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Prediction of price decrease in used cars using decision tree in Habib Car Showroom

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ABSTRACT

This study aims to predict the decline in the price of used cars using the Decision Tree method at the Habib Car Showroom. The main problem at the Habib Car Showroom is that there is no system that can predict the price of cars at the Habib Car Showroom. With this research, the prediction of car prices at the Habib Mobil Showroom will be more objective and very helpful for the Habib Car Showroom. This study predicts through criteria and any damage to the cars at the Habib Car Showroom, such as year of manufacture, engine condition, and body condition. Furthermore, this Decision Tree method is useful for calculating how much the price will drop through the damage to the car that will be seen in the condition of the damage. This study will produce objective and accurate results according to the damage to the car or not damaged to the car, and this study can help the Habib Car Showroom predict prices easily, objectively, and accurately.

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Introduction

Used cars are always an attractive choice for most Indonesians because they are more affordable than new cars. However, the price of used cars is often a problem because it is difficult to determine precisely. There are many factors that influence the price of used cars such as the age of the vehicle, the brand of the vehicle, and the condition of the vehicle which varies from one car to another. To help solve this problem, data mining is present as the right solution (Hasan & Asep, 2021).

A system is an orderly arrangement of interrelated activities and interconnected procedures (Tanjung et al,. 2018). The system is also a collection of components that form a single unit. (R Setiyanto, N Nurmaesah, NSA Rahayu 2019). The problem that occurs in this car showroom habib is that there is no system that can predict the selling price of used cars according to the stock of cars, body condition, engine condition and year of the car each month. If sales increase every month, the company will make a profit exceeding the company's sales target. The selling price of used cars on big days is likely to increase drastically because consumer demand also increases. Here the researcher uses the Decision Tree method to predict the selling price of used cars at this Habib car showroom. There are several factors that influence the selling price of used cars, including taxes that are almost due for payment, and quite severe car damage, a body that is no longer original can affect the selling price of the car. But if it is only scratched from use, the selling price of the car remains stable.

We need to know that the price of a motor vehicle is not cheap, so more preparation is needed to be able to buy a motor vehicle. The price of a motor vehicle is determined by the parts of the vehicle or parts on the vehicle. As the researcher is currently studying. This research is a data mining process or data mining. Data mining is a process that consists of collecting and using data to be processed in order to find patterns or relationships in a dataset. Data mining is part of the Knowledge Discovery in Database (KDD) process stage. With data mining, we can classify data, predict data, and get other useful information from large data sets or datasets.

Decision Tree is a flowchart that is shaped like a tree structure where each internal node states a test of an attribute, each branch states the output of the test and the leaf node states the classes or class distributions. The top node is called the root node. (L Qodrini, A Seppewali, A Aina 2021). The Decision Tree method allows the creation of predictive models by dividing data into smaller parts based on several variables or attributes. Each variable or attribute has a different level of importance in decision making. In this study, the ID3 algorithm is used to create a Decision Tree model that can help users determine the price of used cars accurately (L. Hakim, 2004). This study aims to develop a used car price reduction prediction system using a web-based Decision Tree.

Research methodology

This study uses the Decision Tree method (quantitative). The data collection method is carried out by direct review and research at the Habib Mobil Showroom, Jln. Tritura No. 71 B. The researcher also conducted an interview with Mr. Habib as the Owner of the Showroom on February 27, 2024, to obtain data related to the criteria for damage to cars in the Showroom. The types of software used in this study include the following: Appserv, Used to Combine open source software installer packages for Windows and Linux. Appserv consists of MySQL database program, Apache HTTP Server, and interpreter written in PHP programming language.

The hardware used in this research includes the following : Laptop Asus X441M RAM 4GB

Results & Discussion

The results of the Used Car Price Reduction Prediction Application Using Decision Tree at the Habib Mobil Showroom can be seen as follows:

1. Login Form

The login form for the Used Car Price Reduction Prediction Application Using Decision Tree at the Habib Mobil Showroom can be seen at Figure 1.

