Google Developer Student Clubs
UNSDG 2024

Questify

App Documentation

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THE GLOBAL GOALS

Table of Contents

General

Introduction

In the pursuit of achieving the United Nations' challenge to ensure inclusive and equitable quality education while promoting lifelong learning opportunities for all, our innovative solution endeavors to revolutionize the conventional educational paradigm. Our app breaks free from traditional constraints, where learning is often confined to screens and textbooks, by infusing real-world interaction into its quests. By embarking on these adventures, children not only unravel valuable knowledge but also cultivate essential skills through hands-on, practical applications. This transformative approach not only fosters a love for learning but also aligns with the broader vision of providing accessible and lifelong educational opportunities for every individual, irrespective of background or circumstance. In embracing inclusivity and equity, our app strives to create an engaging and universally accessible platform that empowers learners to thrive in a dynamic and interconnected world.

Abstract

This idea introduces a novel mobile application designed to revolutionize children's learning experiences by transforming education into engaging, real-world quests. The app addresses the challenge of disengagement and frustration often associated with traditional learning methods by incorporating interactive quests that encourage children to explore their surroundings while acquiring valuable knowledge. Through completing quests and earning badges, children are motivated to learn and track their progress, fostering a sense of achievement and excitement for discovery. This innovative approach aims to ignite children's natural curiosity and transform learning into an unforgettable adventure.

About Us

We are a team of four enthusiastic 3rd-year Computer Science students from Dr. Ambedkar Institute of Technology, Bangalore, dedicated to reshaping the learning experience for children. Comprising Amruthamsh, Arjun, Anika, and Chandana, our collaboration brings together a mix of design, technical, educational, and organizational skills. Focused on addressing the dullness of traditional learning methods, our goal is to create an app that engages children in interactive

quests, fostering both knowledge acquisition and skill development. As students, we are excited to apply our collective expertise to make a positive impact on education and inspire a love for learning in young minds.

Challenge and Solution

Problem Statement

Traditional learning confines children to screens and textbooks, hindering their natural curiosity and exploration, leading to disengagement and hindering their learning potential.

Addressing the UN Sustainable Development Goals

Quality Education:

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

Good Health and Well-Being:

Ensure healthy lives and promote well-being for all, at all ages.

Responsible Consumption and Production:

Ensure sustainable consumption and production patterns.

Impact and Effectiveness

Impact

The impact of traditional learning methods confining children to screens and textbooks is multi-faceted and profound. First and foremost, it impedes the natural curiosity and explorative instincts inherent in children. By limiting educational experiences to digital screens and static textbooks, the dynamic and interactive aspects of learning are stifled. This not only hinders the development of a holistic understanding of concepts but also diminishes the joy and excitement associated with the learning process. Furthermore, the confinement to screens may contribute to increased screen time, potentially leading to issues such as eye strain, sedentary behavior, and a disconnect from real-world interactions.

Effectiveness

The effectiveness of addressing this problem lies in embracing a more dynamic and interactive approach to learning. By incorporating real-world interaction into educational methods, children can explore, experiment, and apply their knowledge in practical situations. This approach not only makes learning more engaging and enjoyable but also enhances the effectiveness of knowledge retention and skill development. A learning environment that encourages curiosity and exploration is more likely to foster a lifelong love for learning. Implementing strategies that break away from the limitations of screens and textbooks can positively impact children's overall educational experience, promoting active participation, critical thinking, and a deeper understanding of the world around them.

Implementation

System Architecture

The frontend of the app is built using React Native with Expo, providing a platform for creating interactive user interfaces across different mobile devices. Expo accelerates development by granting access to device APIs and simplifying the deployment process. Users interact with the app through this frontend layer, which includes features such as quest selection, image capture, and displaying generated content.

Firebase serves as the backend infrastructure for the app, offering several services crucial for its functionality. Firebase Realtime Database or Firestore stores game data, user progress, and quest information. Firebase Authentication handles user authentication and authorization, ensuring secure access to app features and personalized content. These Firebase services are integrated seamlessly with the frontend to provide a cohesive user experience.

The app leverages external APIs for advanced functionalities. The Cloud Vision API is used for text recognition in images, enabling quests that require analyzing text from pictures. Firebase Cloud Functions securely interact with this API to process image data and extract relevant text, which is then utilized within the app for generating educational content.

