

SMART APPLICATION COUNTING COST OF INSTALLATION PAVING BLOCK UTILIZING ARCORE API BASED ANDROID

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ABSTRACT

One of the factors of beauty in the yard is a clean yard and a neat. With the use of paving block making the home page is neatly arranged, and the absence of muddy even the absence of grass growing wild. Use of block paving has many forms too, there are even paving block specifically can be overgrown with grass to make it look more neat growth. In the measurement area of the page or a terrace, a user is still using a manual measurement, and a lack of knowledge of farmers about the types of block paving, as well as not knowing how the needs and what's the price range. To handle these problems we built an android-based measurement of the yard or terrace can facilitate the user to measure the area of the page, recommend the number of the purchase of the paving block, and give price range. This application makes use of This API to facilitate the user to measure the area of the page, and utilize the Firebase Database to get information about the price data block paving. After testing with the black box method the conclusion that there is need for applications that can measure the area of a area and can mentaksirkan price needs if you want to install ceramic tile or paving block.

Keywords : paving block, ceramic tile, Android, ARCore API, Firebase Database

1. INTRODUCTION

1.1 Background

One of the beauties included in building or renovating a house is the neatly arranged yard. Most Indonesian people on their yard are only covered with grass, sometimes grass that grows unevenly. And if there is care for the grass, it will cost more. But there are also those who use paving blocks, with this there is no maintenance cost anymore only for the installation fee only once. Seeing trends in ARCore technology also affects how it is used in activities in the field of building services, one of which is renovation or house construction, where there will be a paving block on the yard.

So that the page looks neat and beautiful, when installing a paving block requires planning,

including planning costs that are often not small in price. After the researchers conducted a data search through a questionnaire on February 24, 2019, 45 people out of 59 people wanted to renovate or build a house. They also want to use paving blocks in their yard. Technically there are 6 things done to estimate the cost of installing a paving block, namely the measurement of the area, the reduction of the area that is not installed, the selection of the type of paving block, the calculation of the number of paving blocks used and the total cost.

Before installing a paving block, the first thing to do is to know the width of the page. ARCore plays an important role in the process before installation. The length of measurement with manual tools becomes a pole where users who want to install a paving block become lazy, especially later if the page is wide. However, ARCore can measure the length (Length) and width (Height), so it can measure the pages in a house without manual measurement tools and faster. Once the yard area can be expanded, then it is further reduced by areas that are not installed with paving blocks.

The installation of paving blocks also makes the house renovator confused about how many purchases of paving blocks. Therefore the researchers used the results of the measurement of the page area and divide by the size of one paving block. Each paving block has different size, so the size of the paving block unit follows the type of paving block used.

After the process of measuring the area and knowing how many paving blocks to buy, the next step is to estimate. Even the renovator did not know the range of costs required to install the paving block. Therefore, researchers look for the price of a paving block unit which is often purchased and an estimated number of costs. The amount of the fee is in the form of a range and may be excessive.

ARCore is a Development Kit (SDK) software launched by Google in the field of Augmented Reality (AR). The release of ARCore is stable on May 8, 2018 and runs on the Android platform. ARCore uses three main technologies. The first is motion tracking with functionality to track and understand position relative to the world. Second is an understanding of the environment in which the act as detecting a surface location and size such as a

table or land. The last is the light estimation that allows your phone to be able to estimate lighting conditions in that environment. Google released ARCore aimed at removing hardware dependencies on AR technology [1].

ARCore uses sensors on smartphones and doesn't need any additional hardware. Technically, ARCore does 2 things, first the sensor moves position like the presence of movement and the second is to build understanding for mobile so just understand the real world. ARCore has a motion tracking feature that identifies points and points seen using a mobile camera. At this point, ARCore is able to determine the position and orientation of the mobile if it moves. In addition, ARCore can also identify objects such as flat surfaces such as tables or floors and lighting estimates in the area. With this function, ARCore is able to build its own understanding of the real world around it. Understanding of the real world we can place objects or other information to integrate with the real world.

Based on the description of existing problems, as a solution this research focuses on prototyping / prototyping the application of paving block installation estimation using ARCore technology as a solution to easily calculate the area of the page, how many paving blocks are needed and the costs incurred.

