

# Website Based (We-Retag) as Chemical Foam Quality Tests Record on Foam Tender Vehicles

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## ABSTRACT

This study aims to design a We-ReTag website (we enter record tag) which digitally able to record the outcomes of foam quality testing on foam tender vehicles more efficiently than logbooks or spreadsheets. In addition, this study also ensures that the website is designed to be easy to use (user-friendly) for inputting data on foam quality test results. A material expert and an IT expert who serves as a We-ReTag website validator are the study's subjects. The entire 36 (thirty-six) ARFF personnel at Sultan Mahmud Badaruddin II Airport Palembang are the subject of this website's design. This study used a waterfall model in conjunction with the research and development (R&D) approach. Starting with the requirements stage, this process moves on to desing, implementation, testing, and verification before coming to an end with maintenances. This result of study show that We-Retag website was highly appropriate for usage in ARFF unit of SMB II airport based on validation from IT and material specialist with average scale of 87%. In addition, the average scale obtained from the questionnaire filled out by ARFF personnel was 89 %. The benefit of this research is to increase the effectiveness in chemical foam quality test record and expected its usage can be disseminated to other airport throughout Indonesia in similar operational context.

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## 1. Introduction

Sultan Mahmud Badaruddin (SMB) II Airport is one of the airports managed by PT Angkasa Pura, located in the city of Palembang, South Sumatra, Indonesia. According to Law No. 3 of 2001's rules, article 34, this airport is classified as category 8 and is equipped with an emergency response unit, a type A Aircraft Rescue and Firefighting (ARFF) unit, that has been modified to fit the category and class of the airport.

ARFF unit is part of the airport emergency response unit (one of which is fire hazard), which has technical and operational standards set by the airport regulatory authority. ARFF personnel have primary duties, namely conducting 3 main activities including (1) operations such as administration, rescue and firefighting, and standby readiness, (2) training, and (3) maintenances of operational vehicles and equipments [1]

To anticipated emergencies that occur spontaneously, ARFF personnel according to [2]; [3] must maintain facilities such as vehicles, and equipments to ensure these are always ready for use

at any moment, especially chemical foam concentrate as extinguishing agents which primarily use for suppressing fire in the aircraft incidents. Quality test of chemical foam as extinguishing agents needs to be carried out to ensure its performance to extinguish fires effectively.

During maintenance activities, the sample of chemical foam obtained from foam tender vehicles are subjected to a series of examinations such as physico-chemical properties and performance tests. Typical properties that are routinely tested in this category include pH, refractive index, viscosity, sedimentation and surface tension. To determine chemical foam concentrate continued suitability for use, the ability of its sample to produce and expanded foam at a given induction rate is tested. Practical foaming testing is always included to measure both the amount of expanded foam produced (expansion ratio) from a solution, and the longevity or that foam (25% drainage time) [4].

During the observation and interviews in the ARFF unit, the researchers found that the examinations of chemical foam quality on vehicles has been carried out well and in a structured manner. However, the data collection of chemical foam quality test result is still done manually using work sheets and record tags which is considered less feasible because it poses a risk of data loss, moisture effect, tearing, and other unwanted issues.

People's lives are easier in the digital age since they could work from anywhere at any time by using the internet [5]. For this reason, in order to allow staff working efficiently, the ARFF unit should apply this digitization. Thus the data collection is protected from unwanted dangers and can be utilized as best as possible. In order to address the issues encountered by the ARFF unit during operational activities, the researcher uses a website as a means of gathering data on chemical foam quality testing results which obtained from foam tender vehicles. The researcher suggests "Website Based (We-Retag) As Chemical Foam Quality Test Record On Foam Tender Vehicles" as the final project to achieve this goal.

Based on the background outlined above, the researcher seeks to identify the existing problems as follows:

1. Is the We-ReTag (We Enter Record Tag) website categorized as "suitable" as database for storing chemical foam testing data in comparison to using a logbook/work sheet?
2. How to design the We-ReTag (We Enter Record Tag) website to be user-friendly for ARFF personnel in the process of inputting data resulting from chemical foam quality testing on foam tender vehicles?

## 2. Method

This project uses the research and development method, commonly known as Research and Development (R & D) with Waterfall model approach. Sari & Rizki mention that the research and development method is a systematic approach used to create or improve products. This process consists of a series of stages designed to produce solutions that can be validated and accounted for [6].

