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Project Clinik: A Cross-Platform Scheduling and Appointment Reservation System

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A B S T R A C T

This study aimed to design, develop, and assess a cross-platform scheduling and appointment reservation system for clinics. The software development life cycle (SDLC) was used to guide the development of the system, which included planning, defining requirements, design and prototyping, development, testing, and operations and maintenance. A developmental experts research design was employed, and the technical features of the system were assessed by IT following the ISO 25010 standards, while end-users evaluated the quality of using the system based on selected ISO 25010 standards. The results showed that the SDLC was appropriate in developing the system, and both IT experts and end-users found the system to be of high quality. Based on the results, the researchers drew conclusions and provided recommendations for future studies. The study revealed that a cross-platform scheduling and appointment reservation system for clinics can be developed using the SDLC with the involvement of IT experts and end-users in the assessment process. It is crucial to incorporate the ISO 25010 standards to ensure that the system is of high quality and meets the needs of the end-users

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INTRODUCTION

The use of technology in healthcare has become increasingly important in recent years, especially in hospitals and medical facilities (Thimbleby, 2013). One of the easiest-to-implement technologies is online scheduling, which is being embraced by forward-thinking healthcare providers. As the population grows, more people require healthcare services, resulting in a significant increase in the number of people visiting hospitals, medical facilities, holistic groups, and doctors' offices.

Patient-centeredness has become a growing focus in healthcare, and this has led to significant changes in medical appointment scheduling (Fix, Lukas, Bolton, Hill, Mueller, LaVela, & Bokhour, 2018). Patients are now recognized as having an essential role in the design and delivery of healthcare services. Online scheduling has made it easier for patients to participate in the scheduling process, allowing them to make decisions about their appointment preferences and access the internet as a medium (Zhao, Yoo, Lavoie, Lavoie, & Simoes, 2017). Unlike the traditional method of booking appointments during clinic opening hours, patients can now log in to the clinic's website at any time of the day or night and schedule an appointment that works for them.

Online scheduling has numerous benefits for both patients and healthcare providers (Hasley, 2021). It saves patients time and money by eliminating the need for multiple visits to the clinic for scheduling purposes. Additionally, it increases patient satisfaction by making it easier for them to schedule appointments, which encourages new clients to book appointments. For healthcare providers, online scheduling streamlines the appointment booking process, allowing them to manage their schedules more efficiently. The benefits of online scheduling, including time savings and convenience, make it an essential tool in the modern healthcare system.

Despite the growing demand for online scheduling and appointment reservation systems in healthcare, there is a research gap regarding the development and evaluation of cross-platform scheduling systems. Project Clinik aims to fill this gap by developing a system that is compatible with multiple devices, including laptops, tablets, and smartphones. While several scheduling systems exist in healthcare, few offer cross-platform functionality. Additionally, there is a need for research that evaluates the effectiveness of such systems in improving patient satisfaction and reducing wait times. Project Clinik seeks to address these issues by developing and testing a cross-platform scheduling system that has the potential to revolutionize the way patients access healthcare services.

The Significance of Online Scheduling Systems in Healthcare Industry

The impact of an online scheduling and booking system on the healthcare industry is significant (Sanjana, 2019). In a previous study, the report found that patients in 15 of the top US cities had to wait an average of 24 days to schedule a new patient appointment. The use of an online scheduling system can save patients time and allow more patients to consult on their health problems.

Online scheduling systems have become popular in recent years due to the increased freedom patients have in making appointment preferences and

improved access provided by using the internet as a medium (Zhao et al., 2017). SaaS for medical scheduling has grown in popularity and is delivered and maintained by health IT businesses such as ZocDoc and InQuicker on a subscription basis (Siddiqui & Rashid, 2013). These cloud-based appointment services can be incorporated into the management systems of healthcare providers, providing a more efficient and streamlined scheduling process.

Patients are increasingly turning to the internet for medical information (Skousen, Safadi, Young, Karahanna, Safadi, & Chebib, 2020). Online patient groups provide a platform for patients to ask inquiries, locate peers with similar health concerns, read health-related commentary and experiences, and study reviews and rankings of therapies, doctors, and hospitals. However, these groups face difficulties that necessitate active moderation. The establishment of a website that provides various information about the clinic as well as allows for online appointment management and scheduling could assist an existing clinic in a variety of ways (Olga, 2017).

