



User Acceptance Test For Digital Signature Application In Academic Domain To Support The Covid-19 Work From Home Program

Irawan Afrianto^{1*}, Andri Heryandi², Alif Finadhita³, Sufa Atin⁴

^{1,2,3,4}Universitas Komputer Indonesia (UNIKOM)
Jl. Dipati Ukur 112-116, Bandung, Indonesia

*Corresponding author: irawan.afrianto@email.unikom.ac.id

Abstract

The user acceptance test (UAT) is the final stage in the production of the application. This is intended to see the degree to which the system can function and satisfy the needs of its users. The objectives of this research is to test the function and user acceptance of the digital signature application in the academic environment to support the covid-19 work from home program. The approach used in the user acceptance test is to use the black box method and the Likert scale questionnaire to figure out the functional scope of the program, as well as the acceptance of system by users while using the application. The results of the test show that the digital signature application that has been designed, functionally can run well and generates a user acceptance value of 82.07%. It can be concluded that the application that was developed has been accepted by users and fulfills the needs of its users, it is an alternative solution, especially in signing academic documents during the current Covid-19 pandemic.

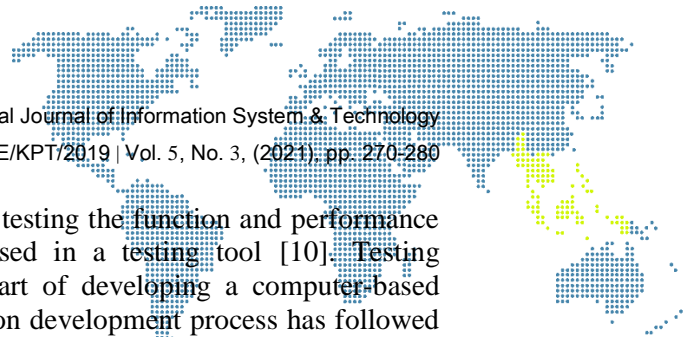
Keywords: User Acceptance Test, Digital Signature Application, Black box, Linkert Scale, Covid-19.

1. Introduction

The COVID-19 pandemic transformed academic activities, from teaching activities to online and electronic document processing[1]. Various ways and methods of digital and online learning are carried out in order to carry out learning activities, the application of various technologies to student admissions related to electronic-based learning systems[2]. Related to the very fast digital transformation during the current Covid-19 pandemic, especially in higher education, online learning problems related to network infrastructure are the main problems [3]. The activity of documenting paper documents has begun to switch to using electronic documents, so an authentication mechanism is needed for these documents using a digital signature-based system approach [4].

This research conducted from previous studies. Starting from the development of a digital signature application model carried out by [5], which is an application for digitally signing electronic documents. Subsequent research is to design and design a digital signature application using the user centered design (UCD) method [6], coupled with the integration of digital certificates issued by the Ministry of Communication and Informatics - Republic of Indonesia with the .p12 file format. The development of digital signature application research is carried out by expanding the scope of public services in the government environment in the form of a digital signature application model that can be applied and become part of e-government - Smart City in Indonesia [7]. The results of the model and design in previous studies were then developed into a digital signature application prototype and directed at the university environment to support its activities [8], especially during the current Covid 19 pandemic.

In order to complete the research that has been done, the last step is to test the applications that have been built. The testing stage is an important stage to ensure



software quality[9]. Software testing is a process of testing the function and performance of a product based on the test plan and flow used in a testing tool [10]. Testing information systems or applications is the final part of developing a computer-based application. This is used to ensure that the application development process has followed the procedures / methods used [11]. The method used in testing the developed application applies the alpha testing approach, beta testing and user acceptance[12]. Alpha testing is a test on the developer side, which aims to see all the functionalities that have been made in the system, while beta testing is a test from the end user of the system as part of the evaluation of the system being built [13]. Testing from the developer side can be done using the black box and white box methods [14], where in essence white box testing is a test that is carried out to the detail of checking program code [15], while black box testing is a test that is based on application details such as application appearance, existing functions in the application, and the suitability of the function flow with the business process desired by the customer[16]. Beta testing is part of non-functional testing[17]. Beta testing is carried out by distributing questionnaires given to respondents. The Likert scale is designed to convince respondents to answer at various levels of each question item contained in the questionnaire [18]. The application of the linkert scale can be used to determine the user usability of the system interface [19], perform external validation of a continuous development of information systems [20], and conduct quality assessments. information and its relation to the intention to use information systems [21].