Despite being the oldest methodology model in existence, the waterfall model is still frequently utilized in many software development projects because of its simple, understandable form. The waterfall model's distinct quality is its methodical, sequential approach, in which every stage must be finished completely before moving on to the next.

The waterfall model is an approach in developing/designing software that arranges the stages of the process linearly. This process starts with the requirements stage, followed by design, implementation, verification/testing, and ends with maintenance [7].



**Fig 1** The Stages of Waterfall Method

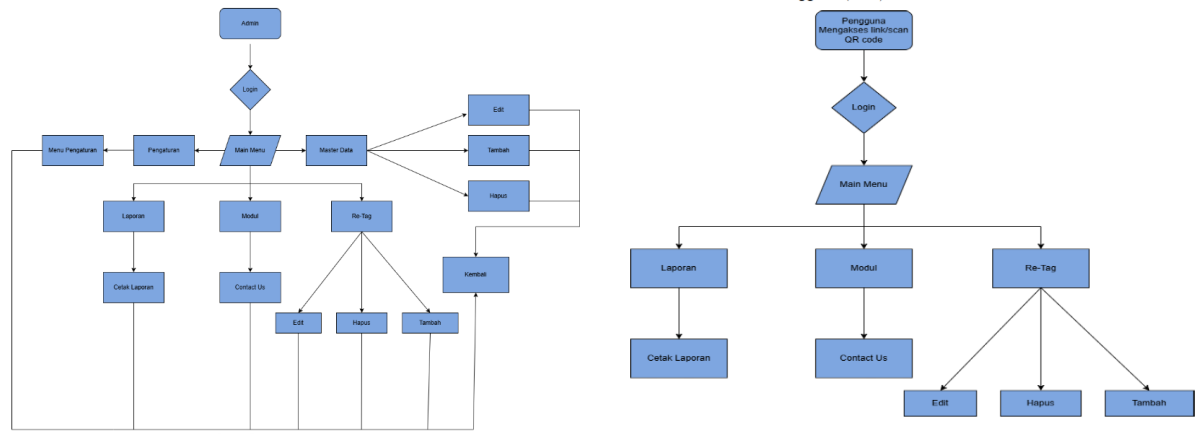
As stated by Pressman, before creating software, developer must understand the stages of a good software development model, which are structured and systematic [8]. For that reason, the purpose of developing (digitalizing) this record tag is to focus on creating a product that is ready to be used for inputting data resulting from chemical foam quality tests on foam tender vehicles and used as a database, thereby facilitating ARFF personnel in conducting maintenance activities and ensuring that the test data is safe from the risk of loss by following some step such as:

1. Requirement  
The researcher used the information obtained from field surveys and interviews to create a new system that utilizes a website which is suitable for data record. The data obtained by the researchers at this stage is very important for the development of system features.
2. Design  
At this stage, a design is created in the form of a flowchart adjusted to various proposals and creates a context diagram, as well as a database and the appearance of the WE-ReTag website.
3. Implementation  
At this stage, the coding work is begin. The database used in this coding is MySQL. Meanwhile, the programming language used by the researcher in developing the information system is PHP.
4. Testing  
The fourth stage will combine several systems that have been loaded with coding in the previous stage. After that, testing will be conducted to ensure that the designated system meets the desired model with minimal errors.
5. Maintenance  
The final stage of waterfall development is maintenance. Users will operate the system to input chemical foam quality test data through a URL address or QR code. Additionally, maintenance will be carried out, which includes error corrections and system improvements.

### 3. Results and Discussion

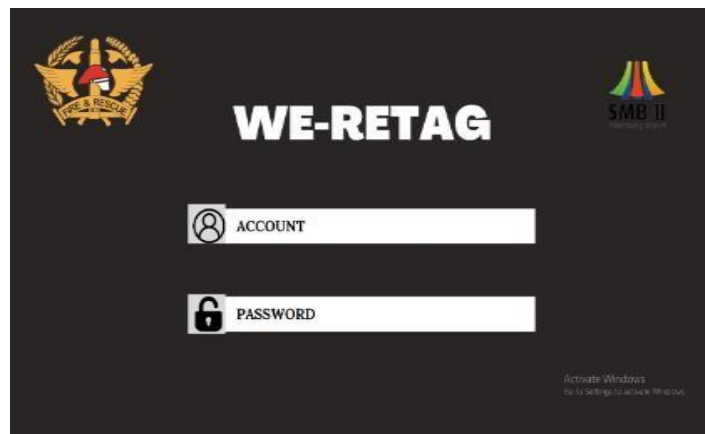
#### Design of We-ReTag

The flowchart design started with data gathered from observations and interviews conducted at the ARFF unit. The flowchart diagram on this website will display the overall workflow of the website and explain the sequence of events that occur within it, as well as describe the appearance and workflow of the We-ReTag website, which consists of an admin access flowchart and a user access flowchart.

