

## E-Learning course design and implementation in fuzzy logic

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**Abstract:** The goal of e-learning in fuzzy logic courses is to assist students in the learning process, create menu structures and simple operation techniques, and create prototypes for e-learning in fuzzy logic courses. The difficulty of students in implementing what they have learned stems from the fact that the advent of e-learning can make it simpler for students to access material that they do not comprehend. In this study, an analytic learning prototype was used as the research approach. The outcomes of e-learning products based on online apps in this fuzzy logic course can be used as learning material. The menu structure developed in this e-learning is a home page with an introduction to e-learning, a site page with participants, calendars, and notes. Pages that can be used to grow the network and courses are the most significant aspects of e-learning. E-learning includes material, discussion, forums, quizzes, and other activities. The findings of the validation by media specialists on this e-learning application are pretty good, indicating that it is suitable for use. According to the results of material expert validation, the material used is excellent, suggesting that it is ideal for use in fuzzy logic courses. The limited test results for Informatics study program students were in the very good category, indicating that this e-learning tool was simple to use.

**Keywords:** design, digital learning, e-learning course, fuzzy logic, implementation

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### Introduction

Internet technology is rapidly evolving and has extended to every corner of the globe. It is employed by numerous countries, institutions, and specialists for various objectives, including education [1]. Learning is defined as teachers and students working together to attain specific goals [2]. There must be aspects of objectives, teaching materials, procedures, and assessments that are indivisible units [3]. Article 31 paragraph (2) of Law Number 20 of 2003 Concerning the National Education System specifies that remote education serves the purpose of delivering educational services to community groups that are unable to attend face-to-face or regular teaching. This assertion is repeated in Article 31 paragraph (2) of Law No. 12 of 2012. Distance education strives to extend access and facilitate higher education in teaching and learning, in addition to offering higher education services to community groups that cannot attend face-to-face or regular schooling.

Meanwhile, according to Government Regulation of the Republic of Indonesia Number 17 of 2010 concerning Management and Implementation of Education (article 118 paragraph 1), distance education aims to increase the expansion and equity of access to education, as well as to improve the quality and relevance of education. According to this situation, Article 2 of the Regulation of the Minister of Education and Culture of the Republic of Indonesia number 24 of 2012 concerning the Implementation of Distance Education in Higher Education states that distance education aims to increase the expansion and equitable distribution of access to quality and relevant education as needed. E-learning is defined as any teaching and learning that employs electronic circuits to give learning content, interaction, or direction [4].

It is easier for students to learn when they have access to the internet [5]. Due to the difficulties in adopting existing distant learning, users rarely use it [6]. According to data received from Informatics Study Program students, out of 100 students, some courses must employ

distance or online learning, which contains more theory than practice. The students in the 60 fuzzy logic course chose to perform online since it can make it easier and faster to access, particularly in materials that explain the theory and work examples. As many as 25 pupils disagreed with the existence of online distance learning because they couldn't immediately ask the lecturer if they had any questions. Because these two learning modalities are connected, 15 other pupils require them.

Other factors that cause these students to be opposed to distance learning include a limited internet network, computer equipment, smartphones, cameras, audio, etc. This fuzzy logic course's e-learning development is designed to make the content being studied easy to understand. There are examples and illustrations of each material offered in this e-learning, such as a movie on fuzzy logic material. Framework and Bootstrap are the software packages used. This software has various advantages, including the following: it has very comprehensive, a logical design display, and it can be used at all levels of schooling.

To participate in online learning, it is also necessary to have tenacity, discipline, independence, and a high level of responsibility for all of the regulations that apply to the teaching [7]. Primarily if the online courses being pursued are from another country. Of course, it is also necessary to be fluent in English. Because the content offered is frequently quite dense, especially if it leads to a better comprehension of the topic. The notion of sharing learning resources has been adopted and improved throughout the previous few decades using information technology media such as Electronic Learning, Virtual Learning, Mobile Learning, and so on [8].

E-Learning, in general, refers to Online Courses with a large number of open registrations that include admission administration services and material, design [9], access points, application methods, and a definition of success [10]. Elearning technology is the latest online learning craze and a viable alternative to traditional higher education programs [11].

