Spell Slinger

Design Document
4th Year Project

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Introduction

This design document's purpose is to detail features of the Spell Slinger application. This document will describe the architecture of the system, as well as the design patterns implemented alongside it. Sequence diagrams are included in order to illustrate the flow of events and data in use cases. Game objects will be shown in detail through a class diagram, and how their data is stored in the database layout. A list of prototype screen layouts will display the general idea of how the Spell Slinger application should look.

System Architecture

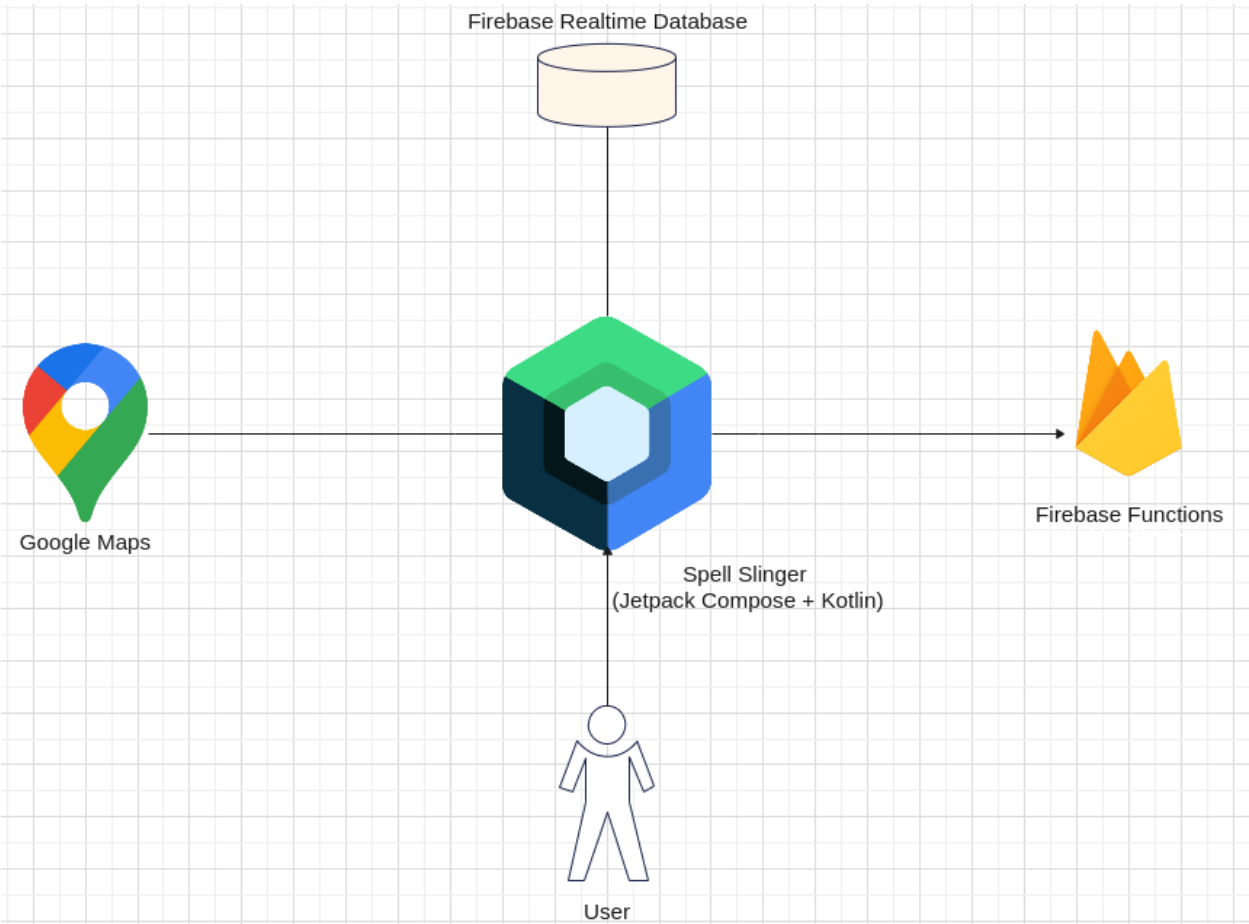


Figure 1-1 System Architecture Diagram

Spell Slinger will target Android and be written in Kotlin. The front-end will be developed in Jetpack Compose. Firebase realtime database will store account and game data. The serverless Firebase Functions will perform any complex code that the security rules for the Firebase real time database isn't suitable for. AR Core will be implemented in order to enrich player's experience, and Google Maps for Compose will be utilized in order to create Spell Slinger's World Map.

Tools & Technologies

Kotlin

> "Kotlin is an open-source statically typed programming language that targets ..Android.. It's developed by JetBrains."
> (https://kotlinlang.org/docs/faq.html)

Kotlin Syntax Example

```
// Variable declaration
// Types are statically inferred where possible
var id = 0;
// Immutable Values
val december = 12;

// Functions
fun greet(person: String) {
    // String interpolation
    println("Hello ${person}")
}

// Classes use primary constructors in their definition
class Person(val firstName: String, val surName: String, var birthYear: Int) {
    val fullName: String
        get() { return "$firstName $surName" }

    var isOver18: Boolean = false
        set(value) { field = value }

    init {
        // Init are functions that run after the constructor to validate date
        if(birthYear < 2005) { isOver18 = true }
    }
}

fun main() {
    var person = Person("David", "Darigan", 1991) // Instances are created by function invocation
    println("${person.fullName} is over 18: ${person.isOver18}")
}
```

Jetpack Compose

Jetpack Compose is a declarative functional framework written in Kotlin developed by Google. It is growing in popularity and looks to be replacing the old Java Views of Android Development.

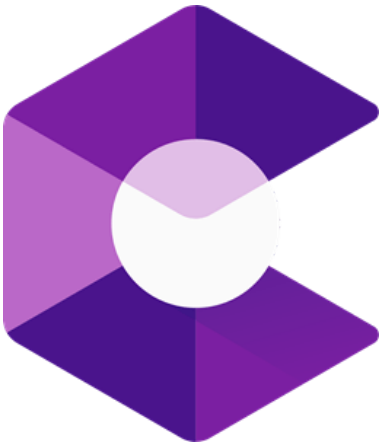
```
class MainActivity : ComponentActivity() {

    override fun onCreate(savedInstanceState: Bundle?) {
        super.onCreate(savedInstanceState)
        setContent {
            AppTheme {
                var count by remember { mutableStateOf( value: 0) }
                var increment = { count++; }
                Surface(
                    modifier = Modifier.fillMaxSize(),
                    color = MaterialTheme.colorScheme.background
                ) {
                    Counter(count = count, incrementCount = { increment })
                }
            }
        }
    }
}

@Composable
fun Counter(count: Int, incrementCount: () -> Unit, modifier: Modifier = Modifier) {
    Button(
        modifier = modifier.fillMaxSize(),
        onClick = { incrementCount }) { this: RowScope
        Text( text: "Pressed $count times")
    }
}
```

Firebase

Firebase is a managed PaaS (Platform-as-a-Service) that offers numerous services. Spell Slinger takes advantage of Firebase Authentication in order to streamline creating accounts and logging users in. The realtime database is useful to store not only account data, but also multiplayer battle data temporally.

Firebase Functions are distributed cloud functions with tight integration with the firebase platform, which allows for the server related capabilities in Spell Slinger.

AR Core



ARCore is a SDK to implement augmented reality in Android applications. It provides APIs for motion tracking, light estimation and environmental understanding (which helps games figure out which elements can be used as planes in augmented reality)..

Google Maps

Spell Slinger uses Google Maps to identify and create the users surrounding environment within the world map. The Google Maps API allows developers to place markers with custom icons (such as player, creature or spell well icons) at specific locations on the map. The detail of the map can be modified through the use of JSON styling in order to add, remove, or change elements (such as line thickness or fill color).

Design Patterns

Jetpack Compose insists on a Model-View-ViewModel (MVVM) Design Pattern.

Model

The Model in MVVM is a data class. It has no behavior, only pure data that is manipulated through the View Model.

View Model

The View-Model in MVVM stores the model as a property and has a number of functions that contain complex logic for manipulating it, that's usually invoked by outside events from the View.

View

The View in the presentation layer bridges the gap between the user and the view-model. The user interacts with the view, the view forwards that to the appropriate ViewModel, the ViewModel performs an operation on the Model, and then the View updates to display the new values of the Model.

