Discourse on Artificial Intelligence Design Using ITS and SDLC Methods in Building Islamic Religious Education Learning Applications

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ABSTRACT

The development of increasingly sophisticated programming language technology where designed algorithms are able to think intelligently have been used for various purposes that are good for humans. This technology can also be applied to Islamic religious learning by using an intelligent tutoring system combined with artificial intelligence to: find sources of books, source modules, hadiths, verses of the Koran and their translations that are really related to learning with correct and solid data and compare Islamic teaching methods. The application program was built using two methods, namely the system design method System Development Life Cycle and the Intelligent Tutoring System method. The System Development Life Cycle method is used to build a comprehensive system that includes design tools such as use cases, activities, classes, sequences. While the Intelligent Tutoring System method is used in designing intelligent algorithms with a programming language as a machine to operate this learning Artificial Intelligence system. The result of this study is a smart application program for Islamic religious learning and is applied in high schools in the province of West Sumatra, Indonesia with an application effectiveness level of up to 96% with an error rate index of 0.23.

1. Introduction

Over the course of this experiment, the researcher made use of an instructional platform known as the Intelligence Tutoring System (ITS). The Intelligent Teaching System (ITS) is an educational platform that features several intelligent components, including Observable of Training, Smart Coaching, Automatic Arrangement, Student Models, Evaluation, and Certificate. Observable of Training's primary objective is to provide students with information that is pertinent to the subject matter that they have selected for their project. The system comes with a trainer called Smart Coaching that is designed to facilitate

continuous and directed comprehension of the subject matter. It does this by providing a variety of modules, materials, and questions to choose from. Students can select learning methods as well as the results that they anticipate achieving from utilising those learning methods thanks to Automatic Arrangement. In addition, Student Models aid students as they determine which learning model is most suitable to meet their requirements. In order to provide a grading scale that is structured in a hierarchical fashion, the evaluation of learning outcomes is performed. After successfully completing the educational programme, the student will be given a Certificate as recognition of their achievement. This Certificate is a tangible and quantifiable representation of the student's learning, and it can be downloaded using a Quick Response Code system that is appropriate for the situation. When students make use of this sophisticated educational platform, they can not only acquire a deep comprehension of the material at hand but also successfully complete the educational programme.

This research was generated through an examination of data that possesses a high level of validity, and it is intended to be continued into the development of a website-based application for learning Islamic religious education in high school in the province of West Sumatra, Indonesia. The end goal of this investigation is to create a web-based application that can be used in different kinds of educational environments. Earlier studies by several different researchers have uncovered the significance of application development for pedagogical reasons. Electronic learning, also known as e-learning, is becoming one of the most important educational facilitators currently, which is characterised by widespread epidemics. As a result of this, digital mobile technology creates new options and possibilities for various learning perspectives, including the relationship that exists between instructors and pupils. These new options and possibilities are made possible by the fact that the technology is portable and digital (Sumardi et al., 2021 quoted from Sulisworo et al., 2016; Bdiwi et al., 2019).

Over this time period, schools have, in general, utilised websites in order to accomplish a range of educational goals. When it comes to dealing with the era of the fourth industrial revolution, the role that websites have played, particularly in the field of education, has been quite significant. The website of the Open University acts as a central hub through which a variety of various student assistance programmes can be accessed. Online admissions, notices and announcements, student records, online examination forms, e-learning portals, evaluation results, and registration for complaints, enquiries, and grievances are all part of these learner support services. (Datt & Singh, 2021).

2. Method

Research and development are a process that can be thought of as the creation of a new application or the improvement of already existing applications, both of which are able to be accounted for in their own right. Research and development can also be thought of as the process of enhancing already existing applications. Instead, research and development might be interpreted as the process of enhancing previously developed software programmes (Abdullah, 2015). It is not necessary for the application to be physical objects or pieces of hardware such as books, modules, or other instructional equipment used in the classroom or laboratory; rather, the application could be software such as a computer programmer. Examples of such tangible objects or pieces of hardware include: books; modules; other instructional equipment used in the classroom or laboratory; (Abdullah, 2015 quoted from Syaodih, 2005). The process of developing software is not an effortless one; in the absence of useful tools and procedures, software is rendered useless and fails to live up to its promise of making human life easier. If you operate in an industry that is heavily reliant on technology, getting high-quality software is an investment that will help a big number of people lead easier lives overall. This is something that you should consider doing. The stages of potential

