The Effect of Implementing Profile Matching Algorithm on Computation Time on Barebone Type Mechanical Keyboard Recommendations

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Abstract. The research aims to determine the comparison of computing time between the AHP method and a combination of AHP and profile matching on a certain amount of data. Apart from that, this research is also aimed at building a system that can provide recommendations for barebone mechanical keyboards based on the criteria or preferences desired by the user. Design/methodology/approach: The methods compared in the research were AHP and a combination of AHP with profile matching using 10 criteria and various scenarios for the amount of testing data. Meanwhile, in the system being built, there are 70 alternative data in the form of a list of barebone mechanical keyboards circulating on the market until August 2023. Findings/result: The computational time testing carried out resulted in the combination of AHP and profile matching methods being 8,217 times faster than the AHP method running alone. Apart from that, the system was also successfully built well as indicated by the results of black box tests carried out by several testers which were in line with expectations. Originality/value/state of the art: The combination of the AHP method with profile matching can be said to be faster than the AHP method when dealing with cases that have a large amount of data, both criteria and alternatives.

Keywords: Matching, AHP, Combination, Keyboard

1 Introduction

Mechanical keyboard is a hardware device on a computer that is used to provide input and has a variety of designs and can be customized by its users [1]. The striking difference between the two is in the mechanism where the mechanical keyboard uses a different mechanical switch for each button, while the membrane keyboard uses rubber that touches a point on the PCB board [2]. Based on the results of a survey conducted, it is known that 60% of Indonesia Mechanical Keyboard Group (IMKG) community members have at least experienced difficulties when trying to find or choose a product that suits their preferences. Therefore, a decision support system is needed that can provide a list of product recommendations that match diverse user preferences. In

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previous research, there was a decision support system that used the AHP algorithm to provide recommendations for laptop products that successfully provided product recommendations as desired [3]. The AHP method has the advantage of calculating the level of consistency of each criterion and alternative used in the decision-making process [4]. However, the disadvantages of this AHP method are that the entire process of inputting comparison values must be repeated from the beginning when used to determine results according to diverse user preferences and long computation time when encountering large amounts of data [5], [6]. To overcome these problems, it is proposed to combine AHP with profile matching. The profile matching method was chosen because it calculates the best alternative based on the similarity between the profile specified by the user and the profile owned by each existing alternative [7]. Previous research using the profile matching method was able to produce recommendations for boarding places for students who were suitable and in accordance with the preference value [8]. This research will create a system that can provide a list of mechanical keyboard product recommendations with barebone type based on 10 criteria, namely PCB type, switch orientation, stabilizer type, plate material, case material, mounting type, connection type, layout size, add-on, and software. This research will also compare the performance between the AHP method and the combination of AHP and profile matching in terms of computation time. The results of the recommendation list and computation time test results are expected to be able to help users, especially members of the IMKG community, to get the best alternative in a short time.

2 Research Method

The method used in this research is a quantitative method where the data used can be analyzed mathematically, statistically, or computationally. The research stage is carried out by identifying problems, collecting data, processing data, making and testing models, implementation, and then ending with drawing conclusions based on system testing and comparing model computing time.

2.1. Data Collection

There are two types of data used in the research, namely data for the list of alternatives and data for criteria. Alternative data is obtained from local marketplace websites and several product websites to complete specifications. The alternative data used is 70 mechanical keyboard data with barebone types on the Indonesian market until August 2023. Meanwhile, the criteria data was obtained from a questionnaire filled out by 102 respondents in the IMKG community.

2.2. Data Processing

The results of the questionnaire that has been filled in by some community members in the form of a list of criteria used to select a mechanical keyboard type are processed first because there are criteria that should not be found on a barebone mechanical keyboard. Details of the specifications used according to the criteria obtained from various sources

such as the brand's official website and several marketplaces are still in the form of string data so they need to be converted or converted into numerical data to enter the calculation of ranking profile matching.

2.3. Model Building and Testing

The model created in the research uses AHP and profile matching algorithms. AHP is used to calculate the weight of each criterion in all models and to calculate alternative rankings, the first model uses AHP and the second model uses profile matching.

2.4. AHP algorithm

AHP is a method in decision support system that works by calculating the best alternative based on pairwise comparisons in a hierarchy both subjectively and objectively [9]. This method has basic principles, namely decomposition, comparative judgment, synthesis of priority, and logical consistency [10]. **Figure 1** is the flow of the algorithm of the AHP method.