Sequence Diagrams

Register

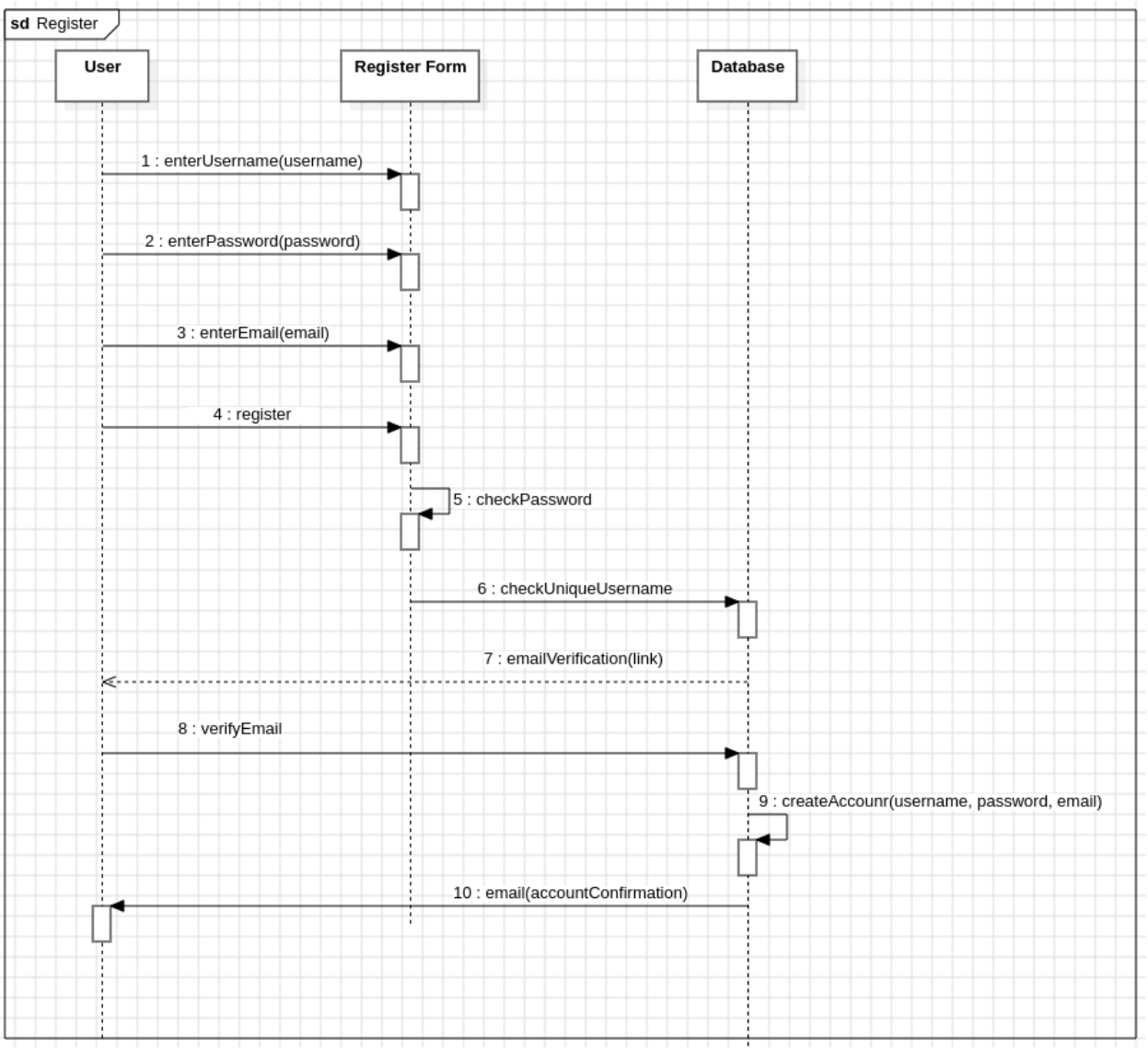


Figure 2-1 Sequence Diagram - Register

Login

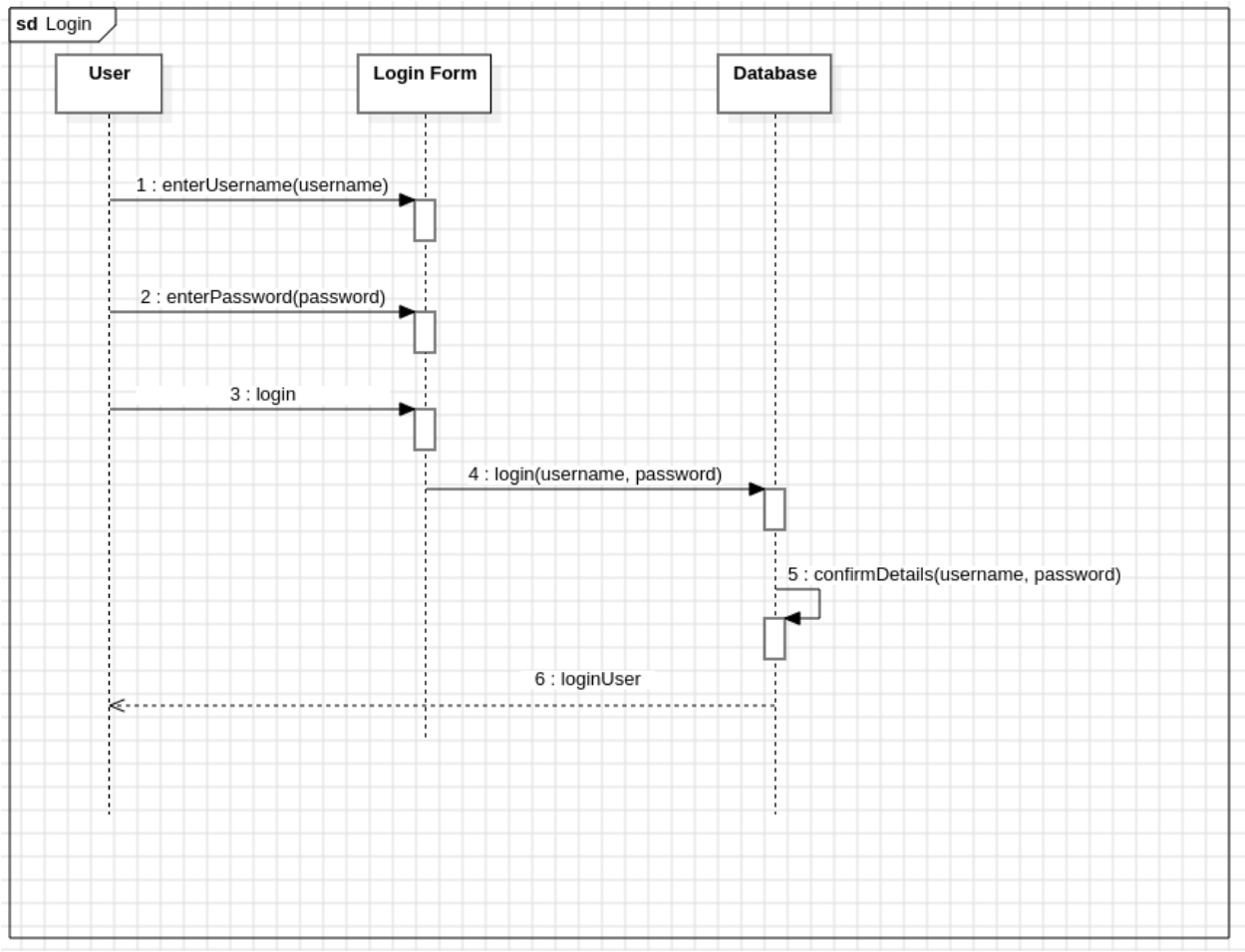


Figure 2-2 Sequence Diagram - Login

Logout

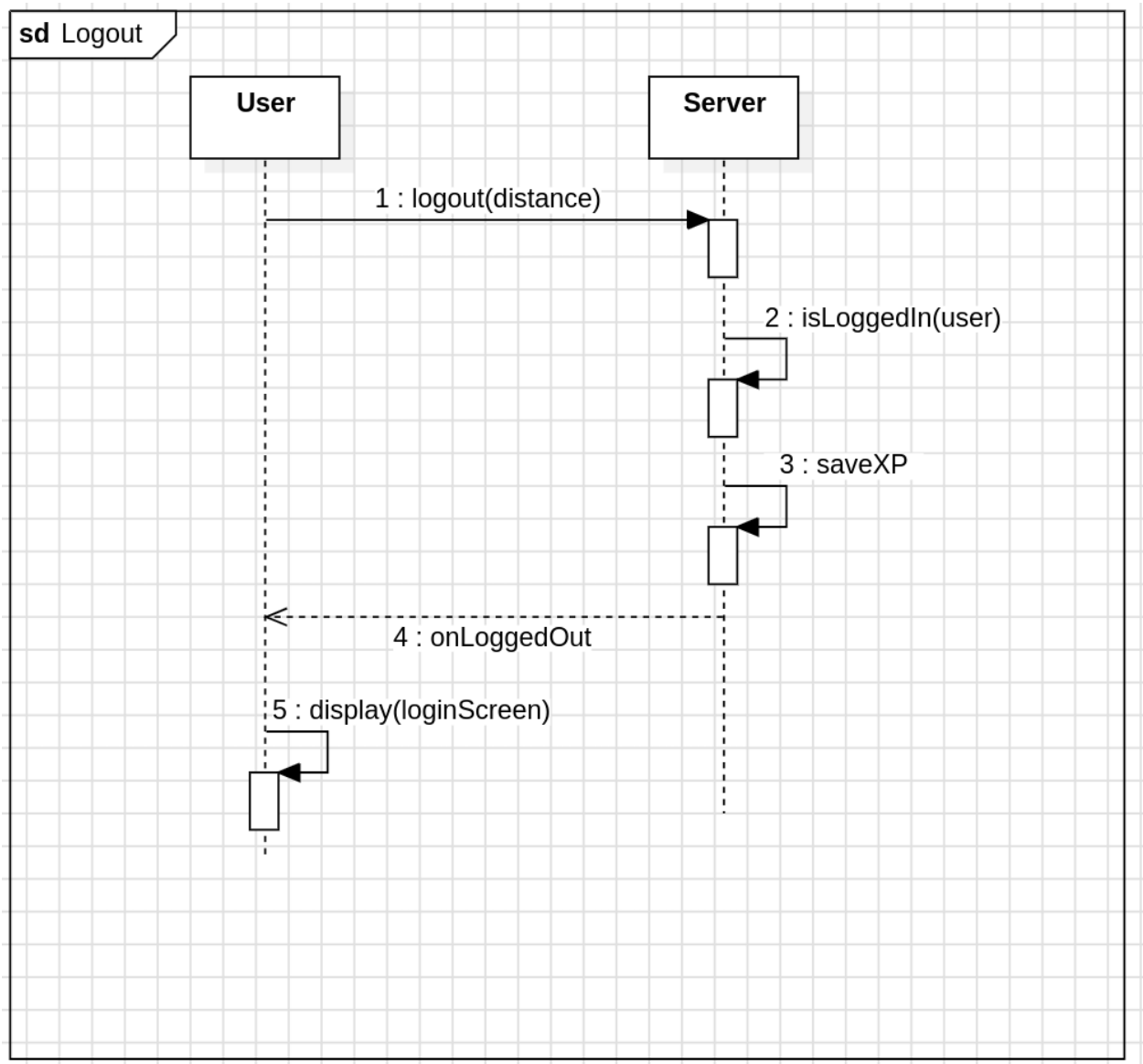


Figure 2-3 Sequence Diagram - Logout

Delete Account

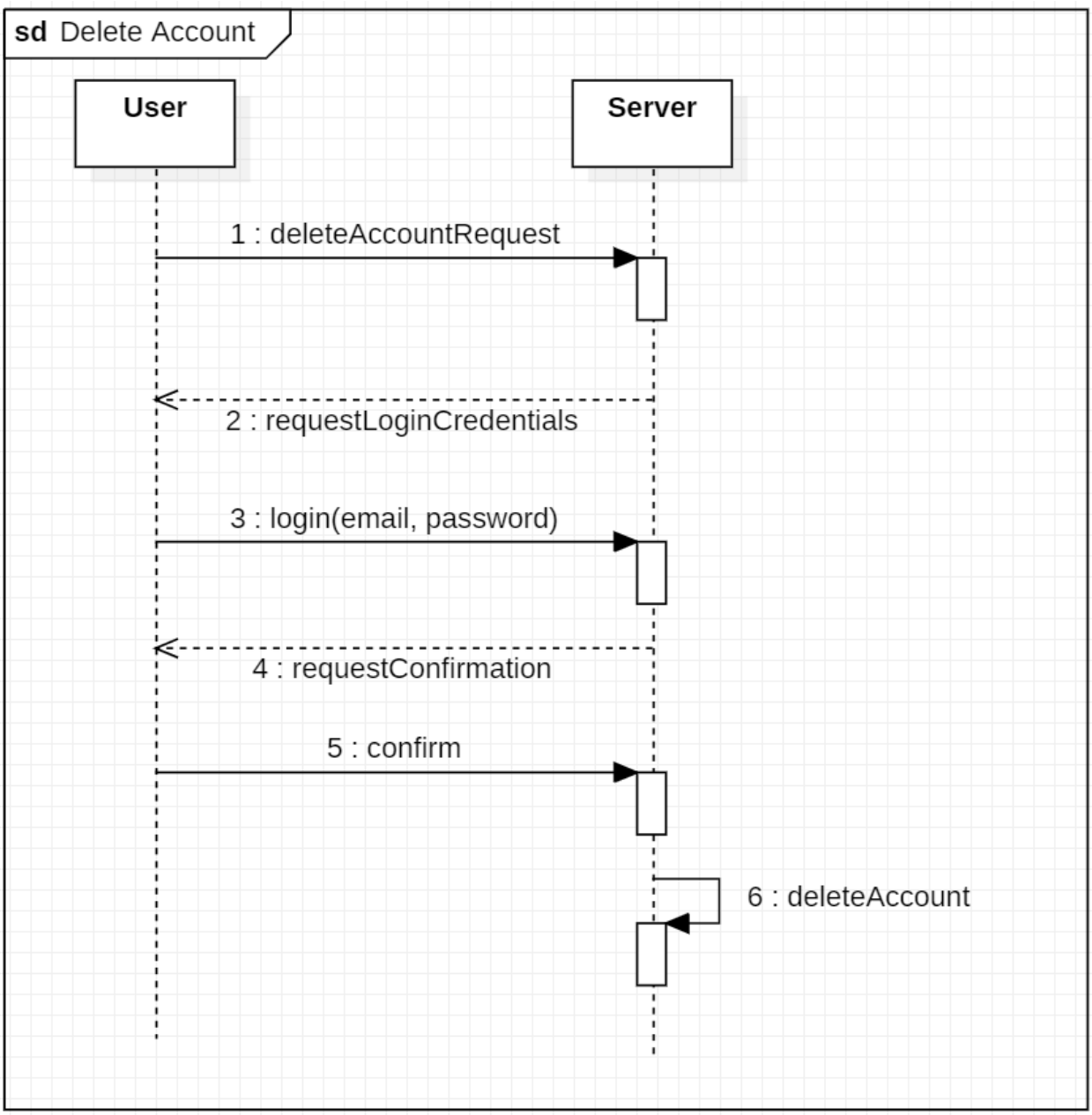


Figure 2-4 Sequence Diagram - Delete Account

Train