In conclusion, the use of an online scheduling and booking system in the healthcare industry can provide significant benefits for both patients and healthcare providers. It allows patients to schedule appointments easily and efficiently, saving them time and providing more access to healthcare. For healthcare providers, it can improve scheduling processes, minimize patient wait times, and provide a more efficient and streamlined scheduling process. The evolution of technology and the internet has made it easier for patients to access healthcare and for healthcare providers to manage their patients' records and appointments.

Enhancing the Process of Healthcare Delivery Through Effective Patient Scheduling

In accordance with Akinode and Oloruntoba (2017), having an appointment scheduling system makes it easier to satisfy both patients and doctors. The effectiveness of the patient scheduling system is solely responsible for the efficiency of healthcare delivery. It reduces the number of dissatisfied patients as well as expert medical errors. Moreover, appointment systems are frequently used to reduce patient wait times and waiting-room congestion, providing valuable effects for both patients and doctors to do their jobs efficiently and without wasting time.

On the other hand, Azadeh, Baghersad, Farahani, and Zarrin (2015) expressed that effective patient scheduling in clinics, laboratories, and emergency departments is becoming increasingly important. Hospitals are required to optimize patient satisfaction despite a limitation of space and facilities. Effective patient scheduling in current settings is critical to improving healthcare delivery. Patients' wait times are reduced, which increases the quality and efficiency of healthcare services. This approach has been effectively applied to scheduling patients in a clinical laboratory, taking into account real-world constraints such as test precedence, the number of test sites or operators, and the problem's semi-online nature.

Based on the review of Zhao et al. (2017), it was found that web-based scheduling has had positive effects on reducing no-show rates, decreasing staff

labor, decreasing waiting time, and improving satisfaction. However, the cost, flexibility, safety, and integrity are major reasons discouraging providers from switching to web-based scheduling, and patients may also be reluctant to use such systems due to their past experiences with computers and the Internet. The study identified the benefits and barriers to implementing web-based medical scheduling that have been discussed in the literature, as well as unmet needs in today's healthcare environment. They suggest that further studies are needed to investigate the benefits of web-based scheduling interventions for patient outcomes.

Statement of the Problem

In general, this study aimed to design, develop, and assess a cross-platform scheduling and appointment reservation system.

Specifically, it sought to answer the following questions:

1. How may the Project Clinik be design and develop based on the stages of Software Development Life Cycle model which include
    1.1. Planning;
    1.2. Defining requirements;
    1.3. Design and prototyping;
    1.4. Development;
    1.5. Testing; and
    1.6. Operations and maintenance?
2. How may the IT experts assess the technical aspects of the developed system based on the ISO 25010 standards which include
    2.1. Functional suitability;
    2.2. Reliability;
    2.3. Usability;
    2.4. Performance efficiency;
    2.5. Compatibility;
    2.6. Security;
    2.7. Maintainability; and
    2.8. Portability?
3. How may the system be assessed by the end-users based on the quality of use in consideration of the selected ISO 25010 criteria which include
    3.1. Functional suitability;
    3.2. Reliability; and
    3.3. Usability?

METHODOLOGY

The Project Clinik was developed using the developmental research design, which is frequently employed in instructional design and technology to create new products and procedures, validate existing methods, and produce knowledge. This design was the most appropriate for evaluating changes over an extended period of time, given that the study sought to create and assess a system.

Purposive sampling was used by the researchers to select participants in Cabanatuan City, Nueva Ecija, Philippines. Selected end-users and IT experts were involved in the study as respondents, and Table 1 displays the frequency and percentage distribution of these participants.

Table 1. Distribution of the Respondents

Type of Respondents	Frequency	Percentage
IT Experts	9	47.00%
End Users	21	53.00%
Total	30	100.00%

To accurately evaluate the technical features and quality of the scheduling and appointment reservation system, the researchers in this study needed to modify two existing sets of instruments to suit the context of their research. Before collecting any data, the researchers took the necessary steps to obtain informed consent from all respondents. They provided detailed information about the project, including its purpose, methodology, and potential risks and benefits. This ensured that the respondents fully understood what the study entailed and were able to make an informed decision about whether or not to participate. Additionally, the researchers emphasized the confidentiality and anonymity of the data collected, ensuring that respondents could provide honest feedback without fear of repercussions.