The purpose of this study was to test digital signature applications to support the work from home program during the Covid-19 pandemic based on UAT. Applications are used in the higher education environment to support academic activities, both in the learning process and in administrative processes that require the role of a digital signature in it.

2. Reseach Methodology

UAT is one of the most innovative methodologies to prevent IT project failures[22]. In software development, there are three things that are done in the UAT process, namely:

- a) UAT exposes undiscovered business logic / functionality, because unit testing and system testing do not focus on functionality / business logic
- b) UAT measures how the system is in accordance with user needs
- c) UAT limits how the system has been completed.

The UAT process begins with providing documentation of business requirements, then continues with a business process (workflow) or scenario and finally testing using data [23]. Effectiveness in testing is needed in the development of an application or information system so that the product can arrive at users on time and according to user needs[24].

Tests carried out on the system being built are divided into two testing mechanisms, namely alpha testing using the black box method and beta testing using the Likert scale. Blackbox testing is focused on system testing activities that are built to see the extent to which each function in the application has been running correctly, as expected and free from errors. In addition to testing the application from a functional side, system testing is also carried out by users who will take advantage of the application. Beta testing in order to determine the acceptance of the use of applications using is done with a questionnaire in order to obtain conclusions about acceptance of application use from the user's side.

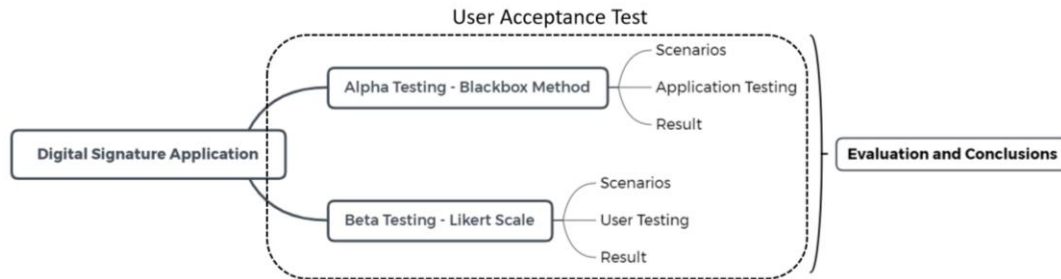


Figure 1. Research Methodology

3. Result and Discussion

In this section, it will be explained how the testing mechanism will be carried out on digital signature applications that have been developed using the blackbox method or by direct testing on users. The limitations of testing the blackbox method are focused on functional testing of each part of the application, while user testing is carried out to determine user acceptance of the application that is built.

3.1. Alpha Testing Using Black Box Method

The test scenario will be carried out on the digital signature application at the website address: <https://tt-el.my.id/>. The test scenario uses alpha testing with the black box method to check the functionality of the features contained in the digital signature application. Table 1 shows the black box testing scenario that will be carried out on a digital signature application.

Table 1. Testing Scenarios Using Black Box Method

Test Component	Scenario Testing Activity	Type of Testing
Access Menu System	Access Menu System Description	Black box
	Access the File Upload Menu	
	Access the File Manage Menu	
	Access the PDF Verification Menu	
	Access the Help Menu	
Upload File	Create File Description	Black box
	Choose a file format	
	Send File	
Manage Files	View original files	Black box
	Sign and download	
	Delete file	
PDF Verification	Access to https://tte.kominfo.go.id/verifyPDF	Black box
	Upload PDF Documents	
	Digital Signature Information Shows	
Help	Download the Guidebook	Black box
	Play Tutorial Video	

The results of black box testing conducted by testing all the functionality contained in the application, entering correct and incorrect data in order to see the response of the developed application as can be seen in Table 2.