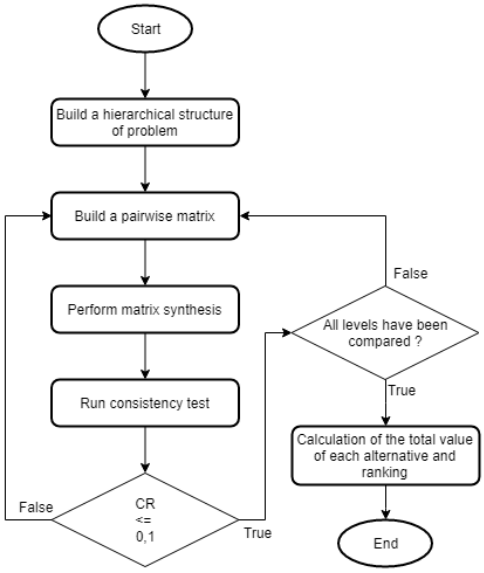

Fig. 1. AHP Flowcahrt

2.5. AHP - Profile Matching Combination Algorithm Model

In the combination model, the AHP method is used to calculate the priority weight of each criterion used. While profile matching is used to calculate the scores of alternatives. Profile matching is a method that works by assuming that the subject or object under study must meet a predetermined level of ideal predictor variables [12]. The

decision results provided by this method are calculated from the level of similarity between 2 profiles, namely profiles of all alternatives and profiles created by users [13].

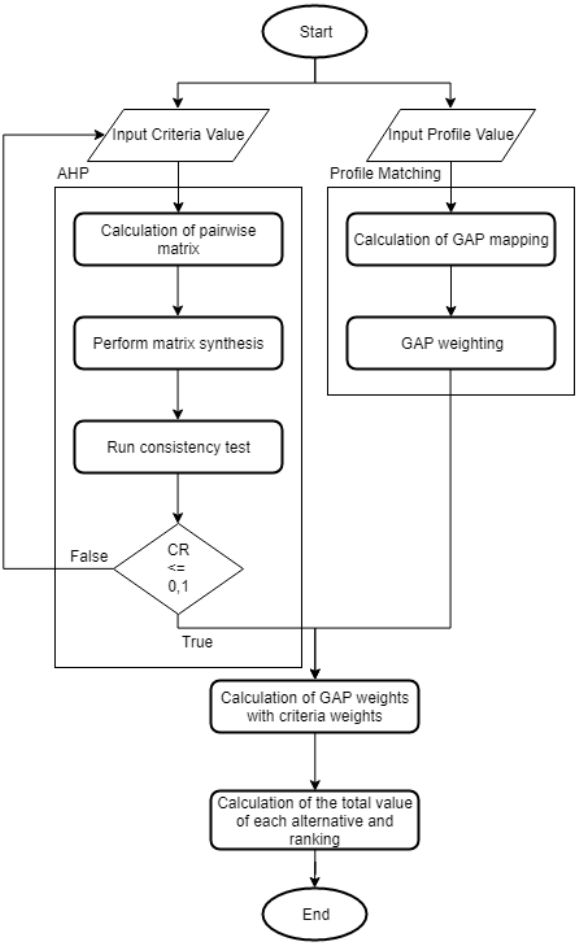

Fig. 2. AHP-Profile Matching Combination Flowcahrt

Figure 2 shows the flow of the algorithm combination. The calculation starts by inputting the importance value of the criteria which is then used to calculate the priority weight using AHP. The weight calculation stage is carried out as in subchapter E, However, the calculation of alternative values is replaced with the profile matching method. The calculation steps of the profile matching method are as follows [14]:

a. Leveling the GAP based on each criterion. GAP determination is done by calculating the difference between the profile of each alternative and the profile created based on user preferences.
b. Performing GAP weighting based on following **Table 1**:

Table 1. RI Value

Difference	Weight Value	Description
0	10	Competence as required
1	9,5	Competency , 1 level advantage
-1	9	Competency , 1 level deficiency
2	8,5	Competency , 2 level advantage
-2	8	Competency , 2 level deficiency
3	7,5	Competency , 3 level advantage
-3	7	Competency , 3 level deficiency
4	6,5	Competency , 4 level advantage
-4	6	Competency , 4 level deficiency
5	5,5	Competency , 5 level advantage
-5	5	Competency , 5 level deficiency
6	4,5	Competency , 6 level advantage
-6	4	Competency , 6 level deficiency
7	3,5	Competency , 7 level advantage
-7	3	Competency , 7 level advantage
8	2,5	Competency , 8 level deficiency
-8	2	Competency , 8 level advantage
9	1,5	Competency , 9 level deficiency
-9	1	Competency , 9 level advantage

c. Calculating the final value and ranking, The final value of all alternatives is calculated based on the GAP weight value of each criterion multiplied by the priority weight of the criteria concerned. Then all these values are summed up which are then used for ranking based on the highest to lowest score. An excellent style manual for science writers is [7].

Model testing is done by testing computation time to find out which method is faster in providing a list of product recommendations. Testing is done with several scenarios with different amounts of data in each test scenario.The system in the study was implemented using the waterfall method which is a structured system development method because the development phase is carried out coherently from top to bottom [15]. The waterfall method starts from the communication stage which is the stage of collecting system development needs. Then proceed with the planning stage which is the resource planning stage. The next stage continues with modeling, namely making a prototype design of the system. Then enter the construction stage, which is starting to build a system that has been designed, including coding and product testing. The last stage is deployment to get feedback from users and periodic maintenance.

3. Results and Discussion

Based on the results of black box testing conducted on the system, it is found that all system pages run as they function. In addition, the results of alternative recommendations can change according to the weights and criteria used in the input process by the user. Testing is also carried out by comparing the computation time between the AHP method with a combination of AHP and profile matching. Testing is done with several scenarios of different amounts of data. Testing in each scenario is done 10 times to find out the average computation time required from each method. The test results can be seen in the following table.

Table 2. AHP Time Testing Result

Data	Trial to										Mean
	1	2	3	4	5	6	7	8	9	10	
50	90,3	103	85,8	156	95,6	98,3	90	93,6	162	83,7	105,83
100	124	241	125	121	250	118	126	121	229	120	157,5
250	279	151	163	154	155	163	157	294	162	159	183,7
500	312	277	288	283	300	295	272	495	266	299	308,7
1000	770	1320	754	703	748	734	726	1010	684	695	814,4
Mean											200,15

Table 3. Combination Time Testing

Data	Trial to										Mean
	1	2	3	4	5	6	7	8	9	10	
50	16,3	27,7	26,6	25,5	22,6	15,8	20,1	23,6	20,5	26,4	22,51
100	26,5	26,3	23,3	16,3	17,4	23,9	20,4	17	22,7	16,5	21,03
250	31,2	17,9	24,2	12,3	25,5	20,5	12,3	23,1	22,7	22,9	21,26
500	34,6	28,3	18,6	24	19,3	28	25	29	28,4	18,8	25,4
1000	40,5	29,4	29,9	38,6	21,5	35,6	34,7	31,8	30,3	23,6	31,59
Mean											24,358

Based on the test results in Table 2 and Table 3, the AHP - profile matching method has a faster average time in various test scenarios by 8.217 times compared to the AHP method that works alone. This can happen because the profile matching method can shorten the process of calculating alternative values. As an illustration, to calculate a case where there are 5 criteria and 3 alternatives used, the first step in both AHP and AHP - profile matching combination methods is the same, namely calculating the priority weight of each criterion based on user input values. The process starts from creating a pairwise comparison matrix and continues with matrix synthesis to get the priority weight value of the criteria and ends with a consistency calculation. The significant difference between the two is in the calculation of alternative values. For the AHP method itself, users are asked to input values to create a pairwise comparison matrix between alternatives based on the first criterion, then synthesize the matrix and end by calculating consistency. Because the criteria used are 5, the calculation is carried out as many as the number of criteria used where the comparison of alternatives is based on the criteria concerned. After the process is complete, the next step is to calculate the final value of the alternative based on the priority weight value multiplied by the comparative value of a pairwise comparison matrix.

4. Conclusion

Based on the research that has been done, the combination of the AHP method with profile matching has an average computation time of 8.217 times faster than the AHP method that runs alone on various test scenarios. In addition, the system built with a combination of AHP with profile matching can run well and provide different product recommendations according to the preferences desired by the user. For further research, the suggestion that can be given is to make changes to both alternative data and criteria that are adjusted to the conditions in the field. In addition, the addition of methods can also be done by adding methods or algorithms that can provide calculations between review results (benefits) and product prices (costs) because the profile matching method does not support this.

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References

1. A. D. Handayani and R. Wardoyo, "DSS for Keyboard Mechanical Selection Using AHP and Profile Matching Method," *IJCCS (Indonesian Journal of Computing and Cybernetics Systems)*, vol. 15, no. 4, p. 369, Oct. 2021, doi: 10.22146/ijccs.67813.
2. T. Pham and N. Kelling, "Mechanical and membrane keyboard typing assessment using surface electromyography (sEMG)," in *Proceedings of the Human Factors and Ergonomics Society*, Human Factors and Ergonomics Society Inc., 2015, pp. 912–915. doi: 10.1177/1541931215591268.
3. G. P. Sanyoto, R. I. Handayani, and E. Widanengsih, "Sistem Pendukung Keputusan Pemilihan Laptop Untuk Kebutuhan Operasional Dengan Metode AHP (Studi Kasus: Direktorat Pembinaan Kursus dan Pelatihan KEMDIKBUD)," *Jurnal Pilar Nusa Mandiri*, vol. 13, no. 2, pp. 167–174, 2017.
4. A. I. J. Nisa, R. Prawiro, and N. Trisna, "Analisis Hybrid DSS untuk Menentukan Lokasi Wisata Terbaik," *Jurnal RESTI (Rekayasa Sistem dan Teknologi Informasi)*, vol. 5, no. 2, pp. 238–246, Apr. 2021, doi: 10.29207/resti.v5i2.2915.
5. C. Devi, A. Setiyanto, and A. B. Prasetio, "METODE AHP DAN TOPSIS DALAM PEMILIHAN RESTORAN DI KOTA PONTIANAK," *Jurnal Aplikasi Teknologi Informasi dan Manajemen (JATIM)*, vol. 3, no. 2, pp. 199–209, 2022.
6. M. A. Noviansyah, I. Cholissodin, and B. Rahayudi, "Penerapan Metode AHP dan TOPSIS sebagai Sistem Pendukung Keputusan untuk Pemilihan Laptop Baru dan Bekas sebagai Media Penunjang Pembelajaran Masa dan Pasca Pandemi COVID-19," *Jurnal Pengembangan Teknologi Informasi dan Ilmu Komputer*, vol. 5, no. 12, pp. 5205–5212, 2021, [Online]. Available: http://j-ptiik.ub.ac.id
7. R. Somya and R. Wardoyo, "Perancangan Sistem Pendukung Keputusan Seleksi Asisten Dosen Menggunakan Kombinasi Metode Profile Matching dan TOPSIS Berbasis Web Service," *KHAZANAH INFORMATIKA*, vol. 5, no. 1, pp. 44–50, 2019.
8. L. Bachtiar, "Sistem Pendukung Keputusan Rekomendasi Tempat Kost Untuk Mahasiswa di Kota Sampit," *Jurnal TEKINKOM*, vol. 6, no. 1, pp. 180–187, 2023, doi: 10.37600/tekinkom.v6i1.833.

9. A. G. Ramadhan and R. R. Santika, “AHP dan WP: Metode dalam Membangun Sistem Pendukung Keputusan (SPK) Karyawan Terbaik,” *Edumatic: Jurnal Pendidikan Informatika*, vol. 4, no. 1, pp. 141–150, 2020, doi: 10.29408/edumatic.v4i1.2163.
10. G. S. Mahendra and K. Y. Ernanda Aryanto, “SPK Penentuan Lokasi ATM Menggunakan Metode AHP dan SAW,” *Jurnal Nasional Teknologi dan Sistem Informasi*, vol. 5, no. 1, pp. 49–56, Apr. 2019, doi: 10.25077/teknosi.v5i1.2019.49-56.
11. I. Syafrinal and D. Aldo, “Implementasi Metode Analytical Hierarchy Process (AHP) Untuk Penilaian Rumah Huni,” *JURNAL INOVTEK POLBENG SERI INFORMATIKA*, vol. 5, no. 2, pp. 205–217, 2020.
12. G. S. Mahendra and E. Hartono, “Komparasi Analisis Konsistensi Metode AHP-MAUT dan AHP-PM pada SPK Penempatan Siswa OJT,” *Jurnal Teknologi Informasi dan Komputer*, vol. 7, no. 2, pp. 164–176, 2021, doi: 10.36002/jutik.v7i2.1317.
13. R. Nuraini, “Implementasi Metode Profile Matching Pada Sistem Pendukung Keputusan Pemilihan Distributor Alat Kesehatan,” *Jurnal Informatika: Jurnal pengembangan IT (JPIT)*, vol. 7, no. 3, pp. 141–148, 2022.
14. Z. Efendi, “Sistem Pendukung Keputusan Pemilihan Lokasi Perumahan Menggunakan Metode Profile Matching,” *JURTEKSI (Jurnal Teknologi dan Sistem Informasi)*, vol. 6, no. 1, pp. 79–86, Dec. 2019, doi: 10.33330/jurteksi.v6i1.408.
15. D. Murdiani and H. Hermawan, “Perbandingan Metode Waterfall dan RAD (Rapid Application Development) Pada Pengembangan Sistem Informasi,” *Jurnal Teknologi Informasi*, vol. 6, no. 1, pp. 14–23, 2022.