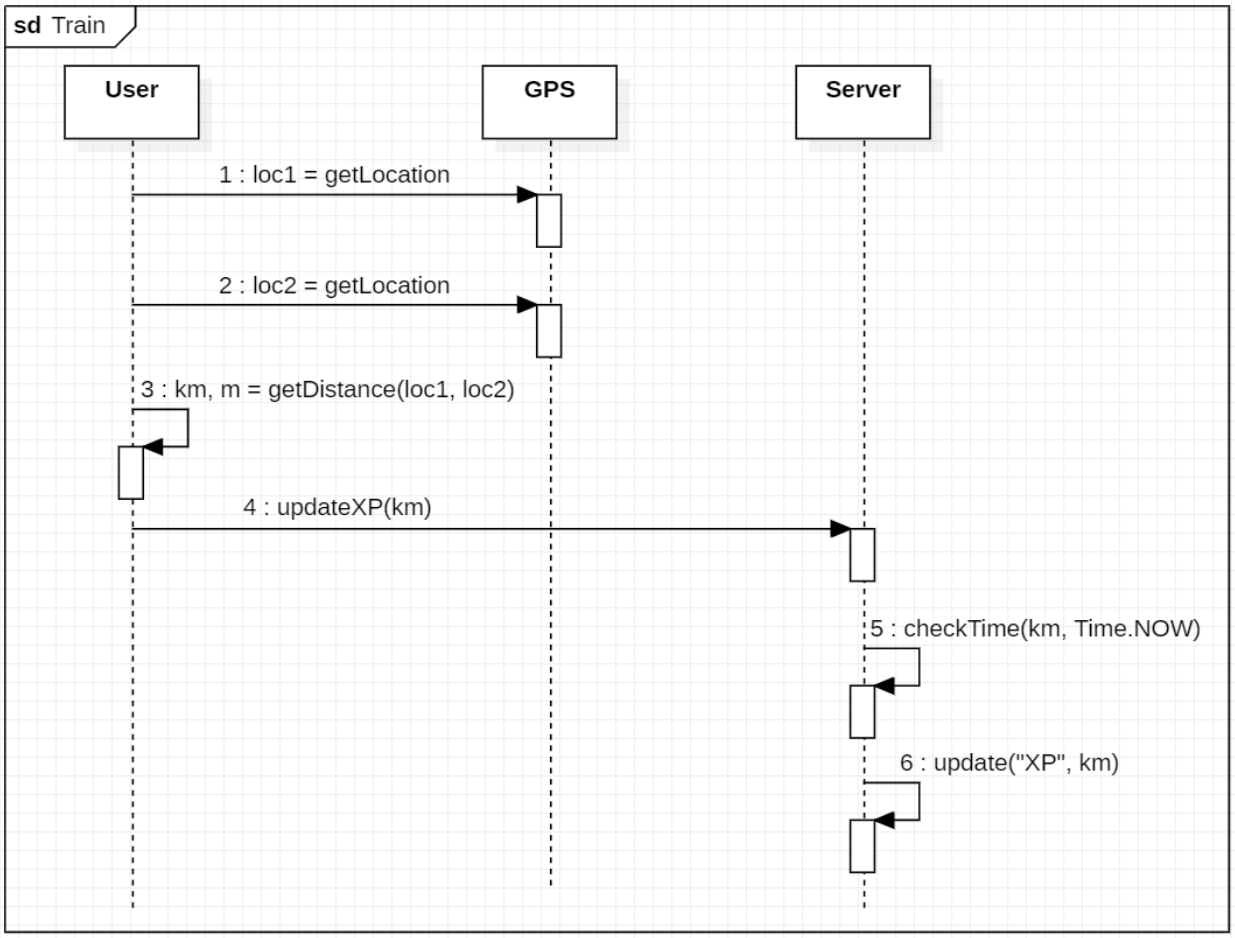


Figure 2-5 Sequence Diagram - Train

Scan

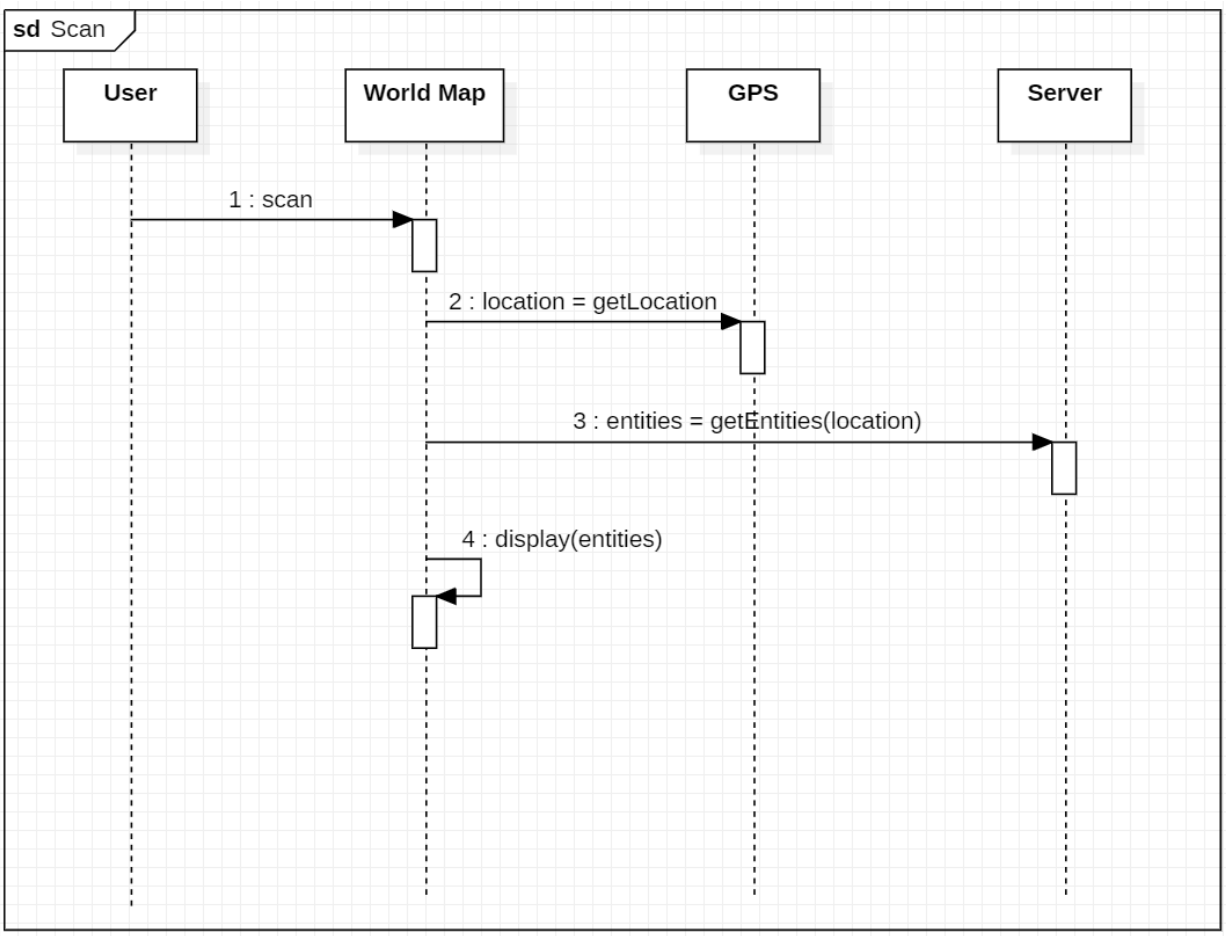


Figure 2-6 Sequence Diagram - Scan

Draw Spell

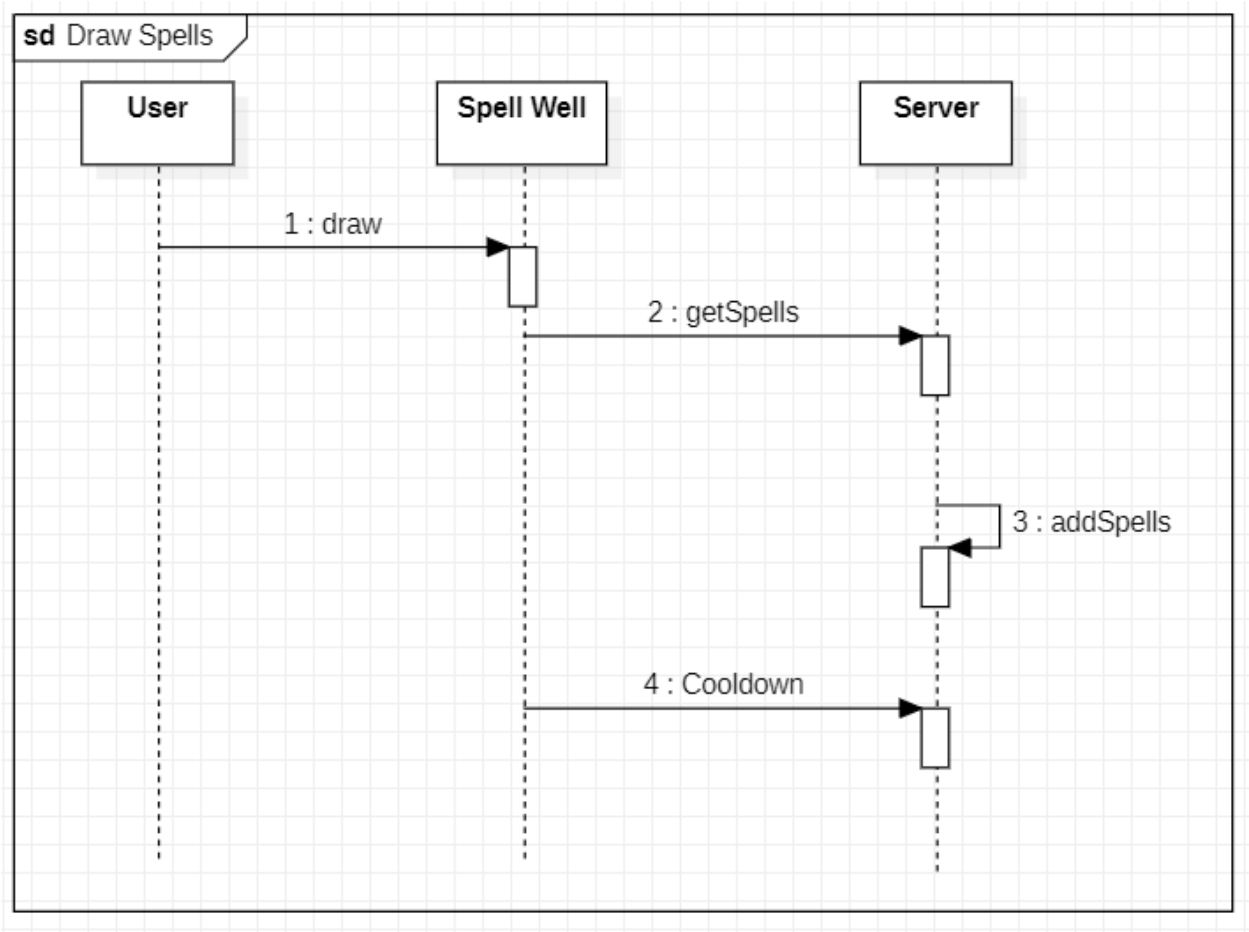


Figure 2-7 Sequence Diagram - Draw

Equip Spell

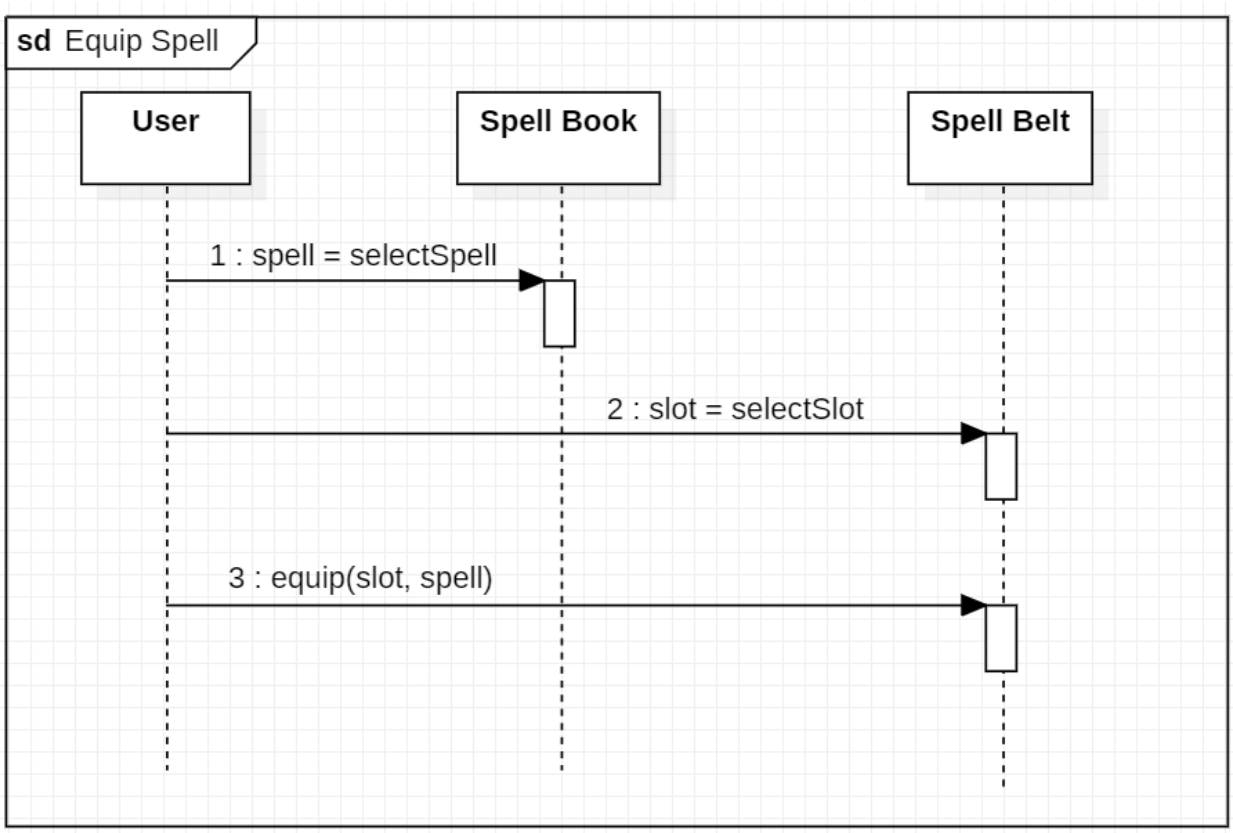


Figure 2-7 Sequence Diagram - Equip Spell

Increase Stat

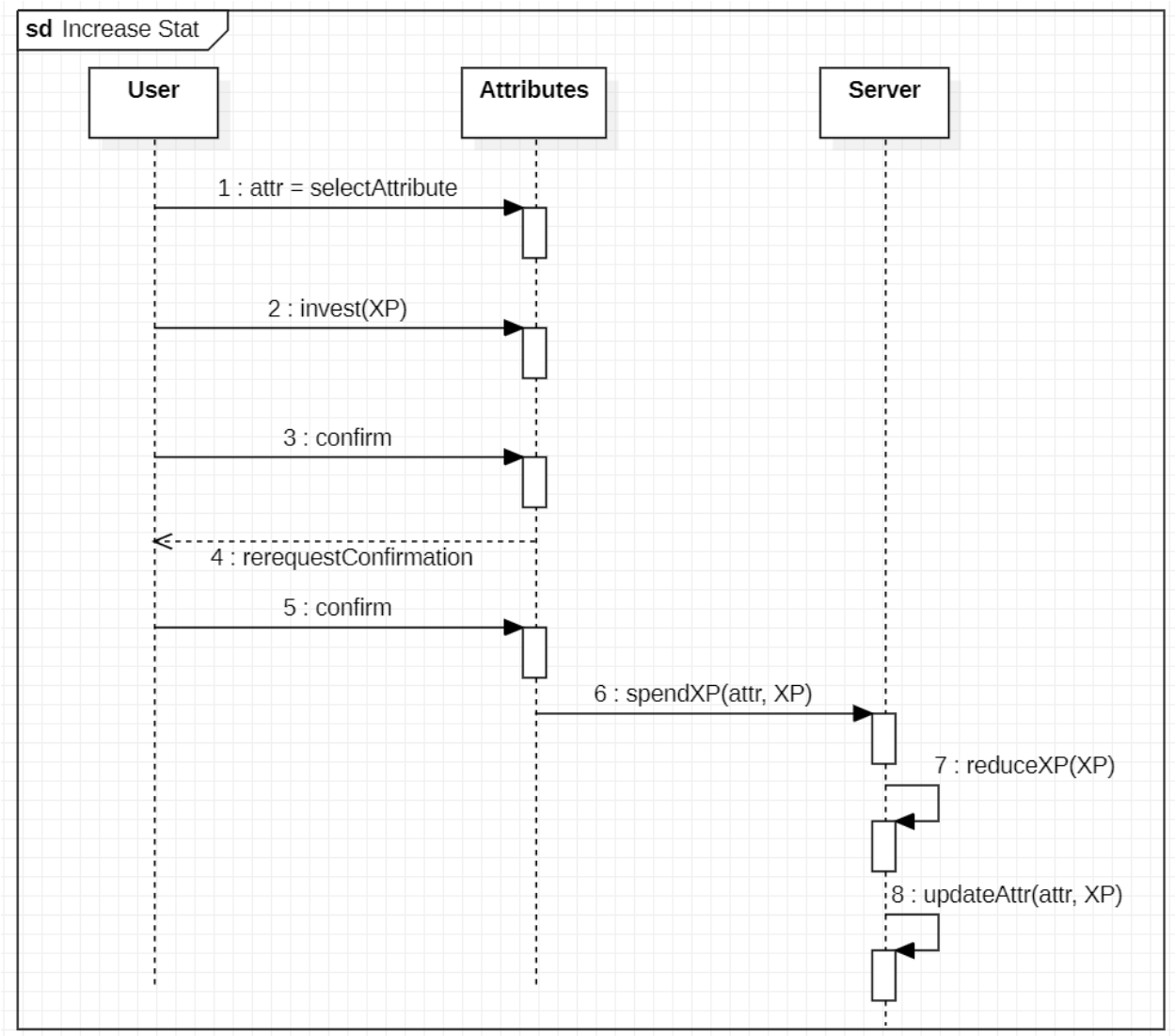