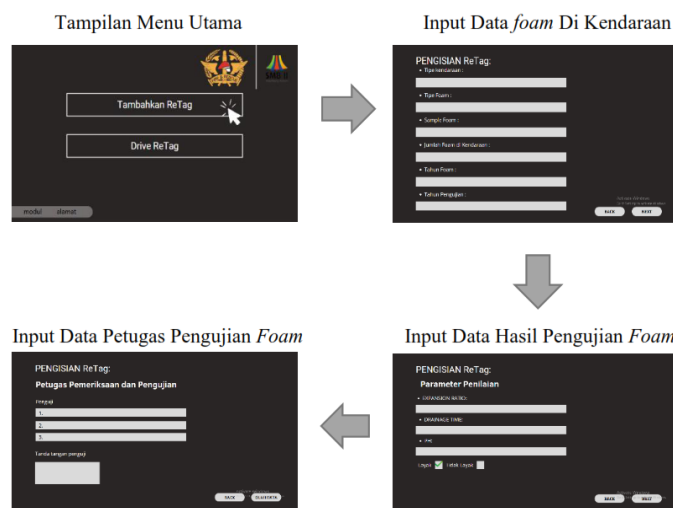


**Fig 2** Flowchart We-ReTag for Admin (Left) and User (Right)

Relying on the flowchart Fig 2 above, in the next stage, the researcher design the menu selection layout in the form of features on the website that have been arranged in such a way and are easy for users to use, as shown below in Fig 3.

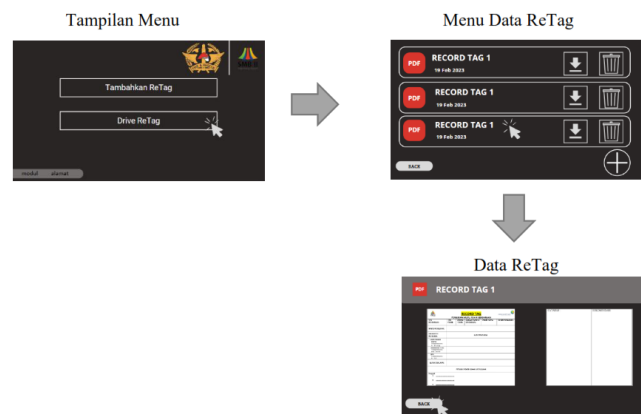


**Fig 3** Log in Display (Admin & User)



**Fig 4** Data Input Display

One of the We-ReTag website's capabilities, the record tag addition feature (also known as the data input tool for chemical foam quality testing results from foam tender vehicles) is shown in Fig 4.



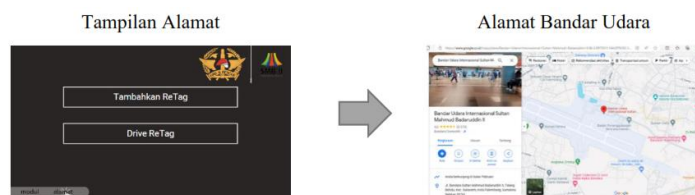
**Fig 5** Drive ReTag Display

Fig 5 shows another feature of the We-ReTag website, which is the feature to access previously added tag records, delete data, and modify tag record data.



**Fig 6** Module Display

Fig 6 & 7 shows the appearance feature for accessing regulations related to chemical foam quality testing and address of the ARFF unit involved.



**Fig 7** Address Display

## Implementation

This website was developed using the PHP programming language, which is based on the Bootstrap Framework, and a MySQL database up until the hosting or publishing step. MySQL is designed with the capability to handle multiple tasks simultaneously (multithreading) and can be used by multiple users at the same time (multiuser). As an SQL database management system, MySQL provides various tools and functions to store, organize, and access data efficiently [9].