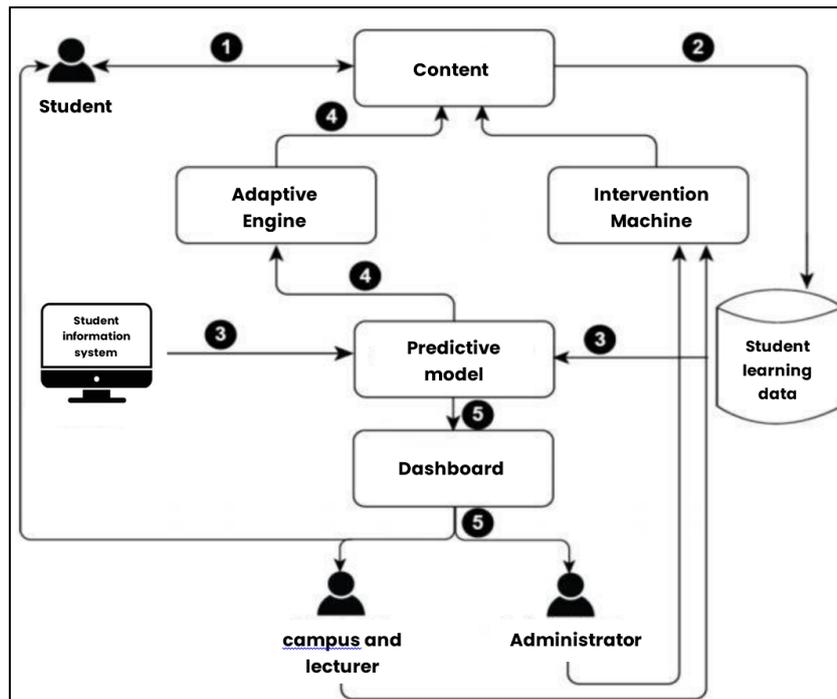
Following this occurrence, E-learning has brought about a transformation in the education sector in a short period, opening up prospects for new pedagogies and business models [12], providing thousands of students with accessible, high-quality education. Because of this open access, people from all over the world can enroll in E-learning [13]. Documents, video recordings, and other technologies are used in e-learning to impart course or training content to an unlimited number of students at any time. There are no restrictions on student attendance or training requirements. Fuzzy logic courses, like E-learning in general, use web-based learning resources, online assessment systems, online laboratories, instructor training and assistance, and preparation tests to get an Industrial Standard Certificate [14]. As a student enrolled in an online course, I have made people aware that learning in an online class is not as simple as previously assumed. It's considerably more challenging than simply designing and preparing online courses for students. Given that all instructional materials are available online, it takes tenacity, time discipline [15], independence, and a strong feeling of responsibility to study the content and complete the tasks (assignments and tests) required before receiving a certificate of completion [16].

## Methodology

The method used in this research is Learning Analytic Prototype, namely by performing several steps or stages as follows:

1. Identify user needs. At this stage, discussions are held to determine user needs between lecturers and students. Users can describe the exact and desired system requirements.
2. Make a prototype design. At this stage, the researcher makes a prototype of the desired system requirements.
3. Testing the Prototype. At this stage, the user can test the e-learning system that has been provided and the user can provide suggestions or feedback.
4. Fix Prototype. At this stage, researchers make improvements and modifications according to user input.
5. Implementation. After the evaluation is done and the system is in accordance with the wishes of the user. Then the system can be implemented in fuzzy logic courses.

A model can be applied in fuzzy e-learning courses as follows:



**Figure 1.** Learning system model implementation of learning analytics

The learning process carried out using the help of an online learning system supports extracting student data during the learning process. The data is processed using LA, which is then used to improve the PBM process. The LA implementation in the adaptive learning system model includes 6 (six) principal components, which can be seen in Figure 1.

1. Content manager: assisting students in providing content and assessment tools to support the learning process
2. Student learning data: store all records of student activities and behavior while interacting in the system
3. Predictive Model: combines demographic and behavioral data of students so that it can be used to track student learning progress to predict their future performance and various potential problems that may be encountered;
4. dashboard: Using the Predictive Model's output to be presented in a dashboard that other users easily understand.
5. Adaptive Engine: utilizes information from Predictive Model results to select teaching materials that can be adapted to the needs and performance of students in various levels of conditions; and
6. Intervention Machine: assisting teachers/instructors, administrators, and system developers in taking over the automated system for the learning needs of students in specific contexts.

