Web Based Aviation Communication Tool Information System

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Abstract

In air transportation, communication systems play a vital role as a link between ground personnel, pilots, and other personnel on the ground. However, the process of recording maintenance and repairs of aviation communication equipment still uses conventional, paper-based methods, which are inefficient, error-prone, and require significant space for archiving. This study aims to design and implement an information system for reporting maintenance and repairs of Aviation Communication Facilities at the Makassar Branch of the Public Company (PERUM) LPPNPI, utilizing a web-based platform. Research data was obtained through field observations, data requests, and literature reviews. The system development method used the Waterfall model. The results indicate that the developed information system facilitates technicians in recording maintenance and repair reports more quickly, accurately, and in an organized manner. The system was tested using Black Box and User Acceptance Test (UAT) techniques with 20 respondents. The test results showed a feasibility rate of 85%, indicating that the system can be implemented effectively in the work environment. This innovation enhances the effectiveness of aviation communication facility management and administrative efficiency, while also supporting improved operational safety in air transportation through the availability of more transparent, accurate, and easily accessible data.

Keywords: Aviation Communication Facilities; Maintenance; Repair; Web-Based Information Systems

Introduction

Public Company (Perum) LPPNPI is a state-owned company engaged in aviation navigation services(Marito & Margono, 2021). Perum LPPNPI, also known as Airnav Indonesia, is a BUMN that has the authority to provide flight navigation services throughout Indonesia's airspace. The services provided are in the form of guiding aircraft from takeoff to landing. In the services provided, there are many units involved, one of which is the engineering unit that plays a role in the maintenance of electronic, electrical, and building equipment. One of them is the Aviation Communications Facility Unit, which is authorized to maintain the Aviation Communications facility equipment(Sakinah, 2017).

ATIS is equipment that can be used to provide aeronautical information services, including meteorological messages that are broadcast (broadcast/continuous) in airport airspace in accordance with its provisions, to support flight navigation safety, regularity, and efficiency(Morioka et al., 2020)(Brock et al., n.d.). ATIS equipment systemically consists of 2 main parts, namely: a) ATIS server equipment, which functions to manage meteorological data/information around airports and runways in use, both coming from mcteo system equipment and data entry from ATC, data is converted into voice (voice), and emitted, which works continuously and automatically. b) VHF Transmitter equipment that functions to transmit ATIS output omni.

The Aviation Communications Facility is one of the three facilities provided by the Aviation Navigation Service Company(Berdermann et al., 2018). Aviation Communication Facilities in the form of Aviation Communication Radio Facilities, Voice Recording Facilities, and Voice Control Switching Facilities(Fiorentino et al., 2020). Aviation Communication Radio Facilities, such as VHF Air Ground, are equipment that functions to transmit and receive electromagnetic waves consisting of a main transmitter and receiver, and a standby transmitter and receiver. In operation, the main transmitter and receiver (main) are connected with an automatic changeover switch, which can switch them automatically according to operational requirements. The VHF A/G used in MATSC is the Telerad and PARK AIR T6 brands.

Meanwhile, HF Air Ground is an aviation communication equipment used for ground-air radio communication, used to exchange news in the form of voice, between: a) Communications officers at FSS (Flight Service Station) stations and pilots on aircraft flying on domestic flight routes. (Regional Domestic Air Route Area). b) Communication officer at the FIC station with pilots on aircraft flying on international flights (Major World Air Route Area). in the context of flight information exchange services. HF Air Ground equipment consists of HF Transmitter equipment with its accessories, HF Receiver with its accessories, and Console Desk and its accessories installed in the Operations Building(Li et al., 2020)(Horstmann et al., 2019).

Communication via HF is divided into several frequencies: HF RDARA (8918 KHz, 11309 KHz, 6544 KHz, 5550 KHz, 2956 KHz), HF MWARA (11396 KHz, 6556 KHz, 3470 KHz). In accordance with the Regulation of the Director General of Civil Aviation Number KP 35 of 2019 concerning Operational Technical Guidelines for Civil Aviation Safety Regulations Part 171-12 (Advisory Circular Part 171-12)(Markus & Eftekari, 2020). Maintenance and Reporting Procedures for Aviation Telecommunication Facilities. According to Article 14, service providers are required to record all activities, including preventive and repair maintenance, of aviation telecommunications facilities. Every personnel of the flight communication facility unit of Perum LPPNPI Makassar Branch, as part of the flight service provider, is required to record every equipment parameter on the form provided.

