# Architecture and Design Document

# Healthy Belly

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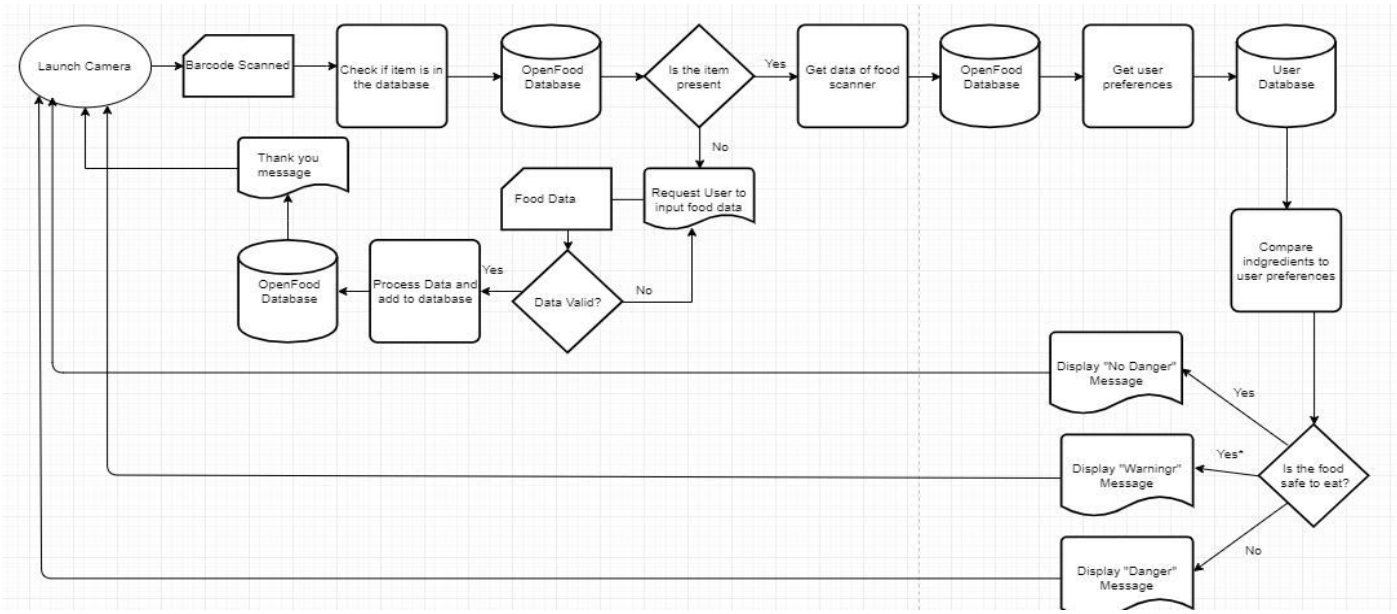
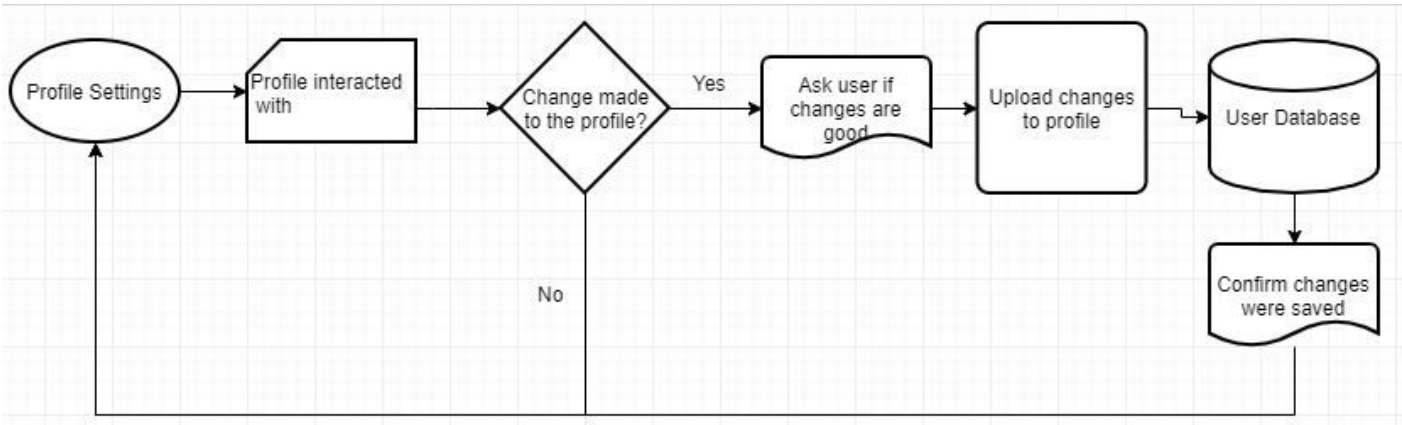
# Information Flow Diagrams

