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USE OF THE FREQUENTLY PATTERN GROWTH ALGORITHM ON MSME TRANSACTION DATA IN THE CULINARY FIELD IN RECOMMENDATIONS FOR SMALL GIFTS OF THE PADANG REGION

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ABSTRACT

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The existence of adequate transaction data turns out to have a similar sales transaction pattern for MSMEs, so it would be a shame if it was left like that. Moreover, this data can be used as a consideration to increase efficiency in MSMEs in the culinary sector, one of which is as a recommendation for all gifts. The study use the Association Rules technique, whereas fp-growth is used to obtain a combination of elements. The goal is to facilitate MSMEs' ability to suggest small gifts to clients. The implementation of the fp-growth algorithm calculation was carried out to process 2043 data originating from transaction data in MSMEs with the specified minimum support value being 5%, while the minimum confidence value determined was 55%. The results of the trial obtained the two best rules, namely "If a customer buys a list of small gifts from Balado Sanjai Chips then the customer will buy Jangek Crackers" and "If a customer buys Jangek Crackers then the customer will buy Sanjai Balado Chips".

Keywords: FP-Growth, MSME, Small Gifts, Transaction Data

I. INTRODUCTION

Recent technology advancements have a significant impact on human lives [1]. One aspect is how people utilize the information [2]. Information is really vital within everything. [3], including the way to boost sales outcomes, customer buying habits and preferences, and the ability to detect present market developments [4]. Saving information in a type of soft copy or cloud makes more simple to process electronic data [5]. Big data is the accumulation of data that is kept on servers and in the cloud, with it

expanding in size and volume over time [6]. With the advancement of technology nowadays, huge amounts of data even plays a major role in producing outcomes [7], due to its relationship with social networks [8].

This kind of food business is the same as a tiny restaurant, which serves a selection of snacks and beverages and markets itself as a stylish spot to unwind and have casual conversations about both personal and public issues [9]. In addition, this type of culinary business only provides a variety of food dishes and beverages, from coffee and non-coffee

drinks to dine-in or take-out options, are supplied in accordance with the theme concept of the particular type of business, there are several types of business that provide takeaway and delivery services. services [10]. Typical Padang small gifts are a type of business that is quite popular in the area. Initially, Small gifts Khas Padang was a type of small business that had a few employees, but currently, Small gifts Khas Padang already has approximately 4 employees. Typical Padang small gifts are a type of business that is quite popular in the area. Consumers who come to Typical Padang Small gifts have problems in determining small gifts recommendations, Specifically, no ideal presentation idea has been developed to determine modest gift recommendations for clients. As a result, it is critical to select the best small gift recommendations so that clients do not waste too much time ordering a list of accessible small gift goods.

At Small Gifts Padang Region, a customer approaches the cashier, who then records the items the buyer wishes to purchase. The current data is just kept or used as transaction history since The recorded information won't be fully utilized; instead, it will be retained as a sales transaction note. Naturally, the abundance of data on typical Padang little presents has sales transaction patterns that are similar to one other. These patterns can be used and taken into consideration by applying data mining science knowledge. Data mining can be used with the aim of analysis to explore data where there has never been a previous idea about what would be the concept of results that are considered interesting [11]. In order to discern the notion of useful outcomes and non-trivial information in enormous datasets and make inferences about the produced data, data mining is necessary in new searches, which is accomplished by balancing human knowledge with the ability of computers to visually represent specific problems and objectives [12].

Association rules are needed in data mining technique that is utilized in the context of this research design in order to get research findings [13]. The directional association of each item in the dataset can be ascertained using rules in data mining techniques, may aid in describing the relationship or correlation between various objects and other items. In other words, association rules will be used to combine the appropriateness of the attributes created for every object in the collection [14]. Fp-growth is

one of many association rules algorithms, in this case will be used to process the dataset and produce conclusions pertaining to the adequacy of the characteristics produced for each item. This study aims to process data in sales transaction with using the fp-growth method in a way that will facilitate MSMEs' recommendation-making process for modest gifts to clients [15].

