

## Information System Design on Project Supervision Related to Quality Control Effectiveness Using Android-Based Smartphone Applications

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### Abstract

### Original Research Article

Quality Control efforts are one of the preventive efforts to anticipate quality degradation and procedural errors carried out and to find out whether Quality Control is running well or not, an integrated application monitoring is needed so that its performance can be analyzed. This study aims to design an information system to improve the monitoring of Quality Control in the construction process by producing accurate and real time data that is very much needed in decision making. The research method is carried out by making an integrated application design via a smartphone consisting of three very important parts, namely the work method or standard operating procedure, Quality Control in defect management and monitoring of the global positioning system where the Building Inspector is in monitoring. Based on the results of the application design, the results obtained are in the form of a blueprint that can be run on project supervision. This application will assist in the process of the correct method of implementation with good results in realtime.

**Keywords:** Android application, smartphone, information system, supervision, Quality Control, realtime.

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## INTRODUCTION

Quality control efforts are preventive or preventive and are carried out before the quality error occurs, but instead directs that quality does not happen in the company concerned. The problem of quality control is how to maintain, run so that the production of the company concerned can meet the quality as planned. So the role of quality control is significant and useful for the company; if quality control is carried out properly, the company's leadership will be able to take action and make good plans for the future and improve the control system or supervision of products that have been done well. To determine whether quality control has been running well or not, an integrated monitoring application is needed to analyze its performance. The analysis is used to find out how high the level of product damage or defect is.

Based on the facts found in the field, it is necessary to develop an application to improve the monitoring of the Quality Control process. Construction development by producing accurate and real-time data which is very much needed in decision making. The very rapid growth in programming the Android system on smartphones is one of the tools in using supervision of the development process.

The current condition of quality control carried out for ongoing work methods is still using hardcopy. Monitoring defects using smartphones was made in 2015, currently considered inefficient, with too much data and complicated systems. Defect resolution and defect data results need to be uploaded to the server and often have problems with long loading appearances, so managers are lazy to evaluate. The control method for the presence of the position of the Building Inspector is detected using handy talky, which was made in 2014; many obstacles are not accurate and are still inputted manually. In detail, these problems can be summarized as follows:

- The current condition of monitoring is still done manually.
- Control of product defects is still done manually.
- Monitoring the position of the Building Inspector every day using a Walkie Talkie whose signal depends on the weather.

This study aims to develop an Information Technology system design in the form of an Android-based smartphone to facilitate project supervision work in the field using an Android-based smartphone. The efficient and effective goal of monitoring Quality Control in construction companies can be achieved

expected. The results of the application design will be generated in the form of a blueprint that can be run on project supervision. Company management can benefit from accurate, reliable, and real-time data. Analysis of the resulting data will provide input to the managerial level in taking policy strategies both during ongoing projects and future plans. This application will assist in the correct implementation method, and the results of the defect work can be resolved by recording real-time data and subsequent actions to repair the defect.

The process of construction development is always based on cost, quality, and time. In the discussion where the author researches very confidential prices, it is not included in this discussion. At the same time, the quality or defects that occur can be openly observed and evaluated directly in the project organization. The total implementation time or master schedule is monitored by other sections so that it is not included in the discussion. The time included in this discussion is in monitoring the duration of completion of defects only.

In this study, it is limited from the user side with an emphasis on making applications in Information System Design on the procedure system for the implementation of work methods, Quality Control of the implementation of building construction with moderate and severe defects as well as monitoring the position of the building supervisor. This research does not include the scope of programming with Android-based coding.

The Android operating system is relatively new, but the Android operating system has developed quite rapidly. It was created as a counter to iOS. Android shows significant development; this can not be separated from the support of large mobile phone manufacturers who also present phones with the Android operating system. However, the Android operating system has various advantages. Here are the advantages of the Android operating system, namely:

- a) *Multitasking*  
Android-based mobile phones or tablet PCs can run various applications, which means users can browse, read e-books and listen to songs.
- b) *Ease of notification*  
Every time there is an SMS, E-mail, or even the latest article from the RSS Reader, it will always be in the notification on the Home Screen, not to forget the blinking LED indicator light so that users will not miss a single SMS, E-mail or miss call.
- c) *Easy access to thousands of Android applications via Google Android App Market*  
Google Android Market provides thousands of applications and games that can be downloaded and installed according to the user's wishes.
- d) *Wide choice of mobile phones*  
Android is available on mobile phones from various manufacturers, Sony Ericsson, Motorola,

HTC, and Samsung. And every cell phone manufacturer presents Android phones in its way, as with Motorola with its Motoblur and Sony Ericsson.

- e) *Its Time-Space*  
Can install a modified ROM, users can change the ROM with the Custom ROM feature if they are not satisfied with the standard appearance of Android.
- f) *Widget*  
With the widget on the home screen, users can easily access various features quickly.
- g) *Google Oriented*  
Android has been integrated with Google services, so users can quickly access various features provided by Google.