But for now, the recording system is still conventional. The maintenance form is currently still using paper for documentation. This traditional system is ineffective because it still relies on paper and requires space for filing. Moreover, searching for data is difficult and time-consuming, especially during an inspection by the Authority. Therefore, it is necessary to have a technology-based system in this work process to enhance efficiency. The web can be interpreted as a collection of pages that display text data, image data, animation data, sound, video, and a combination of all of them, both static and dynamic, which form a series of interrelated buildings, each of which is connected by networks, page (hyperlink)(Jannaty et al., 2018). The author concludes that the web is a software that serves to display documents on the internet, allowing users to access it through software connected to the internet.

Method

When creating a system, start by analyzing the existing problems and identifying the necessary conditions. The goal is that the designed system is efficient, and the resilience of the system will be maintained. This section discusses the design of an information system for web-based flight communication facilities using the waterfall method, while the programming language uses PHP and MySQL(Susilana et al., 2022);(Chaudhry et al., 2019). Making this application starts from system design, system implementation, and system testing/analysis, and concludes. Furthermore, this system requires a database, which is an important part in making the application form for recording equipment parameters, because the database is a place to store all forms with detailed parameter contents(Ali et al., n.d.).

Authentication Table

Authentication is often referred to as validating user data when entering a certain system. One of the authentication systems is to fill in the user name and password before the user can use the application(Zhao et al., 2020). User authentication is a mechanism to determine whether a user has the right to enter the system or not. The implementation is a login. In this case, the user with the right to access will be given a specific username and password. If there is a username and password that is not registered in the user list, then the user is not entitled to access. We must be able to anticipate this if we do not want the system that was built to be randomized by unauthorized people.

Table 1. Login

Field	Type	Width	Information
Username	Varchar	255	Username
Password	Varchar	255	Password

Maintenance table

The Maintenance type page is the page used to add or remove Aviation Communications Facility equipment.

Table 2. Types of Maintenance

Field	Type	Width	Information
app_type	int	20	
No	Varchar	10	
Type	Varchar	255	Primary_Key
Category	Varchar	10	
Image	Varchar		
user_id	Varchar	10	

Table maintenance details

The maintenance detail page displays the equipment form completed by the technician, specifying the equipment type and date of completion.

Table 3. Maintenance Details

Field	Type	Width	Information
App_maintenance	int	255	
No	Varchar	10	
Date	Varchar	30	
Category	Varchar	10	
Unit	Varchar	20	
Tool	Varchar	20	
Description of activities	Varchar	255	Primary_Key
Notes	Varchar	255	
Suggestion	Varchar	255	
Technician	Varchar	100	
Spv	Varchar	20	
Manager	Varchar	20	
Status	Varchar	10	
User_id	Varchar	20	

The following is an interface design that describes how to design an application display that provides information to users. The function of this interface is to connect the user with the operating system, so that the system can be used, as for the appearance as follows:
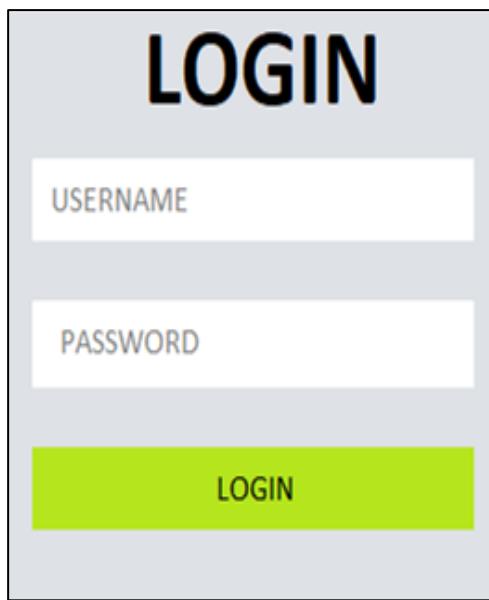
Figure 1. Main Screen Design

Furthermore, the home display is the second layer after logging in to select the form of equipment to use. The user can choose one form, and after filling it in, it will return to the home screen.
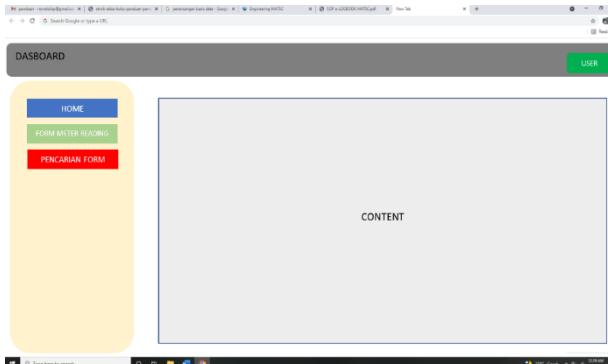
Figure 2. Home Display Design

While the system testing method used a black box, this test is an important part of the software development cycle, and system testing techniques using black box and UAT methods focus on the functional requirements of the software.