1 Previous research conducted by Sigit related to the analysis of the fp-growth algorithm for product recommendations in retail data on sales of cosmetic products concluded that there were significant obstacles in terms of promotion on packages of cosmetic products being sold which were caused by insufficient effectiveness in organizing products that had been sold. interconnected products between each other [16]. Meanwhile, research conducted by Alfanisa related to the application of data mining to analyze consumer purchasing patterns with the FP-Growth algorithm on motorbike spare part sales transaction data, concluded that analysis of consumer purchasing patterns in motorbike spare part sales transactions resulted in the dominant spare part item being sold a lot in the form of oil. seal, axle, cylinder gasket, screw valve adjusting and cable clutch [17]. Another research conducted by Abu related to searching 4r association patterns for arranging goods using a comparison of the apriori and FP-Growth algorithms (a case study of the EPO Store Pemalang distro), concluded by comparing two association search methods, namely apriori and FP-Growth, which resulted in the FP-Growth Algorithm producing the level of accuracy is greater or significant than the a priori algorithm in sales transactions [18]. As far as researchers have observed from previous studies, no one has conducted research related to sales transaction data to produce product recommendations, especially culinary products.

II. METHODOLOGY

After knowing the various scientific steps in the research stage, a framework of thought is needed as a reference in determining the design of the research structure flow from start to finish to be able to obtain significant results for the continuity of the current research. The general research techniques used are as follows:

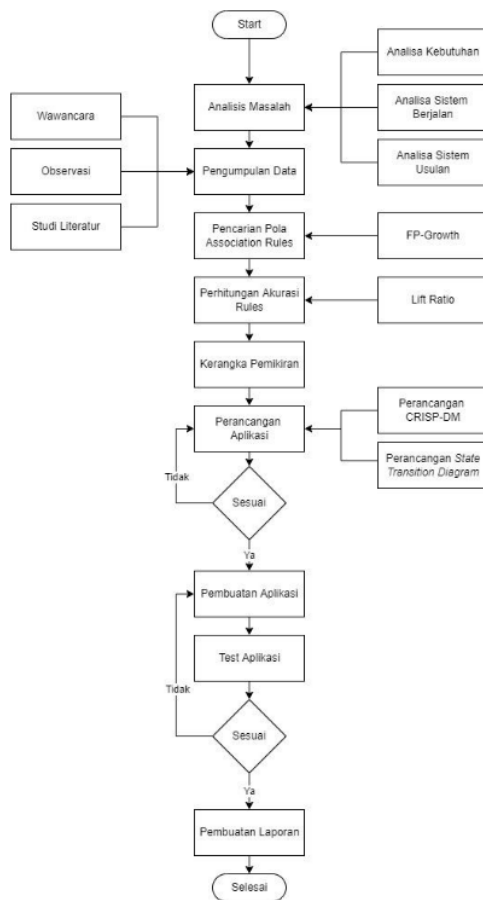


Figure 1. Research flow chart

2.1. STD Design

Applications in this research are designed using State Transition Diagrams using the Harel model. In order to visually represent the current processing in a system whose states are interconnected with the existing states, State Transition Diagrams were invented [19].

2.2. Implementation

At this stage, the focus is on describing the results obtained from the implementation of the design and significant testing of the application. At the implementation stage, the design uses the Perl Hypertext Processor programming language.

2.3. Testing

Getting test results will provide a detailed explanation of the data outcomes of the system which is finished [20]. The results of data calculations are the test results that form sales using the fp-growth method or an algorithm transaction patterns at Padang Typical Small gifts MSMEs and searching for recommendations items at Padang Typical Small gifts MSMEs. Formulas Known More Commonly as fp-growth, frequent pattern growth is a component of the a priori algorithm, which was created as a method for locating and identifying a number of dominant data in the domain of itemsets (frequent itemsets) [13]. Because the fp-growth algorithm favors a strategy based on the notion of tree building (fp-tree) when acquiring dominating data in the itemset domain, candidate generating activities are not necessary. Consequently, this approach outperforms the a priori technique in terms of collecting dominating information in the realm of itemsets (frequent itemset) [21].

III. RESULTS AND DISCUSSION

The stages in application design begin with designing a State Transition Diagram, then proceed to the database design stage with the final output structure in the form of an introduction to the user interface or application interface display.

