A report on

Internship

Google Android Developer Virtual Internship

Submitted in partial fulfillment of the requirements

For the award of the degree of

BACHELOR OF TECHNOLOGY

in

Computer Science & Engineering

by

MOUNIKA M **(204G1A0561)**

Department of Computer Science & Engineering

Srinivasa Ramanujan Institute of Technology
(AUTONOMOUS)
Rotarypuram Village, B K Samudram Mandal, Ananthapuramu - 515 701

2023-2024

Srinivasa Ramanujan Institute of Technology
(AUTONOMOUS)
Rotarypuram Village, B K Samudram Mandal, Ananthapuramu - 515 701

Department of Computer Science & Engineering

Certificate

This is to certify that the internship report entitled Google Android Developer Virtual Internship is the bonafide work carried out by **Mounika M** bearing Roll Number 204G1A0561 in partial fulfillment of the requirements for the award of the degree of **Bachelor of Technology** in **Computer Science and Engineering** for three months from May 2023 to July 2023.

Internship Coordinator

Mr.K.Lokeshnath MTech., (Ph.D).

Assistant Professor

Head of the Department

Mr. P. Veera Prakash M.Tech, (Ph.D)

Assistant Professor

Date:

EXTERNAL EXAMINER

Place: Anantapuram

PREFACE

All India Council for Technical Education(AICTE) has initiated various activities for promoting industrial internship at the graduate level in technical institutes and Eduskills is a Non-profit organization which enables Industry 4.0 ready digital workforce in India. The vision of the organization is to fill the gap between Academic and Industry by ensuring world class curriculum access to the faculties and students. Formation of the All-India Council for Technical Education (AICTE) in 1945 by the Government of India.

Purpose: With a vision to cultivate a skilled workforce poised to lead in the realm of mobile app development, EduSkills and AICTE proudly introduce the 'Virtual Internship' program focused on Google Android Development. This initiative is supported by industry giant Google and aims to empower participants with hands-on experience in Android app development. The demand for skilled Android developers has surged in recent times, reflecting the widespread reliance on mobile technology. As an industry pioneer, Google provides essential tools and frameworks, making the Google Android Developer Virtual Internship a pivotal program for aspiring developers seeking to contribute to the dynamic landscape of Android app development**.**

Company's Mission Statement: The main mission of these initiatives is enhancement of the employability skills of the students passing out from Technical Institutions.

Business Activities:

- Project Planning.
- Technical Design and Documentation.
- Coding and Development.
- Quality Assurance.
- Continuous Learning.
- Communication.

ACKNOWLEDGEMENT

The satisfaction and euphoria that accompany the successful completion of any task would be incomplete without the mention of people who made it possible, whose constant guidance and encouragement crowned our efforts with success. It is a pleasant aspect that I have now the opportunity to express my gratitude for all of them.

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I also express our sincere thanks to the Management for providing excellent facilities and support**.**

Finally, I wish to convey my gratitude to my family who fostered all the requirements and facilities that I need.

Mounika M

(204G1A0561)

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LIST OF ABBREVIATIONS

IDE	Integrated Development Environment
SDK	Software Development Kit
OOP	Object Oriented Programming
MVVM	Model-View-View Model
HTTP	Hypertext Transfer Protocol
REST	Representational State Transfer
SQL	Structured Query Language
DAOs	Data Access Objects

CHAPTER 1

INTRODUCTION

The Google Android Developer Virtual Internship! As a participant in this program, we are embarking on a journey to delve into the dynamic world of Android app development, gaining hands-on experience and insights into the cutting-edge technologies that power mobile applications. This virtual internship is designed to provide you with a comprehensive understanding of the Android development ecosystem, allowing you to contribute to real-world projects and enhance your skills as a developer.

Throughout this virtual internship, you will be immersed in a series of engaging and practical activities that mirror the responsibilities and challenges faced by Google Android Developers. From project planning and design to coding, testing, and collaboration with cross-functional teams, you will have the opportunity to work on various aspects of Android app development.

Business Perspective

In the Google Android Developer Virtual Internship, participants gain valuable insights into the business of mobile app development, honing their skills in designing user-friendly interfaces, collaborating with cross-functional teams, and contributing to real-world projects. Through practical experiences, interns develop a keen understanding of the dynamic Android ecosystem, preparing them for impactful roles in the competitive landscape of mobile technology. The program emphasizes agile methodologies, quality assurance, and community engagement, aligning participants with industry best practices for successful Android development from a business standpoint.