and problems, data collection, product design, design validation, the revised design, product testing, product revision, trial use, and mass production are the stages that make up the process of implementation of research and development strategies undertaken to create applications and to test the effectiveness of the application that is in question. The research and development strategies are implemented to create applications and to test the effectiveness of the application that is in question. The following is a list of the stages that are included in the process of putting research and development plans into action, which is done in order to produce applications and to test how effective the application in question is: (Abdullah, 2015 quoted from Sugiyono, 2011). During this research project, R&D was put to use in order to construct a prototype of an intelligent tutoring system with the goal of educating high school students about the religion of Islam. The system was designed with the intention of educating high school students about Islamic law.

3. Result
System Development Life Cycle

The world has become more advanced with technology that is able to be adapted in any field. Building and implementing information systems in learning should be implemented, the need for information systems is inevitable. Building a learning information system requires the right tools, such as the System Development Life Cycle (SDLC). Software Development Life Cycle (SDLC) is the process of building or maintaining a software system (Chittagong & Islam, 2021). SDLC has become the mainstay method in building programming-related systems. A Software Development Life Cycle (SDLC) adheres to important phases that are essential for developers, such as planning, analysis, design, and implementation (Balaji, S, 2012)
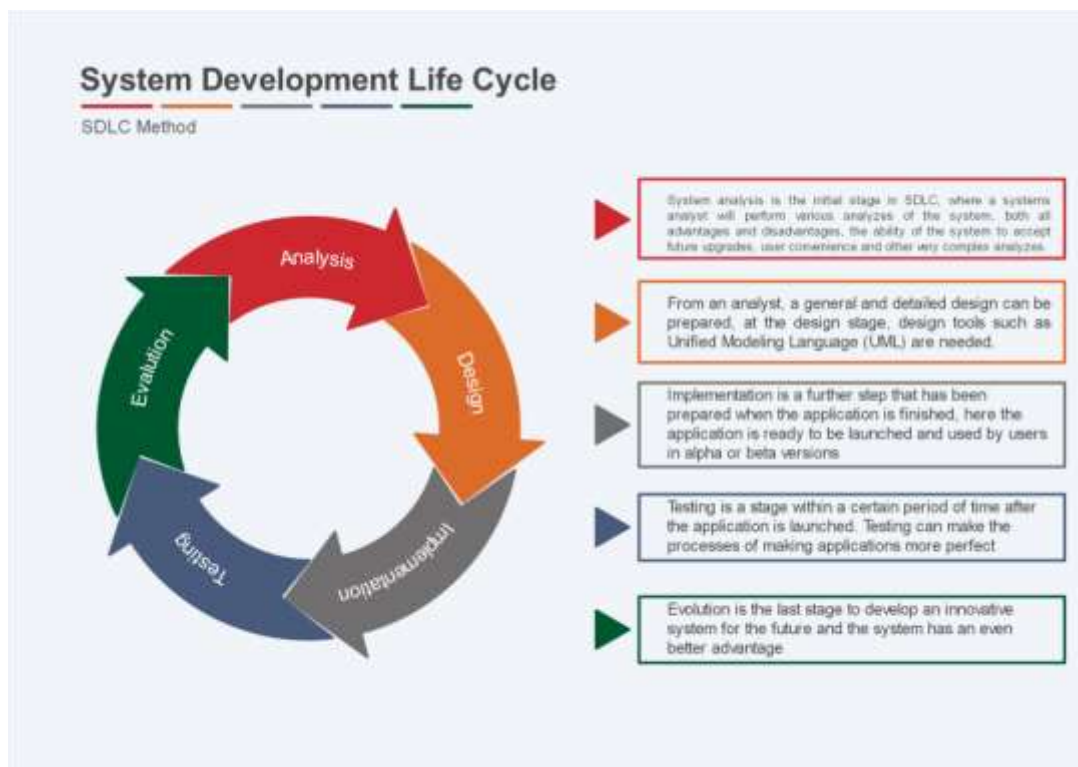

Figure 1. SDLC Islamic Religious Learning Design

This system is built using the algorithmic logic of web-based programming languages, such as PHP, Json, Javascript and Python with object-based programming. The System Development Life Cycle (SDLC) method of the waterfall model is one of the approaches to development for

systematic and sequential software ranging from environmental analysis, design of the application to be made, code in making the application, and testing of the application itself, and application maintenance to keep an application running (Bayu Kristanto et al., 2020).

