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INTERACTIVE MAP-BASED OPTICAL DISTRIBUTION POINT (ODP) MAPPING DESIGN AND IMPLEMENTATION

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Abstract

PT. Radmila Pratama Multireka is facing problems in mapping Optical Distribution Point (ODP) devices. They need a system capable of mapping the deployment of connected ODP devices. This study aims to design and implement a geographic information system as an information medium to convey the details of the connected ODP device. The research method used in this research is the Object-Oriented approach method which uses the Unified Modelling Language (UML) tool and uses the prototype system development method. Data collection was obtained through interviews and field observations. The results of this study prove that mapping fiber devices into interactive maps using geographic information system technology can be used on the user's side to process business information and solve existing problems. Applications that have been built can help companies provide information about device details, location, and ODP coverage information in each region. And the use of the application has an impact on the ease of users in mapping, maintaining, and procuring ODP devices more effectively.

Keywords: Geographic information system, mapping, Unified modelling language. Optical distribution point.

1. Introduction

PT Radmila Pratama Multireka was founded in January 2014, as a company engaged in Information Systems and Telecommunications. This company focuses on services customers of Telecommunications and Cellular Companies in Indonesia. PT Radmila has handled various projects in areas such as Infrastructure and installations, services and systems, and development and integration [1]. PT Radmila has a project called Fiber to the Home (FTTH) network, which is an implementation of fiber optic transmission technology [2]. One of the important components in the FTTH network is the Optical Distribution Point (ODP), which functions to divide the distribution cable from the Optical Distribution Cabinet (ODC) into drop cables using a 1:8 splitter to be forwarded to customer devices, namely the Optical Network Terminal (ONT). Installation of fiber optic services is done by connecting customer equipment (ONT) to the available ODP [3].

In the ongoing business process, problems arise when new customers subscribe. Information regarding ODP devices is often not updated, causing difficulty in connecting ODP devices to these subscribers. This also resulted in the production of reports that were more time consuming and thus less effective. The problem with device information that is not updated causes ODP device information to be not optimal. The absence of detailed information about the installed devices also results in difficulties in managing the devices, especially when maintaining ODP devices. So far, the ODP mapping system used is still manual, which causes inefficient coordination between the technician and the helpdesk because it is only done by telephone and message when connecting or maintaining the ODP, which has an impact on the efficiency of the time it takes to work. In order for technicians to quickly connect customers to the nearest ODP, technicians need specific location information from the ODP they want to work with.

In previous research, Geographical Information Systems (GIS) fiber-based tools provide more accurate planning for new fiber networks and seamless management of integrated infrastructure and propose a new and simple method for achieving deployment [4]. In the project, a system prototype has been developed to plan the FTTH network, automatically, depending on the geographic area data. The significant difference between this study and previous studies lies in how the design process is constructed from the technical side of the device. In this research, a business process is ongoing, we process information on FTTH devices, especially optical distribution point devices and model them into interactive maps, so that users on the service side can use them to exchange information.

The following is research work related to the application of GIS technology in various fields, such as the Geographical Information System for Slum Areas of South Tangerang City designed by Radliya et al. [5] The purpose of this GIS for slum area is to identify slum settlements based on government regulations presented through the geographical information system media [5]. Another work has been conducted in the Development of GIS Database for Infrastructure Management: Power Distribution Network System, which aims to do interactive online mapping providing three important modules, namely the display module, the statistics module, and the query module in integrating all spatial data with complete power distribution information [6]. Based on the previous work, it was concluded that GIS technology is an information system that is useful for making accurate area and location mapping information systems, especially for mapping optical distribution point devices, so that

it can make it easier for companies to obtain detailed information about devices, locations, and information about ODP coverage in each region.

This study aims to design and implementation a system that can manage data for Optical Distribution Point (ODP) devices. In processing ODP data, the parties involved are the helpdesk in charge of coordinating ODP management activities, technicians on duty in the field, sales who carry out promotions in areas that ODP has reached, can work in one system. By using the ODP mapping system in fiber network management, decision making will be much faster, and the best way for modelling of interactive map is to use a geographical information system (GIS). The system approach method used in this research is the Object-Oriented Analysis Design (OOAD) method and system design tools using Unified Modeling Language (UML) such as use-case diagrams, class diagrams, activity diagrams, collaboration diagrams, state diagrams, components diagrams, deployment diagrams, sequence diagrams, and package diagrams [7]. In this research, we only used two diagrams like use-case diagram and deployment diagram. For the system development method in this study is to use the prototype method [8].

