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Barcode-Based Light Fire Extinguisher (Apar) Monitoring with the Waterfall Case Study Method of PT. PLN (Persero) UPK Nagan Raya

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ABSTRACT

Light Fire Extinguishers (APAR) play a very important role in a company, this aims to prevent and overcome in the event of a fire. The development of technology for equipment inspection has now begun to use digital methods including using android applications and barcodes to facilitate the fire extinguisher inspection process. In this study, it uses the waterfall method, which is a technical model in software development, where a project will be detailed sequentially. Based on the results of research, a method of monitoring the fire extinguisher using andorite-based barcodes that can be accessed through the internet network anytime and anywhere. This barcode-based monitoring method can minimize officer errors in writing data on the results of checking the fire extinguisher, searching for data on the results of the fire extinguisher check and can be viewed and accessed easily. Barcodes have been affixed to each fire extinguisher and the barcode has been designed complete with a description of the state of the fire extinguisher in it, including the type of fire extinguisher, weight, name of the officer, expired, type. It can be concluded by using this method the quality of the resulting system will be better because its implementation is carried out gradually or sequentially.

I. Introduction

Light Fire Extinguishers (APAR) play a very important role in a company, this aims to prevent and overcome in the event of a fire. In the implementation of fire extinguisher management at PT. PLN (Persero) UPK Nagan Raya is carried out by the K4 team, the management carried out is the APAR inspection, namely ensuring the pressure of the fire extinguisher and ensuring that there is no fire extinguisher leakage that causes the fire extinguisher to no longer be used, maintaining the condition of the fire extinguisher every week by shaking the fire extinguisher tube by the Security team so that the contents of the fire extinguisher do not settle and are ready to be used in the event of a fire.

Light fire extinguishers (APAR) are mandatory standard equipment for building security. Due to its limited capacity, this fire extinguisher is designed to control fires that have just started or whose fire size is limited [1]. The installation of fire extinguishers is an initial action on fire suppression before the fire becomes large [2].

APAR (Light Fire Extinguisher) is a tool used to extinguish fires or control small fires. Light Fire Extinguishers (APAR) are generally tubular filled with high-pressure fire extinguishers [3]. Fire extinguisher is a pressure device, which means it requires maintenance operations that ensure fire extinguisher equipment will function properly in the event of a fire. The purpose of this fire extinguisher inspection is to verify that its condition is in accordance with the standard [4]. This fire extinguisher is not designed for use in fires that are no longer controlled. This fire extinguisher consists of a high-pressure tube containing fire extinguishing agent [5].

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The development of technology for equipment inspection has now begun to use digital methods including using android applications and barcodes to facilitate the fire extinguisher inspection process. With the advancement of technology, it can make everything related to human activities that were originally done manually can be done more simply and efficiently by utilizing current technological advances. With the rapid development of mobile phone technology today, the need for mobile phones has become very important in the process of finding information or searching data. Human work that is still widely done manually can be facilitated and accelerated by using a structured system [6].

The provision of fire extinguishers is included in the fire emergency response system which is important to anticipate emergencies caused by fires. The application of an emergency response system in this case the installation of fire extinguishers, does not have to wait for a fire emergency to occur, however, it must be made beforehand to anticipate fires and to minimize losses and prevent casualties [7]. The provision of fire extinguishers in open and closed rooms is very important, especially places that are prone to or have the potential for fires [8].

PT. PLN UPK Nagan Raya is an industry engaged in power generation. As a power generation industry, many fire extinguishers are needed to meet government regulations (PERMENAKER). Due to the large number of fire extinguishers that exist today, a method is needed, to help during the process of checking the fire extinguisher and data management of the results of checking the fire extinguisher based on Android. So that the process can be done faster, more precisely, and will get fire extinguisher information that is close to expired / APAR which needs to be replaced by the contents of the fire extinguisher with new contents (Refill APAR).