Adaptive engine for learning, also known as adaptive teaching, is an educational method that uses computer algorithms as well as artificial intelligence to orchestrate the interaction with the learner and deliver customized resources and learning activities to address the unique needs of each learner.

## Results and Discussions

### Result

Students who intend to use this e-learning must register as users to access it. The user is divided into three categories in this development: user, administrator, and lecturer. Users in this topic are students enrolled in fuzzy logic courses who can only access material, work on questions, and ask questions in the forum. The admin user serves as e-learning management by

inspecting, maintaining, and enhancing services, among other things. This website's lecturer users organize resources, give assignments, manage grades, provide student attendance lists, and engage in online chat. Resources and activities are the two fundamental components of e-learning. Resources include instructional resources in various formats, whereas activities include activity facilities that students can use. Indonesian and English are the languages used in this e-learning. In the e-learning used, students have the option of selecting the language of delivery. Expert validation is required for products that have been designed for this application system to be used. An instrument for assessing the system's performance is needed for verification to media professionals. There are 15 assessment items in the assessment instrument. The validation results from media specialists received a score of 60 and were classified as very good.

The learning system that has passed the validation results of media experts and material specialists and is usable then moves on to the limited testing stage. The test was carried out on 100 students from the informatics studies program's fuzzy logic course. The test results yielded an average score of 80 on outstanding criteria, indicating that this e-learning system is simple to use.

### Discussions

Because this e-learning program is housed on a university server, users only need to enter their email addresses and password. Users do not need to install or manage complicated menus because everything is ready to use and easily manageable based on their needs. So creating e-learning is not difficult; anyone can do it. Before creating e-learning, some equipment, such as a computer/ laptop and internet access and different devices such as cameras and audio devices, should be provided. The homepage, menu page, and material options are all highly significant menu areas in this e-learning. The user is guided to the content of e-learning, an overview of the courses to be studied, and so on. In addition to this home menu, there is a university logo, the main menu, the language to be used on the website, navigation, an overview of the material to be studied, and so on. Users who follow the course, a calendar, notes, news, and pages that can be used to develop the network can all be found on the menu page. The context menu is the most significant because the menu on this menu allows students to access the material they will learn. Students can communicate with fellow students or lecturers in addition to the material on this menu. Materials that can be viewed can be entered in various formats, but for this test, the researchers only included ppt, pdf, and video formats. Quizzes, chat, forums, online presentations, and other activities are among those that can be carried out in e-learning. Students are encouraged to be engaged in interacting about the content to be studied due to this.

In the Learning Management Process system shown in Figure 2, lecturers can enter excel format values with data import facilities, which will then be processed by the system according to a predetermined format. The results of the input performed can also be searched to speed up the data being found. And on the student page, students can see the results obtained in real-time and correctly.

