1. INTRODUCTION

The development of the world of technology has led to the emergence of many android applications that help humans in obtaining convenience in living life. There are 2,797,581 applications in the Play Store as of September 2021 [[1]. As time goes by, developers continue to look for ways so that the applications they create can provide good results and experiences for users. Performance is a significant thing in an android application because it will be directly related to power usage, process speed in an application, and how the application interacts with users [7o]. One of the things that affect the performance of an application is the Architecture Pattern [2]. There are several architecture patterns that are used when building an android application, some of which are MVP (Model, View, Presenter), MVVM (Model, View, View-Model), and MVC (Model, View, Controller) [3]. Seven out of ten developers encounter problems in developing or building applications, and these problems can be solved by applying the architecture pattern or design pattern [4]. Android is an open-source Linux-based operating system developed by Google. The android operating system is mainly designed for smartphones and gadgets. Android is a favorite for users and developers because it is open source because developers will be able to modify and add features to this operating system [5]. In designing an android-based application, the application of the architecture pattern in writing code can be more easily understood, this will affect a case when a view on the application will be reused or if there are changes to the code, the developer will easily understand the flow and usability of the code to be used. changed [3].

Architecture Pattern is a pattern that is applied repeatedly to the creation of an application or software in order to build a dynamic and easy-to-understand software design construction [6]. The diversity of architectural models and databases is a challenge for developers so research is needed to find out which architecture is most optimally applied, because it can produce different performances [7].The use of architecture patterns can help accelerate the development of a software because it uses patterns that have been tested for usefulness [8]. The MVVM architecture pattern is an alternative to the previous architectural patterns, namely MVP and MVC. In its application in mobile app-based programming, the architectural pattern used by default is MCV [9]. Meanwhile, compared to MVVM the complexity of the code in the use of the MVC architectural pattern will be higher which will cause the code to be more difficult to debug. In a study conducted by Tian Lou that for performance evaluation, MVVM is superior to MVC [9]. In android applications, of course, the MVVM architectural pattern will present various advantages such as implementing the LiveData feature on the ViewModel. ViewModel will store data in the form of Live Data which will solve the problem of crashes in the application due to the cessation of activity [4]. Using Live Data will also solve the problem of manually setting the lifecycle, reducing code complexity.

In short, the application of MVVM to the android application code will reduce the complexity of the program code which affects the use of the code more efficiently. This research was conducted in order to find out whether it affects the performance of the android application. The purpose of this study is to produce performance values measured from CPU usage, memory usage, and execution time of an android application after the application of the MVVM architecture pattern to the application and to find out whether the advantages that exist in the MVVM architecture pattern make the performance of the Android application to be better. The issue raised is whether the use of the MVVM architecture pattern can affect the performance of Android applications.

In the process of implementation, the programming language used is Kotlin. Kotlin itself is a programming language developed by Jetbrains which was created mainly to develop smartphone applications based on Android, therefore Kotlin is also integrated with Android Studio. This programming language runs on the JVM (Java Virtual Machine) platform. Kotlin is also LLVM as a compiler and can be compiled into Javascript code [10]. In 2017 Google announced that Kotlin was becoming one of the official languages in the development of android-based applications [11].