

Implementation of a Web-Based Village Information System Using the Waterfall Method in Hegarmukti Village

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Abstract: The dissemination of information at the village level is crucial for ensuring transparency to the residents. To facilitate the quick and easy communication of such information, a web-based village information system was developed. This system can be accessed by all community members, both within and outside the village, as long as they have an internet connection. Currently, Hegarmukti Village does not have an effective web-based information system, leading to delays in information delivery and a lack of accuracy. Moreover, the potential of the village remains under-promoted. This study aims to design and implement a web-based village information system for Hegarmukti Village using the Waterfall method. The system is developed using HTML for programming and MySQL for the database, with the goal of enhancing transparency and the efficiency of information dissemination. The system provides features such as village profiles, news updates, and population data searches, improving the accessibility and reliability of village information.

Keywords: Village Information System; Website; Waterfall.

1. Introduction

In the era of globalization, information technology has become an integral part of daily life. The application of this technology spans various aspects, from communication to data and information management, all aimed at enhancing the efficiency and effectiveness of various activities, including governance at the village level. Web-based information systems represent a significant application of information technology in the context of village information management, as they can support transparency and ease of access to information by the community. Hegarmukti Village, like many other villages, faces challenges in disseminating information to its residents. Currently, the information dissemination process in this village is still conducted manually, requiring residents to visit the village office in person to obtain the necessary information. This manual process is not only time-consuming but also ineffective in terms of delivering timely and accurate information. These limitations also hinder the village's ability to promote its local potential, which could add value if properly managed.

The implementation of web-based village information systems has proven effective in improving the quality of public services in various regions. Previous studies have demonstrated that web-based village information systems can help address various challenges in managing village data and information. Asmara (2019) noted that the implementation of a web-based village information system in Netpala Village successfully increased transparency and accelerated the process of information delivery to the community [1]. Similarly, Muqorobin *et al.* (2020) reported that the web-based information system implemented in Krikilan Sub-district successfully integrated various data and information, making access easier for residents [2]. Currently, Hegarmukti Village does not have an adequate information system to effectively manage data and information. As a result, important information is often not communicated effectively to the community, and the village's potential, which could be developed for the common good, is also under-promoted. Therefore, there is a need for an information system that not only manages and disseminates information quickly and accurately but also supports the promotion of the village's potential to a broader audience.

This study aims to design and implement a web-based village information system for Hegarmukti Village using the Waterfall method. This method was chosen due to its systematic and structured approach, which allows each stage of system development to be carried out meticulously and sequentially, from needs analysis, system design, coding, to testing and maintenance. Basten and Ardiansyah (2022) stated that the Waterfall method is particularly suitable for the development of village information systems because it can handle the complexity of development processes that involve multiple components [3]. In the development of this system, HTML is used to design the user interface, while MySQL is utilized as the database to store and manage village data. This combination was chosen due to HTML's capability in generating user-friendly interfaces and MySQL's flexibility in managing complex data. Arundini *et al.* (2021) observed that the use of HTML and MySQL in web-based village information systems offers advantages in terms of access speed and ease of use by village officials and the community [4].

This web-based village information system is expected to enhance transparency and the effectiveness of information dissemination in Hegarmukti Village. Additionally, the system is expected to serve as an effective promotional tool, capable of showcasing the village's potential to a wider audience, both within and beyond the village. Thus, the system not only functions as an information management tool but also as a means to support the overall development of the village. To achieve these goals, this study will evaluate system requirements, design an intuitive user interface, develop an efficient database, and conduct testing of the developed system. This testing is crucial to ensure that the system operates as expected and meets the needs of users, namely village officials and the community. The developed web-based village information system is expected to serve as a model that can be adopted by other villages facing similar challenges in information management and promotion of village potential.

2. Research Method

The methodology employed in this study is based on the System Development Life Cycle (SDLC), specifically utilizing the Waterfall approach. The SDLC is a widely recognized framework in software development that outlines a structured and sequential process, where each phase must be completed before the next phase begins. This approach is named "Waterfall" because, like a waterfall, the process flows steadily downward through phases, ensuring that each stage is systematically addressed before moving to the next [5].

