DentixBuddy

DentixBuddy offers a seamless service that targets the issue of dental anxiety prevalent among children and adolescents. Consisting of a VR game experience to be used in the dental clinic and an AR app for both children and their parents to use at home, this concept design aims to provide comfort to children during dental visits, help them build healthy dental hygiene habits, and alleviate the pressure on parents regarding their children's dental habits. DentixBuddy redefines the children's dental journey and addresses crucial elements of anticipation and trust in reshaping the connection between children and dental visits.

Research

User research for DentixBuddy was conducted through a combination of **qualitative and quantitative methods**. Secondary research, including **literature reviews**, informed the early stages. Primary research, including **surveys, user interviews, and expert interviews** were employed to understand the pain points and preferences of parents, children, and dental care professionals. This multi-faceted approach ensured a comprehensive understanding of user needs and expectations.

Literature Review

- The prevalence of dental fear in children aged 6–12 years (61.5%) had severe dental anxiety
- Individuals might associate negative anticipation with their dentist, and these sentiments may be exacerbated if they have had an unfavorable experience with their dental treatment.
- Someone may fear the noise made by drills and dental instruments the dentist or dental hygienist uses.
- Therapeutic VR has eliminated pain and anxiety in surgical patients by up to 60%. It is genuinely drug-free sedation, even as good as nitrous oxide, and not just a distraction.
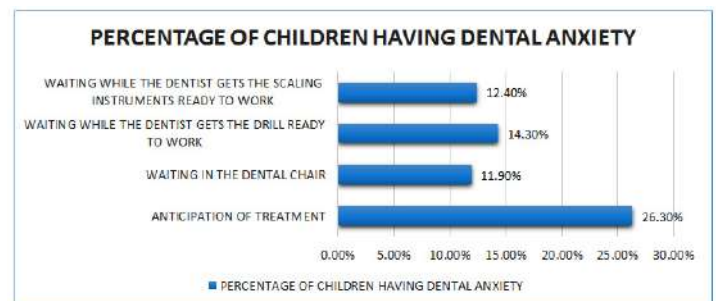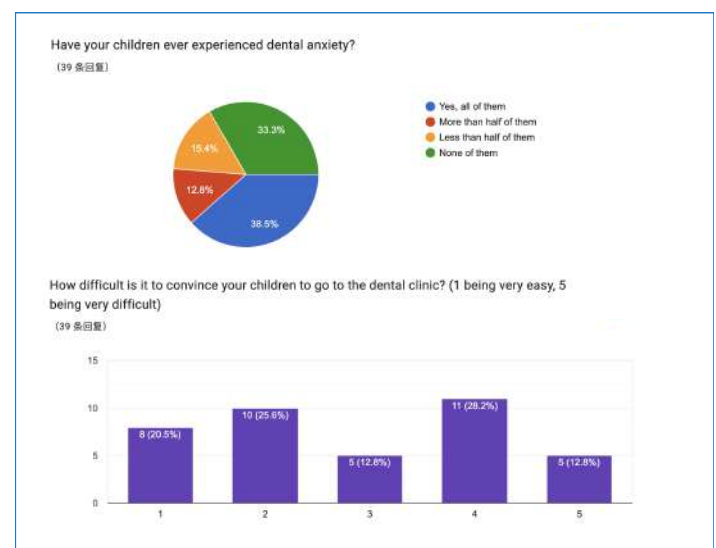

Figure 1: Distribution of Reasons of Dental Anxiety Amongst Participants.

Ummat A, Dey S, Nayak A. P, Joseph N, Rao A, Karuna Y. M. Biomed Pharmacol J 2019;12(2)

Survey

- More than 60% of parents have reported that at least one of their children experience dental anxiety.
- Over 50% of parents have reported that it's at least somewhat difficult to convince their children to go to the dental clinic.
- When being asked how they alleviate their children's anxiety, several have reported ways such as "offering rewards", "explaining the procedure", and "using distractions such as music and TV".

User Interview

Parents

- Resistance and Tantrums: Common in younger children, especially when anticipating a dental visit. Parents frequently mention battles and showdowns to start the journey to the dentist.
- Use of Rewards and Positive Reinforcement: Several parents mention using treats, praise, or rewards post-visit to encourage cooperation.
- Consistency in Dental Routine: Emphasized indirectly through the importance of regular visits and reinforcement of good dental habits at home.
- Dislike of Dental Environment: Specific mentions of the disapproval of the sounds in the dental office or discomfort with the dental chair and equipment.
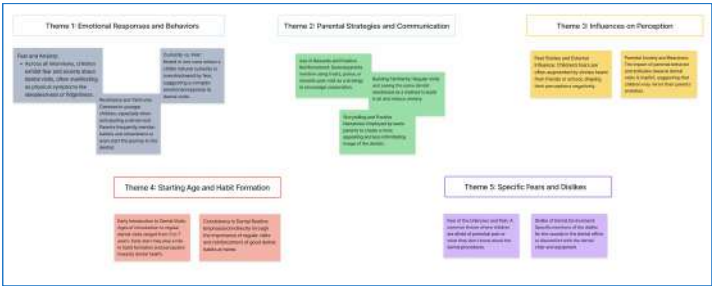
Parents affinity map

