Chapter I. Introduction

Background of the study

This section describes the overview of the study wherein the researchers should be able to explain the reasons why there is a need for the design to be proposed. It also gives the readers an idea why there is a proposal made by the group. The Department of Health reports that oral health issues such as tooth decay and gum disease are highly prevalent across the population, particularly among children. A national survey further indicates that over 90% of Filipinos suffer from dental caries, yet routine dental visits remain uncommon. Experts attribute this behavior to limited understanding of preventive care and the long-term benefits of proper oral hygiene from an early age. Additionally, financial constraints and inadequate access to dental services make it difficult for many families to address oral health concerns before they worsen. These factors show the urgent need to strengthen oral health education and promote greater awareness across communities in the Philippines.

Statement of the problem

1.) Many individuals delay dental check-ups due to time constraints or waiting until pain becomes unbearable.

This behavior often leads to the late detection of oral diseases, making treatment more complex and costly. Early symptoms are usually ignored due to busy schedules or fear of dental visits.

2.) There is a general lack of awareness about the current state of one's oral health.

People are often unaware of developing dental issues like cavities, gum disease, or plaque buildup until they become serious. Without regular check-ups or clear symptoms, oral health problems can go unnoticed.

Assumption of the study

To respond to the previously identified issues, the Oral Health Detector system will implement the following solutions:

Oral Disease Detection: The system uses a CNN-based deep learning model to analyze mouth images, helping identify early signs of common dental problems such as cavities, gum disease, and plaque buildup.

Guides and Tips: Based on image analysis, the system provides personalized tips and preventive care suggestions to help users maintain good oral hygiene.

Dental Chatbot: A built-in chatbot is available to answer frequently asked questions, clarify basic dental concerns, and guide users on the next steps if a dental issue is detected.

Dental Health Calendar: Users can schedule and track their dental check-ups, treatment plans, and daily oral care routines using the integrated calendar.

User-Friendly Interface: The system is designed with an intuitive interface suitable for all age groups, especially for users with limited technical knowledge.

Significance of the study

General Public

This includes individuals of all ages, students, working professionals, parents, and elderly citizens who can use the website to analyze mouth images, receive early dental issue detection, and get personalized guidance. It especially helps those who delay dental checkups due to cost, time, or lack of awareness.

Dental Professionals

Dentists and hygienists can benefit from patients using the tool to pre-screen their oral health, making consultations more efficient. It can also help professionals reach underserved communities remotely.

Local Government Units (LGUs)

LGUs can integrate the system into public health programs, providing residents with a free, accessible tool for oral care awareness and early disease detection, especially in rural areas.

Health Advocates and Educators

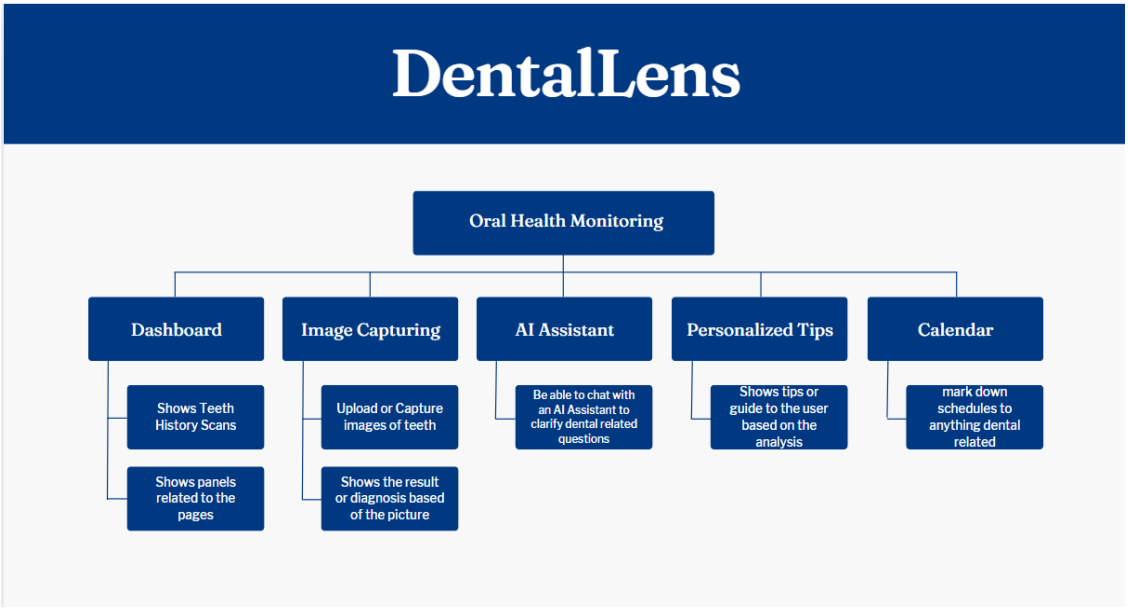
Health workers and NGOs can use the system as part of oral hygiene campaigns and school programs, making dental care knowledge more accessible through AI-powered analysis and chatbot support.

