

My First Mobile App for Students

A comprehensive guide to Android app development for beginners

Zaid Kamil



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Dedicated to

My Mother

Farzana Hafeez

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About the Reviewer

In the ever-evolving landscape of technology, **Mukund Soni** emerges as a dynamic force, bridging the realms of academia, creativity, and practical application. A testament to his dedication, Mukund has achieved remarkable grades, reflecting his unwavering commitment to academic brilliance. His thirst for innovation finds expression in his active involvement in hackathons and technological competitions, where he consistently thrives.

Currently, Mukund crafts his unique narrative in the digital sphere. His forte lies in Frontend development, seamlessly blending the artistic with the utilitarian through platforms like Next.js and TypeScript. His proficiency in Web3 and Blockchain integration unveils new vistas of possibilities, as he engineers innovative solutions. His artistic prowess manifests in AI image generation, while his practicality shines through in Content Management Systems development.

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This visionary individual is not just a product of technology; he is a creator, an innovator, and a catalyst of change. In a world marked by digital transformation, Mukund Soni is a beacon of potential, a harbinger of what is yet to come.

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Lastly, my heartfelt gratitude goes to you, dear readers. Your interest in my book, your engagement with its content, your encouragement – these are the threads that have woven this narrative into a reality. This book is as much yours as it is mine. Thank you for being a part of this odyssey of creation and discovery.

Preface

In today's tech-driven world, mobile apps are how businesses and people connect with each other. Android OS, with a massive 71% share of the global market and a whopping 2.87 billion apps, is where you want to start if you dream of creating your own apps. This book is your guide, showing you step by step how to go from an idea to making real apps.

We start at the beginning, covering the basics you need to know. We will guide you through setting up the tools you will use, like Android Studio, and teach you about Kotlin, the language used for creating Android apps. By the end, you will have a solid foundation to build upon.

Learning is best when you actually do things, so this book is all about hands-on experience. You will create six different apps, each with its own unique design and coding. This way, you will turn what might seem complex into something practical and understandable. As you work through the chapters, you will pick up new skills. You will learn why Kotlin is better than Java for app making, and you will become comfortable with Android Studio. You will also get the hang of designing the look of your apps and making them work smoothly.

By the end of this journey, you will be equipped with the knowledge to build apps with confidence. You will understand the ins and outs of app creation, from the basics like setting up the environment to more advanced topics like connecting to the cloud. Whether you are just starting out or already have some tech experience, this book is your companion in your adventure of creating Android apps.

Chapter 1: Welcome, Future App Developer

Begin your journey with the Android platform's evolution and essential tools. Explore Android Studio, your primary software for development. Learn to download, install, and troubleshoot common issues. Learn how to work with the Kotlin programming language with the help of basics given in the chapter.

Chapter 2: App 1—Dynamic Dice Simulator (Part 1)

Divided into four sections, this chapter guides you through creating a new Android project, understanding Android Studio's interface and project structure, comprehending app architecture, using the design and XML editors, and implementing buttons, text, and images.

Chapter 3: App 1—Dynamic Dice Simulator (Part 2)

This chapter extends the previous app development, introducing wireframes of the completed app, multiple activities, the Android activity lifecycle, and setting up splash screens. Learn to handle intents, data passing, and add animation using `MotionLayout`.

Chapter 4: App 2—State Trivia

Craft a new app project focusing on state trivia. Explore collections, data classes, resources, themes, and applying the Material 3 theme. Dive into `RecyclerView`, data binding, and the Android menu system. Implement implicit intents for external app launches.

Chapter 5: App 3—Movie Booking

Discover Android Jetpack's Navigation Architecture and Jetpack components for creating robust, efficient apps. Understand fragments, navigation components, `ViewModel`, `LiveData`, and `DataBinding`. Create a new project with Basic Activity, design app fragments, manage flow, and handle data passing.

Chapter 6: App 4—Book Finder

Uncover background tasks using coroutines in Kotlin. Utilize `Retrofit` and `Coil` libraries to collect data from Google Books API. Master multithreading, set up the project, handle permissions, and parse data using `Moshi` and `RecyclerView`. Learn to display internet-received images with `Coil`.

Chapter 7: App 5—Flash Cards (Part 1)

Learn data persistence through databases. Build a flashcards app with `ViewPager2`. Set up fragments, Navigation graph, `ViewModel`, and `LiveData`. Understand SQL concepts, queries, and set up the Room library. Dive into `Entity`, `DAO`, `ViewModel`, and `ViewModelFactory`.

Chapter 8: App 5—Flash Cards (Part 2)

Continue the Flash Cards app, integrating different parts. Create a form to save and modify database entries. Utilize `ViewPager2` to display cards from the database. Explore `ListAdapter` for memory optimization and grasp extension functions in Kotlin.

Chapter 9: App 6—Inspire Me

Conclude your journey with cloud database and authentication concepts. Explore `Firestore`, linking Android Studio, and `Firestore` operations. Establish an authentication system, upload text data to the cloud, and receive live updates.

Bonus: Learn to upload your projects to `GitHub`.