Dentist

- Educational 'Show and Tell': "Demystify tools through education."
- Environmental Sensitivity: "Issues with clinic lights, sounds." (Sources of Fear)
- Building Trust: "Focus on rapport and trust."
- Reinforcing Positive Dental Habits: "Encourage good habits at home."
- Pretend Visits for Familiarity: "Acclimatize with pretend visits." (Gamified interaction)
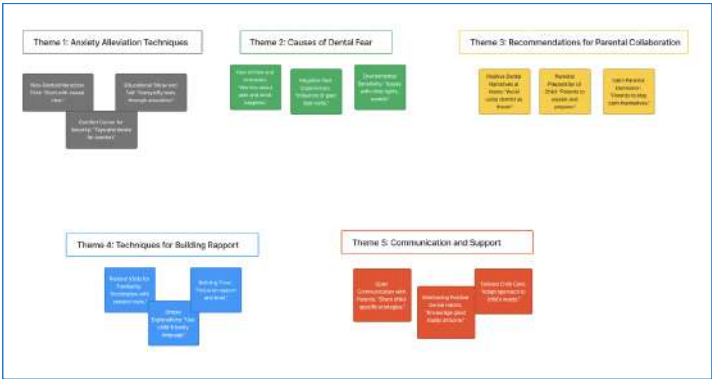
Dentist affinity map

Research Insight

The core of dental anxiety is that kids associate dental visits with fear. We aim to break that mental link and train them to associate it with anticipation and trust.

- **High Prevalence of Dental Fear**: A significant percentage (61.5%) of children aged 6–12 experience severe dental anxiety.
- **Parental Struggles with Children's Dental Anxiety**: Over 60% of parents report that at least one of their children experiences dental anxiety, and more than 50% find it somewhat difficult to convince their children to go to the dental clinic.
- **Negative Anticipation Association**: Negative anticipation with dentists is common, especially if individuals have had unfavorable dental experiences.
- **Diverse Strategies to Alleviate Anxiety and Build Trust**: Parents employ various strategies, including offering rewards, explaining procedures, and using distractions, aiming to not only alleviate their children's dental anxiety but also to build trust with the dentist.
- **Fear of Dental Noises:** Fear of the sounds produced by dental tools, like drills, is a notable source of anxiety.
- **Effectiveness of Therapeutic VR:** Therapeutic VR has been shown to reduce pain and anxiety in surgical patients by up to 60%, offering drug-free sedation.

Competitive Analysis

Orange Pediatric Dental Clinic

Orange Dental is a pediatric dentistry that aims to turn dental visits for kids into a more engaging and less stressful experience. It uses bright colors and cartoon decorations to imagine the clinic as an amusement park.

Too much limitation Interior designs are often hard to change and require space. Meaning these clinic often use the same design for decades. The designs can easily become out of date as patients visit more frequently.

Not sustainable Frequently changing interior design highly unsustainable, often creating wastes that are harmful to the environment. Newly furnished clinics are also sometimes harmful to the human health.

VR as Drug-Free Sedation: OperaVR

Previous research has been conducted on how using VR to serve sedative purposes. OperaVR, for example, creates a meditation session in the VR headset to calm patients. Founder Dr. Laskin calls it "digital nitrous".

Not interactive Existing VR modules that aim to relieve patients' stress often center around meditation, which sometimes isn't enough distraction, especially when working with children

Journey Ends After Visit These modules don't serve other purposes beyond meditation. They end immediately after the treatment is over, with no continuation at home.

App: AR Game

We researched on four types of AR games related to teeth brushing, including Brush Up, Disney Magic Timer, and others.

Not immersive enough We found that some games, such as Brush Up, lacked immersion as kids could only see themselves in the mirror, as shown in the left picture. Pokémon Smile, while providing a slight AR feel with skins for users, didn't fully capture the interactive potential of AR.

The advantage of reward system Since these games are designed for children, a robust reward system proves crucial in fostering persistent tooth-brushing habits. We categorized reward systems into two concepts: the collection concept and the building memory concept.


Brush Up: Toothbrush Trainer

App: Parent Portal

We analyzed direct and indirect competitors to understand their strengths and weaknesses comprehensively. Among the direct competitors, Formula stands out as particularly valuable. This app, developed by a dental office in Ukraine, offers appointment scheduling and tracking functionalities for families. Additionally, it incorporates an educational brushing game.

Centralized management   The dashboard's design is crucial, given that it often presents an overload of information for users. We aim to simplify it for parents, ensuring they can effortlessly access and understand the necessary information.

