DETERMINATION FOR CONSUMER PATTERNS IN BEVERAGE PRODUCT SALES USING THE FREQUENT PATTERN GROWTH ALGORITHM

*Corresponding author
novandapurbatigor@gmail.com
dikyf354@gmail.com

Tigor Novanda Purba[1], Diky Firdaus[2]
[1,2]Department of Computer Science, Mercu Buana University, Jakarta, Indonesia
[1,2]Street Meruya Selatan No. 1 Meruya Selatan, Jakarta, Indonesia

Abstract

The culinary business is now increasingly developing and competition is increasing, so it requires a strategy to market the products to be sold. In the business sector, the results of the implementation of FP-Growth algorithm data mining can help business people find opportunities from consumption trends so that culinary business people can find out what types of products currently have the highest rating in the community so that managers can provide menu recommendations so they can increase sales turnover. The data required is a certain period of transaction data which is analyzed to produce product recommendations by the association rules. The design of this application uses HTML as the base system used in making websites, PHP as a means to develop websites, and SQL as a medium for data storage and processing. The testing process begins with the login process, then determines the support and confidence parameters, and determines the transaction time period. From the conclusion, managers can determine marketing strategies by increasing the stock of raw materials in beverage products that have the highest itemset value. Then the product with the lowest itemset value can provide promos or discounts on the purchase of goods to attract consumer buying interest.

1.0 INTRODUCTION

The culinary business is always growing and never stops. Every year there are always business opportunities created by entrepreneurs. Many people choose to go directly into this business because it has great advantages. Even so, competition in the culinary business realm is also high. Currently, the culinary business is also increasingly mushrooming in various parts of Indonesia. This means that competition is getting tougher and requires more effort to market the products to be sold. In a competitive world business, it is demanded to find the right strategy that can be used to optimize sales.

Large amounts of data can be a problem for companies if not managed properly. Therefore, researchers use the FP-Growth algorithm in solving problems that occur at PT. Kulo Indonesia Group. To look for sales patterns, current management only looks at sales results. Sales results in the form of reports on the number of goods sold and how much their income

can only be seen without any follow-up to determine future decisions [1]. The difficulty that business people have in calculating the inventory of raw material inventories in warehouses is also one of the stocks for business people. This makes business people unable to predict the level of consumer behavior [2]. In the business sector, for example, the results of the application of FP-Growth Jewish data mining can help business people find opportunities from consumption trends so that business people can see what types of products currently have the highest ranking in society so that they do business. the community can provide menu recommendations to increase turnover and profits. sales for business people. From sales data, product categories are used as parameters to identify product groups that tend to be sold together in a certain period using the FP-Growth algorithm [3]. From the sales data, it is necessary to search for goods using the FP-Growth algorithm with the FP-Tree Order process which generates rules from new sample data. Determination of data variables greatly determines the accuracy of FP-Growth in determining support and trust which is used to find items that often appear that are interrelated to determine strategies in sales promotion [4].

The FP-Growth algorithm can be implemented using a sales database to find trends in a combination of item-set patterns so that it can be used as valuable information in making decisions for the necessary future marketing strategies [5]. The application of the FP-Growth algorithm produces many informative association rules to regulate the shopping patterns of PT. Kulo Indonesia Group. In addition, customer association rules can be segmented separately to meet customers' special needs cost-effectively by using several special promotions [6].

2.0 THEORETICAL
2.1. Data Mining
Data Mining is a new technology that has great potential in extracting hidden information. Data mining is also often defined as the process of extracting predictive information hidden from very large databases. Data mining can be applied in most fields, for example, to build trends, predict the future, and analyze the key factors needed for a complex problem [7].
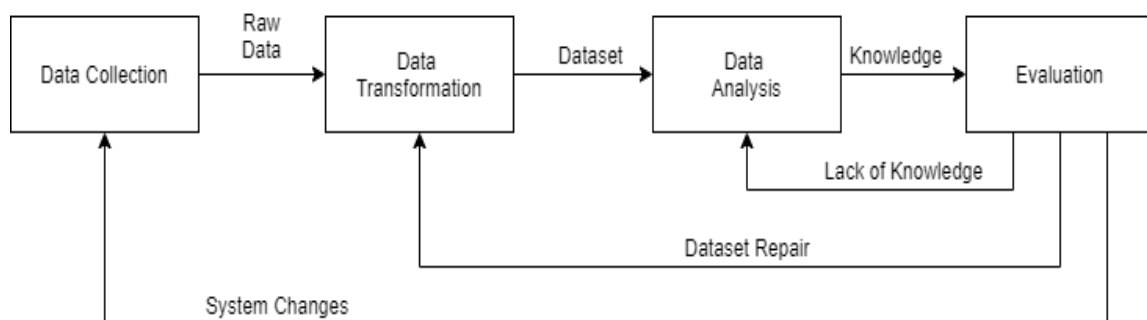