<p> <a href="#">+ Add Data</a>   <a href="#">Import</a>   <a href="#">Cari Data</a> </p> <p> <b>FILTER DATA</b>                  Angkatan :   <a href="#">Tampilkan</a> </p> <table border="1"> <thead> <tr> <th>No</th> <th>Kode</th> <th>NIS</th> <th>Nama Siswa</th> </tr> </thead> <tbody> <tr><td>1</td><td>S0001</td><td>2017345</td><td>Aasyia Pebrina</td></tr> <tr><td>2</td><td>S0002</td><td>2017346</td><td>Andi Nisa Maharani Manjili</td></tr> <tr><td>3</td><td>S0003</td><td>2017347</td><td>Deviyana Dhiyah Ayu. T. P</td></tr> <tr><td>4</td><td>S0004</td><td>2017348</td><td>Ella Nur Halisa</td></tr> <tr><td>5</td><td>S0005</td><td>2017349</td><td>Latifa Nur Wahidah</td></tr> <tr><td>6</td><td>S0006</td><td>2017350</td><td>Mariana Saldin</td></tr> <tr><td>7</td><td>S0007</td><td>2017351</td><td>Nadhifa Nuraini</td></tr> <tr><td>8</td><td>S0008</td><td>2017352</td><td>Nadya Nur Triana</td></tr> <tr><td>9</td><td>S0009</td><td>2017353</td><td>Nuhrah Aprilia</td></tr> <tr><td>10</td><td>S0010</td><td>2017354</td><td>Rantika</td></tr> <tr><td>11</td><td>S0011</td><td>2017355</td><td>Rivaldo Pratama Kasaulia</td></tr> <tr><td>12</td><td>S0012</td><td>2017356</td><td>Reviola Davi Maharani</td></tr> <tr><td>13</td><td>S0013</td><td>2017357</td><td>Satsa Alisia Ramadhani</td></tr> <tr><td>14</td><td>S0014</td><td>2017358</td><td>Tania Artha Akarna. W</td></tr> <tr><td>15</td><td>S0015</td><td>2017359</td><td>Tirsa Lady Betriks</td></tr> <tr><td>16</td><td>S0016</td><td>2017360</td><td>Willa Arfina Anggraini</td></tr> <tr><td>17</td><td>S0017</td><td>2017317</td><td>Alya Fira</td></tr> <tr><td>18</td><td>S0018</td><td>2017318</td><td>Dian Hikma Yanti</td></tr> <tr><td>19</td><td>S0019</td><td>2017319</td><td>Dilla Fransiska</td></tr> <tr><td>20</td><td>S0020</td><td>2017320</td><td>Firda Maulani Hatum</td></tr> <tr><td>21</td><td>S0021</td><td>2017321</td><td>Freska Aprilia Wibowo</td></tr> </tbody> </table>				No	Kode	NIS	Nama Siswa	1	S0001	2017345	Aasyia Pebrina	2	S0002	2017346	Andi Nisa Maharani Manjili	3	S0003	2017347	Deviyana Dhiyah Ayu. T. P	4	S0004	2017348	Ella Nur Halisa	5	S0005	2017349	Latifa Nur Wahidah	6	S0006	2017350	Mariana Saldin	7	S0007	2017351	Nadhifa Nuraini	8	S0008	2017352	Nadya Nur Triana	9	S0009	2017353	Nuhrah Aprilia	10	S0010	2017354	Rantika	11	S0011	2017355	Rivaldo Pratama Kasaulia	12	S0012	2017356	Reviola Davi Maharani	13	S0013	2017357	Satsa Alisia Ramadhani	14	S0014	2017358	Tania Artha Akarna. W	15	S0015	2017359	Tirsa Lady Betriks	16	S0016	2017360	Willa Arfina Anggraini	17	S0017	2017317	Alya Fira	18	S0018	2017318	Dian Hikma Yanti	19	S0019	2017319	Dilla Fransiska	20	S0020	2017320	Firda Maulani Hatum	21	S0021	2017321	Freska Aprilia Wibowo	<p>                 No. Peserta : NU0001                  Kode Siswa : S0142                  Nama Siswa : Adela Saphira Agustine                  Status Peserta : Selesai             </p> <p>                 Hasil Ujian : Lulus             </p> <p> <b>HASIL JAWABAN SOAL</b> </p> <table border="1"> <thead> <tr> <th>No</th> <th>Kode</th> <th>Jawaban Peserta</th> <th>Hasil</th> </tr> </thead> <tbody> <tr><td>1</td><td>S0001</td><td>C</td><td>✓</td></tr> <tr><td>2</td><td>S0002</td><td>D</td><td>✗</td></tr> <tr><td>3</td><td>S0003</td><td>A</td><td>✓</td></tr> <tr><td>4</td><td>S0004</td><td>B</td><td>✓</td></tr> <tr><td>5</td><td>S0005</td><td>C</td><td>✓</td></tr> <tr><td>6</td><td>S0006</td><td>D</td><td>✓</td></tr> <tr><td>7</td><td>S0007</td><td>C</td><td>✗</td></tr> <tr><td>8</td><td>S0008</td><td>A</td><td>✓</td></tr> <tr><td>9</td><td>S0009</td><td>B</td><td>✓</td></tr> <tr><td>10</td><td>S0010</td><td>D</td><td>✓</td></tr> </tbody> </table>	No	Kode	Jawaban Peserta	Hasil	1	S0001	C	✓	2	S0002	D	✗	3	S0003	A	✓	4	S0004	B	✓	5	S0005	C	✓	6	S0006	D	✓	7	S0007	C	✗	8	S0008	A	✓	9	S0009	B	✓	10	S0010	D	✓
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Figure 2. Fuzzy logic learning management process

As figure 2, using the fuzzy system, users with the admin or officer category can add student data according to previously registered and operational data. If there is data that is not active, students cannot access the e-learning system until the student is dynamic Back.

