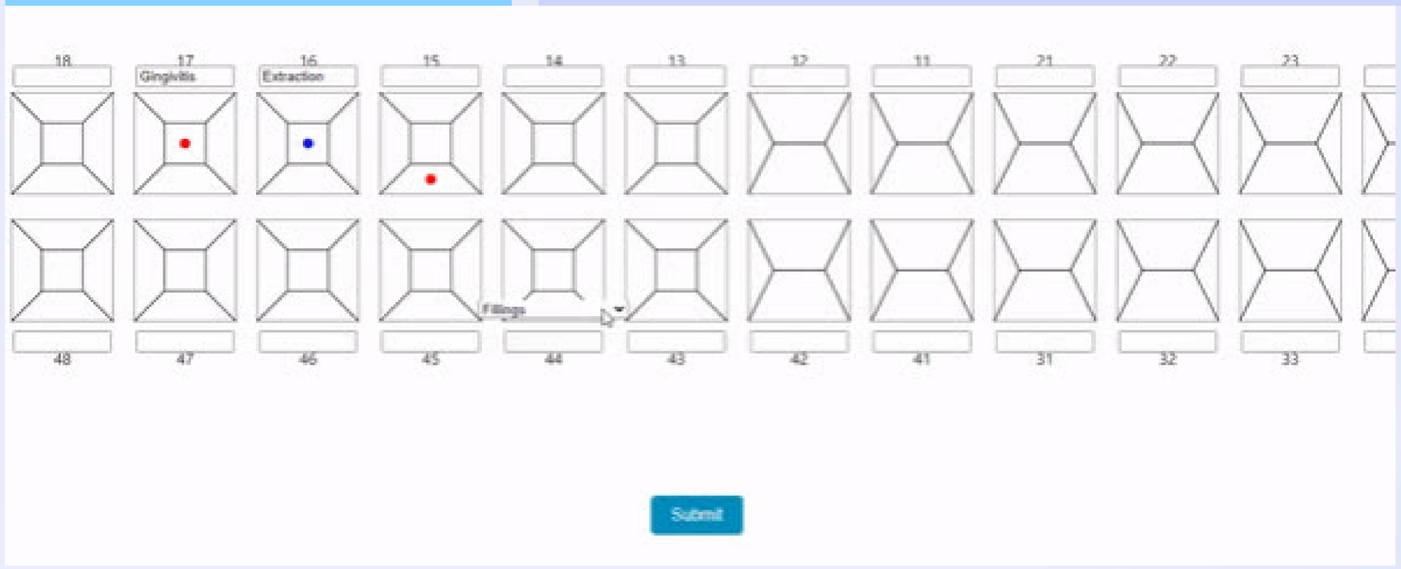
Average Frame Rates on Different Devices

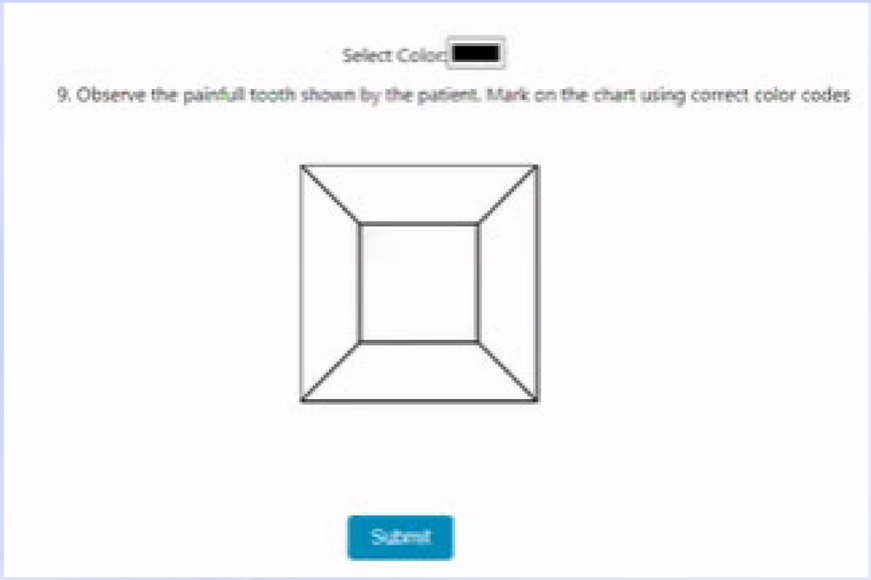


Loading Times (in seconds) and glitches/crashes

Devices	Loading Time (seconds)	Glitches/Crashes
High-end Desktop	5	None
Mid-range Laptop	8	Minor graphical glitches
Low-end computer	15	Frequent crashes and slowdowns

Test	Objective	Procedure
4 **Testing the suitability of the Dental Chart**	To evaluate the accuracy of dental chart drawing	Allow students to select / draw dental chart on react app and evaluate it





PROBLEMS ENCOUNTERED

Problem	Solution
Subject-Matter Expertise • Understanding dental terminology and the procedures that needed to be included.	We consulted with dental experts and created comprehensive documentations
Realism and Clinical Accuracy • Finding the right mix between a realistic simulator/tooth model and one that's easy to learn from.	We improved our simulator and teeth model step by step with expert advice
Evaluating students dental chart marking ability • Creating a dental chart marking tool that is both user-friendly and provides the level of detail needed for dental work.	We tested the UI with dental professionals for ease of use and clinical accuracy

Problem	Solution
System performance • Slow loading times for the heavy dental model in the web app, affecting user experience.	We enhanced the model with lazy loading and WebGL for faster loading and a better user experience."
Testing users Question asking ability • questions to include in the history-taking component and how to evaluate their relevance or importance when asked by the user.	We collaborated with dental experts to rank essential questions based on clinical relevance, guiding users on key questions to ask

DEMONSTRATION

WORK PLAN

Work /Week	7	8	9	10	11	12	13	14	15
Adding audio to the 3D simulator and enhancing the model									
Completing the web interface									
Integrating the web app and the 3D simulator									
Conducting system testing									
Analyzing the test results and performance									
Completing and publishing the research paper									

THANK YOU

Q & A