Previous research by Bagaskara [9], The recording of equipment maintenance was previously written manually, but the Mei-V application has an impact because now recording tool maintenance can be done through an android application by scanning a QR-Code. The Mei-V application was created with the aim of providing a solution so that the recording of tool maintenance can be done through applications connected to the live database. The application uses the Spiral Model method in order to be able to carry out continuous development in the form of adding functions and changes according to existing needs. The result of implementing the Spiral Model that can be felt is the flexibility of application development because it can always be monitored and repaired at any time. The Mei-V application can provide various useful information for maintenance activities, including detailed equipment maintenance information, maintenance report reports that can be downloaded by the supervisor.

Previous research by Kodratillah [10], fire extinguishers play a very important role in overcoming small/light fires in a place. PT. XYZ in Bekasi is an industry engaged in food production, so many fire extinguishers are needed to meet government regulations (PERMENAKER). Due to the large number of fire extinguishers that exist today, a system / application is needed to help during the process of checking fire extinguishers and data management of the results of checking APAR based on Android. So that the process can be done faster, more precisely, and will get fire extinguisher information that is close to expired / APAR which needs to be replaced with the contents of the fire extinguisher with new contents (refill APAR). The methodology used to develop this system uses waterfall methods and the PHP programming language. The result of the development of this application is an apar checking application / system that is useful for minimizing officer errors in writing, finding data on the results of checking fire extinguishers quickly and precisely, and providing information to officers about fire extinguishers that will expire / need to be refilled. The application can be accessed anywhere and anytime via android / smartphone.

Based on the description above, the author is motivated to make changes to the apar checking method online to make it easier and more effective and also efficient in checking fire extinguisher at PT. PLN (Persero) UPK Nagan Raya.

II. Research Methods

The object of this study is the Light Fire Extinguisher (APAR) in each unit in PT. PLN (Persero) UPK Nagan Raya. With specifications as follows:

Table 1. Specification of Light Fire Extinguisher (APAR)

No	Specification	
	Specification of light fire extinguishers	
1	Tip	: HD-10
2	Media weight	: 9 kg
3	Bruton weight	: 14,2 kg
4	Tall	: 590 mm
5	Diameter	: 184 mm
6	Working pressure	: 18 bar
7	Pressure testing	: 27 bar
8	Length of radiance	: 20 sec
9	Transmit distance	: 4-10 m
10	Plunging gas	: N2 (Nitrogen)

The research was carried out in July 2022, the data needed in this study is the entire APAR data from July 2022 to November 2022 at PT PLN (Persero) UPK Nagan Raya.

Fig. 1. Light Fire Extinguisher (APAR)

Light Fire Extinguisher (APAR)

Light Fire Extinguishers (APAR) According to the Regulation of the Minister of Manpower and Transmigration number per.04 / men / 1980 concerning the requirements for the installation and maintenance of light fire extinguishers, fire extinguishers are light tools or tubes and can be used by one person to extinguish small fires that arise at the beginning of a fire. Due to its small shape, the unit has its advantages and disadvantages, in which this type of tube can only extinguish a fire at the very beginning of the occurrence of a fire, but it is not recommended for already enlarged fires. As for several classes of fires:

a) Fires of solid materials except metals (Group A)

b) Fire of combustible liquid or gaseous materials (Group B)

c) Voltage electrical installation fire (Group C)

d) Metal fires (Group D)

Each fire group must be in accordance with the type of fire extinguisher content used. Some types of fire extinguisher tube contents are as follows:

a) Type of liquid (water)

b) Types of foam

c) Types of dry flour

d) Types of gases (halogenous hydrocarbons and so on)

Waterfall

The Waterfall method is the oldest software development method because of its natural nature. The Waterfall method is the earliest SDLC approach used for software development. The sequence in the Waterfall Method is serialized which starts from the process of planning, analyzing, designing, and implementing the system.

The waterfall model uses a systematic and sequential approach. The stages of the waterfall model include requirement, design, implementation, verification, and maintenance. The advantage of using the waterfall method in the development of information systems is that the quality of the resulting system will be good because the implementation is carried out in stages, while the disadvantage is that the system development process takes a long time so that the necessary costs are also expensive.