Figure 1. Data Mining Process

The data mining process is carried out in three stages, namely data collection, data transformation, and data analysis. Before the three stages are carried out, the data mining process begins with preprocessing which consists of the process of collecting raw data needed by data mining, then continues with data transformation to convert raw data into a format that can be processed by data mining, for example through filtration or aggregation. The results of data transformation will be used by data analysis to generate knowledge using techniques such as statistical analysis, machine learning, and information visualization [8].

2.2. PHP Hypertext Preprocessor (PHP)
PHP is a server-side programming language used in creating websites along with CSS and HTML. PHP stands for Hypertext Preprocessor which is used as server-side script language in development of the Web inserted in the HTML document [9]. For web creation, PHP code is generally pasted in HTML documents. Because of this ability PHP is also often referred to as a script programming language or Scripting Language. In this case, the process of creating content on a page becomes more efficient. For example, to perform repetition more effectively, inputting databases, etc. PHP and HTML are almost the same in use to create websites, the difference is that PHP can be used to create dynamic websites, where the

website can adjust the appearance of the content depending on the situation, whereas HTML is usually used to create a static website, where content and web pages are fixed[10].

2.3. MySQL

MySQL is one of the basic applications needed by programmers who are involved in website development that is used specifically for processing the language used to access line data relations. In general, MYSQL has functions to create, manage and access databases in a structured and automatic manner[11].

2.4. Website

A website is a set of interconnected web pages that are generally located on the same server containing a collection of information provided by individuals, groups, or organizations in the form of web pages that are joined to each other in a domain or URL. The main benefit of a website is to spread information through the digital world. Through the website, people around the world can exchange the latest information so that they do not miss the development of technology, culture, and science that are developing in all parts of the world. Apart from being a medium for exchanging information, a website can also be a medium for promotion and business development[10], [12].

3.0 METHODOLOGY

3.1. FP-Growth Algorithm

The FP-Growth algorithm is a development of the Apriori algorithm. So that the shortcomings of the Apriori algorithm are fixed by the FP-Growth algorithm. Frequent Pattern Growth (FP-Growth) is an alternative algorithm that can be used to determine the most frequent itemset in a data set. The Apriori algorithm requires generating candidates to get frequent itemsets. However, the FP-Growth algorithm does not generate candidates because FP-Growth uses the concept of building a tree in searching for frequent itemsets.

Association rules are a process in data mining to determine all associative rules that meet the minimum requirements for support and confidence in a database. These two conditions will be used for interesting association rules compared to the predefined limits [13]. The characteristic of the FP-Growth algorithm is that the data structure used is a tree called the FP-Tree. By using the FP-Tree, the FP-Growth algorithm can directly extract frequent itemset from the FP-Tree. Frequent itemset excavation using the FP-Growth algorithm will be carried out by generating a data tree structure or called the FP-Tree.
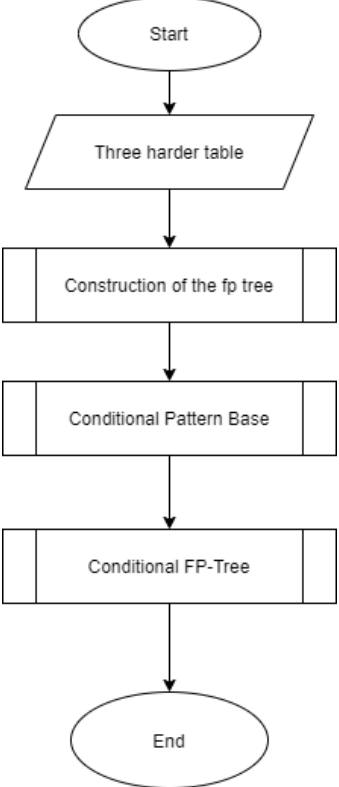

Figure 2. Flowchart of FP-Growth Algorithm

3.2. Data Analysis

In this research, the input is the transaction time, receipt number, product id, product name, and amount. While the output is in the form of the value of support to determine the association of goods sold and the value of confidence to determine the value of the association of goods that has a correlates with between items.

