Design of a Decision Support System for Housing Selection Using the Web-Based Additive Ratio Assessment (Aras) Method

Fabio Junior[1*], R. Wahyudi Darmawan[2], Septa Petriyansyah[3]

[1,2,3] *Program Studi Teknologi Informasi, Universitas Tangerang Raya, Indonesia*

ABSTRACT

Population growth in Indonesia continues to increase, making the need for houses as a place to live also increasing. The current large number of housing complexes with various criteria and their respective advantages makes prospective buyers quite confused about choosing the right and suitable housing for their residence. This research aims to provide recommendations for suitable housing for prospective buyers through a decision support system using the Additive Ratio Assessment (ARAS) Method based on calculations from Criteria Data, Sub-Criteria Data and Alternative Assessment Data. The recommendations given are in the form of a ranking where the housing alternative with the highest degree of utility value is the most recommended alternative. In this research, there are 5 (five) Data Criteria required by prospective buyers, namely Price, Location, Accessibility, Facilities and Environmental Safety. Then there are 5 (five) housing alternatives, namely Batara Parkview, Batara Village, Kota Batara, Triraksa Village 2 and Kota Cakra. The results of the decision support system calculations using the Additive Ratio Assessment (ARAS) method produce (1) Kota Cakra as the most recommended housing, then (2) Triraksa Village 2, (3) Batara Parkview, (4) Batara Village and (5) Kota Batara.

ABSTRAK

Pertumbuhan penduduk di Indonesia yang terus bertambah membuat kebutuhan rumah sebagai tempat tinggal juga meningkat. Banyaknya perumahan saat ini dengan berbagai kriteria dan keunggulannya masing-masing membuat calon pembeli cukup kebingungan memilih perumahan yang tepat dan sesuai untuk menjadi tempat tinggalnya. Tujuan penelitian ini untuk memberikan rekomendasi perumahan yang cocok untuk calon pembeli melalui sistem pendukung keputusan menggunakan Metode Additive Ratio Assessment (ARAS) berdasarkan perhitungan dari Data Kriteria, Data Sub Kriteria, dan Data Penilaian Alternatif. Rekomendasi yang diberikan berupa perangkingan dimana alternatif perumahan dengan Nilai Derajat Utilitas tertinggi menjadi alternatif yang paling direkomendasikan. Pada penelitian ini, terdapat 5 (lima) sampel Data Kriteria yang dibutukan oleh calon pembeli yaitu Harga, Lokasi, Aksesibilitas, Sarana dan Keamanan Lingkungan. Kemudian terdapat 5 (lima) sampel Alternatif perumahan yaitu Batara Parkview, Batara Village, Kota Batara, Triraksa Village 2 dan Kota Cakra. Hasil dari perhitungan sistem pendukung keputusan menggunakan Metode Additive Ratio Assessment (ARAS) diperoleh alternatif dengan Nilai Derajat Utilitas (Ki) tertinggi = 1,000 yaitu Kota Cakra sebagai alternatif perumahan yang paling direkomendasikan, dengan adanya penelitian ini dapat memberikan rekomendasi sehingga dapat membantu calon pembeli dalam mengambil keputusan untuk memilih perumahan yang sesuai dengankebutuhannya.

1. INTRODUCTION

Housing is one of the essential basic needs for human life, officially regulated in Law Number 1 of 2011 concerning Housing and Residential Areas. In this law, housing is defined as a collection of houses that form part of a settlement, whether in urban or rural areas. This housing is equipped with infrastructure, facilities, and public utilities designed to support a livable environment for its residents. The regulation reflects the importance of housing not only as a place of residence but also as a means to support the social and economic

well-being of society.

As time progresses, technology has penetrated nearly every aspect of human life, including the fulfillment of housing needs. The process of purchasing a home, which previously required significant time and effort, has now become much easier and more efficient due to advances in digital technology. Prospective buyers can easily access information about various available housing options through digital platforms without needing to make physical visits to the location. These platforms offer convenience by allowing prospective buyers to explore multiple options, compare prices, assess facilities, and even obtain detailed insights about the surrounding neighborhood of the desired property.

However, this convenience is accompanied by a new challenge: how to choose the most suitable home from the many available options that meet the buyer's desires and needs. In a world where information is readily accessible, the complexity of decision-making increases. Prospective buyers must consider many different criteria, such as price, land area, available facilities, location, accessibility, and various other factors that may influence their quality of life and long-term investment. If there is only one housing option that meets the desired criteria, the decision-making process might not be a problem. However, in reality, in many cases, several housing options meet the desired criteria, making it difficult to determine which one is the most appropriate.