Dental system connection   When establishing a connection with a dental system, a wealth of information should be displayed on the app to assist parents in effortlessly tracking their family's medical history and appointment details, including available time slots with dentists and pertinent dentist information. Our approach involves prioritizing this information based on thorough research conducted on competitors.
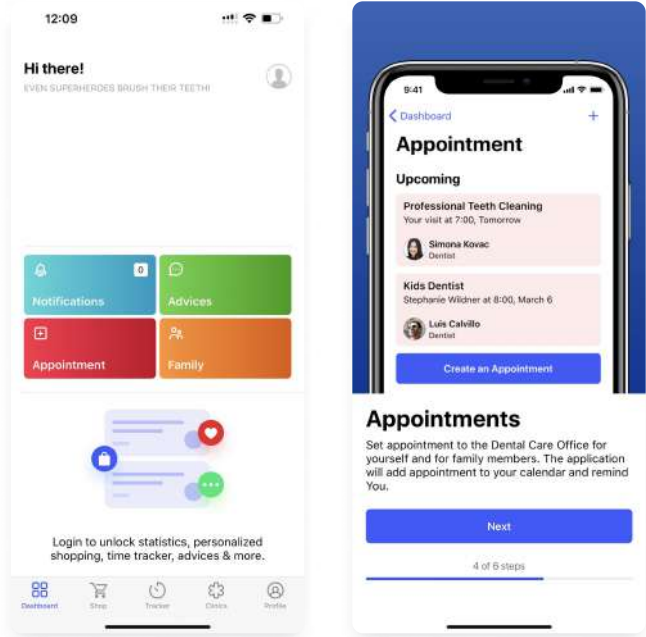
Fomula

Analyzing Our Users

Primary User - Children

Vincent

12 years old

6th grade students

New York, NY

Bio
Vincent has been scared of going to the dentist since a traumatic tooth-pulling experience when he was 8 years old. After that, he always cries and fights during his yearly check ups. He needs to have two fillings done very soon but he's been protesting it to his mother for months.

Pain Points

• Dental tools are very loud and scary
• Doesn't know what the dentist is doing
• Brushing teeth is frustrating and boring

Needs

• Be distracted from the scary sound and visions
• Be able to know that the dentist isn't going to hurt him
• A more fun and engaging way to take care of his dental hygiene

Secondary User - Parent

Jessica

41 years old

Consultant

New York, NY

Bio

Jessica is a work mom and her child is 12 years old. He has been scared of going to the dentist for awhile. Every time she takes him to the dentist, he would cry and scream. Her day job as a consultant is very demanding and she does not have time to make sure he is brushing his teeth on time.

Pain Points

- Can't convince her child to go to the dentist
- Scared of causing more dental trauma for her child
- Cannot tell if her child is taking care of his dental health correctly

Needs

- help with assuring her child that dental visits are not scary
- a way to know her child is keeping up with his dental hygiene

Secondary User - Dentist

Amanda

40 years old

Pediatric Dentist

New York, NY

Bio

Amanda has been doing pediatric dentistry for 14 years now and manages her own clinic. She is very skilled in treating dental problems, and she's always looking for new ways to make kids less stressed about visiting dental clinics.

Pain Points

- Children sometimes refuse to cooperate
- Children sometimes have a hard time understanding what she's trying to do
- Has to work extra precisely and efficiently with children

Needs

- Better ways to keep children focused and stay in place for a longer period
- Communicate in simpler terms the process of the treatments to make them cooperate

Design Concept

We are designing a complete service encompassing an in-clinic VR experience and an app that includes both an AR teeth-brushing game for kids and a progress tracking portal for parents.
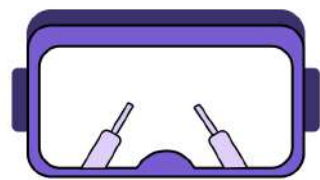

VR Game During Dental Treatment

Immersive and interactive VR game to distract children from the sound and vision, also serving educational purpose and helps to build trust with the dentist character.
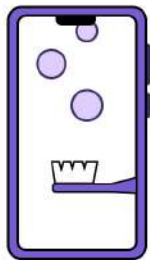
AR Teeth-Brushing Game

App kids portal: Augmented Reality game that helps children build proper brushing habits and collect rewards like animal and virtual character skins.
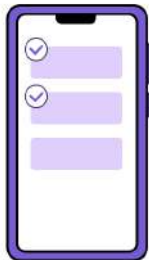
Parent Progress Tracking

App parents portal: Allowing parents to track their children's teeth brushing progress, book dental appointments, and update their children's medical information.

