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jurnalkelola@gmail.com

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Latest Innovations in Facilities and Infrastructure Management: Implementation of an Efficient Management System

Destri Sambara Sitorus
Pendidikan Ekonomi, Universitas Kristen Satya Wacana
destri.sambara@uksw.edu

Lelahester Rina
Pendidikan Ekonomi, Universitas Kristen Satya Wacana
lelahester.rina@uksw.edu

Tri Nugroho Budi Santoso
Pendidikan Ekonomi, Universitas Kristen Satya Wacana
tri.budi.santoso@uksw.edu

ABSTRACT

Schools face significant challenges in managing facilities and infrastructure due to limited awareness of security risks, maintenance procedures, and damage prevention strategies. This research addresses this gap by developing a facilities and infrastructure management system using the ADDIE model. This system not only aims to improve the efficiency and effectiveness of school asset management but also serves as a practical learning tool for vocational high school students specializing in office management and business services. This research employed a Research and Development (R&D) approach. The data conducted by using questionnaire and analyzed descriptively. The developed facilities and infrastructure management system underwent evaluation, and the findings confirmed its highly recommended and effectiveness in streamlining school asset management. Additionally, the system proved to be a suitable educational tool for vocational students, enhancing their practical skills and knowledge.

Keywords*: Inventory, Management System, Infrastructure*

Article Info

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INTRODUCTION

The Indonesian Ministry of National Education Regulation No. 24/2007 outlines standards for school facilities and infrastructure. These standards categorize facilities into distinct types: educational units, land, buildings, and the completeness of equipment (Schiele et al, 2021). Effective facilities and infrastructure management involves ensuring the necessary equipment and materials are readily available to facilitate the educational process within schools (Nurstalis et al, 2021). The increase in diversity of work arrangements which is the impact of office modernization creates a modern work environment and it is an important concern for office management (Meulenbroek, 2016).

Several key issues hinder efficient management of school facilities and infrastructure: 1) Limited awareness and skills regarding security risks, restoration procedures, and ongoing maintenance for facilities (Nurstalis et al., 2021). 2) Inadequate infrastructure management practices: Schools often struggle to restore facilities after damage and maintain them effectively. 3) Need for technological solutions: Implementing new technologies, conducting security risk assessments, and applying application-level backups can significantly improve management (Xiao et al., 2021). 4) Importance of education and personnel: Strengthening technology education for staff and attracting more IT talent specifically for facilities management are crucial steps. Last is 5) Digital literacy gap: Promoting a clear understanding of digital archives and their role in facilities management is vital (Santosa et al., 2022).

Observations and discussions with vocational teachers specializing in office management and business services in Salatiga, Boyolali and Surakarta revealed critical gaps. It is known that there is no digital facilities and infrastructure system available for the head of infrastructure and infrastructure as well as administrative employees. Apart from that, the learning process in managing facilities and infrastructure has not been given digital practice for the benefit of Office Management and Business Services skills. It needs to be realized that the management of facilities and infrastructure in Indonesia currently does not support the implementation of Indonesian E-government (Harisanty & Anugrah, 2022). This is because there is little public awareness about digital archives. A clear commitment to facilities management, supported by transparency and accountability, can prevent the negative impacts of misuse of important documents and facilities (Adu, 2020).

In the context of Vocational High Schools (SMK), management of facilities and infrastructure has a central role in supporting the operational functions of educational institutions. As an institution that has a strategic role in preparing the young generation to enter the world of work, vocational schools are required to have optimal facilities and infrastructure so that the learning and teaching process can take place effectively and efficiently (Darmastuti, 2014).

Facilities and infrastructure at SMK include classrooms, laboratories, libraries, workshops and other supporting facilities that support the vocational curriculum. In the context of the latest innovations, implementing an efficient management system in the vocational school environment can have a significant positive impact (Paat et al, 2022).

