

Optimization of Dental Clinic Selection Using Item-Based Collaborative Filtering with Pearson Correlation

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Article Information	ABSTRACT
Article History Received : June 19, 2025 Revised : July 08, 2025 Published : July 18, 2025	The advancement of technology in the healthcare sector (e-health) has encouraged dental clinics in Bekasi City to adopt digital systems. However, many clinics have yet to take advantage of this technology. The wide variety of dental clinic options often makes it difficult for users to determine which clinic best suits their needs. This study developed a web-based recommendation system using the Item-Based Collaborative Filtering method and Pearson Correlation calculation. The system recommends clinics based on the similarity of ratings between items, calculated from users' historical data, and generates predictions using the Weighted Sum algorithm. Recommendations are displayed in table format on the website. The system was developed using PHP and MySQL, with 20 dental clinics in Bekasi City as the research objects. It was tested using Blackbox Testing and User Acceptance Testing (UAT). The MAE evaluation result of 0.28 demonstrates the system's good prediction accuracy, and the SUS score of 80 places it in the "Excellent" category.
Keywords: <i>Recommendation; Website; Clinic; Filtering; Pearson Correlation.</i>	

INTRODUCTION

The development of information technology in the current era has been significantly utilized across various sectors, including the healthcare field, through the application of e-health (electronic health) concepts (Azizah & Putra, 2019). Several dental clinics in Bekasi City have reportedly begun adopting this technology in their operations. However, the implementation of information technology has not yet been evenly distributed across all dental clinics in the region.

Health is regarded as a fundamental aspect that cannot be separated from the continuity of human life. To optimize public health, accessible healthcare facilities are required throughout all stages of life from birth to death including for treatment, routine check-ups, and disease prevention. One of the national health policy directions in the Strategic Plan of the Indonesian Ministry of Health 2020–2024 focuses on strengthening basic healthcare services through the transformation of primary care, aiming to improve the quality and reach of healthcare services. One essential healthcare facility required in society is the clinic. According to Regulation No. 9 of 2014 by the Ministry of Health of the Republic of Indonesia, a clinic is defined as a healthcare facility that delivers individual healthcare services by providing both basic and specialist medical services (Runggandini & Salim, 2023)(Ministry of Health, 2014-2020).

Dental clinics fall under the category of public healthcare facilities that offer both general and specialist medical services, typically operated by more than one healthcare professional and led by a certified medical practitioner (Raihan, 2021). To support the effectiveness of services

provided by dental clinics, a system is needed that can offer recommendations to patients in determining appropriate treatment locations. However, the increasing spread of information due to technological advancements has created new challenges. The vast amount and diversity of information available on the internet often make it difficult for users to find relevant and accurate data. Previously, health-related information was more commonly found in printed media, but with the advancement of digital technologies, information has shifted to electronic media, particularly the internet, which presents various versions of information some of which may be confusing.

One approach that can be used to overcome this issue is the implementation of a recommendation system, which is designed to help users discover, choose, and decide upon a product, service, or information within a specific domain. A recommendation system is developed to provide and suggest items that match users' needs or preferences (Muarif & Winarno, 2022). This system can predict the items that users are likely to choose based on interaction history or the preferences of similar users. In the context of dental clinics, recommendations can be generated based on the ratings provided by other users or users with similar behavior patterns.

This study aims to develop a dental clinic recommendation system based on user ratings. The Item-Based Collaborative Filtering method was chosen for its ability to generate recommendations by analyzing similarities between clinics from users' rating histories. With this approach, patients can more easily find clinic services that match their needs..

Several international studies have extended the application of Item-Based Collaborative Filtering (IBCF) across various domains. Farokhi et al. (TripAdvisor dataset) reported an MAE of 0.73 for an IBCF model enhanced with fuzzy C-means clustering (Farokhi et al, 2016). Mustika Dewi et al. found an MAE of 2.537 in their implementation of IBCF for tourism destination recommendations in Yogyakarta (Dewi et al, 2025). Arvianti et al., in a hybrid clustering study conducted in Bandung, achieved optimal MAE values ranging from approximately 0.246 to 0.249 (Arvianti et al., 2019). Meanwhile, Xue et al. proposed DeepICF, a deep learning-based approach that captures non-linear relationships between items (Xue et al, 2018).