Figure 2-8 Sequence Diagram - Increase Stat

Battle Player

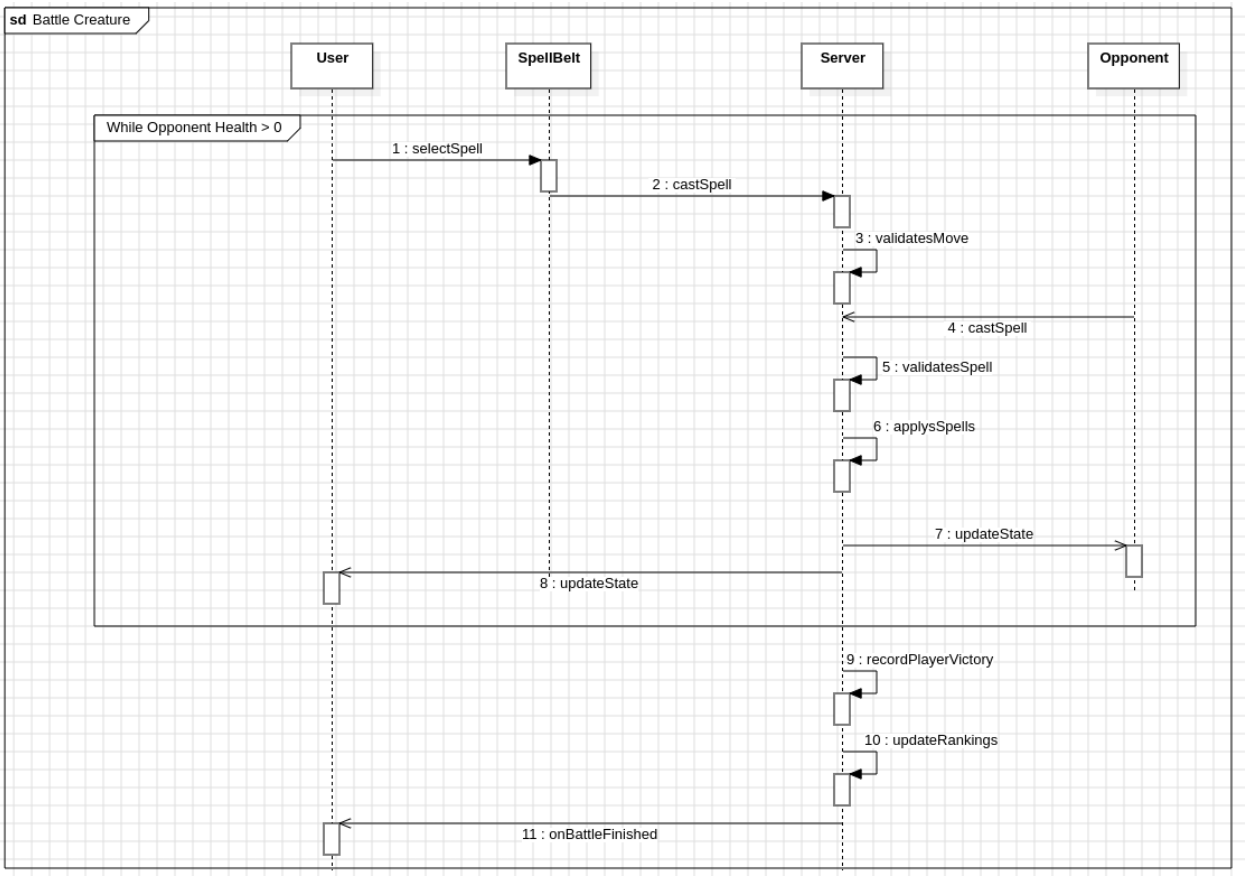


Figure 2-9 Sequence Diagram - Battle Player

Battle Creature

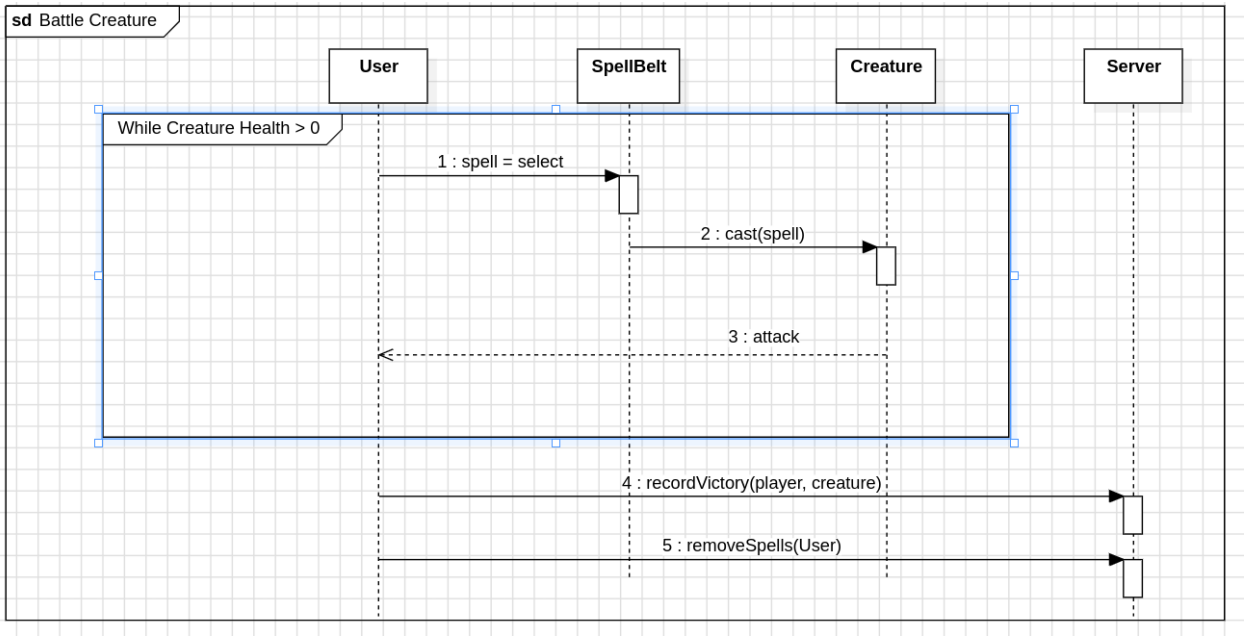


Figure 2-10 Sequence Diagram - Battle Creature

View Leaderboard

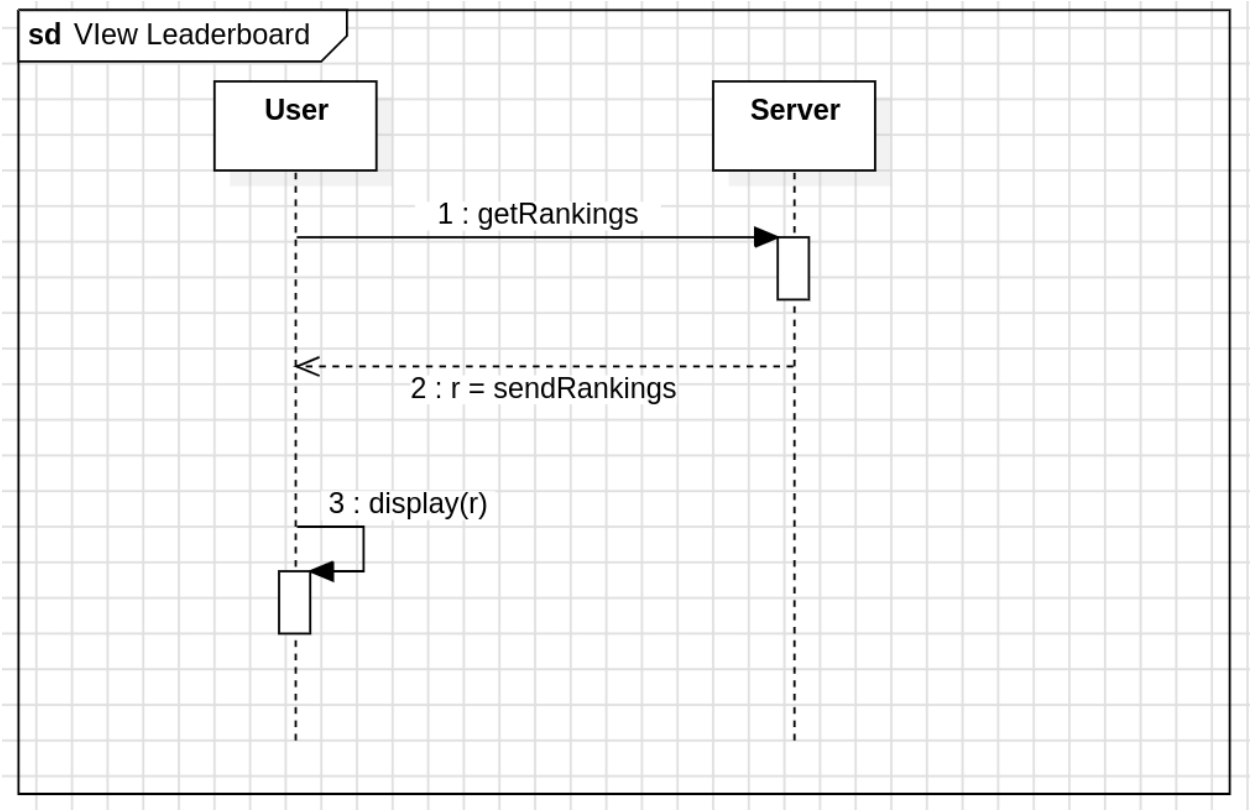


Figure 2-11 Sequence Diagram - View Leaderboard

Class Diagram