Governance Perspective

The Google Android Developer Virtual Internship emphasizes a governance perspective by instilling best practices in code reviews, adherence to security protocols, and compliance with established development standards. Interns engage in collaborative decision-making processes, ensuring alignment with project goals, while promoting transparency and accountability in project management. This governance-oriented approach fosters a culture of continuous improvement, knowledge sharing, and responsible development within the Android development community.

CHAPTER 2

TECHNOLOGY

The Google Android Developer Virtual Internship involves working with various technologies to gain hands-on experience in Android app development. Here are some key technologies you may encounter during the internship:

1. Java or Kotlin Programming Languages

Develop proficiency in either Java or Kotlin, the primary programming languages for Android app development.

2. Android Studio

Use Android Studio as the official integrated development environment (IDE) for designing, coding, and testing Android applications.

3. XML (Extensible Markup Language)

Utilize XML for designing user interfaces and layouts in Android apps.

4. Android SDK (Software Development Kit)

Leverage the Android SDK, which provides a set of tools, libraries, and APIs for Android app development.

5. Version Control Systems (e.g., Git)

Collaborate with version control systems like Git to manage and track changes in the source code.

6. Firebase

Explore Firebase services for features such as authentication, real-time databases, and cloud messaging in Android applications.

7. RESTful APIs

Interact with RESTful APIs to integrate mobile applications with server-side systems and retrieve data.

CHAPTER 3

APPLICATIONS

Google Android, as a prominent mobile development platform, has become widely adopted by numerous companies for diverse applications. As Android continues to be a universal choice for mobile app development, understanding the range of applications and the companies leveraging the platform is essential. Below is a list of Android applications and a glimpse into notable use cases, shedding light on the versatility and widespread adoption of the Google Android platform in the dynamic landscape of mobile application development-

1. Project Planning and Design

In the Google Android Developer Virtual Internship, participants engage in project planning sessions where they define project goals, scope, and milestones. Emphasis is placed on understanding user requirements and collaborating with UI/UX designers to create intuitive and visually appealing app designs. This phase lays the foundation for the development process, ensuring a clear roadmap for successful app creation.

2. Coding and Development

Interns delve into hands-on coding and development activities using Java or Kotlin within the Android Studio IDE. They follow best practices and coding standards while implementing features, functionalities, and responsive user interfaces. The development phase focuses on translating design concepts into functional and efficient Android applications.

3. Quality Assurance and Testing

The internship involves comprehensive quality assurance and testing procedures. Interns collaborate with QA teams to identify, report, and fix bugs, ensuring the reliability and functionality of the developed Android applications. Testing includes unit testing using tools like JUnit and UI testing with Espresso to guarantee a robust and error-free user experience.

4. Collaboration and Agile Development

Participants experience the importance of collaboration in a virtual setting, working with cross-functional teams, including backend developers and QA teams. The internship emphasizes agile development methodologies, with interns participating in sprint planning, regular code reviews, and iterative development processes. This collaborative approach ensures some features of the Flexibility or adaptability and efficient project progression.

5. Security Implementation

The internship places a strong focus on implementing security best practices to safeguard user data and ensure the overall security of Android applications. Interns gain hands-on experience in incorporating encryption, secure authentication, and other measures to address potential vulnerabilities and threats.

6. Community Engagement and Open Source Contributions

Interns are encouraged to engage with the broader Android developer community through participation in forums, events, and potentially contributing to open-source projects. This exposure enhances their understanding of industry trends, fosters networking opportunities, and promotes knowledge sharing within the Android development ecosystem.

7. Continuous Learning and Skill Enhancement

Throughout the virtual internship, participants are encouraged to adopt a continuous learning mindset. They stay updated on the latest Android development trends, tools, and best practices, ensuring that their skills remain relevant and adaptable to the rapidly evolving field of mobile app development.

CHAPTER 4

MODULE EXPLANATION

Module-1: Your First Android App

In this foundational unit of the Google Android Developer Virtual Internship, participants embark on an exciting journey to create their inaugural Android application. The focus is on introducing the essential tools and concepts necessary for Android development, setting the stage for hands-on exploration.

Pathway 1: Introduction to Kotlin

Basics of Kotlin Syntax and Structure:

- Introduction to variables, data types, and Kotlin syntax.
- Understanding the structure of a Kotlin program.
- Hands-on exercises to practice basic Kotlin programming.

Variable Declaration, Data Types, and Basic Operations:

- Declaring variables and understanding data types in Kotlin.
- Performing basic operations such as arithmetic and string concatenation.
- Practical exercises to reinforce variable usage.

Control Flow and Decision-Making in Kotlin:

- Introduction to control flow statements (if, else if, else, when) in Kotlin.
- Decision-making and conditional statements.
- Code examples and exercises to solidify understanding.