Chapter II. Research Design

A. **Task Analysis**

The main functions carried out by the system include the following:

- **Capturing Mouth Images:**
  The system allows users to either take a photo using their device's camera or upload an existing mouth image, providing flexible options for accurate input.
- **Detecting Oral Diseases:**
  A trained Convolutional Neural Network (CNN) processes uploaded images to identify early signs of oral diseases such as cavities, plaque, or gum issues.
- **Providing Personalized Dental Tips:**
  After detection, the system provides users with customized dental care advice and prevention strategies based on their results.
- **Offering a Dental Chatbot:**
  Users can chat with an AI-powered assistant to ask questions about dental issues, recommendations, or procedures.
- **Tracking Dental Appointments and Habits:**
  Users can log upcoming dental appointments and set reminders for brushing, flossing, or follow-up checkups.
- **Displaying Results and Recommendations:**
  The website presents diagnosis results in a user-friendly way, along with recommended actions or next steps.



B. **Requirements Gathering**

The group gathered the necessary data primarily through research and observation. Extensive background research was conducted using credible sources such as scholarly articles, case studies, and related literature to understand the current trends, technologies, and limitations surrounding oral health detection systems.

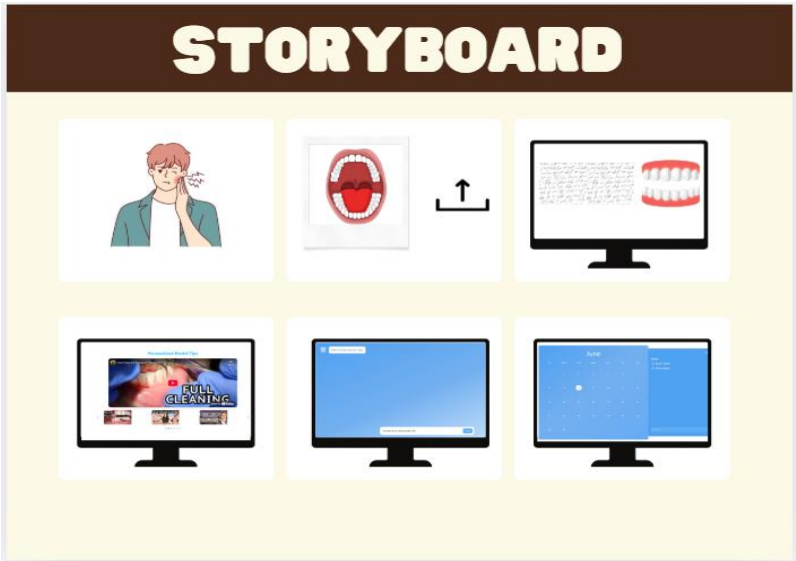
In addition to research, the group also utilized observation to identify common behaviors and challenges that individuals face in maintaining their oral health. This included noting how people delay dental consultations due to time constraints, lack of awareness, or limited access to dental professionals.