To overcome this challenge, prospective buyers need tools to help them make the right and efficient decisions. This is where a Decision Support System (DSS) plays an important role. DSS is an interactive system that combines data and models to assist decision-makers in dealing with semi-structured or unstructured problems. With DSS, prospective buyers can be helped to evaluate the various options available based on predetermined criteria, enabling them to make decisions that best suit their needs and personal preferences.

In the context of housing selection, one method that can be implemented in DSS is the Additive Ratio Assessment (ARAS) method. ARAS is a multi-criteria decision-making method based on the concept of ranking by using utility levels. The working principle of this method is by comparing the overall index value of each alternative housing option with the overall index value of the optimal alternative (Damayanti, 2020). The strength of the ARAS method lies in its ability to provide flexibility for prospective buyers in determining the importance weight of each criterion according to their preferences. For instance, for prospective buyers who prioritize location, the weight of the location criterion can be higher compared to other criteria such as facilities or land area.

Through the development of a DSS based on the ARAS method, it is expected that prospective buyers can obtain more accurate and relevant recommendations, enabling them to make more optimal home purchase decisions. Additionally, the implementation of this method can provide broader benefits, such as assisting property developers in better understanding market preferences and designing products that more closely align with consumer needs. Furthermore, the results of this research are expected to contribute to the development of decision support systems in other fields, especially those involving multi-criteria decision-making, and serve as a valuable reference for researchers in the fields of information technology and decision-making.

2. THEORETICAL FRAMEWORK AND HYPOTHESES

In preparing this thesis, the author has drawn inspiration from and referenced previous research related to the problem background of this study. The following summarizes relevant prior research:

Research conducted by Sitompul & Hasibuan (2018) on the Workforce Selection Decision Support System for Security Services using the ARAS Method identified five assessment criteria: (1) height, (2) weight, (3) age, (4) martial arts skills, and (5) communication skills. The final results of their assessment were summarized to assist personnel in selecting job candidates efficiently and accurately.

Susanto (2018) explored the application of the Additive Ratio Assessment (ARAS) Method in selecting the best gym milk for increasing muscle mass. The study concluded that:

    a. The ARAS method provides a precise and accurate decision-making process by comparing criteria across several gym milk brands.

    b. The decision-making process involves six criteria: (1) calories, (2) cholesterol, (3) sodium, (4) carbohydrates, (5) sugar, and (6) protein, to determine the best gym milk for muscle mass enhancement.

    c. The designed decision support system effectively displays detailed weighting values for each alternative, helping users select the best gym milk.

The system development method employed in this research is the Waterfall model, chosen for its robust design concept and extensive documentation throughout the development process based on thorough initial planning (Arizona et al., 2020). The Waterfall model provides a sequential approach to software development, which is well-suited for projects with stable specifications. The model consists of several stages: analysis, design, coding, testing, implementation, and support & maintenance.
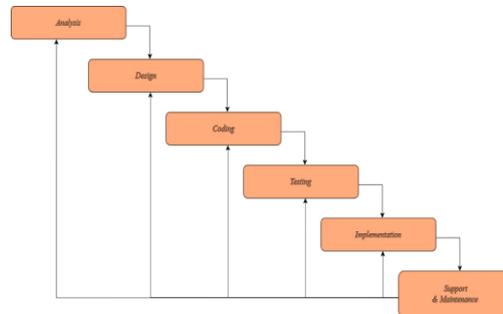

A database is a collection of conceptual and structured data organized in a way that allows for manipulation, including updating, searching, and processing. In essence, a database comprises data that can be managed and analyzed using specific operations. Within organizations, including educational institutions like universities, data represents a significant asset. Consequently, these organizations must efficiently collect and process data to meet their operational needs.