3.1. STD Design

The STD design of the FP-Growth page describes the computation of a dataset used with the FP-Growth algorithm technique. Figure 1 illustrates where a calculation sheet will be entered on the FP-Growth page when choosing current transaction dates and entering the minimum support and minimum confidence values.

The Calculation Results page's State Transition Diagram includes a tool for creating association rules based on the FP-Growth algorithm technique. As demonstrated in Figure 2 below, if each rule is created, it can serve as a solution for suggestions for little gifts of food and drink.



Figure 2. Designing a STD for the FP-Growth page

As seen in Figure 3 below, the Recommendation Result Page of STD provides recommendations for little presents of food and drink along with an explanation of the results.

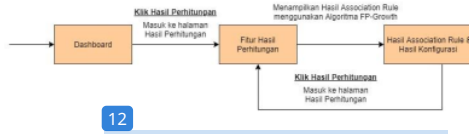


Figure 3. Final Result of C4.5 algorithm decision tree

Figure 4 below illustrates the Recommendation Results page of STD output, which includes suggestions for little presents of food and drink and the explanations that follow.

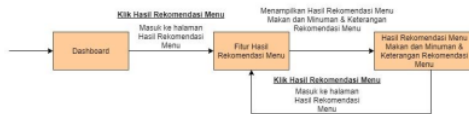


Figure 4. Designing a STD for the Small gifts Recommendation Results page

3.2. Fp-growth

The next step is forming Association rules in the fp-growth algorithm is the generate frequent itemset step, which is the step of searching for items contained in data transactions that have met the minimum support value obtained.

a. High frequency pattern analysis

This stage seeks to maximize the conditions that must be met for the support value with the assumption that the goal is an effort to find a combination of items, with a significant formulation of obtaining the support value of an item as follows:

$$Support(A, B) = \frac{transaction\ contain\ A\ or\ B}{transactions\ summary} \dots (1)$$

Meanwhile, the significant formulation for obtaining support values from two items can be known as follows:

$$Support(A \cap B) = \frac{transaction\ contain\ A\ and\ B}{transactions\ summary} \dots (2)$$

b. Formation of Association Rules

After knowing the assumptions in identifying high-frequency patterns as explained in the previous paragraph, the next step focuses on the mechanism for searching for associative rules, with the assumption that the minimum requirement for confidence is determined by calculating the confidence of the associative rule $A \rightarrow B$. The confidence value of the rule $A \rightarrow B$ is obtained from the following formula:

$$P(B | A) = \frac{transaction\ summary\ contain\ A\ and\ B}{transaction\ summary\ contain\ A} \dots (3)$$

It can be seen the results of the generated frequent itemset step in small gifts of Padang region in obtaining the minimum support value as explained in the table 1 below:

Table 1. Accuracy Rules Result

No	Item	Support	Quantity
1	Keripik Balado Sanjai	58.15%	1188
2	Kerupuk Jangek	52.11%	1065
3	Roti Randang	20.02%	411
4	Galamai	14.53%	299
5	Dendeng Balado Instan	13.20%	272
6	Arai Pinang	13.05%	269
7	Bolu Batik	11.83%	245

This aims to visualize the acquisition of certain data transactions on each domination item which has similarities between the items that will be applied to an FP-Tree trajectory, so that at the ongoing stage of visualizing the acquisition of data transactions, the FP-Tree trajectory allows for the formation of overlapping each other, the more High dominance items that have similarities between items will increase the effectiveness of FP-Tree trajectory data processing.

3.3. User Interface Implementation

On the Add Data feature page, there is a form which functions to store certain additional data for Padang Typical Small gifts. In this form, you are required to input the Transaction ID, goods or items as well as the time and date specified in the columns provided.