1.2 ARCore

ARCore is developing this project Previously, the Tango Project. The difference from ARCore is, Project Tango requires hardware specifications on the camera to run AR like on Asus ZenFone AR phones [4].

In the Tango Project, users must buy a phone with Asus specifications and Android makers make the same specifications. And ARCore, Android users can enjoy AR with all phones having an Android version of Nougat, or in it. Currently Tango provides more real AR because of hardware support compared to ARCore. But, Google will ask and pressure the phone maker to improve the capabilities and specifications of the camera. ARCore uses three virtual capabilities in the real world (5).

The ARCore feature uses three main capabilities to integrate virtual content with the real world as seen through a camera phone, namely:

1. Motion tracking is a function of understanding and tracking its position on the world.
2. Understanding the environment is how to detect the location and size of all surface types, both horizontal, vertical and sloping.
3. Estimating light is a way to estimate light conditions from the environment [6].

1.3 Firebase Database

Firebase is a service from Google that is used to facilitate developers. With Firebase, developers can focus on developing applications without having to give a big effort. The two main features of Firebase

are Remote Config Base and Firebase Realtime Database. In addition there are supporting features for applications that require notification, namely Firebase notifications.

Firebase provides a database on realtime and backend services. This service is useful for providing developer tools then application programming interfaces that allow application data to synchronize on the client and stored in the Firebase cloud. The company provides a client library that enables integration with Android, iOS, JavaScript, Java, Swift and Titik.js app. The database can also be accessed via the backup API and bind it to several JavaScript frameworks such as AngularJS, React, Ember.js and Backbone.js. Developers who use realtime databases can secure data by using security rules that are implemented by company servers. The Firebase Realtime database is a database that is stored in the cloud. Data is stored as JSON and synchronized with every connected client.

1.4 Research Methodology

In conducting research, concrete data are needed to support the research being carried out. These data are obtained by various methods. The research methodology used in writing this research uses descriptive research methodology. Descriptive method is a method of research carried out by trying to describe a symptom, event or event that occurs at the place being investigated ie newly released technology based on fact finding with the right interpretation [10]. This research method has two stages, namely the stage of data collection and the stage of software development. The research framework can be seen in Figure 1 below :

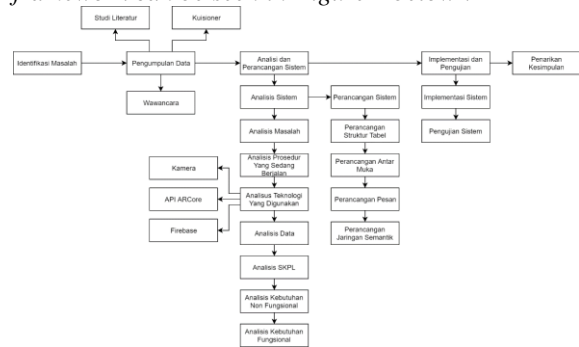


Figure 1. Research Stages

1.5 Software Development Methods

The method used in development the software in this research is the method waterfall [3]. The following picture is a method of development software like image 2 :

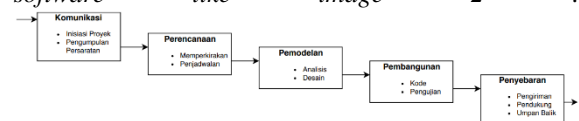


Figure 2. Waterfall Method

2. RESULTS AND DISCUSSION

2.1 Systems Architecture Analysis

The system to be built is the application personal financial planning uses Firebase Database and ARCore API. The system architecture to be built can be seen in Figure 3.

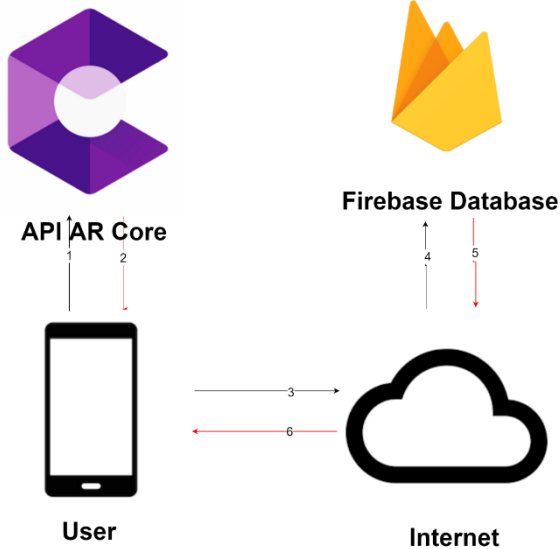


Figure 3. System Architecture

2.2 Problem Analysis

The problem analysis stage is the first step of system analysis. This step is needed in order to find out the problems that occur in the running system. Therefore the first step is to analyze the problems that arise. Based on the problems that have been described in chapter 1, here are the problems in this study, namely:

1. Users find it difficult to measure pages because they still use manual measuring tools. So that during the measurement process takes a long time.
2. In the process of calculating the need for paving blocks, users are afraid if there are advantages or disadvantages when purchasing. The user does not know how many paving blocks to buy. That's because there are many types of paving blocks and the many sizes available
3. Users have difficulty with the range of costs incurred if they want to install a paving block. Because there are many types of paving blocks, each of these types has different prices. This concerns the purchase of paving blocks.

2.3 Analysis Procedure to be built

The procedure to be developed is a proper sequence of activities from the stages that explain what process will be carried out, who will work on the process, and how the process can be done. Analysis of the system to be built

is can be seen in Figure 4.

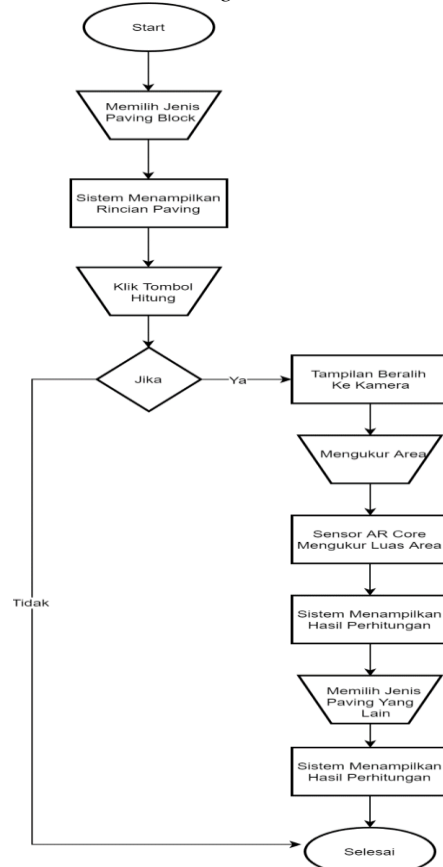


Figure 4. Analysis of built procedures

2.4 Analysis of Technology used

Technology analysis is carried out to determine the technology used in the system to be built. Following are the technologies used in the system to be built, among others:

1. ARCore

ARCore is a Google platform for the AR experience. Using a different API, ARCore can make your phone feel the environment, to understand the world, and interact with objects. Several APIs are available on Android and iOS.

The ARCore feature uses three main capabilities, namely:

- a. movement tracker, cellphone can understand its position against the real world.
- b. understanding the environment, the phone detects the size and location of horizontal, vertical and oblique surface types.
- c. light estimation, the telephone to estimate the lighting conditions of the environment.

2. Camera

Used as a tool for projecting display images and can also capture video on a cellphone or Smartphone as a complementary feature. Most camera phones have various features, such as auto focus, digital zoom, and other features. Some camera features on cell phones have the ability to

work as a digital camera and are able to record videos.

The role of the camera here is as for ARCore itself, where ARCore can be able to see real objects in built applications. The camera cannot upload photos or save images, only as a tool for ARCore to measure the surroundings. This measurement is in realtime where to draw lines on the screen.

3. Firebase Database

Firebase provides a database on realtime and backend services. This service is useful for providing developer tools then application programming interfaces that allow application data to synchronize on the client and stored in the Firebase cloud. The company provides a client library that enables integration with Android, iOS, JavaScript, Java, Swift and Titik.js app. The database can also be accessed via the backup API and bind it to several JavaScript frameworks such as AngularJS, React, Ember.js and Backbone.js. Developers who use realtime databases can secure data by using security rules that are implemented by company servers. The Firebase Realtime database is a database that is stored in the cloud. Data is stored as JSON and synchronized with every connected client.