## User Login:

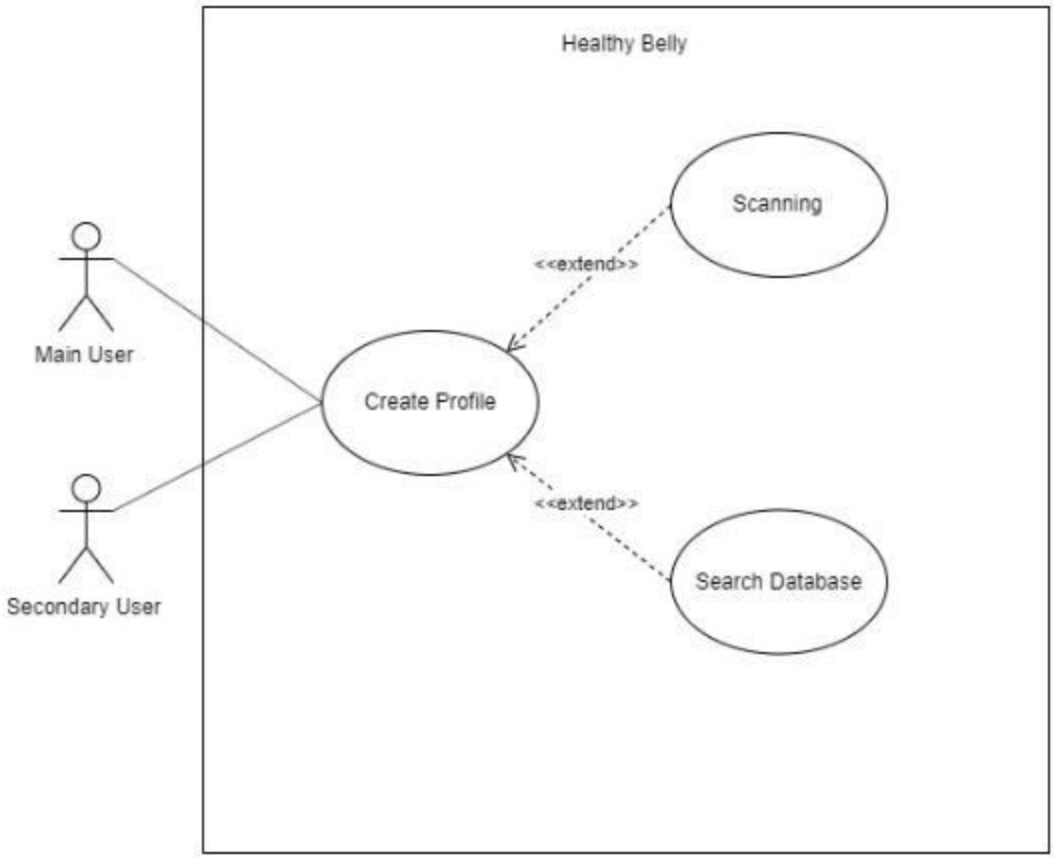
## Scanner:



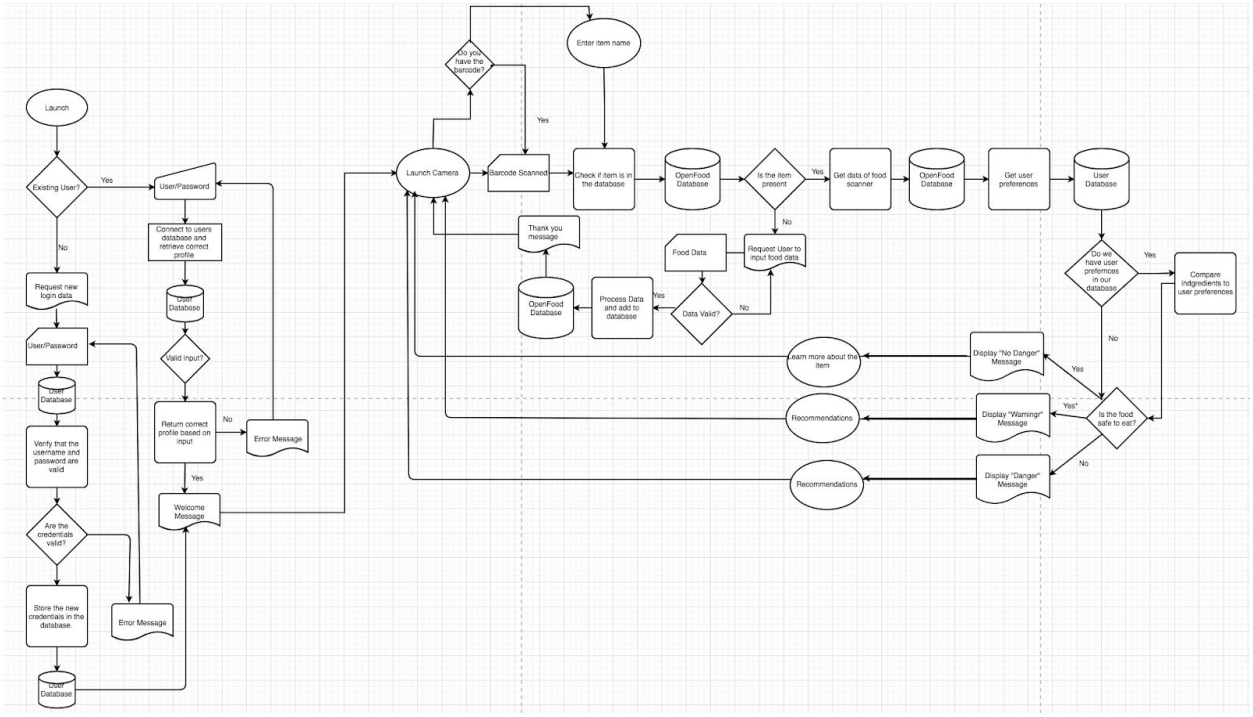

## User Profile Change:



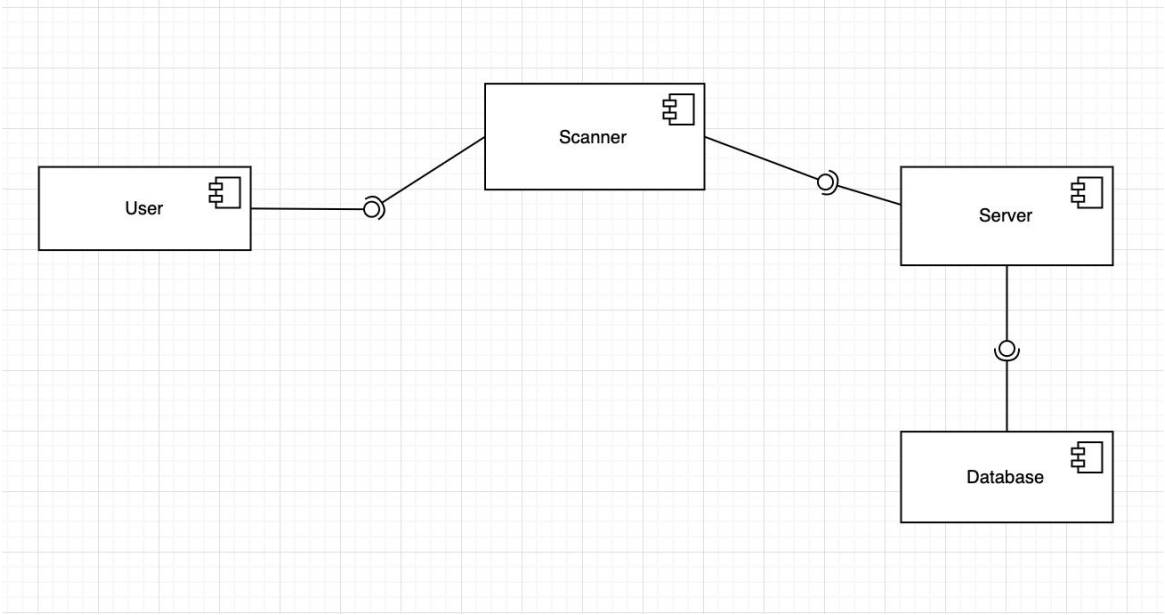
## Use Case Diagram



# Activity Diagram

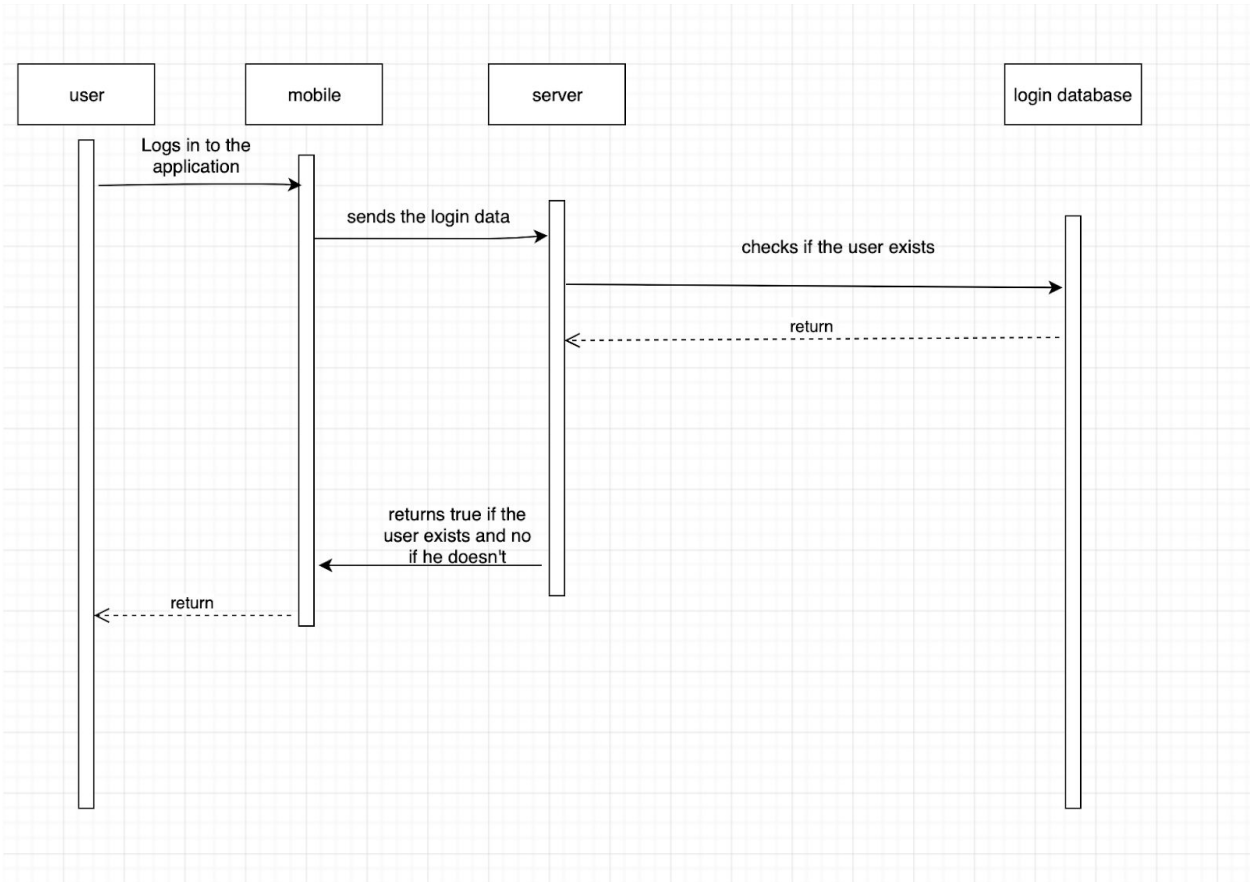



