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Data Integration with RESTful Web Service for Parents Tracking Help Android Application

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Abstract

In this day and age, the development of technology is developing very rapidly so it brings significant changes to the lifestyle of humans today. One of them is the increasing number of smartphones, particularly androids that run on Linux-based cell phones' operating systems. Even some android applications have been developed and used continuously in various areas, particularly in education. A considerable number of educational applications support students in developing their skills online, commonly known as e-learning. However, parents sometimes find it difficult for them to monitor the progress of their studies because they cannot communicate with tutors or teachers who teach their children. Therefore, the LingoParents Android-based application is designed to make it easier for parents to monitor their children's learning progress on the LingoTalks application. The parents can look at the children's profiles, and what courses are learned along with the values gained. In this application, the writer and the developer team use agile methodology by relying on the power of teamwork, incremental product, and iteration processes to bring about satisfying results. The application also supported RESTful web service using JSON to communicate with the server. By trimming the coding efforts and analyzing the data effectively, the developer might speed up the development process.

Keywords: Agile; E-Learning; Education; RESTful; Web Service.

Introduction

In this modern world, technology is rapidly bringing major changes to the lifestyle of human beings today. One of them is the growing number of smartphones, especially Android, a device that runs on Linux-based mobile phone operating systems. In addition, it can be said that Android is a mobile operating system that has grown with other operating systems that are developing today [1]. Moreover, even some android applications have been developed and are used in various areas frequently. One of them is the education field, which is used for children's learning that is not limited by distance because it can be done online and is easier to do [2].

However, this makes it difficult for parents to monitor the progress of their studies because of the difficulties to communicate with tutors or teachers who teach their children. Thus, the LingoParents application is developed as a parent-tracking help application to track the learning progress of their children and show ownership of their children's language lessons. Furthermore, parents can read interesting and helpful articles in the Insight feature that cover a wide range of categories, e.g., childcare, education, and lifestyle. The Live Event is also one of the available features that can be registered by parents in order to attend the seminar.

The implementation of web service makes the data can be integrated from various platforms; accordingly, parents can access the information easily. For instance, data in a web system changed through web service, so it can also allow data on the android application to change automatically through fire [3]. Other users cannot access the database directly, so they must request through the Internet and then use API, and the API will respond.

Literature Review

A. Android

Android is a device that runs on a Linux-based mobile phone operating system. It can be said that Android is a mobile operating system that has grown with other operating systems that are developing today [1]. With the open-source character of Android, this operating system continues to develop very quickly. In the beginning, Android Inc.

was acquired by Google Inc., a newcomer who creates software for mobile phones. Then, to spread the wings of Android, the Open Handset Alliance was formed, a consortium of 34 hardware and software industries, and also telecommunications, including Google, HTC, Intel, Motorola, Qualcomm, T-Mobile, and Nvidia [4].

B. Web Service

Web service is a set of functions and methods that reside on the server and the client can call a remote connection. It is required as an extension to connect the systems between the architecture, platform, and programming language utilized so that the system remains integrated [5]. It can be accessed or invoked by other applications over the Internet using data transfer formats as a form of messaging. HTTP (Hypertext Transfer Protocol) allows other applications to call web services. It also can be accessed using other protocols such as SMTP (Simple Mail Transfer Protocol), and yet, HTTP is the most common [6].

RESTful (Representational State Transfer) is one of the web service architectures which implement the client-server model and is broadly used. For instance, a web application is used to input the data as the server, and an android application is used to access the data as the client [7].

C. Mobile Application Development Technology

In developing an application, developers must determine the right technology and tools. In order to stay relevant, responsive, and on target, developers might consider key factors such as user base and targeting, distribution, code reusability, and performance [8]. Mobile application development can be grouped into three general categories, namely:

- Native

Native application development is the most reliable technology for developing mobile applications. By using this technology, developers can be sure that their applications can be developed according to official instructions and are fully aligned with the standard foundation in terms of UX (User Experience) and UI (User Interface). In general, Android native works well in terms of performance, security, and reliability, which integrates perfectly with the main platform [9].

Table 1. Native Application Development

	Android	iOS
Programming Language	Java, Kotlin, C/C++	Objective-C, Swift
IDE	Android Studio	XCode
SDK	Android SDK/NDK	iOS SDK

When it comes to designing and developing applications, each platform has development tools as well as technologies that are specifically tailored to the needs. In using native application development, developers must have the following specific skills.

- Hybrid

Hybrid development combines the benefits of web apps and native apps. In this case, an application can emulate the UI/UX standards of a platform and even have basic integration with the system [9]. To customize the look of a web application and unlock the full potential to some degree of a particular platform, developers still have to do additional programming with native development and also use additional plugins.

- Cross-Platform

This technology is the best choice if *developers* want to develop apps that are only once and run them anywhere. This can save development and deployment costs by up to 80% [8]. The purpose of this Cross-Platform application is also to solve the performance problems of hybrid technology and cost problems when writing various native languages for each mobile platform. The most important thing to execute all projects with technology is the Cross-Platform frameworks themselves. There are many Cross-Platform frameworks with their disadvantages and advantages. It all depends on the purpose of designing the app, which makes the developer choose the appropriate framework.

D. Design Architecture

Mobile applications represent a growing sector of the software industry and are becoming the most frequently used access point for the majority of company systems. Developers need to implement design architecture in favor of fulfilling the growing demand for quality and maintainable applications. [10]. The architectural design used in designing this Android-based LingoParents application is MVVM which is short for Model-View-ViewModel. MVVM is one of the application development patterns of model demonstrations by Martin Fowler. The advantage of this pattern is in the use of the Binding Engine, where this Binding Engine will avoid all boilerplate code that must be written to associate the ViewModel with the View to keep it updated automatically [11].

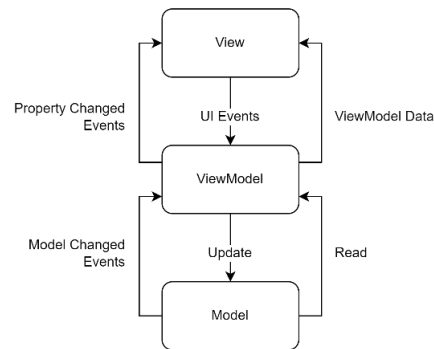


Figure 1. Design Pattern Model-View-View-Model

Based on the Fig. 1, MVVM implementation is divided into three essential parts. The first part is the model responsible for calling the API and controlling the availability of data contained in the repository. The ViewModel is the second part responsible for paying attention to the accessibility of the data and providing responses from the API. As for the third part, View is responsible for the UI settings that will be seen by the user [12].



Figure 2. Project Structure MVVM in LingoParents Application

Writing all the code, from initializing the view to creating the app logic or flow, in an Activity or Fragment class is a common mistake. This UI-based class is only allowed to hold the logic that handles the UI and interactions of the operating system. Coding separately can make the system easier to develop, maintain, and fix to minimize the possibility of bad things happening in the future [13]. Additionally, developers can minimize some of the problems associated with component lifecycles, and improve the testing capabilities of these classes, while controlling these classes remains as streamlined as possible.

Method

The development of an application is closely related to the Systems Development Life Cycle (SDLC) process with several methodologies that can be used. In designing the LingoParents application itself, the author and the developer team used Agile methods that rely on the power of cooperation between team members, *incremental models* and iteration processes to manifest satisfactory results [14]. The methodology iteration process in designing this application consists of six stages, as follows:

A. Planning

At this stage, Product Owners, Project Managers, and Scrum Masters collect requirements from clients or *stakeholders*. Then analyze the requirements given with the aim of seeing the feasibility of making the product, the production costs that will be incurred, to the needs of users.

B. Design

This design phase is the stage in which the plan that has been created is re-detailed into the basic structure of the software, including system design, programming languages, places, platforms to use, and application security measures. In the case of designing this LingoParents application, creating an end-to-end application flow and developing a prototype are also covered in the design phase.

C. Development

Application development is carried out based on the results of the application flow analysis from LingoTalk itself. With the design that has been provided in Figma by the UI/UX Designer team, the design of application's interface

design becomes more structured. After that, the author proceeds to the creation of the application flow by creating the logic in such a way, or the application coding process for short.

D. Testing

After the LingoParents application has been created and exported, it will be tested first by the Product Owner, Project Manager, and several other respondents. App testing is done to find out how each tester reacts or responds to the app that has been designed.

E. Deployment

At this stage, the application will be submitted for its intended use. Such as automating this process and the deployment schedule depending on the type of deployment needed. For example, just wanting to deploy a feature update, can do it with a small number of users (canary release).

F. Review and Maintenance

At this stage, users may already encounter bugs and errors that were not present in the previous testing phase. In some cases, this may lead to a return to the first step of SDLC. This stage can also be restarted for any new features that may want to be added in the next release.

Implementation and Results

A. Web Service Integration

The author creates an `APIClient` object class by using the Retrofit library to communicate with the server.

```
private const val BASE_URL =
    "http://localhost:3000/api/v1/"

private val gson =
    GsonBuilder().setLenient().create()
```

Firstly, the author creates a `String BASE_URL` with the `const val` data type due to its constant and static structure which will be used to set the base API URL in the Retrofit builder. Then declare a "gson" variable that returns the instance value from Gson based on the configuration set on the Retrofit builder.

```
private val httpLoggingInterceptor = HttpLoggingInterceptor().also {
    it.level = HttpLoggingInterceptor.Level.BODY
}

private val okHttpClient = OkHttpClient.Builder()
    .addInterceptor(httpLoggingInterceptor)
    .addInterceptor(TokenAuthenticationInterceptor())
    .connectTimeout(10, TimeUnit.SECONDS)
    .readTimeout(30, TimeUnit.SECONDS)
    .build()
```

To send a request to authenticated API, adding headers by using an `Interceptor` is required. In the development of this application, the author added two interceptors, `HttpLoggingInterceptor`, and a custom interceptor. The level of `HttpLoggingInterceptor` is adjusted to the `BODY` to log each request, response, individual headers, and body if any, through LogCat. Meanwhile, the custom interceptor is used to access the token and also refresh the token.

```
private val retrofit = Retrofit.Builder()
    .addConverterFactory(
        GsonConverterFactory.create(gson)
    )
    .baseUrl(BASE_URL)
    .client(okHttpClient)
    .build()
```

Afterward, a Retrofit variable is declared to return a Retrofit object. In this variable, it is necessary to add a factory converter to convert JSON objects to Java objects by entering the variable "gson" that was written earlier. Then input the constant variable "BASE_URL" to specify the base URL for its service. The author also inputs the variable "okHttpClient" used for custom OkHttp clients.

B. Final Results of The Application

The objective of LingoParents is the Parent Tracking Help application to monitor the progress or progress of children's learning where parents can see the child's profile, as well as the child's activeness towards the courses being studied. There are four main features, namely:

- Live Event

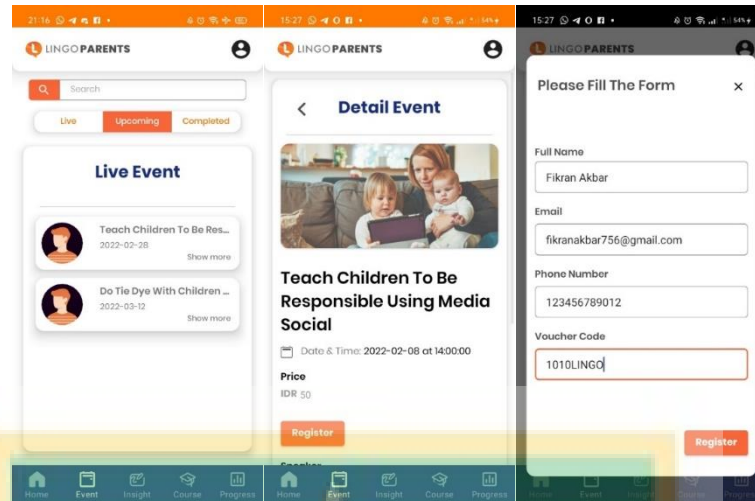


Figure 3. Live Event Menu, Detail Event, and Register Event

Based on Fig. 3 user can see the title and date of each event in the Live Event menu. There are three categories in this feature, namely the ongoing one on that day, which will be held for the next day, and so on, then the last one is the event that has been completed. User can also search for an event in the search box based on the keywords of the show's existing title. After the user has clicked one of the Live Events on the previous page, the user can see the detail of the event. In this Detail Event, there is a cover, title, date and time, and summary of the event. If the user wishes to register, the user must fill out a form containing their full name, e-mail address, telephone number, and voucher code if applicable.

- Insight

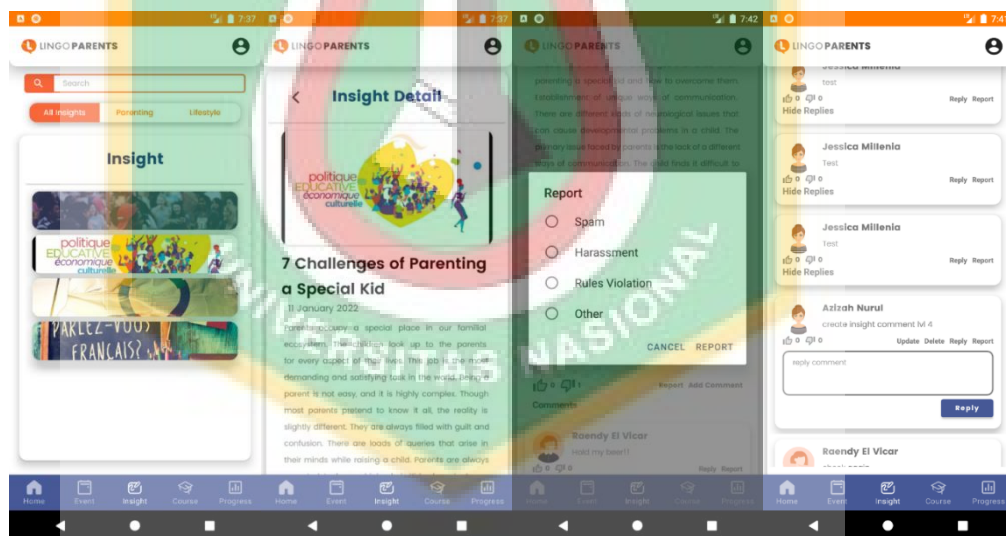


Figure 4. Insight Menu, Insight Detail, and Comment Section

The first screenshot in Fig. 4 shows the screen display when the user opens the Insights (Blog) menu. Users can view the covers of each blog in order from the most recent to oldest blogs by the publication date of the blog and can see a list of blogs by available tags or categories. In addition, users can also search for a blog in the search box based on the keywords of the existing blog title. Once the user has clicked one of the Insights on the previous page, the user can see the detail of the insight. In the Insight Detail, there is a cover, title, date of publication, and the content of the blog. If the user finds the content from the blog inappropriate for publication or other personal reasons, the user can report the content by pressing the "Report" button at the bottom of the content. The comments section of Insight Detail is shown in the last screenshot of Fig. 4. Users can reply to each other's comments by pressing the "Reply" button and also report the existing comments. Users can update and delete comments that have been created previously by the users themselves.

- Learning Progress

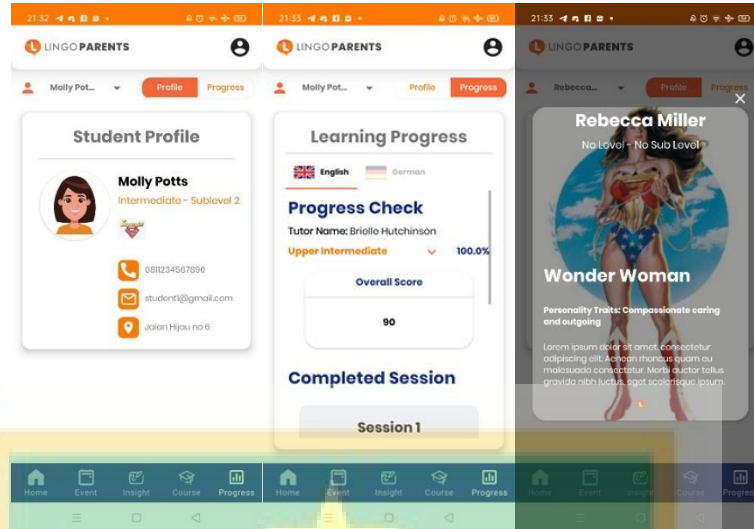


Figure 5. Student Profile, Learning Progress, and Student Character

Users can go to the Progress page to see the child's learning progress in the courses followed on LingoTalk. This page is divided into two parts which are the Student's Profile and the Learning Progress. The profile section displays information from the child, while the Progress page contains the child's information in this LingoTalk course. In the Student Profile section, users can see various badges that show the character that children have in participating in their courses. The badge icons are located below the current level inscription, such as "Intermediate – Sublevel 2", and can be clicked to display details of the badge, as shown in the last screenshot of the Fig. 5.

- Account Setting

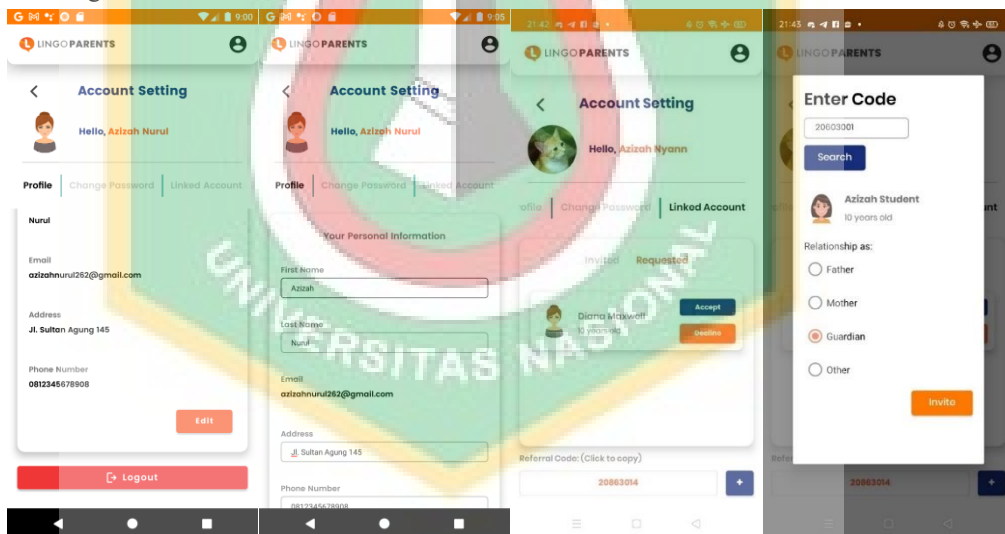


Figure 6. Account Setting, and Linked Account

On the account settings page, users can see personal information that includes their first and last name, e-mail address, profile photo, and home address. Other than that, users can update their account password and existing information except for their e-mail address. If the user wants to log out of the account, the user can press the "Logout" button at the bottom of the device screen, as shown in the first screenshot of the Fig. 6. In addition, users can associate a user account with their child, which can be done in two ways. The first way is to copy the user referral code at the bottom of the screen, and send a request directly from the LingoTalk account. Another way is to invite directly using their child's account code, and then the user must choose their relationship with the child they want to invite.

Conclusion

Based on the statement above, it can be concluded that the parent tracking help application can assist parents or guardians to monitor their children's learning progress, which is carried out online. Apart from that, parents can develop themselves by reading articles and participating in events related to parenting. By integrating the data with RESTful web service, the client side- which in this case is an android application- can access the data effortlessly.

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