

Evaluation Of E-Learning Based On Nau (Nielsen'S Attributes Of Usability) According To Students

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Abstract— STMIK Sumedang is one of the high schools that provides e-learning. As many access, there were several problems. After scrutinized, the problem is more inclined to usability, then in this research will be conducted evaluation of the usability of STMIK Sumedang e-Learning. Usability is an aspect of the quality of software that needs to be tested and is a perspective of non-functional needs that have the most important benchmarks and the most fundamental factors in the application, as this perspective can determine the success or failure of an application when used by its users. Nielsen's Attributes of Usability (NAU) is one of the methods of measuring the Usability aspects of an application and will be used in this research. The usability variables to be evaluated are learnability, efficiency, memorability, errors, and user Satisfaction's, with a significance level of 0.1 (10%), respondents amounting to 743 and sample size 111 (df = 109). Overall from a range of values is not very good – excellent, assessment aspects of usability towards STMIK Sumedang e-learning average assessed enough by the user (students) in fulfilling the usability aspects according to Nielsen's Model. It is hoped that suggestions for improvement/recommendation of this evaluation can be considered as guidance in the framework of application development process.

Keywords— Usability, E-Learning, Nielsen's Attributes of Usability, Student

I. INTRODUCTION (HEADING 1)

Human activities are facilitated by information technology, one of which is the concept of digital-based learning. E-learning is a concept of changing the conventional teaching and learning process to digital form, both in terms of content and system. The concept of e-learning is used to increase the effectiveness of learning and the teaching and learning process in class is not yet optimal, and class time sometimes hinders lecturers from giving all material to their students [1]. E-learning can be defined as a form of information technology that is applied in the field of education in the form of virtual worlds. The term e-learning is more precisely intended as an effort to make a transformation of the learning process in schools or colleges into a digital form that is bridged by internet technology [2].

STMIK Sumedang is an IT-based high school located in Sumedang Regency, STMIK Sumedang itself has three Study Programs namely Informatics Engineering, Information

Systems, and Informatics Management. STMIK Sumedang is one of the high schools that provides e-learning to help students to be able to carry out academic activities online. However, according to the results of interviews conducted by the author with several students, e-learning still requires improvement for user and especially for the progress of STMIK Sumedang.

Some of the problems found based on the results of interviews include, interface design (interface), no notifications (notifications), limited file size for submitting assignments, language that is not translated as a whole, there are advertisements, and you cannot preview when opening a file sent by the lecturer. These things become a problem for the user, especially due to the absence of socialization before using the e-learning .

In the development of information technology, there are various aspects that become a review of the quality of a software. According to McCall [3], factors supporting the success of software quality (software quality factors), among others, are correctness, reliability, efficiency, integrity, usability, maintainability, flexibility, testability, portability, reusability and interoperability with the aim of satisfying user needs. Because the problems encountered in the use e-learning STMIK Sumedang usability, this study will evaluate the usability.

Usability is a measure of the conditions in which software users can easily understand how to operate and use the software without requiring a lot of training [4]. Usability is also a technique used to evaluate products by direct testing by users. In addition, usability can be defined as the perspective of non-functional needs in its use which has the most important benchmarks and the most fundamental factors in applications, because this perspective can determine the success or failure of the application when it is used by its users [5].

Based on this description, an evaluation of e-learning point of view usability Model NAU (Nielsen's Attributes of Usability). The NAU measurement methodology usability and is appropriate for obtaining quantitative results.factors Usability that must be evaluated include learnability, efficiency, memorability, errors, and user satisfaction's [5].

The results of this evaluation can be used as material for developing the quality of e-learning STMIK Sumedang.

II. METHOD

The initial step taken in this research is the identification of the problem, where the results of the problem are applied in the research that will be conducted. The issues to be raised in this study are how to evaluate the quality of e-learning test factor usability based on Nielsen's Attributes of Usability. Then collect data by distributing questionnaires that have been prepared based on the NAU method to identify the needs and desires of users.

The population used as respondents is an active student of STMIK Sumedang based on three study programs namely Informatics Engineering (IT), Information Systems (SI) and Informatics Management (MI), totaling 743 students. sampling technique used in this study is the Probability Sampling using proportional Simple Random Sampling. Where Probability sampling is a sampling technique that provides equal opportunities for each element (member) of the population to be selected as a member of the sample. Simple random sampling is stated as simple (simple) because the sampling of members of the population is done randomly without regard to the existing strata in the population. This way is done when members of the population are considered homogeneous. The significance level used was 0.1 (10%) with a sample size of 111 ($df=109$) students.