# Component Diagram:

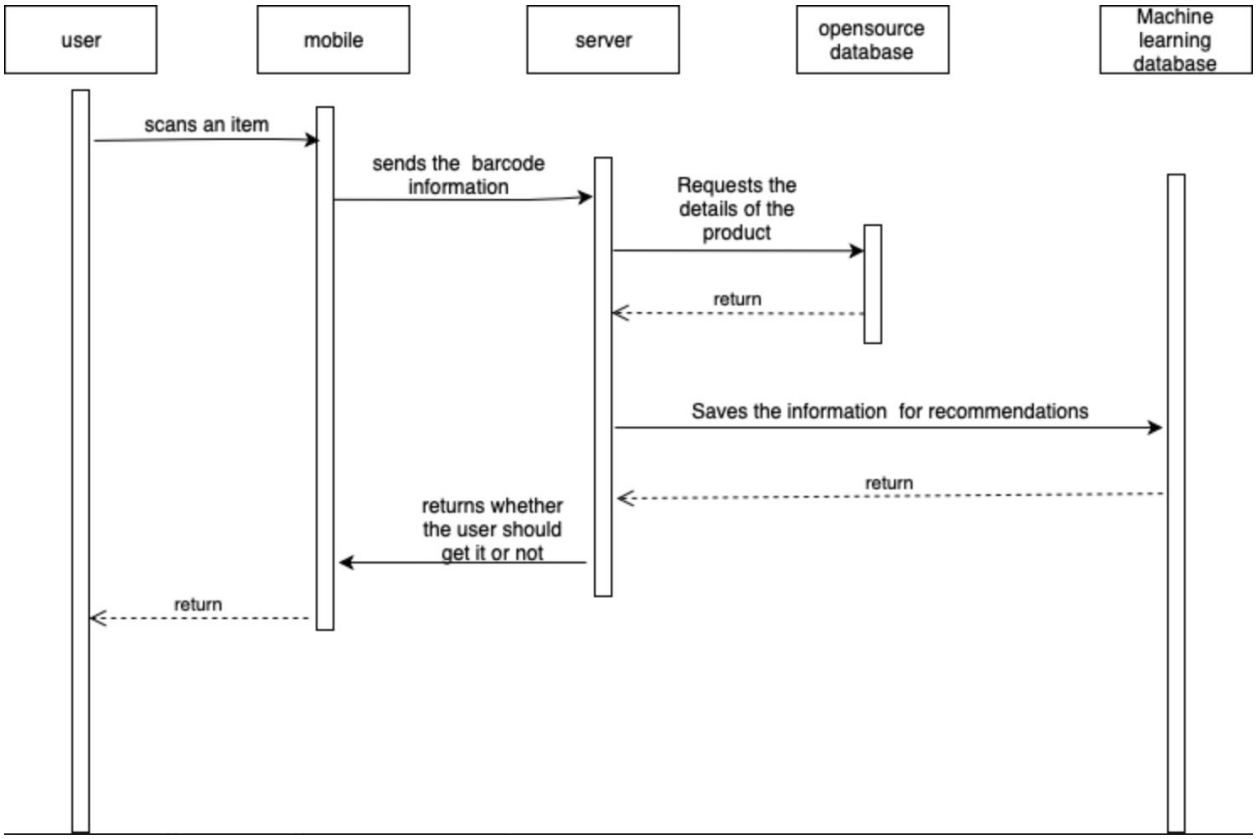


# Sequence diagrams

## User login sequence diagrams:



**Scanning sequence diagrams:**




## Tradeoff Analysis:

**Major Architecture Patterns:**

After carefully looking at some of the major software architectural patterns in software engineering, we came to the conclusion that these two listed below are the best ones for the purposes of our Application.