3	Transaction Time	Receipt Number	Product ID	Product Name	Quantity
4	01/08/2020	HQE1MV0	BRG2011003	Salted Caramel Boba Fresh Milk	1
5	01/08/2020	HQE1MV1	BRG2011002	Brown Sugar Boba Milk Tea	1
6	01/08/2020	HQE1MV1	BRG2011001	Brown Sugar Boba Fresh Milk	1
7	01/08/2020	HQE1MV2	BRG2011013	Brown Sugar Dalgona Boba	1
8	01/08/2020	HQE1MV3	BRG2011013	Brown Sugar Dalgona Boba	1
9	01/08/2020	HQE1MV3	BRG2011001	Brown Sugar Boba Fresh Milk	4
10	01/08/2020	HQE1MV4	BRG2011013	Brown Sugar Dalgona Boba	1
11	01/08/2020	HQE1MV5	BRG2011015	Salted Caramel Dalgona Boba	1
12	01/08/2020	HQE1MV5	BRG2011001	Brown Sugar Boba Fresh Milk	1
13	01/08/2020	HQE1MV6	BRG2011001	Brown Sugar Boba Fresh Milk	1
14	01/08/2020	HQE1MV7	BRG2011001	Brown Sugar Boba Fresh Milk	1
15	01/08/2020	HQE1MV7	BRG2011006	Yuzu Sakura Macchiato	1
16	01/08/2020	HQE1MV8	BRG2011001	Brown Sugar Boba Fresh Milk	1
17	01/08/2020	HQE1MV9	BRG2011003	Salted Caramel Boba Fresh Milk	1
18	01/08/2020	HQE1MV9	BRG2011016	Brown Sugar Boba	1
19	01/08/2020	HQE1MVA	BRG2011014	Signature Dalgona Boba	1
20	01/08/2020	HQE1MVA	BRG2011001	Brown Sugar Boba Fresh Milk	2
21	01/08/2020	HQE1MVB	BRG2011003	Salted Caramel Boba Fresh Milk	1
22	01/08/2020	HQE1MVC	BRG2011003	Salted Caramel Boba Fresh Milk	2
23	01/08/2020	HQE1MVC	BRG2011015	Salted Caramel Dalgona Boba	1
24	01/08/2020	HQE1MVD	BRG2011001	Brown Sugar Boba Fresh Milk	1
25	01/08/2020	HQE1MVE	BRG2011001	Brown Sugar Boba Fresh Milk	1

Figure 3. Transaction data analysis

4.0 RESULANTS AND DISCUSSION

4.1. System Design

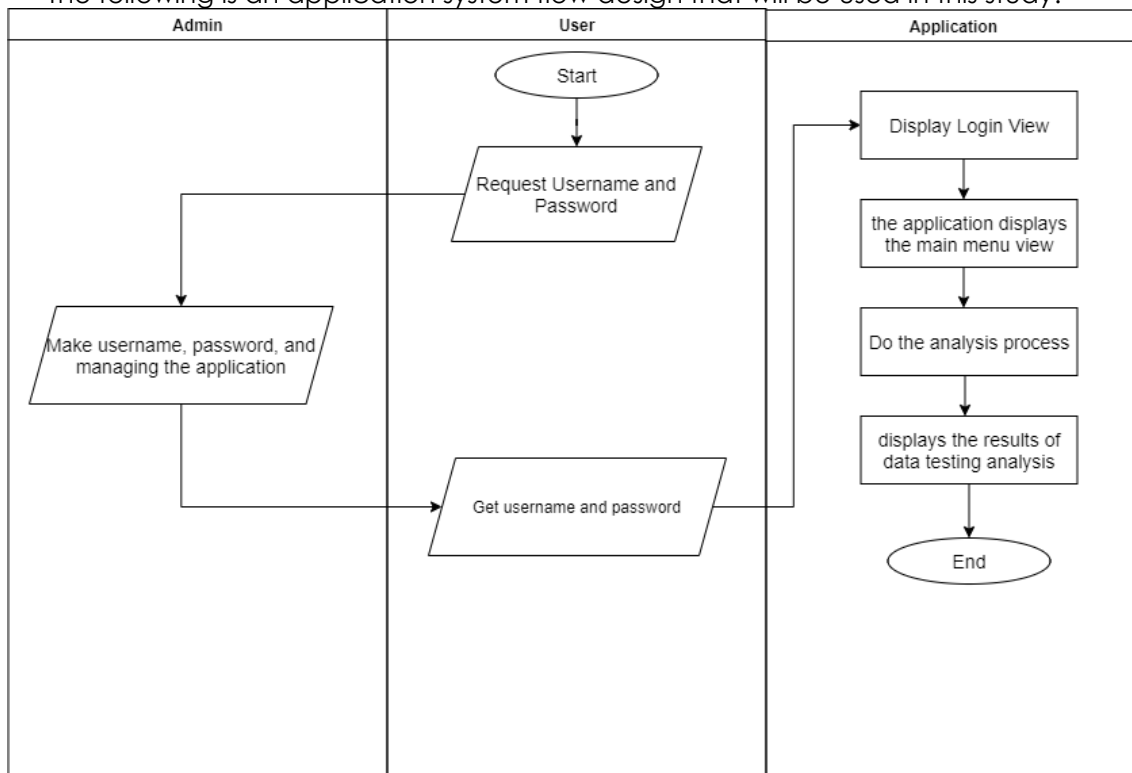The following is an application system flow design that will be used in this study.