Identify the problems faced in the management of facilities and infrastructure in vocational schools based on the description above, namely 1) lack of awareness and ability regarding security risks, restoration and maintenance of facilities and infrastructure. 2) There is no digital facilities and infrastructure system available for school managers and administrative employees. 3) The learning process in managing facilities and infrastructure has not been given digital practice for office management and business services skills. 4) Management of facilities and infrastructure in Indonesia currently does not fully support the implementation of E-government. 5) Public awareness about digital archives is still low. The impact of these problems can result in ineffective and efficient teaching and learning processes (Khusnul & Suharyadi, 2021), difficulties in managing and maintaining facilities and infrastructure, lack of preparation for students to enter the world of work, and loss of important documents and facilities due to misuse and negligence. The importance of efficient management in vocational schools is not only related to optimizing the use of resources, but also involves improving the quality of the learning

process. Therefore, innovation in managing facilities and infrastructure in vocational schools does not only focus on technical aspects but also on adapting to the special characteristics of vocational learning activities (Lestari, 2017). In order to increase the competitiveness of vocational school graduates in the industrial world, the implementation of the latest innovations in the management of facilities and infrastructure in vocational schools is something important to research. Seeing the urgency of that, the researchers thus conducted this study. This research aims to produce a facilities and infrastructure management system "SIMASPRAS" that is used by schools to manage assets effectively and efficiently and also as a learning medium in the classroom. This article discusses the development of "SIMASPRAS" that can be implemented in schools and also as a practical laboratory for vocational school students.

RESEARCH METHODS

This research is research and development using ADDIE development steps, namely Analysis, Design, Development, Implementation, Evaluation. In detail, development research is a process used to develop and validate educational products which include not only material objects, textbooks, instructional films, but also procedures and processes, such as teaching methods or methods of organizing instruction. The subjects in this research were 14 teachers who were members of the Subject Teachers' Conference (MGMP) majoring in office management and business services in Salatiga City, Surakarta City and Boyolali Regency. Data was collected using questionnaires and interviews. The collected data was analyzed quantitatively descriptively. This research was carried out from September to November 2023. The research and development stage process was carried out only up to stage three, namely Analysis, Design and Develop, as follows (Reiser & Molenda, 2008):



Figure 1. Stage of ADDIE Model

This research employed a mixed-methods approach, utilizing both quantitative and qualitative data. Quantitative data was collected through a questionnaire and consisted of suggestions, comments, and input from three expert groups: System experts, material experts, and practitioners. This data served as the foundation for system improvement. Qualitative data, in the form of assessment scores, was analyzed descriptively using a predefined value conversion table.

Table 1. Predefined Value Conversion

Score Interval	Score	Category
$X < 4.21$	5	Highly Recommended
$3.40 < X \leq 4.21$	4	Recommended
$2.60 < X \leq 3.40$	3	Sufficient
$1.79 < X \leq 2.60$	2	Needs Improvement
$X < 1.79$	1	Not Recommended

RESULTS AND DISCUSSION

Results

The first stage for developing SIMASPRAS is needs assessment and system design. The development of SIMASPRAS commenced with a comprehensive needs assessment (Reiser & Molenda, 2008). This stage included analyses of:

- Needs: Identifying the school's requirements for a facilities and infrastructure management system.
- Problems: Defining and pinpointing the root causes of existing issues in managing facilities and infrastructure.
- Tasks: Analyzing the tasks involved in facilities and infrastructure management, identifying inefficiencies, and potential areas for improvement.
- Students: Understanding student interaction with facilities and their potential needs.
- Environment: Examining the physical and operational environment to ensure system compatibility.

Through this multi-faceted analysis, researchers identified a critical gap: the lack of a dedicated system for managing facilities and infrastructure. This resulted in un-recorded inventory, leading to inefficiency and potential damage. The findings from this stage formed the foundation for the subsequent design phase.

The second stage is System Design and User Interface. This stage focused on designing SIMASPRAS. A comprehensive flowchart was created, outlining the system's functionalities and user interface elements. The flowchart details:

- Menus and their functions: This includes key functionalities like login, dashboard, inventory data management, reporting, and system settings.
- User-friendly interface: Emphasis on creating an intuitive and easy-to-use interface that simplifies user interaction.
- Attractive and informative initial display: Designing an engaging and informative welcome screen.
- Role-based access control: Implementing a system that grants different user roles varying levels of access based on their needs.