*Layered Architecture Pattern:*

This pattern breaks down a program into groups of subtasks, and each layer provides services to the next higher layer. Most common found layers are UI Layer, Service Layer, Domain Layer, and Persistence Layer.

| Pros | Cons |
|---|---|
| Reusability- Being able to reuse components if needed for a similar Application or for future such as exporting to different O.S.'s | Performance- Extra overhead when calling a component directly |
| Independent- Components of the Application can be independently deployed and maintained. Also allows to test components individually and independently | Time- Typically applications take longer to program when layering configurations are off since combining the said separated layers could result in mismatches |
| Secure- Layered architecture allows flexibility to configure different layers of security to different components. | Complexity- great for big projects, but can make simple projects harder |
| Flexibility- Allows team to work on different parts of the Application since every layer is separated from one another | |

*Client-Server Pattern:*

C-S Pattern consists of two parties; a server and multiple clients. Servers will provide services to many clients. Client requests services from server and server handles the said requests.

| Pros | Cons |
|---|---|
| Centralization- Servers help administer the whole setup and the access rights and resource allocation is done by servers | Costs- Client-Server network is very expensive |
| Management- All files are stored in the same place. Also allows for easy backup. And since the data is stored on the servers, it reduces the amount of data replication | People- Need PROFESSIONAL IT people to maintain the servers and other details of the network |
| Security- Rules and access rights are defined at the time of server creation | Failure- Server failure leads to whole network failure |

| | |
|---|---|
| Performance- Does not slow down with heavy usage | Congestion- Too many requests from clients may lead to overload, which can lead to breaking down of servers |

The Architectural pattern we considered implementing but chose not to is listed below:

*Model-View-Controller Pattern*

This pattern divides an interactive application into 3 parts as: Model (contains the core functionality and data), View (displays the information to the user), and Controller (handles the input from the user).

| Pros | Cons |
|---|---|
| Clean design- Good module design keeps classes separate and clean | Complexity- VERY complex if the entire idea is not completely grasped |
| Views- Multiple views of the same model | Workload- workload is unevenly distributed between everyone |
| SOLID- it satisfies the Single Responsibility Principle of SOLID | Outdated- Modern user interface tools are hard to use with MVC |
| | Development issues- Each and Every team needs to be working at the same speed. |

**Component Choices**

Components are something we were unable to analyze and complete a Trade-off analysis based on our progress. We have not yet made enough progress for us to properly research which components would be best for our Application.

**Language Choices:**

Since we are making the Application for Android O.S. we have two options, either Java or Kotlin. In future iterations we will move towards iOS but for our first iteration of the Application it will be for Android. Out of the two options we chose Java based on our Analysis done below between the two languages

*Java*

| Pros | Cons |
|---|---|
| Popular- Every member on the team is familiar with the coding language | Performance- It is more memory consuming than Kotlin |
| Cross-Platform- The ability to use Java on multiple different platforms. | Security- Older versions of Java have a reputation of being Vulnerable |
| Object Oriented- Language is focused on creating objects, manipulating said objects, and making objects work together | |

*Kotlin*

| Pros | Cons |
|---|---|
| Interoperable- It is possible to switch back and forth between Kotlin and Java since it is consistent with Java and all related tools and frameworks | Limited- Used only for Android unlike Java. |
| Future- Android development seems to be moving towards Kotlin, as seen by Google who are treating it as a preferred Programming language for Android | Learning- Although it is an easy language to learn, there is a learning period needed for using Kotlin, since every member needs to spend time learning about the language |
| Simplified- Coding in Kotlin is shorter compared to Java codes | Performance- It is noted to be slower than Java in compilation speed. |

