Exploring Best Practices with Google Firebase and Developing Instructional Materials

Degree programme : BSc in Computer Science
Specialisation : Distributed Systems and IoT
Thesis advisor : Prof. Dr. Ulrich Fiedler
Expert : Dr. Andreas Spichiger

Connecting Android apps with a reliable backend is essential in modern mobile development. This thesis presents instructional material that teaches how to use Google Firebase—specifically Firestore and Firebase Authentication—to build secure, real-time Android applications. The material includes slides, exercises, and app templates designed to help students practice core backend skills such as CRUD operations, real-time listeners, and authentication flows.

Introduction

Many modern Android applications require a reliable and scalable backend for features such as user authentication and cloud data storage. Google Firebase, a cloud-based platform, offers an integrated solution with tools like Firestore and Firebase Authentication. This thesis explores how Firebase can be taught effectively and how best practices can be introduced in the classroom.

Objectives & Approach

The main goal of this thesis was to identify and apply current best practices when working with Firebase Authentication and Firestore. To support student learning, a comprehensive set of instructional materials was created. These included a lesson with slides, an exercise sheet for a Kotlin Android app and a complete reference solution. The goal was also to foster confidence using Firebase in real projects.

Methodology

- Studied Firebase services and their integration in Jetpack Compose
- Created a lesson with hands-on tasks using a code skeleton and solution
- Provided students with an exercise requiring implementation of CRUD operations, SnapshotListeners, and Success/Failure handlers
- Delivered the session during class and collected feedback via a questionnaire

Results & feedback

The teaching unit was well received by students, who reported that the materials were useful for understanding both Firebase and its integration in Android via Jetpack Compose. An anonymous feedback survey provided valuable insights into areas for improvement. Students suggested adding visual illustrations and contextual examples to enhance understanding. Overall, the lesson proved to be an effective way to introduce Firebase in a classroom environment.

Riccardo Schenoni

Conclusion & Outlook

In this thesis, we have developed and classroom-tested instructional materials for teaching Firebase Firestore and Authentication. The developed resources will continue to support future iterations of the Smart Device Programming course. In the future, the materials can be expanded to cover additional Firebase features. As a student, contributing to the course in this way was especially meaningful to me. It allowed me to apply my knowledge in a real educational setting and give something back to the course and future students.

Firestore Structure

Slide out of an introductory teaching sequence of Firestore explaining the overall data structure

Securing Data with Authentication

Slide out of an introductory teaching sequence on authentication in Firestore