The COBIT 5 framework will assist companies in achieving the objectives of IT management governance. It has 5 principles (ISACA, 2020). There are five principles of GEIT:

- a) *Meeting stakeholder needs*  
It consists of processes and enablers to support business value creation through IT implementation. A company can adopt COBIT 5 to the context of the company.
- b) *Covering the enterprise end-to-end*  
It is integrating corporate IT management into corporate governance. This is possible because it covers all functions and processes in the company. COBIT 5 focuses on IT functions and becomes technology and information as assets related to other assets that everyone in a company manages. Consider all enablers of governance and management related to IT from an enterprise an end-to-end perspective. This means considering all entities in the company as parts that influence each other.
- c) *Applying a single, integrated framework*  
It is aligned with related standards that usually provide guidance for some IT activities and a framework addressing high-level enterprise IT governance and management.

COBIT 5 provides high-level guidance, and other relevant standards offer detailed guidance

- a) *Enabling a holistic approach*  
Effective and efficient corporate IT governance and management requires a comprehensive approach, which considers the interacting components. COBIT 5 defines a set of enablers to support the comprehensive implementation of corporate IT system governance and management.
- b) *Separating governance from management.*  
Provide a clear separation between management and governance. They cover different activities, require other organizational structures, and serve different purposes. The government ensures that stakeholders' needs, conditions, and preferences are evaluated to determine the company's objectives that will be agreed to be achieved. Governance

provides direction for prioritization and decision-making. In addition, the government also monitors performance and conformity to agreed objectives. Meanwhile, management includes; the activities of planning, building, executing and monitoring activities aligned with the directions set by the governance organization to achieve the company's objectives.

The COBIT 5 process is divided into two major sections with five domains as follows

- a) *Governance of Enterprise IT*  
*Evaluate, Direct and Monitor (EDM) – 5 processes*
- b) *Management of Enterprise IT*  
*Align, Plan and Organise (APO) – 13 processes*  
*Build, Acquire and Implement (BAI) – 10 processes*  
*Deliver, Service and Support (DSS) – 6 processes*  
*Monitor, Evaluate and Assess (MEA) - 3 processes*

The Project Management Body of Knowledge (PMBOK) is a collection of processes and areas of knowledge generally accepted as best practices in the project management discipline. As an internationally recognized standard, it provides the basics of project management, regardless of the type of project, be it construction, software, engineering, automotive, and others.

Project Manager (PM) Knowledge Area, the setting as Project Manager is distinguished as functional manager and operation manager. Operational managers focus on fulfilling management or business unit oversight. The operations manager is responsible for ensuring efficient business operations. A project

manager is a person who leads the organizational performance team accountable for achieving project goals (Project Management Institute, 2017). The Project Manager is appointed by the company or project sponsor to lead, plan, and control a project. According to A Guide to the Project Management Body of Knowledge, special skills and general management skills are needed for projects in all areas or fields. The knowledge areas of the Project Manager are as follows:

- a) Integration Project Management
- b) Project Scope Management
- c) Project Time Management
- d) Project Cost Management
- e) Project Quality Management
- f) Project Risk Management
- g) Human Resource Management
- h) Project Communication Management
- i) Project Procurement and Purchasing Management
- j) Project Stakeholder Management

The discussion will focus on quality management in the Quality Control process. In today's increasingly competitive industrialization era, every actor who wants to win the competition in the business and industrial world will pay full attention to quality. Full attention to quality will positively impact the business through two events: the impact on decreasing production costs and the effect on increasing revenue.

## METHODS

The method used in this research is carried out in several stages; the following is the framework used in this research.

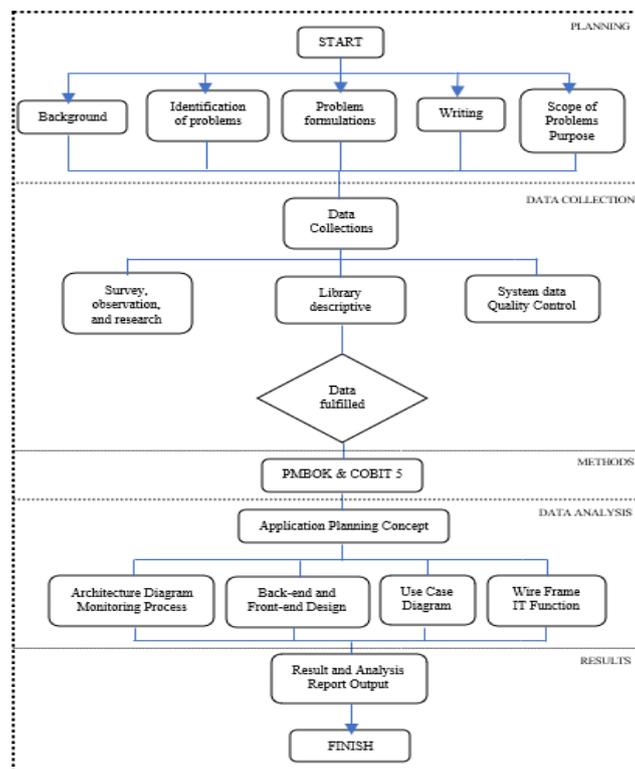


Fig-1: Research Framework

## RESULTS AND DISCUSSIONS

### A. Current Condition of Project Monitoring System

In the discussion of this research, three monitoring systems will be discussed which will be the object of research, namely:

- 1) Monitoring the construction implementation process or standard operating procedures for the stages of building construction
- 2) Monitoring the results of defective products or defects in the implementation of construction carried out by the contractor by the Building Inspector.
- 3) Monitoring the position of the Building Inspector in carrying out supervision through the cycle time system.