Gemini LLM (Language Model) is employed for question generation based on the extracted text. It receives the text data from the Cloud Vision API and utilizes Gemini LLM to formulate multiple-choice questions (MCQs) related to the image content. These generated questions are presented to users as part of quests, enhancing the educational aspect of the app.

Another quest involves object detection in images using the Gemini Vision Pro API. This API detects objects within the images captured by users and retrieves supply chain cycle information related to the identified objects. The app utilizes this data to educate users about the lifecycle of various objects, fostering a deeper understanding of supply chain processes.

Client-server communication is facilitated through a RESTful API, enabling interaction between the frontend app and backend services. This API handles requests related to user authentication, game data retrieval, and interactions with external APIs such as Cloud Vision and

Gemini APIs. It is implemented using Node.js/Express.js or similar backend frameworks and may utilize Firebase Cloud Functions for serverless execution.

The architecture also includes provisions for documentation and logging. The API endpoints, request/response structures, and authentication mechanisms are documented using Swagger/OpenAPI Specification, ensuring clarity and consistency in the API design. A logging service records app events, errors, and user interactions for monitoring and troubleshooting purposes, utilizing Firebase Analytics or other logging services like Firebase Crashlytics or Sentry.

Security measures are implemented using Firebase Security Rules to define access rules to Firebase resources based on user authentication and authorization. Additionally, API key management ensures secure storage and usage of keys for accessing external services like Cloud Vision API and Gemini APIs.

Deployment involves using Expo CLI for development and testing, allowing rapid iteration and validation of app features. The finalized app is published to app stores such as the App Store and Google Play for distribution to end-users.

Finally, monitoring and scalability are addressed through Firebase Performance Monitoring, which tracks app performance metrics, and auto-scaling capabilities provided by Firebase services and serverless architecture, ensuring the app can handle varying loads efficiently. This comprehensive architecture provides a robust foundation for your educational game app, integrating various technologies seamlessly to deliver a rich and engaging user experience.

Tech Stack and Responsibilities

Firebase

- Firebase Authentication: Provides secure and scalable user authentication methods (email/password, social logins, custom tokens). Integrates seamlessly with React Native, offering a familiar API for managing user accounts.
- Firebase Realtime Database: NoSQL database that stores and synchronizes data in real-time across devices. Ideal for applications requiring immediate updates and collaborative features.

React Native

- Cross-platform mobile development framework, allowing you to build native-looking iOS and Android apps using JavaScript and JSX.
- Streamlines development by reducing code duplication and leveraging native UI components.

Expo

- Open-source platform for building mobile apps with React Native.
- Simplifies development by providing tools for:
    - Code editing and live preview
    - Managed app hosting
    - Push notifications and other backend services
    - Access to native device APIs
- Expo Go: App for previewing and testing your Expo apps on your device without needing to build separate native app bundles.

Cloud Vision API

- Google Cloud's computer vision service that analyzes images and videos for various tasks:
    - Object and landmark detection
    - Text recognition
    - Image properties extraction (colors, labels, etc.)
- Can be integrated into your React Native app using its REST API or client libraries.

Gemini

- Gemini is a family of multimodal large language models developed by Google DeepMind, serving as the successor to LaMDA and PaLM 2. Comprising Gemini Ultra, Gemini Pro, and Gemini Nano, it powers the generative artificial intelligence chatbot of the same name.
- Provides the capability to generate queries based on the information provided by the Cloud Vision API.

Gemini Pro Vision

- Gemini Pro Vision is a foundation model that performs well at a variety of multimodal tasks such as visual understanding, classification, summarization, and creating content from image and video. It's adept at processing visual and text inputs such as photographs, documents, infographics, and screenshots.
- Provides image processing capabilities to show the supply chain cycle of the processed image.

Supported Platforms

- **Android**: React Native has official support for building Android apps from version 5.0 (Lollipop) and above. This enables development for most modern Android devices.
- **iOS**: You can create iOS apps from version 11 and later using React Native's official support. This covers a wide range of iPhones and iPads currently in use.

- **Web**: While not officially supported by React Native, the community-driven project "React Native Web" enables building web apps using React Native code. This allows for cross-platform development with a single codebase.