Ideation

User Flow of Entire Experience

We first mapped out a user flow of the end-to-end experience in order to understand how the VR experience and the AR app relate to each other. Specifically, we're looking at key touch points in going to the dental office, getting treatment, and going home to continue dental hygiene practices, as well as the stakeholders involved in the process.
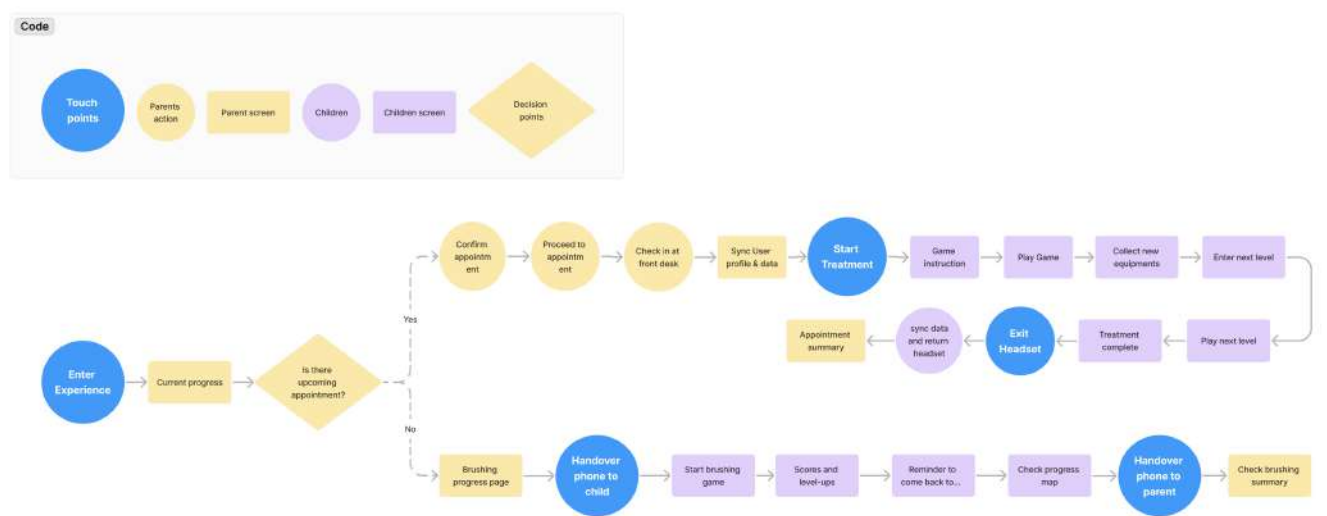
VR Experience - "Cavity Ninja"

The primary goal of the VR experience is to distract the user from the dental treatment they're receiving. In addition to the use of sound, we also wanted the user to direct their undivided attention to the experience. The most intuitive solution is to create a VR game that's **interactive, immersive, and educational**. We started by mapping out a straightforward user flow of the VR experience.
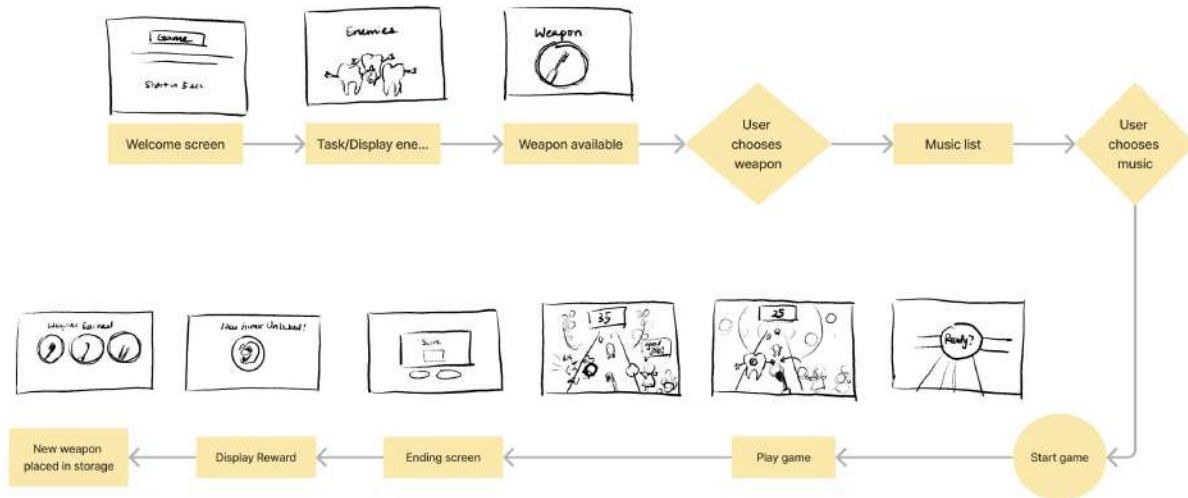
Concept Design

The game features a trainer (player) being trapped in an alternate universe invaded by little monsters that look like cavities. The player has to protect themselves by fighting off these monsters with the help of a dentist NPC (Non-Player Character). The monsters increase in power with each level and their appearances also vary depending on the amount of infection. This game concept aims to help children **associate dentists with companions** that fight alongside them against their common enemies.