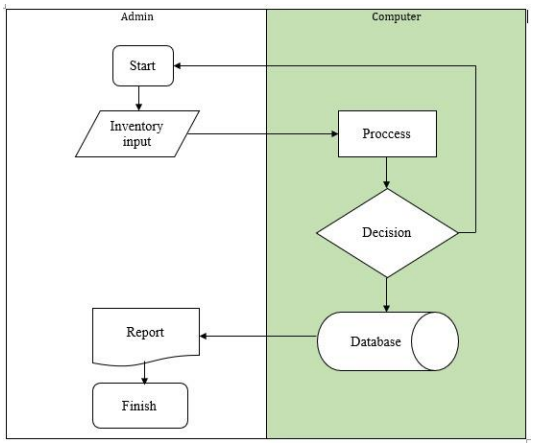


Figure 2. Flowchart Design SIMASPRAS

The third stage focused on the actual development of SIMASPRAS, translating the design specifications from stage two into a functional system. This stage involved rigorous validation processes to ensure the system's feasibility and suitability for its intended purpose. Expert validation involved the evaluation of the developed system by domain experts to assess its:

- Feasibility: This evaluation determines whether the system can be effectively implemented with available resources and technological constraints.

- Appropriateness: This assessment ensures the system aligns with the identified needs and addresses the problems outlined in the needs assessment stage.

Expert feedback played a crucial role in refining the system and ensuring its effectiveness. Following the validation process, the final version of SIMASPRAS was deemed both feasible and appropriate for implementation in the target environment.

Below are the results of the development of the SIMASPRAS school inventory system in the following display:

Login and User Roles

The initial user interaction point with SIMASPRAS is the Login menu. The system implements a role-based access control system, offering two user types:

- Administrator: Admin users possess full system access, including functionalities for adding user data and managing master data.
- Standard User: Standard users have access to specific functionalities, primarily focused on inputting school inventory data.

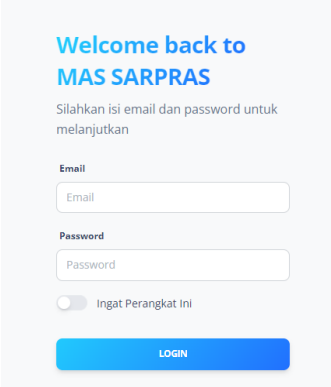


Figure 3. SIMASPRAS Login Display

Based on the display in Figure 3, SIMASPRAS users can use the application by entering the user's email and password.

System Functionality

Home Dashboard

Upon successful login, both users and administrators are presented with the SIMASPRAS Home Dashboard. This screen serves as the primary landing page and provides an overview of the system's functionalities. Figure 4 illustrates the SIMASPRAS Home Dashboard layout:

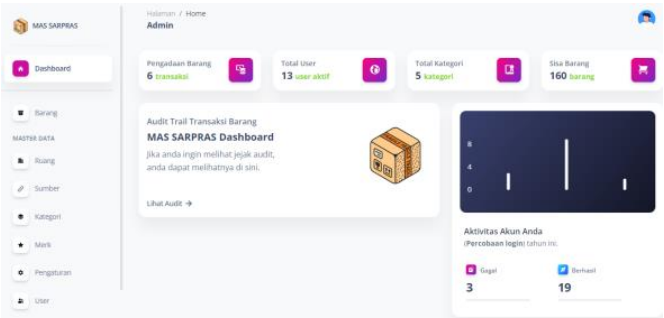


Figure 4. SIMASPRAS Home Dashboard

Item Menu

Following the home dashboard, users can access the inventory data management section, specifically through the Items Menu. This menu allows users to input data for new items within the SIMASPRAS system.

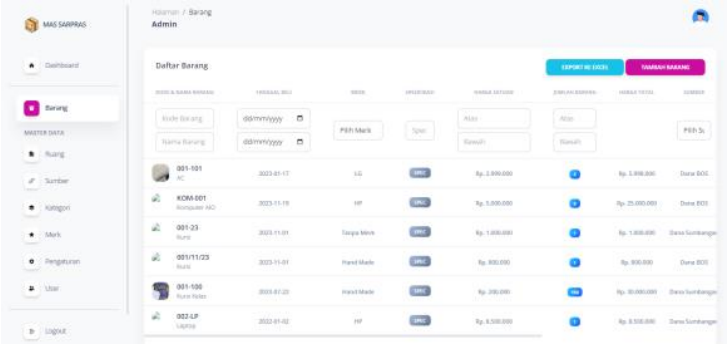


Figure 5. Inventory Item Menu Display

There are two sub menu options in this menu, containing “add items” and “export to excel”. “Add item” is the user's choice to enter the desired item. The following displays the inventory item input in SIMASPRAS:

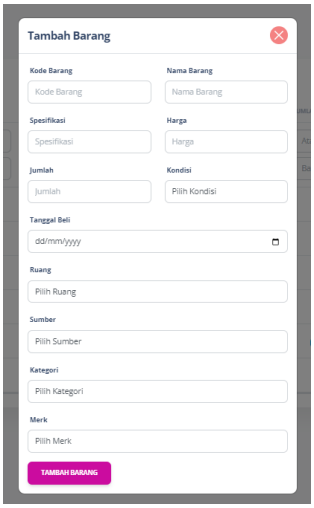


Figure 6. Display of Inventory Item Input Process

The system facilitates data entry for new inventory items through the "Items" menu. Users encounter a form with various fields designed to capture detailed item specifications. These fields include: item code, name, specifications, price, quantity, condition, purchase date, location (space), source, category, and brand. Upon completing data entry for all desired items, users can generate a comprehensive inventory report. This report functionality is accessible through the "Export to Excel" sub-menu, allowing users to download a recordable file onto their computers.

Space Management

The "Space" menu serves as a repository for room information, categorized based on the inventory items entered through the "Items" menu. This menu encompasses various school inventory items, including classrooms, the principal's office, computer labs, and other spaces, each categorized according to their real-world counterparts.

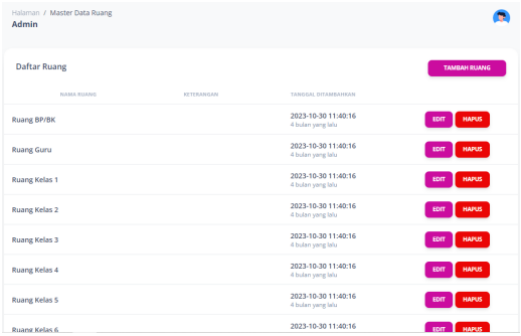


Figure 7. Item Menu Display

Inventory Source Management

The "Source" menu serves as a comprehensive inventory source management system, categorizing the origins of the school's inventory items. This menu encompasses various sources of inventory acquisition, including: government grants from district and provincial administrations, BOS (Block Grant for School Operational Costs) funds, and other sources.

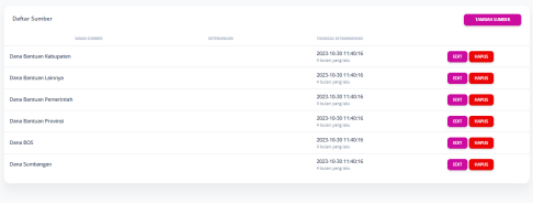


Figure 8. Inventory Source Menu Display

Inventory Categorization

The “Category” menu serves as a repository for inventory item categorization, classifying the school’s inventory based on predefined categories. This menu encompasses the following inventory categories:

KIB A: Land
KIB B: Equipment and Machinery
KIB C: Buildings and Structures
KIB D: Roads, Irrigation, and Networks
KIB E: Other Fixed Assets

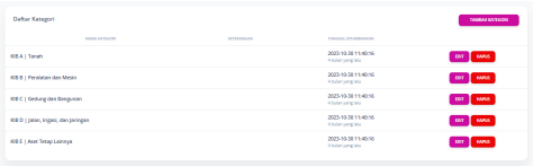


Figure 9. Inventory Categorization Menu Display

Brand Management

The “Brand” Menu serves as a repository for brand information associated with the school’s inventory items. This menu encompasses the various brands represented among the school’s assets, accurately reflecting the actual brands of the inventory items.

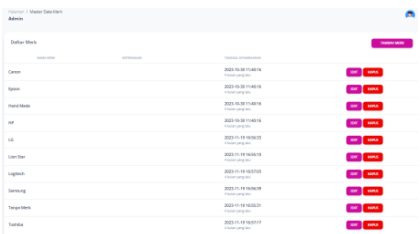


Figure 10. Brand Menu Display

Settings Menu

This menu is a place to manage the SIMASPRAS user's personal account as desired in the application settings and user agency profile.