The research method used is to use the waterfall method. The stages carried out in this study include:

1. Perform software needs analysis. At this stage, an analysis of the need for the development of a method of checking light fire extinguishers (APAR) using android-based Barcodes is carried out.
2. Perform the role of the system. At this stage, the role of a method of making a Barcode is carried out. Such as Unified Modeling Laguage (UML) design, Barcode user inteface design.
3. Conducting implementations. At this stage, it is done by creating a program code (Barcode) in accordance with the design that has been done before. At this stage an Excel application, google is required.
4. Melakukan Testing. At this stage, testing is carried out how it works to monitor fire extinguishers using barcodes using the black box testing method.

Perform a Deployment. At this stage, the installation is carried out to the smartphone device used by the user.

Advantages of the Waterfall Method

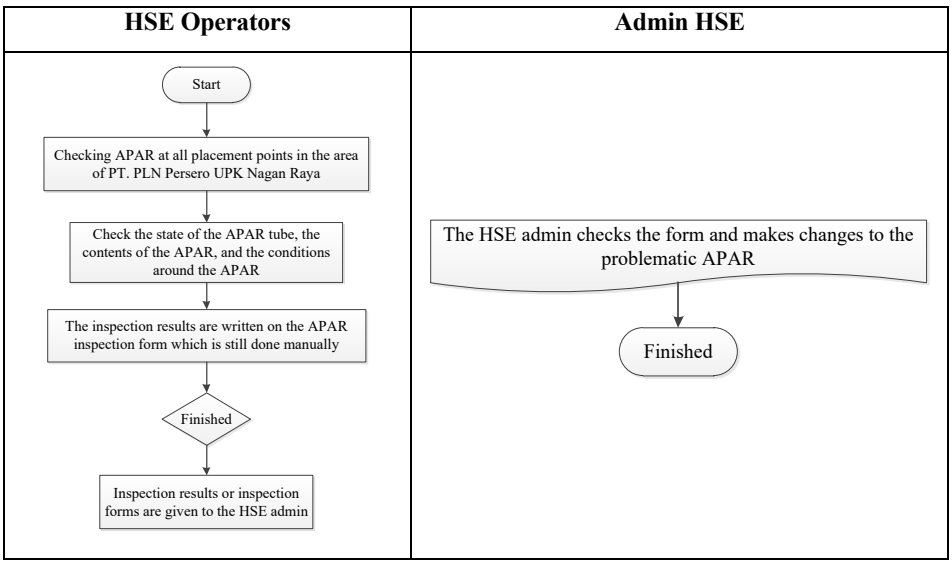
The advantage of using the waterfall method is that it allows for departmentalization and control. phase one by one model development process, thus minimizing possible errors. Development moves from concept, i.e. through design, implementation, testing, installation, problem solving, and ends in operation and maintenance.

Disadvantages of the Waterfall Method

The downside of using the waterfall method is that it doesn't allow for multiple revisions if something goes wrong in the process. Because after this application is in the testing stage, it is difficult to go back again and change something that was not well documented in the previous concept stage.