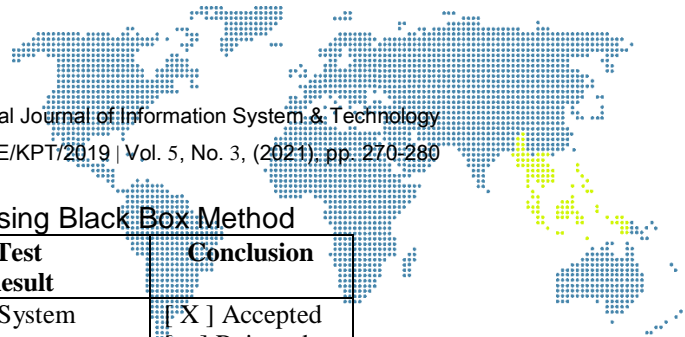
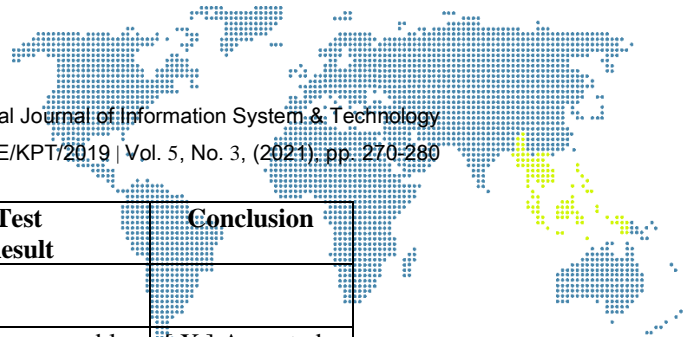


Table 2. Result Testing Scenarios Using Black Box Method

Testing Activities	Expected Realization	Test Result	Conclusion
Access Menu System Description	Connected to system description	Appears System description menu	[X] Accepted [] Rejected
Access File Upload Menu	Connected to file upload menu	Appears File upload menu	[X] Accepted [] Rejected
Access File Manage Menu	Connected to file manage menu	Appears file manage menu	[X] Accepted [] Rejected
Access PDF Verification Menu	Connect to PDF verification menu	Appears PDF verification menu	[X] Accepted [] Rejected
Access Help	Connected to help menu	The help menu appears	[X] Accepted [] Rejected
Create File Descriptions	Confirmed file descriptions (minimum 10 characters)	a) Valid Data - System accepts input b) Invalid Data - system gives notification	[X] Accepted [] Rejected
Select File format	Format and file size according to the rules (pdf format and max size 20 MB)	a) Valid Data -The system accepts input b) Invalid Data - system gives notification	[X] Accepted [] Rejected
Send File	a) Save data if input is correct b) Provide input error notification if it is wrong	a) Save input data b) Provides input error notification	[X] Accepted [] Rejected
View original file	Shows original file before signing	Application shows original file before signing	[X] Accepted [] Rejected
Sign and download Files	Automatically signed and downloaded directly	Application automatically signed and downloaded directly	[X] Accepted [] Rejected
Delete file	Files are deleted from database	a) System notifies file deletion b) File deleted from database	[X] Accepted [] Rejected
Access to https://tte.kominfo.go.id/verifyPDF	System able to connected to the Kominfo digital signature service	The application is able to connect to the Kominfo digital signature service	[X] Accepted [] Rejected
Upload PDF Documents	Sytem able to upload PDF files	Digital Signature Kominfo service is able to accept PDF files	[X] Accepted [] Rejected
Display Digital Signature Information	System able to indicate whether or not a digital	System indicate presence / absence of a digital signature in	[X] Accepted [] Rejected



Testing Activities	Expected Realization	Test Result	Conclusion
	signature is in the file	the file	
Download Guidebooks	System able to download manuals application in pdf format.	Applications are able to provide access to download manual files	[X] Accepted [] Rejected
Play Application Tutorial Videos	System able to play video tutorials using the application	Applications are able to play application tutorial videos	[X] Accepted [] Rejected

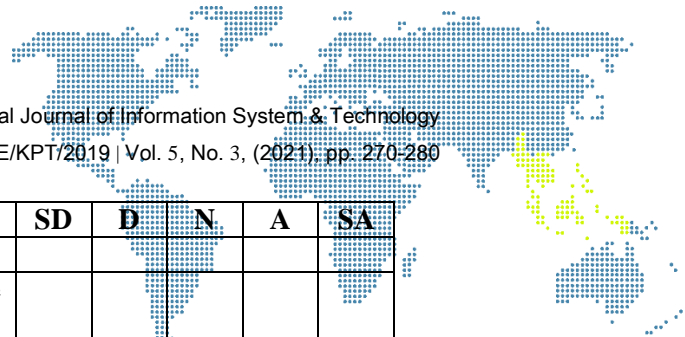
The results of alpha testing using the black box method show that all modules in the digital signature application have run according to their function, there are no bugs or problems in the access process to the menus contained in the system, the transaction process - upload and download documents, the verification process and the data contained in the help menu.