PHP is used because one of PHP's advantages is its flexibility in integrating with HTML, the standard markup language for creating web pages. This allows developers to embed PHP code directly into the HTML structure, creating dynamic and interactive web pages [10]. At this point, the tools that will be utilized in the system/website design process, including the following software and hardware was set up:

### Hardware

The laptop device that was utilized to create the We-ReTag website has the following specifications:

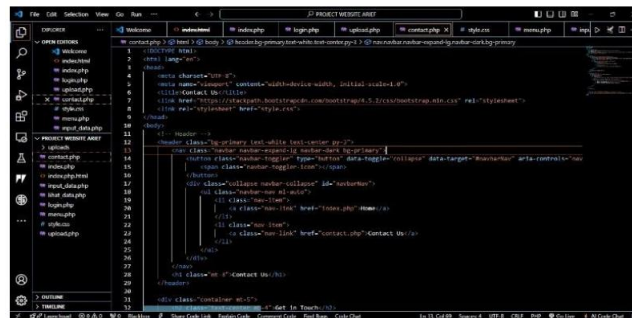
1. Intel Core i5 8th Generation Processor with up to 3.90 GHz cache of 6M
2. RAM of 4 GB
3. SSD with 256 GB
4. Windows 11 Home 64-bit Software
5. Hard-drive(1TB)

## Software

The following pieces of software were utilized to create the We-ReTag website:

1. Browser
2. Code Editor for Visual Studio
3. PHP as the programming language
4. MySQL as the database
5. CMS as web content management

As seen in Fig 8 the outcomes of this implementation phase signals the start of the system's (or design's) program code creation (programming/coding).



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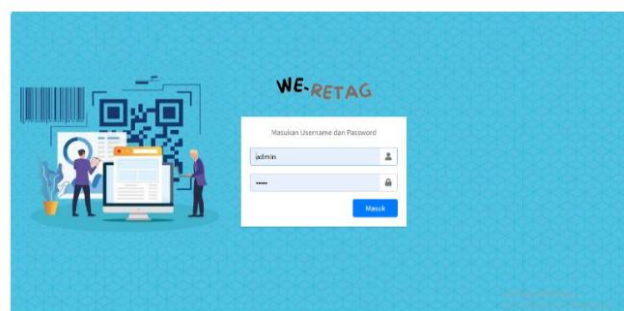
1 <input type="text" />
2 </div>
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4 <input type="text" />
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6 <input type="submit" value="Kontak" />
7 </div>
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**Fig 8** Coding Using Visual Studio Code

Visual Studio Code was the program that the used to code the We-ReTag website. VSCode is a productive and user-friendly programming tool. Its flexibility in working with multiple widely used operating systems, including Windows, macOS, and Linux, is one of its advantages. Modern programming languages like JavaScript, TypeScript, and the Node.js environment are the main focus of VSCode's architecture. Furthermore, VSCode may be expanded to support a wide range of additional programming languages and development environments thanks to its flexible extension mechanism [11].

In the design and development of websites, researchers use a Content Management System (CMS). A CMS is a system that helps users develop the required system. Content Management System (CMS) is a system that is used to control or manage content on a website such as text, links, image, HTML documents and other form of media. The aim of CMS is to help non-technical users to design their website [12]. By using a CMS, users can choose and understand the system creation process, which allows them to easily obtain a system that matches the design that has already been made. Like the addition of website features, as well as the refinement of the website to be ready for use and implementation, which could be adjusted according to the needs of user in this case is ARFF unit in SMB II Airport. The following Figs 9 shows the design implementation of We-ReTag CMS.



**Fig 9** Implementation of the Log In Page

This page serves as the We-ReTag website's login view, showing the homepage and login options for both users and administrators. his page aims to ensure the website's security and detect who accesses this website.

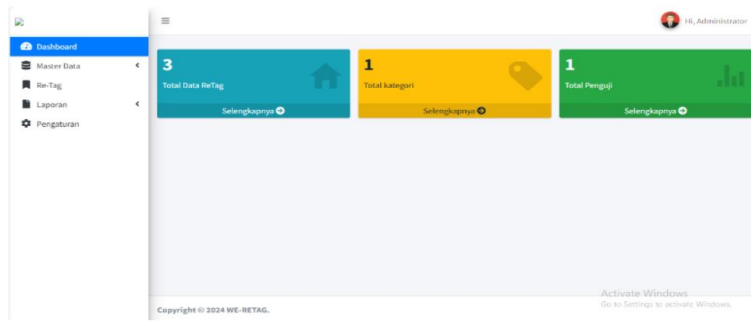


Fig 10 Implementation of the Dashboard Page

Fig 10 shows the total number of record pages added, the total number of chemical foam categories tested, and the total number of testers added by the administrator in the master data.