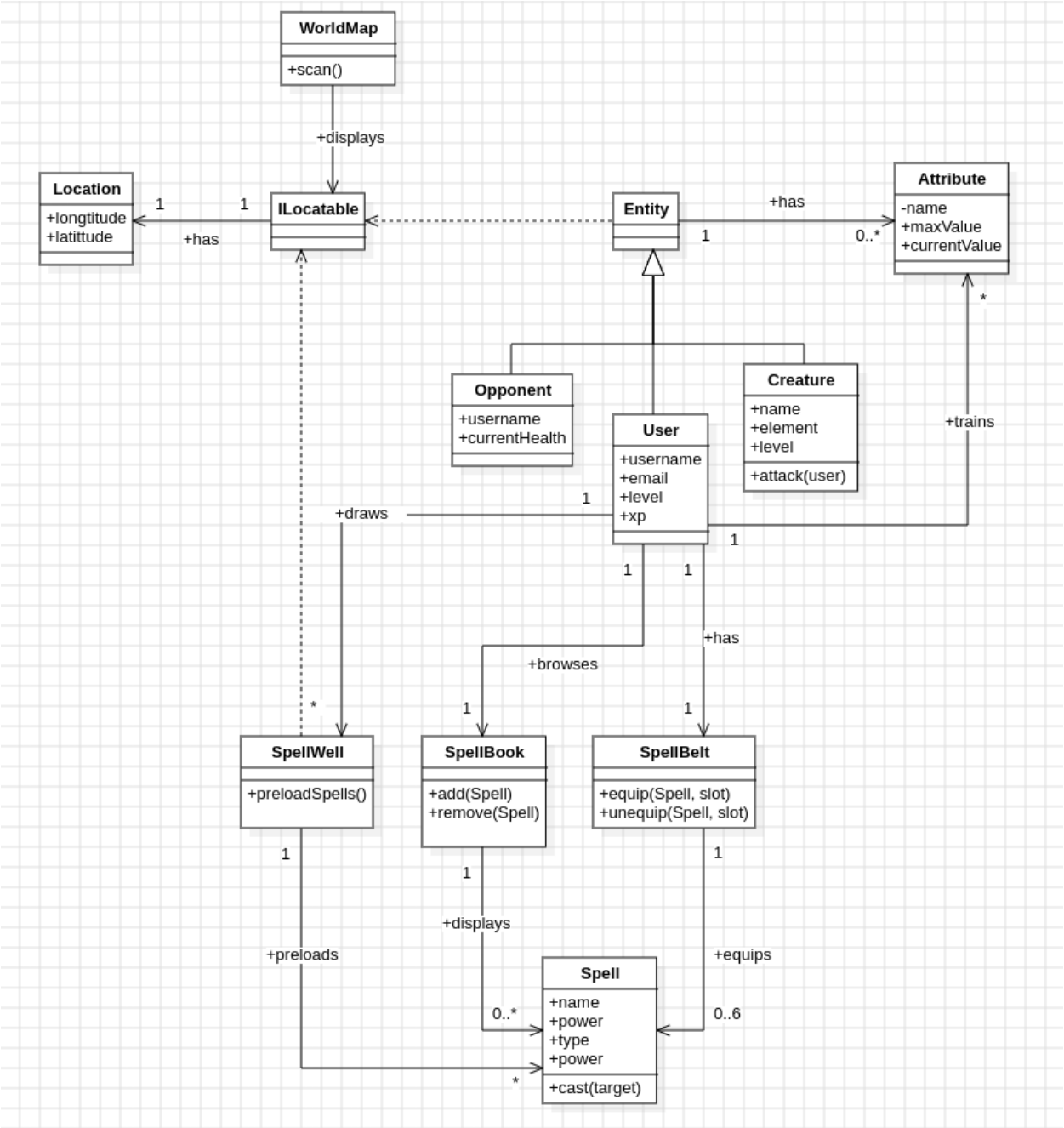


Figure 3-1 Class Diagram

Database Layout

Users

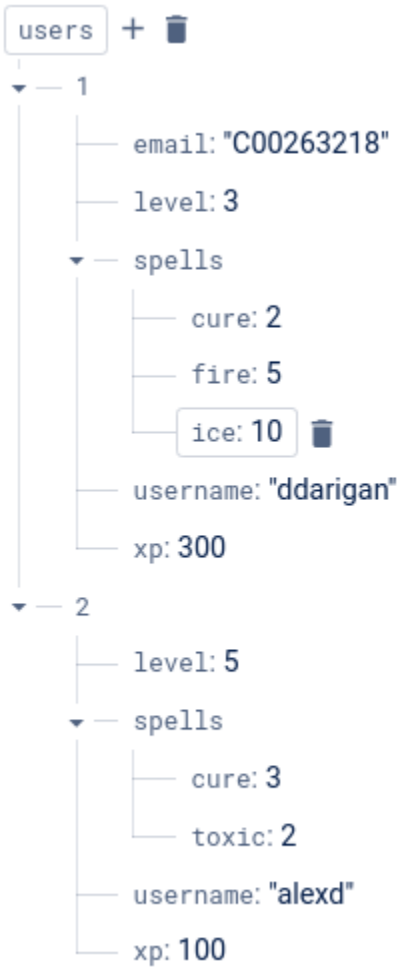


Figure 4-1 Database Layout - User

Creature

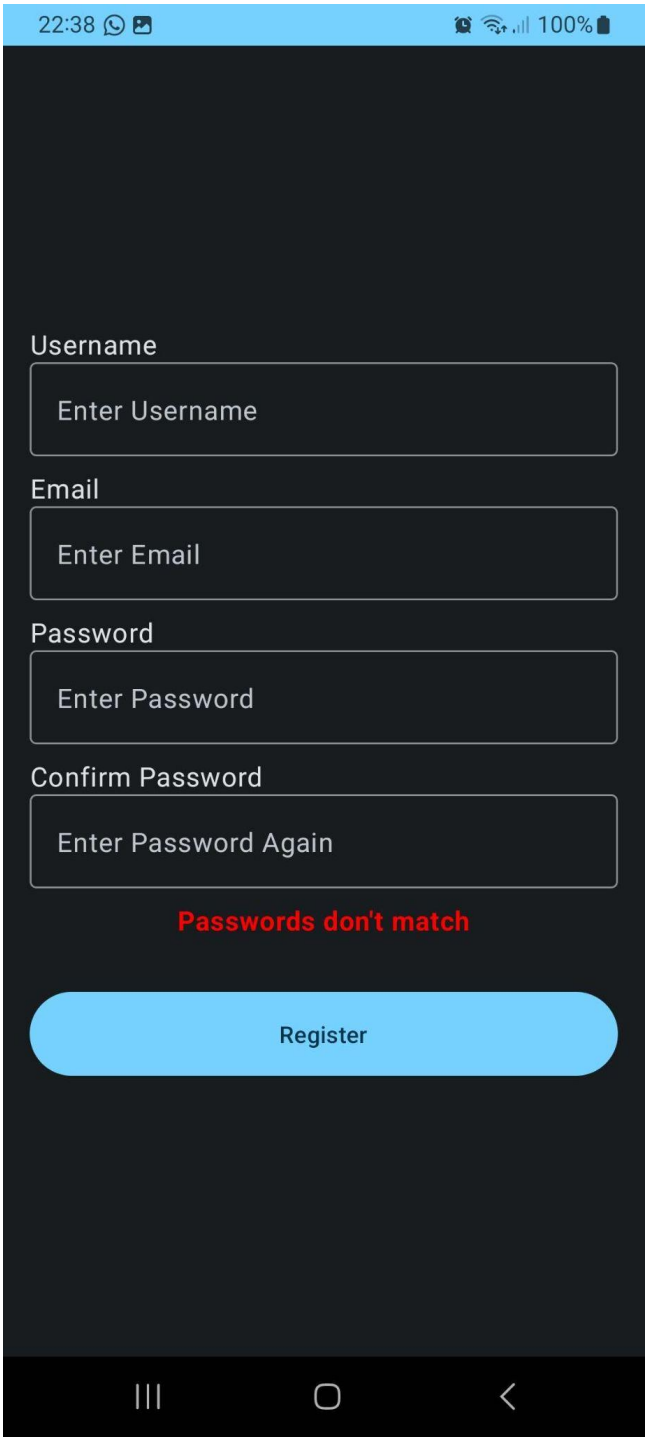
Figure 4-2 Database Layout - Creature

Spell Well

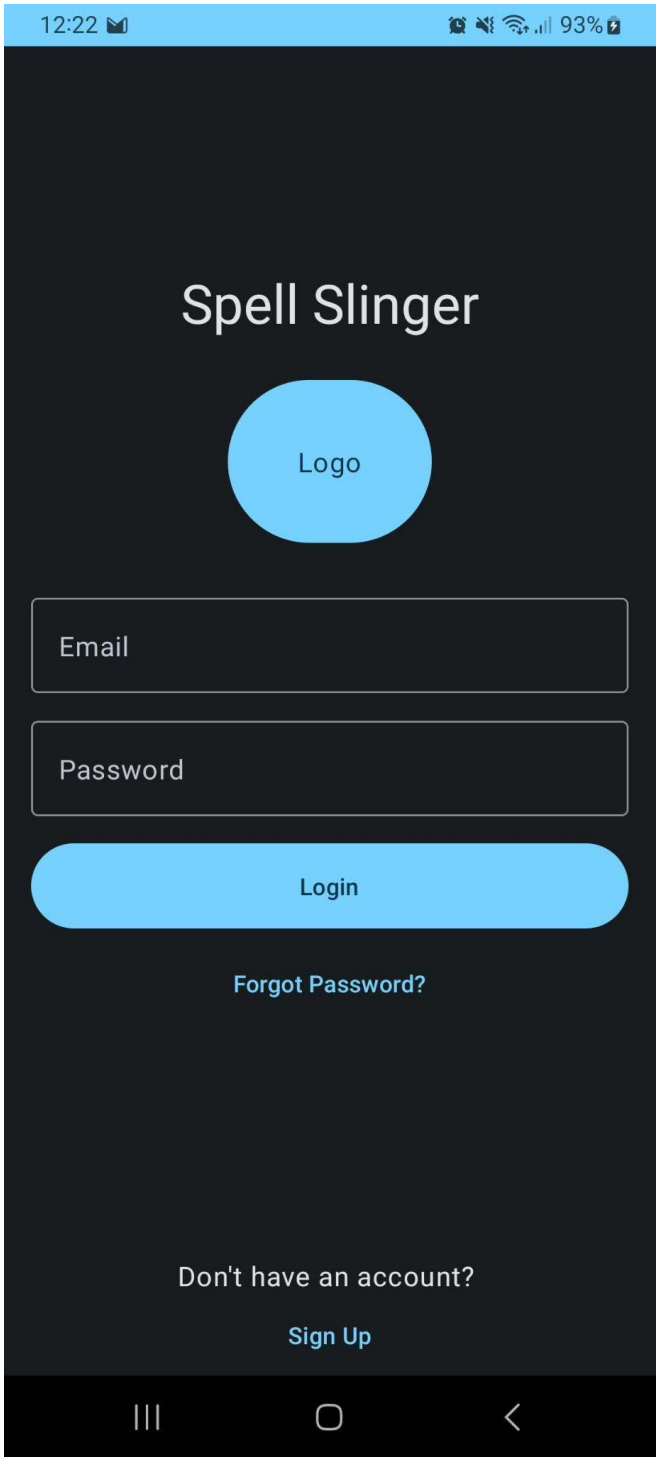
Figure 4-3 Database Layout - Well

Prototype Screens

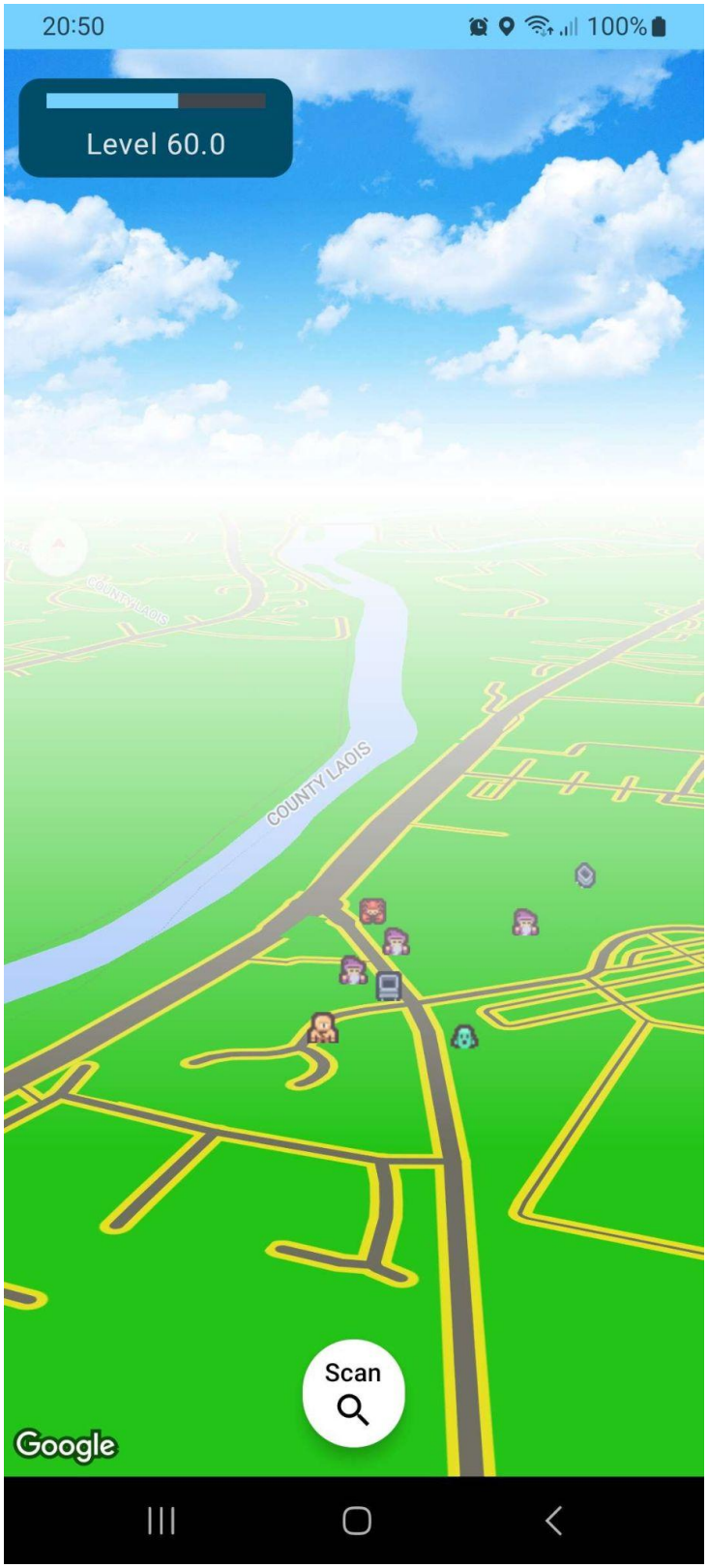
Register Screen