3.2. Beta Testing Using a Likert Scale

Evaluation is carried out to determine the level of acceptance and support from potential users of the system. Measurements were made using a Likert scale to 52 potential system users with 10 statements covering the usefulness of the system being built, namely aspects of accessibility, aspects of navigation, and aspects of content. Evaluation is carried out by providing ten statements with five answer choices for each statement in the form of a Likert scale of 1 to 5. The answer choices include Strongly Disagree (SD), Disagree (D), Neutral (N), Agree (A), and Strongly Agree (SA). Point 1 means Strongly Disagree up to point 5 which means Strongly Agree. Table 3 shows the questionnaire used in measuring user acceptance of the developed digital signature application system.

Table 3. Beta Testing Questionnaire Using a Likert Scale

No	Questions	SD	D	N	A	SA
1	The use of the digital signature application is easy to learn					
2	The Digital Signature application service can simplify the interaction of related sections in my work environment					
3	The use of the Digital Signature application can increase my effectiveness in doing administrative tasks in my work environment					
4	The digital signature app allows me to do administrative tasks more quickly in my work environment.					
5	Digital Signature application service allows me to more easily process documents related to signing a document.					
6	I received an authorization model on the digital signature application service for the security of my account					
7	I refuse to show my personal identity when I use the digital signature					



No	Questions	SD	D	N	A	SA
	application.					
8	I will suggest using the digital sSignature app to friends who are not already using it.					
9	Even though I don't Work From Home anymore, I will still use the Digital Signature application service in my work environment.					
10	All the functions in the application have met my needs					

The results of the evaluation are carried out using the following formulas.

- Maximum score:
= 52 x 5 = 260 (number of respondents x highest Likert score)
- Minimum score:
= 52 x 1 = 52 (number of respondents x lowest Likert score)
- Index (%):
= (Total Score / Maximum Score) x 100

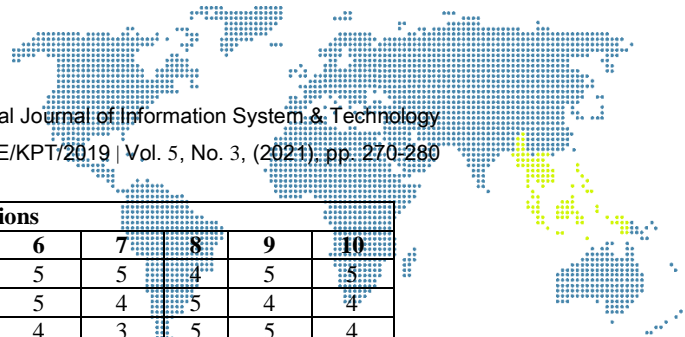
Provide interval value on index (%)

- Index 0% - 19.99% : Strongly Disagree
- Index 20% - 39.99% : Disagree
- Index 40% - 59.99% : Neutral
- Index 60% - 79.99% : Agree
- Index 80% - 100% : Strongly Agree

Based on the formulas, the results of the calculations are shown in Table 4.