In designing an information technology-based information system for Islamic religious education in high schools in several schools in the province of West Sumatra which is applied in this study, SDLC is required through the following steps:

1. **Analysis**: The first stage in SDLC is analysis. At this stage, the system development team will carry out a system requirements analysis by identifying problems and opportunities related to Islamic learning in senior high schools. The team will analyze the user's problems and needs to determine system goals and requirements. The team will consider factors such as target users, data requirements, information flows and related business processes. User Requirements Gathering: The system development team will communicate with users, namely teachers and students, to understand their needs related to Islamic education in high school. These needs may include the type of material to be taught, effective learning methods, tools and technology needed, as well as the preferred format and teaching style of the students. User requirements gathering can be done through interviews, surveys, or focus groups.

   a. **Requirements Analysis**: After user requirements gathering, the system development team will analyze and identify the needs that must be fulfilled by the system. These requirements must be clear, measurable, and testable to ensure that the developed system meets user needs. The system development team will also identify factors that influence the needs, such as resource availability, budget, and schedule.

   b. **Current System Analysis**: In addition to analyzing user requirements, the system development team will also analyze the current system, if any. This analysis aims to identify problems and gaps between the existing system and user needs. The system development team will also evaluate aspects of the system that are functioning well and should be maintained in the new system.

   c. **System Objectives and Requirements**: After the requirements and current system analysis are completed, the system development team will determine the objectives and requirements of the system to be developed. These objectives and requirements must be based on user needs and problems identified in the requirements analysis. System requirements include aspects such as functionality, performance, security, and availability.

   d. **Requirements Documentation**: The final stage of analysis is the preparation of requirements documentation containing a detailed description of the system objectives and requirements. This document will be a guide for the system development team during the next stage, which is system design. Requirements documentation can also be used as a reference for evaluating the system that has been developed in the evaluation stage.

2. **Design**: After completing the analysis phase, the system development team will carry out the system design. At this stage, the team will design how the system should work, including database design, user interface design, and system architecture. System design must meet user requirements and consider factors such as resource availability, security, and scalability. At this stage, the system development team must also choose the right technology and platform for the system being built. At this stage, the system development Research Team will design a system based on the needs analysis in the previous stage. System design must meet user requirements and

consider factors such as resource availability, security, and scalability. The design stage includes several important aspects, namely:

a. **System Architecture Design**. The system development research team will design the overall system architecture, namely how the parts of the system will interact with each other. The system architecture should take the user's needs into account and should include the operating system, software, hardware, database, and user interface.

b. **User Interface Design.** User interface design is an important aspect of the design stage. The system development research team will design the user interface so that it is easy for users to use and understand. User interface design should take into account factors such as security, scalability and usability.

c. **Database Design**. At this stage, the system development Research Team will design the database structure. Database design must take into account factors such as data dependability, data volume, and data security. The system development Research Team must also consider the Research Team considering data processing methods and how to access data.

d. **Algorithm and Programming Logic Design**. Algorithm and programming logic design are important aspects of the design phase. The system development research team must design programming algorithms and logic so that the system can function properly and efficiently. This design must take into account factors such as complexity, performance, and security.

e. **Security Design**. Security design is an important aspect of the design phase. The system development Research Team must consider security factors such as authentication, authorization, and data encryption. The security design must also consider the security risks and threats that may occur. Once the system design is complete, the system development Research Team will review the design to ensure that the system meets user requirements and considers all relevant factors. If there are problems or weaknesses in the design, the system development Research Team will return to the analysis stage or revise the system design.