Functions, Parameters, and Return Types:

- Defining functions in Kotlin.
- Working with function parameters and return types.
- Practical application through coding exercises.

Pathway 2: Set up Android Studio

Android Studio Installation and Configuration:

- Step-by-step guide for installing and configuring Android Studio.
- Setting up the Android Development Environment (SDK, JDK).
- Troubleshooting common installation issues.

Project Creation and Configuration:

- Creating a new Android project in Android Studio.
- Configuring project settings, including package name and project location.
- Overview of the project file structure.

Basics of Navigating the Android Studio Interface:

- Introduction to key features and tools within Android Studio.
- Navigating the project explorer, code editor, and other essential panels.
- Tips for efficient navigation and customization.

Running and Debugging Applications:

- Running an Android app on a physical device.
- Emulator setup and running apps in the emulator.
- Introduction to debugging tools and techniques.

Pathway 3: Build a Basic Layout

Basics of XML for Designing User Interfaces:

- Introduction to XML as a markup language for designing Android interfaces.
- Understanding XML elements, attributes, and their roles in UI design.
- Creating a basic XML layout file.

Layouts, Views, and Resource Management:

- Exploring different layout types (Linear, Relative, Constraint) in Android.

- Adding and styling views within a layout.
- Managing resources efficiently (strings, images, etc.).

Creating a Simple User Interface:

- Combining Kotlin code with XML to create a simple Android app.
- Incorporating text and image elements into the user interface.
- Testing the app in the Android Emulator.

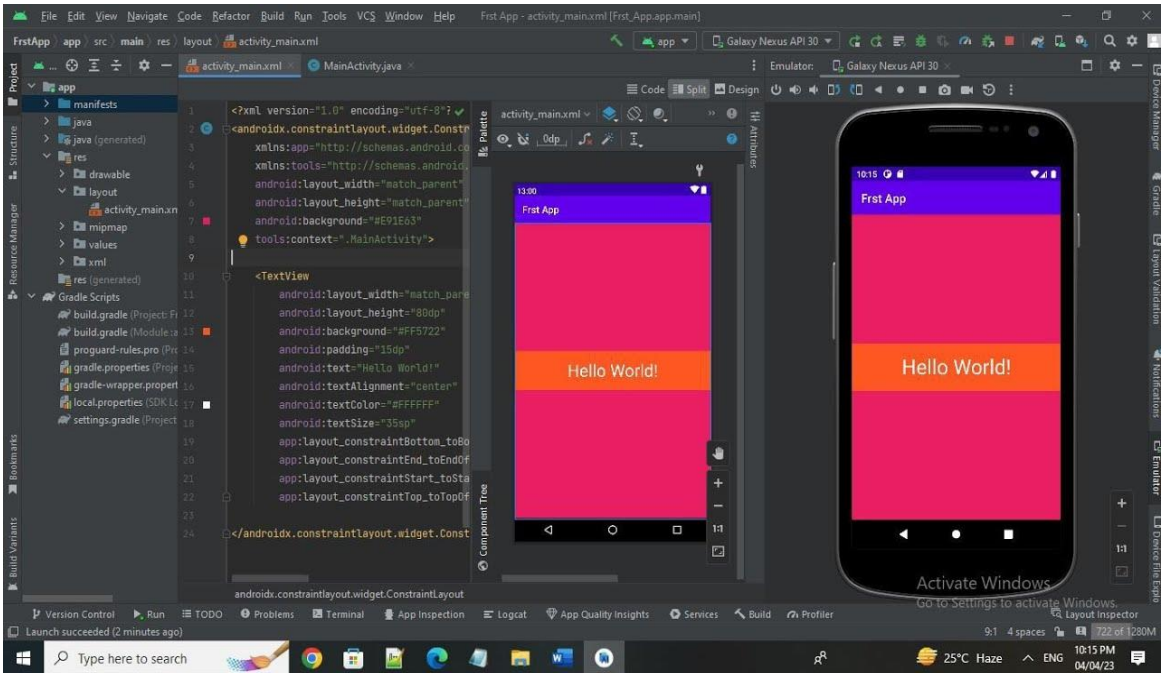

Fig 4.1: First Android App

Module-2: Building App UI

Pathway 1: Kotlin Fundamentals

Object-Oriented Programming (OOP) in Kotlin:

- Understanding the principles of OOP such as classes, objects, inheritance, and Polymorphism in Kotlin.
- Practical examples and exercises to solidify OOP concepts.