The system can also manage exam results in real-time and automatically according to a predetermined time at the admin level. The exam process has been completed so that the grade or graduation predicate can be known by students directly and transparently.

Building e-learning necessitates interactive activities between students and lecturers, such as chat, forum discussion, and virtual meet. The results of media expert validation reveal that the final product is usable. To create engaging and appealing e-learning, three criteria must be met when building e-learning: simple, personal, and fast [17]. In making this e-learning, the researcher condensed the navigation into three main parts: home, site page, and course. Because the language employed or the message transmitted was not effectively delivered, communication did not receive the total value; to overcome this to be more communicative, the researchers fixed it by simplifying the message and making the language easier.

The presentation that is less appealing to pupils, resulting in a value in attractive and straightforward characteristics that is not optimal. To simplify and attract students to e-learning, this is accomplished by exhibiting portions of video examples that entice students to access it. In terms of interactivity, there is a lack of interaction between other students and lecturers. Developing e-learning necessitates interaction activities between students and teachers, such as chat and discussion/forum. As instructed by media professionals, media, chat, and discussions are included in this e-learning. Some of the characteristics of developing a learning site or an e-learning website include that the explanation technique is effective, transparent, and easily understood by learners through pictures, examples, and demonstrations [18].

The following is a table relation and e-learning display in the fuzzy logic course, in Figures 3 and 4.

