

White Paper

# Xorbix White Paper: Flashcard Study Buddy

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## Executive Summary

**Xorbix Technologies Inc.**, a source for Artificial Intelligence (AI) solutions and revolutionary software, recently released a new mobile application that highlights the power of AI as a means of learning. Combining a classic training method, flashcards, and state-of-the-art technology, **Xorbix** has developed a portable study application, aimed at consumers of all ages.

The plan was to develop a modern, easy-to-use app that allows people of all ages to learn and study topics of their choosing. Now that Artificial Intelligence is at the forefront of modern technology, **Xorbix** was eager to tap into its potential. What started off as a simple flashcard creator, quickly shifted into a generation tool to make lives easier. Integrating Azure's OpenAI, offline and online databases, as well as the Flutter software development framework, **Xorbix** brought this concept to life. *Flashcard Study Buddy* is now available on both iOS and Android Devices.

Features of the application include the ability to create flashcards sets on any topic the user desires, multiple methods to study the material, cross-device data syncing, and harnessing the power of AI to generate flashcards with just a few taps. **Xorbix** combined Google's Firebase databases, Azure's OpenAI GPT3.5-Turbo, and various Flutter packages to bring this idea to life.

The app not only allows users to create flashcards by manually entering questions and answers, but it also utilizes AI to produce them automatically. By filling out three simple questions, the topic, difficulty level, and number of flashcards, users receive a fresh set of study material. Today, there isn't a lot of software taking advantage of Artificial Intelligence, so **Xorbix** is at the frontlines of this technological shift.

In conclusion, **Xorbix** saw a need in the mobile app market for a learning tool, powered by Artificial Intelligence. Flashcards have been a tried-and-true study method for over a hundred years.

By combining this with brand new technology, it was a formula for success. *Flashcard Study Buddy* is now available in the App Store and Google Play Store.

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## 1. Introduction and Background

**Xorbix Technologies Inc.**, a producer of innovative software and IT solutions designed to revolutionize businesses in today's rapidly evolving digital landscape. With a core focus on harnessing the power of Artificial Intelligence, Machine Learning, and Automation, **Xorbix** is committed to delivering world-class technology solutions that streamline operations and drive sustainable growth. As evidenced by its recognition as one of the 2023 Fastest-Growing Private Companies in America, **Xorbix** prides itself on its dedication to excellence, integrity, and innovation. The company's core values, including a commitment to exceeding customer expectations, fostering teamwork and collaboration, and embracing leading-edge technologies, serve as the guiding principles behind its success. **Xorbix's** culture is centered around its exceptional team of professionals who are passionate about delivering the highest quality digital solutions on time and within budget. With a strong emphasis on customer satisfaction and a relentless pursuit of excellence in software engineering, **Xorbix** stands as a trusted partner for organizations seeking innovative technology solutions to meet their enterprise IT needs.

## 2. Project Overview

**Xorbix** not only provides software solutions to clients, but also develops mobile applications and software internally. The company first explored the possibility of creating a basic flashcard app, allowing users to manually enter in their own questions and answers to later review and study. Thus, *Flashcard Study Buddy* was born. Developed using Flutter, a software development framework created by Google, it was released on both iOS and Android at the end of 2023. It integrated a handful of Flutter development packages, one of which simulated the look and feel of a physical flashcard. By swiping or tapping a flashcard on screen, it would flip over to reveal a different set of information than the front displayed. However, **Xorbix** wasn't satisfied and began exploring further options to

increase its abilities as a means to learn. After a brief brainstorming period, the company realized the next steps.

### 2.1 Goal

The main goal of the project was to implement Artificial Intelligence into *Flashcard Study Buddy* in some capacity. One of the first ideas was to use it for speech recognition, giving users the option to speak into their device in order to answer the question presented on the front of the flashcard. While a viable option, it would also require users to be in an area where they could speak, limiting where this feature could be used. Such as a library, for example, a common place for students to study. Focus quickly shifted to another option, content generation. ChatGPT was already a well-known chatbot-like software. Given a prompt, it could generate a response in the format the user expects. By harnessing this same technology, **Xorbix** could prompt ChatGPT to generate flashcards. So, development began to accomplish just that.

### 3. Common Terms

- Mobile App
- Chatbot
- Azure
- Artificial Intelligence
- Data Synchronization
- Firebase

- Flutter

## 4. Prompt Training

**Xorbix** underwent extensive prompt training in order to generate the exact content that was needed. At a very basic level, a flashcard contains a front and back side. The back of a flashcard usually defines, describes, or answers the corresponding word, phrase, or question the front had. So, the AI had to be trained to generate a set of data in pairs, as well as what exactly the data's topic was. **Xorbix** found that a templated prompt would be the best approach. Users wouldn't want entirely random flashcards, instead they would want them on a specific topic.