Questionnaire data processing is carried out with several tests, including validity tests, reliability tests and descriptive analysis. Validity test is used to measure whether or not a questionnaire is valid. A questionnaire is said to be valid if the questionnaire is able to reveal something that will be measured by the questionnaire [6]. The numbers obtained must be compared with the standard validity correlation value through the Pearson Product Moment Correlation. validity Pearson correlation can be done by comparing the value of r_{count} and r_{table} :

- a) If value $r_{count} > r_{table} = \text{valid}$
- b) If value $r_{count} < r_{table} = \text{not valid}$

Then test the reliability to show the consistency and stability of a measurement scale using Cronbach's Alpha on the results of the analysis. Reliability analysis using Cronbach's Alpha has the following formula:

$$\alpha = \left[\frac{n}{n-1} \right] \left[\frac{S^2 - \sum_{i=2}^n S_i^2}{S^2} \right]$$

Description:

α = The reliability coefficient of the Cronbach's Alpha

n = Number of statement items

S^2 = Variance of the overall score

Reliability testing will be carried out with the help of SPSS 21.0 software. Reliability decision making provisions [7] are as follows:

- a) If the value *Cronbach's Alpha* $> 0,6 = \text{reliable}$
- b) If the value *Cronbach's Alpha* $< 0,6 = \text{not reliable}$

Descriptive analysis is carried out to explain the overall answers of the respondents, describe in a systematic, factual and accurate manner the facts, characteristics and relationships between phenomena investigated as is. At this stage the Likert scale used as an answer with a scale of 1-5, namely (1) "strongly disagree", (2) "disagree", (3) "neutral", (4) "agree" and (5) "strongly agree".

III. RESULT AND DISCUSSION

With a sample size of 111, the value of $df=109$. Then the significance level used is 10% (0.1), then the R-Table is 0.1569.

Table 3.1 Validity Test Results for Learnability

Items Statement (<i>Learnability</i>)	Pearson Correlation	Sig. 2- tailed (P- Value)	Critical Point (R- Table)	Desc.
<i>E-learning</i> STMIK Sumedang is easy to understand	0,000	0,804	0,1569	Valid
Use of <i>e-learning</i> STMIK Sumedang can be learned easily without socialization instructions	0,000	0,793	0,1569	Valid
<i>E-learning</i> STMIK Sumedang provides related information (notifications) lectures easily and quickly without having to open the application first	0,000	0,687	0,1569	Valid
The content and <i>interface design</i> presented <i>e-learning</i> are not confusing and can be easily understood	0,000	0,793	0,1569	Valid

The navigation flow of <i>e-learning</i> is not confusing and can be understood easily	0,000	0,819	0,1569	Valid
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Table 3.2 Reliability Test Results Learnability

Reliability Statistics	
Cronbach's Alpha	N of items
.830	5

It can be seen that the Cronbach's Alpha value obtained is . Requirements for the reliability of an indicator/item statement are . Thus it can be concluded that the five indicators/item statements are valid and reliable in measuring the learnability variable.

Table 3.3 Validity Test Results for Efficiency

Items Statement (<i>Efficiency</i>)	Pearson Correlation	Sig. 2-tailed (P-Value)	Critical Point (R-Table)	Desc.
The language translation feature in <i>e-learning</i> can be accessed easily and quickly	0,000	0,795	0,1569	Valid
Other features in <i>e-learning</i> can be accessed easily and quickly	0,000	0,861	0,1569	Valid
Can Upload assignments and exams given by lecturers quickly and accurately	0,000	0,838	0,1569	Valid
Can download or view files (<i>preview</i>) sent by lecturers directly easily and quickly	0,000	0,838	0,1569	Valid

Table 3.4 Reliability Test Results Efficiency

Reliability Statistics	
Cronbach's Alpha	N of items
.850	4

It can be seen that the Cronbach's Alpha value obtained is . Requirements for the reliability of an indicator/item statement are . Thus it can be concluded that the four indicators/item statements are valid and reliable in measuring the efficiency variable.