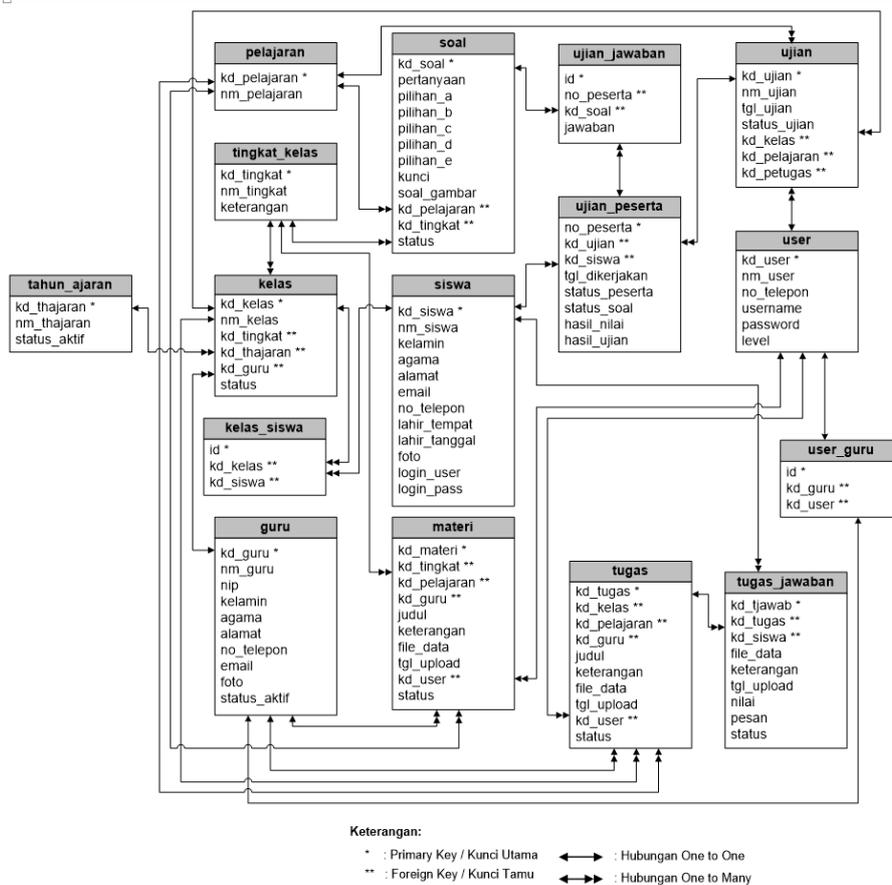


Figure 3. Fuzzy course e-learning system table relation

In the table, the relationship shows the access rights that flow in the e-learning system. the relationship is a relationship between tables in the database made using Indonesian following the application of the e-learning application system on the campus. The relation describes a collection of data that can be obtained and stored from the main sources so that e-learning activities can be recorded and documented regularly and accessed at any time and at any time by the user. All the built relationships are aimed to meet the requirement so that the data does not experience redundancy and has a clear direction.

HASIL JAWABAN SOAL				
No	Kode Soal	Jawaban Siswa	Hasil	Info
1	S0001	C	✓	Benar
2	S0002	D	✗	Salah
3	S0003	A	✓	Benar
4	S0004	B	✓	Benar
5	S0005	C	✓	Benar
6	S0006	D	✓	Benar
7	S0007	C	✗	Salah
8	S0008	A	✓	Benar
9	S0009	B	✓	Benar
10	S0010	D	✓	Benar

PENYERTA UJIAN									
No	No Pst	Kode	NIS	Nama Siswa	Qty Soal	Jwb Benar	Nilai(%)	Hasil	Boleh
1	NU0001	S0142	2015193	Adela Saphira Agustine	50	38	76	Lulus	✓
2	NU0002	S0143	2015194	Adella Angelica	50	49	98	Lulus	✓
3	NU0003	S0144	2015199	Dinda Ayu	50	43	86	Lulus	✓
4	NU0004	S0145	2015200	Ditha Faradiah Milena	50	49	98	Lulus	✓
5	NU0005	S0146	2015201	Fauziah Nur Ummiy	50	35	70	Gagal	✗
6	NU0006	S0147	2015202	Kharisma Clarisha Aurelia	50	38	76	Lulus	✓
7	NU0007	S0148	2015203	Lita Lailatul Amalia	50	41	82	Lulus	✓
8	NU0008	S0149	2015204	Mella Fitrianti Samallo	50	48	92	Lulus	✓
9	NU0009	S0150	2015205	Monica Putri Heriyanto	50	48	96	Lulus	✓
10	NU0010	S0151	2015206	Nia Piranta	50	39	78	Lulus	✓
11	NU0011	S0152	2015207	Novita Sampe Tambora	50	33	66	Gagal	✗
12	NU0012	S0153	2015208	Nur Hissanah	50	30	60	Gagal	✗
13	NU0013	S0154	2015209	Nur Khoifia Indah Faradina Muhtis	50	33	66	Gagal	✗
14	NU0014	S0155	2014118	Okky Oktavian	50	23	46	Gagal	✗
15	NU0015	S0156	2015210	Purni Octaviana Rizanti	50	44	88	Lulus	✓

Figure 4. Display of fuzzy logic e-learning results

The display shows the results obtained by students, which can be seen directly after the exam process, and these results are not the results of one semester's learning but only the results of the exam for each subject. The results displayed cannot be changed by students and cannot be changed by lecturers before carrying out gradual clarification to the authorities according to the data to be corrected.

### Conclusion

The results obtained can be concluded that fuzzy logic e-learning can run as targeted and expected. E-learning can provide real-time and transparent results, so no longer have to worry about data loss and delays. Fuzzy logic courses using e-learning media can be more interactive in the learning process, and lecturers construct material and knowledge. In this case, new approaches to learning technology are very well and quickly. The e-learning system can also be applied to all courses, which can then be adapted to the curriculum material, and everything can be done quickly by the application system.

