

## CASE STUDY

# Web-based Aligner Treatment Platform



The orthodontic industry is undergoing a digital transformation, driven by the need for greater accessibility, efficiency, and precision in aligner treatments. Traditional workflows for designing teeth aligners are time-consuming, require specialized software installations, and depend heavily on manual intervention.

The client sought a cloud-based, web-enabled solution that allows orthodontists and clinicians to create, review, and customize aligner treatment plans seamlessly, without any installation or setup. The solution needed to be highly accurate, time-efficient, and flexible.

### Solution

- A web-based online aligner technology platform was developed by leveraging **AI and ML algorithms** to automatically generate an optimized aligner treatment plan using patient data such as **intra-oral 3D scans and X-rays**.
- It is a fully **cloud-hosted platform**, eliminating installation requirements.
- It automates **alignment, segmentation, and staging** of treatment sequences.
- It supports **3D visualization** of dental scans from all angles.
- Also provides ability for orthodontists to **review, refine, and customize** AI-generated plans.
- The system provides a **balance between automation and clinical control, ensuring both** efficiency and precision in treatment planning.

### Product Features

- **AI-Driven Treatment Planning**
  - Automatically processes **3D intraoral scans and X-rays**
  - Generates complete **aligner treatment sequences** with minimal manual effort
- **Advanced 3D Visualization**
  - Enables clinicians to **view scans from multiple angles**
  - Improves diagnosis and treatment accuracy
- **Smart Segmentation with Manual Override**
  - AI performs **automatic teeth and gum segmentation**
  - Clinicians can manually **refine segmentation boundaries** for accuracy
- **Orientation and Alignment Tools**
  - Displays a **maxillary guide (ideal orientation)** alongside the uploaded scan
  - Provides intuitive tools to
    - Rotate
    - Translate
    - Align uploaded scans to match ideal orientation
- **Precision Control with Landmark Points**
  - Dentists can define **occlusal and facial surface points**
  - These points guide the algorithm to determine **optimal tooth movement paths**
- **Teeth Classification & Control Tools**
  - "**Mark Stationary Teeth Tool**" allows classification of:
    - Stationary teeth
    - Movable teeth
    - Missing teeth
    - Restricted movement teeth
- **Staging and Treatment Sequencing**
  - AI generates complete **step-by-step staging of treatment**
  - Interactive interface includes:
    - Slider to view each stage
    - Editable table for fine-tuning movement and rotation of individual teeth
    - Enables complete **custom modification of treatment paths**
- **Intuitive User Experience**
  - Lightweight, **web-based UI**
  - Designed to eliminate **redundant and complex workflows**
  - Accessible from anywhere, ensuring **high portability**

### Key Technical Achievements

- **End-to-End Automation:** Successfully automated teeth alignment, segmentation and treatment staging. **Reduced manual workload significantly**
- **Integration of AI & Machine Learning:** Implemented ML models for accurate segmentation, predictive tooth movement and optimized treatment sequencing
- **Performance & Efficiency:** Delivered results **faster than traditional software workflows** by reducing treatment planning time for orthodontists
- **Fully Web-Based Architecture:** Eliminated dependency on local installation, high-end hardware while ensuring **scalability and easy access**
- **High Precision with Human-in-the-Loop:** Combined **AI automation with clinician expertise** and enabled manual overrides and fine-grained control over treatment
- **Improved Clinical Outcomes:** Better visualization and control led to more accurate treatment plans and higher predictability of results
- **Seamless User Experience:** Designed an **intuitive UI/UX** for complex clinical workflows by simplifying traditionally complicated orthodontic processes

### Technology Used

- React js, Babylon js, Python
- AWS Cognito, AWS Lambda, AWS SQS, SNS