Running conditions of each of these will be explained one by one with the problems that occur as follows:

- 1) Implementation of project standard operating procedures. The current standard operating procedure uses Form P15, which guides what should be checked in the development supervision.

The obstacles that very often occur:

- a) The scan process must be accurate because the paper used must be read with a scan tool, and if it shifts just a little, then the program reading is wrong and needs to be corrected manually on the desktop dashboard—scan time 15 minutes one sheet.
  - b) The paper used a lot. Each house needs 20 sheets of paper.
  - c) scanned paper is generally problematic because it is filled in at the Lecak project, especially in the wet rainy season, so it needs to be re-copied to take more time.
- 2) Monitoring the results of product defects in the form of production defects from work carried out by the contractor due to the implementation method or craftsman's error, for example, the results of uneven ceramic installation, porous concrete, and others. Monitoring the results of this work is made and carried out by Quality Control. In one house, it has been agreed that there are 15 (fifteen) items of the construction section that will be checked for work with 4 (four) criteria, namely:
    - a) *no defect.*
    - b) *minor defects.*
    - c) *moderate defects*
    - d) *severe defects*

#### In short, the flow of this system is

- a) SM opened the Android program and assigned the QC Officer to take photos to the field.
- b) QC officer sees the assignment given by SM and downloads the assignment if any.
- c) QC to the location or point assigned by SM.

- d) The officer gives the defect status.
- e) upload photos by QC officers.
- f) Report on the progress of defects.
- g) Display of Building Quality.
- h) The process of repairing severe defects.
- i) Report display.

The current running condition has problems and constraints. It can be seen from the data that:

- a) The average number of photos taken per housing unit is 50 photos. In one cluster, the average is 150 units, so a total of 7,500 photos of criteria, and if there are 12 clusters, the number of photos taken is 90,000. This condition is now too much at all.
- b) here is 1 QC officer available to cover 2 clusters, or  $2 \times 7,500 = 15,000$  photos of this work are very many, and the results are not achieved; it is always late. This can be seen from the report image so that the analysis is always late.
- c) The number of criteria taken is too many.
- d) Long bureaucracy, when it starts with every day there is an assignment first.

- 3) Monitoring the existence of the position of the Building Inspector location.

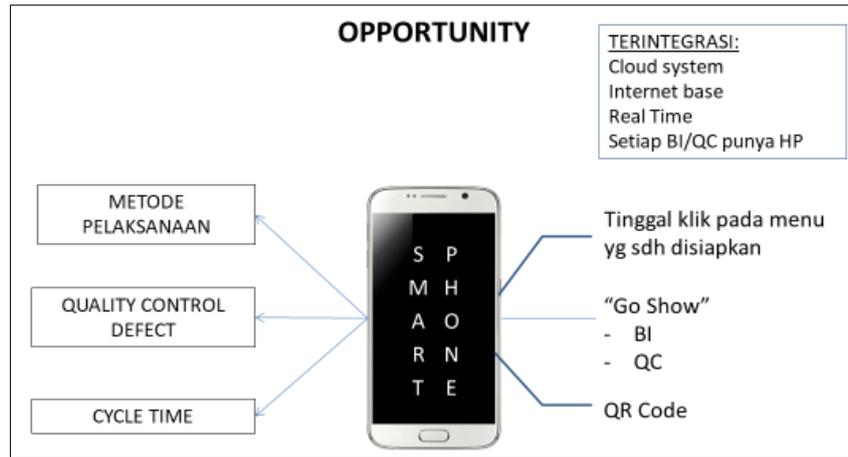
In the supervision of human resources, the existence of the Building Inspector needs to be monitored daily. It can be analyzed how many times the Building Inspector has supervised or entered the house to check the progress of the work. This is important because, from previous data, officers are lazy and rarely enter or see houses, often in the canteen and chatting. Monitoring is now running using a handy talky SmartPTT since 2015, which is connected to GPS.

The report reflects an average of 60 percent correct. From the results of monitoring using the Motorola version of Smart PTT, there are weaknesses, namely:

- a) Inaccurate location data, especially during cloudy rains.
- b) Manually input data into excel and need continuous administration to see the correct location position. One administration person is needed.
- c) This smart PTT version uses a paid google map. Moreover, it has been going on since 2015.

### B. Concept of Quality Control Integration Planning

- 1) From the observation of pain and opportunity data, it can be seen that there is no synchronization. Each one stands alone. Each of these monitoring also has problems. So, the author plans to design an integrated application using a smartphone, the concept looks like Figure 2, and all Building Inspectors and QC officers have smartphones in supervising construction projects.