Within the app itself, there would have to be a way for the users to input what the subject the flashcard set would generate, which is where the templated prompt comes in. For example, "Generate a set of flashcards on \_\_\_\_." That gap would then be filled in with whatever the user inputted on their end. This was a promising start but also created more unknowns. What would the difficulty level of these generated questions be? And how can the number of flashcards generated be controlled? After further prompt training, and a more robust generation menu for users, **Xorbix** developed a fine-tuned prompt that would generate accurate and structured results.

## 5. Functional Requirements

- Make the user experience as streamlined as possible
- Accurate return of flashcard-like data
- Quick conversion from ChatGPT response to our internal flashcard model
- Prevent users from losing their data in the event the app is deleted or switch devices

## 5.1 Streamlined User Experience

### 5.1.1 AI Generation Menu

- Provide users with a concise menu, requiring them to fill out 3 simple questions in order to complete the templated prompt:
  - The topic the user wanted the flashcard to be about.
  - The difficulty level of the questions, in a school grade type level. 5th Grade, bachelor's degree, etc.
  - The number of flashcards to create in the set.
- Upon pressing the 'Generate' button at the bottom of this menu, the template would be populated with these responses and sent off to Azure's OpenAI GPT3.5-Turbo.

### 5.1.2 Response to Flashcard Conversion

- Expected the AI response to be a dataset of pairs in a JSON format.
- The response would then need to be parsed and converted into the app's pre-defined flashcard model. Similarly to the already in place conversion that occurs when a user manually creates flashcards.

## 5.2 Data Loss Prevention

### 5.2.1 Database Syncing



- Due to the commonality of users switching devices, or deleting and reuploading the app, there needed to be a way for users to back up their data. So, they never risk losing their AI-generated flashcards or the ones they entered by hand.
- An online database would need to sync with the offline database, stored in the user's device.

## 5.3 Error Handling

### 5.3.1 Loss Prevention

- The app needed methods to ensure that the call to the AI was successful, and that a response was received and accurate.
- In the event that the user's device lost internet connection, there were ways to handle, cancel, and retry the process.

## 5.4 Performance Optimization

### 5.4.1 Background Processing

- The entire call and conversion process needed to occur in the background.
- Upon a call to the AI, the user needed to be shown indications of the processes occurring, so they weren't left in the dark.

## 6. Solution

In response to these challenges, primarily dealing with state-of-the-art technology, a solution was developed that generates and sends a prompt to Azure's GPT3.5-Turbo. The response, in the

form of a JSON dataset, is then parsed into pairs representing the front and back of a flashcard and inserted into the user's local database to be accessed and reviewed. The flashcards provide the users with random questions on the topic and difficulty level they provided. Giving them a fresh and interesting way to learn new information on it. To ensure that the generated data is saved, methods of syncing the offline database to an online one through Google's Firebase were developed. Now users can manually create, automatically generate, and back up all their study material.