Figure 4. System design flow map

In Figure 4 above, there are admin and user roles. In the first stage, the user asks the admin for a username and password. After that, the admin who acts as application management creates a password and username and gives it to the user. After the user enters the username and password, the application will automatically display the main menu display. In this application, the user can perform the data testing process and the application will automatically display the results of the data testing.

4.2. System Implementation

Interface design is a very important part of an application. The interface is a link for users to be able to communicate with the application. The design of the interface display is needed to facilitate the process of implementing the application [14]. Username and password are required to use this application to maintain data security and credibility. The login interface is shown in the image below:
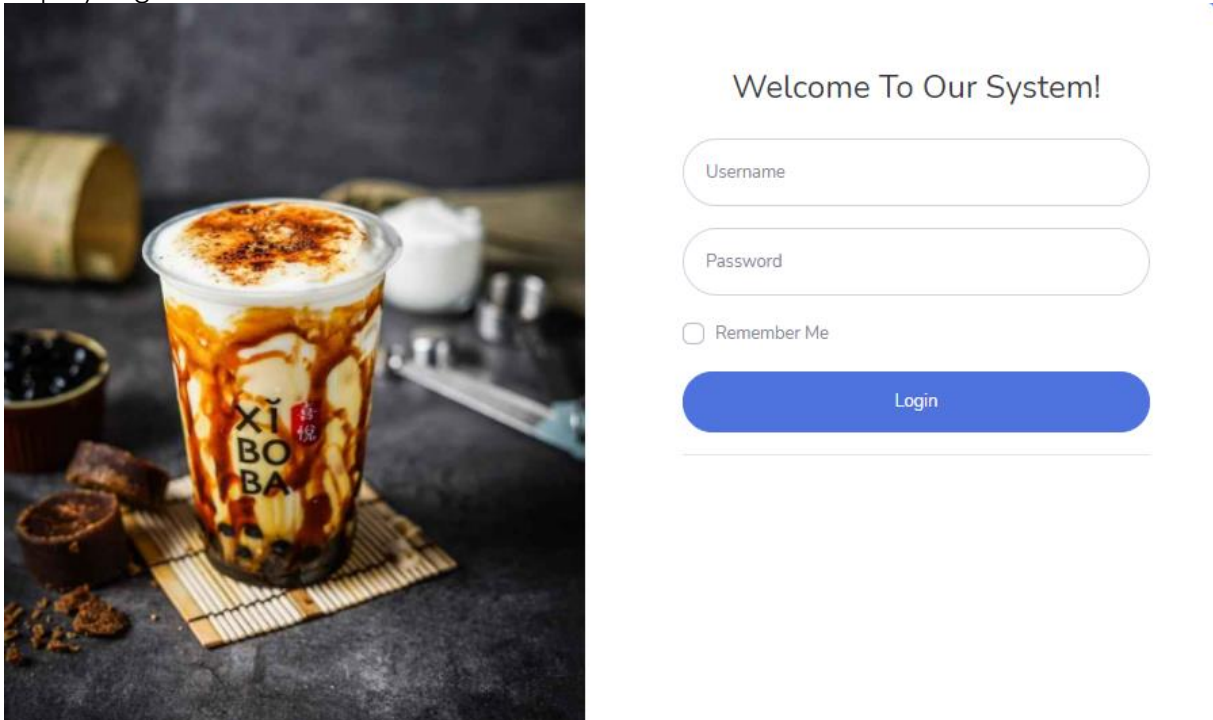
Display Login Form