2. Research Method

The method used in developing the GIS is the prototype development method. In the prototype development method, there are several stages that need to be considered in building a system, the stages in the prototype method can be seen in Fig. 1. Needs analysis is the first stage in the research method being carried out. At this stage, data collection related to system development was carried out through observation and interviews with the leadership of PT Radmila Pratama Multireka. In supporting this research, researchers are looking for literature studies related to the development of geographic information systems and optical distribution point devices or FTTH architecture. In addition, an analysis of the system processes running in PT Radmila Pratama Multireka was conducted to find out what information the technicians, sales and helpdesk needed as system users. This stage can produce data and information that will be used in the development of a geographic information system in accordance with the wishes and needs of system users.

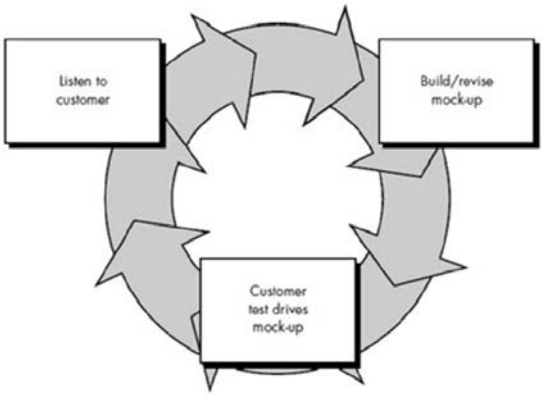

Fig. 1. Prototype method [9].

The second stage in this research is the design of a geographic information system for optical distribution point mapping. At this stage, the design of the system is carried out using the data that has been obtained in the first stage according to the needs of the system user. This stage analyses and translates needs and data into prototypes that are easily understood by users. This prototype is given and presented to system users, if the prototype is in accordance with the user's wishes, the process will continue to the system development stage.

The geographic information system of optical distribution point mapping that has been completed is given and presented back to the user of the system. Then the system will be evaluated and tested. At this stage, the system testing is carried out using black-box testing [8]. In the last stage the completed system can be directly used and operated by the user. In the system implementation process, system users will be given training related to learning geographic information systems, optical distribution point mapping and how to operate it.

3. Results and Discussion

This section discusses the steps in implementing the prototype method based on the evaluation of the current system, designing the system, testing the system then implementing the system design.

3.1. Existing analysis

To find out in detail what to do to build a system, the first step that must be done is to analyse how the system is implemented. The description of the system applied can be seen in Fig. 2.

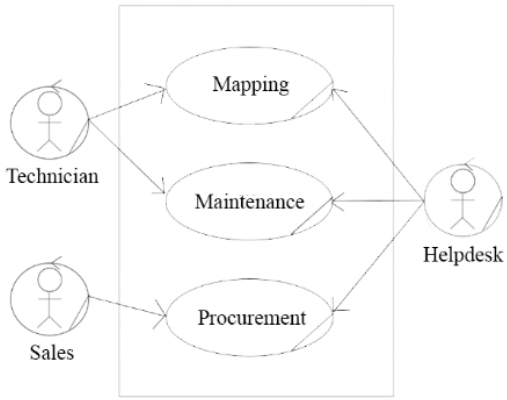

Fig. 2. Business use case current system.

There are 3 use cases namely mapping, maintenance, procurement and 3 actors, namely technician, sales, and helpdesk. The technician has two cases to do in the system, there are Mapping for the device and Maintenance of the device. Sales only have to do procurement. and the last actor is the helpdesk, who is connected to all the main case. This business use-case gains from a business activity at the company procedures.

3.2. Evaluation

In this stage, the existing system has to be analysed to find vulnerabilities and the actual problem. The evaluation stage is used to find the best solution, and to get the proper proposed system. The results of the analysis that have been carried out, found some weaknesses and shortcomings and the solutions can be seen in the Table 1.

Table 1. Evaluation of existing systems.