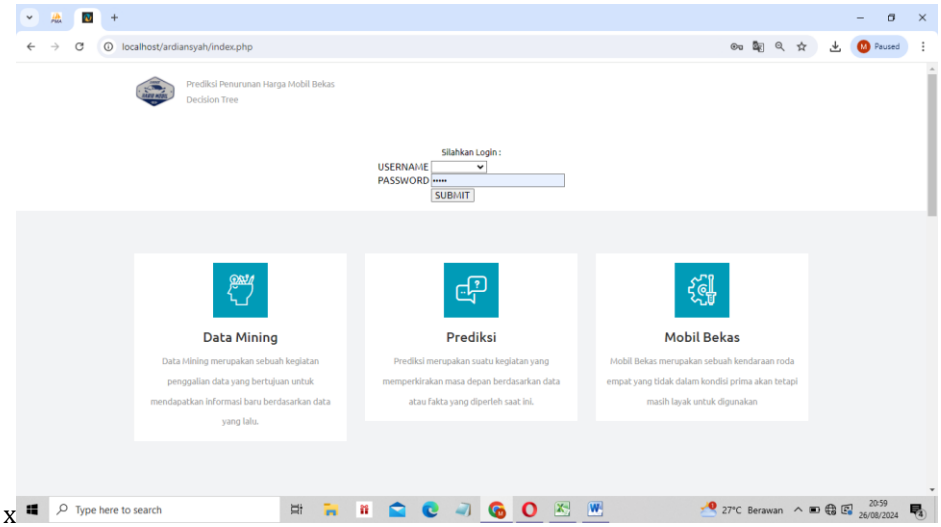

Figure 1. Login Form

2. Home Form

The Home Form of the Used Car Price Reduction Prediction Application Using Decision Tree at the Habib Mobil Showroom can be seen at Figure 2.

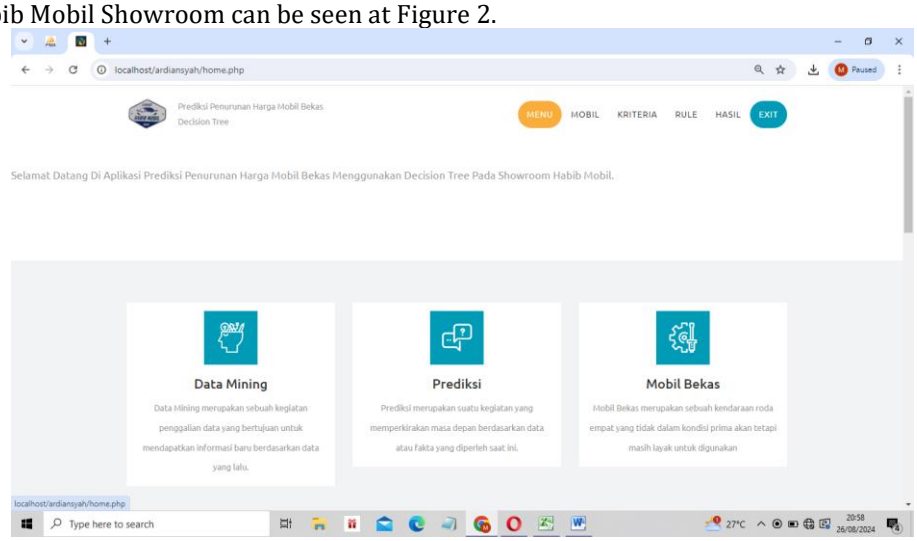

Figure 2. Home Form

3. Car Form

The Car Form from the Used Car Price Reduction Prediction Application Using Decision Tree at the Habib Mobil Showroom can be seen at Figure 3.