- **User Requirements**
  - Easy-to-read dental scan results
  - Accurate oral health analysis
  - Option to upload photos or use device camera
  - Accessible via web browser on various devices
- **Functional Requirements**
  - Capture or upload mouth images
  - Analyze images using a CNN model
  - Provide health insights
  - Offer tips and recommendations
  - Provide chatbot assistance for user questions
  - Store and manage user data securely
  - Display calendar for dental appointments
- **Data Requirements**
  - Image data of user's mouth/teeth
- **Environmental Requirements**
  - Works on modern smartphones or computers with camera access
  - Stable internet connection for analysis and results display
  - Clean image background with good lighting for accurate detection
- **Usability Requirements**
  - Simple and responsive interface
  - Easy navigation and minimal clicks to operate
  - Clear instructions for capturing/uploading images
  - Understandable diagnostic feedback
- **Designers Requirements**
  - Use pre-trained CNN model
  - Web-based interface compatible with common browsers
  - Scalable database for storing user and analysis data
  - Secure and privacy-respecting user data management

C. **Storyboarding and Prototyping**

Storyboarding

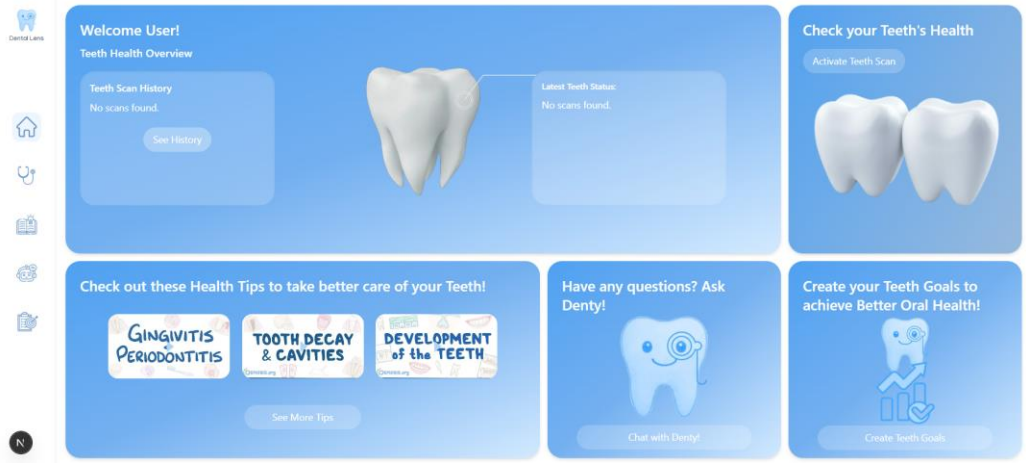
This storyboard demonstrates how the system functions from the user's perspective, showcasing key features such as teeth analysis, chatbot, dental tracking, and personalized video recommendations.



Prototyping

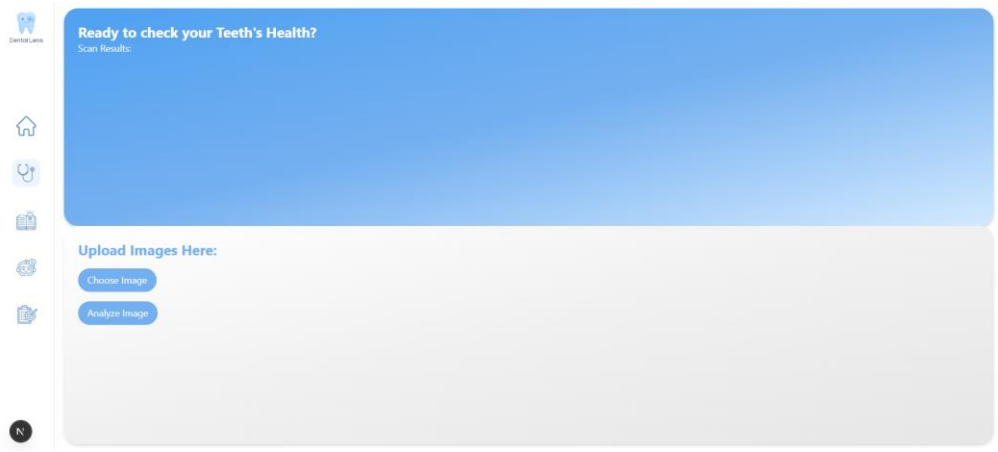
Main Dashboard

Upon accessing the website, the user is presented with the main dashboard, which serves as the central hub for all key features. This dashboard includes a detailed history of previous teeth scans, a summary of the current condition of their oral health, and clearly organized panels that provide quick access to other important pages of the site such as the chatbot, dental tips, and appointment tracking.