Initially, data was recorded manually in ledgers. However, with advancements in technology, data is now stored in computerized files. This shift has made it easier for organizations, including campuses, to handle large volumes of data without encountering processing difficulties. When an organization, such as a campus, manages a substantial amount of data, the complexity of processing this information increases. To address this challenge, the concept of data management systems (DBMS) is employed. A DBMS provides tools for efficient data management and accessibility, facilitating the handling of extensive data sets (Nugrahanti, 2019). The following outlines the concept of database design:
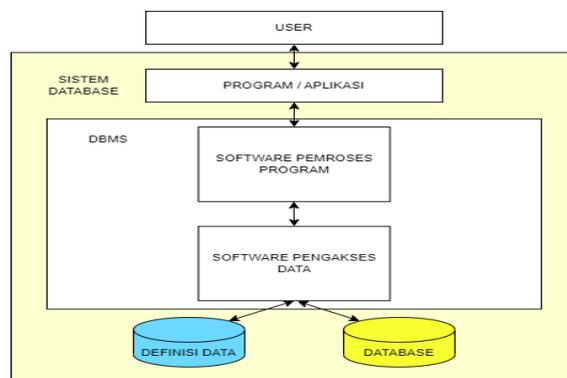
In the current system analysis stage, the objective is to examine the existing system utilized by the company to assess and detail the procedures involved. This analysis aims to understand the functionality and efficiency of the current system. The existing system at Badak Perkasa Group is as follows:
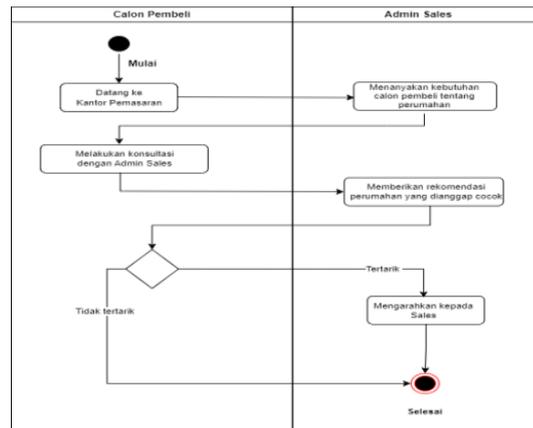
3. RESEARCH METHOD
Definition of the Additive Ratio Assessment (ARAS) Method
The Additive Ratio Assessment (ARAS) method is a multi-criteria decision-making approach based on the intuitive principle that the most optimal alternative should have the largest ratio concerning the considered criteria. This method ranks alternatives by comparing the value of each criterion for every alternative, taking into account the weight of each criterion to find the most ideal alternative. In the ARAS method, the value of the utility function, which determines the relative efficiency of feasible alternatives, is directly proportional to the relative effect of the value and weight of the main criteria considered in determining the best alternative. ARAS is based on the argument that complex problems can be simplified through relative comparisons, where the ratio between the sum of normalized and weighted criteria values for the alternative under consideration and the sum of normalized and weighted criteria values for the optimal alternative is evaluated (Maulana et al., 2019).

The primary advantage of the ARAS method over other methods lies in its ease of calculation and ranking of decision alternatives. With this method, the priority of each alternative can be determined based on the calculated utility function value.

Calculation Stages of the Additive Ratio Assessment (ARAS) Method
The calculation process in the Additive Ratio Assessment (ARAS) method involves seven main steps:
1. Formation of the Decision Matrix: Constructing a matrix that lists all relevant alternatives and criteria.
2. Formulation of the Decision Matrix: Calculating the value of each criterion for each available alternative in the decision matrix.
3. Determination of the Normalization Matrix: Normalizing the values in the decision matrix to eliminate the influence of different units.
4. Criteria Weighting: Assigning weights to each criterion based on its importance to the decision.
5. Formation of the Weighted Normalization Matrix: Calculating the normalized matrix that has been multiplied by the weights of the respective criteria.
6. Determination of Utility Values: Calculating the utility values for each alternative based on the weighted normalization matrix.
7. Ranking Based on Final Calculated Values: Ranking the alternatives based on the final calculated values, where the alternative with the highest utility value is considered the optimal choice.

Application System Development Methods
The application system development method used in this research is the **Waterfall** method, chosen for its strong design concept and extensive documentation of the entire development process based on accurate planning from the beginning of the research (Arizona et al., 2020). The Waterfall method provides a sequential or orderly approach to the software development lifecycle, making it well-suited for developing software with stable specifications throughout the process. The Waterfall model consists of several stages, which are:
1. Analysis: Identifying system requirements and specifications based on the existing problem.
2. Design: Designing the architecture and key components of the system to be developed.

3. Coding: Implementing the design into functional code.
4. Testing: Ensuring that the developed code functions according to specifications and is free from errors.
5. Implementation: Installing and running the software in the intended environment.
6. Support & Maintenance: Performing maintenance and updates after the software is implemented to ensure its continued functionality.