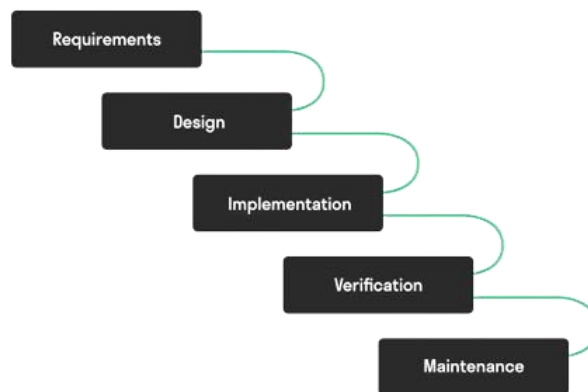


Figure 1. Waterfall Method

The first phase in the Waterfall model is the analysis phase. During this phase, a thorough examination of the problems and risks associated with the user requirements is conducted. This phase involves intensive data collection through observations and interviews to gather all necessary information about the needs and expectations of the users. The focus is primarily on understanding the software requirements to ensure that the final product aligns with the users' needs [5]. Proper analysis is crucial as it sets the foundation for the subsequent phases of development. Following the analysis, the system design phase begins. In this phase, the requirements identified during the analysis are translated into a blueprint or design specification. This blueprint serves as a guide for developers, detailing how the software should function and how the system architecture should be structured. The design phase ensures that all identified needs are accurately reflected in the proposed system before any coding begins. Effective design is essential as it provides a clear roadmap for the developers and minimizes the risk of errors during the coding phase [3][6]. The next phase is programming, where the design is transformed into actual software through coding [7]. This phase involves writing code in a programming language, in this case, Java, to implement the design specifications. The quality of coding is critical as it directly impacts the functionality and performance of the software. The choice of Java as the programming language is due to its robustness, security, and platform independence, which are essential for developing reliable web-based systems [8]. Once the software is coded, it undergoes rigorous testing in the trial phase. This phase involves validating that the software functions as expected and is free from errors. Testing is conducted to ensure that all functionalities meet the predefined requirements, and any discrepancies are addressed before the system is deployed. The Waterfall model emphasizes thorough testing to ensure that the final product is both reliable and effective [9]. The final phase in the Waterfall model is maintenance. This phase involves ongoing support and enhancement of the software after it has been deployed. Maintenance is crucial because software needs to evolve to meet changing requirements or to fix any issues that arise after deployment. This phase ensures that the software remains functional and relevant over time, with updates and improvements being implemented as necessary [10][11]. Throughout the development process, several design models are employed, including Use Case Diagrams, Activity Diagrams, and Sequence Diagrams [12][13]. These models provide a visual representation of the system's functionality, helping both developers and stakeholders to understand how the system operates and how different components interact [14][15]. The use of these diagrams is a standard practice in software engineering, as they facilitate communication, reduce complexity, and ensure that the system design aligns with the project's goals.

3. Result and Discussion

3.1 Results

The research results presented here are the continuation of the development of the web-based village information system for Hegarmukti Village. This section details the implementation of the design and provides a comprehensive overview of the functionalities and performance of the system. The user interface (UI) of the web-based village information system for Hegarmukti Village has been designed with user accessibility and simplicity in mind. The interface is divided into several key sections, each tailored to specific functionalities that cater to both the village administrators and the general public. The Admin Login page serves as the gateway for administrators to access the backend of the system. It is designed to ensure secure access by requiring users to input a valid username and password. Once authenticated, administrators can manage the

content and settings of the website. The login page is straightforward, featuring input fields for credentials and a secure login button to facilitate ease of access while maintaining robust security protocols.

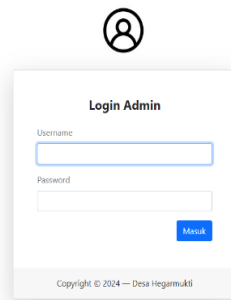


Figure 2. Admin Login Page



Figure 3. Vision and Mission Menu

The Vision and Mission menu provides detailed information about the village's long-term goals and aspirations. This section is crucial for communicating the village's development agenda to residents and stakeholders. The UI here is designed to present this information clearly and effectively, with emphasis on readability and structured presentation. The design ensures that the village's vision and mission are easily accessible to all visitors, promoting transparency and community engagement.