No	Transaksi	Date	Tanggal	Jml
1	700001	2021-01-01	2021-01-01	1
2	700002	2021-01-01	2021-01-01	1
3	700003	2021-01-01	2021-01-01	1
4	700004	2021-01-01	2021-01-01	1
5	700005	2021-01-01	2021-01-01	1
6	700006	2021-01-01	2021-01-01	1
7	700007	2021-01-01	2021-01-01	1

Figure 5. Web view for the Add Data page

The data import feature web page has a choose file button as a means of using the application to input data which will be processed with the fp-growth algorithm. It should be noted in the data input process that the Excel file format is required to be in .csv format and have a writing format in the form of data_id, transaction_id, item and date fields. If the Excel file is not in .csv format, the file will indirectly be rejected by the system that will import the data into the database, so it will not appear on the application page.



Figure 6. Web view for the Import Data page

Figure 7 below shows a page that will present the configuration and results obtained from the association rules in the form of a structured table.

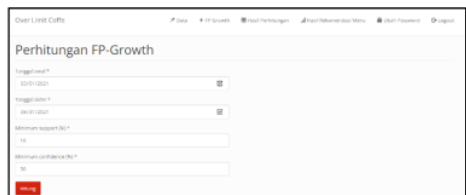


Figure 7. Web view for the Calculation Results page

The small gifts recommendation results page will present recommendations for food and drink small gifts and descriptions of recommended recommendations from Padang Typical Small gifts in graphical form, which is formed using calculations from the fp-growth algorithm.

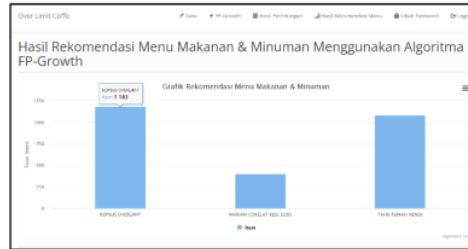


Figure 8. Web view for Small Gifts Recommendation

3.4. Accuracy Test

The primary objective of the test outcomes is to ascertain the precision of the outcomes for every data transaction that arises from association rules. The lift ratio is used as a reference assumption to assess the validity of the transaction patterns observed in this investigation. The lift ratio has a decision-making premise attached to it. In particular, when the lift ratio is smaller than one (<1), it can be presumed that the item's connection with item B is negatively correlated, meaning that there is no meaningful linkage between the item and other items. Conversely, the link between item A and item B is probably considered to be favorably associated. if the lift ratio result is larger than or equal to one (>1). The assumption used to make decisions is that items A and B are categorized as independent if the final value is equal to one (=1).

The system testing technique uses one of the parameters in the Association Rule, namely the Lift Ratio, which is used in the current research process. The formula that can be used to calculate the Lift Ratio is as follows:

$$Lift(A, B) = \frac{P(A \cup B)}{P(A) \cdot P(B)} \quad \dots (4)$$

- $P(A \cup B)$: Obtaining confidence values from itemset product A with product B
- $P(A)$: Number of transactions containing product A
- $P(B)$: Number of transactions containing product B

The Lift Ratio itself is a mapping measuring tool of how important or dominant the rules that have been created or produced are based on the value of the support and confidence results. In this context, the Lift Ratio is part of the acquisition of value which can

indicate the truth or authenticity of the ongoing process of a transaction and contributes to providing significant information or information from purchasing product A with product B simultaneously [3].

Table 2. Accuracy Rules Result

No	Rule	Support	Confidence	Lift Ratio
1	If customers buy Roti Randang and Galamai small gifts, then customers will buy Balado Sanjai Chips	220/2043 = 10.77%	220/411 = 53.58%	0.93
2	If a customer buys small gifts Balado Sanjai Chips, then the customer will buy Jangek Crackers	707/2043 = 34.61%	707/1188 = 59.51%	1.15
3	If a customer buys Jangek Crackers as a small gifts, the customer will buy Balado Sanjai Chips	707/2043 = 34.61%	707/1065 = 66.38%	1.15

Table 2 displays the outcomes of multiple rules, such as "if a customer buys Roti Randang and Galamai small gifts, then the customer will buy Balado Sanjai Chips" With a lift ratio value of 0.93, a support value of 10.77%, a confidence value of 53.58%, and a lift ratio value of less than 1, it can be categorized as invalid or adversely associated. Meanwhile, the next rule is "If a customer buys small gifts Balado Sanjai Chips then the customer will buy Jangek Crackers" A rule can be classified as legitimate or positively correlated if it has with a value of 1.15 for the lift ratio, 34.61% for support, 59.51% and for confidence. Next, the last rule is "If a customer buys Jangek Crackers as a small gifts, the customer will buy Balado Sanjai Chips" this rule can be classified as genuine or positively associated because the lift ratio value is greater than 1, with a support value of 34.61%, a confidence value of 66.38%, and a

lift ratio value of 1.15. From the results of the rules that have been created, As can be seen, there are just two guidelines that are considered to be reliable and that can be followed when suggesting little gifts to clients.