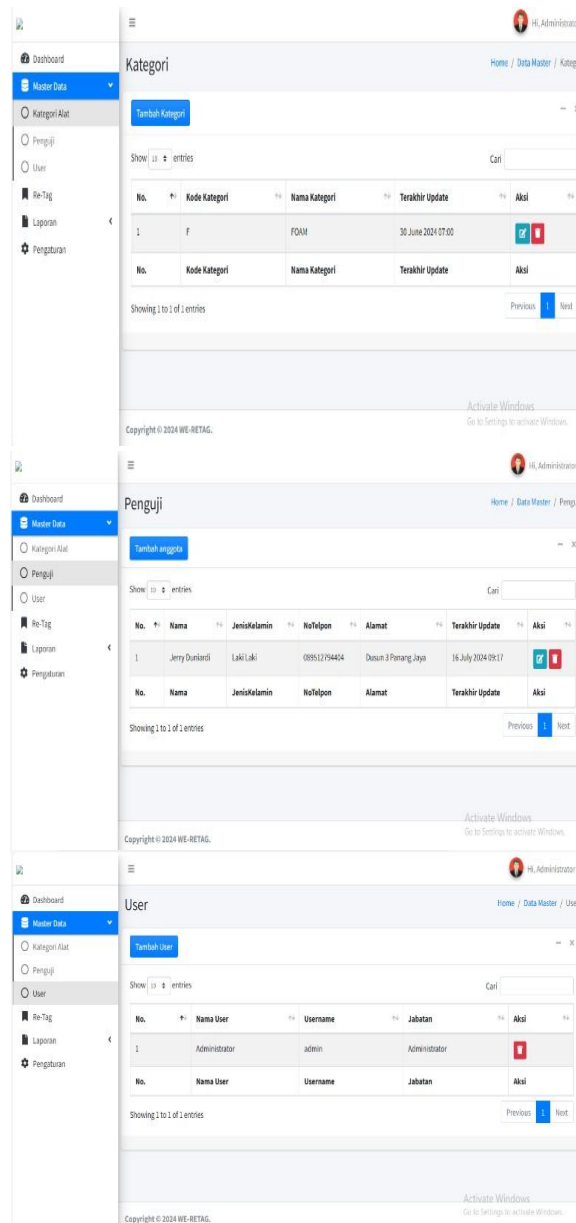
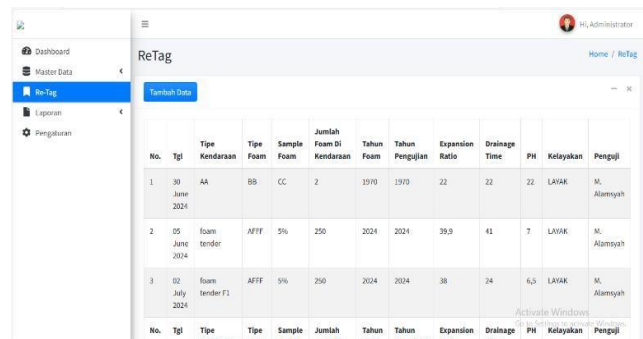


Fig 11 Implementation of Master Data Page

This page allows the administrator to add data consisting of several options such as tool categories, testers, and users. The administrator has the ability to change or remove the added data. The total of the added data for each option can be displayed on the dashboard menu as shown in Fig 11.

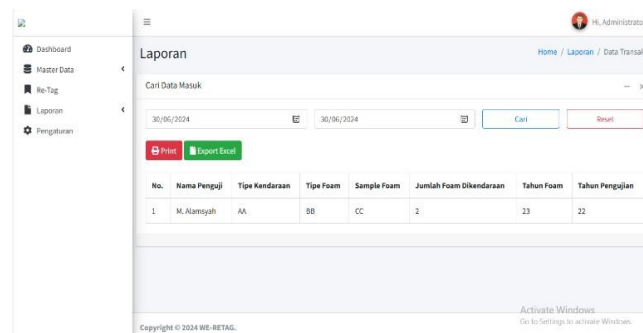


The screenshot shows the 'ReTag' page with a sidebar menu containing 'Dashboard', 'Master Data', 'Re-Tag', 'Laporan', and 'Pengaturan'. The main content area has a 'Tambah Data' button and a table with the following data:

No.	Tgl	Tipe Kendaraan	Tipe Foam	Sample Foam	Jumlah Foam Di Kendaraan	Tahun Foam	Tahun Pengujian	Expansion Ratio	Drainage Time	pH	Kelayakan	Penguji
1	30 June 2024	AA	BB	CC	2	1970	1970	22	22	22	LAYAK	M. Alamsyah
2	05 June 2024	foam tender	AFFF	5%	250	2024	2024	39,9	41	7	LAYAK	M. Alamsyah
3	02 July 2024	foam tender F1	AFFF	5%	250	2024	2024	38	24	6,5	LAYAK	M. Alamsyah

Fig 12 Implementation of ReTag Page

Data from the chemical foam quality testing results, including the date and year of testing, vehicle type, foam type, foam sample, amount of foam in the vehicle, year of foam production, expansion ratio, drainage time, pH, feasibility, and tester's name, can be entered by the administrator and users on the page shown in Fig 12.

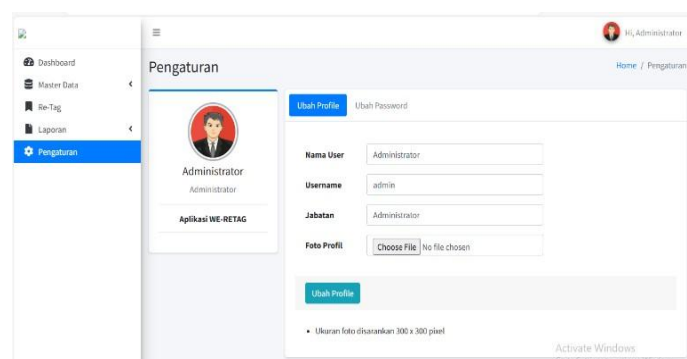


The screenshot shows the 'Laporan' page with a sidebar menu containing 'Dashboard', 'Master Data', 'Re-Tag', 'Laporan', and 'Pengaturan'. The main content area has a search form with 'Cari Data Masuk' and a table with the following data:

No.	Nama Penguji	Tipe Kendaraan	Tipe Foam	Sample Foam	Jumlah Foam Di Kendaraan	Tahun Foam	Tahun Pengujian
1	M. Alamsyah	AA	BB	CC	2	23	22

Fig 13 Implementation of Report Page

Fig 13 shows the admin and users can check/access the data that has been previously added by searching for the test date, and the data will be retrieved. In addition, there is a "Print" feature that can convert the data into PDF format and can be directly printed using a printer connected to a computer/smartphone.



The screenshot shows the 'Pengaturan' page with a sidebar menu containing 'Dashboard', 'Master Data', 'Re-Tag', 'Laporan', and 'Pengaturan'. The main content area has a user profile card for 'Administrator' and a form to update the profile:

Administrator  
Administrator  
Aplikasi WE-RETAG

Ubah Profile    Ubah Password

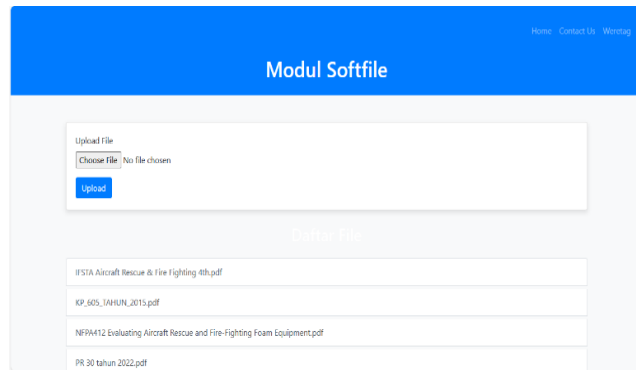
Nama User: Administrator  
Username: admin  
Jabatan: Administrator  
Foto Profil: Choose File (No file chosen)

Ubah Profile

• Ukuran foto disarankan 300 x 300 pixel

Fig 14 Implementation of Setting Page

On the setting page, admins and users can access and edit user profile data, such as changing the name, username, position, uploading a profile photo, and changing the password as shown in Fig 14.



**Fig 15** Implementation of Module Page

Fig 15 shows the administrator can submit regulations and foam quality testing modules to this website, and users can only view it and unable to upload other files.

**Verification/Testing**

At the verification/testing stage, a trial will be conducted to assess the success of the implemented system that has been designed to ensure that the system meets the requirements and is in accordance with user needs. This stage begins with product validation by an IT expert and subject expert, followed by testing the use of We-ReTag by all ARFF unit personnel accompanied by a validation sheet using the black box testing method.