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Please follow the link to download the
Code Bundle and the *Coloured Images* of the book:

<https://rebrand.ly/ns791wq>

The code bundle for the book is also hosted on GitHub at **<https://github.com/bpbpublications/My-First-Mobile-App-for-Students>**. In case there's an update to the code, it will be updated on the existing GitHub repository.

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CHAPTER 1

Welcome, Future App Developer

Introduction

Welcome, developer of the future! You are reading this chapter so that you can get an idea about the history of the Android operating system and the different versions of the Android operation system, and its impact on the mobile OS market. Then you are going to understand how to correctly install Android studio and its SDK on your pc/laptop. Finally, you will learn the language Kotlin, the official language for developing Android apps. To summarize, this chapter will provide you with a basic idea about Android, installation of Android studio, and coding in Kotlin. Concentrate on the coding portion of Kotlin, which will be very useful, as we are going to develop a lot of Android apps through each chapter. So, let us get started.

Structure

In this chapter, we will cover the following topics:

- History of Android OS
- History of Kotlin
- Market impact of Mobile OSes
- Setting up Android Studio

- Android SDK setup
- Kotlin classes and objects
- Functions and variables
- Condition and loops

Objectives

By the end of this chapter, the reader will know about the Android OS history, the market impact of Android, how to setup Android Studio IDE, and setup the software for developing Android apps. Finally, the reader will learn about Kotlin language and its main concepts, such as classes and objects, functions, conditions, and loops.

History of Android OS

It has been more than a decade since the first Android phone came out, and with it came the Android operating system. However, the real beginning of Android was in the year 2003, well before Apple iOS. Android Inc was founded by Andy Rubin, Rich Miner, Nick Sears and Chris White, and their aim was to develop *smarter mobile devices that are more aware of its owner's location and preferences*. Originally, the Android OS was meant to improve digital cameras but due to declining digital camera market, Android Inc, changed their target to mobile phones. The biggest change, however, came in 2005, when Google bought the Android Inc. company.

All the founding members continued developing the OS under the ownership of Google. Google made Android an open-source operating system that allowed it to become highly popular with third-party phone manufacturers. In September 2008, the first Android smartphone was released: T-Mobile G1, or the HTC Dream, with Android 1.0, and the rest became history. Over the years, various Android versions were released, and every major Android OS update had a special public name based on deserts. Following is the list of major Android versions and what they bring to the table:

Version	Release year	Features
Android 1.0–1.1	2008	Basic app support, support for Wi-Fi, Bluetooth, Web browsing, and camera.
Android 1.5 Cupcake	2009	Introduced auto rotation in phones, support for third-party keyboards, and the ability to upload YouTube videos.

Version	Release year	Features
Android 1.6 Donut	2009	Added CDMA networks, quick google search box, camera/video toggle system, and introduced power widgets for Wi-Fi, Bluetooth, and GPS.
Android 2.0–2.1 éclair	Oct, 2009	Google released version 2.0 of Android OS and named it Eclair. It added text to speech, live wallpapers, multiple accounts, and Google map navigation system.
Android 2.2 Froyo	May, 2010	Wi-Fi hotspot functionality, push notification, and flash support.
Android 2.3 Gingerbread	Sep, 2010	UI got a major overhaul, added support for Near Field Communication (NFC) to allow sharing, and also added support for multiple cameras.
Android 3.0 Honeycomb	Feb, 2011	Support for Android Tablet screens and included the new concept of fragmented sections in app, that could be arranged responsively for small and large screens, and both.
Android 4.0 Ice Cream Sandwich:	Oct, 2011	Added support for face-unlock (biometric sign-in), on-screen buttons for navigation, swipe gesture, and data usage monitor.
Android 4.1–4.3 Jelly Bean	2012	Notification action buttons, full Google Chrome browser support, introduction of Google now, and screen casting support.
Android 4.4 KitKat	2013	Now run on a minimum of 512 MB of RAM, which allowed manufacturers to make cheaper Android smartphones, and it led to increased market share.
Android 5.0 Lollipop	2014	New UI design component called Material Design. This new UI was very well received by the users.
Android 6.0 Marshmallow	2015	Support for USB-C, the introduction of Google Pay, fingerprint recognition support, and a vertically scrolling app drawer.
Android 7.0 Nougat	2016	Better multitasking system, split-screen mode, better 3D graphic support, and Vulkan API for graphics.
Android 8.0 Oreo	2017	New settings menu, picture in picture mode, notification grouping, and autofill system for forms.
Android 9.0 Pie	2018	New gesture-controlled slim button at the bottom center. Battery performance improvement using on-device Machine learning and features such as shush and app slices.

Version	Release year	Features
Android 10	2019	Google ditches the naming convention, new development API, dark mode, gesture navigation control, new sharing menu, smart reply, and app-based permissions.
Android 11	2020	record screen, the control system for smart home devices, conversation notifications and bubbles, one-time permissions, surface devices, and media in the controls.
Android 12	2021	Better notification control, Wi-fi sharing, and nearby share, privacy dashboard, approximate location, scrollable screen capture, one-handed mode, and a new UI called Material You .
Android 13	2022	Wallpaper themed of app icons, supports better haptic, notification permission, per-app languages, clipboard preview, and per-app languages.
Android 14	2023	Regional preferences, custom actions for sharing, better accessibility, better battery performance, and enhanced security.