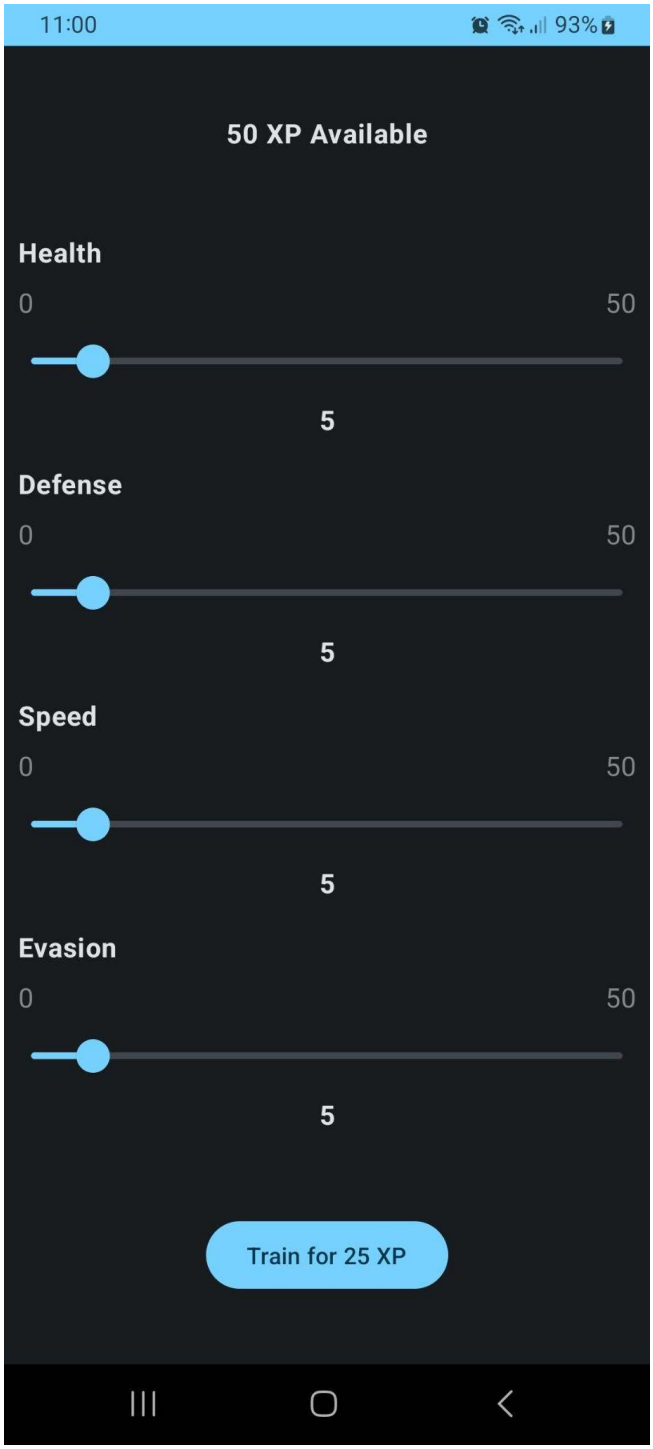
Login Screen



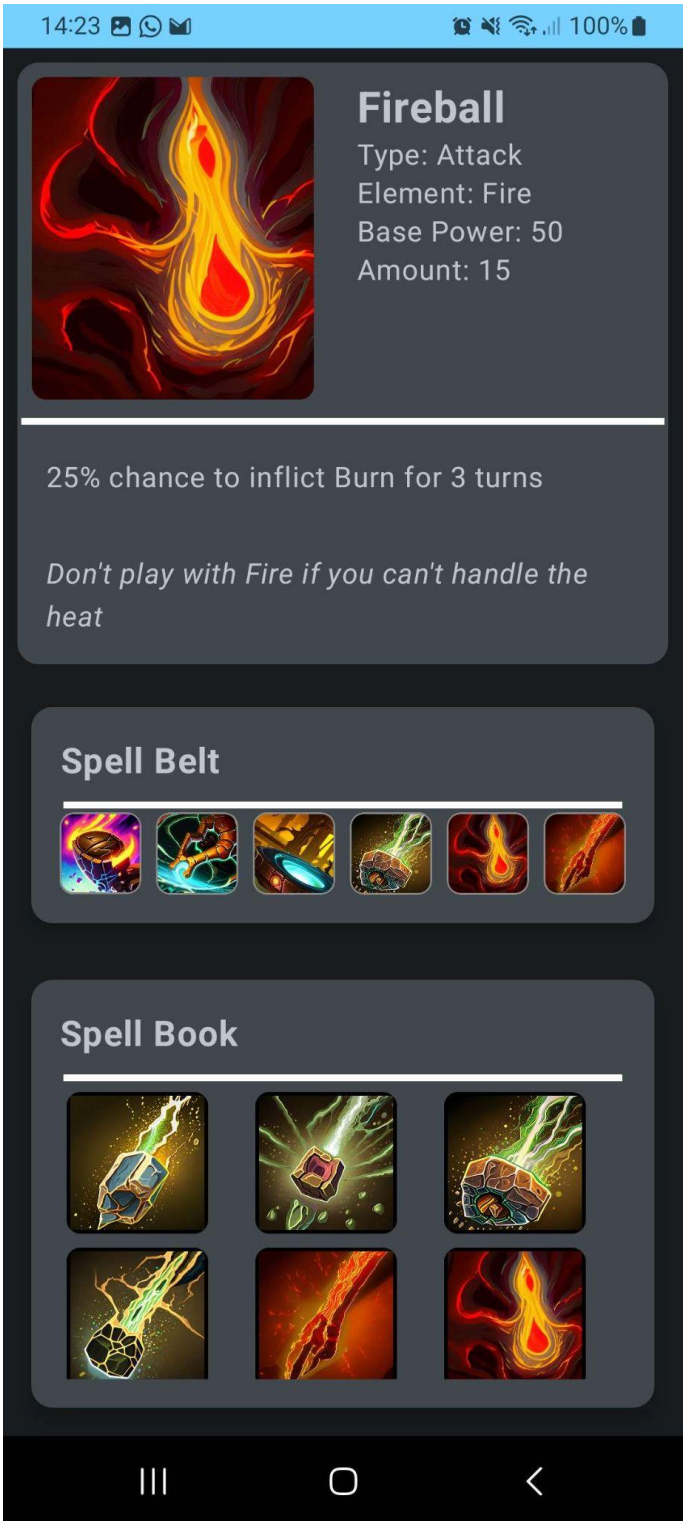
World Screen



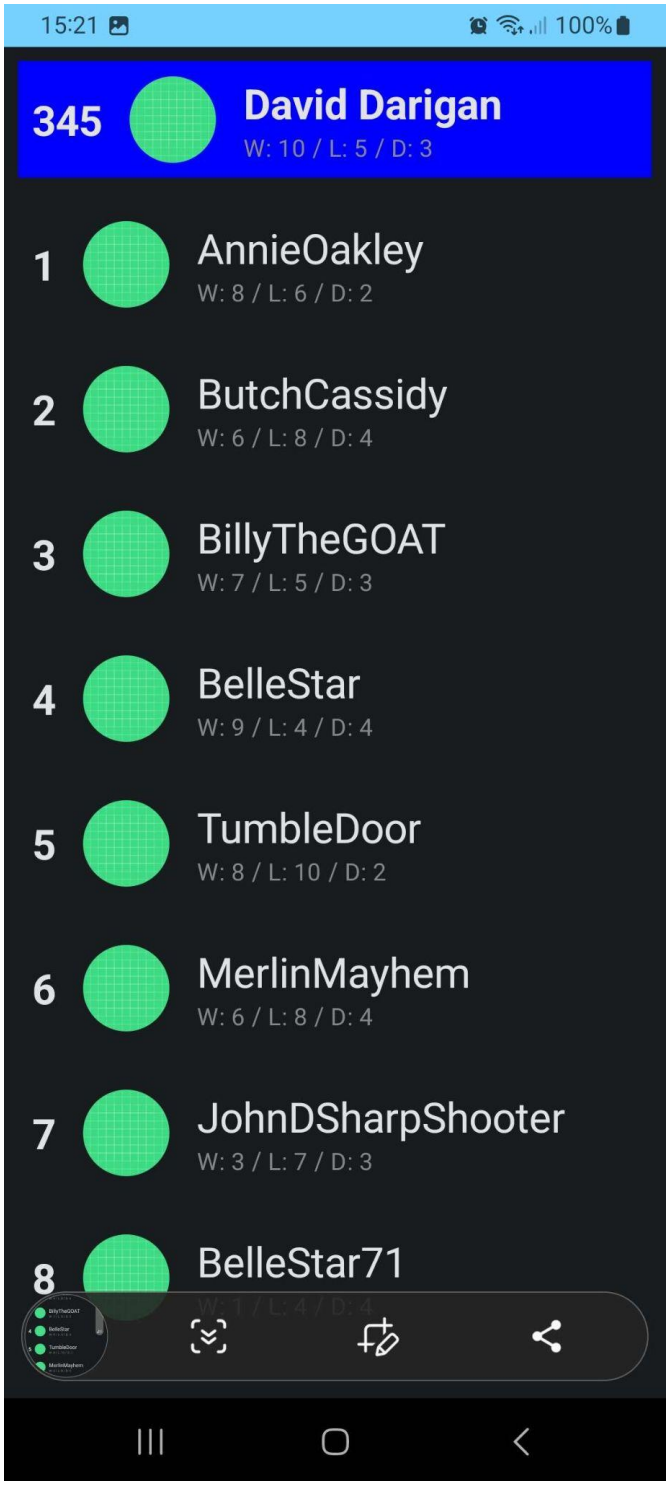
Training Screen



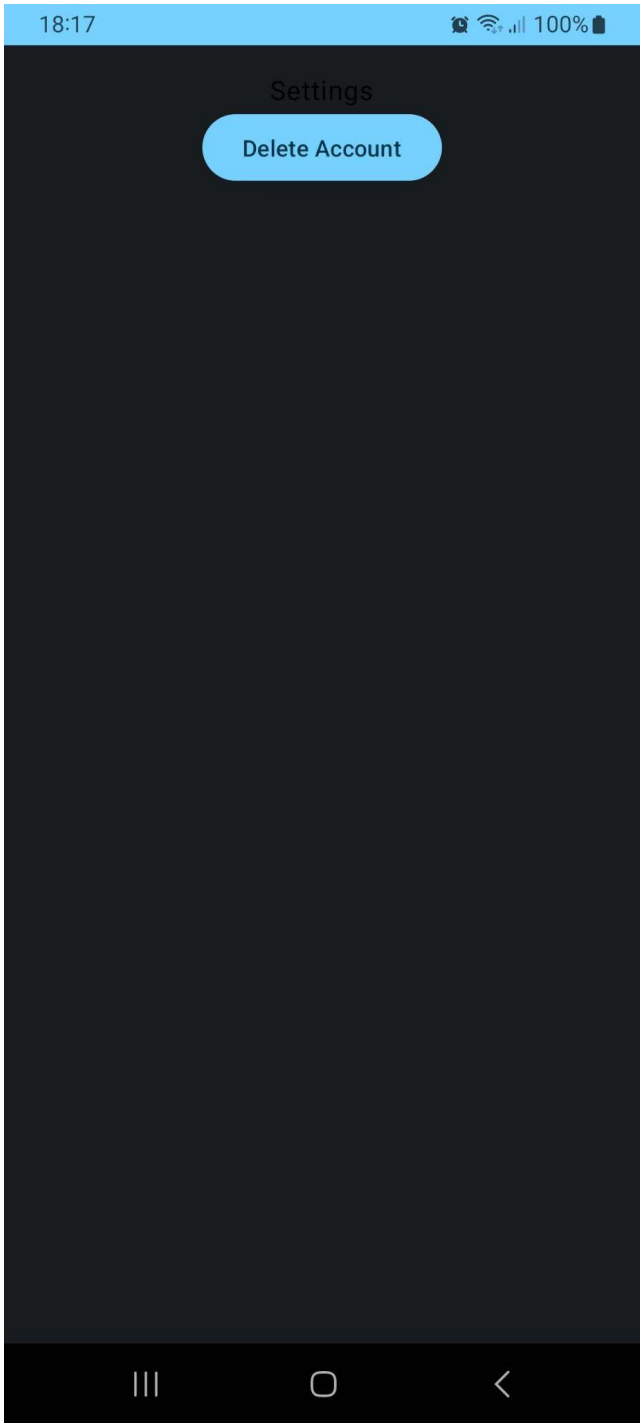
Spell Book Screen



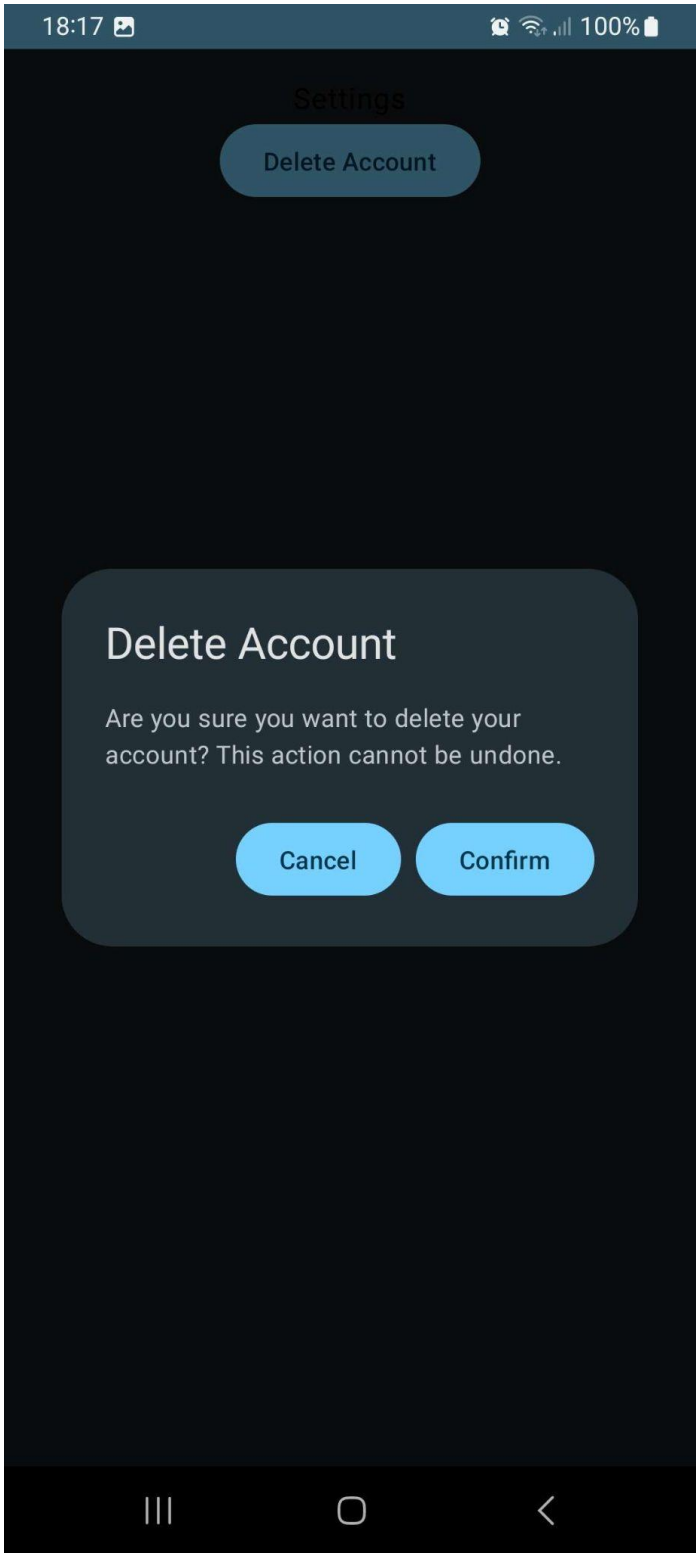
Leaderboard Screen



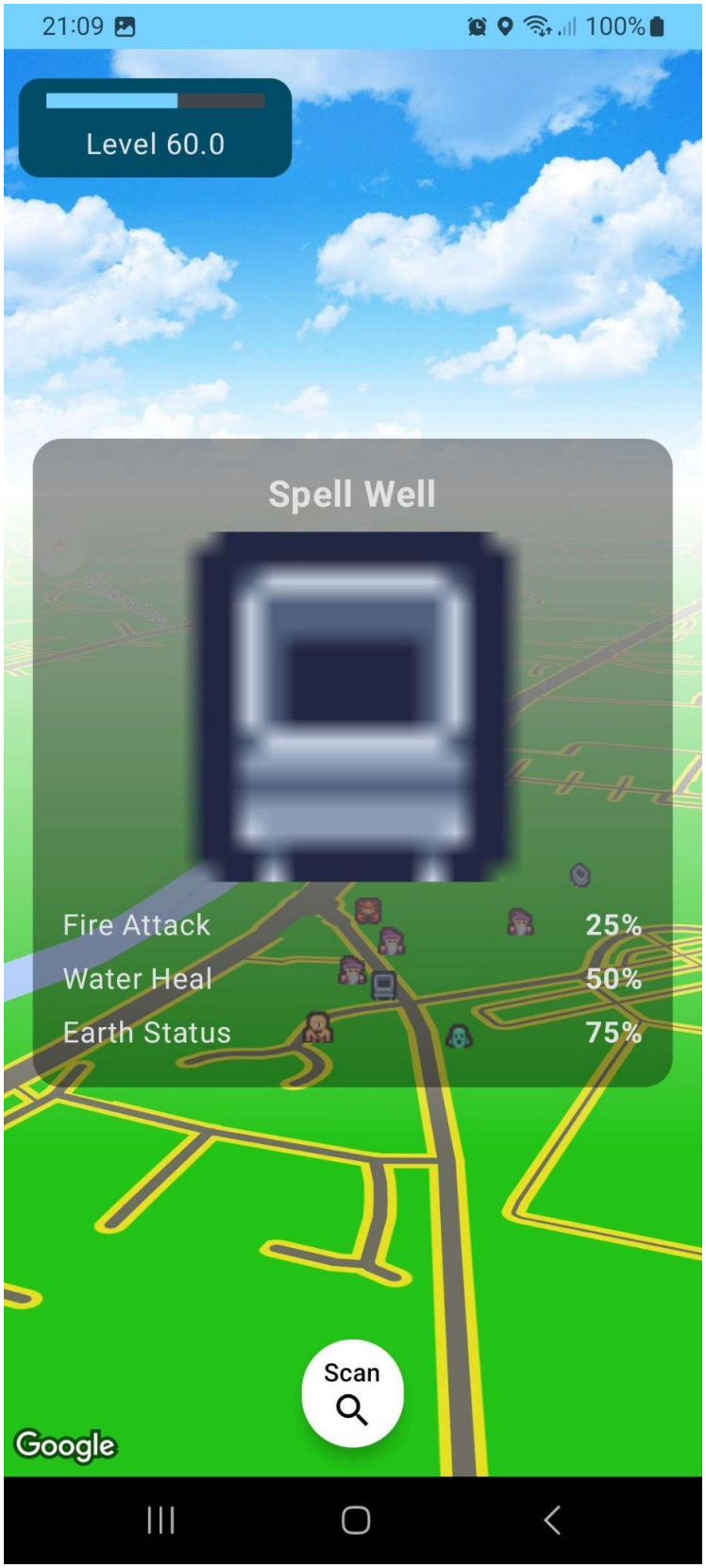
Settings Screen



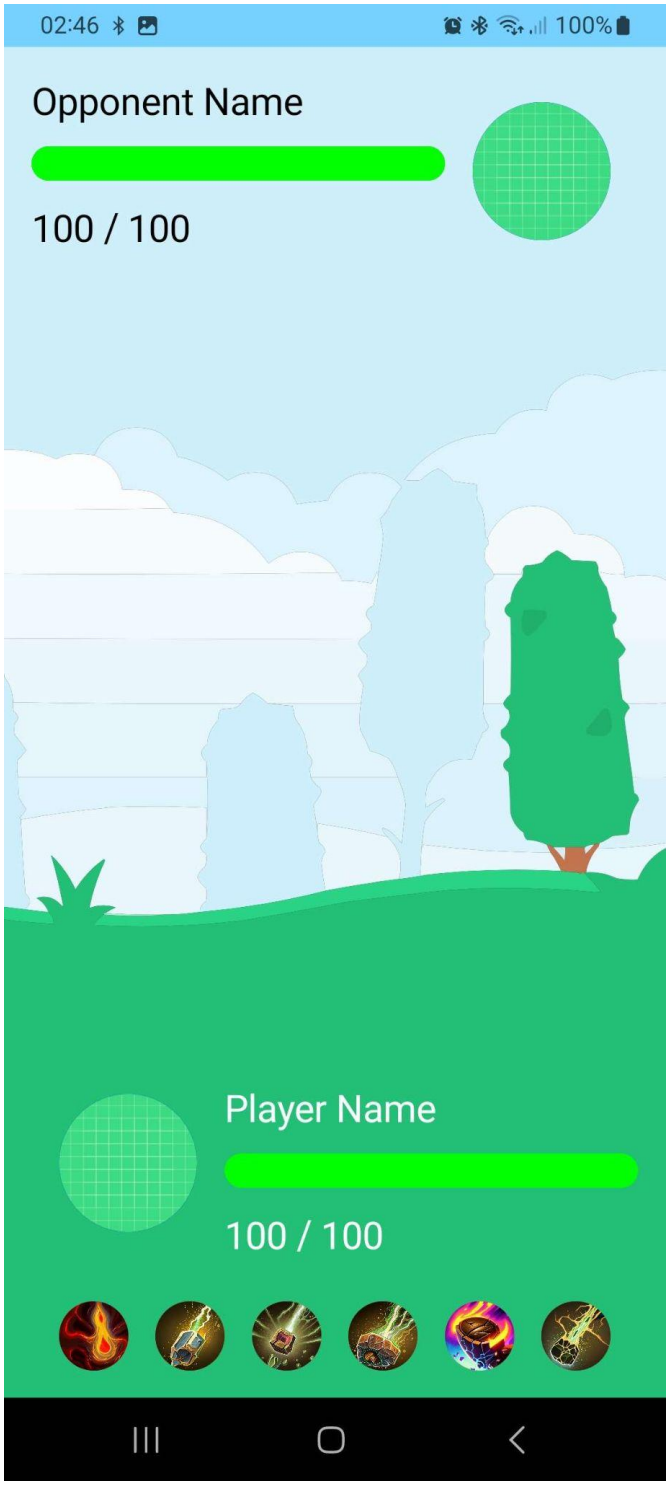