Lambdas and Higher-Order Functions:

- Exploring Kotlin's support for functional programming through lambdas.
- Understanding higher-order functions and their application in Kotlin.
- Hands-on coding exercises to practice working with lambdas.

Pathway 2: Add a button to an App

Button Widget in Android:

- Introduction to the Button widget and its properties in Android.
- Adding buttons to an app layout using XML.

Handling Button Clicks:

- Responding to button clicks through event listeners.
- Implementing onClick methods to execute specific actions when a button is clicked.

Pathway 3: Interact with UI and state

User Input Handling:

- Capturing user input through text fields and other input mechanisms.
- Validating and formatting user input for processing.

Interactive UI Design:

- Designing an interactive UI for a tip calculator app.
- Incorporating buttons, text views, and other UI elements for a seamless user experience**.**

Module-3: Display Lists and Use Material Design

Pathway 1: More Kotlin Fundamentals

Advanced Kotlin Syntax:

- Exploring more advanced Kotlin syntax and language features.
- Concepts such as extension functions, delegation, and inline functions.

Coroutines and Asynchronous Programming:

- Understanding Kotlin coroutines for efficient asynchronous programming.
- Implementing background tasks and managing concurrency in Android apps.

Pathway 2: Build a Scrollable List

Introduction to Jetpack Compose:

- Overview of Jetpack Compose, the modern Android UI toolkit.
- Setting up a Compose project and understanding its structure.

Building a Basic List with Compose:

- Creating a scrollable list using Compose.
- Adding text items to the list and handling item interactions.

Pathway 3: Build beautiful Apps

Material Design Principles:

- In-depth exploration of Material Design principles for Android.
- Incorporating material elements, color schemes, and typography.

Animations and Transitions:

- Implementing animations to enhance the user interface.
- Creating smooth transitions between different app states.

Module-4: Navigation and App Architecture

Pathway 1: Architecture Components.

Introduction to App Architecture:

- Understanding the importance of app architecture for scalable and maintainable code.
- Overview of popular architecture patterns like MVVM (Model-View-ViewModel).

ViewModels in Android:

- Implementing ViewModels to separate UI-related logic from UI components.
- Utilizing ViewModels for handling UI state and data**.**

Pathway 2: Navigation in Jetpack Compose

Introduction to Navigation Component:

- Overview of the Navigation component in Jetpack Compose.
- Setting up navigation within a Compose project**.**

Navigating Between Screens:

- Implementing how to pass data between different screens.
- Using the Navigation Component to handle navigation actions.

Pathway 3: Adapt for Different Screen Sizes

Responsive UI Design:

- Understanding the principles of responsive UI design.
- Adapting layouts and views for various screen sizes.

ConstraintLayout and Flexible UI Components:

- Understanding the principles of responsive UI design.
- Implementing responsive UI Components.

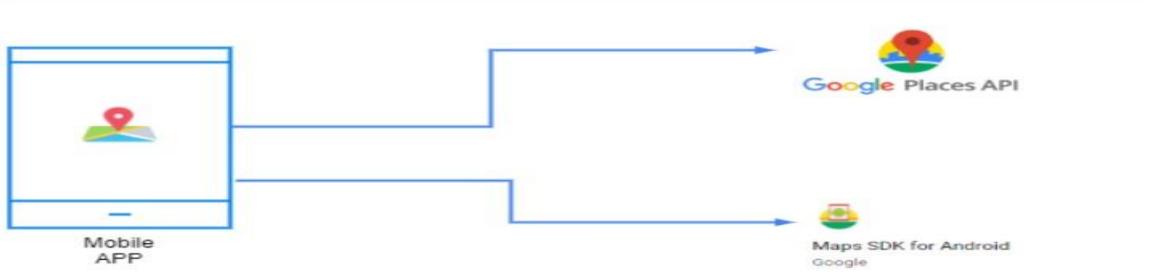

Fig 4.2: App Architecture

Module-5: Connect to the Internet

Pathway 1: Get Data from the Internet

Introduction to Coroutines:

- Understanding coroutines as a mechanism for asynchronous programming.
- Implementing coroutines to handle concurrent tasks without blocking the app.

HTTP and REST Concepts:

- Overview of HTTP (Hypertext Transfer Protocol) and its role in web communication.
- Understanding REST (Representational State Transfer) as an architectural style for web services.

Retrofit Library for API Integration:

- Integrating Retrofit, a popular HTTP client library, to communicate with RESTful APIs.
- Performing CRUD (Create, Read, Update, Delete) operations using Retrofit.

Handling JSON Data:

- Parsing JSON data retrieved from the internet using libraries like Gson.
- Mapping JSON responses to Kotlin data classes for easy manipulation.

