

Mobile-Based Design of Cost Estimation Calculation Application with Using Framework Cordova Case Study of Dki Jakarta Region

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Abstract: *Cost estimation is a part that will be used as a basis for determining whether a construction project is feasible or not, the estimated cost is also required at the beginning before the start of a project. Cost estimation has an important role for the parties involved in it such as the Project owner, Consultant Planner and contractor.*

In general, construction cost estimates are divided into conceptual cost estimates and detailed cost estimates. Conceptual cost estimation is the estimated cost based on the concept or general description of the building to be built, for example a modest house, a luxury home, and. Through this estimation, conceptual costs are obtained, namely costs based on a general description that becomes a reference to the planned building construction before the detailed costs are calculated. Detailed cost estimation is the estimated cost based on a detailed calculation of the quantity and unit cost of each building component so that a more accurate total cost is obtained.

The data used in this study came from the Indonesian Association of Appraisers (MAPPI) and the Ministry of Public Works and Homework which have been reviewed and used in the professional world.

Keywords: *Estimated construction costs, cordova, hybrid based mobile applications.*

I. INTRODUCTION

With the development of the era a lot of new buildings have sprung up, especially in Indonesia. In Jakarta, high-rise buildings are growing very rapidly, on detik.com daily November 3, 2017 Colliers International Indonesia's research said that until 2019, there will be 189 new high-rise buildings that meet Jakarta, of which 113 buildings are apartments, 31 hotels and 45 offices.

Property growth has positive effects for the government and society, such as tax revenue, helping to reduce unemployment, create jobs, and make the investment climate grow.

The realization of a building due to a process ranging from planning to implementation known as the project. In the process of implementation and financing, it is necessary to first make a cost estimate.

In a construction project, the estimated cost is one part that will be used as a basis for determining whether a construction project is feasible or not. cost estimation has an important role for the parties involved in it such as the Project owner, Consultant Planner and contractor.

In general, construction cost estimates are divided into conceptual cost estimates and detailed cost estimates. Conceptual cost estimation is the estimated cost based on the concept or general description of the building to be built, for example, a simple house, luxury house, and so on. Through this estimation, conceptual costs are obtained, namely costs based on a general description that becomes a reference to the planned construction of buildings before the detailed costs are calculated.

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Detailed cost estimation is the estimated cost based on detailed calculations of the quantity and unit costs of each building component so that a more accurate total cost is obtained.

In its routine there are obstacles that are often faced by the community as project owners, namely ignorance of how to calculate the estimated construction costs needed to build a building. For contractors or corporations the calculation of cost estimation takes a lot of time and inaccurate data because the calculations are still manu and not digitally documented. Therefore the authors are interested in limiting the research to the topic "Application Design Calculation of Estimated Construction Cost (Estimated Construction Cost) based on cross-platform mobile using the Cordova framework." The author uses a mobile platform for the first reason the population of mobile internet users in Indonesia is very significant, seen from the results of a survey conducted by Infographics below:



Figure 1.1 Indonesian Internet User Statistics 2016 Source 1: <http://isparmo.web.id/2016/11/21/data-statistik-pengguna-internet-indonesia-2016/>

Secondly, this is the era of embedded device platforms where smartphones are always attached to their users and are the main needs of the community in supporting their daily activities. In addition, the authors use the Cordova Framework with the reason that connoisseurs of this application can be used on various mobile platforms, so that people are not complicated to use this application if the platform used is not Android, because Indonesian android users dominate other platforms such as IOS. Infographic released by Waiwai Marketing said that Android users in Indonesia reached 41 million users while for iOS there were 2.8 million users.



Figure 2 Indonesian Android User Data Source 2: <https://inet.detik.com/consumer/d-3054169/android-k-controlled-asia-tenggara-di-indonesia-paling-juara>

II. METHOD

2.1 Cordova

Cordova is a platform for building native mobile applications using HTML, CSS and JavaScript. Native mobile applications supported include Android, iOS, Windows Phone and Blackberry.