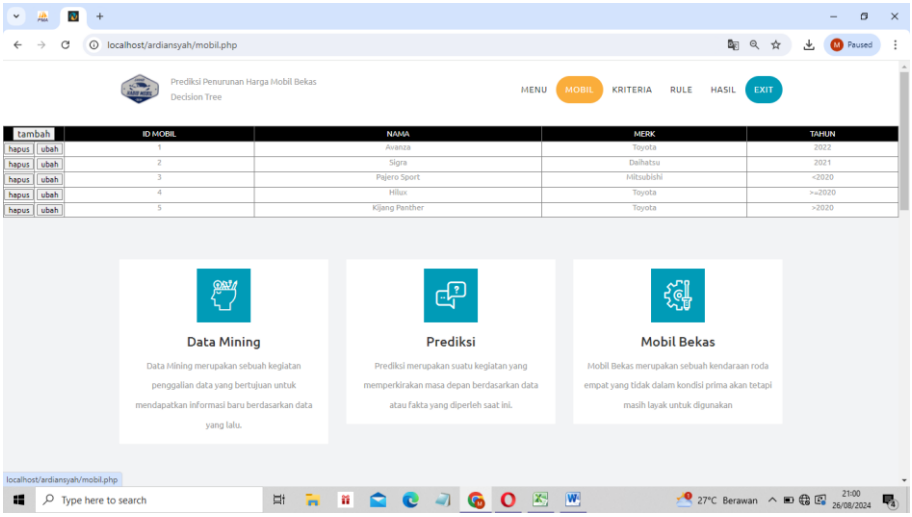

Figure 3. Car Form

4. Criteria Form

The Criteria Form for the Used Car Price Reduction Prediction Application Using Decision Trees at the Habib Mobil Showroom can be seen pada Figure 4.

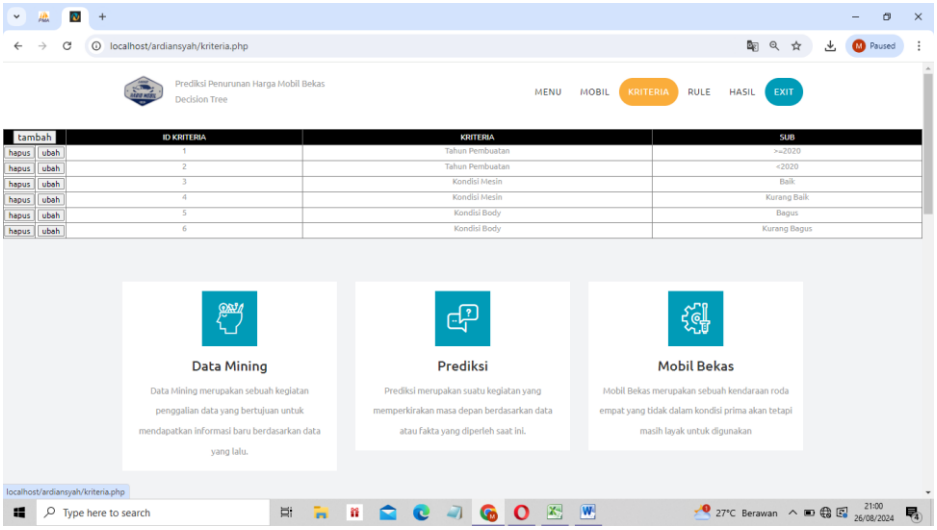

Figure 4. Criteria Form

5. Form Rule

The Rule Form of the Used Car Price Reduction Prediction Application Using Decision Tree at the Habib Mobil Showroom can be seen at Figure 5.

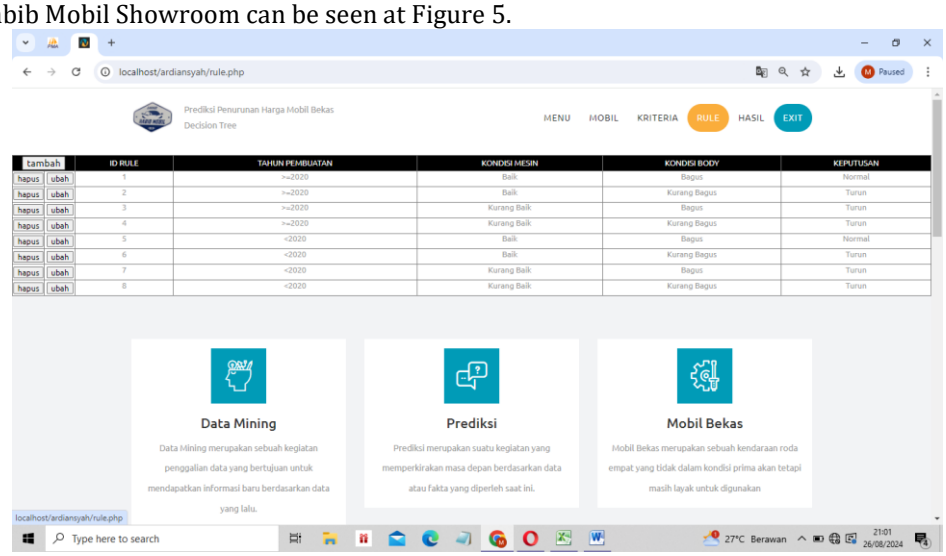

Figure 5. Form Rule

6. Prediction Form

Form Prediksi dari Aplikasi Prediksi Penurunan Harga Mobil Bekas Menggunakan Decision Tree Pada Showroom Habib Mobil dapat dilihat pada Figure 6.