3. **Implementation**: The third stage in SDLC is implementation. At this stage, the system development team will start developing the system, coding the system design into a programming language that can be run by computers. They will also build the database and install and configure the software and hardware needed to run the system. At this stage, the team will make modules or small parts of the system first to ensure the system can run properly. In this phase, the team will perform several tasks as follows:

a. **System Development**: The system development team will begin to develop the system, coding the system design into a programming language that can be run by computers. They will use various programming languages that have been selected in the design phase. In addition, they will develop software, set up the database, and prepare the development environment.

b. **Software and Hardware Installation and Configuration**: After the software is developed, the system development team will install and configure the necessary software to run the system. They will also ensure that the hardware used meets the requirements set in the design phase.

c. **System Integration**: In this phase, the system development team will integrate all the developed system components, such as applications, databases, and existing systems (if any). They will also ensure that the system

is well integrated and functions according to the specifications set in the design phase.

    d. **Testing**: After the system is integrated, the system development team will perform testing to ensure that the system runs well and meets user requirements. They will perform functional testing to check every function and feature of the system, as well as non-functional testing such as load testing, speed testing, and security testing.

    e. **Training**: After the system is tested, the system development team will provide training to users to be able to use the system correctly and effectively. Training can be done in person or through online tutorials.

    f. **Problem Resolution**: If any problems are found during the implementation phase, the system development team will fix the problems and ensure that the system runs well before moving to the next phase.

4. **Testing**: After the system has been developed, the next stage is testing. The system development team will carry out various types of tests to ensure that the system works properly and meets user requirements. This test includes function tests, performance tests, and security tests. If any issues or errors are found during testing, the system development team will revert the system to a design or implementation version to fix the problem. This phase is crucial as it aims to ensure that the developed system works well and meets user requirements. The following is a detailed explanation of the testing stages in SDLC:

    a. **Functional Testing**. Functional testing aims to ensure that the system performs its functions correctly according to user requirements. This testing involves testing various features and functions of the system. If any system function fails, the software development team will fix it and repeat the testing until all functions work well.

    b. **Performance Testing**. Performance testing aims to ensure that the system can handle the expected workload and provide satisfactory performance in normal and peak situations. This testing is done by loading the system with a large amount of data and measuring the time it takes to access, process, and produce output. Performance testing also involves comparing the test results with previously established performance standards.

    c. **Security Testing**. Security testing aims to ensure that the system is secure and protected from security threats such as hacking and malware attacks. This testing involves security testing at the application, database, network, and infrastructure levels. Security testing also involves penetration testing to determine if there are any security gaps in the system that can be exploited by unauthorized parties.

    d. **Acceptance Testing**. Acceptance testing is carried out by users and stakeholders to evaluate whether the system has met their requirements and expectations. This testing is carried out at the final stage after the system has been developed and tested by the software development team. Users will test the system and provide feedback to the software development team to ensure that the system works well and meets user requirements. After the testing phase is complete, the software development team will evaluate the test results and fix any errors or issues found during testing. After the system has been tested and validated, it is ready to be implemented and operated in a production environment.

5. **Evaluation**: The last stage in SDLC is evaluation. At this stage, the system development team will evaluate the system that has been developed and identify problems and weaknesses that need to be fixed. After the evaluation is complete, the system development team will fix problems and carry out further testing to ensure the system works properly before being implemented in high schools. Evaluation can also be carried out by system users, so that it can provide useful input in developing an even better system. This stage is crucial as it aims to ensure that the developed system works well and meets user requirements. The following is a detailed explanation of the testing stages in the SDLC:

   a. **Functional Testing**. Functional testing aims to ensure that the system performs its functions correctly according to user requirements. This testing involves testing various features and functions of the system. If a failure is found in any system function, the software development team will fix it and repeat the test until all functions work properly.

   b. **Performance Testing**. Performance testing aims to ensure that the system can handle the expected workload and provide satisfactory performance in normal and peak situations. This testing is done by loading the system with a large amount of data and measuring the time it takes to access, process, and produce output. Performance testing is also done by comparing test results with predefined performance standards.

   c. **Security Testing**. Security testing aims to ensure that the system is secure and protected from security threats such as hacking and malware attacks. This testing involves security testing at the application, database, network, and infrastructure levels. Security testing also involves penetration testing to determine if there are any security vulnerabilities in the system that can be exploited by malicious parties.

   d. **Acceptance Testing**. Acceptance testing is performed by users and stakeholders to evaluate whether the system has met their requirements and expectations. This testing is done at the final stage after the system has been developed and tested by the software development team. Users will test the system and provide feedback to the software development team to ensure that the system works well and meets user requirements. After the testing stage is complete, the software development team will evaluate the test results and fix any errors or issues found during testing. Once the system has been tested and validated, it is ready to be implemented and operated in a production environment.