To administer the instrument, the researchers used Google Forms, an online survey tool that allowed for efficient and accurate data collection. The researchers took care to ensure that the data collected was treated with the utmost care and protection. They ensured that the data was securely stored, only accessible to authorized individuals, and used exclusively for the purposes of this study. The researchers also took steps to anonymize the data, ensuring that individual respondents could not be identified from the data collected. These measures ensured that the study was conducted in an ethical and responsible manner, protecting the rights and privacy of all participants while collecting the necessary data to assess the scheduling and appointment reservation system.

RESULTS AND DISCUSSION

The Design and Development of the Cross-platform Scheduling and Appointment Reservation System Based on the Phases of Software Development Life Cycle.

A. Planning Stage

The primary objective of the system's construction stage was to develop a strategy that included figuring out how the system was made and how it worked. During this stage, the researchers brainstormed about how the problems could be solved, leading them to the idea of a booking or appointment system for a clinic. To aid in the development of the system, a Gantt chart was developed containing various activities. The researchers aimed to ensure that the system would be efficient and meet the needs of both patients and medical professionals, ultimately providing a solution to the problems identified during the brainstorming phase.

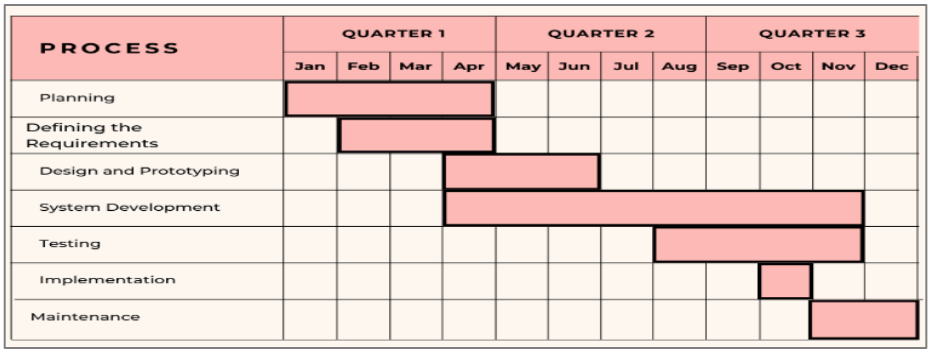

Figure 1. Gantt Chart of Activities

B. Defining the Requirements Stage

In the Software Development Life Cycle (SDLC), the defining requirements stage involves gathering, understanding, and documenting the business requirements necessary for the development of Project Clinik. The researchers employed various techniques such as creating diagrams and processes to fully comprehend the project's significance. One of the diagrams used was the data flow diagram (DFD), which depicted the flow of data between external parties and the system's operations and data storage as shown in figure 2. Additionally, a use-case scenario schematic was employed to display the activities involved and how each external component interacts with the system as shown in figure 3. These methods allowed the researchers to have a clear understanding of the requirements for the successful development of Project Clinik, ensuring that it met the specific needs of its intended users.

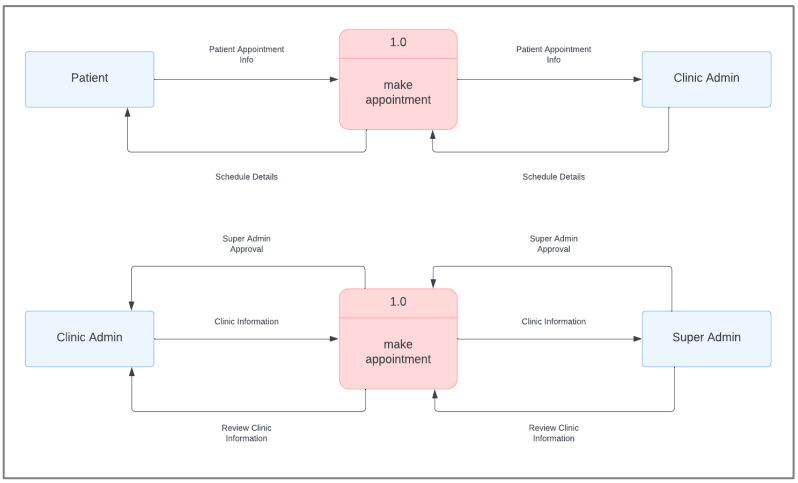

Figure 2. Data Flow Diagram – Context Level

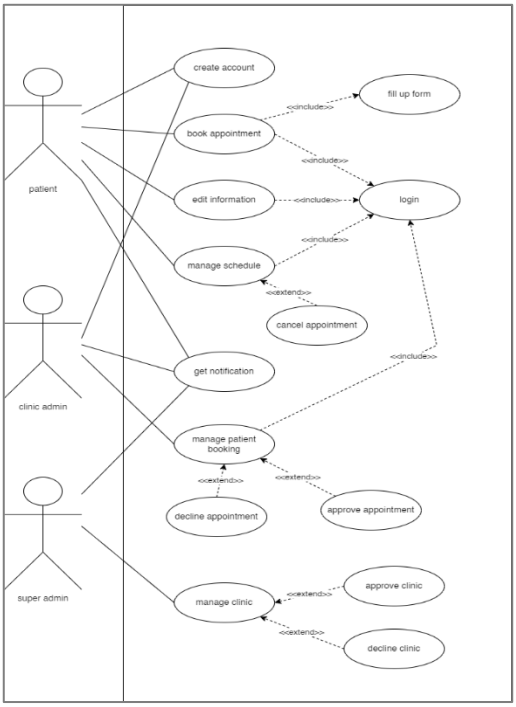

Figure 3. Use-Case Diagram

C. Design and Prototyping Stage

In the design and prototyping stage, the researchers conducted activities to design and develop the actual system. The use of several integrated development environments (IDE) like visual studio code and XAMPP were utilized in this study. Figure 5 shows the IDE for visual studio code and in figure 6, the MySQL admin interface is shown.

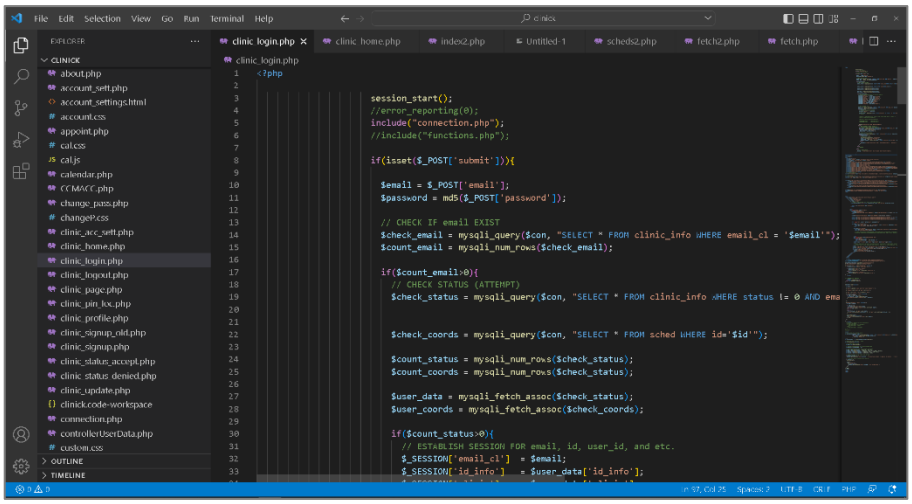

Figure 4. Integrated Development Environment – Visual Studio Code

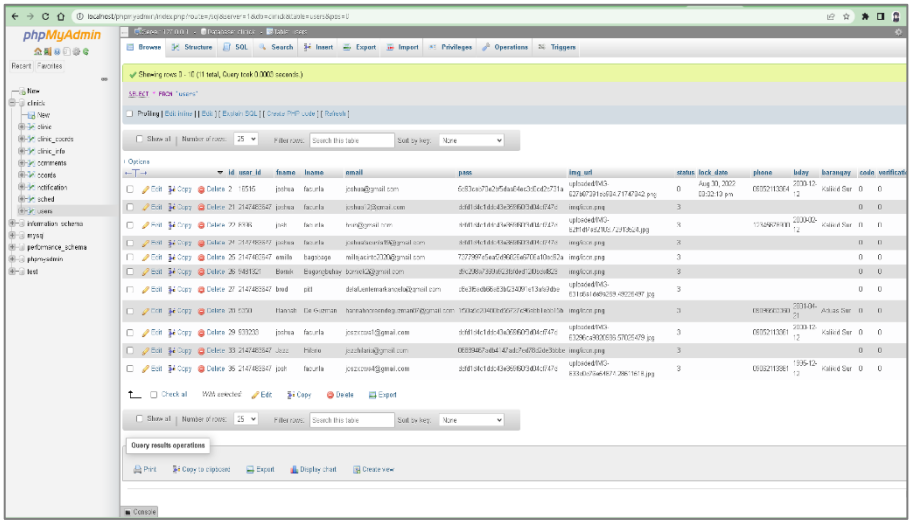

Figure 5. MySQL Interface – PHP My Admin

The following user interfaces shown in below are the sample user interfaces of the developed system. The developed UI were all based from the result of the previous activities conducted. Thus, the researchers successfully developed the system.

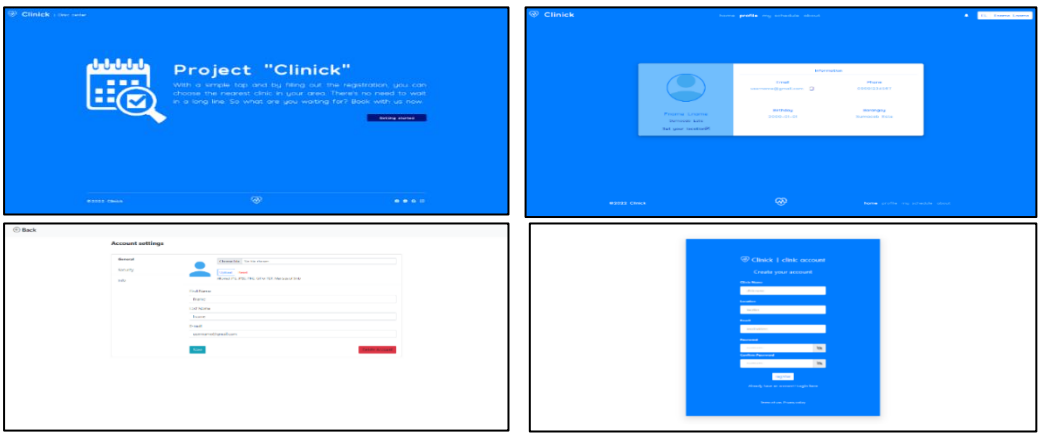

Figure 6. Project Clinik Sample User Interfaces

D. Testing Stage

During the testing stage, the software system developed in the earlier stages undergoes a series of systematic tests to ensure its quality. The researchers employed quality assurance as a testing technique, which is a process that guarantees the calibre of software products or services offered by a company to its users. The primary objective of quality assurance is to enhance the efficiency and effectiveness of the software development process in accordance with the quality standards set for software products.

E. Maintenance Stage

In this stage, the researchers conducted different maintenance activities such as preventive maintenance, adaptive maintenance, corrective maintenance, and preventive maintenance. Preventive Maintenance protected the application's and assets' effectiveness and helped to avoid major, costly repairs in the future. Corrective maintenance was concerned with fixing or restoring the application after failure. It was a lower-cost, simpler process, and it could inspect the application. With adaptive maintenance, if an error occurred or the application crashed, it could be changed, including all the related functions in the application, to meet the evolving needs of the user and the environment. Lastly, perfective maintenance was needed to enhance the app to its full potential, and due to an increase or decrease in performance, this could be handled by adding better data and some features that can meet the needs of the users.

Assessment on the Technical Quality of the Project Clinik made by IT Experts

The technical quality of the developed system was evaluated by IT experts, and the results are presented in Table 2. The assessment provided the researchers with valuable insights into the experts' opinions regarding the system's technical aspects.