Apache Cordova contains a set of APIs (Application Programming Interface) for accessing devices from mobile devices. Devices include cameras, GPS (Global Positioning System), storage and others. With

using UI (User Interface) frameworks like jQuery Mobile, Dojo Mobile or Sencha Touch, then we can access this API. In other words we can build applications using only HTML, CSS and Javascript.

By using the API from Cordova, we don't need to build applications using native code like Java, Objective-C and others. We only use web technology with web programming languages and are installed on the relevant mobile devices. Because it uses Javascript, applications that we build on a mobile platform can be used on other platforms with little or no change.

Applications generated from Cordova are packaged in applications using the SDK of each platform and can be applied to other platforms using the SDK platform.

2.1.2 Cost Estimation Calculation

Cost estimation is the calculation of cost requirements used to complete an activity or work in accordance with requirements or contracts.

According to experts, Estimates and Costs are interpreted as:

Estimated:

1. (Harinaldi 2005)
the whole process that requires and uses an estimator to produce an estimate of a parameter.
2. (Tockey 2004) a
measurement based on quantitative results or in other words, the level of accuracy can be measured by numbers.

Costs:

1. Madiasmo (2000: 9) argues that cost in the broadest sense is the use of economic resources as measured by a unit of money that occurs or is likely to occur for a particular object or purpose.
2. Supriyono (1999: 16) according to him the costs (expenses) are the economic cost that is sacrificed or used in order to obtain income and will be used as a reduction of income.

According to Pratt (1995: 19) in his book states that the function of cost estimates in the construction industry are:

- a. To see whether the estimated construction costs can be met with existing costs.
- b. To regulate the flow of funds when construction is underway.
- c. For competence during the bidding process. Cost estimates based on specifications and work drawings prepared by the contractor must ensure that the work will be carried out properly and the contractor can receive a decent profit.

3. System Method Development

The method that I use in developing this system is Extreme Programming (XP). The method with the Extreme Programming approach was chosen because it can make changes quickly, it is very suitable for the application that the author developed, other than that this model does not require a lot of teams in its design.

Extreme Programming is a model included in the Agile approach introduced by Kent Back. According to his explanation, the definition of Extreme Programming is: "Method of developing software that is fast, efficient, low risk, flexible, predictable, scientific, and fun".

3.1. Planning Stage

The steps undertaken in this stage are: Planning, Design, Coding and Testing.

In the planning stage, developers and clients usually make plans about the requirements of the software to be made. In this way it allows the technical team members to understand the business context for the software to be developed and to feel the need for outputs, key features, and functionality.

After doing the design, the XP team conducted Requirements Analysis. This step is an analysis of system requirements. Data collection in this stage can carry out a research, interview or literacy study. This stage will produce a user requirement

document or can be said as data related to the user's wishes in making the system. This document will be the system analyst's reference for translating into programming language.

After that the team carries out the design process, the design process will define the requirements and requirements of a software design that can be estimated before coding (coding). At this stage the team focused on data structures, software architecture, interfaces, and algorithms. This stage ultimately produces a software requirement. The document will be used by the technical team (programmer) to make the system.

In the coding process, designs that have been made previously will be translated into programming languages. This is the core of the application that will be made later.

If the coding stage is complete, the team can do the testing. Testing is done so that the team can find out the errors or errors that occur in the program.

The next step is documentation. Documentation is the most important part of software development, from the documentation can contain writing, diagrams, pictures, flowcharts, explanations that the end result is a user manual, or a user manual, so that users can be facilitated to operate applications that have been made previously will be translated into programming languages. This is the core of the application that will be made later. If the coding stage is complete, the team can do the testing. Testing is done so that the team can find out the errors or errors that occur in the program.

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3.1. Planning Stage

A. Process Calculation System Model using Use Case Diagrams

Calculation System Process Modeling using Use Case Diagrams.