Gameplay Design

Avoiding head movement: The main challenge with VR game is that users often like to look around the 3D world. However, we need to make sure they don't move their heads during the treatment. When designing for children, specifically, we can't force them to act according to our instruction. Instead, we had to make design decisions that afford these actions. We referenced games like Beat Saber and created an environment where enemies are spawned from the far center of the screen so that users are always intuitive looking straight ahead.

Level Design: To avoid fatigue, we implement a level structure and introduce breaks in between levels, where they are awarded equipment upgrades. Since the levels increase in difficulty, they can use these upgraded equipments in the next level.

Economy Design: The game economy system is simple and straightforward to avoid taking up too much of the player's attention. The player gains points by hitting the right monsters with the correct sprayer and loses points when the wrong sprayer is used. If a monster reached the player, one point is also deducted. The player would win the game after reaching the passing score for the level.

Hardware

The interactive feature of the game could pose risks such as players' hands interfering with the dentists' performance. We considered using eye tracking to control the actions, but from observational study, we noticed that when doing eye tracking, users often subconsciously move their head as well, which should not be allowed during dental treatment.

We returned to the more traditional way of using hands to hold the controllers, but we fixed the equipments in the VR game in place and allow only one "spraying" action for attacking the enemies. We also attach the controllers to the arms of the dental chair to ensure users are intuitively keeping their hands on the controllers.

App Experience

To continue the narrative at home, we designed and App that involves both the children and the parents into the experience. However, instead of considering it as two separate portals, we analyzed the entire process as a whole, specifically looking at which touch points involve children and which touch points involve parents. To understand this, we first mapped out an entire information architecture.
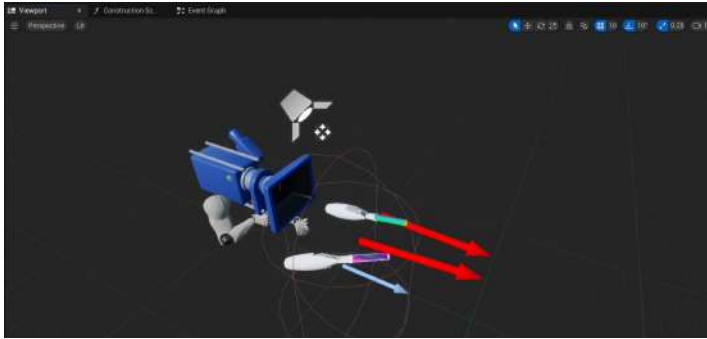
User Flow
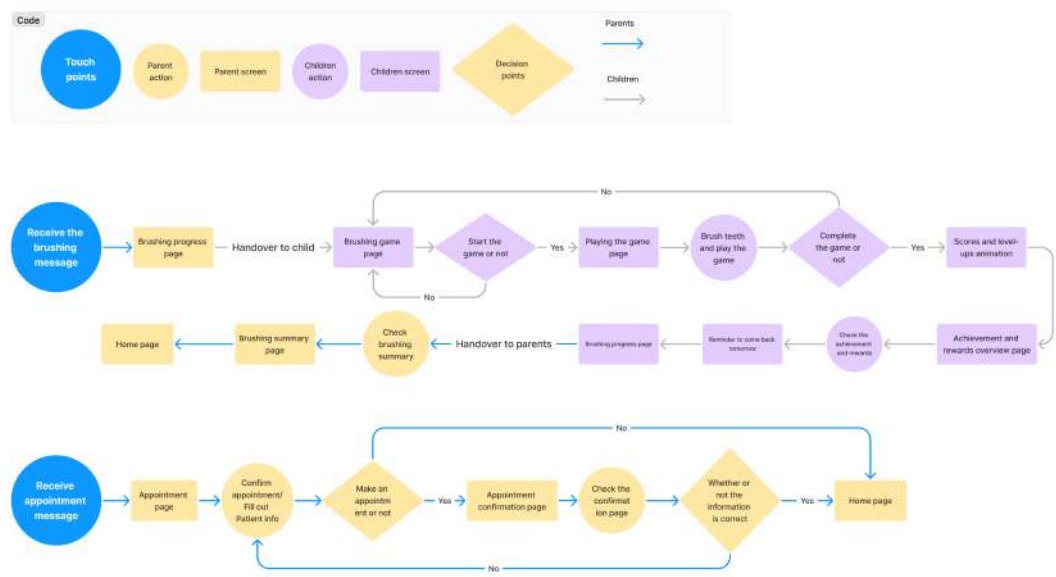