Results and Discussion

Result

The result of designing an information system is a computer software that is ready to use according to the needs of users, and a good operating system is one that is able to provide a secure state and remains consistent when the hardware and software applications communicate, while also providing an easy, comfortable, and attractive interface for the user. users. The concept of operating systems can be more easily understood if you also understand the type of hardware used. Vice versa. Information systems are not created haphazardly. In its manufacture, mature principles and concepts are needed so that the system runs as expected in its application(Sharma et al., 2020).

Not infrequently, an information system is raw when applied, because there are no proper principles in making a good information system. From history, it is known that the operating system and hardware influence and complement each other. The structure of an operating system is heavily influenced by the hardware used to develop it. Meanwhile, hardware development is strongly influenced by the things required by an operating system(Berdik et al., 2021). The data processed through the model becomes information. The recipient then makes a decision and takes an action, which in turn produces another action that generates some data.

This discussion will cover each page of the web-based flight communication facility information system at the LPPNPI Makassar Branch Public Company. The system enables technicians to report maintenance and repairs more easily and Allows Managers to monitor technician activities. While the display of the results of the system design can be seen as follows:

a. Login Page: This is the page that will appear if you successfully access the Web-Based Aviation Communication Facility Information System link at Perum LPPNPI Makassar Branch. The login view can be seen in Figure 3.


Figure 3. Login Page Display.

b. The dashboard page is the start page if the user successfully logs in using the username and password. The dashboard page menu in Figure 4 is different for each user according to the authority.
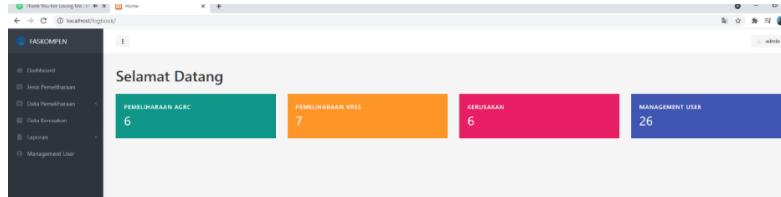

Figure 4. Dashboard Page Display.

c. VHF AG Equipment Parameter Recording Form Display
    Figure 5 shows the form to be filled out on the VHF AG radio equipment

Figure 5. VHF AG. Equipment Parameter Form

d. Voice Recorder equipment parameter recording form display

    Figure 6 shows the form to be filled in the Voice Recorder equipment

Figure 6. Voice Recorder Equipment Parameters

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e. FREQUENTIS VCSS Equipment Parameter Recording Form Display

Figure 7 will display the form that will be filled in the VCSS FREQUENTIS equipment
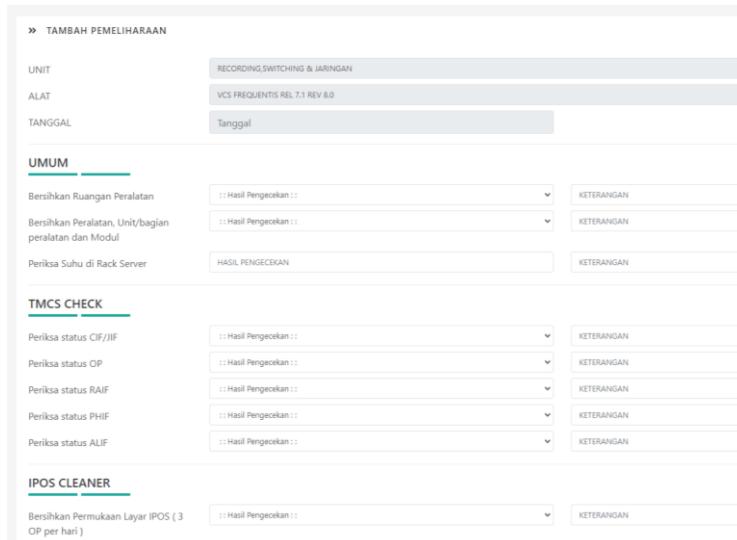
Figure 7. Frequentis VCSS Equipment Parameter Form