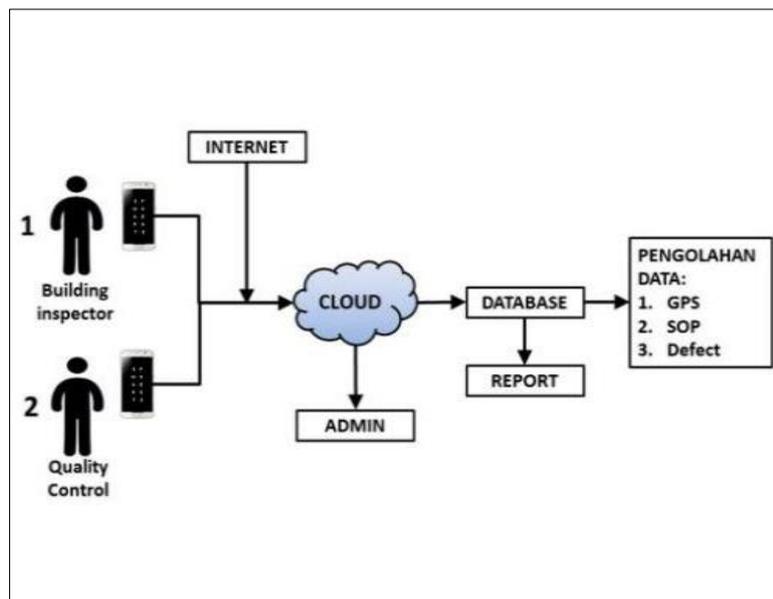
**Fig-2: Quality Control Integration Planning Concept**

Each monitoring has re-evaluated the pain that occurs and needs to be updated with current conditions so that:

- 1) integrated system;
- 2) data is obtained quickly;
- 3) *reliable on-time* data;
- 4) efficient by combining the three monitoring.

**C. Application Planning Concept**

The smartphone used in this process is connected through an internet system connected to a server in the cloud and processing data on a cloud server. All analysis data processing occurs in the cloud. The results of processing the monitoring analyzes and reports can be displayed on a desktop in the office or on the smartphone via an available dashboard. Figure 3 shows the design concept.



**Fig-3: Infrastructure Design Concept**

The main core of this application system there are 3 major activities, namely:

- 1) Creation of master data, by project Admin into back-end
- 2) Monitoring implementation, by Building Inspector, Quality Control, Site Manager and Contractor using smartphone
- 3) Monitoring implementation, by Building Inspector, Quality Control, Site Manager and Contractor using smartphone.

**D. Architecture Diagram in Monitoring Process**

The activities of sections related to the system will be illustrated through the linkage diagram of the activities and responsibilities of this monitoring process. There are two (2) systems that differentiate in this process. In order to fully understand:

- 1) The Architecture process in monitoring initiated by the Building Inspector can be seen in Figure 4 below.

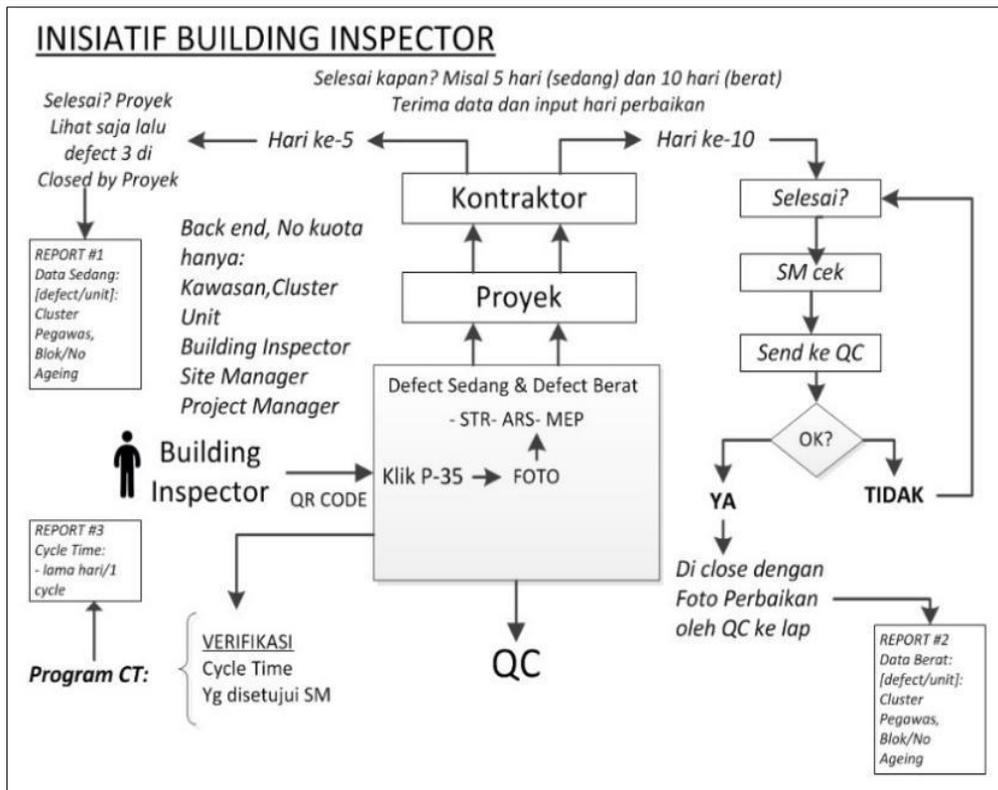


Fig-4: Flow Initiative Building Inspector

2) The process of architecture in monitoring initiated by Quality Control can be seen in Figure 5 below.

