Development of an Agricultural Department Application to Predict Small Chili Prices

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***Abstract*— Small chili farmers in Soppeng Regency face challenges in planning production and marketing due to fluctuating prices. To assist various stakeholders, an accurate price prediction system is needed. This research proposes a system solution to predict small chili prices using the *Gradient Boosting* Algorithm. The *Gradient Boosting* Algorithm is employed to predict prices based on historical data using tools such as Visual Studio Code, Microsoft Excel, Python, PHP, CSS, and SQL. The dataset used consists of chili price data provided by the Department of Agriculture of Soppeng Regency, covering prices from 2018 to April 2024. The developed prediction system is capable of providing accurate price predictions, aiding farmers, traders, and consumers in production and purchasing planning. This algorithm is highly effective in predicting small chili prices and offers significant benefits to farmers, traders, and consumers in the region. The system was tested using *Mean Absolute Error* (MAE) and *User Acceptance Testing* (UAT). The results showed that the prediction error, measured using MAE, was 2730.83. Meanwhile, the User Acceptance Testing yielded a questionnaire score of 86.27%, indicating that the system has excellent performance and is highly suitable for use. It is hoped that this system will provide benefits to the entire community, especially small chili farmers, in production planning.**

Keywords— Price Prediction, Small Chili, Gradient Boosting

I. Introduction

Small chili, or *Capsicum frutescens,* is one of the most important agricultural commodities in Indonesia and many Southeast Asian countries. Soppeng Regency, located in South Sulawesi, has made small chili one of its primary commodities by launching the "One Million Tampaning Chili Seedlings" campaign [1].

One effective approach to predicting small chili prices is using the Gradient Boosting Algorithm. Gradient Boosting is an ensemble learning technique that combines multiple weak learners into a strong model. This algorithm is capable of handling data with complex features, intricate interactions, and non-linear relationships [2]. The Gradient Boosting Algorithm can be used in a price prediction system for small chilies to gather historical data on chili prices and various factors that may influence those prices. By analyzing patterns and trends from this historical data, the Gradient Boosting Algorithm can make more accurate predictions of small chili prices. Gradient Boosting incorporates gradient descent, an optimization technique that helps minimize errors. It is also more effective at handling data with high complexity [3].

The implementation of a small chili price prediction system using the Gradient Boosting Algorithm can provide several benefits. First, farmers can obtain valuable information about future small chili prices, enabling them to plan planting and production more effectively. Second, traders can use the price predictions to manage inventory and marketing strategies. Third, consumers can get price estimates for small chilies, which can assist them in planning their shopping and expenses.

With the implementation of a small chili price prediction system using the Gradient Boosting Algorithm, it is hoped that efficiency will be improved and uncertainty in the small chili market will be reduced. Stakeholders in the industry will be able to make better decisions and minimize the risk of losses due to high price fluctuations [4].

The Soppeng Regency Agriculture Office and the Soppeng Regency Food Crops, Horticulture, Plantation, and Food Security Office face several significant issues in terms of farmer empowerment. One of these issues is the shortage of human resources and technology, which has led to an agricultural information website that has not been accurately updated since 2017. This has resulted in outdated and irrelevant information. Additionally, a small chili price prediction system is crucial because farmers often struggle to predict changes in small chili prices, leading to overproduction and the risk of losses when prices drop. Traders also frequently face challenges when small chilies become unsellable during periods of surplus production and falling prices, resulting in losses for them.

A price prediction system can assist farmers and traders in better planning production and marketing by providing up-to-date and accurate data on small chili prices. With precise prediction information, farmers can reduce the risk of overproduction and optimize their yields, while traders can manage sales more effectively. Additionally, this data can be used by the Agriculture Office and Food Crops Office to enhance planning and policies in the agricultural sector. This application will support local agriculture in Soppeng Regency, reduce the risk of losses, and help the agricultural industry make better decisions.

Through its potential to integrate information and facilitate interaction among stakeholders, this application has great potential to become a powerful tool in supporting the growth and well-being of the agricultural industry as a whole. To address these issues, this research will develop a small chili price prediction system using the Gradient Boosting Algorithm, which is expected to contribute positively to the development of the agricultural sector, particularly in managing small chili prices in Soppeng Regency. The research contribution includes providing a solution to small chili price fluctuations, which can assist farmers, traders, and consumers in making better decisions. It is hoped that this will enhance the efficiency and productivity of farmers by providing accurate price predictions, allowing them to plan planting and production more effectively. With this price prediction system, it is expected to improve the income of farmers and agricultural businesses by utilizing price prediction information for smarter marketing strategies.