The depiction of the use-case system is a depiction of the business use case which is described in detail and specifically. The use case system model in the application system of the estimated building cost application is illustrated in the figure below:

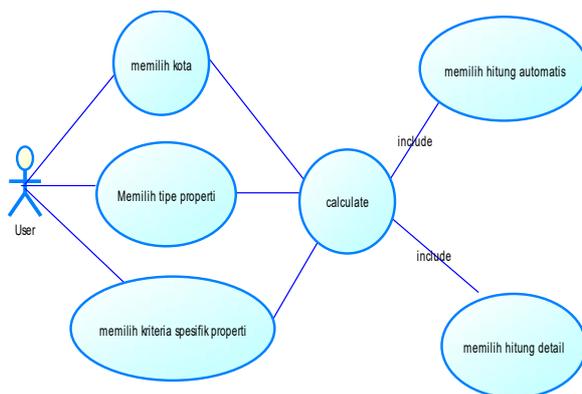


Figure 9.1. Use Case Diagrams (Source: Processed Researchers)

B. Modeling Process System Calculations using Activity Diagrams

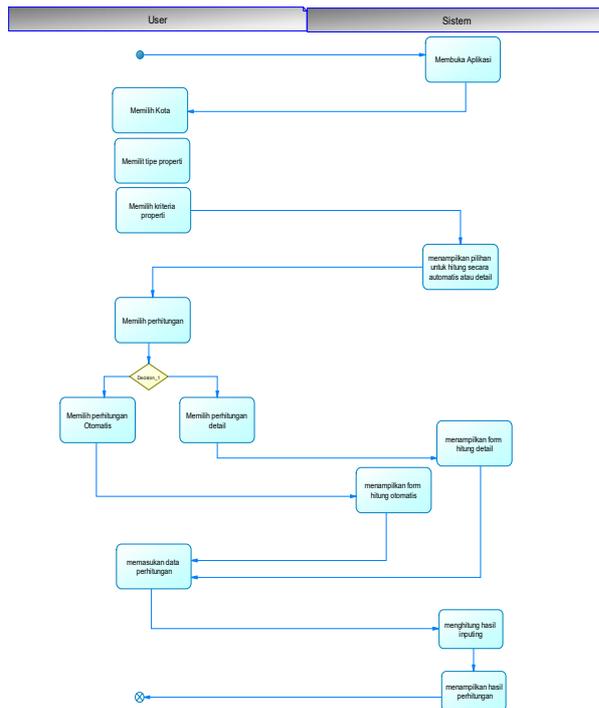


Figure 9.3.3 Activity Diagram (Source: Processed Researchers)

In the picture above, it is explained that the initial step of the user is to start opening the construction cost estimation application, then the user chooses the city first, because each city has different material prices and wages, then chooses the type of property, because the type of property is used by the system in order to differentiate the composition of buildings from each existing type. Then property criteria are sub of property types, for example residential property types, have sub criteria such as simple houses, medium houses and luxury homes. Then the user chooses to count automatically or count in detail. What distinguishes the calculation automatically and in detail is, the automatic calculation of the user only enters the area of the building and the system will display the estimated cost of the building with the selected property classification. This calculation can be called a conceptual calculation. Meanwhile, if the user wants a more detailed and specific calculation, the user can choose the detailed calculation. Detailed calculations have better output accuracy than automatic calculations. Then the system will send the calculation form based on the user's choice, if you choose automatically the system displays the calculated form automatically and vice versa for detailed calculations. Then if the user has filled in the data in the calculated form the system will calculate the calculation and display the output of the estimated construction costs.

III. DISCUSSION

4.1 Initial Design of the Program

4.1.1 Home Screen The screen display

In the image is the main screen display in the application. Where users can choose the menus available on this page such as the calculation of construction costs, general building specifications, floor indexes, material indexes, news and publications.



Figure 4.1: application, main display
Source 4: Researcher's processed data

4.1.2 City Selection Page

In the city selection page, the user can choose which city would be used to calculate the estimated cost, because each city has different unit prices of materials. After the user selects a city the screen will move to the Property Type page

4.1.3 Property Type Selection page

In the Property Type page. Where users can choose the type of property they want according to the desired criteria for example: Residential Houses, Warehouse Buildings, Multi-storey Buildings. After the user selects the property type, the screen will move to the Property Type page.