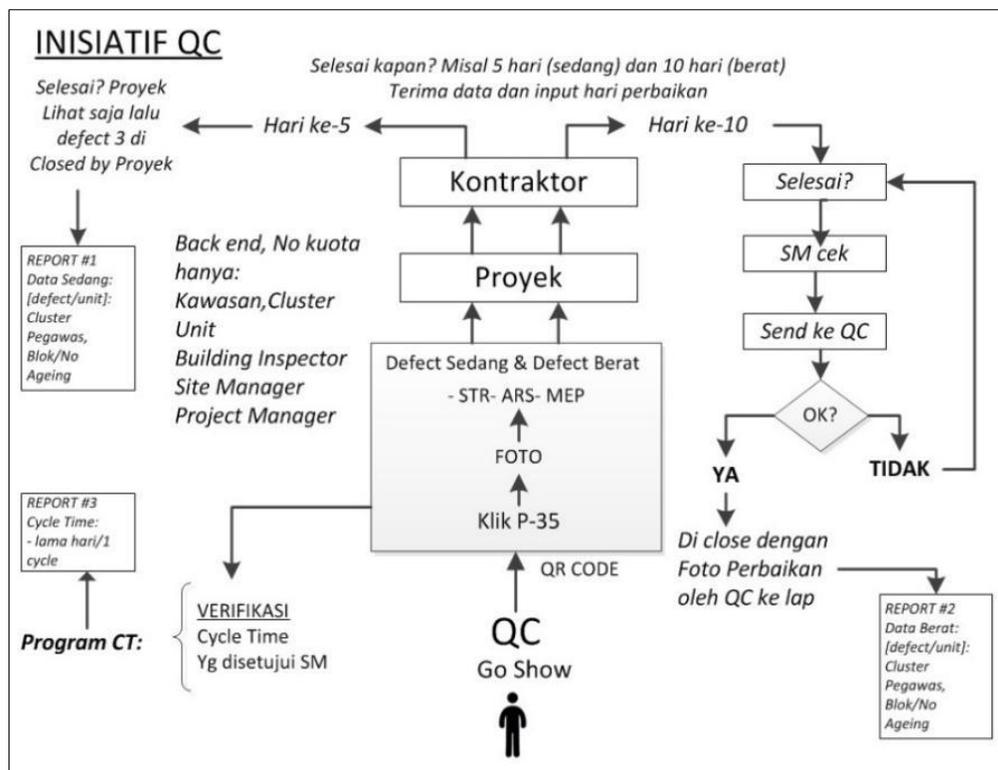


Fig-5: Initiative Quality Control

**E. Back-end and Front-end design**

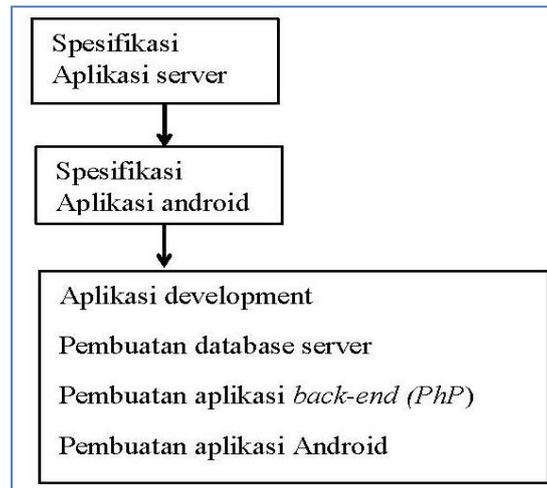
From the diagram described in section D, it is necessary to prepare specifications from the server

(Back-end), specifications for android applications, and application development. Figure 6 shows the design concept.

Because the system to be built is integrated, a Relational Database Management System is used on the Web Base Application Platform. The data will be published to a server in the cloud. For more details, the criteria for the system to be built technically will meet the system standards as follows:

- 1) Web-based Application with PHP Tools
- 2) The database is Microsoft SQL Server 2008
- 3) The application is made based on the existing framework at PT. XYZ, so the operation is easy, user friendly.

- 4) The Web Server and Database Server will be placed in the Cloud so that the data can be real-time anywhere; there is no more uploading and downloading images from gadgets, so the process is faster.
- 5) Modules and viewable data according to the access rights and units of each user.
- 6) Filter system to display data; if the data is already displayed, the filter will still appear (not lost).



**Fig-6: Back-end development process**

#### Android Application Specifications on Front End

- 1) One round in taking pictures on the device is a maximum of 20 seconds.
- 2) Image captured and stored on the Cloud Server is automatically resized to a maximum size of 200kb.
- 3) Each step of the process must be displayed quickly. It cannot load too long.
- 4) Contractors will be given direct access rights to receive notifications if there are defects and input the length of repair.
- 5) Devices for Android are expected to be of various brands and types, not just fixing on one brand.