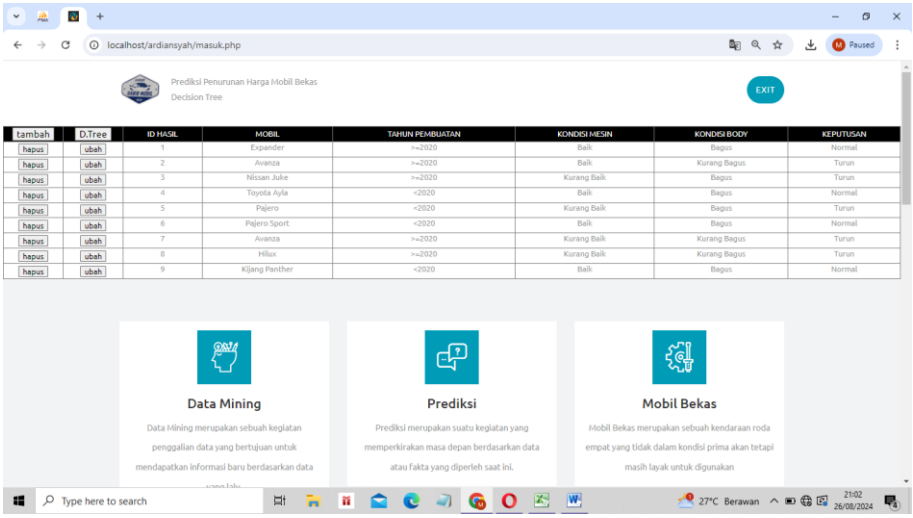

Figure 6. Prediction Form

7. Result Form

The results form of the Used Car Price Reduction Prediction Application Using Decision Tree at the Habib Mobil Showroom can be seen at Figure 7.

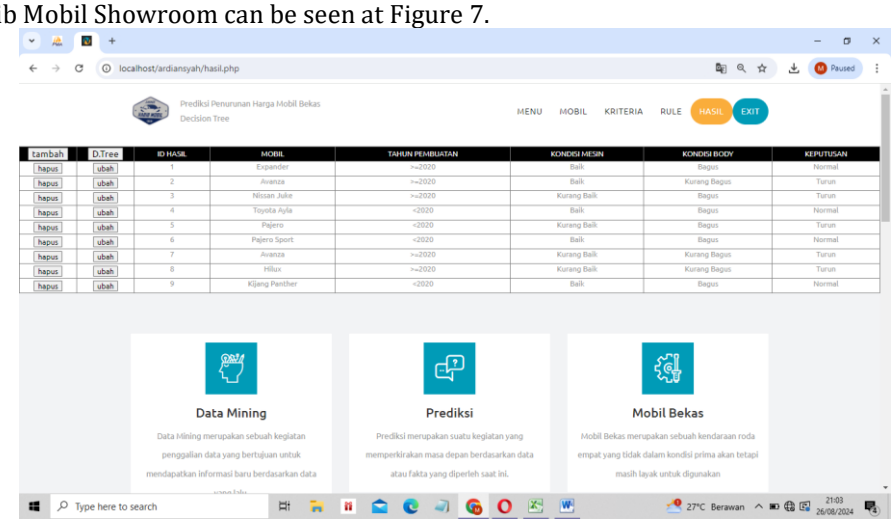

Figure 7. Result Form

Discussion

The discussion includes device requirements, results used and testing in this study.