Table 4. Questionnaire Calculation Using a Likert Scale

Respondents	Questions									
	1	2	3	4	5	6	7	8	9	10
Responden1	4	3	3	3	3	3	2	3	4	3
Responden2	4	4	4	4	4	4	4	4	3	3
Responden3	3	4	4	4	4	4	3	3	4	3
Responden4	5	5	4	4	4	3	3	4	5	4
Responden5	4	5	5	5	5	5	5	5	5	5
Responden6	3	4	5	5	5	3	3	3	4	4
Responden7	4	5	5	5	5	4	3	3	4	4
Responden8	4	4	4	3	5	4	5	4	4	4
Responden9	4	4	4	4	4	4	2	4	4	4
Responden10	3	4	4	4	4	4	3	3	4	3
Responden11	2	5	5	5	5	5	4	4	3	3
Responden12	4	4	4	4	4	4	1	4	3	2
Responden13	5	5	5	5	5	4	4	4	4	4
Responden14	5	5	5	5	5	5	5	5	3	3
Responden15	4	4	4	4	4	4	4	4	2	2
Responden16	4	4	4	4	4	4	2	4	2	2
Responden17	5	5	5	5	5	5	5	5	5	5
Responden18	4	4	4	4	4	3	1	4	4	3
Responden19	4	4	4	4	4	3	4	4	3	3
Responden20	4	4	4	4	4	4	2	1	3	3
Responden21	4	5	5	5	5	5	5	4	4	4
Responden22	5	5	4	5	4	5	5	5	4	4
Responden23	3	4	5	5	4	3	4	3	4	4
Responden24	5	5	5	5	5	5	5	5	5	5
Responden25	2	5	5	5	5	5	1	5	5	5



Respondents	Questions									
	1	2	3	4	5	6	7	8	9	10
Responden26	4	5	5	5	5	5	5	4	5	5
Responden27	5	5	5	5	5	5	4	5	4	4
Responden28	3	5	5	5	5	4	3	5	5	4
Responden29	4	5	4	5	5	4	5	5	5	4
Responden30	4	4	5	4	4	4	2	4	4	4
Responden31	5	5	4	5	5	4	5	4	5	5
Responden32	3	5	5	5	5	5	5	5	5	5
Responden33	4	4	4	4	4	4	4	4	4	4
Responden34	3	4	4	4	4	4	4	4	4	4
Responden35	3	4	3	4	4	4	3	3	4	4
Responden36	3	4	4	4	4	4	4	4	4	3
Responden37	4	4	4	4	4	4	4	4	4	4
Responden38	4	5	5	5	5	5	5	5	5	5
Responden39	5	4	4	5	5	5	3	4	4	3
Responden40	4	4	4	4	4	4	4	4	4	4
Responden41	4	5	5	5	4	4	5	5	5	5
Responden42	5	5	5	5	5	5	2	5	3	3
Responden43	3	5	4	5	4	5	2	3	3	3
Responden44	4	5	4	4	4	4	3	4	4	4
Responden45	4	5	5	5	5	4	4	5	5	4
Responden46	5	4	5	5	4	4	5	3	4	5
Responden47	3	3	3	4	4	3	3	3	3	3
Responden48	4	4	4	4	4	4	4	4	4	4
Responden49	4	4	4	4	4	4	4	4	4	4
Responden50	4	4	4	4	4	4	4	4	4	4
Responden51	5	5	5	4	5	5	3	4	2	2
Responden52	3	4	3	4	4	4	3	3	4	4
Total Skor	204	230	226	231	229	217	187	208	206	196
Indeks (%)	78,46	88,46	86,92	88,85	88,08	83,46	71,92	80	79,23	75,38

Questionnaire Calculation

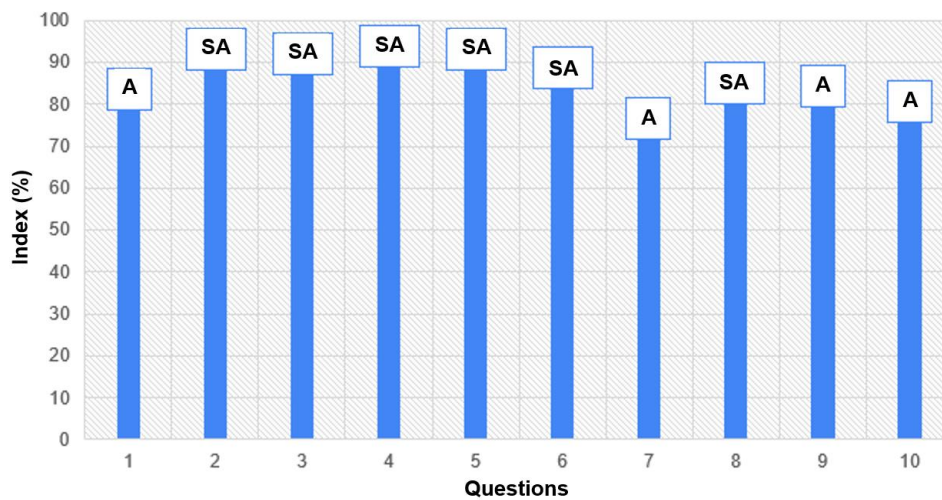


Figure 2. Results of Assessment Questionnaire Using a Likert Scale

Figure 2 shows the results of the questionnaire after being processed using a Likert scale. These results indicate that the respondents agree with questions no.1, no.7, no. 9 and no.10, and gave a very agreeable response to questions no.2, no.3, no.4, no.5, no.6, and no. 8. Meanwhile, to determine the extent of user acceptance of the system, the following calculation formulas are made:



- a) Mean score user acceptance:
 $= (\text{Total Score1} + \text{Total Score2} + \dots + \text{Total Score 10}) / 10$
- b) User acceptance index (%):
 $= (\text{Average Score} / \text{Maximum Value}) \times 100\%$

The system user acceptance interval is measured as follows:

- a) Index 0% - 19.99% : Very Unacceptable
- b) Index 20% - 39.99% : Not Accepted
- c) Index 40% - 59.99% : Neutral
- d) Index 60% - 79.99% : Accepted
- e) Index 80% - 100% : Very Accepted

Calculation of the mean score user acceptance:

$$\begin{aligned} &= (204 + 230 + 226 + 231 + 229 + 217 + 187 + 208 + 206 + 196) / 10 \\ &= 2134 / 10 \\ &= 213,4 \end{aligned}$$

The Acceptance Index is calculated by the formula:

$$\begin{aligned} &= (213,4 / 260) \times 100\% \\ &= 82,07\% \end{aligned}$$

The results of the acceptance test show that the level of acceptance of the respondents to the application system that was built resulted in 82.07%, which means that the respondents gave an assessment of being very accepting of the application developed.

4. Conclusion

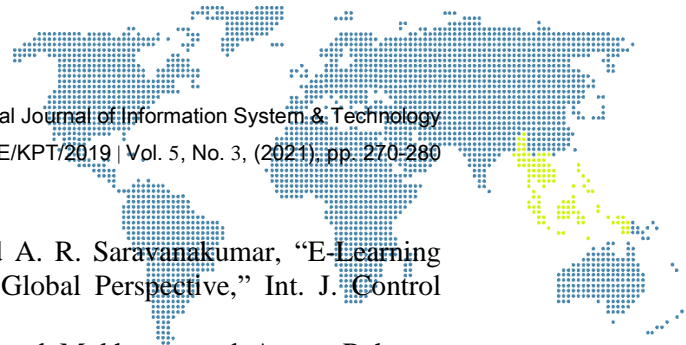
Based on the results of the user acceptance test using alpha and beta testing, the following results were obtained: alpha testing using the blackbox method showed that functionally, all modules in the digital signature e-document application were running well, there were no bugs or problems in process access to menus contained in the system, transaction processing - upload and download documents, verification process and access data contained in the help menu. While the results of beta testing using a measurement with a linkert scale indicate that the acceptance test results show the level of acceptance of the respondents to the system being built shows a value of 82.07%, which means that responsiveness gives a very accepting assessment of the application being developed. The result was then analyzed through some justification approaches and indicated that the digital signature application was categorized acceptable to use in education institution activities. However, the application testing that is built still needs to be improved by testing to analyze and understand the factors that affect the acceptance of the use of computer technology such as the Technology Acceptance Model (TAM) approach[25].

Acknowledgments

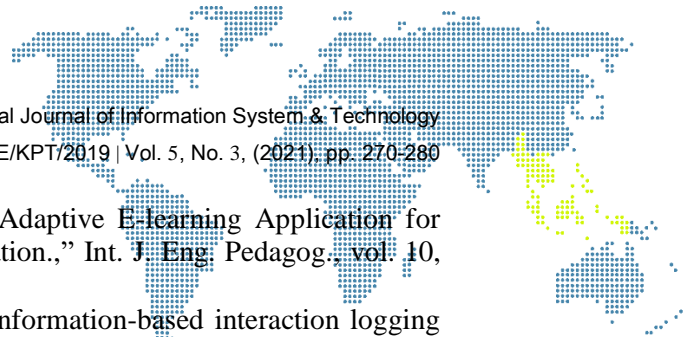
This research was presented at the ASEAN Workshop on Information Science and Technology 2020 (AWIST 2020) organized by Universiti Teknologi MARA (UiTM), Universiti Kebangsaan Malaysia (UKM), Japan Advanced Institute of Science and Technology (JAIST), and Indonesian Computer University (UNIKOM). This research was also funded by The Ministry of Research and Higher Education (KEMENRISTEKDIKTI) Republic of Indonesia - No. SK. 7 / E / KPT / 2019 - 019 / SP2H / LT-AMAND / LL4 / 2020, No. Contract. 011 / SP / LPPM / UNIKOM / VII / 2020, in the applied research grant scheme for 2019-2020.