Site Map
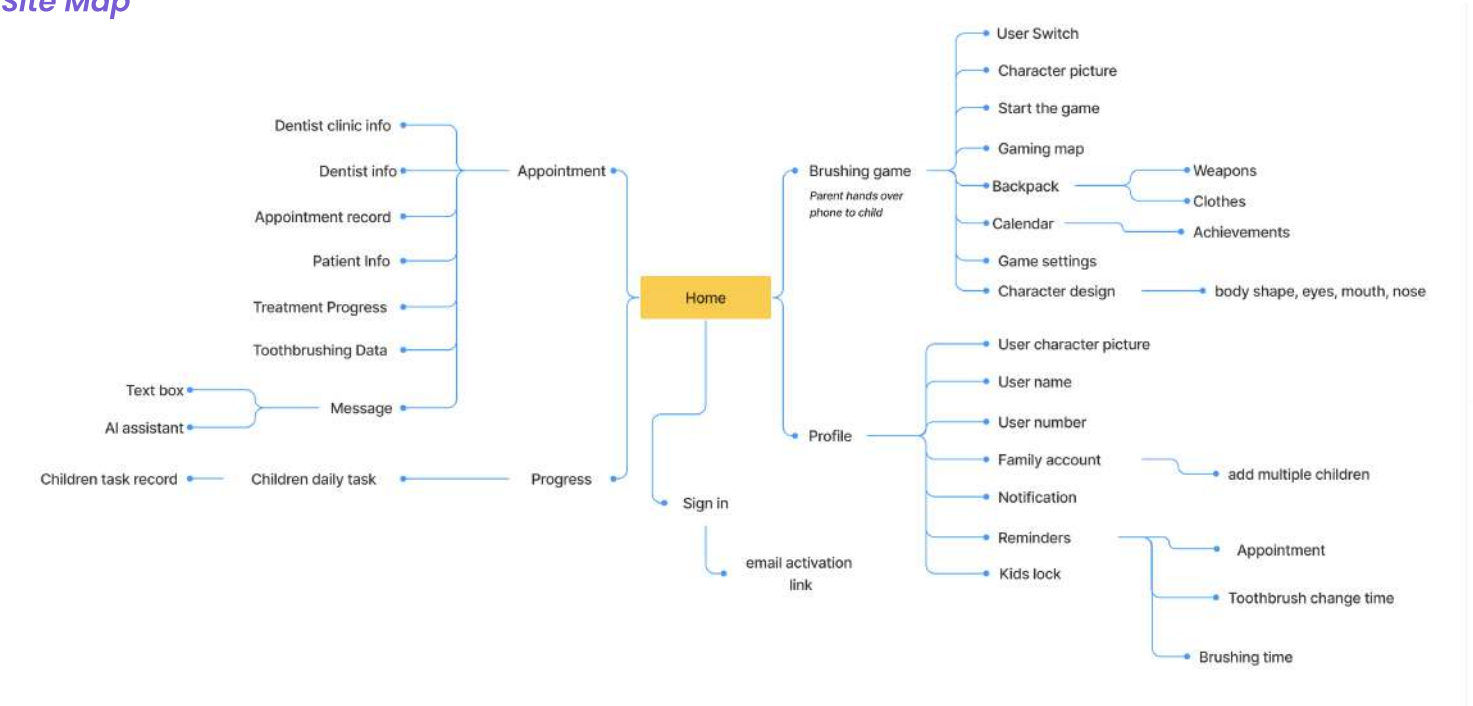
Design and Development

VR Experience

Coding the Gameplay

The game mechanism is very similar to a first-person-shooter game, involving a player, player's weapons, and enemy AI that spawns and moves towards the player. We used blueprints to program these interactions.


Imported a first person player character from the Unreal Engine template and added two weapons to the character.
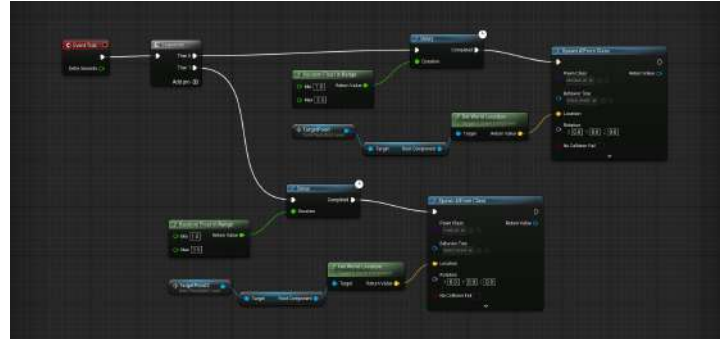
Created and randomized the enemy "spawn and move toward player" blueprint in the level blueprint.
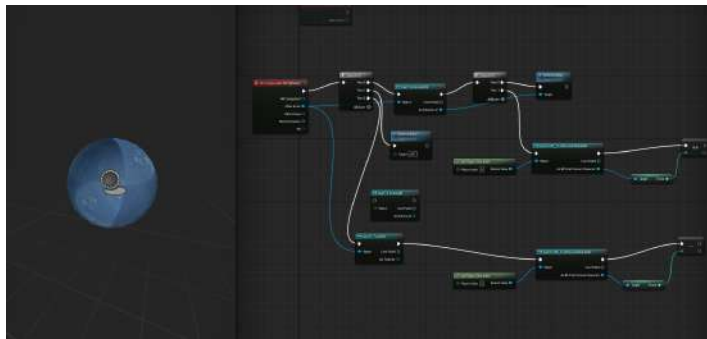
Created the projectiles that emit from the equipments and "destroy enemy" blueprints. Made sure that each enemy is only destroyable by its matching projectile.
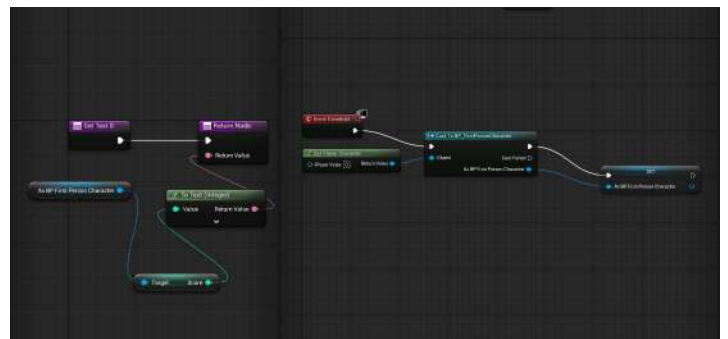