3.5. Functionality Test

This testing aims to find errors in the systems, especially for recommendation items at Small Gifts of the Padang Region. This testing is carried out as an analysis of the objectives of the vision and mission of the system according to the criteria that must be met in the application design objectives. The test will be carried out directly by the owner who uses a food and drink in recommendation feature. Overall test results are presented in table 3 below.

Table 3. Functionality Test Result

No	Scenario	Expected Result	Status
1	Login	Admin can enter the application	Valid
2	Dashboard	Admin can see information about food and drink menus	Valid
3	Viewing Transaction Data	Admin can view existing transaction data	Valid
4	Changing Transaction Data	Admin can change transaction data if necessary	Valid
5	Importing Transaction Data	Admin can import transaction data that has been entered into Microsoft Excel	Valid
6	Deleting Transaction Data	Admin can delete transaction data if necessary	Valid
7	Transaction Data Calculation Using the FP-Growth Method	Admin can determine the start date, end date, support and confidence which will determine food and drink menu recommendations	Valid
8	FP-Growth Method Calculation Results	Admins can view data and also metadata results from calculations that have been carried out on the FP-Growth page	Valid
9	Results of Food and Drink Menu	Admins can see what menus are purchased the most and also see menu	Valid

No	Scenario	Expected Result	Status
10	Change Password	Admin can change the admin account password if necessary	Valid

3.6. Effectiveness Test

Effectiveness testing is carried out to see how useful or effective the system that has been created is, and the testing is carried out which is directly related to the system and uses the system directly. In testing the effectiveness of the recommendation items using the fp-growth method. The effectiveness test was carried out face-to-face. Examiners make conclusions using a Likert scale with selected aspects. In general, there are 3 most important test questions related to the effectiveness test for this system, namely: is this system what the user expects, can this system help users in determining recommendations for typical Padang ⁴uvenirs, does the system interface appear? can make it easier for users to operate this system.

IV. CONCLUSION

The fp-growth algorithm approach can be implemented to get a considerable output in terms of understanding the transaction patterns that arise from buying little gifts or food and drink products. This implementation is also able to produce a precise determination of recommendations for small gifts or items from food and drinks that are based on sustainable patterns of purchasing transactions by customers in MSMEs in the culinary sector. The results obtained from the customer's sustainable purchasing transaction patterns or expressed as rules for typical Padang small gifts MSMEs, apparently produce two transaction patterns which are stated as unique rules, namely: "If a customer buys Balado Sanjai Chips, then the customer will buy Jangek Crackers", then "If a customer buys Jangek Crackers as a small gifts, the customer will buy Balado Sanjai Chips". Only two rules can be deemed legitimate and utilized as a guide when making suggestions for food and drink based on the outcomes of the rules that were created small gifts at Padang Typical Small gifts MSMEs. So data that can support customer decisions are obtained from

two patterns which are based on the assumption that the greater the support value used, the impact it will have on the confidence value and also the lift ratio value for the rule formed, the better the rule will be. suggestions for further research include using other methods such as a priori or market basket analysis.

The display on the small gifts recommendation results web page shows recommendations for food and drink small gifts and descriptions of recommended recommendations from Padang Typical Small gifts in graphical form, which is formed using calculations from the fp-growth algorithm. So that it can make it easier for Padang Typical Small gifts MSME managers to determine the list of small gifts recommended to customers. So the results of this research can be useful for applying to MSMEs, especially in terms of small gifts recommendations.

Based on the results of effectiveness tests that have been carried out, this system has an effectiveness level of 87% in recommending typical Padang small gifts products. So it can be concluded that this system really helps users in determining recommendations for typical Padang small gifts products.

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