References

- [1] S. Brammer and T. Clark, "COVID-19 and Management Education: Reflections on Challenges, Opportunities, and Potential Futures," Br. J. Manag., vol. 31, no. 3, pp.



- 453–456, **2020**, doi: 10.1111/1467-8551.12425.
- [2] R. Radha, K. Mahalakshmi, V. S. Kumar, and A. R. Saravanakumar, “E-Learning during Lockdown of Covid-19 Pandemic: A Global Perspective,” *Int. J. Control Autom.*, vol. 13, no. 4, pp. 1088–1099, **2020**.
- [3] A. N. Bahasoan, Wulan Ayuandiani, Muhammad Mukhram, and Aswar Rahmat, “Effectiveness of Online Learning In Pandemic Covid-19,” *Int. J. Sci. Technol. Manag.*, vol. 1, no. 2, pp. 100–106, **2020**, doi: 10.46729/ijstm.v1i2.30.
- [4] U. Rahardja, S. Sudaryono, N. P. L. Santoso, A. Faturahman, and Q. Aini, “Covid-19: Digital Signature Impact on Higher Education Motivation Performance,” *Int. J. Artif. Intell. Res.*, vol. 4, no. 1, **2020**, doi: 10.29099/ijair.v4i1.171.
- [5] A. Finandhita and I. Afrianto, “Development of E-Diploma System Model with Digital Signature Authentication,” in *IOP Conference Series: Materials Science and Engineering*, **2018**, vol. 407, no. 1, doi: 10.1088/1757-899X/407/1/012109.
- [6] I. Afrianto, A. Heryandi, A. Finadhita, and S. Atin, “Design Of E-Document System With Digital Signature Using User Centered Design Method,” in *Conference SENATIK STT Adisutjipto Yogyakarta*, **2019**, vol. 5, pp. 345–356.
- [7] I. Afrianto, A. Heryandi, A. Finandhita, And S. Atin, “E-Document Autentification With Digital Signature Model For Smart City In Indonesia.” *Journal of Engineering Science and Technology*, **15**, **2020**, pp. 28-35
- [8] I. Afrianto, A. Heryandi, A. Finandhita, and S. Atin, “Prototype of E-Document Application Based on Digital Signatures to Support Digital Document Authentication,” *IOP Conf. Ser. Mater. Sci. Eng.*, vol. 879, no. 1, **2020**, doi: 10.1088/1757-899X/879/1/012042.
- [9] Y. Maruli and Y. Kerlooza, “The Designing of User Acceptance Measurement Tool for Web-Based Application Interface Using Combination from Nielsen’s Method and Questionnaire Technique,” in *IOP Conference Series: Materials Science and Engineering*, **2020**, vol. 879, no. 1, p. 12081.
- [10] Z. A. K. Hamza and M. Hammad, “Testing approaches for Web and mobile applications: An overview,” *Int. J. Comput. Digit. Syst.*, vol. 90, no. 4, pp. 657–664, **2020**, doi: 10.12785/ijcds/090413.
- [11] S. Basak and M. S. Hosain, “Software Testing Process Model from Requirement Analysis to Maintenance,” *Int. J. Comput. Appl.*, vol. 107, no. 11, **2014**.
- [12] C. K. N. C. K. Mohd and F. Shahbodin, “Personalized learning environment: alpha testing, beta testing & user acceptance test,” *Procedia-Social Behav. Sci.*, vol. 195, pp. 837–843, **2015**.
- [13] Zamtinah, E. Supriyadi, and Soeharto, “Functional test of the online Recognition of Work Experience and Learning Outcome System using black box testing,” *J. Phys. Conf. Ser.*, vol. 1446, no. 1, pp. 0–8, **2020**, doi: 10.1088/1742-6596/1446/1/012060.
- [14] S. Nidhra, “Black Box and White Box Testing Techniques - A Literature Review,” *Int. J. Embed. Syst. Appl.*, vol. 2, no. 2, pp. 29–50, **2012**, doi: 10.5121/ijesa.2012.2204.
- [15] S. A. Deshpande, N. A. Deshpande, V. M. Marathe, and G. V Garje, “Improving software quality with agile testing,” *Int. J. Comput. Appl.*, vol. 1, no. 22, pp. 68–73, **2010**.
- [16] S. Sutiah and S. Supriyono, “Software Testing on The Learning of Islamic Education Media Based on Information Communication Technology Using Blackbox Testing,” *IJISTECH (International Journal of Information System & Technology)*, 3(2), 254-260, **2020**, [Online]. Available: <http://ijistech.org/ijistech/index.php/ijistech/article/view/57>.
- [17] P. O. Thatawong and A. Jiamsanguanwong, “User requirement and usability testing framework for information system development: case study of financial institution,” in *IOP Conference Series: Materials Science and Engineering*, **2020**, vol. 784, no. 1, p. 12032.