1. Device Requirements

The hardware and software requirements for creating the application are as follows:

a. One laptop unit with the following specifications:
   - Minimum Core 2 Duo processor
   - Minimum RAM 1 GB
   - Hard disk minimum 80 GB

b. Software with the following specifications:
   - Windows Operating System
   - Notepad++
   - Appserv

2. Decision Tree Method

This study uses a decision tree which is used as a result search process. The following are the stages of the decision tree method.

a. Decision Rule

The decision rule in a decision tree determines the decision outcome based on the criteria to be used.

Table 1. Decision Rule

No	TP	KM	KB	Keputusan
1	>=2020	Good	Good	Normal
2	>=2020	Good	Not Good	Down
3	>=2020	Not Good	Good	Down
4	<2020	Good	Good	Normal
5	<2020	Not Good	Good	Down

b. Data Used

The decision tree method requires some data to be processed and Table 4.2 is data on used cars that have been purchased.

Table 2. Car Data

No	Mobil	TP	KM	KB	Keputusan
1	Expander	>=2020	Good	Good	Normal
2	Avanza	>=2020	Good	Not Good	Down
3	Nissan Juke	>=2020	Not Good	Good	Down
4	Toyota Ayla	<2020	Good	Good	Normal
5	Pajero	<2020	Not Good	Good	Down

c. Grouping of All Attributes

The decision tree method requires grouping of all attributes and Table 4.4 is a grouping of all attributes.

Table 3. Grouping of All Attributes

	Amount	Normal	Down
Total	5	2	3
Year of Manufacture			
<2020	2	1	1
>=2020	3	1	2
Engine Condition			
Good	3	2	1
Not Good	2	0	2
Body Condition			
Good	4	2	2
Not Good	1	0	1

d. Calculation of Entropy Value

Entrophy Total = ((2/5)*log(2/5)) + ((3/5)*log(3/5))

= (0.4*-0.398) + (0.6*0.222)
= -0.1592 + -0.1332
= -0.2924

Year of Manufacture:

<2020 = ((1/2)*log(1/2)) + ((1/2)*log(1/2))
= (0.5*-0.301) + (0.5*-0.301)
= -0.1505 + -0.1505
= -0.301

>=2020 = ((1/3)*log(1/3)) + ((2/3)*log(2/3))

= (0.333*-0.477) + (0.667*-0.1761)
= -0.15904 + -0.1174
= -0.276

Engine Condition:
Good = ((2/3)*log(2/3)) + ((1/3)*log(1/3))
= (0.667*-0.1761) + (0.333*-0.477)
= -0.11741 + -0.15884
= -0.276
Not Good = ((0/2)*log(0/2)) + ((0/2)*log(0/2))
= (0 * 0) + (0 * 0)
= 0 + 0
= 0

Body Condition:
Good = ((2/4)*log(2/4)) + ((2/4)*log(2/4))
= (0.5*-0.301) + ((0.5*-0.301)
= -0.1505 + -0.1505
= -0.301
Not Good = ((0/1)*log(0/1)) + ((1/1)*log(1/1))
= (0 * 0) + (0 * 0)
= 0 + 0
= 0

|S| : Number of cases in S
Gain TP = -0.2924 – (-0.301*-0.276)
= -0.37548
Gain KM = -0.2924 – (-0.276*0)
= -0.2924 – 0
= -0.2924
Gain KB = -0.2924 – (-0.301 * 0)
= -0.2924 – 0
= -0.2924

The correlation of gain to the decision is seen from the highest value, from the results above the highest value is the body condition and engine condition then the year of manufacture. So the correlation is Body Condition -> Engine Condition -> Year of Manufacture..

So :

If the body condition is good, the engine condition is good and the year of manufacture is >=2020 then the car will not get a price reduction.

If the body condition is not good, the engine condition is not good and the year of manufacture is >=2020 then the car will get a price reduction.