Table 3.5 Validity Test Results for Memorability

Items Statement (<i>Memorability</i>)	Pearson Correlation	Sig. 2-tailed (P-Value)	Critical Point (R-Table)	Desc.
How to use <i>e-learning</i> STMIK Sumedang can be remembered easily	0,000	0,849	0,1569	Valid
Can remember each menu navigation and layout of <i>e-learning</i> STMIK Sumedang information easily	0,000	0,870	0,1569	Valid
Can remember how to the use <i>e-learning</i> if I use it again after a while (> 1 month)	0,000	0,842	0,1569	Valid

Table 3.6 Reliability Test Results Memorability

Reliability Statistics	
Cronbach's Alpha	N of items
.808	3

It can be seen that the Cronbach's Alpha value obtained is . Requirements for the reliability of an indicator/item statement are . Thus it can be concluded that the three indicators/item statements are valid and reliable in measuring the variable memorability.

Table 3.7 Validity Test Results for Errors

Item Statement (<i>Errors</i>)	Pearson Correlation	Sig. 2-tailed (P-Value)	Critical Point (R-Table)	Description
found <i>Error</i> when using <i>e-learning</i> STMIK Sumedang	0,000	0,628	0,1569	Valid Failed

to find the menu you want to search for in <i>e-learning</i> STMIK Sumedang	0,000	0,611	0,1569	Valid
Found ads while accessing <i>e-learning</i> STMIK Sumedang	0,000	0,664	0,1569	Valid
Difficulty correcting errors when using <i>e-learning</i> STMIK Sumedang	0,000	0,761	0,1569	Valid

Table 3.8 Reliability Test Results Errors
Reliability Statistics

Cronbach's Alpha	N of items
.563	4

It can be seen that the Cronbach's Alpha value obtained is . Requirements for the reliability of an indicator/item statement is , then the value is not reliable. However, the reliability level value of Cronbach's Alpha according to Hair et al. (2010: 125) is shown in the following table [8]:

Table 3.9 Reliability Level

Reliability of Cronbach Alpha Value	Level of Reliability
0.0-0.20	Less Reliable
>0.20-0.40	Somewhat Reliable
>0.40-0.60	Fairly
>0.60-0.80	Reliable
>0.80-1.00	Very Reliable

From the above data it can be said that the variables used in this study fall into the reliability sufficientreliable, then the results obtained with values are acceptable, and it can be concluded that the three indicators/item statements are valid and reliable in measuring the errors variable.

Table 3.10 Validity Test Results Satisfaction

Item Statement (<i>Satisfaction</i>)	Pearson Correlation	Sig. 2-tailed (P-Value)	Critical Point (R-Table)	Desc.
I am pleased overall with the <i>interface design e-learning</i> STMIK Sumedang	0,000	0,870	0,1569	Valid
I think the use of <i>e-learning</i> STMIK Sumedang is in line with expectations	0,000	0,909	0,1569	Valid
I feel comfortable using <i>e-learning</i> STMIK Sumedang	0,000	0,890	0,1569	Valid
I would recommend <i>website</i> to other students	0,000	0,816	0,1569	Valid

Table 3.11 Reliability Test Results Satisfaction
Reliability Statistics

Cronbach's Alpha	N of items
.894	4

It can be seen that the Cronbach's Alpha value obtained is. Requirements for the reliability of an indicator/item statement are . Thus it can be concluded that the four indicators/item statements are valid and reliable in measuring the satisfaction variable.

Table 3.12 Descriptive Analysis Interval

Variable Usability	Interval Value	Assessment Range	Information
<i>Learnability</i>	1730	Sangat Tidak Baik: 555-999 Tidak Baik: 999-1443 Cukup: 1443-1887 Baik: 1887-2331 Sangat Baik: 2331-2775	Enough

<i>Efficiency</i>	1620	Sangat Tidak Baik: 444-799,2 Tidak Baik: 799,2-1154,4 Cukup: 1154,4-1509,6 Baik: 1509,6-1864,8 Sangat Baik: 1864,8-2220	Good
<i>Memorability</i>	1107	Sangat Tidak Baik: 333-599,4 Tidak Baik: 599,4-865,8 Cukup: 865,8-1132,2 Baik: 1132,2-1398,6 Sangat Baik: 1398,6-1665	Enough
<i>Errors</i>	1380	Sangat Tidak Baik: 444-799,2 Tidak Baik: 799,2-1154,4 Cukup: 1154,4-1509,6 Baik: 1509,6-1864,8 Sangat Baik: 1864,8-2220	Enough
<i>Satisfaction</i>	1441	Sangat Tidak Baik: 444-799,2 Tidak Baik: 799,2-1154,4 Cukup: 1154,4-1509,6 Baik: 1509,6-1864,8 Sangat Baik: 1864,8-2220	Enough