Figure 4. Organizational Structure Menu

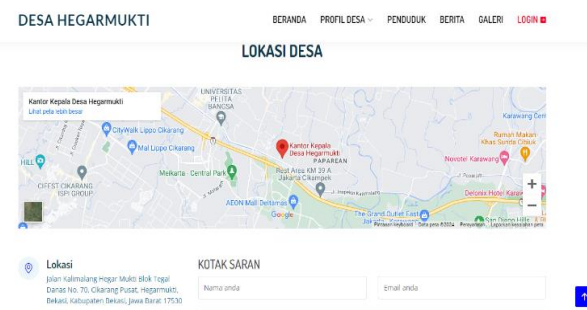


Figure 5. Village Location Menu

The Organizational Structure menu displays the current hierarchy of the village administration. This section utilizes a sliding mechanism that automatically shifts through the organizational chart, making it visually engaging and easy to navigate. The design allows users to quickly identify the key personnel and their roles within the village administration, thereby enhancing the transparency of the village governance. The Village Location menu provides essential details about the geographical location of the village, including contact information for the village office. This feature is particularly useful for residents and outsiders who need to locate the village or require assistance with village-related matters. The interface includes a map and contact details, ensuring that this critical information is readily available to users.



Figure 6. Population Menu



Figure 7. News Menu

The Population menu presents detailed demographic data of Hegarmukti Village. It includes information on the number of residents, as well as a breakdown of the population by neighborhood (kampung), community unit (RW), and neighborhood unit (RT). This section is designed to provide a clear and concise overview of the village's population statistics, which can be useful for planning and resource allocation. The data is

presented in a manner that is easy to interpret, with graphical representations where appropriate. The News menu serves as a platform for disseminating information about recent events and developments within the village. It is designed to function as a promotional tool, highlighting the activities and achievements of the village. This section is regularly updated to ensure that residents and visitors are informed about the latest happenings in Hegarmukti Village. The design focuses on accessibility, with news items presented in a list format for easy browsing.

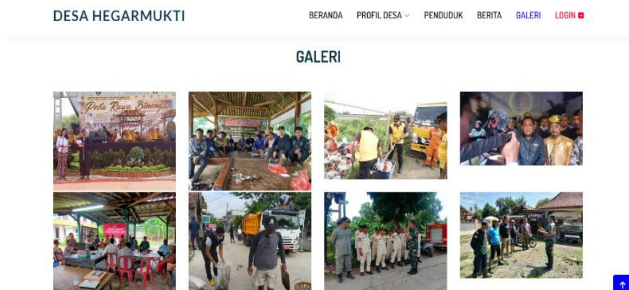


Figure 8. Gallery Menu

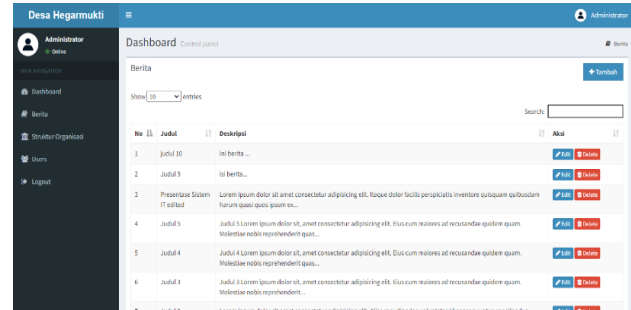


Figure 9. Admin News Dashboard

The Gallery menu showcases visual content related to the village's activities. This includes photographs of social events, development projects, and other significant moments in the village. The gallery is organized into categories, making it easy for users to browse through images. The visual presentation is clean and intuitive, allowing users to engage with the content effortlessly. The Admin News Dashboard is a critical feature for managing the village's news content. It provides administrators with CRUD (Create, Read, Update, Delete) functionalities, enabling them to add new news articles, edit existing ones, and manage the content efficiently. The dashboard is designed with user-friendly forms that simplify content management tasks, ensuring that administrators can keep the news section up-to-date with minimal effort.