Problems	Solution
Lack of information to determine the availability of tools and mapping information.	Design and develop proposed procedures to inform the availability of tools and mapping information for conducting device mapping.
Technician's ignorance of the last device that was previously maintained.	Design and develop proposed maintenance procedures to view schedules can be done online and the technician can monitor the order of maintenance.
Reports on the delivery of new equipment by sales cannot be handled properly by the helpdesk	Design and develop proposed procedures for procurement or submission of equipment to facilitate submission of equipment procurement data
A system that has not been integrated with a database makes files and files stored in several different locations making work ineffective and efficient.	Designing and building an integrated system to make it easier for device data management, maintenance and procurement.

3.3. System design

This system design aims to produce an optical distribution point mapping system which is expected to improve the weaknesses of the current system. Use case diagrams are diagrams that can model system users and the functions provided by the system, use cases help demonstrate how the system communicates with actors [9]. GIS optical distribution point use case diagram can be seen in Fig. 3.

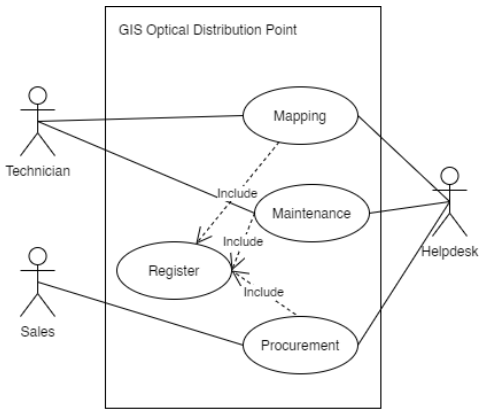

Fig. 3. Use case design system.

There are 4 use cases, namely register, mapping, maintenance, procurement and 3 actors, namely technician, sales, and helpdesk. The use case description of GIS optical distribution point is presented in Table 2.

Table 2. Use case description.

Use Case	Description
Register	The process of registration for an account to gain access to the system.
Mapping	The process of mapping devices by technicians
Maintenance	The process of performing periodic maintenance of the optical distribution points by technicians.
Procurement	The process of procurement devices by sales.

3.4. Deployment

Deployment package specifies constructs that can be used to define the execution architecture of systems and the assignment of software artifacts to system elements [10]. Fig. 4. describes the application architecture designed, on the web server side it includes MySQL as a database management system and Laravel as a PHP framework which uses MVC Architecture [11,12], on the external server side includes the corporate web and the domain for the application itself. To access the system the client uses a web browser connected to the internet.

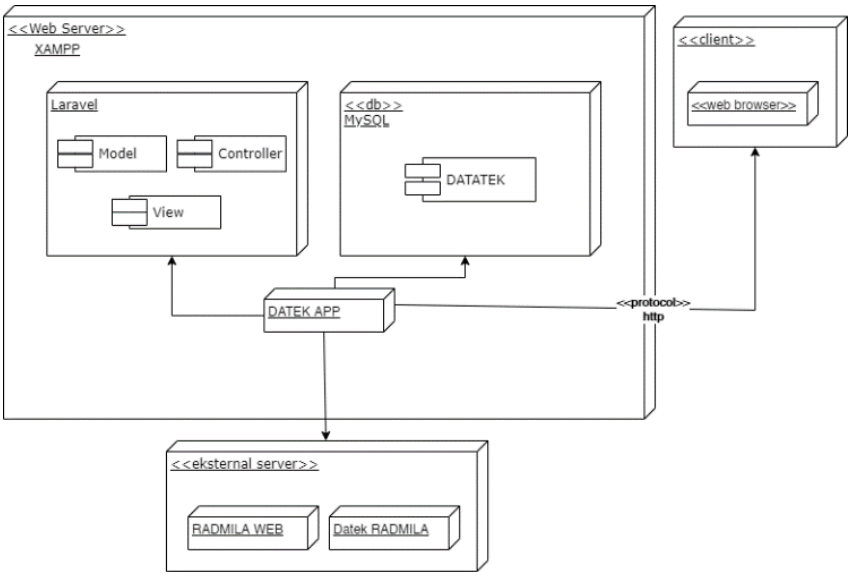

Fig. 4. Deployment diagram.

3.5. Interface

Interfaces are very important in building applications. If there is no interface, the application cannot be viewed and followed up. Therefore, the following is an interface in the program that has been designed and what its function is and how the description is show in Table 3.