Figure 5. Display Login Form

To use this application you need to input a username and password to maintain data security. Only users with active status can access the application.
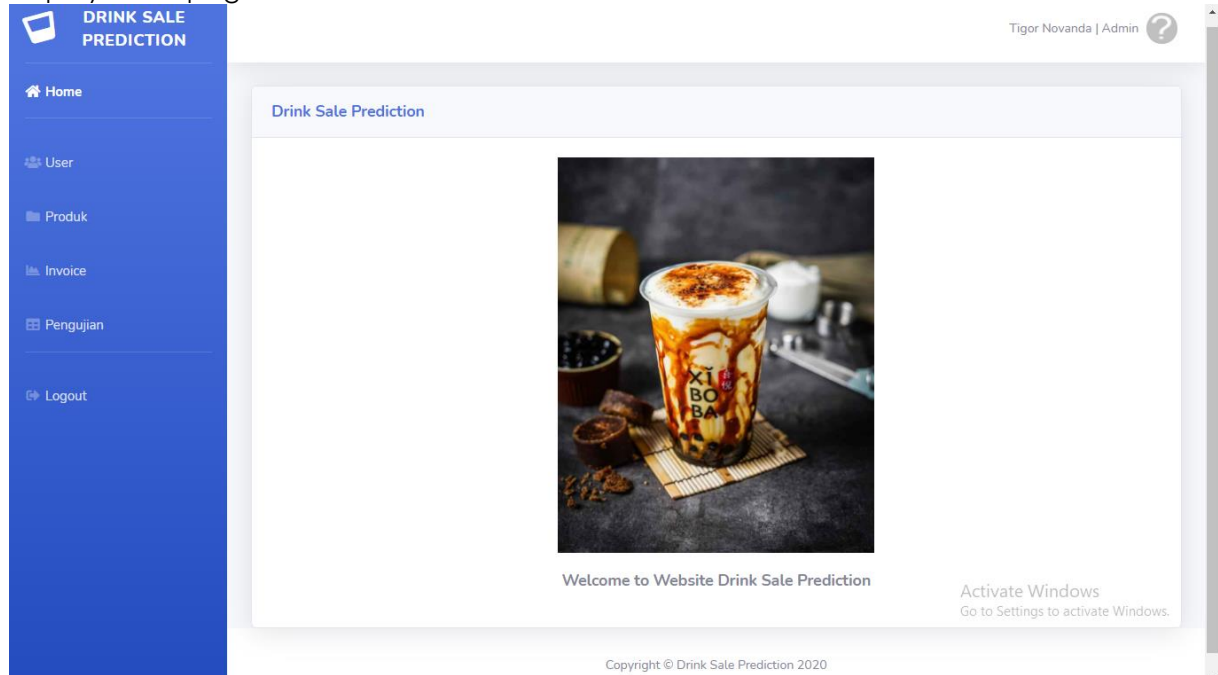
Display Homepage

Figure 6. Display Homepage

The homepage display has 4 menus, namely user, product, invoice, and testing. The user menu is used to manage user data who will use this application, manage user data that is still