2.5 Functional Requirements Analysis

The system to be built consists of two types of architecture, OOP (Object Oriented Programming). The stages of design analysis using UML are use case diagrams, activity diagrams, and class diagrams. Analysis of functional requirements will be explained as follows:

2.5.1 Spesifikasi Kebutuhan Fungsional

Functional requirements specifications are system specifications provided to users. Specifications of the functional needs of users can be seen in Table 1.

Table 1. User Functional Specifications

Kode SKPL	Software Requirements Specifications
SKPL-F-001	The system provides facilities for application users to use the paving block recommendation feature
SKPL-F-002	The system provides facilities to search for types of paving blocks
SKPL-F-003	The system provides facilities for application users to access the select paving block feature
SKPL-F-004	The system provides facilities for application users to exit the system

2.6 Use Case Diagrams

Use case diagram used to describe the relationship that occurs between actors with activities on the system. Use case diagrams in this application are as in Figure 5 below.

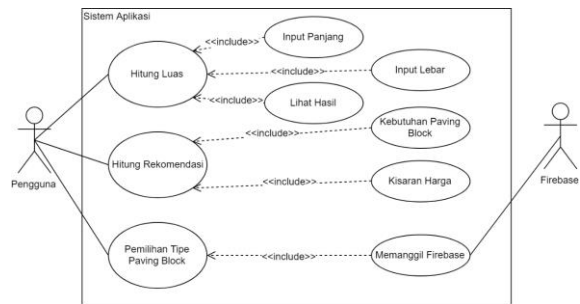


Figure 5. Use Case Diagram

2.7 Scenario Use Case

Use case scenario aims to explain how the steps of each process exist in each use case. The use case scenarios created can be seen in Table 2-4

Table 2. Scenario Use Case Measuring Area

Use case name	Measuring Area	
Related Requirements	A.1	
Goal Context	In	Users can access broad measurements
Preconditions	The user selects a wide measuring menu	
Successful End Condition	Showing results from area measurements	
Failed End Condition	-	
Primary Actors	The user	
	Secondary Actors	-
	Trigger	The user selects a wide measuring menu
Main Flow	Step	Action
	1	The user selects a wide measuring menu
	2	The system displays an extensive measurement menu page
	3	The user enters data A.1
	4	The system processes data A.1
	5	The system displays broad results

Table 3. Scenario Use Case Calculating Recommendations

Use case name	Calculating Recommendations	
Related Requirements	-	
Goal Context	In Users can access optimization of paving block requirements and price ranges.	
Preconditions	The user selects the Calculating Recommendations menu.	
Successful End Condition	Displays the optimization page for paving block requirements and the price range needed.	
Failed End Condition	-	
Primary Actors	The user	
	Secondary Actors	-
	Trigger	The user selects the Calculating Recommendations menu.
Main Flow	Step	Action
	1	The user selects the Calculating Recommendations menu
	2	The system displays the Calculating Recommendations menu page
	3	The user chooses the type of paving block
	4	The system processes data requirements A.2
	5	The system displays the results of optimization of paving block requirements.
	5	The system displays the price range.

Table 4. Scenario Use Case Type Selection

Use case name	Choose the Type of Paving Block	
Related Requirements	-	
Goal	In Users can access	

Context	Firebase Database	
Preconditions	The user has been displayed as a recommendation	
Successful End Condition	Showing various types of paving block types	
Failed End Condition	-	
Primary Actors	Pengguna	
	Secondary Actors	-
	Trigger	The user chooses paving blocks
Main Flow	Step	Action
	1	The user has entered the recommended results
	2	The system displays paving block options

2.8 Class Diagram

Class Diagram is used to describe the classes involved in the analysis of a system to be built. The class diagram that is created is shown in Figure 6.

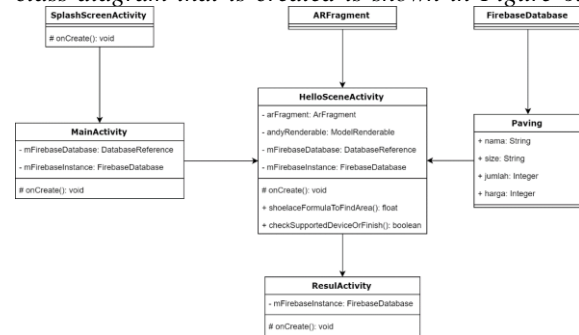


Figure 6. Class Diagram

2.9 Sequence Diagram

Sequence Diagram is describing the interaction between objects that serves to indicate communication between these objects. There are several sequence diagrams in the system that is built, such as Figure 7-8.