Table 3. System Interface

Name	Description
Dashboard	Displays the main page
Map	Displays a map page
Mapping ODC	Displays the ODC device mapping page
Mapping ODP	Displays the ODP device mapping page
Mapping Customer	Displays the Customer device mapping page
Maintenance ODP	Displays the ODP device maintenance page
Maintenance Customer	Displays the Customer device maintenance page
Customer Data	Displays the Customer data page
Procurement Devices	Displays the device procurement page
User Data	Displays the User Data page
Device Data	Displays the ODP, ODC device page
Report	Displays a report on each function available to the technician and helpdesk

3.6. Testing

The component of the system was evaluated by using Black Box method. Its approach focuses on device functional requirement analysis [13-15]. Table 4 provides results of Black Box Testing. It defines numerous features indicates that system functionality fit the expected result. Therefore, a system performance is acceptable.

Table 4. Black box testing results.

System Feature	Expected Results	Actual Results
Register	Technicians and sales can register for an account and Helpdesk can verify registrant data.	Valid
Login	All users can log in and enter the system.	Valid
Mapping	Technicians can input data for mapping of ODP devices.	Valid
Maintenance	Technicians can input data for maintenance of ODP devices.	Valid
Procurement	Sales can input data for device procurement.	Valid

3.7. Implementation

To be able to access the system, users must log in first by entering the email and password that has been verified by the helpdesk after passing account registration. A successful login will bring the user to the dashboard of the system as seen in Fig. 5. The dashboard displayed contains the number of user data on the system, the number of subscribed subscribers, the number of devices covering ODC and ODP devices, and the number of status devices that are experiencing interference at that time. This system allows system user to show the ODC, ODP, and customer mapping pages. The amount of data displayed in accordance with the limit of the amount that has been set to display and divide it into several table pages. Mapping data can also be edited or deleted by user.

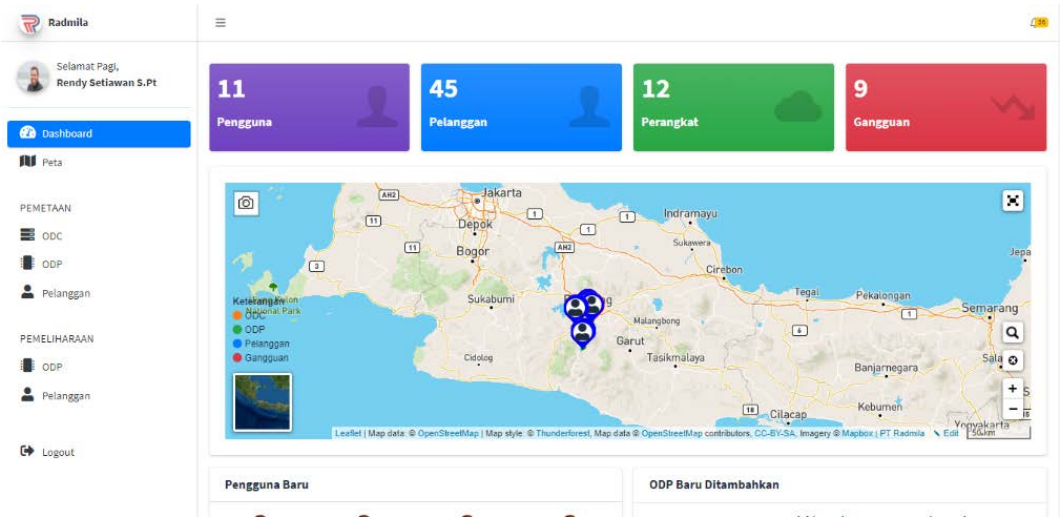

Fig. 5. Dashboard interface.

Users can view detailed device information via an interactive map and filter by region (showed by the blue line). The map displays symbols for devices and colour codes for interference or current status. As seen as in Fig. 6. which is a map view containing device data. With this interface implementation, the system user can be clearly getting information about the relations between ODC, ODP, and its customers. The interactive map will display optical distribution point details such as device name, address, and which ODC is connected to.

