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FITERN: Firefighting Tactic and Technique Application as A Web-Based Learning Media Integrated with A Robotic Simulator

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Abstract: In the era of technological disruption and digital revolution, vocational higher education must align its graduates' competency and qualification needs and follow developments in science and technology in the workplace. Education is becoming increasingly complex, so it is necessary to implement new learning methods, one of which is e-learning-based education. This research aims to design and develop Fire Fighting Tactic and Technique Learning Media (FITERN) as a web-based learning media application product integrated with a robotic simulator. This research uses Research and Development (R&D) techniques with the ADDIE approach to ensure that information system development meets quality standards. The research results show that the feasibility assessment by media experts received an average score of 18.62 and a percentage of 93.12%, The feasibility assessment by material experts received an average score of 18.17 and a percentage of 90.83%, and Students' evaluation responses to FITERN learning media as seen from the aspects of programming (technical), media appearance (media presentation), material, and usefulness receive an average score of 18.62 and a percentage of 90.83%. So, the Development of The FITERN Application as A Web-Based Learning Media is proper for interactive multimedia learning. This research resulted in developing new and interactive learning media for firefighting tactics and techniques courses that utilize information technology and are integrated with firefighting robot systems so that students' learning outcomes can be further improved.

Keywords: Application, ARFF, Learning Media

A. Introduction

Technology can be felt almost throughout the world at various levels of society (Haleem et al., 2022). One of the technological advances many people currently feel is in education (Sukran, 2023). Advances in information technology have had many positive impacts on educational progress, providing offers and options for the world of education to support the learning process. One is that technological developments have contributed to changing learning styles, especially in using learning media (Septiani et al., 2023). Learning media is an essential component in the learning process because the learning media can influence student motivation and learning outcomes (Peprizal, 2020).

In the era of technological disruption and digital revolution, vocational higher education must align its graduates' competency and qualification needs and follow developments in science and technology in the workplace (Amalia et al., 2022). Education is becoming increasingly complex, so it is necessary to implement new learning methods, one of which is e-learning-based education (Sinana, 2021). Therefore, the Diploma Three Study Program in Aviation Rescue and Fire Fighting (ARFF) must prepare its lecturers, teaching staff, and graduates to face the challenges of this industry. It is implementing the Internet of Things (IoT), Robotics Technology and increasing digital-based skills and expertise (Amalia et al., 2020).

Appropriate learning media has yet to be fully implemented in Fire Fighting Tactics and Technique courses. Where the course still uses conventional learning media (Sari & Ardianti, 2021). The conventional learning process is tedious for most students because they only listen to lecturers' explanations and use textbooks. Therefore, students are not required to be active in learning because the conventional learning process needs to prioritize student-centered learning (Setiadi et al., 2018). Meanwhile, let us look at the learning outcomes of this course. Participants are expected to be able to explain the basics of fire extinguishing techniques analyze and verify extinguishing techniques according to the type and classification of fire (Nugraha et al., 2021). To reduce student boredom learning with conventional learning media and to meet learning outcomes, conventional learning media needs to be combined with learning media that utilizes technological developments that can simulate basic firefighting techniques. When deep learning is used with e-modules, higher graduation outcomes will result (Junita, 2020).

This research aims to design and develop Fire Fighting Tactic and Technique Learning Media (FITERN) as a web-based educational software program that incorporates a robotic simulator. This application is designed as a learning media/application that can simulate a fire prevention and control system and be used as a learning media for Fire Fighting Tactics and Technique material (Hakiki et al., 2022). With the support of an appropriate curriculum, Students can study independently anywhere and at any time, and activities toward student-based learning as a characteristic of vocational education should be undertaken to maximize understanding of Fire Fighting Tactics and Techniques through e-learning media with a practical material approach. (Maria et al., 2023).

B. Methods

This research uses Research and Development (R&D) techniques to ensure that information system development meets quality standards. Information system development can meet software quality standards (Sugiyonno, 2013). The R&D model used as a guide in this research was used to adapt the ADDIE model. The model development stages are explained in five steps/development stages, including analysis, design, development or production, implementation or delivery, and evaluation (Afrilia et al., 2021).