Pathway 2: Load and Display Images from the Internet

Architecture Best Practices for Network Operations:

- Implementing architecture components to handle network requests efficiently.
- Managing the lifecycle of network-related tasks in Android apps.

Introduction to Coil Image Loading Library:

- Overview of Coil, a modern image loading library for Android.
- Integrating Coil into the app for efficient image loading.

Image Caching and Performance Optimization:

- Implementing image caching strategies to enhance app performance.
- Configuring Coil for optimal image loading and memory management.

Advanced Image Loading Techniques:

- Implementing placeholder and error handling for images.
- Customizing image loading behaviors for diverse use cases.

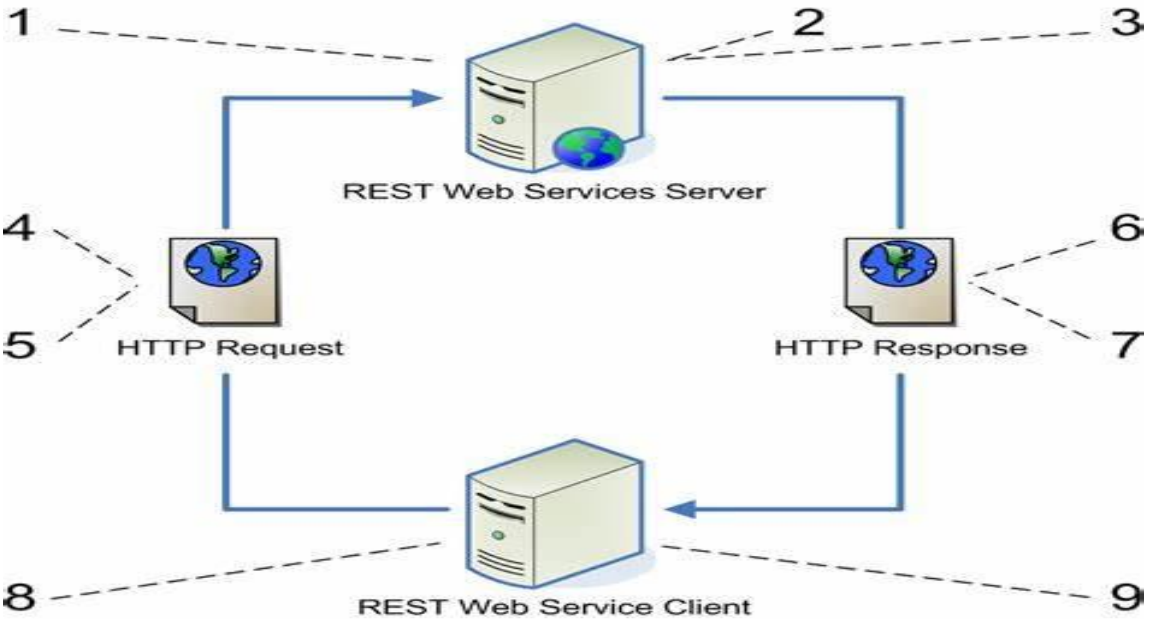

Fig 4.3: REST Web services

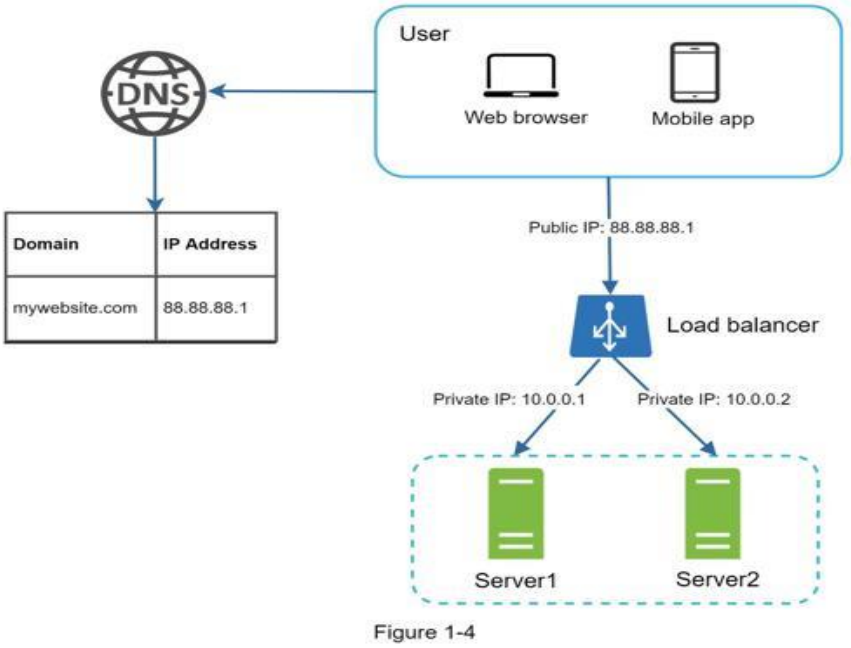

Fig 4.4: System Design

Module-6: Data Persistance

Pathway 1: Introduction to SQL

Fundamentals of SQL:

- Introduction to Structured Query Language (SQL) as a domain-specific language for managing relational databases.
- Understanding SQL syntax, data types, and basic operations (SELECT, INSERT, UPDATE, DELETE).

Database Design and Normalization:

- Principles of database design and normalization.
- Creating well-structured tables to minimize redundancy and ensure data integrity**.**

Pathway 2: Use Room for Data Persistance

Introduction to Room Persistence Library:

- Overview of the Room Persistence Library as an abstraction layer over SQLite for Android.
- Setting up Room in an Android project**.**

Entity Definition and DAOs:

- Defining entities to represent database tables.
- Creating Data Access Objects (DAOs) to perform database operations

Pathway 3: Store and Access Data Using Keys with DataStore

Introduction to DataStore:

- Overview of DataStore as a modern data storage solution in Android.
- Understanding the benefits of using DataStore for key-value pair data**.**

Preferences DataStore:

- Implementing Preferences DataStore to store and retrieve simple data.
- Handling different data types and preferences in DataStore**.**

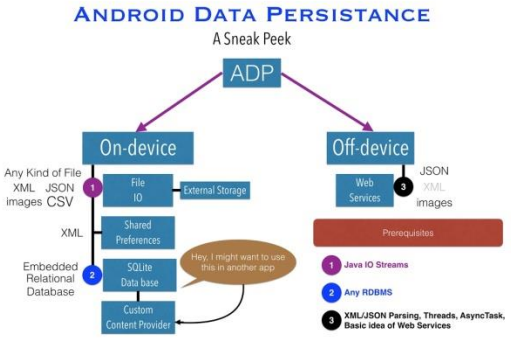

Fig 4.5: Android Data Persistance

Module-7: WorkManager

Pathway 1: Schedule Tasks with WorkManager

Introduction to WorkManager:

- Overview of WorkManager as a background task scheduling library in Android.
- Understanding the need for background tasks and how WorkManager addresses this.

WorkManager Basics:

- Setting up WorkManager in an Android project.
- Creating simple background tasks using WorkManager.

Constraints and Execution Control:

- Defining constraints for when a task should run.
- Controlling the execution of tasks based on conditions like network availability or charging status.

Periodic and OneTime Work Requests:

- Scheduling tasks to run periodically using WorkManager.
- Implementing one-time work requests for specific actions.

Chaining and Parallel Execution:

- Chaining multiple tasks together for sequential execution.
- Running tasks in parallel to optimize background work.

Error Handling and Retry Policies:

- Handling errors in background tasks using WorkManager.
- Implementing retry policies for robust background execution.

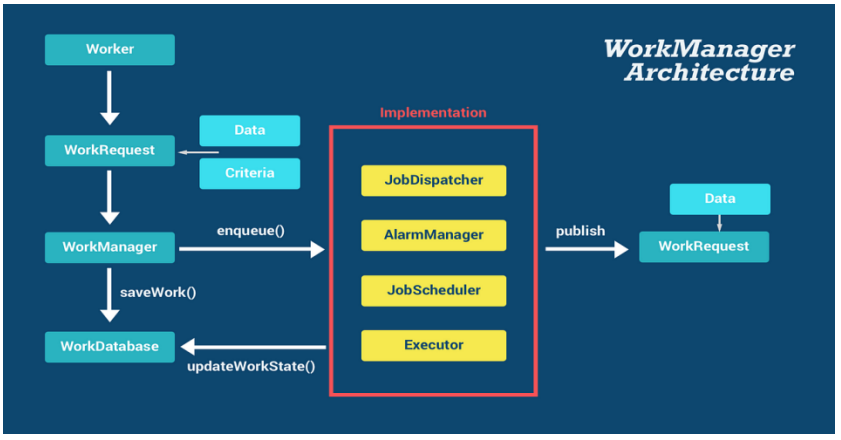

Fig 4.6: Background tasks on Android Using WorkManager

Module-8: Compose with Views

Pathway 1: Android Views and Compose in Views

Introduction to Android Views:

- Understanding traditional Android Views and the XML-based layout system.
- Exploring the hierarchy of Views such as TextView, ImageView, and more.

Jetpack Compose Integration:

- Integrating Jetpack Compose into an app built with Android Views.
- Adding a Compose composable within an existing View-based layout.

Pathway 2: Views in Compose

Embedding Android Views in Compose:

- Integrating traditional Android Views into a Compose-based app.
- Understanding how Views can coexist with Compose elements.

View Composition and Styling:

- Composing layouts with both Compose components and existing Views.
- Styling and theming for a cohesive user interface.

View Interactivity and Compose Events:

- Handling user interactions with both Compose and traditional View elements.
- Listening to and responding to events from mixed UI components.

Performance Considerations:

- Understanding the performance implications of using both Views and Compose in the same app.
- Optimizing the app for a smooth user experience.

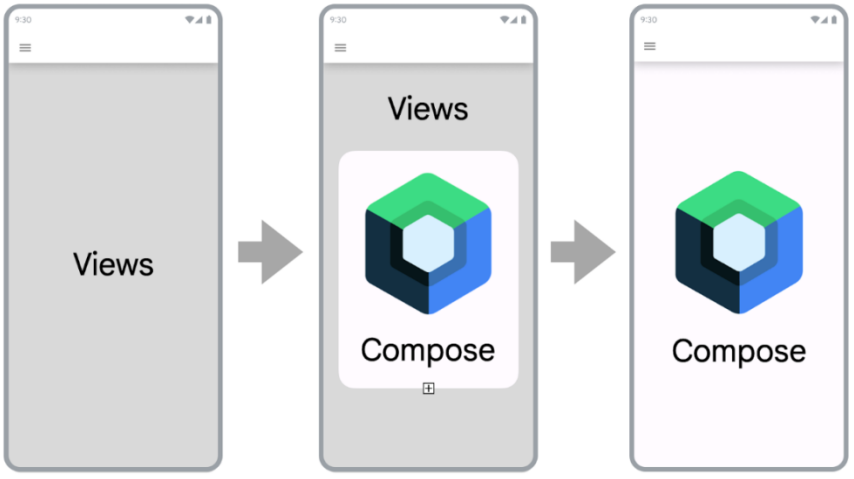

Fig 4.7: Jetpack Compose

Module-9: Course Wrap-up

The Google Android Developer Virtual Internship has been an immersive and comprehensive journey, guiding you through the intricacies of Android app development. Over the course's eight units, you have acquired proficiency in Kotlin, the modern language for Android, and honed your skills in designing visually appealing user interfaces. The emphasis on app architecture, connectivity, and background task scheduling using WorkManager has equipped you with the tools to create robust and efficient applications.

In the realm of data management, you've mastered SQL, Room, and DataStore, gaining the ability to handle persistent data with precision. The integration of Jetpack Compose with traditional Android Views in the later units has provided you with a versatile toolkit for building flexible and dynamic user interfaces. With each unit building upon the last, the course has not only deepened your technical knowledge but also instilled best practices in app development.

As you wrap up this virtual internship, consider this a springboard for your future endeavors. Whether you choose to delve deeper into Android development or explore related technologies, the skills acquired in this course form a solid foundation. Congratulations on completing the Google Android Developer Virtual Internship – the journey you've undertaken is a testament to your commitment and potential in the world of Android development. Best of luck in all your future projects!

Moreover, this virtual internship has emphasized the importance of a holistic approach to app development. Through units focused on connectivity, you've learned to fetch data from the internet, seamlessly integrating it into your applications. The insights gained in adapting user interfaces for various screen sizes showcase a keen understanding of user experience, ensuring that your apps are not only functional but also accessible and visually cohesive across different devices.

In conclusion, this internship has provided more than just technical skills; it has fostered a mindset of continuous learning and adaptation. The Android development landscape is ever-evolving, and the knowledge gained here positions you to stay abreast of emerging trends and technologies. Whether you're embarking on personal projects or joining professional endeavors, the Google Android Developer Virtual Internship has laid a solid foundation for a successful career in Android development.

CHAPTER 5

Real Time Examples

In real-world scenarios, the skills acquired through the Google Android Developer Virtual Internship find practical applications in various contexts. For instance, imagine developing a social media application where the knowledge gained from Unit 5, "Connect to the Internet," becomes crucial. Implementing coroutines for concurrent tasks, utilizing HTTP and REST to fetch user data, and efficiently loading and displaying images from the internet contribute to a seamless and responsive user experience. The ability to navigate and adapt the user interface based on different screen sizes, as learned in Unit 4, ensures that the app remains visually appealing and functional across a diverse range of Android devices.

Consider a health and fitness application as another example, where data persistence plays a pivotal role. Leveraging the skills acquired in Unit 6, developers can implement a robust system using SQL, Room, and DataStore to store user preferences, exercise logs, and other health-related data. This ensures that users can track their progress over time, and the app can offer personalized recommendations based on historical data. Moreover, the implementation of WorkManager for background tasks becomes valuable for scheduling reminders, sending push notifications, or updating health-related data periodically.

In the realm of e-commerce, the principles of Unit 3, "Display Lists and Use Material Design," come into play. Developing a shopping app involves creating scrollable lists of products, employing advanced Kotlin concepts for enhanced functionality, and incorporating Material Design principles for a visually cohesive and user-friendly interface. The seamless integration of Jetpack Compose with traditional Android Views, as explored in Unit 8, provides flexibility in designing interactive and dynamic product displays. Overall, the Google Android Developer Virtual Internship equips developers with the skills needed to tackle real-world challenges across diverse application domains.

CHAPTER 6

LEARNING OUTCOMES

By the end of this we will be able to know about:

1. **Foundational Understanding of Android Development**: Participants will establish a solid foundation in Android development by comprehending key concepts and frameworks. This includes gaining insights into the Android architecture, understanding the role of components such as Activities, Fragments, and Services, and exploring essential elements like layouts, views, and resources. This foundational knowledge lays the groundwork for an in-depth exploration of Android app development.

2. **Proficiency in Android App Building**: Through hands-on experience and practical exercises, participants will become proficient in building Android applications. They will learn to create and manage user interfaces using XML and Kotlin, handle user interactions, and implement essential features such as navigation, data storage, and multimedia integration. The program focuses on leveraging Android Studio, the official IDE for Android development, and participants will gain practical skills in deploying and testing their applications on virtual or physical devices.

3. **Database Integration and Data Management**: Participants will gain expertise in integrating databases into Android applications, both local and remote. They will explore SQLite for local data storage and learn to interact with remote databases using technologies like Firebase Realtime Database or Room Persistence Library. This knowledge empowers participants to make informed decisions about choosing the right data storage solutions for diverse Android applications.

4. **Networking and Security in Android Apps**: The course equips participants with the knowledge to implement secure networking in Android apps. They will understand how to make network requests, handle responses, and ensure data protection. Additionally, participants will explore best practices for securing user data, implementing authentication mechanisms, and managing permissions within Android applications.

5. **Efficient App Monitoring and Debugging**: Participants will develop skills in monitoring and debugging Android applications using Android Studio's powerful tools. They will learn to identify and resolve common issues, optimize app performance, and leverage debugging features for a seamless development experience. The emphasis is on equipping participants to deliver high-quality, bug-free applications.

6. **Scalability and User Experience Optimization**: Participants will understand the principles of scalability and user experience optimization in Android app development. They

will explore techniques for designing responsive layouts, optimizing app performance, and ensuring a smooth user experience across various Android devices. This knowledge enables participants to create scalable and user-friendly applications.

7. **Real-World App Development Scenarios**: Through practical projects and real-world examples, participants will be prepared to apply their Android development skills in diverse scenarios. They will learn to address common challenges faced in app development and explore opportunities to innovate within their projects. The program aims to empower participants to contribute effectively to the Android app development landscape across different industries.

CONCLUSION

In conclusion, the Google Android Developer Virtual Internship offers a transformative and comprehensive exploration of Android app development, providing participants with a wealth of knowledge and hands-on experience crucial for thriving in the dynamic world of mobile application creation. Throughout the internship, participants have acquired a foundational understanding of Kotlin programming, delved into UI/UX design principles, mastered data persistence, and navigated the intricacies of connectivity and background task management. Armed with this diverse skill set, participants are not only prepared to build innovative and user-friendly Android applications but are also poised to adapt to evolving industry trends and emerging technologies.

As participants emerge from this virtual internship, they carry with them the ability to craft scalable and responsive user interfaces, implement effective data management strategies, and navigate the complexities of Android app architecture. Beyond addressing the challenges of contemporary app development, graduates of this internship are well-prepared to contribute to the ever-expanding Android ecosystem. Whether pursuing individual projects, collaborating on team endeavors, or seeking further specialization, participants are empowered to make a significant impact in the Android development landscape. The Google Android Developer Virtual Internship serves as a springboard for participants to embark on successful careers, leveraging their newfound skills to drive innovation, enhance user experiences, and thrive in the fast-paced world of Android app development.

CERTIFICATE

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