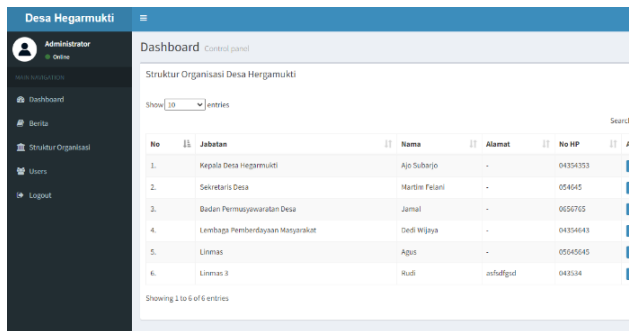


Figure 10. Admin Organizational Structure Dashboard

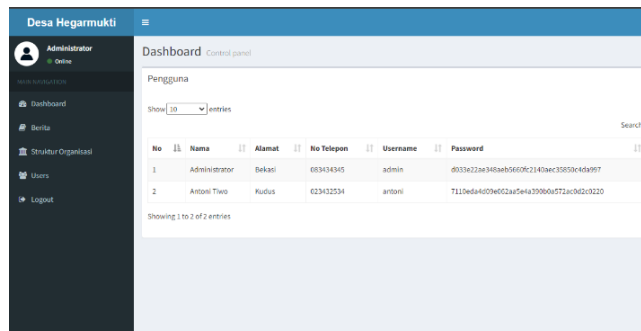


Figure 11. User Management Menu

The Admin Organizational Structure Dashboard allows administrators to edit and manage the village's organizational chart. This feature is essential for maintaining accurate and up-to-date records of the village administration's structure. The interface is designed to be intuitive, with forms that allow for the easy addition or modification of organizational details. The User Management Menu is designed for administrators to manage login credentials and access permissions for various users. This feature is crucial for maintaining security and ensuring that only authorized personnel can access certain parts of the system. The interface allows for the creation of multiple user accounts, each with specific roles and permissions, which helps in the efficient management of the system.

The testing phase was conducted to evaluate the functionality and reliability of each module within the developed system. Blackbox Testing was employed as the primary testing method. This type of testing focuses on verifying that the input and output of each system component align with the specified requirements, without delving into the internal workings of the software. The testing process involved executing various test cases to observe the system's behavior under different conditions. The results from the Blackbox Testing indicate a high success rate, confirming that the system performs as expected across all tested functionalities.

For instance, the Login Menu was tested to ensure that valid credentials allow access to the admin dashboard, while invalid credentials trigger an appropriate error message. This functionality was confirmed to be working correctly, as the system reliably differentiated between correct and incorrect login attempts.

Table 1. System Testing Results Using Blackbox

No	Testing	Testing Activity	Expected Result	Testing Result	Testing Status
1	Login Menu	Login with correct username and password	User can access the admin dashboard	User can access the admin dashboard	Successful
		Login with incorrect username and password	Error notification appears	Error notification appears	Successful
2	Home Menu	User clicks on the home menu	Home menu appears	Home menu appears	Successful
3	Village Profile Menu (Vision & Mission, Organizational Structure, Village Location)	User clicks on the vision & mission menu	System responds and navigates to vision & mission page	System responds and navigates to vision & mission page	Successful
		User clicks on the organizational structure menu	System responds and navigates to organizational structure page	System responds and navigates to organizational structure page	Successful
		User clicks on the village location menu	System responds and navigates to village location page	System responds and navigates to village location page	Successful
4	Population Menu	User clicks on the population menu	System responds and navigates to population page	System responds and navigates to population page	Successful
5	News Menu	User clicks on the news menu	System responds and navigates to news page	System responds and navigates to news page	Successful
6	Gallery Menu	User clicks on the gallery menu	System responds and navigates to gallery page	System responds and navigates to gallery page	Successful
7	Admin News Dashboard	Admin adds news via the form	Form to add news appears	Form to add news appears	Successful
		Admin edits existing news	Form appears with pre-filled news for editing	Form appears with pre-filled news for editing	Successful
		Admin deletes existing news	Confirmation notification appears on the website	Confirmation notification appears on the website	Successful
8	Admin Organizational Structure Dashboard	Admin adds a member to the organizational structure	Form to add a member appears	Form to add a member appears	Successful
		Admin edits a member in the organizational structure	Form appears with pre-filled member details for editing	Form appears with pre-filled member details for editing	Successful
		Admin deletes a member in the organizational structure	Confirmation notification appears on the website	Confirmation notification appears on the website	Successful