4.1.4 Property Kind Selection page

The display in Figure 14 is a view to select the type of property. Where the user can choose the type of property that is cool according to the desired criteria for example: If the user previously chose the type of residential property then in the type of property the user can choose one of the existing criteria such as Simple Dwelling, Medium Dwelling, Middle Dwelling After the user selects the type of property then the screen will move to the Building Specifications page.



Figure 14 Property type selection page
(Source: Processed Researchers)

4.1.5 Building Specifications Screen with Automatic Calculation Type

The display in Figure 15 is a display for entering building specifications. Where the user can enter building specifications such as land area and building area and property type, the screen will move to the last page of this menu, which is the Estimated Construction Cost Result.

Hitung Anggaran Rumah

Data Rumah

Panjang Rumah Meter

Lebar Rumah Meter

Harga Bangunan

Batu M3

Bata Satuan

Semen Kg

Pasir M3

Kerikil M3

Besi Kolom Meter

Genteng Satuan

Genteng Bubungan Satuan

Rangka Baja M2

Tukang Hari

Pekerja Hari

Kepala Tukang Hari

Mandor Hari

Total Anggaran

Figure 15 Property kind selection page
(Source: Processed Researchers)

4.1.6 Building Specifications Page With Detail Calculation

Type The display in Figure 16 is a display for entering building specifications with a manual calculation type. If in the building specification screen with the automatic calculation type the user only enters land area and building area data, then on this page the user can enter more detailed specifications of the building such as land area, building area, foundation, structure, roof frame, roof cover , ceiling, wall, door, floor and others. and other types of properties, the screen will move to the last page of this menu, the Construction Cost Estimation Result.

Hitung Anggaran Pondasi
Data Rumah

Panjang Pondasi Meter

Harga Bahan

Batu	<input type="text" value="93750"/>	M3
Pasir	<input type="text" value="125000"/>	M3
Semen	<input type="text" value="1300"/>	Kg
Tukang	<input type="text" value="45000"/>	Hari
Pekerja	<input type="text" value="30000"/>	Hari
Kepala Tukang	<input type="text" value="45000"/>	Hari
Mandor	<input type="text" value="40000"/>	Hari
Total Anggaran	<input type="text" value="3817125"/>	

Figure 16 Building specifications page with detail calculation

(Source: Processed Researchers)

4.1.7 Results of Calculation of Estimated Construction Costs

The final display of this menu is the Calculation of Construction Cost Estimation Results.

In this screen the user can see the estimated cost needed to build a selected building with the existing criteria. On this screen the user can also see the details of existing calculations such as the costs required for the foundation, structure, roof truss, roof coverings, ceilings, walls, doors, floors and so on.

IV. CONCLUSIONS AND SUGGESTIONS

5.1 Conclusions

Based on the results and discussion of the application of the estimated construction cost calculation, it can be concluded as follows:

- a. The construction cost estimation application runs on two platforms namely android and IOS which can be used to calculate the estimated construction costs.
- b. Application calculation of the estimated construction costs can simplify the calculation of estimated construction costs with the automatic calculation model and manual calculation.
- c. The application of the estimated construction cost is able to facilitate the property owner by shortening the work time compared to conventional / traditional ways.
- d. The application of the calculation of the estimated construction costs can improve the accuracy of the work process compared to conventional / traditional ways.
- e. Changes in raw material prices occur, and users no longer need to manually recalculate each work unit price because it has been handled by the application.
- f. The results of the calculation of estimated construction costs are more accurate because the data used as a basis for calculations are stored in a database so that it is consistent.

5.2 Suggestions

This application can only be used to calculate only simple, medium, luxury houses, warehouse buildings, medium, high- and high-rise buildings. bi-level buildings can be added with a higher number of floors.

And also the list of cities can reach more other cities throughout Indonesia.

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