Discussion

To ensure the usability and effectiveness of the developed system, a comprehensive validation process was undertaken. This process involved three group experts:

System Information Experts

System information experts consist of two information systems lecturers and one IT admin. These experts evaluated the technical aspects of the system, ensuring its adherence to sound software development principles and industry standards. System information experts were carefully selected as respondents based on their educational background and relevant work experiences. The minimum educational qualification was a Diploma 3 in related field, along with at least two years of professional experiences. These experts were primarily involved in validating the design and architecture of the information system.

Tabel 2. System Information Experts' Assessment

Responden	Job	Institution	Years of Service	Needs	Ease of Use	Database Structure	Database Management	Supporting Components	Component Integration	Authentication	Data Encryption	Features	System Updates	Average Score
Responden 1	Admin IT	BPR Harta Sarana	3	5	5	4	5	4	5	5	4	4	5	4,60
Responden 2	Lecturer	UKSW	10	5	5	5	4	5	5	4	4	5	5	4,70
Responden 3	Lecturer	UKSW	15	5	5	4	5	5	4	5	5	5	5	4,80
								Average						4,70

Source: Data analysis of system information experts validation instruments (2023)

As summarized in the table above, the average score for the system evaluation is 4.70 out of 5. This high score indicates that the SIMASPRAS system is deemed to be "Highly Recommended" for implementation based on the assessment of system information experts. The positive evaluation of the SIMASPRAS system aligns with the findings of Santoso (2022), who highlights the importance of well-designed and structured information systems for ensuring system feasibility and overall success. The robust design and architecture of the SIMASPRAS system, as evidenced by the expert evaluation, are likely to contribute to its effectiveness in fulfilling its intended purpose of streamlining inventory management processes within educational institutions. The SIMASPRAS system has received a highly favorable evaluation from system information experts, indicating its strong potential for successful implementation. The system's well-designed architecture and robust structure align with existing research on the importance of these factors for system feasibility and effectiveness.

Content Experts

Content experts consist of 14 teachers member of MGMP majoring in office management and business services in Salatiga City, Surakarta City and Boyolali Regency. These experts assessed the accuracy and relevance of the system's content, ensuring that it aligns with the intended educational objectives and accurately reflects the curriculum. Fourteen content experts participated in the evaluation, all of whom were teachers of the Office Management and Business Services subject in vocational high schools (SMK) in Salatiga City, Surakarta City, and Boyolali Regency. The purpose of the meeting was to conduct a limited trial of the SIMASPRAS system and gather feedback from content experts for the improvement of the product.

Tabel 3. Content Experts' Assessment

Responden	Institution	Years of Service	Visualization	Use	Feature	Utility	Effectiveness	User Satisfaction	Average Score
Responden 1	SMK N 1 Salatiga	21	5	5	5	5	5	5	5
Responden 2	SMK Negeri 1 Banyudono	15	5	4	4	4	5	4	4,33
Responden 3	SMKN 1 Banyudono	3	5	5	4	4	5	4	4,5
Responden 4	SMKN 1 Boyolali	8	4	4	4	4	5	4	4,167
Responden 5	SMK PGRI 2 Salatiga	26	5	5	5	5	5	5	5
Responden 6	SMK PGRI 2 SALATIGA	23	5	4	4	4	4	4	4,167
Responden 7	SMKS PGRI 2 Salatiga	4	4	4	4	3	4	4	3,83
Responden 8	SMK Negeri 1 Salatiga	17	4	5	5	5	4	5	4,67
Responden 9	SMK Kristen BM Salatiga	28	4	4	4	4	4	4	4
Responden 10	SMK kristen BM Salatiga	30	4	4	4	4	4	5	4,167
Responden 11	SMK N 1 Salatiga	22	4	4	4	4	3	4	3,83
Responden 12	SMKN 1 Salatiga	19	4	5	3	4	4	4	4
Responden 13	SMK N 1 Salatiga	30	4	4	4	4	4	4	4
Responden 14	SMK Wijaya Kusuma Surakarta	7	5	5	5	5	5	5	5
			Average						4,33

Source: Data analysis of content experts validation instruments (2023)