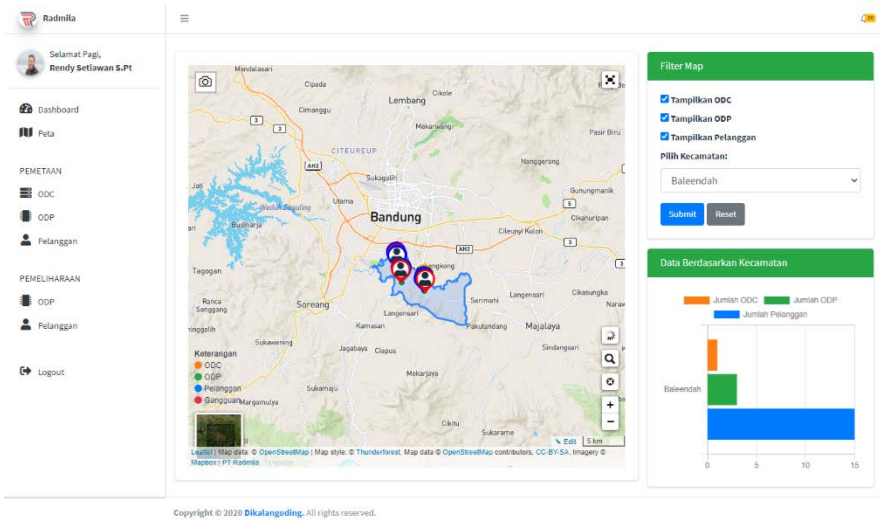

Fig. 6. Map display.

Detail text on device popup will point to full details information containing which device is connected to the related device as shown in Fig. 7. An example region shown in Fig. 7. represents how the system used. Detail device information

also contains ODP capacity that can be used to inform the customer about the network available on the coverage area.

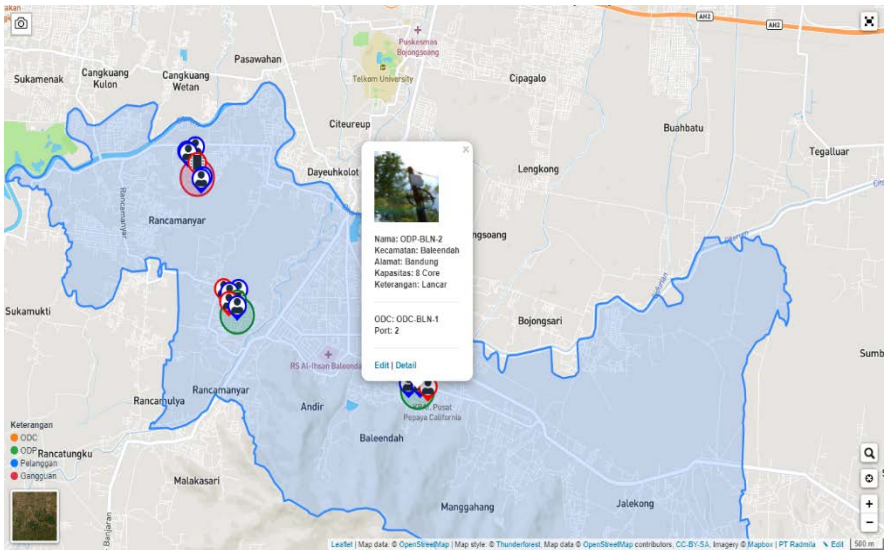

Fig. 7. Device detail view.

This system is built using an interactive Java script-based GIS framework. This interactive GIS framework makes it easy to develop web-based applications by utilizing standard GIS features. The FTTH mapping is based on the company's area coverage in running its business, integrated with an interactive GIS framework and applied in the form of a web-based information system. Similar studies have previously been conducted by Matrood et al. [4] using ArcGIS and the application of multiple layers in its FTTH mapping based on data from the local government. The purpose of that study was to provide information predictive mapping of FTTH based GIS application and provide information on related costs and strategy [4]. Generally, this study emphasized how the whole developed system works to produce ODP and ODC information specifically.

Even though the system that is built functionally is as expected from this study, this application still has minor flaws. The FTTH architecture is very complex, there are many devices in FTTH [4]. In this study the device only focuses on optical distribution points (ODP) which causes information from the data center to the customer cannot be traced well.

4. Conclusion

From the results of the analysis and design that has been carried out, the system for mapping Optical Distribution Point devices, has been supported by an integrated system, enabling the collection of network infrastructure data to be efficient and fast, making it easier for organizations to handle infrastructure data when the network gets bigger. In addition, in the process of developing and maintaining network infrastructure, technicians will find it easy to identify the details of connected devices and users and also facilitate the sales process in determining positions or regions to promote, because devices that are still available to be connected to customers can be

known through the system and can immediately submit a new device to the system if a customer wants to subscribe but there is no device available.

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