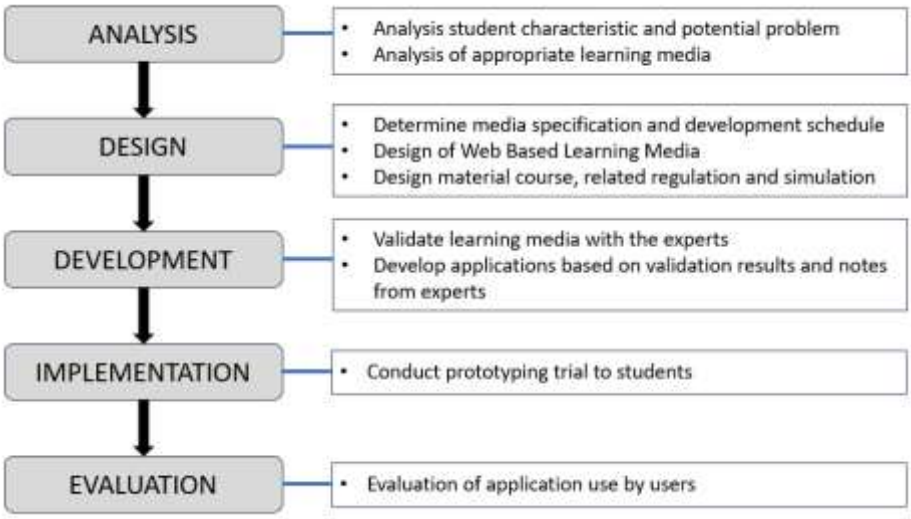

Figure 1. ADDIE Model

The score display is used to determine the degree of viability of a development research-based product. The following table lists the selection criteria for approving this online learning resource. (Silaban et al., 2022).

Table 1. Validation Criteria

Percentage (%)	Validity Level	Description
76 - 100	Valid	Eligible/No Need to be Revised
51 - 75	Quite Valid	Quite Eligible/Partial Revision
26 - 50	Less Valid	Less Eligible/Partial Revision
0 - 25	Invalid	Not Eligible/Total Revision

C. Results and Discussion

The design and development of this application went through several stages. The first stage is analyzing the needs for the application to be created—problem analysis consisting of needs analysis and student characteristics analysis (Soleh et al., 2019). Needs analysis is carried out to determine the initial problems or problems faced in the learning process. Information system design is created to analyze the actual situation that exists in an entity (Yulaini, 2018). Its use is to look for indications of essential components and elements in building an information system. Information system design is carried out by visual modeling, which is used to design object-oriented systems (Taufiq et al., 2021).

This design method is called Unified Modeling Language (UML). UML takes the form of diagrams that explain the application system being developed (Abdillah et al., 2019). The UML diagrams used are Use Case, Activity, and Class Diagrams. The first diagram is the Use Case Diagram. Use Case Diagrams are UML diagrams explaining the interaction between actors and systems.

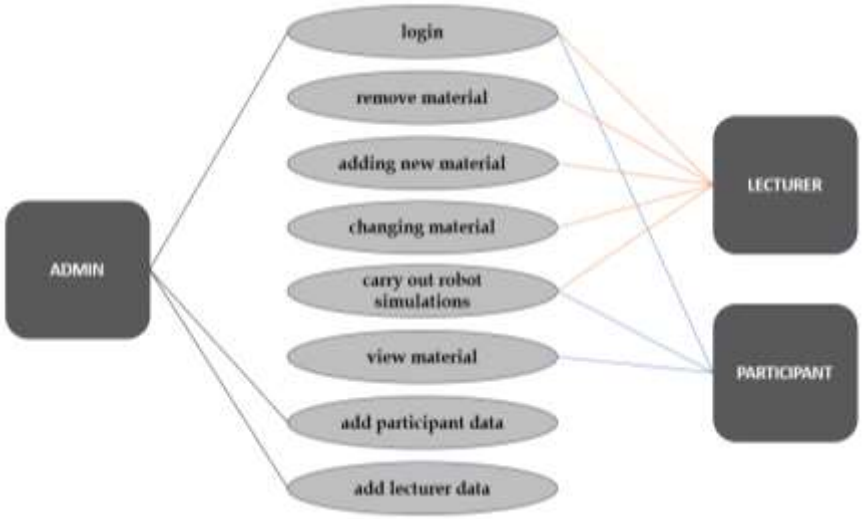

Figure 2. Use Case Diagrams

Use Case describes the type of interaction between system users and the system. The first step to building a system is the need for a use case diagram (Nugraha et al., 2021). There are three groups of users, including administrators, lecturers, and participants. Adding lecturer data and user data can only be done by admin users.