Added a score system. Made sure that when the wrong projectile hits the enemy, one point is deducted. When an enemy reaches player, one point is also deducted.

3D Modeling and World Building

We designed, sculpted, and painted the cavity monsters and dental tools in Blender and built the world in Unreal Engine. The UI designs are all created in Figma.

Cavity monster (Slightly decayed)
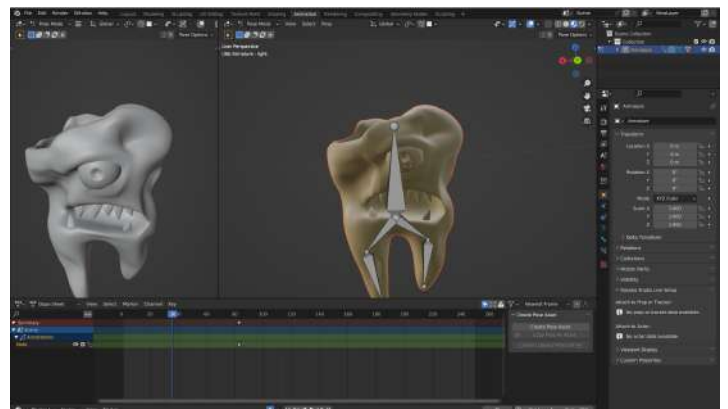
Cavity monster (Severely decayed)

Dental Tool

World-Building

Instruction UI

Dentist UI

App Experience

The app offers both a parental and a children's portal. Parents can seamlessly switch between the two using the 'switch button.' The children's portal features a game system to cultivate a brushing habit and create a joyful connection to the dental office through a seamless reward system and a virtual dentist. The parent portal provides a tracking system, enabling parents to monitor their children's brushing and appointment records. Additionally, we have integrated an appointment system directly into the app, making it easy for parents to manage their child's dental health effortlessly.
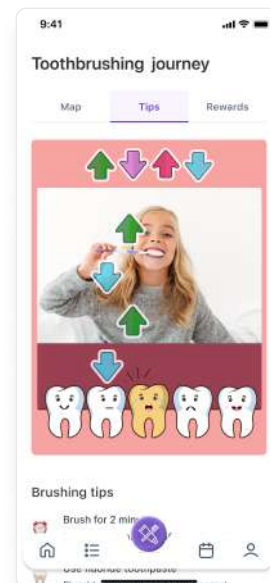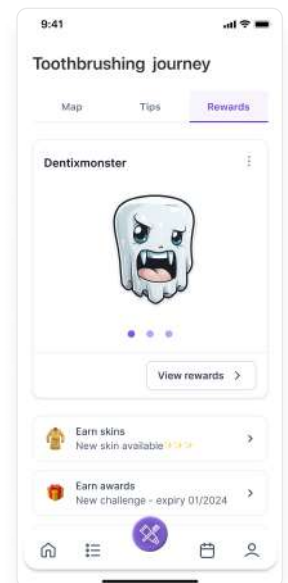
Children portal
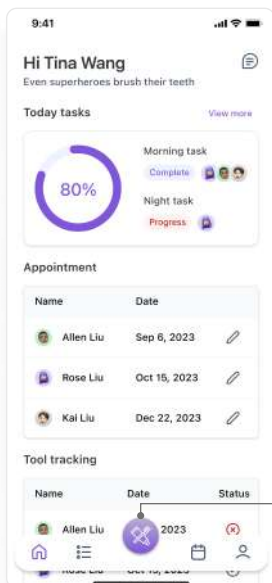
Parent mode
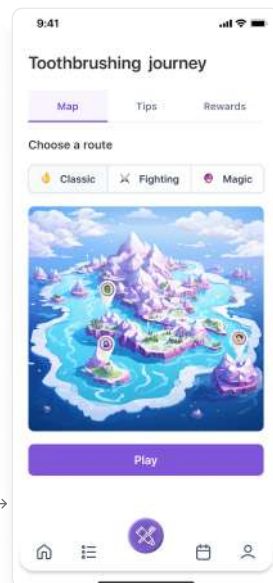
Switch to child mode

Joyful brushing tips

Reward bag

Brushing game

The top features arrows indicating dynamic brushing directions, flowing down to guide users on where to brush. The tooth at the bottom provides guidance on which tooth needs brushing. Through the game, children can learn how to brush their teeth correctly.