User Feedback and Iteration

Throughout the development process of our educational game app, we prioritize user feedback and continuous iteration to ensure that the app meets the needs of our target users while also contributing to broader societal goals, such as those outlined in the United Nations Sustainable Development Goals (UNSDGs). By integrating user feedback and aligning our app's features with the principles of the UNSDGs, we aim to create an engaging and impactful learning experience that supports quality education, promotes good health and well-being, and encourages responsible consumption and production practices.

Empathize

- We began by understanding the needs and preferences of our target users, primarily students or individuals interested in educational games, while also considering the broader societal goals outlined in the UNSDGs. Our app aims to contribute to UNSDG Goal 4: Quality Education by providing engaging and educational content. Additionally, we consider UNSDG Goal 3: Good Health and Well-Being by ensuring that our app promotes healthy learning habits and mental well-being. Furthermore, we address UNSDG Goal 12: Responsible Consumption and Production by designing our app to encourage sustainable and responsible use of resources.

- We accessed already available data on the internet to gain insights into user preferences, challenges, and behaviors related to learning and gaming.

- Common pain points and opportunities for improvement in existing educational games or learning experiences were identified through analysis of existing data and user feedback from online platforms and forums.

Define

- Based on the insights gathered during the empathy phase, we defined the specific problem or opportunity we aim to address with our app, aligning it with the UNSDG goals of Quality Education, Good Health and Well-Being, and Responsible Consumption and Production.

- The goals and objectives of the app were clearly articulated, considering both the educational outcomes we want to achieve and the user experience we aim to deliver.
- User personas and user stories were created to capture the needs, goals, and behaviors of different types of users who will interact with the app.

Ideate

- A wide range of creative ideas and potential solutions to address the defined problem or opportunity were generated, with a focus on supporting the UNSDG goals.
- Brainstorming sessions were conducted with cross-functional teams, including designers, developers, educators, and potential users, to ensure alignment with the UNSDG goals.
- Different game mechanics, educational content formats, and interactive features were explored to engage users and support their learning objectives while contributing to the UNSDG goals.
- Techniques such as mind mapping, sketching, and rapid prototyping were used to visualize and refine ideas.

Prototype

- Prototypes of the app were developed to test and validate our ideas with real users, keeping in mind the alignment with UNSDG goals throughout the prototyping process.
- Low-fidelity prototypes were created using wireframing tools or paper sketches to quickly iterate on the app's layout, navigation, and key features, ensuring that they support the UNSDG goals.
- The fidelity of the prototypes was gradually increased as we refined the design, incorporating visual design elements, interactive components, and simulated content that promote the UNSDG goals.

- Usability testing sessions were conducted with representative users to gather feedback on the prototypes and identify areas for improvement, with a focus on enhancing the app's alignment with the UNSDG goals.

Test

- Comprehensive testing of the app was conducted to ensure that it meets the needs and expectations of users, while also contributing to the UNSDG goals.
- The app's functionality, performance, and usability were tested across different devices and platforms to identify and address any technical issues or inconsistencies that may hinder its alignment with the UNSDG goals.
- Feedback from users was gathered through surveys, interviews, and user testing sessions to understand their impressions, preferences, and pain points, with a particular emphasis on how well the app supports the UNSDG goals.
- Iterations on the app were made based on the feedback received, making adjustments to the design, features, and content to improve the overall user experience and better align with the UNSDG goals.

Implement

- The app is being developed based on the finalized design and specifications, with a continued focus on supporting the UNSDG goals throughout the implementation process.
- We are following best practices for mobile app development using frameworks and technologies such as React Native, Firebase, and Expo, ensuring that the app's development process aligns with the principles of the UNSDG goals.
- Robust authentication and data management systems will be implemented using Firebase Authentication and Realtime Database/Firestore to ensure the security and reliability of user data, while also considering the principles of responsible consumption and production outlined in the UNSDG goals.

Support for Various Platforms

- The app is designed to support multiple platforms, including iOS and Android, ensuring accessibility to a wide range of users across different devices, in line with the principles of the UNSDG goals.
- Compatibility with various screen sizes and resolutions is considered during the development process to provide a consistent and optimized user experience on different devices, further supporting the UNSDG goals.
- By supporting multiple platforms, we aim to maximize the reach of the app and provide a seamless learning experience to users regardless of their preferred device, in accordance with the principles of the UNSDG goals.