II. Research Methodology

A. *Price Prediction*

Price prediction is a technique used to estimate future values based on historical data and relevant factors. In this context, the Gradient Boosting Algorithm has proven effective for price prediction. This algorithm is an ensemble technique that combines multiple weak learners to improve overall prediction performance [5].

B. *Small Chili*

Bird's eye chili (*Capsicum frutescens L.*) is a type of vegetable plant with small, spicy fruits. Farmers cultivate this type of chili because it is in high demand, not only at the household level but also in the food industry, and it is exported to both domestic and international markets. Bird's eye chili can generally be grown in almost all regions of Indonesia [6].

Maintaining the quality and quantity of bird's eye chili production is a primary focus for farmers. The Agriculture Office and the Food Crops, Horticulture, Plantation, and Food Security Office of Soppeng Regency play a vital role in providing technical assistance to farmers, including the selection of superior seeds, soil management, and the implementation of sustainable farming practices. The success of bird's eye chili production relies not only on weather and planting seasons but also on supportive agricultural policies and regulations that facilitate farmers. Therefore, synergy between farmers and relevant agencies is expected to create a conducive and sustainable agricultural environment, ensuring that bird's eye chili production continues to meet both domestic and international market needs with optimal quality.

C. *Gradient Boosting Algorithm*

Gradient Boosting is a machine learning algorithm that is effective for prediction, particularly in regression and classification tasks. The algorithm operates by iteratively building predictive models, with each iteration focusing on correcting the prediction errors of the previous model. In each iteration, a new model is added to the ensemble to address existing errors [7], thereby gradually improving prediction quality. Here's how the Gradient Boosting Algorithm works:

a. Initialize the Model : In the Gradient Boosting Algorithm, the model is initially built as a constant model, which is typically the median or mean of the target variable.
b. Create Weak Models : Weak models are developed to predict the errors of the previous model. These weak models are usually shallow decision trees with one or two branches.
c. Calculate Residual Error : The residual error is computed by comparing the actual values of the target variable with the predictions from the previous model after the weak model has been created.
d. Reconfigure Training Data : The residual error is used as the target variable to update the training data.
e. Build New Models : New models are created using the residual errors from the previous model to make predictions.
f. Combine Models : The newly created models are combined with the existing ensemble to improve predictions.
g. Repeat Iterations : The above process is repeated iteratively until a specified number of iterations is reached or until the model no longer shows significant improvement.
   Here is the translation:
   The formula for the Gradient Boosting Algorithm is as follows:

$$\mathbf{y(x) = F0(x) + \alpha F1(x) + \alpha 2F2(x) + \ldots + \alpha mFm(x)} \quad (1)$$

- **y(x)** is the target value that we want to predict.
- **F0(x)** is the baseline model used as the initial reference.
- α is the learning rate, which controls how much each model contributes to the final prediction.
- $F1(x), F2(x)$, …, Fm(x) are additional models built incrementally to improve the prediction performance.

One of the main advantages of Gradient Boosting is its ability to address the problem of overfitting [8]. Overfitting occurs when a model is too complex and overly tailored to the training data, making it less applicable to new data. In Gradient Boosting, additional models are incorporated into the ensemble by focusing on the remaining errors, thereby reducing the effect of overfitting and resulting in a more generalized model.

Additionally, Gradient Boosting is also effective in dealing with imbalanced data or when there are differences in the number of samples for each class. This algorithm can adjust the weights or place more emphasis on the less frequent samples, thereby improving prediction performance for the less common classes.

Another advantage of the Gradient Boosting Algorithm is its ability to handle both numerical and categorical features. This algorithm can manage these two types of features without requiring special preprocessing, such as one-hot encoding for categorical features. During the model-building process, Gradient Boosting can automatically optimize the splitting and combination of variables to maximize prediction accuracy.