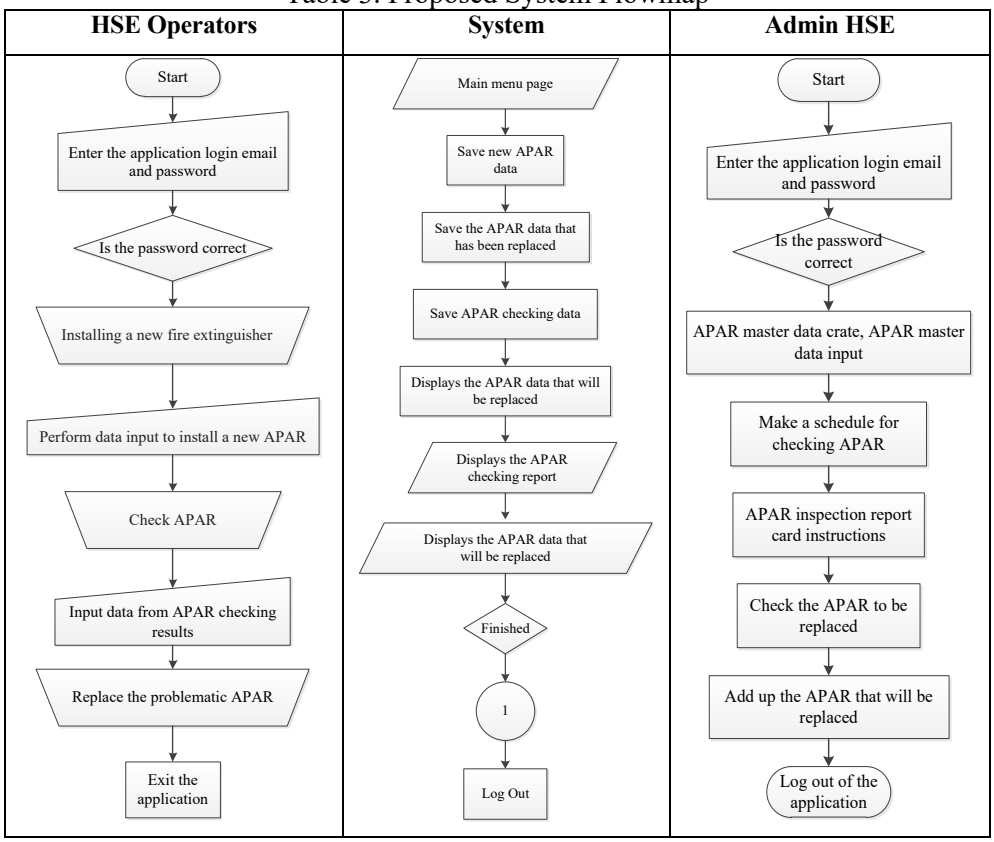
1. The ongoing system is in accordance with the field survey that has been carried out by the author during research at PT. PLN (Persero) UPK Nagan Raya, concluded about the system that runs in the current fire extinguisher checking data input process in PT. PLN (Persero) UPK Nagan Raya, which is as follows:

Table 2. Running Systems



2. The proposed system to overcome problems related to apar checking data input, the following is the design of the fire extinguisher checking data input application system that the author advoked, using support from smartphone technology. So that the existing work process can run quickly and can minimize input errors in fire extinguisher checking data and make it easier to find out which fire extinguisher will expire and need to be replaced.
3. A flowmap or flowchart is a type of diagram that represents an algorithm, work flow or process, which displays the steps in the form of a symbolic graphic symbol, and the sequence is connected by arrows. The following is a flow chart of the fire extinguisher checking process that the author shows:

Table 3. Proposed System Flowmap



4. Use Case Diagram
   Use Case diagram diagram to find out who can interact with the system and what the system can do and what the system can do. The following is a use case analysis diagram of designing a fire extinguisher checking application system.
5. User Interface
   User interface is a part where users can see and interact with computers, websites, or applications with the aim of making the user experience easier and more intuitive.
6. Class Diagram
   A class diagram is a type of static structure diagram in UML that illustrates the structure of a system by showing a system of classes, their attributes, methods, and relationships between objects.

   Diagram classes are called types of structure diagrams because they illustrate what should be present in a system modeled with various components. Here is the class diagram that is:

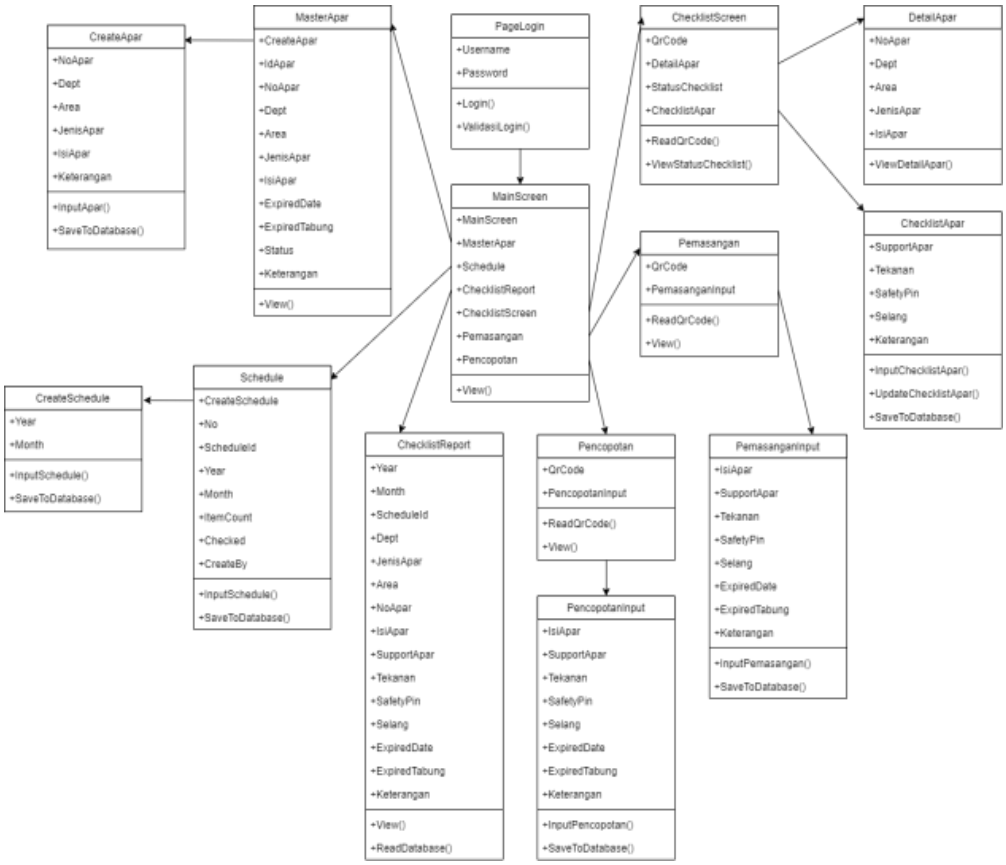


Fig. 2. Class Diagram

Fig. 3. Enter Email to log in to the next step and also provide apar location info

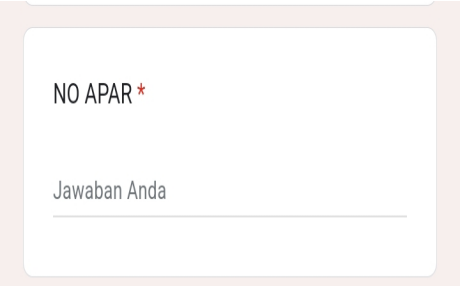


Fig. 4. The next step is to do the compressing that has been read by the Barcode

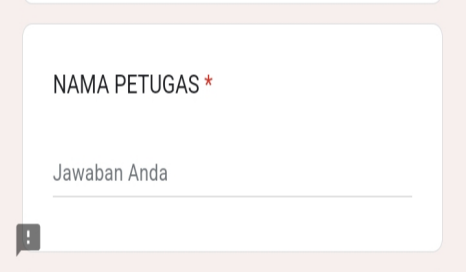


Fig. 5. The next step is to enter the identity of the operator such as Name that performs the Aapar check that is in a particular unit

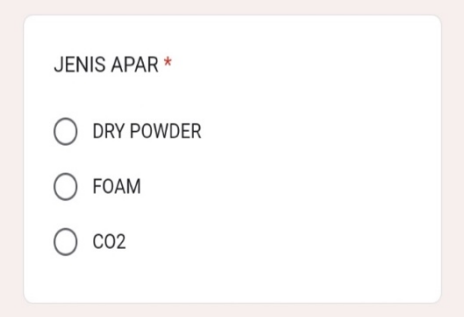


Fig. 6. The following step is to enter the type of fire extinguisher that will be in the data, among which there are several choices of Powder, Foam and CO_2

Fig. 7. For the next step is to sigh the condition of the Normal or empty fire extinguisher

Fig. 8. Next step is to do the shifting of the weight size of apar consisting of 3 kg,5 kg,6 kg,7 kg,9 kg,25kg,35 kg,50kg.