The dentist (NPC) plays a crucial role by providing bubbles to assist children in completing the brushing task. Additionally, positive reinforcement is offered through encouraging words such as 'good job' and 'keep going.' As a result, this process facilitates task completion and nurtures a positive and supportive relationship between the dentist and the children.

| Game page | Player choice | Level map UI | Brushing game UI | Direction bubble |

Dentist NPC
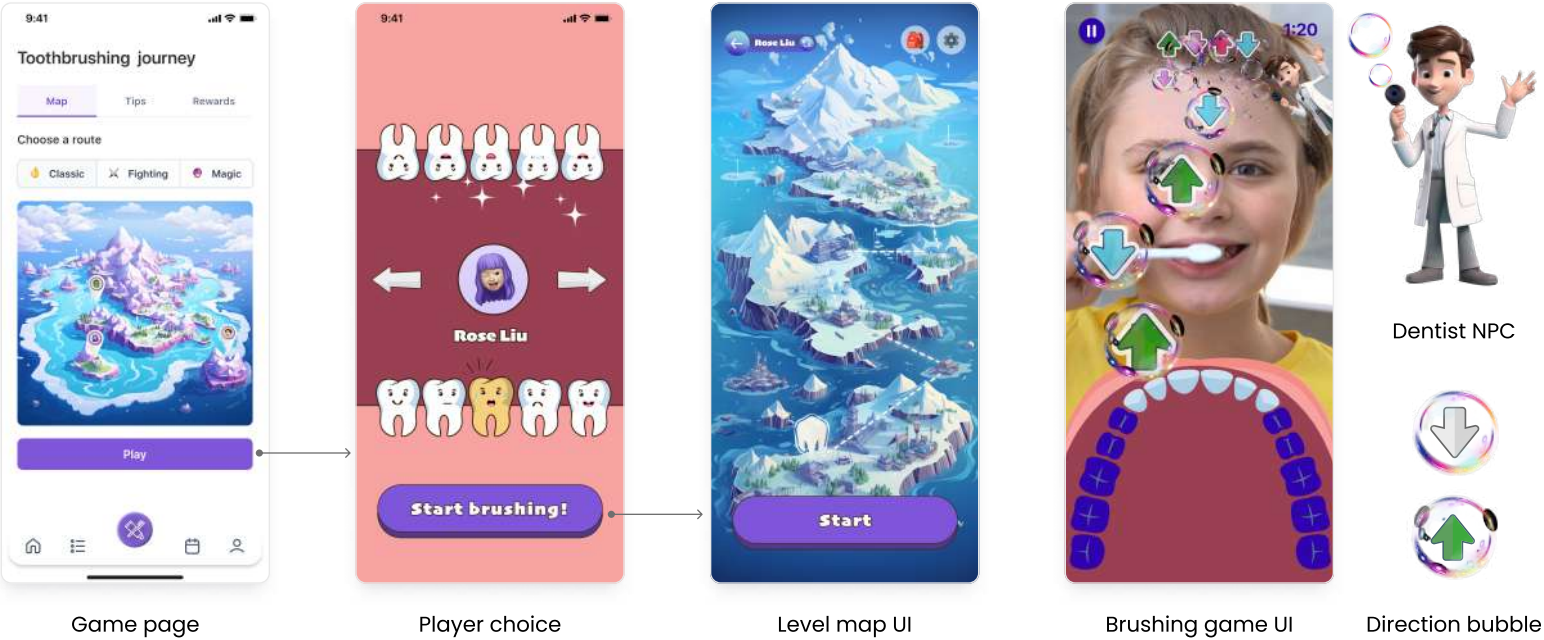
Parental portal - Track system, Appointment system

The kid's tracking system simplifies parental monitoring of children's brushing habits, while the landing page conveniently displays appointment information to help parents remember upcoming dental visits. Integrated into the app, the dental system enables parents to monitor and schedule their children's dental appointments effortlessly. Additionally, dental assistants can seamlessly assist patients in booking appointments via their computers, with the information syncing directly with the app. The entire user flow is designed to assist parents in easily and efficiently caring for their children.

| Parental landing page | Track system page | Appointment page | Appointment detail page | Confirmation page |