f. HARRIS VCSS Equipment Parameter Recording Form Display

This display will present the form that will be filled out in the HARRIS VCSS equipment
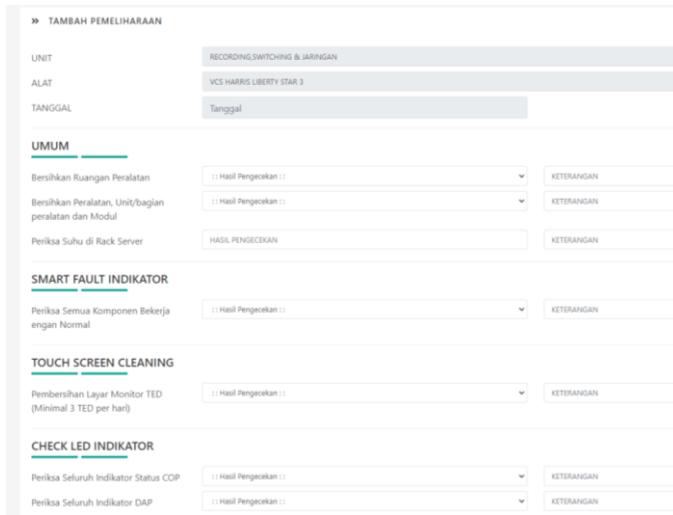
Figure 8. HARRIS VCSS equipment parameter form

Application testing using the UAT method

UAT (User Acceptance Test) is a testing process carried out by users, with the output of a test result document that can be used as evidence that the software has been accepted and has met the requested requirements. UAT is not much different from the questionnaire in the early stages of application development. The system testing results were obtained by asking respondents to evaluate the application through questionnaires, ranging from number 1 to number 10. Based on the analysis results, it is evident that this system falls within the assessment grade 76-100, namely 'Very easy to use', with an average value of 3.5, and the percentage is 87%.

Discussion

Technical Guidelines for Operational Civil Aviation Safety Regulations Section 171-12 (Advisory Circular Part 171-12) Maintenance and Reporting Procedures for Aviation Telecommunication Facilities. To maintain the capability, capacity, and quality of aviation telecommunications facilities, service providers must carry out maintenance of aviation telecommunications facilities in accordance with the provisions stipulated in this regulation (Efthymiou et al., 2022). Daily maintenance of aeronautical telecommunications facilities, as referred to in Article 10 paragraph (1) letter a, can be carried out using an information technology application system and/or methods determined by the service provider to monitor and ensure the performance of aviation telecommunications facilities according to standards by referring to the service operator's operating manual.

Level 1 maintenance, as referred to in Article 12 paragraph (1) letter a, is preventive maintenance that is carried out periodically, including:

   a. Cleaning of aviation telecommunications facilities;
   b. Inspection of aviation telecommunications facilities includes status indicators and parameter readings;
   c. Inspection of supporting facilities for aviation telecommunications services;
   d. Replacement of indicator lights, safety components, and other consumables.

Service providers must record preventive maintenance activities and repair maintenance of aviation telecommunications facilities(Rajee Olaganathan et al., 2020). Currently at the Makassar branch of the Perum LPPNPI Office, especially in the Aviation Communication Facility Engineering division, he handles Aviation Communication Radio equipment (23 Radios), voice recorder equipment, Voice Communication Switching equipment (2 VCS), and DATIS equipment. He still uses conventional methods to record equipment parameters, writing them on a paper form that must be archived monthly. With the system that has been developed, it is hoped that this web-based flight communication technology facility can increase the efficiency of maintaining flight communication facilities at Perum LPPNPI Makassar Branch.

Conclusions and Suggestions

Conclusions

The conclusion from this study is that the design of the information system for flight communication facilities at Perum LPPNPI Makassar Branch is web-based using the waterfall method, so that the system design process runs well. The design process starts with system requirements analysis, system design, implementation, system testing, analysis of results, and conclusions. The implementation of an information system for aviation communication facilities at Perum LPPNPI Makassar Branch is web-based, utilizing PHP and JavaScript programming languages to integrate maintenance and damage report forms with the system design. MySQL is employed to connect the database system. Based on the results of testing using the Black Box testing technique and UAT testing, 85% of 20 respondents.

Suggestions

As for suggestions for the future, this information system is not only used by the division of aviation communication facilities of Perum LPPNPI Makassar Branch, but can be developed so that it can be used by other Divisions in Perum LPPNPI Makassar Branch and throughout Perum LPPNPI in Indonesia.

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