The use of the Waterfall method in this research is expected to provide a clear and organized structure in the development of a decision support system based on the ARAS method, thereby producing a final product that meets the users' needs and the research objectives.

4. DATA ANALYSIS AND DISCUSSION

System Specifications

To ensure the successful operation and alignment of the decision support system with user needs, specific hardware and software specifications are required. Additionally, detailed processes and steps must be outlined to ensure that the system functions as intended.

System Implementation

The system implementation phase involves deploying the developed system and explaining its usage to the end-users. This stage also includes validating the design modules to ensure they meet user requirements, and gathering user feedback to make necessary improvements.

User Interface Implementation

User Interface Login Page Description: This page features a form for entering a username and password. Users or administrators must complete this form to gain access to the system's features.
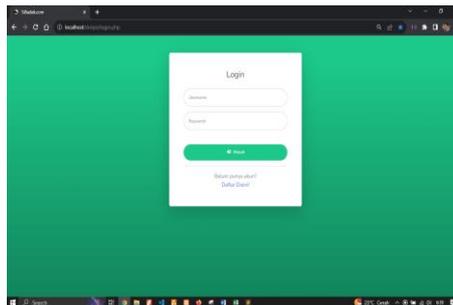

Image 1. User Interface Login Page

User Interface Account List Page

Description: This page includes a form for registering a new account on the system. The registration form requires the user to provide the following information: username, full name, password, email address, and user level.
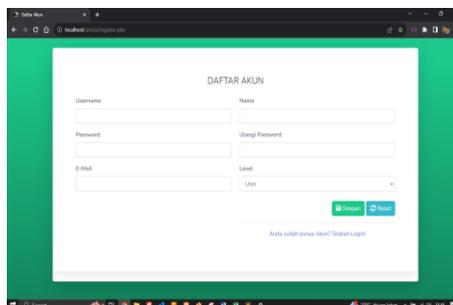

Image 2. User Interface Account List Page

User Interface Admin Dashboard Page

Description: This page serves as the initial view of the Admin dashboard. It features a menu of options accessible to users with Admin privileges, allowing them to navigate and manage various system functions.
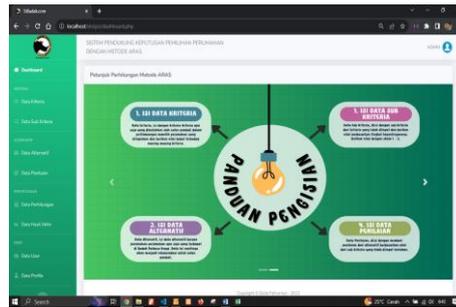
Image 3. User Interface Admin Dashboard Page

User Interface User Dashboard Page
Description: This page serves as the initial display of the User dashboard. It includes a menu of options available to users, allowing them to access and interact with the features specific to their account.
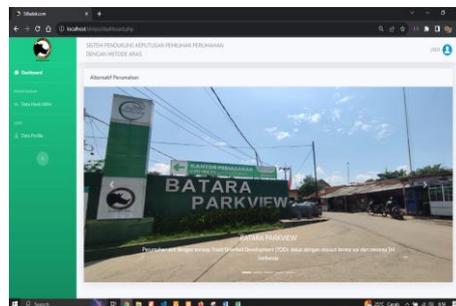

Image 4. User Interface User Dashboard Page

User Interface Criteria Data Page
Description: This page features a Criteria Data form that the Admin must complete to specify the criteria required by users. The Admin can add new criteria by clicking the "Add" button and filling out the necessary fields in the form.
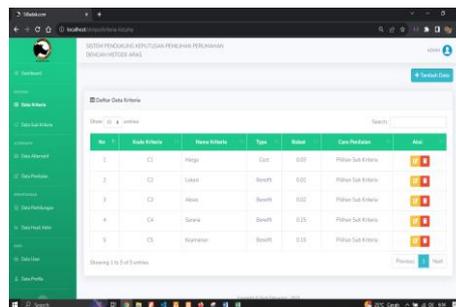