active, and has an inactive status. From this menu, the admin can create a password and username for the user to log in to the application. The product menu is used to manage product data by inputting and changing the product name, product category, and product status whether it is still available or not. The invoice menu is used to input and classify sales data according to transaction time, transaction code, product name, and the number of products sold. And the test menu is used to process data analysis on transaction data. And the results menu is used to view the results of the analysis process data that has been stored in the association application.
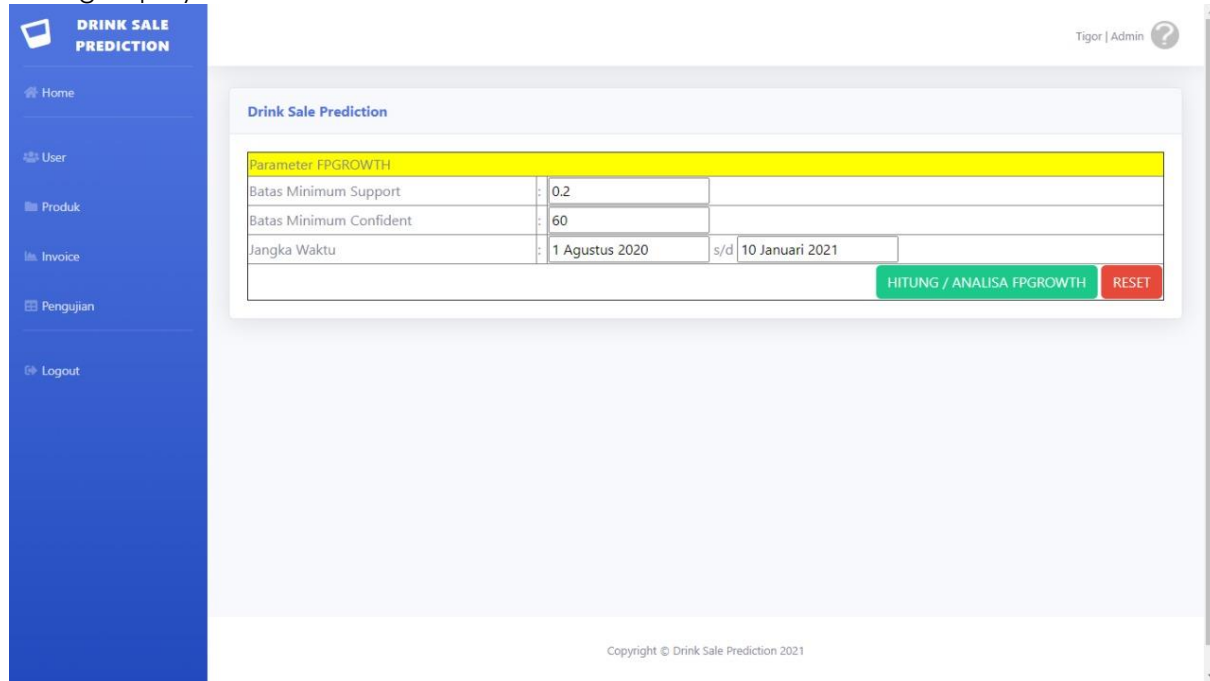
Testing Display

Figure 7. Testing Display

The test menu is used to carry out a testing process that contains two parameters, namely the percentage of support and confidence. admin can change the value of these two parameters, while the user cannot change it. Apart from these two parameters, to carry out the testing process, it takes a transaction time period to be analyzed.
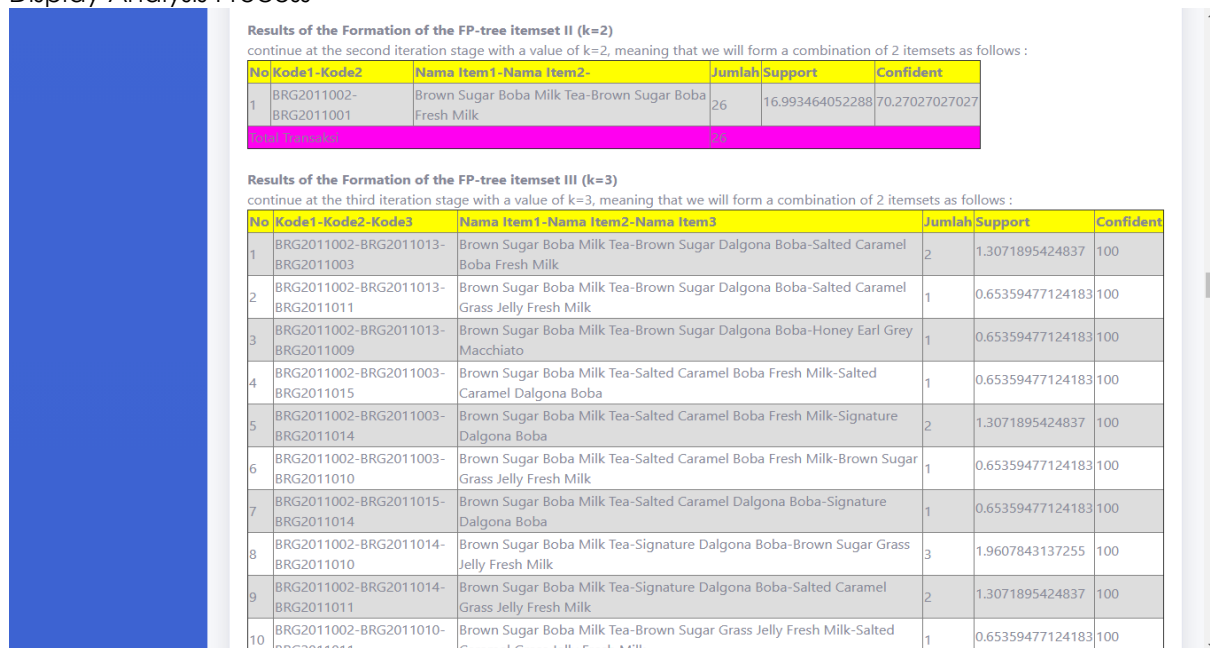
Display Analysis Process