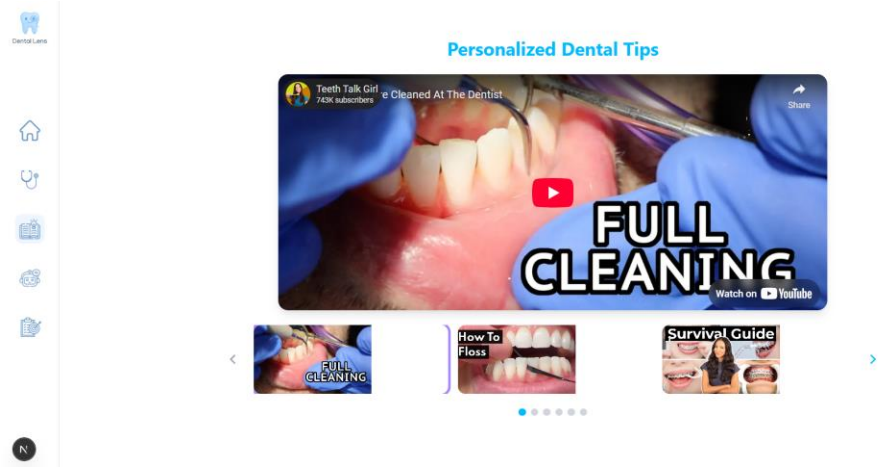
Scanning Page

The next section is the scanning page, where users have the option to either upload an existing photo of their mouth or take a real-time picture using their device's camera. Once the image is submitted, the system processes it using deep learning models to analyze the user's oral health condition. After the analysis, the system provides a detailed diagnosis, including the severity of the issue, possible symptoms, and the likely cause of the identified dental disease.



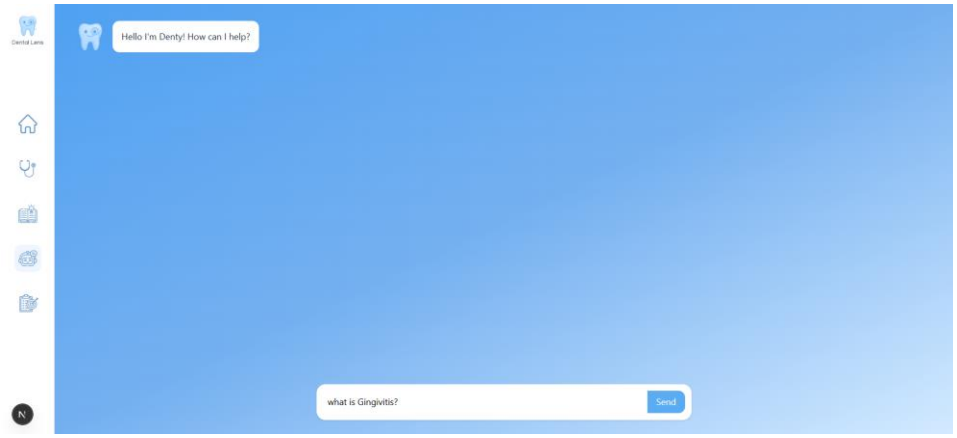
Recommended Videos Page

The next section is the recommended videos page, which dynamically updates based on the user's most recent teeth analysis. This feature ensures that the content is tailored to the user's specific oral health needs. The page presents a collection of informative videos, such as proper brushing techniques or tips for managing identified dental issues. Users can navigate through the available videos using the left and right arrows to browse, and their selected video will appear in the larger main video frame for easy viewing.