Image 5. User Interface Criteria Data Page

User Interface Sub Criteria Data Page
Description: This page features a Sub Criteria Data form that the Admin needs to complete to specify sub-criteria related to previously input criteria.
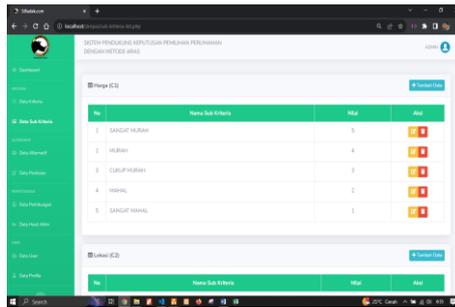
Image 6. User Interface Sub Criteria Data Page

Alternative Data Page User Interface
Description: On this page there is an Alternative Data form that must be added by the Admin regarding Alternative Data in the form of housing which will later become a recommended choice for the user.
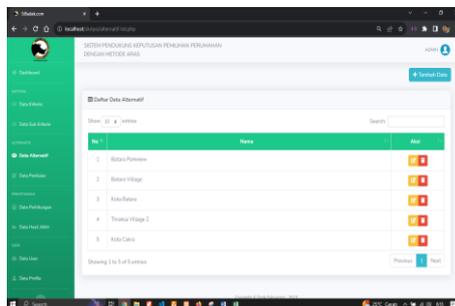

Image 7. Alternative Data Page User Interface

User Interface Assessment Data Page
Description: This page contains the Alternative Assessment Data form, which the Admin must complete to input values for alternatives based on the criteria previously entered. This allows the system to evaluate alternatives according to user-defined criteria.
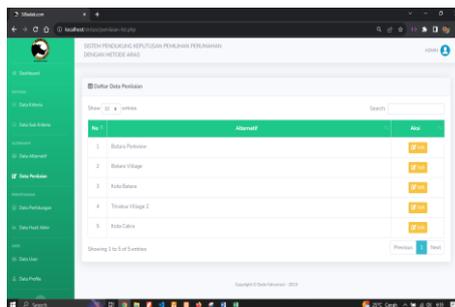

Image 8. User Interface Assessment Data Page

User Interface Calculation Data Page
Description: This page displays the calculation stages using the ARAS Method based on Criteria Data, Sub-Criteria Data, Alternative Data and Alternative Assessment Data that have been previously input into the system.
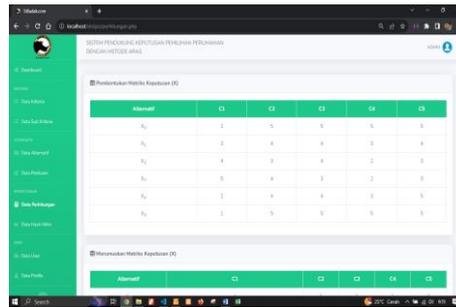
Image 9. User Interface Calculation Data Page

User Interface Final Result Data Page
Description: This page displays the final calculation results in the form of a ranked list, showing which housing alternatives best meet the criteria specified by the user.
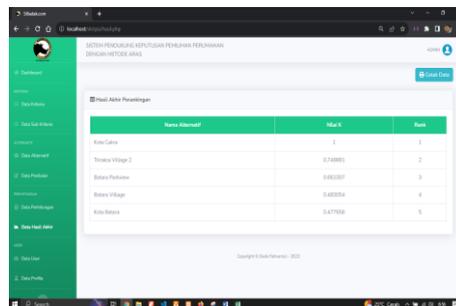

Image 10. User Interface Final Result Data Page

User Interface User Data Page
Description: This page displays the data of registered users and is accessible exclusively to Admin accounts.
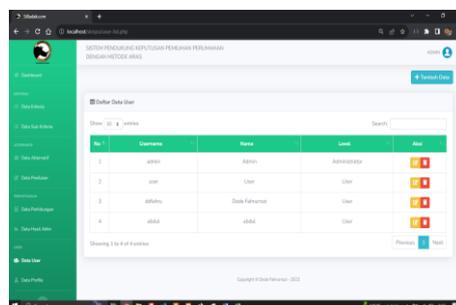

Image 11. User Interface User Data Page

User Interface Profile Data Page
Description: This page displays the user's profile information. It allows users to update their username, password, and email address.
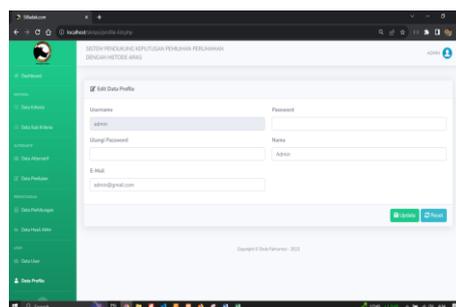

Image 12. User Interface Profile Data Page

User Interface Logout Page
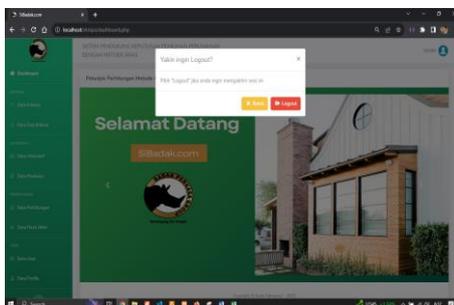Description: This page displays a confirmation notification to verify the user's intent to log out of the system.