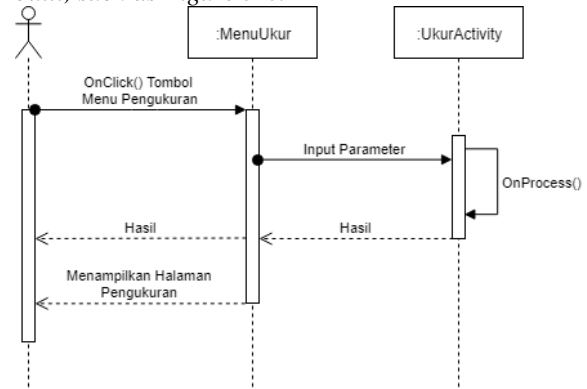
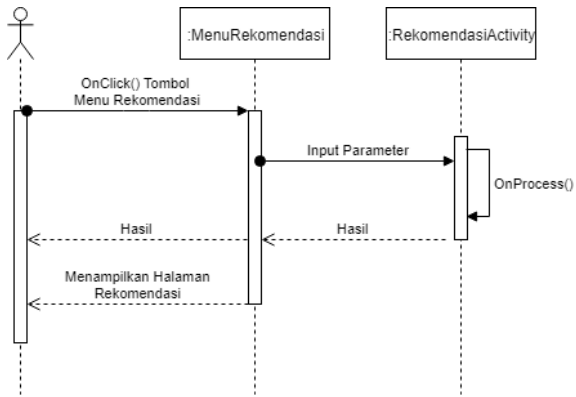


Figure 7. Sequence Diagram Calculate Area



Gambar 8. Sequence Diagram Calculating Recommendations

2.10 System planning

2.10.1 Menu Structure Design

The design of the menu structure is a description of the path of application usage so that applications that are built are easy to understand and easy to use. The following application menu structure can be seen in Figure 9.

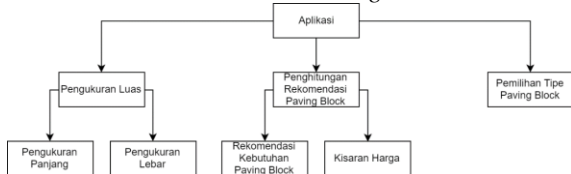


Figure 9. Application Menu Structure

2.10.2 Interface Design

The design of the interface describes the display plan in the application, making it easier for implementation and application development. Here is an overview of the application interface that is built :