3. Program Trial

The system test aims to ensure that the system is ready to use. The instrument used to conduct this test is by using Blackbox Testing :

Table 4. Blackbox Testing

Blackbox Testing Login Form			
No	Login Form	Information	Validity
1.	Click the Submit Button	Application displays menu form	Valid
Blackbox Testing Form Menu			
1.	Click Home Button	Application displays home form	Valid
2.	Click Car Button	Application displays Car form	Valid
3.	Click Criteria Button	Application displays Criteria form	Valid
4.	Click Rule Button	Application displays rule form	Valid

5. Click Prediction Button	Application displays Prediction form	Valid
6. Click Result Button Result	Application displays result form Result	Valid
Blackbox Testing Form Car		
1. Click Save Button	The application saves all data in the textbox into a database table.	Valid
2. Click Change Button	The application changes the contents of the database table according to the changed data.	Valid
3. Click Delete Button	Application deletes data contents in database.	Valid
Blackbox Testing Form Criteria		
1. Click Save Button	The application saves all data in the textbox into a database table	Valid
2. Click Change Button	The application changes the contents of the database table according to the changed data	Valid
3. Click Delete Button	The application deletes the contents of the data in the database	Valid
Blackbox Testing Form Rule		
1. Click Save Button	The application saves all data in the textbox into a database table	Valid
2. Click Change Button	The application changes the contents of the database table according to the changed data.	Valid
3. Click Delete Button	The application deletes the contents of the data in the database.	Valid
Blackbox Testing Prediction Form		
1. Click Save Button	The application saves all data in the textbox into a database table.	Valid
2. Click Change Button	The application changes the contents of the database table according to the changed data	Valid
3. Click Delete Button	The application deletes the contents of the data in the database	Valid
Blackbox Testing Form Results Results		
1. Click Save Button	The application saves all data in the textbox into a database table.	Valid
2. Click Change Button	The application changes the contents of the database table according to the changed data.	Valid
3. Click Delete Button	The application deletes the contents of the data in the database	Valid
Blackbox Testing Form Results		
1. Click the Save Button	The application saves all data in the textbox into a database table.	Valid
2. Click the Result Button	The application displays the results of AHP and ROC results.	Valid

4. Trial Results

After conducting a trial on the system, the results obtained can be concluded as follows :

a. The design interface is in accordance with the resulting interface.l.
b. The Decision Tree method has been applied to the application created..
c. The application interface is user friendly so that users can use it easily.
d. The application that has been created runs well..
e. The application that has been created does not have any logical errors..

5. Application Disadvantages

The shortcomings of the application in this study include :

a. The application that has been created uses the decision tree method for decision search..
b. The application that has been created requires rules in decision search.
c. The execution process does not take a long time.

Discussion

The black-box testing results for each form in the application demonstrate that the login, menu, car, criteria, rule, prediction, and result forms all perform as expected, allowing users to save, modify, and delete data accurately within the database. Each form's button functionality is validated, ensuring the user interface is user-friendly and that all data entry and retrieval processes are efficient and error-free. The application design aligns with the interface layout intended, and the decision tree method is effectively implemented for decision-making, allowing users to navigate and utilize the application with ease. No logical errors were encountered during testing, indicating that the system operates smoothly and reliably. Despite the strengths, some limitations of the application are noted. The current model relies exclusively on the decision tree method for decision-making, which, while effective, could be enhanced by integrating additional algorithms for broader decision support. Additionally, the application depends on preset rules for decisions, which could be expanded to incorporate more dynamic criteria. Although the execution process is efficient and does not experience delays, future research might focus on optimizing the decision-making framework and incorporating more advanced prediction techniques to improve flexibility and accuracy in decision generation.

Conclusion

Used Car Price Reduction Prediction Application Using Decision Tree at the Habib Mobil Showroom can be seen as follow, by using the decision tree method, it can produce a decision to reduce the price of used cars. By using the rule criteria data and used car data, the decision tree method can be applied to determine the reduction in the price of used cars. By using web programming, it can produce a Used Car Price Reduction Prediction Application Using Decision Trees at the Habib Mobil Showroom. Suggestions from the Used Car Price Reduction Prediction Application Using Decision Tree at the Habib Mobil Showroom can be seen as follows, The application that has been created should use more accurate criteria so that it gets better results. For future research development is to improve the accuracy of the used car price drop prediction application by expanding and deepening the assessment criteria, such as considering external factors, including economic conditions, market trends, and consumer behavior that can affect used car prices. In addition, algorithm development with more complex machine learning methods, such as Random Forest or Gradient Boosting, can be explored to improve prediction accuracy. Integration of real-time data and automation features for price updates can also be considered so that the app can continue to provide relevant estimates according to current market conditions.

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