Image 13. User Interface Halaman Logout

5. CONCLUSION, IMPLICATION, SUGGESTION, AND LIMITATIONS

Based on the research results on "Designing a Decision Support System for Housing Selection Using the Web-Based Additive Ratio Assessment (ARAS) Method," it can be concluded that this study successfully minimizes the risk of errors in housing selection by prospective buyers. By utilizing a decision support system based on the ARAS method, prospective buyers can obtain housing recommendations presented in the form of rankings according to the criteria they have set, thereby helping them make more accurate decisions aligned with their needs and personal preferences. Additionally, the study has successfully designed a decision support system that employs the ARAS method, incorporating computerized calculation processes to generate accurate and relevant recommendations. Supported by web technology, this system is easily accessible to prospective buyers, facilitating a more streamlined self-selection process for housing.

This research has several significant implications. For prospective buyers, the designed system provides crucial support in making more informed decisions, enhancing confidence in choosing housing that meets their criteria, and reducing the likelihood of regret in the future. These implications also extend to property developers, as understanding how a decision support system can aid buyers can be used to tailor their product offerings to market preferences identified through this system, thus increasing customer satisfaction and sales potential. Furthermore, for researchers and system developers, the ARAS method used in this study can serve as a foundation for further development in decision support systems across various fields that require multi-criteria decision-making.

However, this study also has some limitations that need to be considered. One limitation is the use of a limited set of criteria in the decision-making process, which may result in neglecting other important aspects for prospective buyers, such as aesthetic features, building quality, and developer reputation. Additionally, the designed system has not been extensively tested in real-world conditions, so its effectiveness in practical scenarios may differ from the simulation results. Another limitation is the system's accessibility and speed for users in areas with poor internet connectivity, as well as the lack of integration with real-time data that could enhance recommendation relevance. Despite these limitations, the system still provides valuable contributions to the decision-making process, although it involves subjective factors from buyers in determining criteria weights, which can lead to varied recommendation results based on individual preferences.

Based on the conclusions and identified limitations, several recommendations can be made for further development. The system could be improved by incorporating additional relevant criteria for prospective buyers, such as environmental aspects, accessibility to public facilities, and safety, thereby enhancing the system's ability to provide more comprehensive recommendations. Moreover, integrating artificial intelligence (AI) and machine learning technologies could be considered to improve recommendation accuracy and relevance, as these technologies can learn user preferences and behavior patterns over time. Testing the system in a broader market is also recommended to assess its effectiveness and efficiency in diverse contexts, and educating prospective buyers about the system's benefits and usage is crucial to improve understanding, acceptance, and utilization of the system in the housing selection process.

REFERENCES
Abdulghani, T., Maulana, M., & Gozali, H. (2019). Sistem Konsultasi dan Bimbingan Online Berbasis Web

Menggunakan Webrtc (Studi Kasus : Fakultas Teknik Universitas Suryakancana). Media Jurnal Informatika, 11(2). http://jurnal.unsur.ac.id/mjinformatika

Adib, D. F., & Lestanti, S. (2020). Penerapan Metode Additive Ratio Assessment (ARAS) Untuk Mendukung Penilaian Kinerja Guru Pada SDN Sentul 02. Journal of Informatics, Information System, Software Engineering and Applications, 3(1), 1–13. https://doi.org/10.20895/INISTA.V2I2

Arizona, K., Abidin, Z., & Rumansyah, R. (2020). pembelajaran online berbasis proyek salah satu solusi kegiatan belajar mengajar di tengah pandemi covid-19. Jurnal Ilmiah Profesi Pendidikan, 5(1), 64–70. https://doi.org/10.29303/jipp.v5i1.111

Ayu, F., Permatasari, N., Informatika, M., Riau, M., Soebrantas, J. H., & 77 Panam, N. (2018). perancangan sistem informasi pengolahan data praktek kerja lapangan (pkl) pada devisi humas pt. pegadaian. 2(2).

Barita, P., Simangunsong, N., & Sinaga, S. B. (2019). 878-Article Text-4573-1-10-20220405 (1). 173–178.

Cholil, S. R., & Prisiswo, E. S. (2020). Sistem Pendukung Keputusan Seleksi Calon Karyawan Baru PT. Dawam Prima Perkasa Menggunakan Metode Aras Berbasis Web. Jurnal Rekayasa Sistem & Industri (JRSI), 7, 107. https://doi.org/10.25124/jrsi.v7i2.422

Damayanti. (2020). Sistem Pendukung Keputusan Penerimaan Member Merah Untuk Pedagang Yang Layak Pada Indogrosir Dengan Menggunakan Metode ARAS. Seminar Nasional Teknologi Komputer & Sains (SAINTEKS), 453–458.

Hafiz, A. (2018). 277334-Sistem-Pendukung-Keputusan-Pemilihan-Kar-260B939D. XV(April), 23–28.

Kurniawati Zai, E., Hafizah, H., & Ginting, R. I. (2022). Sistem Pendukung Keputusan Rekomendasi Tempat Wisata Menggunakan Metode Additive Ratio Assessment (ARAS). Jurnal Sistem Informasi Triguna Dharma (JURSI TGD), 1(3), 207. https://doi.org/10.53513/jursi.v1i3.5269

Laisina, L. H., Haurissa, M. A. F., Hatala, Z., Teknik, Politeknik, E., & Ambon, N. (2018). sistem informasi data jemaat gpm gidion waiyari ambon dan jemaat gpm halong anugerah ambon. 8(2).

Maulana, C., Hendrawan, A., Praba, A., & Pinem, R. (2019). pemodelan penentuan kredit simpan pinjam menggunakan metode additive ratio assessment (ARAS). Pengembangan Rekayasa Dan Teknologi, 15(1). http://journals.usm.ac.id/index.php/jprt/index

Nugrahanti, F. (2019). Pengenalan Aplikasi dan Implementasi Basis Data di Lingkungan Kampus. In منشورات جامعة دمشق (Vol. 1999, Issue December).

Prasetyo, B., Pattiasina, T. J., & Soetarmono, A. N. (2015). 12 TEKNIKA Volume.4 Nomor 1.

Puspita, D., & Anggita, M. (2020). penerapan unified modeling language (uml) dalam membangun sistem pengenalan usaha kecil menengah (ukm) kota pagaralam. JUSIM (Jurnal Sistem Informasi Musirawas), 5(02), 103–110. https://doi.org/10.32767/jusim.v5i02.805

Ridwan, M., Arifin, Z., Studi Ilmu Komputer, P., Ilmu Komputer dan Teknologi Informasi, F., Mulawarman Jalan Barong Tongkok Kampus Gunung Kelua Samarinda, U., & Timur, K. (2016). rancang bangun e-voting dengan menggunakan keamanan algoritma rivest shamir adleman (rsa) berbasis web (studi kasus: pemilihan ketua bem fmipa). Jurnal Informatika Mulawarman, 11(2). http://doc.google.com

Rosmini, R., Darmawati, D., & Fadlan, M. (2021). Sistem Pendukung Keputusan Pemberian Reward Dan Punishment Karyawan Bank Bri Menggunakan Metode Additive Ratio Assessment (Aras). Sebatik, 25(2), 748–755. https://doi.org/10.46984/sebatik.v25i2.1659

Sitompul, T. R., & Hasibuan, N. A. (2018). Sistem Pendukung Keputusan Seleksi Tenaga Kerja Untuk Security Service Menggunakan Metode Aras. Jurnal Media Informatika Budidarma, 2(1), 1–9. https://doi.org/10.30865/mib.v2i1.812

Sri Agustiani Br Siburian, Mohammad Taufan Asri Zaen, Setiawansyah, Dodi Siregar, Erlin Windia Ambarsari, & Yuwan Jumaryadi. (2023). Penerapan Metode Additive Ratio Assement (ARAS) dalam Pemilihan Customer Service Terbaik. Journal of Informatics Management and Information Technology, 3(1), 12–17. https://doi.org/10.47065/jimat.v3i1.239

Sukamto, Salambue, R., Fitriansyah, A., & Mahdiyah, E. (2023). Jurnal Politeknik Caltex Riau Penerapan Metode ARAS untuk Menentukan Kelayakan Perpustakaan Sekolah Diakreditasi. Jurnal Politeknik Caltex Riau, 9(1), 65–73.

Surbakti, J. F., Zulkarnain, I., & Hutasuhut, M. (2023). Sistem Pendukung Keputusan Dalam Menentukan Prioritas Wilayah Perbaikan Jalan Menggunakan Metode ARAS. Jurnal Sistem Informasi Triguna Dharma (JURSI TGD), 2(1), 19. https://doi.org/10.53513/jursi.v2i1.5416

Susanto, H. (2018). Penerapan Metode Additive Ratio Assessment(Aras) Dalam Pendukung Keputusan Pemilihan Susu Gym Terbaik Untuk Menambah Masa Otot. Majalah Ilmiah INTI, 13(2), 1–5.

William, W., & Andah, B. D. (2020). penerapan electronic customer relationship management (e-crm) dalam upaya meningkatkan pendapatan penjualan pada pt. cipta aneka buah. idealis: InDonEsiA JournaL Information System, 3(1), 20–25. https://doi.org/10.36080/idealis.v3i1.1467

Abdulghani, T., Maulana, M., & Gozali, H. (2019). Sistem Konsultasi dan Bimbingan Online Berbasis Web Menggunakan Webrtc (Studi Kasus : Fakultas Teknik Universitas Suryakancana). Media Jurnal Informatika, 11(2). http://jurnal.unsur.ac.id/mjinformatika

Adib, D. F., & Lestanti, S. (2020). Penerapan Metode Additive Ratio Assessment (ARAS) Untuk Mendukung Penilaian Kinerja Guru Pada SDN Sentul 02. Journal of Informatics, Information System, Software Engineering and Applications, 3(1), 1–13. https://doi.org/10.20895/INISTA.V2I2

Arizona, K., Abidin, Z., & Rumansyah, R. (2020). pembelajaran online berbasis proyek salah satu solusi kegiatan belajar mengajar di tengah pandemi covid-19. Jurnal Ilmiah Profesi Pendidikan, 5(1), 64–70. https://doi.org/10.29303/jipp.v5i1.111

Ayu, F., Permatasari, N., Informatika, M., Riau, M., Soebrantas, J. H., & 77 Panam, N. (2018). perancangan sistem informasi pengolahan data praktek kerja lapangan (pkl) pada divisi humas pt. pegadaian. 2(2).

Barita, P., Simangunsong, N., & Sinaga, S. B. (2019). 878-Article Text-4573-1-10-20220405 (1). 173–178.

Cholil, S. R., & Prisiswo, E. S. (2020). Sistem Pendukung Keputusan Seleksi Calon Karyawan Baru PT. Dawam Prima Perkasa Menggunakan Metode Aras Berbasis Web. Jurnal Rekayasa Sistem & Industri (JRSI), 7, 107. https://doi.org/10.25124/jrsi.v7i2.422

Damayanti. (2020). Sistem Pendukung Keputusan Penerimaan Member Merah Untuk Pedagang Yang Layak Pada Indogrosir Dengan Menggunakan Metode ARAS. Seminar Nasional Teknologi Komputer & Sains (SAINTEKS), 453–458.

Hafiz, A. (2018). 277334-Sistem-Pendukung-Keputusan-Pemilihan-Kar-260B939D. XV(April), 23–28.

Kurniawati Zai, E., Hafizah, H., & Ginting, R. I. (2022). Sistem Pendukung Keputusan Rekomendasi Tempat Wisata Menggunakan Metode Additive Ratio Assessment (ARAS). Jurnal Sistem Informasi Triguna Dharma (JURSI TGD), 1(3), 207. https://doi.org/10.53513/jursi.v1i3.5269

Laisina, L. H., Haurissa, M. A. F., Hatala, Z., Teknik, Politeknik, E., & Ambon, N. (2018). sistem informasi data jemaat gpm gidion waiyari ambon dan jemaat gpm halong anugerah ambon. 8(2).

Maulana, C., Hendrawan, A., Praba, A., & Pinem, R. (2019). pemodelan penentuan kredit simpan pinjam menggunakan metode additive ratio assessment (ARAS). Pengembangan Rekayasa Dan Teknologi, 15(1). http://journals.usm.ac.id/index.php/jprt/index