**Table 1** Results of IT Expert Validation

Assesment Aspect	Percentage	Criteria
User Friendliness	93%	Excellent
Appearance	87%	Excellent
Languange	80%	Good
Flexibility	87%	Excellent
Feasibility	93%	Excellent
<b>Mean</b>	<b>89%</b>	<b>Excellent</b>

The results of the IT expert validation questionnaire conducted by IT Lecturer at Palembang Aviation Polytechnic, Mr. Eldy Kurniadi stated that the We-ReTag website is deemed Highly Feasible with a score of 89% shown in Table 1.

**Table 2** Results of Material Expert Validation

Assesment Aspect	Percentage	Criteria
Funtional Requirement	93%	Excellent
Main Display Menu	86%	Excellent
Flexibility	80%	Good
Security	80%	Good
Compatibility	80%	Good
Performance	80%	Good
<b>Mean</b>	<b>85%</b>	<b>Excellent</b>

Table 2 shows the results of expert material validation questionnaire assessed by Chief of ARFF unit Mr. Ridho Kurniawan stated that the We-ReTag website is declared very feasible with a score of 85%.

The next stage involves testing this product using the black box testing method. Black box testing is a type of testing that focuses on specific details of a website, such as the appearance of the website, the functions available on the website, and the adjustment of processes in the form of functional flows needed by users. Black box testing is used as a tool to assess whether the application is functioning well or still needs improvement [13].

**Table 3** Results of the We-ReTag Test Questionnaire

Participant	Maximum Score	Percentage	Criteria
36 ARFF personnels	1800	89%	Highly Feasible

The data processing result which carried out by 36 ARFF personnels shows a percentage of 89% and fall into the "Highly Feasible" category as shown in Table 3.

## Maintenance

Routine procedures are performed during the maintenance phase to maximize product performance and lower the chance of system failure over time.

Software changes brought on by system upgrades, technological developments like the release of the newest operating system, or the requirement to introduce new features necessitate modifications.

## 4. Conclusion

The results of the We-ReTag website testing conducted on research subject received a score of 89% from survey participants with total of 36 ARFF personnels which falls into the "Very Feasible" category. The validation results conducted by material experts and IT experts sequentially yielded an average percentage scale of 89% and 85% with the category "Very Feasible."

As a result, it can be concluded that the We-ReTag website is ideal for assisting ARFF personnels during maintenance tasks, particularly when it comes to evaluating the quality of chemical foam, which serves as the primary extinguishing agent on foam tender vehicles. The We-ReTag website also serves as a more efficient data storage medium with minimal risk of data loss or damage compared to using worksheets/logbooks. To maintain the sustainability of the We-ReTag website, it is important to conduct regular evaluations with rechecks to ensure it meets user needs.

Incorporating subject matter and IT specialists, as well as taking user feedback and recommendations into account, is crucial to the ongoing enhancement of this website's effectiveness, such as adding a signature function to enable electronic signatures on the form. It is expected that other Indonesian airports or comparable operational environments will be able to use the We-ReTag website.

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## Declarations

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Conflict of interest. The authors declare no conflict of interest.

Additional information. No additional information is available for this paper.

## Data and Software Availability Statements

Data and Software availability statements provide a statement about where data and software supporting the results reported in a published article can be found, including hyperlinks to publicly archived datasets and software analyzed and generated during the study/experiments.