### References

- [1] M.u Yani, F. Rizal, and M. R. Padillah, "Content management system for school information website," *Multica Sci. Technol.*, vol. 1, no. 1, 2021, doi: 10.47002/mst.v1i1.203, 2021.
- [2] Z. Zaini, "Mathematical reasoning abilities of students in terms of field dependence (fd) cognitive style in problem-solving," *Multica Sci. Technol.*, vol. 1, no. 1, 2021, doi: 10.47002/mst.v1i1.198, 2021.
- [3] F. Fathiah, N. Raharti, and M. R. Fachri, "Analysis of the ability of lecturers in the use of online learning media in the faculty of tarbiyah and keguruan (FTK) Uin Ar-Raniry Banda Aceh," *Multica Sci. Technol.*, vol. 1, no. 1, 2021, doi: 10.47002/mst.v1i1.207, 2021.
- [4] M. Ula, A. Pratama, Y. Asbar, W. Fuadi, R. Fajri, and R. Hardi, "A new model of the student attendance monitoring system using RFID technology," in *Journal of Physics: Conference Series*, 2021, vol. 1807, no. 1, doi: 10.1088/1742-6596/1807/1/012026.
- [5] A. S. Pribadi, R. Hardi, Suhartati, R. Kusdyawati, and Sumardi, "ICT academy at the university," in *Journal of Physics: Conference Series*, 2021, vol. 1807, no. 1, doi: 10.1088/1742-6596/1807/1/012036.
- [6] H. R. Hardi, "Pengembangan sistem informasi perpustakaan menggunakan kerangka pieces (studi kasus Perpustakaan STITEK Bontang)," *Ilm. Teknol. Inf. Terap.*, vol. 1, no. 3, 2017.

- [7] A. Junaidi, I. Kresna A, and R. Hardi, "Analysis of community response to disasters through twitter social media," in *Journal of Physics: Conference Series*, 2021, vol. 1807, no. 1, doi: 10.1088/1742-6596/1807/1/012033.
- [8] J. F. Rusdi *et al.*, "Collaborative of ICT research in Indonesia," in *Journal of Physics: Conference Series*, 2021, vol. 1807, no. 1, doi: 10.1088/1742-6596/1807/1/012009.
- [9] F. Rizani, "Image quality improvement using image processing method image brightness contrast and image sharpening," *Multica Sci. Technol.*, vol. 1, no. 1, 2021, doi: 10.47002/mst.v1i1.200, 2021.
- [10] Gunawan, Sumardi, R. Hardi, Suprijadi, and Y. Servanda, "Integration of academic mobile applications at university," in *Journal of Physics: Conference Series*, 2021, vol. 1807, no. 1, doi: 10.1088/1742-6596/1807/1/012035.
- [11] R. Hardi, Gunawan, and Sumardi, "Pendekatan baru teknologi mooc sebagai media pembelajaran pada matakuliah pemrograman," *SNITT- Politek. Negeri Balikpapan 2018*, 2018.
- [12] R. Hardi, "Rancang bangun sistem smart library pada perpustakaan SMK Airlangga Balikpapan," *JST (Jurnal Sains Ter.*, vol. 3, no. 2, 2017, doi: 10.32487/jst.v3i2.260.
- [13] S. Sigalayan, M. Adriyanto, R. Hardi, J. T. Informatika, and K. Balikpapan, "Sistem pendukung keputusan menggunakan metode topsis dalam penentuan pemberdayaan masyarakat," *Seminastika*, 2018.
- [14] J. F. Rusdi *et al.*, "Reporting of hospital facility on smartphone," in *Journal of Physics: Conference Series*, 2021, vol. 1807, no. 1, doi: 10.1088/1742-6596/1807/1/012013.
- [15] Sri Winar, "Automatic train door portal system using regulated straight motion formulas," *Multica Sci. Technol.*, vol. 1, no. 1, 2021, doi: 10.47002/mst.v1i1.199, 2021.
- [16] R. Hardi, "Pengembangan antivirus berbasis client server," *Telematika*, vol. 12, no. 2, 2015, doi: 10.31315/telematika.v12i2.1406, 2015.
- [17] R. Hardi, "Preface," *Journal of Physics: Conference Series*, vol. 1807, no. 1, 2021, doi: 10.1088/1742-6596/1807/1/011001.
- [18] R. Rahim *et al.*, "INA-Rxiv: The missing puzzle in Indonesia's scientific publishing workflow," in *Journal of Physics: Conference Series*, 2018, vol. 1007, no. 1, doi: 10.1088/1742-6596/1007/1/012032.

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