Similarly, the Home Menu was tested to ensure that clicking on the menu directs users to the correct homepage. This function was also verified to work as expected, with the menu consistently navigating users to the appropriate page. The testing of the Profile Menu, which includes Vision, Mission, Organizational Structure, and Village Location, confirmed that the system accurately responds to user interactions, displaying the relevant information when each menu item is selected. Further testing was conducted on the Population, News, and Gallery menus. These tests confirmed that the system correctly displays the relevant content, including population statistics, news articles, and gallery images, in response to user interactions. The Admin Dashboard for managing news and organizational structure was also thoroughly tested. The tests verified that administrators could successfully add, edit, and delete content within these sections, ensuring that the system supports effective content management. The Blackbox Testing results demonstrated that the system meets the required specifications and functions reliably. The successful completion of these tests indicates that the web-based village information system for Hegarmukti Village is ready for deployment, with all key functionalities operating as intended.

3.2 Discussion

The implementation of the web-based village information system for Hegarmukti Village involved a series of design and development phases that culminated in the creation of a fully functional platform. This platform is intended to enhance the transparency, accessibility, and efficiency of village administration by providing a centralized system for managing and disseminating information.

The user interface (UI) of the system was designed with a focus on simplicity and ease of use. Each menu and section within the system was developed to address specific needs of the village administration and the public. The Admin Login page, for instance, provides secure access for administrators to manage the website's content. The login mechanism ensures that only authorized personnel can enter the backend system, thus maintaining the integrity and security of the information. The Vision and Mission menu is a crucial component for communicating the village's long-term goals. This section is not only informative but also designed to encourage community engagement by making the village's objectives easily accessible. Similarly, the Organizational Structure menu offers a clear and organized view of the village administration, using a sliding mechanism to present the information dynamically. This feature helps in improving transparency by allowing residents to easily identify village officials and understand their roles. Another critical section is the Village Location menu, which provides essential contact information and geographical details. This menu is especially important for those who need to reach out to the village administration for various needs. By incorporating a map and contact details, the system ensures that this information is readily available and easily accessible to both residents and visitors. The Population menu offers detailed demographic data, presenting statistics in a clear and concise manner. This feature is valuable for both village planning and public information, allowing users to gain insights into the population distribution across different neighborhoods within the village. The data is displayed in a user-friendly format, which includes graphical representations to enhance understanding. The News and Gallery menus serve as platforms for showcasing village activities and developments. The News menu allows the village administration to post updates and announcements, keeping the community informed about recent events. This feature also doubles as a promotional tool, highlighting the achievements and initiatives of the village. The Gallery menu complements this by providing visual documentation of village activities, categorized for easy navigation. The backend functionalities are managed through the Admin News Dashboard and the Admin Organizational Structure Dashboard. These dashboards provide administrators with comprehensive tools to manage content effectively. The Admin News Dashboard, for example, allows administrators to add, edit, and delete news articles. This ensures that the content on the website remains current and relevant. The Admin Organizational Structure Dashboard similarly enables administrators to update the organizational chart, ensuring that the information reflects the most current structure of the village administration.

The system underwent rigorous testing using Blackbox Testing methodology to ensure that all functionalities met the required specifications. This testing focused on verifying that the system's input and output behaviors aligned with the predefined expectations. The testing process covered all major components of the system, including the Login Menu, Home Menu, Profile Menus, and various administrative functions. The results from the testing phase were highly positive. For instance, the Login Menu was tested to ensure that users could access the admin dashboard with the correct credentials and that incorrect credentials would trigger an appropriate error message. Both scenarios were handled correctly by the system, demonstrating its reliability in managing user authentication. Other menus, such as the Home, Vision & Mission, Organizational Structure, and Village Location menus, were also tested. The system consistently responded accurately to user

inputs, navigating to the appropriate pages as expected. This consistency in performance underscores the robustness of the system's design and implementation.