Intelligence Tutoring System

Intelligent tutoring system is a computer system designed to simulate a human teacher, provides dedicated instruction for learners without human teacher intervention (mahdi & naser, 2016). In this study, the its design was made as shown below.

Figure 2. Design of ITS Using Artificial Intelligence in Application

A dialog system is a computer program that communicates with a human user by using natural language. Dialog systems are currently gaining interest in different elds of application, such as e-commerce, personal assistants, and call centers . Latest growths on intelligent tutoring systems have clearly proved that users of tutoring systems can make swift improvement and radically enhance their performance in precise areas and skills (Almasri et al., 2019). ITS is developed using various technologies such as artificial intelligence, natural language processing, and data mining. ITS can work in various ways, ranging from providing learning material tailored to individual needs, giving feedback to correct mistakes, to providing challenges and tasks designed to help students master the subject matter. ITS can also use technologies such as chatbots or voice assistants to interact with students and answer their questions. The main advantage of using ITS is that it can provide personal and interactive assistance to students, which can enhance the effectiveness of learning and help students master the subject matter more quickly and efficiently. ITS can also assist teachers in providing personalized and measurable instruction, as well as provide useful data to identify students' learning problems and provide appropriate interventions.

The following are some work steps that can be taken to implement the Intelligence Tutoring System (ITS) in Islamic religious learning which are concrete steps carried out in this study, namely:

1. **Identification of learning objectives**: The first step in implementing ITS is to identify the learning objectives to be achieved. This will assist in selecting appropriate learning technologies and approaches. in this case ITS is designed to provide personal assistance to students so they can understand difficult concepts and maximize their learning potential. ITS is developed using various technologies such as artificial intelligence, natural language processing, and data mining. In identifying learning objectives, we as researchers get a number of things that need special attention, including:

    a. **Competency Standards**: learning objectives must be in accordance with competency standards set by the government or related educational institutions. This is so that students can acquire competencies that are in accordance with the needs of the world of work or the needs of society, so that later the system created to assist learning is used and in line with all government policies and educational institutions.

b. **Student Needs**: learning objectives must also consider the needs of students in the learning process. Like, do students need a deeper understanding of a concept or just need a general understanding. By considering the needs of students, learning can be more effective and efficient. This allows students to get the right method on target.

c. **Technology and Learning Approach**: identification of learning objectives also helps in choosing the right learning technology and approach to achieve these goals. In this case, ITS can assist in providing personal and interactive assistance to students according to their learning needs and preferences. By Identifying Learning Objectives, the ITS development process can be more directed and effective. This is because the development of learning technology must be carried out by considering the goals and needs of students, so that the technology developed can meet these needs and help students achieve the desired learning goals.

2. **Identification of Student Needs**: ITS must be able to adapt learning to student needs and preferences. Therefore, it is necessary to identify students' needs in learning and their learning preferences. The main advantage of using ITS is that it can provide personal and interactive assistance to students, which can increase learning effectiveness and help students master subject matter more quickly and efficiently. ITS can also assist teachers in providing personalized and measurable teaching, and can provide useful data for identifying student learning problems and providing appropriate interventions. To identify student needs, researchers take important actions, including:

a. **Collect data on students' needs and preferences**. Data can be obtained from the results of tests or quizzes, observations, interviews, or questionnaires. This data will assist ITS in understanding the characteristics and needs of students and assist ITS in adapting learning to student preferences.

b. **Observing student behavior while studying**. In the learning process, students may show some behaviors that indicate their needs. For example, if students more easily understand subject matter through a visual approach, then ITS should be able to provide visual learning according to the student's preferences.

c. **Conduct an analysis of student needs**. After collecting data and observing student behavior, an analysis is then carried out to determine student needs that need to be met. This analysis will assist ITS in adapting learning to the needs and preferences of students and assisting in the development of appropriate learning materials. By identifying student needs, ITS can provide more personal and interactive learning and can increase learning effectiveness. ITS can also assist teachers in providing personalized and measurable teaching as well as providing useful data for identifying student learning problems and providing appropriate interventions.