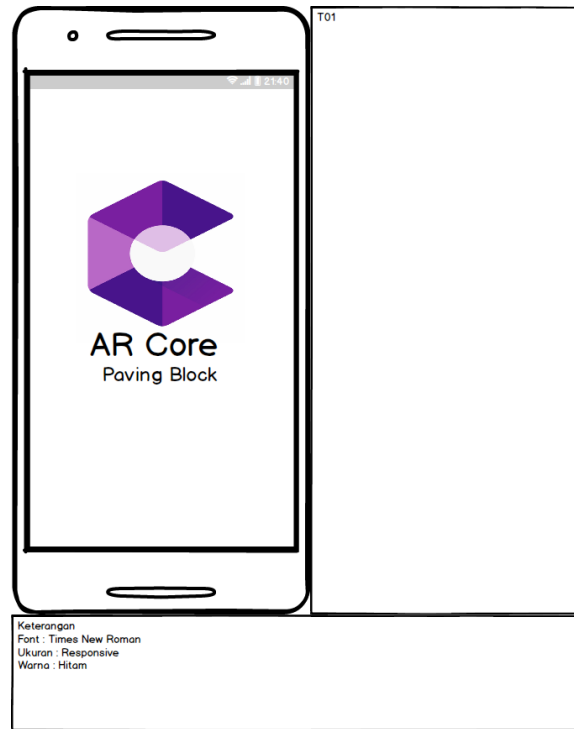


Figure 10. Loading Interface

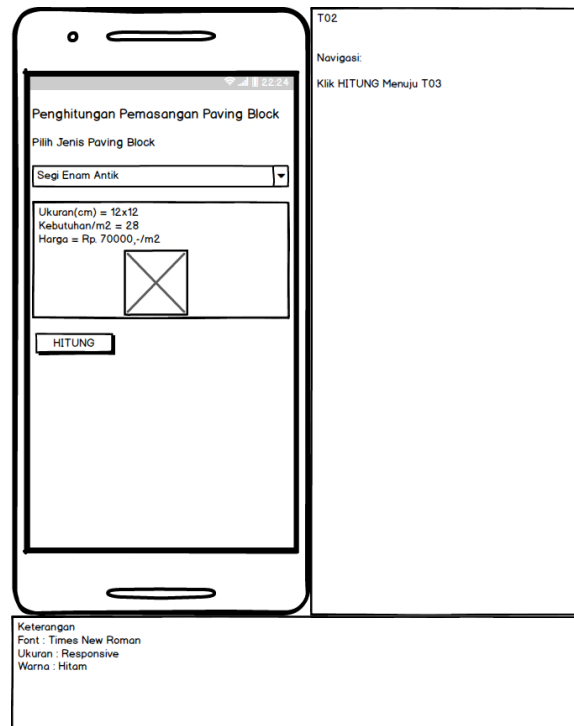


Figure 11. Main Menu Interface

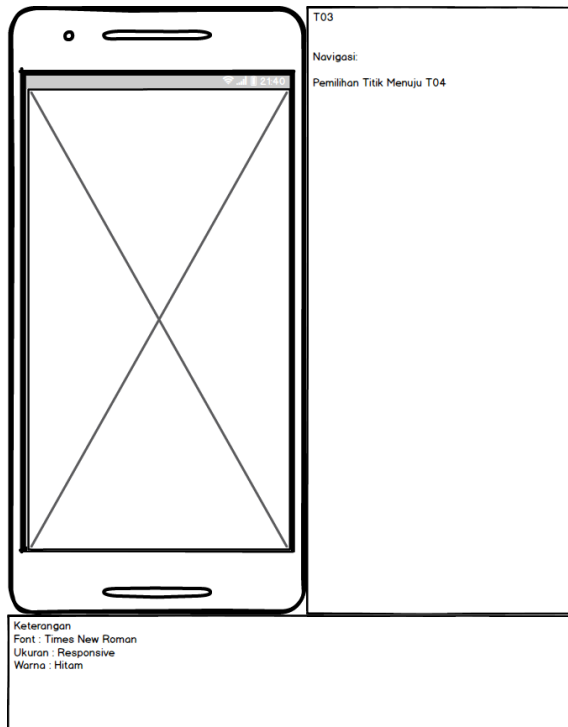


Figure 12. Camera Usage Interface

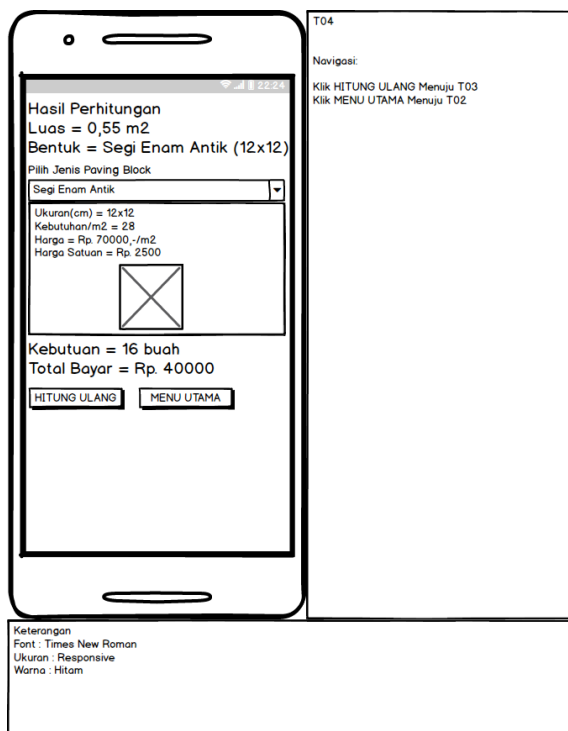


Figure 13. Results Interface

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3. CONCLUDING

3.1 Conclusion

Based on the results of the design made, the smart application design calculation of the cost of installing paving blocks utilizing the Android-based ARCore API is in accordance with what is expected for further testing.