Delete Account Screen



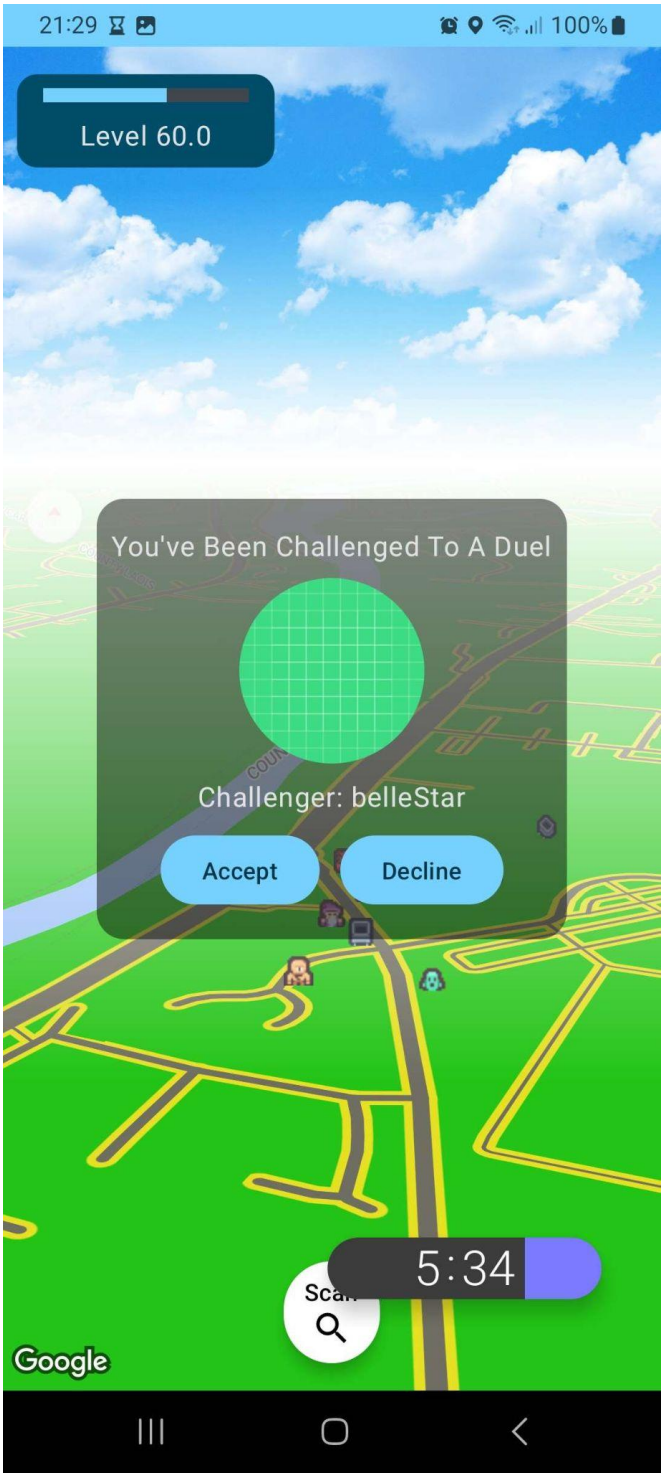
Spell Well Screen



Battle Screen



Battle Invite Screen



Milestones

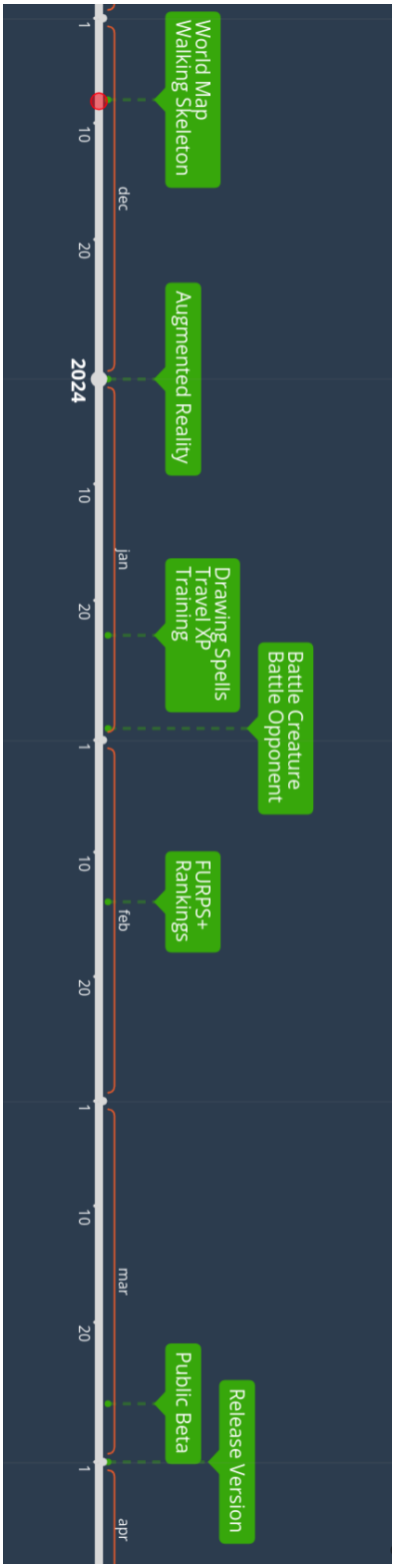


Figure 5 - Milestones

Attributions

Spell Icons from https://captaincatsparrow.itch.io/
Other Assets from https://www.kenney.nl/assets

Conclusion

The features of the SpellSlinger geolocation mobile gaming have been outlined in this document. The reasonings for the particular technologies, tools and design patterns have been detailed. The flow of code in the game has been detailed through Sequence Diagrams and a class diagram. The database layouts were presented to demonstrate the data model used in the application. Prototype screens are used to display the initial style of the game and a guideline going forward.