3. **Technology selection**: Various technologies can be used in ITS, such as artificial intelligence, natural language processing, and data mining. Choose the most suitable technology to meet the learning goals and needs of students. ITS was developed using machine learning algorithms that can study student behavior and provide recommendations according to student learning abilities and preferences. ITS can also adjust the learning approach used based on student learning preferences, such as visual or auditory.

4. **Data collection and analysis**: ITS can collect data about student behavior and their learning experiences. This data can be used to improve the system and provide appropriate feedback to students.

5. **Development of learning materials**: Once learning objectives and student needs are identified, appropriate learning materials can be developed. This material must be adapted to the curriculum and learning standards that have been set. ITS can work in various ways, from providing learning materials tailored to individual needs, providing feedback to correct mistakes, to providing challenges and assignments designed to help students master the subject matter. ITS can also use technology such as chatbots or voice assistants to interact with students and answer their questions.
6. **Testing and evaluation**: After ITS is implemented, it is necessary to carry out testing and evaluation to evaluate its effectiveness in improving student learning. Evaluation results can be used to improve ITS and increase its effectiveness in learning.
7. **ITS user training**: Students, teachers and parents need to be trained to use ITS effectively. This training should cover the use of technology and how to access learning materials.
8. **Provision of technical support**: ITS also needs adequate technical support. Therefore, it is necessary to provide sufficient resources to ensure that ITS can function properly and can be repaired if a problem occurs.

The result of the research is the design of the ITS application for Islamic religious learning with a display like the following picture:

Figure 3. Design of ITS in Mobile Aplication

This research is about creating a system related to intelligent learning through computer applications, where the application acts as a tutor by having a complete database of material, including the following:

1. Simulation System (SS)
    a. Has a Simulation User Interface (SUI), as a communication medium from the database to humans
    b. Has a Simulation Engine (SE), as a machine with programming language algorithms in human interaction
    c. Having a Tutor User Interface (TUI), as a media interface between systems and tutoring
2. Intelligence Tutoring System (ITS)
    a. Having Observable of Training, as an intelligent means of presenting material related to the selected material, whether it's a smart search system, or displaying the results of the search for materials that match the required theme.
    b. Have Smart Couching, in the form of modules, materials, questions, simple ways of understanding with continuous and directed training by intelligent systems
    c. Has Automatic Arrangement, as a smart programming language algorithm to guide students in choosing learning, methods and expected results from the learning
    d. Have Student Models, as a guide in the desired learning model, where students can choose such as: preferred learning method (discussion, question and answer, demonstration, experiment), use animation or not, use simulation or not, use questions and answers that are already available , as well as other things that are fun and make students feel at home in learning, such as quizzes, animations, light evaluations that contain direct answers and so on.
    e. Have an Evaluation, as a result of smart learning, the evaluation is carried out at the end of the lesson where all the material has been given and has been thoroughly understood, the final result of the evaluation is the value made with the Range System which is sorted in stages starting from understanding the basic range, understanding the middle range and high-range understanding. So with the Range System there are no student learning failures in this system, this benefits students who have studied seriously and have completed their tutoring lessons.
    f. Have a Certificate, as a tangible and measurable form of student learning. The certificate is created using the Quick Response Code, which has validated its authenticity, the certificate can be directly downloaded on the system.

5. Conclusion

According to the results of the research, the researcher used something called an Intelligence Tutoring System (ITS). This is a type of learning system that includes intelligent components like Observable of Training, Smart Coaching, Automatic Arrangement, Student Models, Evaluation, and Certificate. The purpose of Observable of Training is to deliver content that is relevant to the topic that the students have chosen. The system comes with a trainer known as Smart Coaching that offers different modules, different resources, and different questions in order to facilitate continuous and directed comprehension of the subject matter. Automatic Arrangement provides pupils with the opportunity to select learning techniques as well as anticipated results from those methods. In addition, Student Models aid students as they select the learning model that best fits their needs. The evaluation of learning outcomes gives a grading scale organized in a hierarchical structure. The completion of the educational programmed results in the awarding of a Certificate to the student. This Certificate is a physical and quantifiable representation of the student's learning and can be downloaded using an appropriate Quick Response Code method. Students can get a comprehensive understanding

of the subject matter and effectively finish the learning programmed when they use this intelligent learning system.

Declaration of Conflicting Interest
The authors must state that there is no conflict of interest concerning the publication of this paper.

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