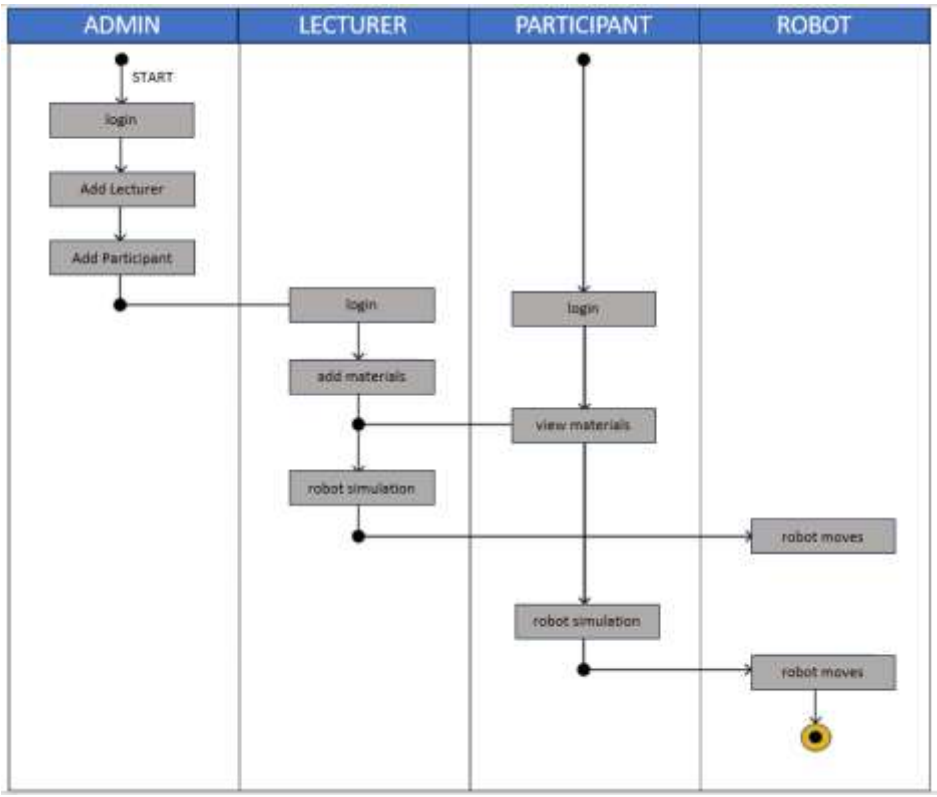

Figure 3. Activity Diagrams

The second diagram is the Activity Diagram, which is a diagram that explains user and system activities. This diagram can model various process sequences

running on the system and is depicted vertically (Susanti et al., 2020). This diagram is a diagram developed from the use case diagram.

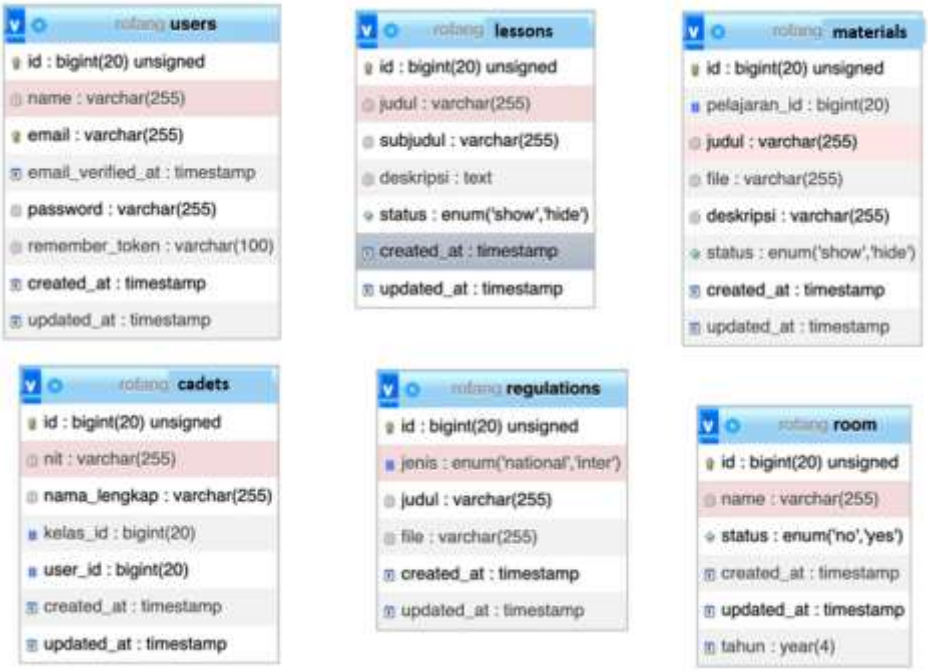

Figure 4. Class Diagram

The third diagram is the Class Diagram, where the diagram displays classes in the form of packages to fulfill one of the needs of the package that will be used later (Subhiyakto & Astuti, 2020). The Class Diagram contains a domain model description, an abstraction, and a database.

After determining the UML diagram, the next step is to create a UI/UX design, which is included in the second stage of the application creation process (Akbar et al., 2023). The UI/UX design process refers to the diagrams we have created in the design process (Rully Pramudita et al., 2021). The initial stage is creating a display wireframe. FITERN uses a menu button design that is placed on the navbar at the top. The menus are Lessons, Regulations, Quizzes, and Simulations. Apart from the menu, the Navigation Bar also has the FITERN logo in the top left.

Figure 5. Application Initial Display

In the Regulation Menu Display, there are existing regulations, both national and international. Each regulation can be viewed and downloaded via a button to the right of the existing regulation.

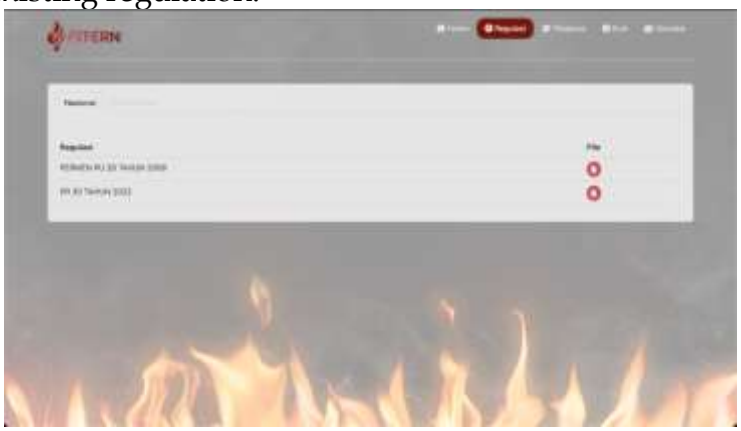

Figure 6. Regulation Menu Display

Next, in the lesson menu, there is lesson material. These materials are files that can be accessed and downloaded via the button to the right of the material title.

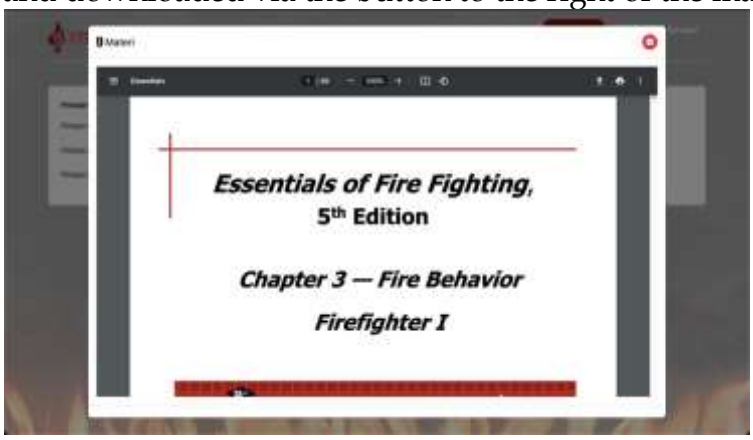

Figure 7. Study Material Menu Display

In the Simulation Menu, there is a fire extinguishing simulation display. Users can simulate fire incidents and extinguish fires. FITERN is connected to the hardware in the arena, making it possible to simulate a fire with the 'Fire' button. The filter is connected to a fire-extinguishing robot for the extinguishing process. The 'Extinguishing' button commands the fire-extinguishing robot to move to the room where the fire occurs.

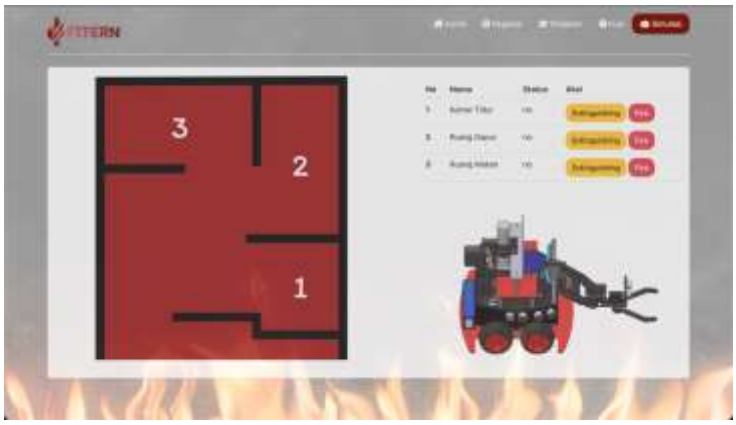

Figure 8. Simulation Menu Display

Software development was carried out using the PHP programming language using the Laravel framework. The PHP programming language was chosen because PHP is a very reliable programming language for developing web-based applications. Frameworks are used to make it easier for programmers to build software. Therefore, software development uses the Laravel framework. An information technology software is equipped with a database. This software uses a SQL-based database, namely MySQL.