- [18] D. Hariyanto and T. Köhler, “A Web-Based Adaptive E-learning Application for Engineering Students: An Expert-Based Evaluation.,” *Int. J. Eng. Pedagog.*, vol. 10, no. 2, pp. 60–71, **2020**.
- [19] J. W. Jeong, N. H. Kim, and H. P. In, “GUI information-based interaction logging and visualization for asynchronous usability testing,” *Expert Syst. Appl.*, vol. 151, p. 113289, **2020**, doi: 10.1016/j.eswa.2020.113289.
- [20] S. Mellikeche, H. de Fatima Marin, S. E. Benítez, A. C. O. de Lira, F. G. B. de Quirós, and P. Degoulet, “External validation of the unified model of information systems continuance (UMISC): An international comparison,” *Int. J. Med. Inform.*, vol. 134, **2020**, doi: 10.1016/j.ijmedinf.2019.07.006.
- [21] N. W. Masri, J. J. You, A. Ruangkanjanases, S. C. Chen, and C. I. Pan, “Assessing the effects of information system quality and relationship quality on continuance intention in e-tourism,” *Int. J. Environ. Res. Public Health*, vol. 17, no. 1, **2020**, doi: 10.3390/ijerph17010174.
- [22] T. Fujii, T. Dohi, H. Okamura, and T. Fujiwara, “A software accelerated life testing model,” in *2010 IEEE 16th Pacific Rim International Symposium on Dependable Computing*, **2010**, pp. 85–92.
- [23] T. M. Branch, “User Acceptance Testing (UAT) Process,” *Inf. Technol. Manag. Branch*, vol. Ed. Britis, pp. 111–112, **2008**.
- [24] H. C. Zhang, “Research on New Techniques and Development Trend of Software Testing,” in *Advanced Materials Research*, **2013**, vol. 760, pp. 1298–1301.
- [25] S. Zaineldeen, L. Hongbo, and B. M. A. Hassan, “Technology Acceptance Model’Concepts, Contribution, Limitation, And Adoption In Education,” *Univers. J. Educ. Res.*, vol. 8, no. 11, pp. 5061–5071, **2020**.

Authors



Irawan Afrianto is a lecturer at the Department of Informatics, Universitas Komputer Indonesia (UNIKOM) Bandung. Currently completing the Computer Science Doctoral Program at IPB University Bogor with the research field of blockchain technology in agroindustry.



Andri Heryandi is a lecturer at Department of Informatics, Universitas Komputer Indonesia (UNIKOM). The areas of research undertaken are in internet and mobile technology, database technology and algorithms.



Alif Finandhita is a lecturer at Department of Informatics, Universitas Komputer Indonesia (UNIKOM). The areas of research undertaken are in internet and mobile technology, database technology and algorithms.



Sufa Atin is a lecturer at Informatics Department, Universitas Komputer Indonesia (UNIKOM) Bandung. The areas of research undertaken are in information systems, software project management and socio-informatics.