Table 3.13 Recommended

Statement Items	Recommendation
<i>Learnability</i>	
<i>E-learning</i> STMIK Sumedang is easy to understand	variable <i>learnability</i> when viewed from the interval value of this variable, it has an adequate rating. Judging from each statement item, it can be seen that the way to use <i>e-learning</i> is currently easy to

The use of <i>e-learning</i> can be learned easily without socialization instructions.	understand. The quality of <i>e-learning</i> can be improved by increasing indicators that affect the <i>usability</i> of <i>e-learning</i> , namely applications that are easy for users to learn and understand and make it easy to use. Therefore, as material for consideration for the <i>e-learning</i> , it is expected to consider the results of this test. The following recommendations can be given based on the explanation above:
<i>learning</i> having to open the application first.	<ol style="list-style-type: none"> 1. Increase the level of user convenience so that there are notifications or notifications via <i>e-mail</i>, so that students find information easily without having to open the application first. 2. Increasing <i>familiarity</i>, namely knowledge and <i>user</i> that can be applied when interacting with the new system. 3. Improve <i>interface design</i> to make it more unique, the layout, as well as the navigation flow to make it <i>simpler</i>.
STMIK Sumedang - without and can be understood easily.	The rest continues to be maintained and improved.
navigation flow <i>e-learning</i> not confusing and can be understood easily.	
Efficiency	
The language translation feature in <i>e-learning</i> can be accessed easily and quickly.	variable <i>efficiency</i> when viewed from the interval value of this variable, it has a good assessment . Judging from each statement item, it can be seen that <i>e-learning</i> is currently efficient when used. Therefore, as material for consideration for the <i>e-learning</i> , it is expected to consider the results of this test. Based on this explanation, the recommendations that can be given by researchers are as follows:
Other features in <i>e-learning</i> can be accessed easily and quickly by	<ol style="list-style-type: none"> 1. Improve the language feature so that it can function even better, when the user wants to <i>translate</i> into Indonesian, all

students can upload assignments and exams given by lecturers quickly and accurately	words or sentences in the application can be translated as a whole, not in part just. 2. Increase the maximum <i>file</i> for job submission attachments. The rest continues to be maintained and improved.
Students can download or view files (<i>preview</i>) sent by lecturers directly easily and quickly	
Memorability	
How to use <i>e-learning</i> STMIK Sumedang can be remembered easily	On the variable <i>memorability</i> , when viewed from the value of this variable interval has sufficient judgment. The quality of <i>e-learning</i> can be improved by increasing indicators that affect the <i>usability</i> of <i>e-learning</i> , namely applications that are easy for users to remember. Therefore, as material for consideration for the <i>e-learning</i> , it is expected to consider the results of this test. Based on this explanation, the recommendations that can be given by researchers are as follows:
Students can remember each menu navigation and information layout <i>e-learning</i> that they want easily	1. Maintain and improve user-friendly displays, especially if users have not used this application for a long time. 2. Make use of and layout navigation such as features and menus that are easy for the <i>user to remember</i> .
Students remember how to use <i>e-learning</i> if I use it again after a while (> 1 month)	3. Eliminate redundant menu displays, so as not to confuse users. The rest continues to be maintained and improved.
Errors	
<i>Errors</i> found when using <i>e-learning</i> STMIK Sumedang	variable <i>error</i> when viewed from the interval value of this variable, it has an adequate assessment. The quality of <i>e-learning</i> can be improved by increasing indicators that affect the <i>usability</i> of <i>e-learning</i> , namely applications that do not