Table 1.1: Android versions over the years

As you can see, Google continues to develop Android, adding new features and fixing problems and bugs with each new release.

History of Kotlin

Google, in 2019, made the Kotlin programming language an official language for Android app development. They made Kotlin the preferred language for app development. So, Kotlin is now the third language that can be used to develop Android apps after Java and C++.

Kotlin was developed by JetBrains in the year 2010, and it was released under the name of Project Kotlin in the year 2011. The first official version of Kotlin was released in 2016. The current version of Kotlin is 1.7, published in 2022.

The language is a cross-platform, statically typed, and general-purpose programming language that is fully interoperable with Java. This is beneficial because Java and Kotlin both run inside **Java Virtual Machine (JVM)**.

There are many benefits of choosing Kotlin over Java when doing Android App development; a few of them are listed as follows, but they will be detailed in the upcoming chapters:

- **Concise code:** As a rough estimate, code is 40% less than similar Java code.
- **Type safety:** Kotlin supports non-nullable types, which make apps less prone to the dreaded **Null Pointer Exception (NPE)** (a runtime error that crashes software/apps when a variable that is used is null) known to every Java developer.
- **Smart casting:** A feature that reduces code lines by allowing Kotlin to track conditions inside an expression.
- **Extension functions:** A Kotlin feature that helps to add functionality to a predefined class with the sub-classing technique that is used in Java language.
- **Higher-order functions:** Kotlin allows functions to accept other functions as parameters.
- **Lambdas with receivers:** Another Kotlin feature that makes code concise and makes it more readable and understandable.

So, looking at the preceding list of jargon, you might start to think that Kotlin would be hard to learn. But it is not. Instead, Kotlin is inspired by existing languages such as Java, C#, JavaScript, Scala, Groovy, and Python, and by doing so, the JetBrains developer cherry picked the best features from each language while skipping the problems seen in the other languages. Kotlin is easy to learn, and so, be it newcomers or experienced, both types of coders can learn in a matter of days. A few advanced features may take some time, but overall, Kotlin is not a complicated language. You can check the official website <https://kotlinlang.org/> to know more about Kotlin.

Market impact of mobile operating systems

The Android OS left a significant impact on the market because of its dominance as the leading mobile OS worldwide. Its open-source nature encouraged diverse device offerings and a vast app ecosystem. This spurred economic growth, global accessibility, and healthy competition. Android's integration with Google services bolstered Google's online dominance, whereas its affordability expanded internet access and digital services. Overall, Android's influence spans hardware innovation, app development, and increased digital inclusion.

When it comes to the market share worldwide of the mobile operating system, Android has been dominating the market since 2012, as the highest third-party smartphone manufacturers tend to select Android as their operating system.

The latest report from *statista.com* tells us that Google's Android is leading the market with approximately 71%, with Apple's iOS at second position with 28.3 %, and in

third place is KaiOS, a special operating system for feature phones with 0.07%. Refer to *Figure 1.1* for an illustration of the Worldwide Mobile OS Market share:

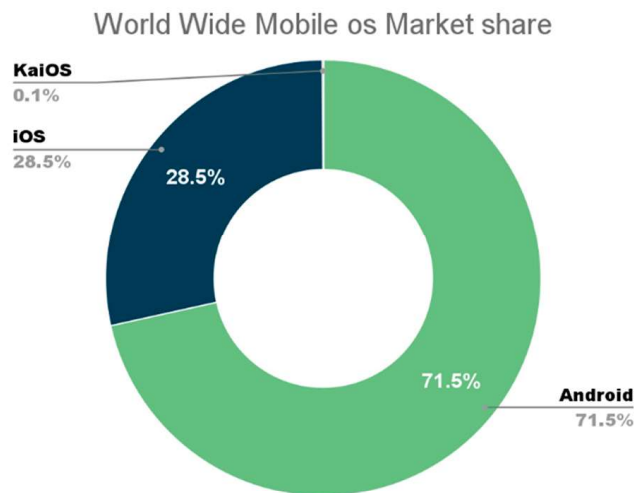


Figure 1.1: Word wide mobile OS market share

Setting up Android Studio

To begin developing Android applications on your pc, you have to install and setup only one software, which is the officially supported Android **Integrated Development Environment (IDE)** and the Android Studio. The Android Studio is developed by the JetBrains company, specifically for developing Android apps easily, and is also free to use.

It provides benefits such as follows:

- A single environment where you can develop for all Android devices.
- A fast and feature-rich emulator.
- A Gradle build system.
- Testing tools.
- Intelligent code editor.
- Integration with Play Store, and much more.

You can download Android Studio from <https://developer.android.com/studio>, Android Studio can be installed on Microsoft Windows, MacOS, Linux, and Chrome OS. You can install it in a few simple clicks. Refer to the *Figure 1.2*: