ORIGINAL CONTRIBUTION

An Android-Based Information System for Enhancing Rural Transportation Services in Banjarnegara, Indonesia

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Abstract— Transportation is the movement of people or goods from one place to another using a tool driven by humans or machines. The large number of people in Banjarnegara Regency makes the need for rural transportation in Banjarnegara regency very important, especially for those who do not have private vehicles to travel from one place to another. Mobile technology is developing very fast, both in terms of hardware and software. Mobile-bile technology can now be used in various fields, including in the field of transportation. Therefore, in this study, an application will be made to help make it easier to find rural transportation and get information on the route of each rural transportation. There is also an admin website to make it easier for the ban-jarnegara regency transportation service to monitor the position of each rural transportation and also verify the account of drivers who register as online rural transportation. The system development method in this study uses the SDLC (software development life cycle) method with the waterfall model. The final results of the research are an online Angkot application and an online Angkot admin website.

Index Terms— Android, Website, Transportation information system, Waterfall

I. INTRODUCTION

The development of information and communication technology (ICT) has had a significant impact on various aspects of people's lives, including the transportation sector. In today's digital era, the use of technology, especially Android-based smartphones, has become a major need in supporting people's mobility. This phenomenon can be seen from the increasing use of online transportation applications that offer various conveniences such as fast booking, fare transparency, real-time vehicle tracking, and convenience in transactions [1, 2].

App-based transportation systems have been widely used in urban areas and have succeeded in changing people's behavior in accessing transportation services. However, rural areas such as banjarnegara regency still face challenges in the application of this technology. Banjarnegara regency, which is mostly mountainous, has a rural transportation system (angkudes) as the main mode of transportation for the community. The existence of angkudes is very important, especially in connecting villages with centers of economic activity, education, and public services in sub-districts or district cities.

Unfortunately, with the presence of motorcycle taxis and online transportation services, the income of angkudes drivers has decreased drastically. This is due to people's preference for online services, which are considered more practical, fast, and efficient [3, 4].

On the other hand, online transportation services have not been able to reach all rural areas due to the limitations of road infrastructure and uneven internet networks. According to the Banjarnegara Regency Transportation Office, this condition has an impact on the sustainability of conventional transportation operations, including limitations in fleet rejuvenation and service quality.

This phenomenon reflects the digital gap between urban and rural areas, both in terms of access and people's readiness to adopt technology. In fact, transportation digitalization has great potential to improve service efficiency, expand reach, and support local economic empowerment. Therefore, it is necessary to design an innovative solution in the form of an android-based rural transportation information system that can bridge the community's need for modern transportation services without overriding local potential.

This research aims to build an android-based rural transportation information system that allows the public to obtain information related to routes, fares, and vehicle locations in real time, as well as make online orders. This system will also be integrated with a web-based dashboard for the Department of Transportation, which functions as a tool for supervision, driver verification, and service evaluation. With this approach, it is hoped that rural transportation can be transformed into an inclusive, adaptive, and sustainable transportation service.

II. LITERATURE REVIEW

A. Transportation information system

Transportation information systems are technology-based systems used to manage, present, and analyze information related to transportation services. This system allows for the integration of passenger, driver, schedule, and fleet data digitally. In the context of public transportation, a good in-

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formation system can improve operational efficiency, service transparency, and convenience for users [1, 5, 6].

B. Android apps in transportation

Android is the most popular mobile operating system in the world, and it makes it easy for developers to build apps based on local needs. Android apps for transportation allow service booking, vehicle tracking, and estimated fares and travel time. A study by [7, 8] shows that Android apps are able to improve transportation accessibility, especially in areas with limited infrastructure.

C. Technology and social change

Technology and social change Information technology is one of the most significant agents of social change in the contemporary era. [9, 8], in the diffusion of innovations theory, states that the adoption of technology by society is influenced by five attributes: relative superiority, compatibility, complexity, testable, and observable. The application of technology will be more successful if it is in line with local social and cultural values and is able to provide real benefits. In the context of rural areas, the adoption of Android-based systems must take into account factors such as digital literacy, trust in technology, and availability of infrastructure. If implemented with a participatory and educational approach, the social changes caused are constructive and sustainable [10, 11].

According to [9, 12], in the theory of innovation diffusion, public acceptance of technology is influenced by the perception of the convenience, benefits, and suitability of technology with social values. In the rural context, technology adoption needs to be adjusted to the level of digital literacy, infrastructure, and culture of the local community [10, 13]. Native apps that are built using a special programming language depending on the operating system. For Android, use Java or Kotlin, while for iOS, use Swift or Objective-C. This type of application has advantages in performance and full access to device features [14, 15].

D. Firebase and its services

Firebase is a cloud-based application development platform that provides a variety of essential features such as: real-time database: storage of json-based data that is automatically synchronized to all users in real-time [16]. Authentication: a user authentication system based on passwords, phone numbers, or social media accounts such as google and facebook [16].

E. Web and supporting technologies

The web is part of the internet that presents information through hyperlinks between pages [17]. Static web presents fixed content written with HTML and CSS without high interactivity [2]. HTML is the standard markup language for creating and publishing web content [18]. CSS is used to design the look and design of web pages [17]. Javascript enables interactivity on web pages and plays an important role in the development of browser-based applications [18, 19]. Bootstrap is a CSS framework that makes it easy to develop responsive interfaces based on HTML, CSS, and JavaScript [20].

III. METHODOLOGY

This research is a development research with a quantitative and qualitative approach. This research aims to design and develop an Android-based rural transportation information system application that is integrated with a monitoring dashboard for the transportation agency. The research was conducted in the Banjarnegara Regency, and the research subjects included rural transportation drivers, passengers, and officers of the transportation office. Respondents were selected purposively according to their involvement in rural transportation systems. Data collection techniques include observation of the activities of drivers and rural transportation users, interviews with drivers, users, and officials of the transportation agency, questionnaires to measure user needs and satisfaction, and literature studies related to the development of transportation information systems.

A. System development methods

In a study on an android-based rural transportation information system in Banjarnegara Regency, the author developed a system using the software development life cycle (SDLC) method. The software development life cycle (SDLC) model used in this study uses a waterfall model. The author uses the waterfall model because it is a model in the software development life cycle (SDLC) that is simple and easy to understand and use in the development of a system. The waterfall model has several processes or stages in designing the system. The following are the stages in the waterfall model:

- Analysis this stage will produce a user requirement document or commonly referred to as data related to user desires in creating the system. This document will be the reference for the analysis system to translate into a programming language.
- Design The design stage is carried out with the aim of helping to provide an overview of the implementation of the Android-based rural transportation information system. The following are the designs made: a. Business design, the business design used is the unified modeling language (uml) using use case diagrams and activity diagrams as the system workflow. The tools to be used are Microsoft Visio 2013. B. An application architecture design will be created using a client and server architecture system. This architecture system will allow users to access the server directly with the help of firebase's api. C. Database design: This application uses storage with a Firebase database. By using firebase, all user data can be synchronized with other users and can be accessed in real-time. By using firebase, researchers no longer need to use a related database schema model because it uses the NoSQL concept. D. User interface design User interface design is used to help provide a design overview in building an Android-based rural transportation information system. The tools used to create user interface designs are figma.
- Coding the coding stage is to translate the design that has been made into a computer program. The result of this stage is a computer program that matches the design that has been made at the design stage. The programming language used at this stage is kotlin for the android platform and javascript for the web platform. While from the database side, it uses firebase real-time database as a centralized database.
- Testing the testing or testing stage is carried out using alpha testing. Alpha testing is carried out using the black box method, namely by conducting tests based on the functionality or functions that exist in the system.

IV. RESULTS AND DISCUSSION

A. Needs analysis

At this stage, the developer collects the needs completely and then analyzes what is needed and fulfilled by the program being built. The analysis carried out among them :

1) Functional needs

- Admins can register an account, log in, change their profile, verify and unverify their driver's account, add route information, delete route information, view the position of the driver, and see the position of the driver and potential passengers.
- Drivers can register an account with email, register an account with google, log in with email, log in with google, edit profile, change status from not working to working.
- Customers can register an account with email and google, log in with email and google, edit profiles, view a list of booking history and route types.

2) Non-functional needs

- Hardware, this analysis includes all the hardware that will be used in designing and manufacturing a system. The hardware used is an intel(r) core(tm) i3-7020u processor cpu @ 2.30GHz 2.30 GHz, 8.00 GB RAM, 128 GB SSD, 1 TB HDD and Android phones.
- Software, this analysis includes all the software that will be used in designing and building a system. The software used is Windows 11 Pro, System Type 64-bit Operating System, x64-based Processor, Android Studio Idea, Visual Studio Code and Bluestacks 5 Emulator.

B. Design

1) Business design

Use case diagram digunakan untuk menggambarkan aktivitas aktivitas yang dapat dilakukan pengguna pada aplikasi atau website seperti yang ditampilkan pada gambar 4.1 sebagai berikut :
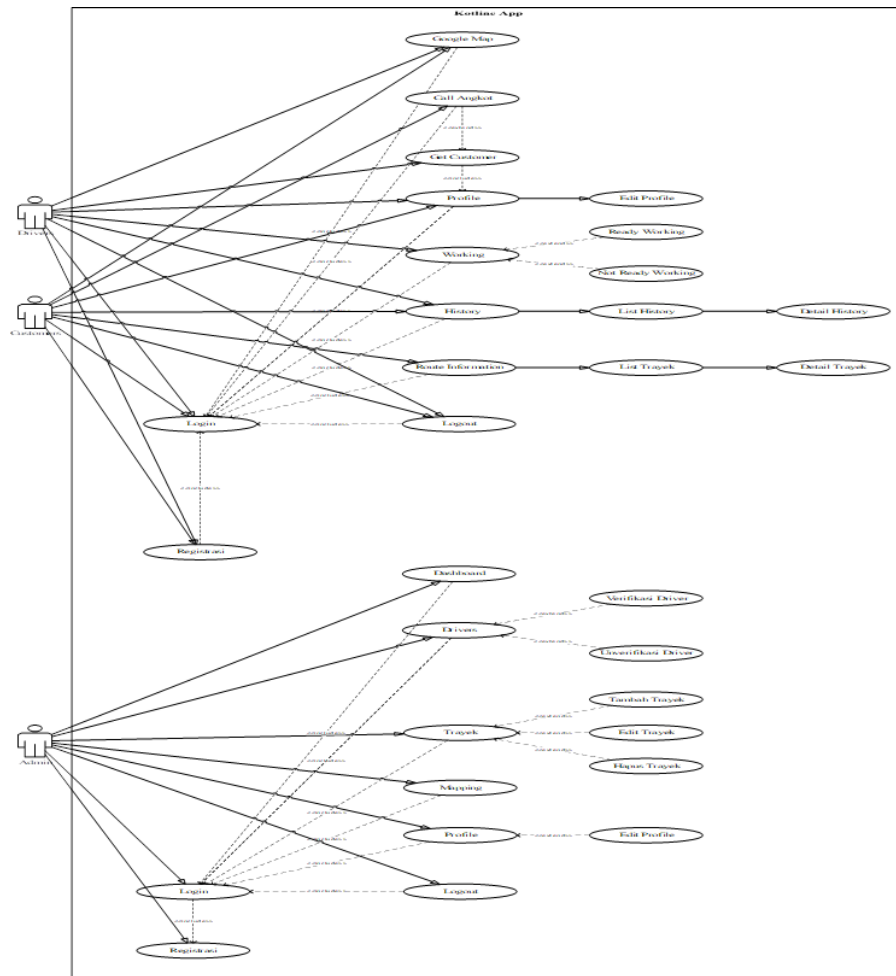

Fig. 1. Use case diagram application and website kotline

Activity diagrams are created to describe the system workflow on an application or website.

The workflow described is the parts in the use case diagram such as admin registration and login, admin dashboard, admin drivers, admin routes, admin mapping, admin profile menu, admin logout menu, customer login and registration, driver search, customer profile, customer history, route information, customer logout, driver log in and registration, getting customer, driver profile, working driver, driver history, and logout driver.

2) Architectural design

Mobile apps and websites authenticate accounts using Firebase authentication.

For the storage side, both use firebase real-time database and firebase storage, along with the client and server architecture design using firebase.
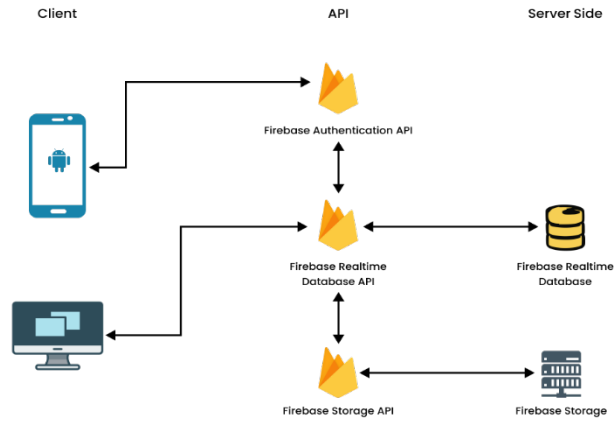
Fig. 2. Firebase architecture design

3) Database design

The database design of the firebase real-time database uses a tree model scheme where the database uses a unique key-value concept as follows
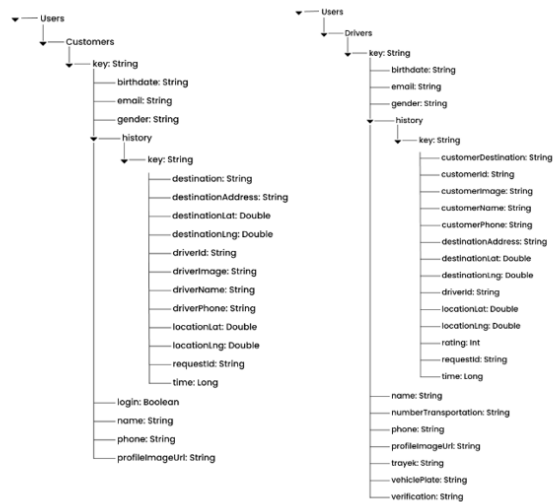

Fig. 3. Tree model scheme

4) Design user interface

Here are some mockup images from the splash screen page that feature the kotline logo and text.
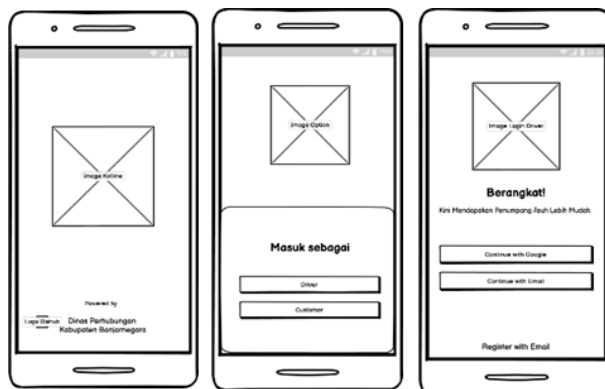

Fig. 4. Mockup images

C. Implementation

Implementation is the final stage in the construction of a system; where at this stage, the system will be implemented through a computer program code that can transform a design into a usable application.

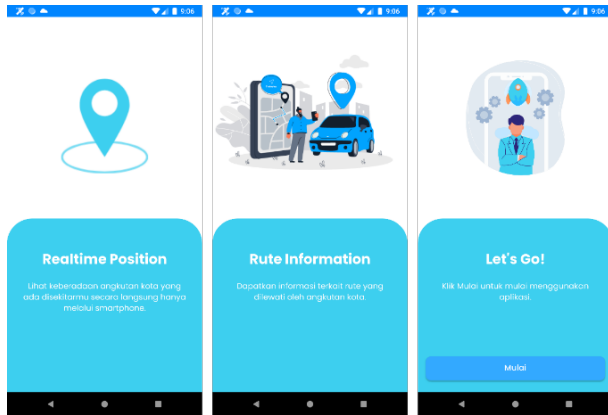The results of the implementation of the system are as follow:

Fig. 5. Implementation

D. Software testing

System testing is the process of executing a software system to determine whether the system matches the system specifications and runs in the desired environment. System testing is often associated with bug searches, program imperfections, errors in programs that cause failures in software execution.

Testing is done by testing each process and the possible errors that occur for each process. The system testing used is a black box. Black box testing is done to test software in terms of functionality specifications without testing the design and code of the program. The test is intended to determine whether the input and output functions of the software conform to the required specifications.

From the results of the tests carried out, it was found that the driver registration, driver login, driver profile edit, working driver, driver history, get customer, driver logout, customer registration, customer login, customer profile, customer history, route information, angkot order, driver logout, admin registration, admin login, drivers page, route page, mapping page, and setting page showed that all the tests that had been carried out produced successful outputs So that this test can be concluded to be valid.

V. CONCLUSION

The online Angkot application (online) is an application that can be used to make it easier for the public to see Angkot information and make it easier for drivers to get passengers through smartphones. There is also a feature to view travel history, which can give ratings from customers to drivers to determine customer satisfaction with driver services. In addition, there is an admin website where you can see information on the use of public transportation, verify driver accounts, add public transportation information, and see the positions of public transportation and customers in real time.

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