Fig. 9. The next step is to do a sigh of the apar condition

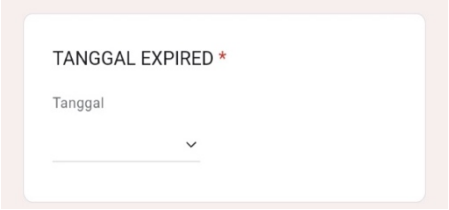


Fig. 10. In this hold is to enter the Expired date

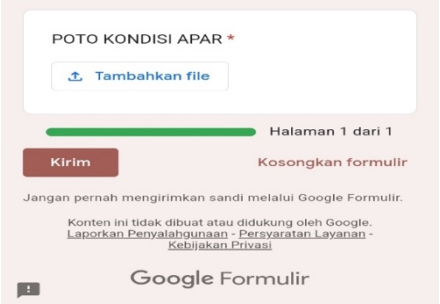


Fig. 11. The last one is to enter the file or photo of the fire extinguisher and finish

III. Result and Discussion

Fire extinguisher is a fairly important component in a company that is useful for preventing fires. In this company, the fire extinguisher reaches 150 fire extinguishers that are used and also already have barcodes and are spread across several points in the company.

Test Results

The system testing method in this study is to use the Black Box Testing method. The black box testing method is a system test that focuses on testing the function needs of a system. This test method aims to find bugs or errors in a system. Here is more details about the origin of testing how Barcode work to check light fire extinguishers (APAR) usinf the black box testing method:

Black Box Testing Mobile Software (Android)

The following is a test table using the user helper on android or mobile. The results obtained are as follows:

Table 4. Black Box Testing Mobile Display

No	Scenario Testing	Expected Results	Conclusion
1	Sign in using Gmail	Successful login displays	Compliant (Ok)
2	Click the fire extinguisher location number	Display the fire extinguisher location number	Compliant (Ok)
3	Click the apar no button	Displaying no APAR	Compliant (Ok)
4	Click write the officer's name	Display the officer's name	Compliant (Ok)

No	Scenario Testing	Expected Result	Conclusion
5	Click the apar type button	Displaying apar types	Compliant (Ok)
6	Click the add user button	Display the size of the fire extinguisher	Compliant (Ok)
7	Click the description of the contents of the fire extinguisher	Displaying the contents of the fire extinguisher	Compliant (Ok)
8	Click the findings of the fire extinguisher contents	View fire extinguisher conditions	Compliant (Ok)
9	Contents of the EXPIRED APAR Date	Displaying the contents of the EXPIRED APAR Date	Compliant (Ok)
10	Inserting a photo of the condition of the fire extinguisher	Display photos of fire extinguisher conditions	Compliant (Ok)
11	Click the "submit" button	Finish and submit	Compliant (Ok)

Black Box Testing Desktop system, can be seen in the table above is a test table using the HSE admin user on the desktop or website.

In this company, there are several fire extinguishers that have been damaged, including:

1. Damage to the seal as many as 12 fire extinguishers
2. Can't be used and has been blistered as many as 24
3. Corrosion 12
4. Empty fire extinguisher 11 Empty fire extinguisher 11

In the use of this fire extinguisher, there are several factors that affect the process of accelerating damage to the fire extinguisher, both physically and the contents in the fire extinguisher, including the process of checking the fire extinguisher which is still manual so as to slow down the process of checking the fire extinguisher so that not all fire extinguishers are realized or exposed. Apar treatment action with waterfall method with barcode with 6 damage modes.

IV. Conclusion

1. The research that the author conducted can produce a method of monitoring using androite-based barcodes that can be accessed through the internet network anytime and anywhere.
2. This barcode-based monitoring method can minimize officer errors in writing data on the results of checking the fire extinguisher, searching for apar checking data and can be viewed and accessed easily.
3. Barcodes have been affixed to each fire extinguisher and the barcode has been designed complete with a description of the state of the fire extinguisher in it, including the type of fire extinguisher, weight, officer's name, expiret, type of.

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