#### F. Use Case Diagrams

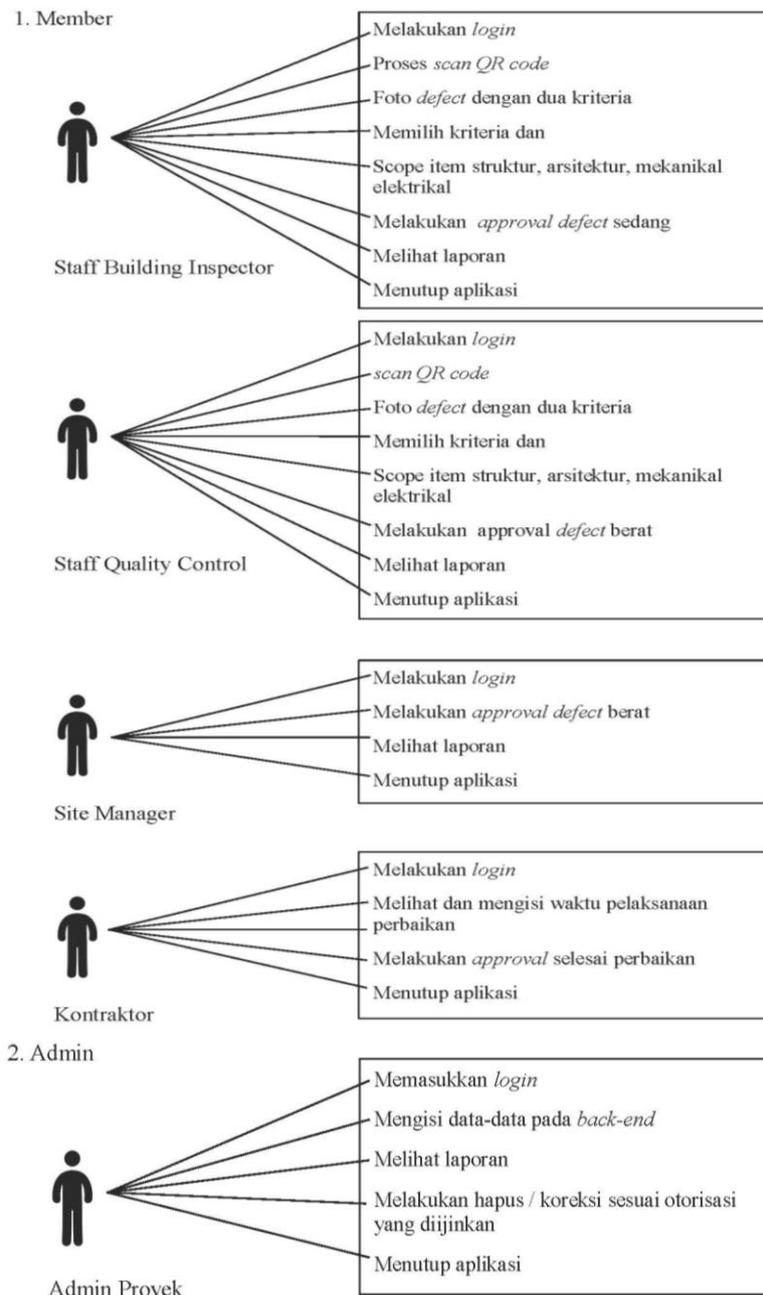
Use case diagrams to describe the functions that exist in the system. This diagram focuses on features of the system from the point of view of

outsiders, which in this case, the users are classified into (2) two; it can be seen in Figure 7.

#### G. Application Back-end Module

The back-end in question is the main application on the server computer whose functions are: data input, storage, data processing, and user data generation and report generation.

- 1) Master data, a place to input and compile data related to technical work data, divided into:
  - a) Defect item data
  - b) Standard Operating Procedure data items
  - c) Data block/unit number
  - d) Unit plan data
  - e) QR Code generating feature
 Once generated, print code can be done and then installed at the unit location, at the agreed place



**Fig-7: Use case diagram**

2) Administration, a place for inputting and compiling personal matters, is divided into:

- Staff allocation data for locations in blocks/numbers.
- Assignment data, containing the allocation of the Building Inspector assignment, the name of the Site Manager, and the relevant Contractor
- After the allocation of the Building Inspector officer and the block/number is created, it will be equipped with the names of the Site Manager and Contractor through the following input menu.

User access rights feature.

Display the appropriate user access rights input, must enter photos, the appropriate admin

can only do the user access rights menu, must enter photos, the admin can only do the user access rights menu.

**H. Wire Frame IT Function and Development Screen**

The activities and displays are made by taking into account the users who use them, respectively, described through a description of the activities as follows:

- 1) Activity Description of the *Staff Building Inspector*
- 2) Description of Quality Control Staff Activities
- 3) Description of Contractor Activities
- 4) Site Manager Activity Description
- 5) Project Manager Activity Description

In its use, it is found that all the services on the smartphone are running as expected.

**I. Results and Analysis of Report Output**

The design that has been made is expected to answer the formulation of the problem that occurs by displaying reports that can analyze and monitor the effectiveness of quality control. By integrating into a system, the prototype report will provide an overview of the project situation to make quick decisions because

real-time data is available. The following will explain the results and analysis of the planning of the enterprise architecture monitoring system for this project.

**1) Building Quality Report**

The performance report screen is active, and the Building Inspector is clicked to enter the report details. For example, by clicking: "Number of defects" (1) above, it will display a display as shown in the following image.