The objective of this study is to design and develop a web-based dental clinic recommendation system by applying the Item-Based Collaborative Filtering method in combination with Pearson Correlation and the Weighted Sum algorithm. Through this approach, a system is expected to be provided that can automatically generate clinic recommendations based on user preferences. The benefit of the developed system is to facilitate users in obtaining relevant information about dental clinics, thereby producing recommendations in the form of clinic ratings that align with each user's individual needs and preferences.

RESEARCH METHODS

Recommendation systems have been developed to assist users in overcoming the problem of information overload by providing specifically tailored suggestions based on user preferences, with the expectation that these recommendations will fulfill user needs and desires. Various domains have adopted recommendation systems to generate predictions, such as in the selection of movies, clinics, hospitals, tourist destinations, and others. To produce relevant recommendations, appropriate recommendation modeling is required so that the information provided can support users in making more accurate item selection decisions (Ilyasa & Yamasari, 2023) (Jaja, V. L., Susanto, B., & Sasongko, L. R., 2020).

According to Hartatik, Nurhayati, and Widayani (2021), recommendation systems are designed with the objective of suggesting items that are likely to be of interest to users based on observed preferences. These systems have been widely implemented on various digital platforms such as marketplaces and social media. Currently, there are three popular approaches in recommendation systems: Collaborative Filtering, Content-Based Filtering, and the Hybrid approach (Muliadi & Lestari, 2019).

Item-Based Collaborative Filtering

Item-Based Collaborative Filtering provides recommendations to users by calculating the similarity between items or products, based on the ratings given by users (Ritdrix & Wirawan, 2018). Item-Based Filtering, one of the Collaborative Filtering methods, was introduced by Amazon in 1998. Collaborative Filtering itself is a technique used to predict user preferences and identify items that users may like, based on information gathered from other users with similar preferences (Febrianto, F., Andjarwirawan, J., & Intan, R., 2021).

In the Item-Based Collaborative Filtering method, items that have been rated by users are used as the basis for computation. The term “collaborative” refers to the fact that users collaborate with one another indirectly to recommend items. The method calculates how similar the rated items are to other items, and then selects a group of items with the highest similarity values. These similarity values are then recorded and used as weights to predict the rating of an item that a user may be interested in (Jaja, V. L., Susanto, B., & Sasongko, L. R., 2020).

Pearson Correlation

The Pearson Correlation approach is a method developed by Karl Pearson (Kennedy P. S. J. & Helena, 2024). Correlation is a measurement technique used to determine how closely related two different sets of numerical values are. These sets must have a consistent and corresponding order, meaning each value in one set aligns with a value in the other. The result of the measurement can show either a positive or negative relationship. A positive correlation indicates that both sets tend to increase or rise together in a parallel manner. Conversely, a negative correlation indicates that both sets tend to decrease or decline together. In this context, “parallel” means that the increase or decrease in one variable is followed by a corresponding increase or decrease in the other variable. One of the most widely used techniques for measuring correlation is the Pearson Product-Moment Correlation, commonly referred to as Pearson Correlation (Yuniardini & Widiyaningtyas, 2024). The following Equation (1) is typically used to calculate the similarity between items rated by users.

$$r_{xy} = \frac{\sum_{i=1}^n (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^n (x_i - \bar{x})^2} \sqrt{\sum_{i=1}^n (y_i - \bar{y})^2}} \quad (1)$$

Description:

- r_{xy} is the similarity value between item x and item y.
- n is the total number of users who rated both item x and item y.
- $\bar{x}$ and $\bar{y}$ represent the average ratings for item x and item y, respectively.
- x_i and y_i are the ratings given by user i to item x and item y, respectively.

This research was conducted using an iterative method because this approach allows software development to be carried out in stages and repeated cycles. Each phase can be evaluated and refined before proceeding to the next, making it more flexible in addressing changing requirements during the development process. This method involves several iterative cycles, which include the stages of requirements analysis, system design, implementation, and testing. Each iteration produces a version of the system that increasingly aligns with the users' final needs. An illustration of the iterative method stages can be seen in Figure 1.

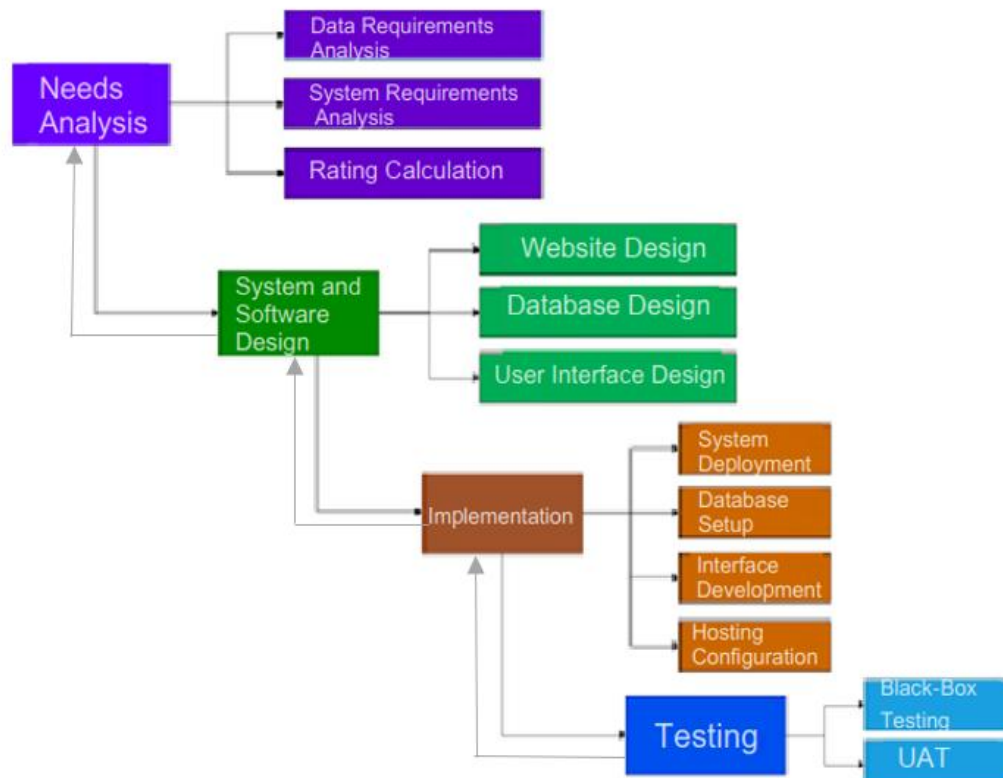


Figure 1. Research Stages

RESULTS AND DISCUSSION

In this study, a method was used to calculate the correlation between two variables, known as the Pearson Correlation Similarity algorithm and the Weighted Sum method. The input data were obtained from user-submitted ratings on the rating page. These data were stored in a rating table. An example of user rating data for five dental clinics used in this study can be seen in Table 1.

Table 1. Dataset Rating

Id User	Audy Dental Clinic	Griya Denta Clinic	Alldent Clinic	Damessa Clinic	FDC Clinic
	Rating	Rating	Rating	Rating	Rating
1	5	4	4	5	2
2	5	4	4	3	2
3	4	5	0	4	3
4	3	4	4	4	4
5	5	4	5	4	3

The dataset refers to the data that will be implemented in the recommendation process. The dataset is obtained from attributes whose values meet the requirements necessary for generating recommendations. The flowchart of the recommendation system can be seen in Figure 2.

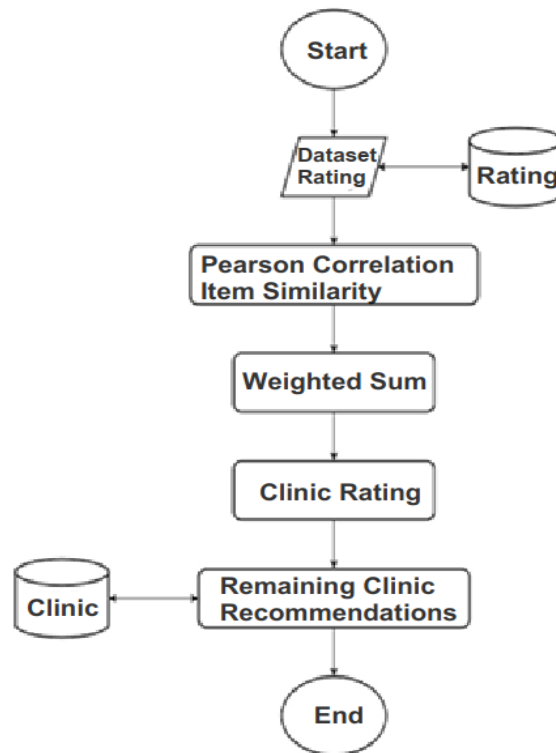


Figure 2. Recommendation System Flowchart

The process of determining ratings to generate clinic recommendations is as follows:

1. The rating process for dataset entries with a value of 0 begins by reading the existing rating dataset. Thus, the input for this process is the rating dataset.
2. The next step is to calculate the correlation between data points that influence dataset entries with a value of zero using the Pearson Correlation algorithm.
3. Once the correlation values are obtained, specific weights are then calculated to predict the missing ratings using the Weighted Sum formula.
4. After the predicted rating data is generated, the system performs a sorting process based on the predicted values before displaying them as recommendations for the active user.

Similarity Process

The similarity process contains similarity data obtained through Pearson Correlation calculations. This data is used in the prediction stage, where it is sorted in descending order based on similarity values. A total of n data points are selected for the prediction calculation stage.

The Pearson Correlation–Based Similarity method is one of the most widely implemented correlation-based methods for computing similarity values. Pearson Correlation measures the degree of linear relationship, with the assumption that the relationship between the two variables must be linear, the errors must be independent, and the probability distribution must have a mean of 0 and a normally distributed variance (0.1) (Rian Oktavian et al., 2023).

As an example taken from the dataset, there exists rating data comparing the ratings given by users 1 to 5 across several clinics. In the rating dataset, five clinics are included, of which three—Griya Denta Clinic, Alldent Clinic, and FDC Clinic—are used as sample data, as shown in Table 2.

Table 2. Sample User Ratings

Id User	Griya Denta Clinic	Alldent Clinic	FDC Clinic
	Rating	Rating	Rating
1	4	4	2
2	4	4	2
3	5	0	3
4	4	4	4
5	4	5	3

Calculation Steps Based on the Data in Table 2 Are as Follows:

Calculating the Average Rating

In this step, the average rating value is calculated for each clinic used as a sample, namely Griya Denta Clinic, Alldent Clinic, and FDC Clinic. The average values can be seen in Table 3.

Calculating the Average Rating for Each Clinic:

- Griya Denta Clinic:

$$= \frac{4 + 4 + 5 + 4 + 4}{5} = \frac{21}{5} = 4.2$$

- Alldent Clinic:

$$= \frac{4 + 4 + 0 + 4 + 5}{5} = \frac{17}{5} = 3.4$$

- FDC Clinic:

$$= \frac{2 + 2 + 3 + 4 + 3}{5} = \frac{14}{5} = 2.8$$

Table 3. User Rating Example with Average Computation

Id User	Griya Denta Clinic	Alldent Clinic	FDC Clinic
	Rating	Rating	Rating
1	4	4	2
2	4	4	2
3	5	0	3
4	4	4	4
5	4	5	3
Average	4.2	3.4	2.8

Calculating Similarity

The second step involves calculating the similarity between clinic ratings using the Pearson Correlation Similarity formula. The results of similarity calculations between clinics are presented in Table 4.

$r(\text{Griya Denta Clinic, Alldent Clinic}) =$

$$\begin{aligned}
& \frac{(4-4.2)(4-3.4)+(4-4.2)(4-3.4)+(5-4.2)(0-3.4)+(4-4.2)(4-3.4)+(4-4.2)(5-3.4)}{\sqrt{(4-4.2)^2+(4-4.2)^2+(5-4.2)^2+(4-4.2)^2+(4-4.2)^2}} \\
& \quad * \sqrt{(4-3.4)^2+(4-3.4)^2+(0-3.4)^2+(4-3.4)^2+(5-3.4)^2} \\
& = (-0.2)*(0.6)+(-0.2)*(0.6)+(-0.8)*(-3.4)+(-0.2)*(0.6)+(-0.2)*(1.6) \\
& \quad = -0.12-0.12-2.72-0.12-0.32=-3.4 \\
& \quad \frac{\sqrt{(-0.2)^2+(-0.2)^2+(-0.8)^2+(-0.2)^2+(-0.2)^2}}{\sqrt{(-0.6)^2+(-0.6)^2+(-3.4)^2+(-0.6)^2+(1.6)^2}} \\
& = \sqrt{0.04+0.04+0.64+0.04} \sqrt{0.36+0.36+11.56+0.36+2.56} \\
& \quad = \sqrt{0.8} \sqrt{15.2}=0.89*3.9=3.47 \\
& \quad = \frac{-3.4}{3.47} = -0.98
\end{aligned}$$

r (Griya Denta Clinic, FDC Clinic) =

$$\begin{aligned}
& \frac{(4-4.2)(2-2.8)+(4-4.2)(2-2.8)+(5-4.2)(3-2.8)+(4-4.2)(4-2.8)+(4-4.2)(3-2.8)}{\sqrt{(4-4.2)^2+(4-4.2)^2+(5-4.2)^2+(4-4.2)^2+(4-4.2)^2}} \\
& \quad * \sqrt{(2-2.8)^2+(2-2.8)^2+(3-2.8)^2+(4-2.8)^2+(3-2.8)^2} \\
& = (-0.2)*(0.8)+(-0.2)*(0.8)+(0.8)*(0.2)+(-0.2)*(1.2)+(-0.2)*(0.2) \\
& \quad = 0.16+0.16+0.16-0.24-0.04=0.2 \\
& \quad \frac{\sqrt{(-0.2)^2+(-0.2)^2+(-0.8)^2+(-0.2)^2+(-0.2)^2}}{\sqrt{(-0.8)^2+(-0.8)^2+(-0.2)^2+(1.2)^2+(-0.2)^2}} \\
& = \sqrt{0.8} \sqrt{2.4}=0.89*1.55=1.38 \\
& \quad = \frac{0.2}{1.38} = 0.14
\end{aligned}$$

r (Alldent Clinic, FDC Clinic) =

$$\begin{aligned}
& \frac{(4-3.4)(2-2.8)+(4-3.4)(2-2.8)+(0-3.4)(3-2.8)+(4-3.4)(4-2.8)+(5-3.4)(3-2.8)}{\sqrt{(4-3.4)^2+(4-3.4)^2+(0-3.4)^2+(4-3.4)^2+(5-3.4)^2}} \\
& \quad * \sqrt{(2-2.8)^2+(2-2.8)^2+(3-2.8)^2+(4-2.8)^2+(3-2.8)^2} \\
& = (0.6)*(-0.8)+(0.6)*(-0.8)+(-3.4)*(0.2)+(0.6)*(1.2)+(1.6)*(0.2) \\
& \quad = -0.48-0.48-0.68+0.72+0.32=-0.6 \\
& \quad \frac{\sqrt{(0.6)^2+(0.6)^2+(-3.4)^2+(0.6)^2+(1.6)^2}}{\sqrt{(-0.8)^2+(-0.8)^2+(-0.2)^2+(1.2)^2+(-0.2)^2}} \\
& = \sqrt{13.52} \sqrt{2.4}=3.68*1.55=5.7 \\
& \quad = \frac{-0.6}{5.7} = -0.11
\end{aligned}$$

Table 4. Similarity Values Between Clinics

Clinic Pair	Pearson Correlation Value
r (Griya Denta Clinic, Alldent Clinic)	- 0.98
r (Griya Denta Clinic, FDC Clinic)	0.14
r (Alldent Clinic, FDC Clinic)	- 0.11

Rating Prediction Process

This stage explains the process of calculating the predicted rating for each clinic. In the dental clinic recommendation website, the Weighted Sum method is used to perform the rating prediction process.

The collaborative filtering-based recommendation system uses the Weighted Sum technique, which predicts the rating of item x for user u by calculating the sum of the rating values given by users to items that are correlated with item x . Each rating on a correlated item is multiplied by the similarity value of that correlated item. The formula used to calculate the Weighted Sum is presented in Equation (2) (Aryani, Susilo, B., & Setiawan, Y., 2019).

$$P_{u,x} = \frac{\sum_{i=1}^n R_{u,t} * R(x,y)}{\sum_{i=1}^n |R(x,y)|} \quad (2)$$

Description:

- $P_{u,x}$ is the predicted rating of item x for user u .

- n is the number of items rated by user u .
- $R_{u,t}$ is the rating given by user u to item y .
- $R(x, y)$ is the similarity value between item x and all rated items y .

Since there is one missing rating in Table 3, the rating prediction is calculated only for Alldent Clinic using Equation (2). The result of the predicted rating calculation for Alldent Clinic by user with ID 3 is as follows:

$$P(\text{user ID 3, Alldent Clinic}) = \frac{(5 * -0.98) + (3 * -0.11)}{-0.98 + (-0.11)} = \frac{-5.23}{-1.09} = 5$$

The result of this rating prediction is considered as the rating value for Alldent Clinic given by user ID 3, as shown in Table 5. When recalculating the average rating for Alldent Clinic, the previous average of 3.4 increases to 4.4.

Table 5. User Similarity Rating Results with Average Calculation

Id User	Griya Denta Clinic	Alldent Clinic	FDC Clinic
	Rating	Rating	Rating
1	4	4	2
2	4	4	2
3	5	5	3
4	4	4	4
5	4	5	3
Average	4.2	4.4	2.8

Evaluation of Prediction Accuracy using MAE (Mean Absolute Error)

To objectively evaluate the accuracy of the recommendation system, we calculated the Mean Absolute Error (MAE) from a simulated dataset. MAE measures the average magnitude of the errors between predicted and actual user ratings. The lower the MAE value, the more accurate the prediction. Below is a sample of prediction vs. actual ratings for five users:

Tabel 6. Result MAE

Id User	Predicted Rating	Actual Rating	Absolute Error
1	4.5	4	0.5
2	3.8	4	0.2
3	5.0	5	0.0
4	2.5	3	0.5
5	4.2	4	0.2
Total Error			1.4
MAE			0.28

User Interface Design

The home page is the initial screen displayed when users access the website. This page appears the same both before and after the user logs in. The dashboard page displays information about the various clinics available on the recommendation website. The clinics shown on this page are those that have already received ratings from users. Additionally, the page provides information such as operating hours, contact persons, and clinic addresses. The home page interface is shown in Figure 3. The clinic detail page presents the clinic's profile, including a photo of the clinic building, a brief description, the clinic's address, contact information, and a list of doctors practicing at the clinic. Doctor details include their names, practice schedules, and specialties. The interface of the clinic detail page is shown in Figure 4, 5 and 6.

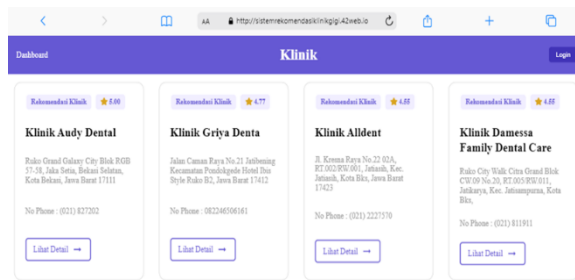


Figure 3. Home Page

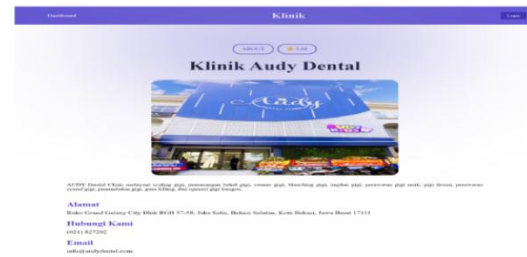


Figure 4. Clinic Detail Page

Data Dokter di Klinik Audy Dental

#	Nama	Spesialisasi	Jadwal
1	drg. Fata Rahmadita, Sp.KGA	Spesialis Keskhatan Gigi Anak	Selasa, Rabu 16.00 - 20.00
2	drg. Shabrina Lirisa, Sp.KG	Spesialis Konservasi Gigi	Jumat 10.00 - 14.00
3	drg. Lia Saifini, Sp.KG	Spesialis Konservasi Gigi	Rabu, Minggu 16.00 - 20.00
4	drg. Putri Yulandita, Sp.KG	Spesialis Konservasi Gigi	Senin - Jumat 16.00 - 20.00
5	drg. Suci Sandra, Sp.KG	Spesialis Konservasi Gigi	Sabtu 10.00 - 14.00
6	drg. Widy, Sp.KG	Spesialis Konservasi Gigi	Selasa, Jumat 16.00 - 20.00
7	drg. Rana Dita Jannart (R.BM)	Dokter Gigi Umum	Kamis 16.00 - 20.00
8	drg. Adela Andartya Awwazi, Sp.KGA	Spesialis Keskhatan Gigi Anak	Kamis, Jumat 16.00 - 20.00
9	drg. Fransiska Suciati, Sp.Pro	Spesialis Prostodontia	Selasa, Kamis 16.00 - 20.00
10	drg. Maryada, Sp.KGA	Spesialis Keskhatan Gigi Anak	Senin, Rabu 16.00 - 20.00

Figure 5. Doctor Data

Rating di Klinik Audy Dental

 aditya calvin hima 2024-08-19 18:35:59 ★ 5 Bagus Sekali
 Betrand Anwin 2024-08-19 18:36:29 ★ 5 Bagus Sekali
 fahri fahri ahmadya 2024-08-19 18:36:50 ★ 4 Bagus

Figure 6. Clinic Rating

Figure 7 shows the login page, which serves as the interface where users can enter either admin or user credentials in the form of a username and password to validate their access. After logging in, admins will be directed to the admin home page, while regular users will be directed to the user home page. The registration page, shown in Figure 8, is the interface used by users to create an account that will later be used to access the clinic recommendation website. However, if the user already has an account, they can simply click the login button located below the registration form.

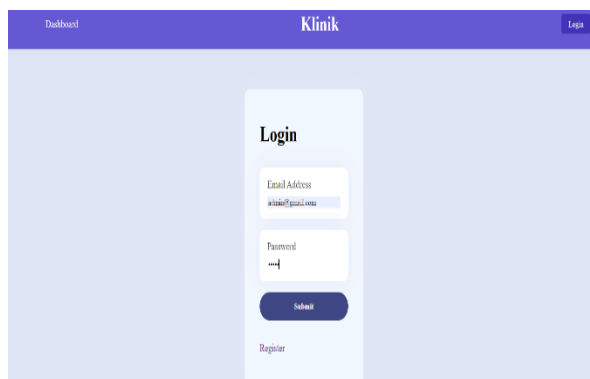


Figure 7. Login Page

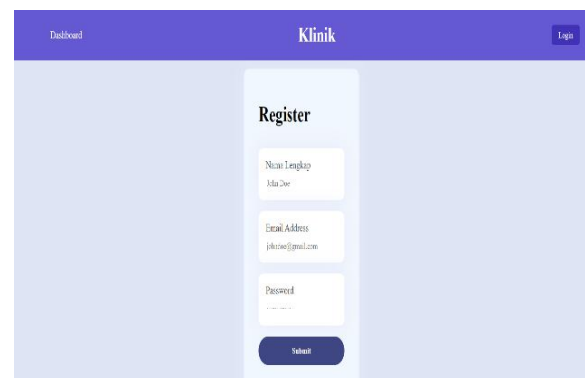


Figure 8. Registration Page

The doctor management page available to the admin is an interface that displays doctor related data, including the doctor's name, area of specialization, and practice schedule. The admin is also able to edit or delete existing doctor records. The doctor management page is shown in Figure 9. The clinic management page for the admin contains clinic related data, including the clinic name, address, phone number, and email. The admin can also edit or delete existing clinic data on this page, as illustrated in Figure 10.

#	Nama	Spesialisasi	Jadwal	Action
1	dr. Fion Rakanetra, Sp.KGA	Spesialis Kardiologi Gigi Anak	Selasa, Rabu 16.00 - 20.00	Edit Delete
2	dr. Sheem Lucine, Sp.KG	Spesialis Konservasi Gigi	Jumat 10.00 - 14.00	Edit Delete
3	dr. Liu Sadira, Sp.KG	Spesialis Konservasi Gigi	Rabu, Minggu 16.00 - 20.00	Edit Delete
4	dr. Petri Yulandari, Sp.KG	Spesialis Konservasi Gigi	Senin - Jumat 16.00 - 20.00	Edit Delete
5	dr. Siti Samira, Sp.KG	Spesialis Konservasi Gigi	Sabtu 10.00 - 14.00	Edit Delete

Figure 9. Doctor Page

#	Nama	Alamat	Phone	Email	Action
1	Klinik Asdy Dental	Ruko Grand Galaxy City Blok R6B 57-58, Jalan Setra, Bekasi Selatan, Kota Bekasi, Jawa Barat 17111	(021) 827202	info@asdydental.com	Edit Delete
2	Klinik Geyza Dental	Jalan Cemeria Raya No.21 Jatiwangi Kecamatan Perodagode Hord Dis Style Ruko R2, Jawa Barat 17412	082246966161	admin@geyzadental.com	Edit Delete
3	Klinik Alkhan	Jl. Keema Raya No.22 02A, RT.002 RW.001 Jatinuh, Kec. Jatinuh, Kota Bks, Jawa Barat 17423	(021) 2227579	cs@alkhan.id	Edit Delete
4	Klinik Dunesa Family Dental Care	Ruko City Walk Citra Grand Blok CW09 No.20 RT.005 RW.011, Indahjaya, Kec. Jatisampurna, Kota Bks, Jawa Barat 17433	(021) 813911	dunesa.dental@gmail.com	Edit Delete
5	Klinik FDC Dental Care	Jl. KH. Noer Ali No. No. 1-2 Kec. Bekasi Selatan, Kota Bks Jawa Barat, 17144	(021) 811191	fdkdental@indosat@gmail.com	Edit Delete

Figure 10. Clinic Page

User Acceptance Test (UAT)

User Acceptance Testing (UAT) was conducted by collecting data from 10 respondents who were asked to evaluate the dental clinic recommendation website. The questionnaire used consisted of 10 questions and was administered through direct interviews. The results of the questionnaire were calculated to draw conclusions regarding the quality and usability of the system. The UAT results were measured using the System Usability Scale (SUS) approach.

Table 7. System Usability Scale (SUS) Test Results

No.	Question	SUS Statement	Average Score
1.		I would like to use this system frequently.	4.4
2.		I found the system unnecessarily complex.	4.5
3.		I thought the system was easy to use.	4.6
4.		I think I would need the support of a technical person to use this system	1.6
5.		I found the functions in this system well integrated.	4.4
6.		I thought there was too much inconsistency in this system.	1.7
7.		I would imagine that most people would learn to use this system very quickly.	4.7
8.		I found the system very cumbersome to use.	1.5
9.		I felt very confident using the system.	4.6
10.		I needed to learn a lot of things before I could get going with this system.	1.4

Total score from all statements (based on the average values):

$$= (4.4 - 1) + (5 - 4.5) + (4.6 - 1) + (5 - 1.6) + (4.4 - 1) + (5 - 1.7) + (4.7 - 1) + (5 - 1.5) + (4.6 - 1) + (5 - 1.4)$$

$$= 3.4 + 0.5 + 3.6 + 3.4 + 3.4 + 3.3 + 3.7 + 3.5 + 3.6 + 3.6$$

= 32

$$\text{SUS Score} = 32 \times 2.5 = 80$$

With a SUS score of 80, the dental clinic recommendation system falls into the "Excellent" category according to the standard SUS interpretation (a score above 68 is considered above average).

CONCLUSION

The development of the Web-Based Dental Clinic Recommendation System using the Item-Based Collaborative Filtering method and Pearson Correlation has been successfully carried out in accordance with its objective, which is to help users obtain dental clinic recommendations based on their preferences and the clinics they have rated. The process involved calculating the similarity between dental clinics using the Pearson Correlation algorithm, followed by rating prediction using the Weighted Sum algorithm. Based on the testing results, when users provide ratings, the system is able to generate appropriate clinic recommendations along with predicted ratings as expected. The evaluation results show that the system achieved a Mean Absolute Error (MAE) of 0.28, demonstrating good prediction accuracy, and a System Usability Scale (SUS) score of 80, placing it in the "Excellent" usability category.

To improve the system further, several enhancements can be considered. First, integrating real-time clinic data through APIs would allow the system to provide updated information on doctor availability, queue capacity, and service promotions. Additionally, incorporating filters based on user location and clinic specialization would make recommendations more relevant and personalized. Future development could also explore hybrid recommendation approaches by combining Item-Based Collaborative Filtering with Content-Based Filtering, which would help address the cold-start problem for new users. More advanced prediction algorithms such as Matrix Factorization or deep learning models like DeepICF could further enhance the system's accuracy and performance.

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