### References

- [1] N. Krisna Adiguna, R. Ramadhan, I. Sadiq Arjuna, I. Mohammad Fadillah, R. Sadiatmi, and O. Hendra, "Dampak Kelebihan Jam Kerja Pada Personil PKP-PK Bandar Udara Internasional Juanda," *Airman: Jurnal Teknik dan Keselamatan Transportasi*, vol. 4, no. 2, pp. 112–116, Dec. 2021, doi: 10.46509/ajtk.v4i2.197
- [2] A. Ardiansyah and F. Albanna, "Analisis Pemeliharaan pada Kendaraan Operasional PKP-PK di Bandar Udara Adi Soemarmo Solo," *Aurelia: Jurnal Penelitian dan Pengabdian Masyarakat Indonesia*, vol. 1, no. 1, pp. 19–28, 2022, doi: 10.57235/aurelia.v1i1.21.
- [3] Kharisma Sevi Nur Safitri and Rahimudin, "Analisis Kelayakan Fasilitas Unit Pertolongan Kecelakaan Penerbangan Dan Pemadam Kebakaran(Pkp-Pk) Di Bandar Udara Dewandaru Karimunjawa," *Jurnal Publikasi Manajemen Informatika*, vol. 1, no. 3, pp. 95–101, Aug. 2022, doi: 10.55606/jupumi.v1i3.511.
- [4] M. Sobolewski, B. Król, J. Jakubiec, and D. Gancarczyk, "Proportioning accuracy of foam concentrate testing in periodic control of foam fixed extinguishing systems," *MATEC Web of Conferences*, vol. 247, p. 00046, Dec. 2018, doi: 10.1051/mateconf/201824700046.
- [5] Iis Ariska Nurhasanah, Muhamad Brilliant, Kustia Reni, and Agus Mulyanto, "Analisis Perancangan E-Business B2C (Business to Consumer) Upaya Digitalisasi Pengembangan UMKM (Studi Kasus : Kabupaten Pesawaran, Indonesia)," *Jurnal Nasional Pendidikan Teknik Informatika (JANAPATI)*, vol. 11, no. 3, pp. 236–248, 2022, doi: 10.23887/janapati.v11i3.49787.
- [6] P. N. Sari and S. Rizki, "Media Pembelajaran Matematika Berbasis Android Pada Materi Program Linear," *Journal of the Society of Mechanical Engineers*, vol. 121, no. 1191, p. 47, Feb. 2018, doi: 10.1299/jsmemag.121.1191\_47.
- [7] I. Y. I Gede Iwan Sudipa, Made Suci Ariantini, Suwito Pomalingo, Achmad Ridwan, Dewi Primasari, Anak Agung Gede Bagus Ariana, Rohmat Nur Ibrahim, Rozali Ilham, I Nyoman Alit Arsana, Irmawati Irmawati, *Buku Ajar Rekayasa Perangkat Lunak*. Pt. Sonpedia Publishing Indonesia, 2023. [Online]. Available: [https://www.google.co.id/books/edition/Buku\\_Ajar\\_Rekayasa\\_Perangkat\\_Lunak/22zdeaaaqba?hl=En&Gbpv=0](https://www.google.co.id/books/edition/Buku_Ajar_Rekayasa_Perangkat_Lunak/22zdeaaaqba?hl=En&Gbpv=0)
- [8] R. S. Pressman, *Rekayasa Perangkat Lunak - Buku 1, Pendekatan Praktisi Edisi 7*. Penerbit Andi, 2023. [Online]. Available: <https://books.google.co.id/books?id=j4QD0AEACAAJ>
- [9] Jubilee Enterprise, "MySQL untuk Pemula - Jubilee Enterprise," in *MySQL untuk Pemula*, 2014, pp. 1–3. Accessed: Oct. 22, 2024. [Online]. Available: <https://books.google.co.id/books?hl=id&lr=&id=ExJDwAAQBAJ&oi=fn>
- [10] "Pemrograman Web dengan PHP dan MySQL - Achmad Solichin - Google Buku." Accessed: Oct. 22, 2024. [Online]. Available: [https://books.google.co.id/books/about/Pemrograman\\_Web\\_dengan\\_PHP\\_dan\\_MySQL.html?hl=id&id=kcD4BQAAQBAJ&redir\\_esc=y](https://books.google.co.id/books/about/Pemrograman_Web_dengan_PHP_dan_MySQL.html?hl=id&id=kcD4BQAAQBAJ&redir_esc=y)
- [11] B. Johnson, *Visual Studio Code: End-To-End Editing and Debugging Tools for Web Developers*. 2019. Accessed: Oct. 22, 2024. [Online]. Available: [https://books.google.co.id/books?id=bXuoDwAAQBAJ&pg=PA1&source=gbs\\_toc\\_r&cad=2#v=onepage&q&f=false](https://books.google.co.id/books?id=bXuoDwAAQBAJ&pg=PA1&source=gbs_toc_r&cad=2#v=onepage&q&f=false)
- [12] C. C. Hoong and M. A. Ameen, "Intuitive Content Management System," in *2015 International Conference on Computer, Communications, and Control Technology (I4CT)*, IEEE, Apr. 2015, pp. 541–543. <https://ijarsct.co.in/A9056.pdf>
- [13] N. M. D. Febriyanti, A. Sudana, and ..., "Implementasi Black Box Testing pada Sistem Informasi Manajemen Dosen," *Jurnal Ilmiah ...*, vol. 2, no. 3, 2021, [Online].