Students fail to find the menu they want to search for in <i>e-learning</i> STMIK Sumedang	hinder their use. Therefore, as material for consideration for the <i>e-learning</i> , it is expected to consider the results of this test. Based on this explanation, the recommendations that can be given by researchers are as follows: 1. Continue to maintain the system so that there are no gaps for <i>bugs</i> (ads) to enter when using <i>e-learning</i> . 2. Added a notification for <i>error</i> if there is a failure when the user encounters an error in the application. The rest continues to be maintained and improved.
Students find <i>bugs</i> (advertisements) when accessing <i>e-learning</i> STMIK Sumedang	
If they find errors when using <i>e-learning</i> , students have difficulty fixing them	
Satisfaction	
I am overall happy with the <i>interface design e-learning</i> STMIK Sumedang	variable <i>satisfaction</i> when viewed from the interval value this variable has an adequate rating. The quality of <i>e-learning</i> can be improved by increasing indicators that affect the <i>usability</i> of <i>e-learning</i> , namely applications that are fun and comfortable to use. Therefore, as material for consideration for the <i>e-learning</i> , it is expected to consider the results of this test. Based on this explanation, the recommendations that can be given by researchers are as follows:
I think the use <i>e-learning</i> is in line with expectations	1. Maintain consistency of application performance and quality so that it continues to satisfy users in supporting user convenience in using <i>e-learning</i> . 2. Improving <i>ease of use</i> , personalization <i>attractive</i> applications and an easy and familiar display.
I feel comfortable using <i>e-learning</i> STMIK Sumedang	3. Improving the quality and appearance of the <i>user interface</i> to make it more fun and easy to understand. Some users are satisfied with the overall appearance of the <i>user interface</i> , but it is better if this quality is maintained and improved.

I would recommend <i>website</i> to other students	The rest continues to be maintained and improved.
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The following are a number of other things that need to be considered for application developers in the framework of the development process based on input from respondents or users directly:

1. Adding a notification feature for assignments, materials, deadlines, or other information that entry, whose function is to remind students when there is a new task/material from the lecturer. At least with an automatic notification via e-mail. Then notifications for reminders when the deadline for submitting assignments is near, for example D-1 for assignment
2. It would be even better if 's e-learning was adapted into a mobile. Where it functions to make it easier for students in the lecture process with a view that is much more accessible and understandable, it can also make it easier for lecturers and students to upload material/assignments. Then we can also still get notifications even though e-mail is not synchronized or e-mail not turned on.
3. It is better if the language translation feature in e-learning is improved, so that it can function properly. Because e-learning, if we translate a language from English to Indonesian the result is still not fully translated, that is, the two languages are still mixed.
4. Improve interface design to make it more unique, layout, navigation flow to make it simpler, also eliminate redundant menu displays.

Table 3.14 Assessment of Optimization Results Recommendations

Assessment	Add
a notification feature for incoming assignments, materials, deadlines, or other information.	Yes, Optimal. If <i>e-learning</i> STMIK Sumedang implements the notification feature, the teaching and learning system will be more optimal. Because with the notification, it can reduce the risk of missing information. So students can more quickly respond to assigned assignments, as well as get reminder notifications when the assignment submission deadline is near, for example D-1 assignment collection in order to reduce the risk of late assignment submission.
Adaptation into <i>mobile</i> .	Yes, Optimal. If <i>e-learning</i> STMIK Sumedang is adapted into a <i>mobile</i> , it will be very helpful. Because besides being able to be accessed anywhere and anytime, the appearance should also be easier to understand. Not only that, by adapting it to the form of a <i>mobile</i> it will be easier for us to get notifications. So even if <i>e-mail</i> is turned off, we can still get notifications through the application.
Improvements to the language translation feature.	Yes, Optimal. Not infrequently students are more comfortable with displays that use English, but there are also those who are more comfortable using Indonesian. So if the language translation feature is improved, it will be very helpful, because the language used is not confused after being translated, so it can overcome the problem of pages or text that are not translated.
Improve <i>interface design</i> to make it more unique, layout, navigation flow to make it <i>simpler</i> , also eliminate redundant menu displays.	Yes, Optimal. It would be great if <i>interface design</i> is optimized, because it concerns the user experience. Then if improvements to the layout, navigation flow and removal of redundant menu views are made, it will make it easier and less confusing for users.