Figure 8. Display Analysis Process

After determining the minimum value of support, confidence, and transaction period, the application will automatically display the itemset set and association rules from the transaction data.
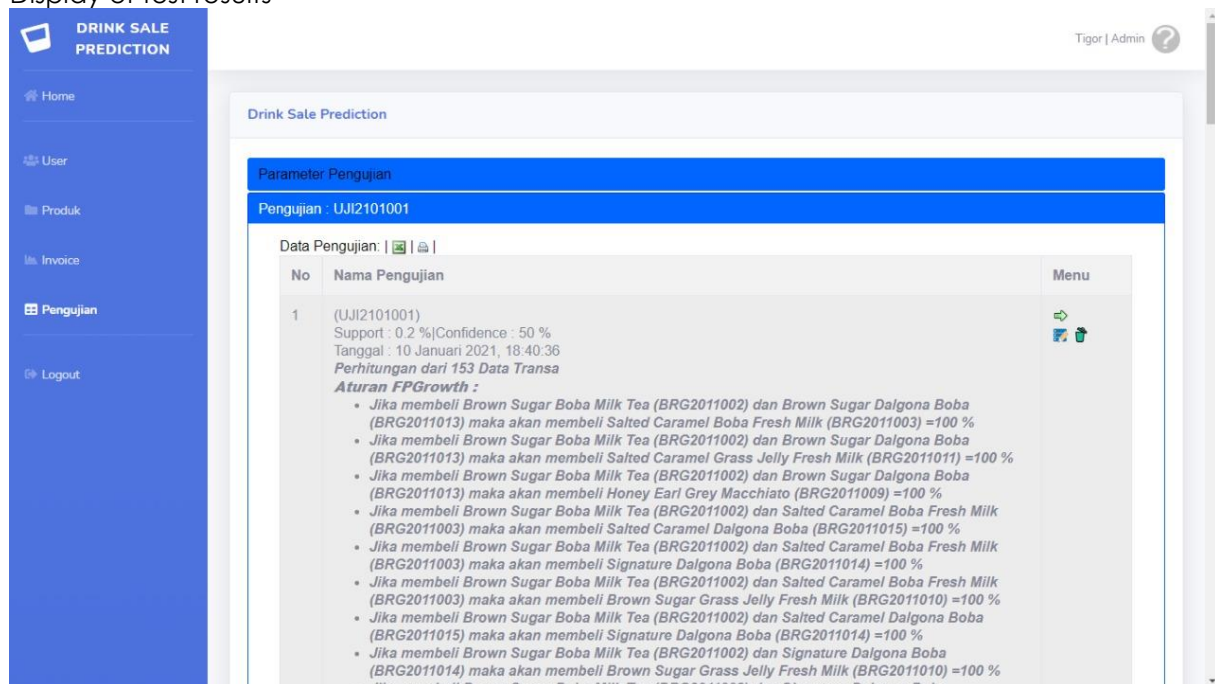Display of test results

Figure 9. Display of test results

The test results display shows the test results in the form of a percentage of the sales transaction pattern based on a predetermined transaction date period.

4.3. Black Box Testing
To get appropriate results, application testing is required to check directly on the application according to the application test plan. The application testing plan is carried out using the black-box testing method. Following are the plans and results of application testing using black-box testing.
1.   Display Login Form

Table1. Login Display Testing

Input	The Result	Conclusions
Correct Username and Password	Displays notification of success	Successful
Correct Username, Incorrect Password	Failed to display a notification	Successful
Incorrect Username, Correct Password	Failed to display a notification	Successful
Incorrect Username and Password	Failed to display a notification	Successful

1.   Display Homepage

Table 2. Display Homepage

Input	The Result	Conclusions
Notification of Success from The Login Display	Display the home view	Successful

2.   Analysis Test Display

Table 3. Analysis Test Display

Input	The Result	Conclusions
Input the value of support and confidence	Save the value of support and confidence	Successful
Click save test	Save testing	Successful

Click the test process button	Do the testing process	Successful
Click the test process button	Save the testing result	Successful
Select a test and press the print button	Print the testing result	Successful
Click Export Data	Export data testing	Successful