Overall, Gradient Boosting is a powerful and flexible algorithm for making predictions, particularly in the context of regression and classification [9]. Its strengths lie in its ability to address overfitting, handle imbalanced data, and manage both numerical and categorical features.

D. Machine learning

Machine learning is another field of computer science that designs algorithms enabling computers to learn from data, often referred to as learning from data [10]. In other words, machine learning involves programming computers to use past data to learn a model, allowing the computer to extract information from data sets in the most efficient way possible [11]. However, according to Tom M. Mitchell, machine learning is defined as a computer program that improves its performance on a given task based on experience [12].

E. Agricultural Conditions of Soppeng Regency

Soppeng Regency is also developing small-scale chili farming with a focus on the Tampaning Chili variety, which is a superior variety. This variety is well-known for its resistance to various environmental conditions and its ability to produce multiple harvests. Due to its exceptional durability, this chili has gained international recognition [13].

The local government's goal is to reduce inflation and improve food security by promoting large-scale chili cultivation through the "Quick Harvest Crop Planting Movement" program. The Tampaning Chili is highly favored for its disease resistance and financial profitability. Under optimal conditions, production yields can reach between 600 million and 800 million rupiahs per hectare per year. Additionally, several companies have expressed their readiness to purchase chili crops from local farmers. Aiming to reduce dependence on external supplies and increase local income, this program not only focuses on chili planting but also distributes seedlings to all districts in Soppeng Regency [14].

F. Market Prices

The instability of price fluctuations makes meeting needs a challenge. Generally, prices are determined by the interaction between supply and demand. When supply exceeds demand, prices tend to fall. Conversely, if supply is limited while demand is high, prices tend to rise. However, when it comes to staple goods, especially agricultural products, the situation is somewhat different. This is because staple goods play a crucial role in daily life, leading to demand that tends to be stable (inelastic) with respect to price changes. This is what makes the prices of staple goods highly volatile when there are changes in market supply [15].

G. Supply Data

The supply of chili is a crucial factor that influences the price of small chili in Soppeng Regency. Supply data includes the amount of chili available in the market, both locally produced and imported. Local production is affected by the size of the agricultural land, cultivation techniques, and weather conditions. Distribution and transportation play a key role in efficiently delivering chili from farmers to markets. Additionally, imports from other regions can bolster the local supply when production is insufficient.

Stock and reserves also have an impact, with good stock management ensuring an adequate availability of chili. The influence of supply data on chili prices is significant, with excess supply tending to lower prices, while supply shortages can lead to price increases. By effectively utilizing supply data, small chili price predictions can be made more accurately, aiding farmers, traders, and policymakers in making better decisions.

A. Needs Analysis

The needs analysis of the system is conducted to determine what is required for the system. The system requirements for this research include both hardware and software as follows:

Table 3.1 Hardware Requirements

Hardware	Description
Laptop (Minimum specification: 8GB RAM, AMD Ryzen 5 Processor)	As the main device used for conducting research tasks..

Software	Description
Windows 10 Operating System	Windows 10 is a widely used operating system that supports most of the hardware and software needed for the research.
Microsoft Excel	A highly useful tool for initial data analysis, data processing, and simple visualization.
Visual Studio Code (Code Editor)	Visual Studio Code (VS Code) is a powerful and lightweight source code editor with extensive support for various programming languages and development tools.
Python	Python is a highly popular and versatile programming language widely used in data analysis, machine learning, and web development.
PHP (Hypertext Preprocessor)	PHP is a server-side scripting language designed for web development.
CSS (Cascading Style Sheets)	CSS is used to style and layout web pages created with HTML.

phpMyAdmin	phpMyAdmin is a web tool for managing MySQL or MariaDB databases through a graphical interface.