Challenge and Solution Highlights

Key Decisions and Implementations

Expansion of "Supply Chain Story" Quest

- **Decision:** Responding to user feedback requesting more comprehensive information, we decided to expand the "Supply Chain Story" quest to include ways to dispose of the object in the picture.
- **Implementation**: We integrated additional features within the quest interface to provide users with insights into the disposal methods of the depicted object. This enhancement aims to offer users a more holistic understanding of the lifecycle and environmental impact of the objects they interact with.

Enhancement of "Reading Adventures" Quest

- **Decision**: In response to user feedback suggesting a desire for a broader range of questions, we decided to augment the "Reading Adventures" quest.
- **Implementation**: Alongside the existing feature of scanning book content, we introduced a new functionality enabling users to manually input the book's name. This addition allows users to access a wider variety of questions related to the specified book, enriching their learning experience and promoting engagement with diverse literary materials.

Introduction of "Know Your Nutrients" Quest

- **Decision**: Based on user suggestions for nutritional information and sustainability considerations, we decided to introduce an entirely new quest titled "Know Your Nutrients."
- **Implementation**: This new quest provides users with comprehensive insights into the nutritional content of various foods, their sustainability impact, and recommended intake frequencies. Through interactive features and informative content, users can deepen their understanding of dietary choices, environmental implications, and health-conscious decision-making.

These key decisions and implementations were made in direct response to user feedback, aiming to enhance the overall user experience, promote engagement, and address user preferences and needs more effectively.

Overcoming a Technical Challenge

Prompt Design Strategies

We employed prompt design strategies to guide the AI model in generating more relevant and coherent prompts. This involved refining the structure and content of the prompts to provide clearer instructions and context for the desired output.

Playing with Input Parameters

We experimented with various input parameters and configurations to fine-tune the AI model's behavior and improve the consistency and relevance of the generated prompts. Adjusting parameters such as temperature, max tokens, and response length helped in achieving more desirable outcomes.

Cross-Platform Compatibility

Addressing the challenge of ensuring consistent output across Android and iOS devices, we conducted thorough testing and debugging to identify and resolve any platform-specific issues. This involved optimizing the app's codebase and implementing platform-specific adjustments to accommodate differences in device specifications and operating systems.

Codebase Refactoring

To mitigate inconsistencies arising from the same code producing varying outputs across different devices, we performed codebase refactoring and optimization. This included modularizing the codebase, adhering to platform-specific development guidelines, and implementing device-specific handling where necessary.

Continuous Testing and Iteration

Throughout the development process, we prioritized continuous testing and iteration to monitor the performance of the AI model across different devices and platforms. This iterative approach

allowed us to identify and address any discrepancies or inconsistencies promptly, ensuring a more seamless and consistent user experience.

Future Plans and Scalability

As we look towards the future, we envision expanding the app's capabilities and scalability through various technical enhancements and feature additions. Some key aspects of our future plans include:

Adding More Quests

We plan to continuously enrich the user experience by adding more quests that offer diverse educational challenges and activities. These quests will cover a wide range of topics and subjects, catering to the varied interests and learning objectives of our users.

Introduction of "Time Machine" Quest

In our future roadmap, we aim to introduce a new quest called "Time Machine" that leverages advanced features such as location tracking and historical image analysis. This quest will enable users to:

- Track their current location and explore historical images from decades ago.
- Transport themselves to that location and observe how it has evolved over time.
- Engage in a comparative analysis by juxtaposing historical and current images, providing valuable insights into the passage of time and urban development.

Multiplayer Option for Collaborative Quests

To enhance social interaction and engagement, we plan to incorporate a multiplayer option where users can collaborate and complete quests together. This feature will enable users to team up with friends or other app users, fostering a sense of community and cooperation while tackling educational challenges.

In terms of technical implementation, these future plans and scalability initiatives will involve:

- Utilizing advanced geolocation and image processing technologies to support the "Time Machine" quest.
- Implementing real-time multiplayer functionality using networking protocols and server-side infrastructure to facilitate seamless collaboration among users.

- Scaling the app's backend infrastructure to accommodate increased user activity and data processing demands resulting from the addition of more quests and multiplayer features.

By incorporating these technical enhancements and feature additions, we aim to further elevate the educational gaming experience offered by our app while ensuring scalability to accommodate a growing user base and evolving user needs.