Table 2. Assessment on Technical Qualities of Project Clinik by IT Experts

Criteria	Mean Rating	Verbal Interpretation
Functional Suitability	3.41	Strongly Agree
Reliability	3.30	Strongly Agree
Usability	3.64	Strongly Agree
Performance Efficiency	3.44	Strongly Agree
Compatibility	3.33	Strongly Agree
Security	3.42	Strongly Agree
Maintainability	3.42	Strongly Agree
Portability	3.26	Strongly Agree
Overall Mean	3.40	Strongly Agree

Table 2 presents the assessment of Project Clinik's technical qualities by IT experts based on various criteria. The mean rating and verbal interpretation are provided for each criterion, which includes functional suitability, reliability, usability, performance efficiency, compatibility, security, maintainability, and portability. The overall mean rating is also presented.

Based on the results, the IT experts strongly agree that Project Clinik possesses excellent technical qualities across all criteria, with mean ratings ranging from 3.26 to 3.64. The highest mean rating was given for usability, indicating that the system is easy to use and navigate. The criteria of functional suitability, performance efficiency, security, and maintainability received mean ratings above 3.40, indicating that the system meets the requirements and expectations of the IT experts in terms of these aspects. However, the criterion of portability received the lowest mean rating of 3.26, indicating that there may be some limitations in terms of moving the system from one environment to another.

The results of this assessment provide valuable insights into the technical qualities of Project Clinik, which can be used to further improve the system's performance. The high ratings across all criteria indicate that the system is well-designed and meets the expectations of IT experts. However, the lower rating in the portability criterion suggests that improvements may be needed to ensure that the system can be easily transferred from one environment to another. Overall, the results suggest that Project Clinik is a high-quality system with strong technical capabilities, which can provide effective support for its intended users.

Assessment on the Quality of Using the Project Clinik made by End-Users

The assessment results of the quality of using Project Clinik by end-users are shown in Table 3. The table provides insights into the end-users' perceptions of the quality of the project developed by the researchers.

Table 3. Assessment on Quality of Using the Project Clinik by End-Users

Criteria	Mean Rating	Verbal Interpretation
Functional Suitability	3.45	Strongly Agree
Reliability	3.52	Strongly Agree
Usability	3.52	Strongly Agree
Overall Mean	3.50	Strongly Agree

Table 3 shows the assessment results of the Project Clinik's quality based on three criteria: Functional Suitability, Reliability, and Usability. The mean rating for each criterion and the overall mean rating are presented, along with their corresponding verbal interpretation. The assessment was conducted on end-users who utilized the system in Cabanatuan City, Nueva Ecija, Philippines.

Based on the results, the end-users strongly agreed that the Project Clinik has good quality in terms of Functional Suitability, Reliability, and Usability, with mean ratings ranging from 3.45 to 3.52. The Overall Mean Rating of 3.50 indicates that the end-users have a positive perception of the system's quality. The high ratings for the three criteria suggest that the Project Clinik is effective, dependable, and easy to use, which can contribute to its potential success and acceptance among the end-users.

The results of the assessment on the quality of using the Project Clinik by end-users have significant implications for the system's developers and stakeholders. The positive ratings on the three criteria suggest that the system has met the end-users' expectations and needs, which can increase the likelihood of adoption and continued use. The developers can use the assessment results to identify the strengths and weaknesses of the system and make necessary

improvements to enhance its quality further. Moreover, the stakeholders can use the results to evaluate the system's success and impact on the end-users' health and well-being.

CONCLUSIONS AND RECOMMENDATIONS

This study aimed to design, develop, and assess a cross-platform scheduling and appointment reservation system for clinics. The stages of the software development life cycle were described, which included planning, defining requirements, design and prototyping, development, testing, and operations and maintenance. A developmental research design was used in this study. In assessing the technical features of the system, the IT experts followed the ISO 25010 standards, while the end-users assessed the quality of using the system, considering the selected ISO 25010 standards.

The results showed that the SDLC was appropriate in developing the system. The technical feature assessment revealed that the IT experts found the system to be of high quality, while the end-users rated the quality of using the system as also being of high quality. The findings from this study provide valuable insights into the effectiveness of using the SDLC and the ISO 25010 standards in developing and assessing a scheduling and appointment reservation system for clinics.

In conclusion, the study successfully developed and assessed a cross-platform scheduling and appointment reservation system for clinics. The findings suggest that the SDLC and the ISO 25010 standards can be effective tools for developing and assessing similar systems. The researchers recommend further studies on the system's effectiveness, usability, and accessibility to a wider range of users to improve its overall performance.

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