Further testing on the Population, News, and Gallery menus confirmed that these sections functioned as intended, displaying the relevant content accurately. The Population menu correctly presented demographic data, while the News and Gallery menus provided up-to-date information and visuals of village activities. These functionalities are crucial for keeping the community informed and engaged. The administrative dashboards were tested for their ability to manage content effectively. The Admin News Dashboard, for example, was tested for its CRUD (Create, Read, Update, Delete) operations. The testing confirmed that administrators could successfully add, edit, and delete news articles, ensuring that the system supports effective content management. Similarly, the Admin Organizational Structure Dashboard was tested for its capability to manage the organizational chart, with tests confirming that administrators could update member details accurately. The successful testing and implementation of the web-based village information system for Hegarmukti Village highlight the effectiveness of the design and development process. The system not only meets the functional requirements but also enhances the overall efficiency and transparency of village administration. The positive results from the testing phase indicate that the system is ready for deployment, offering a reliable tool for managing and disseminating village information. This system serves as a model that could be adopted by other villages facing similar challenges in information management and communication.

4. Related Work

The development of web-based village information systems has been extensively explored in various studies, each contributing unique insights and advancements in the field of local governance and community engagement. This research builds upon existing studies while introducing specific innovations tailored to the needs of Hegarmukti Village. Asmara (2019) conducted a study focused on the design and implementation of a web-based information system for Netpala Village. The study highlighted the system's role in improving transparency and accessibility of village information for residents [1]. While the system provided a foundation for effective information management, it lacked advanced features such as user management and dynamic organizational charts, which are key components in the Hegarmukti system. These enhancements are designed to increase administrative efficiency and provide more tailored functionalities for village management.

Similarly, Muqorobin *et al.* (2020) developed a web-based information system for Krikilan sub-district, focusing on the integration of administrative data to facilitate easier access for residents [2]. Although the Krikilan system shares similarities with the Hegarmukti system, such as the management of population data and news dissemination, the Hegarmukti system distinguishes itself by incorporating a more intuitive interface and a comprehensive administrative dashboard. These features address the need for more effective content management and user interaction, which were identified as limitations in the Krikilan study. Pujiantoro *et al.* (2023) focused on the integration of various village services into a single platform for Karangsalam Village [16]. While the integration of services is a shared goal with the current study, the Karangsalam system primarily addressed basic services and did not include the advanced content management capabilities present in the Hegarmukti system. Furthermore, the use of the Waterfall methodology in the Hegarmukti project ensured a systematic and thorough development process, which contrasts with the less structured approach seen in the Karangsalam study. Arundini *et al.* (2021) utilized the Rapid Application Development (RAD) methodology to develop a village information system for Sukatani Village [4]. While RAD allowed for quicker development, the Hegarmukti system, developed using the Waterfall model, benefits from a more deliberate and structured process. This approach allowed for comprehensive testing and integration at each stage of development, resulting in a more robust and scalable system that is better suited to the long-term needs of Hegarmukti Village. Basten and Ardiansyah (2022) employed the Waterfall model for the development of a village information system in Banjarsari Village [3]. This methodology aligns closely with the approach used in the Hegarmukti project. Both studies emphasize the importance of a structured development process; however, the Hegarmukti system introduces additional features, such as dynamic content management and automated updates to the organizational structure. These enhancements aim to address specific administrative needs and improve the system's functionality and adaptability. While previous studies provide a solid foundation in the development of village information systems, the Hegarmukti system advances the field by integrating features that address specific administrative challenges and improve user experience. These enhancements, including advanced user management, a comprehensive administrative dashboard, and dynamic organizational updates, position the Hegarmukti system as a more effective tool for village governance. The system's design and functionality set a new benchmark for future developments in village

information systems, demonstrating a significant step forward in the application of technology to local governance.

5. Conclusion

The development and implementation of the web-based village information system for Hegarmukti Village represent a significant advancement in the use of technology for local governance. By adopting the Waterfall methodology, the project was able to ensure a structured and thorough development process, resulting in a robust and scalable system that effectively addresses the specific administrative and informational needs of the village. The system provides a user-friendly interface that facilitates easy access to critical information, enhancing transparency and engagement within the community. Features such as the dynamic organizational structure, comprehensive administrative dashboard, and advanced user management tools distinguish the Hegarmukti system from similar projects. These features not only streamline administrative processes but also ensure that the system remains adaptable to the evolving needs of the village. The successful testing and deployment of the system demonstrate its reliability and effectiveness in improving information management and communication within the village. This project sets a new standard for the development of village information systems, offering a model that can be replicated and adapted by other villages facing similar challenges. Ultimately, the Hegarmukti village information system exemplifies how carefully designed technology solutions can significantly enhance local governance and community engagement.

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