As summarized in the table above, the average score for the system evaluation is 4.33 out of 5. This high score indicates that the SIMASPRAS system is deemed to be "Highly Recommended" for implementation as a learning medium based on the assessment of content experts. The positive evaluation of the SIMASPRAS system aligns with the findings of Santoso and Siswati (2021), who emphasize the crucial role of the content and quality of a learning medium in determining its suitability for educational purposes. The rich and accurate content of the SIMASPRAS system, as evidenced by the expert evaluation, is likely to contribute to its effectiveness in enhancing student learning outcomes. The SIMASPRAS system has received a highly favorable evaluation from subject matter experts, indicating its strong potential as a valuable learning tool. The system's high-quality content aligns with existing research on the importance of content quality for effective learning media.

Practitioners

Practitioners are people who will use this system later. Consists of a secretary and two administrators. These experts, representing actual users of the system, provided feedback on its usability, ease of navigation, and overall effectiveness in facilitating inventory management tasks. Practitioners were carefully selected based on their educational background and relevant work experience. The minimum educational qualification was a Diploma 3 in a related field, along with at least three years of professional experience in the field. These practitioners were primarily involved in validating the usability and effectiveness of the information system in a real-world setting. The evaluation of the practitioners' feedback was conducted using a structured instrument. The results of this evaluation are summarized in the following table:

Tabel 4. Practitioners Assessment

Responden	Job	Institution	Years of Service	Use	Work Implementation	Feature	Satisfaction	Procedure	Efficiency and Effectiveness	Fluency	Practically	Average Score
Responden 1	Secretary	UKSW	10	5	5	5	5	4	4	5	5	4,75
Responden 2	Administration	UKSW	4	5	5	5	5	4	5	5	5	4,875
Responden 3	Administration	UKSW	20	5	5	4	5	5	4	5	5	4,75
Total Rata-rata												4,79

Source: Data analysis of practitioners validation instruments (2023)

As summarized in the table above, the average score for the system evaluation is 4.79 out of 5. This high score indicates that the SIMASPRAS system is deemed to be "Highly Recommended" for implementation based on the assessment of practitioners. The positive evaluation of the SIMASPRAS system aligns with the findings of Santoso, Sanoto, and Kusuma (2023) & Rina & Sugiarto (2022), who emphasize the potential benefits of information systems in enhancing work efficiency, job satisfaction, and overall productivity. The

usability and effectiveness of the SIMASPRAS system, as evidenced by the practitioner evaluation, are likely to contribute to these positive outcomes for users. The SIMASPRAS system has received a highly favorable evaluation from practitioners, indicating its strong potential for improving work processes and user satisfaction. The system's ease of use and effectiveness in facilitating tasks align with existing research on the benefits of information systems in the workplace.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The SIMASPRAS has been thoroughly evaluated and deemed highly suitable for implementation. This conclusion is strongly supported by the positive outcomes of the validation tests conducted by three groups of experts: System Information Experts: The system information experts rated SIMASPRAS with an average score of 4.70, indicating its strong alignment with design principles and overall effectiveness in facilitating inventory management tasks. Content Experts: The content experts evaluated the system's content and instructional materials, providing an average score of 4.33. This positive rating highlights the accuracy, relevance, and overall quality of the system's educational content. Practitioners: The practitioners, who represent the target users of the system, assessed its usability and effectiveness in real-world settings. Their evaluation resulted in an average score of 4.79, indicating that SIMASPRAS is easy to use, efficient, and significantly enhances inventory management processes. The convergence of these positive evaluations from diverse expert groups provides compelling evidence that SIMASPRAS is a well-designed, effective, and highly suitable system for managing inventory within educational institutions.

Recommendations

The SIMASPRAS has undergone comprehensive evaluation by system information experts, content experts, and practitioners, yielding highly positive feedback. Based on the evaluation findings, here are recommendations for further development of SIMASPRAS to enhance its functionality, effectiveness, and user experience: Enhance Reporting and Analytics Capabilities, Strengthen Integration with Existing Systems, Enhance User Interface and User Experience, Provide Ongoing User Support and Training, Continuously Monitor and Evaluate System Performance, Explore Advanced Features and Integrations, and Promote System Adoption and Utilization.

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