IV. CONCLUSION

Based on the results of usability using the NAU (Nielsen's Attributes of Usability), it can be concluded that the evaluation results of e-learning referring to the Nielsen's Model (learnability, efficiency, memorability, errors, and user satisfaction's) are averagely assessed enough by user (student). With a significance level of 10% (0.1), there are 743 respondents and a sample size of 111 (df= 109), producing a continuum line value for each variable, namely learnability variables 1730 (enough), efficiency variables 1620 (good), memorability variable 1107 (enough), errors variable 1380 (enough) and satisfaction variable 1441 (enough). The results of this evaluation can be considered as a guide in the application development process.

Based on the research as a whole, the suggestions that can be given to further researchers are:

1. Recommended to test e-learning from the point of view of other subjects/users, namely according to the lecturer.
2. It is recommended to conduct further research related to other aspects such as the user interface and user experience, acceptance user of e-learning STMIK Sumedang
3. It would be nice if the number of population used as respondents was increased to make it more accurate. However, it is better not to include level 1 students because they are considered still unfamiliar or don't really understand e-learning STMIK Sumedang.
4. For further researchers, it is suggested that they consider the results of this study to be used as a guide in following up on the process of improving or developing e-learning, such as adding notification features so students don't miss any information automatically via e-mail, adapted it into a mobile and other things that need to be reviewed, namely those listed in the recommendations section.

REFERENCES

- [1] A. Venkatesh and M. S. Eastaff, "A study of data storage security issues in cloud computing," *Int. J. Sci. Res. Comput. Sci. Eng. Inf. Technol.*, vol. 3, no. 1, pp. 1741–1745, 2018.
- [2] M. Almorsy, J. Grundy, and I. Müller, "An analysis of the cloud computing security problem," *arXiv Prepr. arXiv1609.01107*, 2016.
- [3] A. El Bouchti, S. Bahsani, and T. Nahhal, "Encryption as a service for data healthcare cloud security," in *2016 Fifth International Conference on Future Generation Communication Technologies (FGCT)*, 2016, pp. 48–54.
- [4] A. Narang, "A review-Cloud and cloud security," *Int. J. Comput. Sci. Mob. Comput.*, vol. 6, no. 1, pp. 178–181, 2017.
- [5] P. Samarati, S. D. C. di Vimercati, S. Murugesan, and I. Bojanova, "Cloud security: Issues and concerns," *Encycl. cloud Comput.*, pp. 1–14, 2016.
- [6] J. Che, Y. Duan, T. Zhang, and J. Fan, "Study on the security models and strategies of cloud computing," *Procedia Eng.*, vol. 23, pp. 586–593, 2011.
- [7] S. Sridhar and S. Smys, "A hybrid multilevel authentication scheme for private cloud environment," in *2016 10th International Conference on Intelligent Systems and Control (ISCO)*, 2016, pp. 1–5.
- [8] M. A. Babar and B. Ramsey, "Understanding container isolation mechanisms for building security-sensitive private cloud," *Tech. Report, CREST, Univ. Adelaide, Adelaide, Aust.*, 2017.
- [9] M. A. Helmiawan and I. Fadil, "PRIVATE CLOUD STORAGE IN RURAL'S MANAGEMENT AND INFORMATION SYSTEM USING ROADMAP FOR CLOUD COMPUTING ADOPTION (ROCCA)," *Intern. (Information Syst. Journal)*, vol. 2, no. 2, pp. 172–183, 2019.
- [10] A. Hashmi, A. Ranjan, and A. Anand, "Security and compliance management in cloud computing," *Int. J. Adv. Stud. Comput. Sci. Eng.*, vol. 7, no. 1, pp. 47–54, 2018.
- [11] B. T. Rao, "A study on data storage security issues in cloud computing," *Procedia Comput. Sci.*, vol. 92, pp. 128–135, 2016.
- [12] M. K. Kiskani and H. R. Sadjadpour, "Secure and private cloud storage systems with random linear fountain codes," in *2017 IEEE SmartWorld, Ubiquitous Intelligence & Computing, Advanced & Trusted Computed, Scalable Computing & Communications, Cloud & Big Data Computing, Internet of People and Smart City Innovation (SmartWorld/SCALCOM/UIC/ATC/CBDCom/IOP/SCI)*, 2017, pp. 1–8.
- [13] T. Yan, S. Zeng, M. Qi, Q. Hu, and F. Qi, "Cyber security detection and monitoring at IHEP private cloud for web services," in *EPJ Web of Conferences*, 2019, vol. 214, p. 7016.