### 6.1 System Architecture

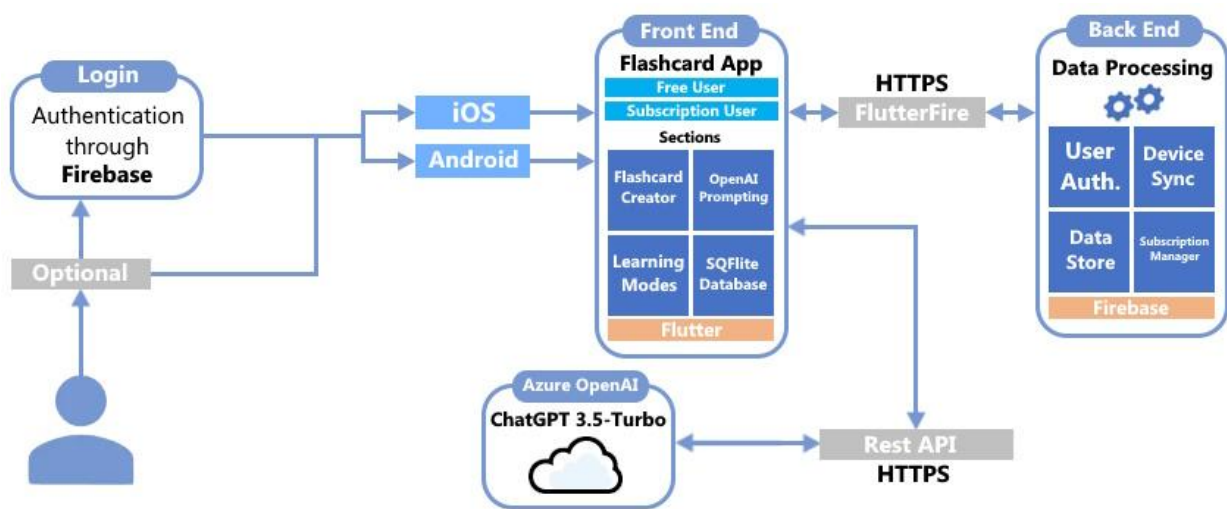


Figure 1: System Architecture

The diagram begins with the user icon in the bottom left, representing the user interacting with the application. An arrow connects to an optional step of a user creating an account through Firebase or choosing not to. Creating this account allows users to back up their data so they can access it on another device, as the application needs some identifier to tie their sets of data to. The paths reconnect to point at either iOS or Android, since the app is written with Flutter, everything remains the same across the operating systems. Both arrows point towards the front end, which contains the UI elements such as creating flashcards, the two different modes for learning, and the

AI prompting menu. The primary method of data storage is done through SQFlite, which is a similar version of the database model SQLite, just used in Flutter projects.

The Diagram then splits off in two ways, depending on what the user wants to accomplish. The upper one signifies the connection between the mobile application, and the back end data processing through Firebase, via FlutterFire, another Flutter package. The Firebase backend handles the previously mentioned data syncing between the offline SQFlite database and the online one through a Firestore Database. A user authentication process also occurs to ensure the correct data is being tied to the correct user.

As for the other arrow connecting to the frontend, a Rest API connects the application to Azure's OpenAI ChatGPT3.5-Turbo. The bidirectional arrows signify the initial prompt being sent from the app, and then receiving the response sent back from the AI. The app then processes the response and converts it into viewable flashcards.

## 7. Testing

Testing this AI feature was treated with as much importance as the development of it. Due to the pseudo-random nature of ChatGPT, there was no definitive way to tell if responses from it were correct. This was the primary reason prompt training was also so important, as **Xorbix** had to finetune the prompt in order to get data formatted in a specific way, every single time. A group of internal testers spent time generating flashcards and noted any issues they encountered. One of the most prominent bugs we encountered was special characters. Sometimes when it was prompted to create questions on mathematics or music, the response would include complex math or music symbols. Since the flashcards only handled text-based characters, some of these symbols returned would cause errors when attempting to view them. Upon noticing this pattern, the developers made additions to the template prompt, basically telling the bot if the question/answer included special characters, to generate a different one without them.

Another area of concern was internet connection. For both AI calls and database syncing, an internet connection was required through each process. If this connection was interrupted halfway through a process, it could create major issues. Thanks to testing, the developers were able to add proper checks during every step of the process, and display appropriate error messages to the user, in the event anything went wrong. Following these bug fixes, a final round of vigorous testing occurred. The testers went through the entire app, trying to break anything they could. Once no more bugs were reported, it was finally published to the App Store and Google Play Store.

## 8. Benefits and Impact of Solutions

The implementation of **Xorbix's** knowledge of Artificial Intelligence and drive to create products never seen before aligned to produce *Flashcard Study Buddy*. There are countless number of mobile apps with the goal of helping users learn, but not many have implemented AI into them yet. Manually entering each individual flashcard can be time-consuming, and users already become familiar with those questions and answers just from doing so. However, by having GPT3.5-Turbo generate random flashcards on a user's specific topic, they'll never know what to expect. The addition of data synchronization also provides users with the ability to access their material from any device, anytime, anywhere.

## 9. Conclusion

In conclusion, the developers at **Xorbix Technologies Inc.** achieved their goal of implementing Artificial Intelligence into a mobile application. Giving users the ability to generate hundreds of flashcards on any topic with only a few taps. The addition of data synchronization also allows more portability for a user's study material, as they can access it virtually anywhere.

This is only one of the many AI solutions the engineers at **Xorbix** have produced in the past year. They've created AI chatbots for a handful of companies, speech interpreters for medical companies, and much more. **Xorbix's** steadfast commitment to excellence, integrity, and innovation, combined with its unwavering dedication to surpassing customer expectations, positions it as a trusted partner for organizations in need of comprehensive technology solutions. With expertise spanning software development, AI implementation, and IT consulting, **Xorbix** offers a multifaceted approach to addressing the diverse needs of its clients in the realm of enterprise IT. This integrated approach ensures that **Xorbix** delivers tailored solutions that not only meet but exceed the evolving demands of today's digital landscape.

For more information about **Xorbix Technologies** and its innovative software and IT solutions, please visit [www.xorbix.com](http://www.xorbix.com). Our team of exceptional engineers is passionate about delivering the highest quality digital solutions on time and within budget, and we look forward to the opportunity to partner with you on your next technology project.