After all the application design processes have been completed, the next step is validation. The first validation was carried out on the media aspect. The validity of the media was measured from the assessment of experts in the media field consisting of two experts in the field of information technology and application design (Peprizal, 2020). The assessment data analysis and average validation of media experts are explained.

Table 2. Media Expert Validation Assessment Results

No	Criteria	Score	Percentage	Category
1	Display Aspects	18.5	92.5%	Valid
2	Programming Aspects	19.5	97.5%	Valid
3	Media Aspect	18.0	90%	Valid
4	Language Aspects	18.5	92.5%	Valid
	Average Value	**18.62**	**93.12%**	**Valid**

According to table 2, the FITERN application was evaluated based on all media characteristics, and the average score was 18.62, with a percentage score of 93.12%, placing it in the category of "Valid for use as interactive learning multimedia."

Then, validity was also carried out regarding the material, which two experts in the material field measured. The average outcomes of the material validation assessment are displayed in the table below.

Table 3. Material Expert Validation Assessment Results

No	Criteria	Score	Percentage	Category
1	Content Feasibility Aspect	18	90%	Valid
2	Presentation Feasibility Aspects	18.5	92.5%	Valid
3	Contextual Assessment	18	90%	Valid
	Average Value	**18.17**	**90.83%**	**Valid**

Based on Table 3, the assessment of the FITERN application based on material expert validation obtained an average score of 18.17% with a percentage score of 90.83%, which is in the valid category for use as interactive learning multimedia. The following trial outcome information was used to determine how students responded to assessments as users of interactive learning media.

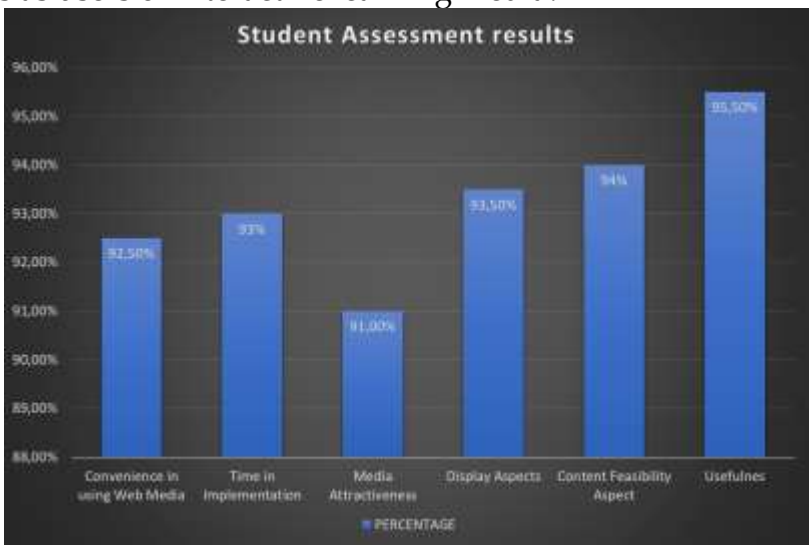

Figure 9. Student Assessment Results Diagram

The average score obtained from student assessments of the FITERN is 93.25%, which, based on the assessment range table, is 76%-100%, which can be categorized as Valid. As for measuring the quality of material aspects and their use, among others, the convenience aspect of using web media, the time in implementation aspect, the media attractiveness aspect, the display aspect, the content feasibility aspect, and the usefulness aspect, it can be concluded that the application has been created Suitable for use as interactive learning multimedia (Anif, 2023).

D. Conclusion

The author's research yielded the following findings, which are the conclusions: 1) The feasibility assessment by media experts received an average score of 18.62 and a percentage of 93.12%; 2) The feasibility assessment by material experts received an average score of 18.17 and a percentage of 90.83%; and 3)

Students' evaluation responses to FITERN learning media as seen from the aspects of programming (technical), media appearance (media presentation), material, and usefulness receive an average score of 18.62 and a percentage of 90.83%. So, from the overall score obtained, FITERN learning media can be categorized as valid and appropriate as an interactive learning media. Hopefully, this application will continue to be developed and used as a digital-based learning medium to increase student motivation in the learning process.

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