5.0 CONCLUSION

5.1. Conclusion

With this beverage sales prediction application, the manager or management can solve the problems that occur, besides that the application can also provide better information in a systematic and computerized manner. The results of research on a web-based beverage sales prediction application with a minimum support parameter of 0.2% and minimum confidence of 60% can provide information that sales of beverage products at PT KGI which have the highest itemset that consumers are often looking for is Brown Sugar Boba Fresh Milk product code BRG2011001) and beverage products that have the lowest sales frequency that consumers rarely look for, namely Honey Earl Gray Macchiato with product code (BRG2011009), Black Tea Macchiato with product code (BRG2011007), and Earl Gray Grass Jelly Milk Tea with product code (BRG2011012). From these test results, managers can determine marketing strategies by increasing the stock of raw materials in beverage products that have the highest itemset value. Then with the lowest itemset value, the manager can provide promos or discounts on the purchase of goods to attract consumer buying interest.

5.2. Suggestion

Based on the above recommendations, the suggestions given to support the product recommendation system are that in designing this application there are still several deficiencies, especially from the interface display factor. So that the author's suggestion for further research is expected that the data input process can be developed so that the data processing process can be faster so that the application system can present more perfect product recommendations.

REFERENCES

[1] A. Junaidi, "Implementasi Algoritma Apriori dan FP-Growth Untuk Menentukan Persediaan Barang," J. Sisfokom (Sistem Inf. dan Komputer), vol. 8, no. 1, hal. 61–67, 2019.

[2] B. Mulyawan dan T. Sutrisno, "Product recommendation system on building materials shopping using FP-Growth algorithm Product recommendation system on building materials shopping using FP-Growth algorithm," hal. 0–6, 2020.

[3] A. N. Sagin dan B. Ayvaz, "Determination of Association Rules with Market Basket Analysis: Application in the Retail Sector," Southeast Eur. J. Soft Comput., vol. 7, no. 1, 2018.

[4] A. Ikhwan et al., "A novelty of data mining for promoting education based on FP-growth algorithm," Int. J. Civ. Eng. Technol., vol. 9, no. 7, hal. 1660–1669, 2018.

[5] M. I. Perangin-angin, A. H. Lubis, dan A. Ikhwan, "Association Rules Analysis on FP-Growth Method in Predicting Sales," Int. J. Recent Trends Eng. Res., vol. 3, no. 10, hal. 58–65, 2017.

[6] Mustakim et al., "Market Basket Analysis Using Apriori and FP-Growth for Analysis Consumer Expenditure Patterns at Berkah Mart in Pekanbaru Riau," J. Phys. Conf. Ser., vol. 1114, no. 1, 2018.

[7] M. I. Ghozali, R. Z. Ehwan, dan W. H. Sugiharto, "Analisa Pola Belanja Menggunakan Algoritma Fp Growth, Self Organizing Map (Som) Dan K Medoids," Simetris J. Tek. Mesin, Elektro dan Ilmu Komput., vol. 8, no. 1, hal. 317–326, 2017.

[8] M. Muslihudin dan A. Larasati, "Perancangan Sistem Aplikasi Penerimaan Mahasiswa Baru di STMIK Pringsewu Menggunakan PHP dan MYSQL," J. TAM (Technol. Accept. Model), vol. 3, no. 1, hal. 12–23, 2014.

[9] D. Firdaus, "Penggunaan Data Mining dalam Kegiatan Sistem Pembelajaran Berbantuan Komputer," J. Format, vol. 6, no. 2, hal. 91–97, 2017.

[10] F. Satria, Pemrograman WEB (HTML, CMS dan JavaScript). Yogyakarta: Andi Offset, 2016.

[11] M. M. A. Fauzi, Program Database Visual Basic 6 and SQL Server 2000. Yogyakarta, 2013.

[12] O. Muhammad Muslihudin, Analisis Dan Perancangan Sistem Informasi Menggunakan Model Terstruktur Dan UML. Yogyakarta: Andi Offset, 2016.

[13] R. Amelia dan D. P. Utomo, "Analisa Pola Pemesanan Produk Modern Trade Independent

Dengan Menerepakan Algoritma Fp. Growth (Studi Kasus: Pt. Adam Dani Lestari)," KOMIK (Konferensi Nas. Teknol. Inf. dan Komputer), vol. 3, no. 1, hal. 416–423, 2019.

[14] F. Paper, U. Salamah, E. Maulana, dan U. M. Buana, "Development of Art Performance Tickets Information System At," hal. 29–39.