**Framework Choices**

Two of the choices for frameworks we considered are analyzed below:

*Node.js*

| Pros | Cons |
|---|---|
| Asynchronous event driven IO helps concurrent request handling. | Every time using a callback end up with tons of nested callbacks. |
| Share the same piece of code with both server and client side. | Node.js is not suited for CPU-intensive tasks. It is suited for I/O stuff only (AKA us). |
| Active and vibrant community, with lots of code shared via GitHub | Learning curve for those who are not familiar with JavaScript |
| Node packaged modules has already become huge, and still growing. | Node.js doesn't provide scalability. |

*FireBase*

| Pros | Cons |
|---|---|
| Javascript Object Notation storage means no barrier between data and objects | Limited querying and indexing |
| Minimal setup | No Aggregation |
| Easy access to data, files, auth, and more | Cannot query or list users/stored files |
| Secure, AND ITS GOOGLE | |

**Databases Choices**

The three databases we looked into for our app are SQLite, OrmLite and Realm. Based on the Trade-off analysis, we have decided to work with SQLite.

*SQLite*

| Pros | Cons |
|---|---|
| Lightweight so easy to use it as an embedded software | Used to handle low to medium traffic HTTP requests |

| | |
|---|---|
| Great performance only loads data when needed | Database is restricted to 2GB |
| Reliable: constantly updates content so no work lost if app crashes | |

*OrmLite*

| Pros | Cons |
|---|---|
| Can use any programming language | Slow compared to other databases |
| Adding new data and updating data is really easy since the databases treats them as the same | Some queries are limited forcing you to use raw SQL |
| Will pull the data automatically for you | Requires lots of optimizing to make database smooth |

*Realm*

| Pros | Cons |
|---|---|
| Simple: fewer lines of codes for similar methods in other databases. | Does not work well for large scale projects |
| Faster than other databases | Takes up more memory than other databases |

**Server vs Serverless Choices**

Based on our Analysis, we find that choosing either server/serverless Architecture would work best for our Application. We will decide which would be better for our App as we continue with the Development of the Application. Here are the two trade-off Analysis we conducted:

*Servers*

| Pros | Cons |
|---|---|

| | |
|---|---|
| Reliability- Proper servers would maintain redundant hardware for critical internal devices in case a component fails. One server failing would not crash the entire program | Update- Requires constant updating and maintaining |
| Collaboration- Servers allow us to divide use-cases into multiple different servers so each server handles one specific task | Cost- Server based software as well as server based network will cost money as the company increases. Can't run on student options forever |

*Serverless*

| Pros | Cons |
|---|---|
| Cost- Pay for what you use not for any hardware or services that you are not utilizing | Commitment- once you commit to a service provider, you are stuck with them till the contract ends. |
| User- since we do not have to worry about servers, devs can focus on developing and improving Customer-facing elements | Complexity- learning curve is huge if people have not used a serverless architecture. Will require extra time to go into organizing the functions |

**Front-end Framework Choices**

There are a lot of different front-end frameworks we can use for our app. The three we looked into are Android studio,Corona SDK, and Appcelerator Titanium**.**

*Android Studio*

| Pros | Cons |
|---|---|
| Supported by google | High memory use |
| Easy to integrate with google services | Android development only |
| Allows GPU tracking | Can be slow sometimes |
| Supported by many platforms | |

*Corona SDK*

| Pros | Cons |
| --- | --- |
| Uses C# | Does Not support 3rd party libraries |
| Easy to create prototypes quickly | Not suitable for apps with heavy graphics |
| Can create for multiple platforms at the same time | Larger app size |
| | |

*Appcelerator Titanium*

| Pros | Cons |
| --- | --- |
| Easy to create prototypes quickly | Web oriented |
| Can create for multiple platforms at the same time | Uses javascript |
| | Not smooth compared to other front end frameworks |
| | Limited compared to other front end frameworks. |