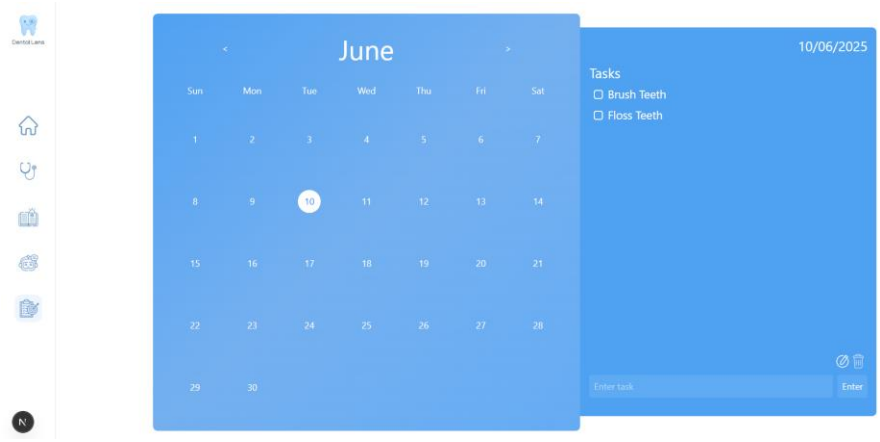
Chatbot Page

The next section is the chatbot page, where users can ask questions or seek clarification about anything related to oral health. This feature is powered by our AI assistant Denty,
represented by a friendly tooth icon with a smiling face to create a more approachable and engaging experience. Denty is designed to provide helpful responses in real-time, guiding users with accurate dental information, tips, and support based on their concerns or curiosity.



Tracker Page

Lastly, the tracker page allows users to manage their dental-related schedules with ease. This feature is represented by a user-friendly calendar interface where individuals can input important dates such as dental checkups, treatments, or personal reminders related to their oral health. Users have the ability to add, edit, or delete entries as needed, helping them stay organized and consistent with their dental care routines.



D. **Evaluation of prototype**

Area of Evaluation	5	4	3	2	1
A. Visibility of System Status - The system design provides appropriate feedback like message prompts in response to user actions.	✓				
- The message prompts are clear, visible and understandable.	✓				

B. Match between the system and the real world - Used words, phrases and concepts according to users' language rather than system oriented words and computer jargons.		✓			
C. User control and freedom - The system design provides ways of allowing users to easily "get in" and "get out" if they find themselves in unfamiliar parts of the system.	✓				
D. Consistency and Standards - The colors, text, labels, buttons and other elements in the design are uniform from start to finish**.**	✓				
- Text and icons are not too small or too big. **-** Menus and other features of the system are arranged and positioned in a consistent way. (For ex. If your website has navigation buttons on the top under the page title on one page, the users will automatically look there for the same features on other pages.	✓				
	✓				
E. **Error Prevention** - The system design provides an automatic detection of errors and preventing them to occur in the first place.		✓			
- Idiot proofing mechanisms are applied		✓			
F. Help users recognize, diagnose and recover from errors **-** Error messages and the terms used are recognizable, familiar and understandable for the users.	✓				
G. Recognition rather than recall **-** Objects, icons, actions and options are visible for the user. - Objects are labeled well with text and icons that can immediately be spotted by the user and matched with what they want to do.	✓				
H. Flexibility and efficiency of use - The system design provides easy to navigate menus. - the system does not make wasteful time of system resources.	✓				
I. Aesthetic and minimalist design **-**Graphics and animations used are not difficult to look at and does not clutter (mess) up the screen. - Information provided is relevant and needed for the system design.	✓				
J. Help and Documentation **-**the system design provides information that can be easily searched and provides help in a set of concrete steps that can easily be followed.	✓				

Chapter III. Conclusion and Recommendation

Conclusion

The development of DentalLens addresses the common issue of delayed dental checkups due to lack of awareness, time constraints, or limited access to dental professionals. By using image analysis powered by Convolutional Neural Networks (CNNs), the system provides an accessible and efficient solution to detect early signs of oral diseases.

The system's features including mouth image scanning via camera or upload, detailed analysis results, dental care tips, a dental calendar, and a chatbot for further clarification, make it user-friendly and informative. It serves not only as a diagnostic aid but also as a learning tool for promoting dental hygiene.

Designed with both general users and non-technical individuals in mind, the web-based platform ensures that users receive clear feedback, reliable health insights, and helpful dental guidance. This project shows the value of using deep learning and Human-Computer Interaction (HCI) principles to ensure that the website's design remains simple, clean, and not overwhelming for users. With a focus on clarity and ease of navigation, non-technical individuals can comfortably interact with the system.

Recommendations

- **Offline Functionality** – Include the option to temporarily store data and scan results for areas with poor internet access, syncing them once connected.
- **Multi-language Support** – Provide language options for local dialects to increase accessibility for diverse users.
- **Mobile Responsiveness** – Optimize the interface further for mobile phone users to increase ease of use.
- **Professional Integration** – Add a feature for users to connect or send their results directly to a licensed dentist.
- **Reminder Notifications** – Implement smart alerts for regular dental check-ups or follow-up scans based on past data.