LAPORAN KINERJA							
Kawasan : Cluster : Site Manager : Periode : 1/1/2020 sampai 12/31/2020							
Nama Building Inspector	Jumlah Unit	Total Defect		Ageing			Cycle Time (Rata-rata Unit/hari)
		Jumlah Defect (b)	(b) / (a) (c)	Sudah Lewat			
				1 - 7	8 - 13	> 14	
	34	162 (1)	1.25	67 (4)	22	1	16 (5)
	30	141	1.08	34	84	2	14
	32	267	2.05	75	30	0	18
	34	114	0.88	56	24	0	13
<b>TOTAL</b>	<b>130</b>	<b>684 (6)</b>	<b>5.26</b>	<b>232</b>	<b>160</b>	<b>3</b>	
	(a)						

**Fig-8: Performance Report Display**

**2) Defect Recap Report**

An example of an opened defect recap display, such as the Building Inspector, will show all the moderate and severe defects. So that if want to know

the report's details on the type of structure work, click on the line: "Structure" (2), the display discussed in the following section will appear.

REKAP DEFECT						
Kawasan : Cluster : Site Manager : Building Inspector : Jumlah Unit : 34 unit Total Unit (a) : 130 unit						
Jenis Pekerjaan	Defect Sedang (b)		Defect Berat (c)		Total Defect (d)	
	Jumlah	(b)/(a)	Jumlah	(c)/(a)	Jumlah	(d)/(a)
Struktur (2)	42	0.32	41	0.32	83	0.64
Arsitektur	51	0.39	28	0.22	79	0.61
MEP	0	0.00	0	0.00	0	0.00
<b>TOTAL</b>	<b>93</b>	<b>0.72</b>	<b>69</b>	<b>0.53</b>	<b>162</b>	<b>1.25</b>

**Fig-9: Display of Defect Recap**

**3) Quality Detail Report, which contains description of defects and aging.**

A detailed view of the quality of structural work from the Building Inspector will appear in all the

details. If you want to know the detailed report's photo on the type of structure work, then click on the row of data you want to see the photo of (3), the display discussed in the following section will appear.

DETAIL LAPORAN KUALITAS							
Periode Temuan :							
Kawasan :							
Cluster :							
Site Manager :							
Building Inspector :							
Jumlah Unit : 34 unit							
Total Unit (a) : 130 unit							
No.	Blok/Unit	No. Formulir	Jenis Pekerjaan	Item Defect	Deskripsi defect	Kategori Defect	Ageing (hari)
1	RNG/01	F001001	#1 Struktur	Poer sloof, Pile cap, Tiebeam, Matt, Pondasi	Senggang Tiebeam Tumpuan kurang	Berat	-1
2	RNG/05	F001002	#1 Struktur	Poer sloof, Pile cap, Tiebeam, Matt, Pondasi	Senggang Tiebeam Tumpuan kurang	Berat	-1
3	RNG/06	F001003	#1 Struktur	Poer sloof, Pile cap, Tiebeam, Matt, Pondasi	Beton Decking tidak terpasang	Sedang	+2
4	RNG/16	F001025	#1 Struktur	Poer sloof, Pile cap, Tiebeam, Matt, Pondasi	Beton Decking tidak terpasang	Sedang	-2
5	RNG/17	F001026	#1 Struktur	Poer sloof, Pile cap, Tiebeam, Matt, Pondasi	Beton Decking tidak terpasang	Sedang	-2
6	RNG/18	F001027	#1 Struktur	Poer sloof, Pile cap, Tiebeam, Matt, Pondasi	Beton Decking tidak terpasang	Sedang	-2
		F001035	#1 Struktur	Poer sloof, Pile cap, Tiebeam, Matt, Pondasi	Jumlah Tulangan Tumpuan Tiebeam Kurang	Berat	+62
7	RNG/19	F001028	#1 Struktur	Poer sloof, Pile cap, Tiebeam, Matt, Pondasi	Beton Decking tidak terpasang	Sedang	-2
8	RNG/20	F001029	#1 Struktur	Poer sloof, Pile cap, Tiebeam, Matt, Pondasi	Beton Decking tidak terpasang	Sedang	-2
9	RNG/21	F001004	#1 Struktur	Poer sloof, Pile cap, Tiebeam, Matt, Pondasi	Senggang Tiebeam Tumpuan kurang	Berat	-1

Fig-10: Detail View of Structure Work Quality

4) Building Quality Form Report (containing photos and data needed for follow-up repairs in the field)

Display of building quality reports containing floor plans, photos of findings, and repairs (if closing). If there is a special case where a printed copy of the document is required, a printing facility is provided. By setting the tile, can print four (4) to six (6) data on one

(1) sheet of paper so that the Building Inspector saves money. However, for coordination, they generally use their respective smartphones. Likewise, for aging defects, monitoring cycle time, and the top five defects, you can click on the active screen of the Building Quality Report. Clicking on the screen will display the data in question (4) (5) (6).

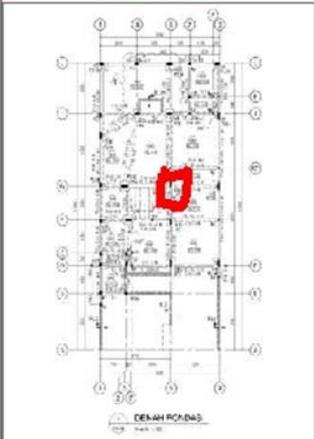
FORMULIR LAPORAN KUALITAS BANGUNAN		
No. Penugasan :	Jenis Pekerjaan :	
Kawasan :	Item Defect :	
Cluster :	Tgl. Penugasan :	
Blok/Nomor :	Tgl. Temuan :	
Lokasi Lantai :	Kategori Defect :	
Nama Kontraktor :	Lama Perbaikan :	
Site manager :	Target Perbaikan :	
Pengawas :	Selesai Perbaikan :	
Petugas QC :	Response Time :	
<b>FOTO PENUGASAN</b>		
<b>Foto Denah</b>	<b>Foto Temuan</b>	<b>Foto Perbaikan #1 : Finish</b>
		

Fig-11: Building Quality Report Display

The display of aging, cycle time, and top five reports are discussed in another section.

5) Defect Settlement Aging Report Details, the purpose of the aging report is to track records of defect completion by contractors with a planned time

target. If completed before maturity will be green; if the old Building Inspector completion will be red. Each box has a number and color. This feature is also connected to the notification in the email of each related user and the front-end.

DETAIL LAPORAN AGEING KUALITAS							
Periode Temuan :							
Kawasan :							
Cluster :							
Site Manager :							
Building Inspector :							
Jumlah Unit :	34 unit						
Total Unit (a) :	130 unit						
No.	Blok/Unit	No. Formulir	Jenis Pekerjaan	Item Defect	Deskripsi defect	Kategori Defect	Ageing (hari)
1	RNG/06	F001003	#1 Struktur	Poer sloof, Pile cap, Tiebeam, Matt, Pondasi	Beton Decking tidak terpasang	Sedang	+2
		F001031	#2 Struktur	Poer sloof, Pile cap, Tiebeam, Matt, Pondasi	Beton Decking tidak terpasang	Sedang	+6
2	RNG/25	F001032	#2 Struktur	Poer sloof, Pile cap, Tiebeam, Matt, Pondasi	Bekisting Tiebeam tidak lot	Sedang	+7
3	RNG/26	F001002	#1 Struktur	Poer sloof, Pile cap, Tiebeam, Matt, Pondasi	Bekisting Tiebeam tidak lot	Sedang	+7

Fig-12: Defect Resolution Aging Display

6) Cycle Time Monitoring Report, the purpose of cycle time monitoring is to ensure that the Building Inspector visits the unit according to the planned cycle time. Columns are blocked/units visited, and rows are visit dates. The standard visit is 12 units per day with a visit time of 25 minutes per unit. For

example, suppose the number of units supervised is 25-30 units. In that case, it will return to the first unit on the third day (with a note: supervision per day is 5 hours of work out of a total of 8 hours per day, after deducting other work, including meetings).

MONITORING CYCLE TIME																																					
Nama :																																					
Cluster :																																					
Bulan :																																					
Unit :																																					
TGL	DATA	BLOK/ UNIT																																			
		RUKO NORTH GOLDFINCH																																			
		1	2	3	5	6	7	8	9	10	11	12	15	16	17	18	19	20	21	23	25	26	27	28	29	30	32	33	35	36	37	38	39	50	51		
	Kunjungan Januari																																				
	Kumulatif Visit Januari (Per Unit)	14	13	13	9	9	8	13	13	17	19	18	12	14	15	15	13	14	12	14	9	9	13	16	16	16	10	10	24	22	22	14	12	12	12		

Fig-13: Display of Cycle Time Monitoring

7) Top Five Defect Report

Making the top five will make it easier for the project to target quality targets that are still not good.

This report will often be used during meetings with contractors.

Laporan Grafis Pie Chart		
Top 5 per jenis pekerjaan per item defect		
struktur	Arsitektur	MEP
1	1	1
2	2	2
3	3	3
4	4	4
5 Lain-lain	5 Lain-lain	5 Lain-lain

Fig-14: Display of the Top Five Defects

The concept of preparing the report has gone through previous studies and observations to find out which report pages are often opened. The interface settings are made in such a way as to make it easier because it is appropriate to follow habits.

## CONCLUSION

The results of designing a project monitoring application with an Android-based smartphone can be controlled in real-time, resulting in monitoring the building's quality. With this monitoring system, it is expected to solve the problems in the discussion of this research:

- a) From the results of planning the screen display of the standard operating procedure monitoring report, it can be seen which work is appropriate and not in the project implementation method. This is very good in anticipating the possibility of defects or product defects in quality.
- b) The quality of monitoring product defects during implementation is well monitored and recorded digitally with real photo evidence. The prototype screen also shows aging or the duration of the defect terminator work, and there is a warning if it has passed the specified time.
- c) The global positioning system monitoring system is carried out with a QR Code, so the presence of the Building Inspector can be detected so that management knows how many times the supervisor has visited the project building.
- d) With the integration of monitoring in one smartphone, it will look very efficient because all data and reports can be displayed on the prototype screen in real-time what is happening.

In making this application, it is recommended to be developed with links to other project activities for future improvement; things that need to be considered as suggestions are:

- a) The prototype monitoring system can be applied to all projects in the developer group, first conducting a pilot project and technical training.
- b) In an implementation, the actions of users are monitored to evaluate consistency and level of compliance with their use.
- c) An IT programmer monitors each implementation activity to ensure that the report data is by the user's wishes.

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