B. Research Procedure

The research procedure is used to ensure that the research conducted is more focused and structured, thereby achieving the research objectives. The description of the research process to be carried out is shown in Figure 1 as follows:

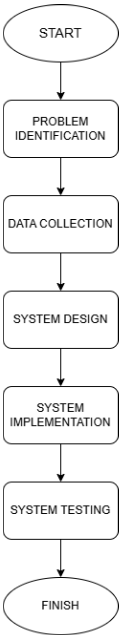

Figure 1 Research Procedure

a. Problem Identification

In the initial stage, the problem in the agricultural sector is identified. One of the issues faced is climate change, which causes irregularities in the onset of the rainy and dry seasons, as well as an increase in the frequency of extreme events such as floods, droughts, and attacks by Plant Pest Organisms (PPO). This leads to crop failures and harvest losses, as well as price instability of commodities in the market, which affects people's decisions on planting. Fluctuations in supply also impact the prices of staple goods. The next step is to determine the scope of the system to be developed and conduct a literature review to study and identify the requirements for the system, including referring to relevant books and journals.

b. Data Collection

This research uses datasets sourced from the Department of Agriculture of Soppeng Regency, the Department of Food Crops, Horticulture, Plantations, and Food Resilience of Soppeng Regency, and the Central Statistics Agency of Soppeng Regency. The dataset includes historical data on small chili prices and historical data on small chili supply. The historical data on small chili prices contains 5 features and 2032 rows of data spanning from 2018 to April 2024. The historical data on small chili supply contains 5 features and 462 rows of data covering the period from 2018 to 2020.

Table 3.3 Initial Rows of Historical Small Chili Price Data

Year	**Month**	**Week**	**Day**	**Price (IDR)**
2018	March	1	1	25.000
2018	March	1	2	30.000
2018	March	2	1	30.000
2018	March	2	2	30.000
2018	March	3	1	30.000
2018	March	3	2	30.000
2018	March	4	1	30.000
2018	March	4	2	30.000
2018	March	5	1	30.000
2018	April	1	1	37.000

Table 3.3 Initial Rows of Historical Small Chili Supply Data

Year	**Month**	**Week**	**Day**	**Supply Amount**
2018	March	1	1	117
2018	March	1	2	117
2018	March	2	1	117
2018	March	2	2	117
2018	March	3	1	117
2018	March	3	2	117
2018	March	4	1	117
2018	March	4	2	115

c. System Design

In this stage, the system design is carried out to outline the workflow of the system to be created.

1. System Architecture

This stage involves outlining the system architecture that will be developed.

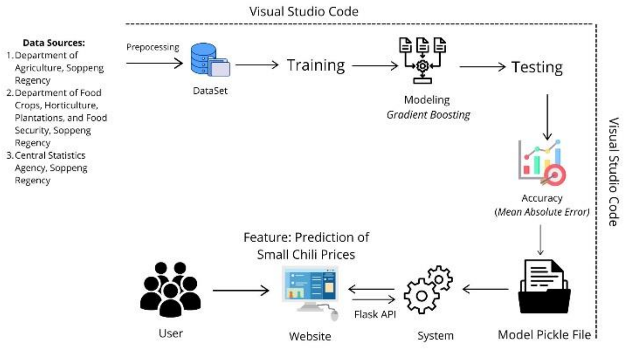

Figure 2 System Architecture

In Figure 2, the system development involves utilizing data from the Department of Agriculture of Soppeng Regency, the Department of Food Crops, Horticulture, Plantations, and Food Resilience of Soppeng Regency, and the Central Statistics Agency of Soppeng Regency, with the data stored in Excel format. The next stage is preprocessing, where the data is trained using the Gradient Boosting Algorithm. Subsequently, the results from training the Gradient Boosting Algorithm will generate a model, which will then be used to predict the chili prices in Soppeng Regency.

2. Use Case Diagram

A use case diagram describes the interaction between one or more actors and the system to be developed. Use case diagrams are used to identify the functions available within a system and who is authorized to use these function

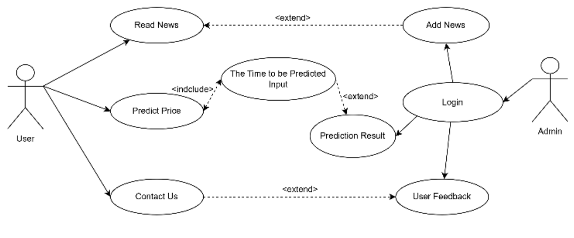

Figure 3 Use Case Diagram

d. System Testing

This testing process is carried out by the system designer to ensure the quality of the system being developed. The following are some of the tests to be conducted:

a. MAE (Mean Absolute Error) Testing

In prediction system testing, a crucial metric is Mean Absolute Error (MAE). MAE measures how accurately the model predicts the value by calculating the average absolute difference between the predicted values and the actual values. A small MAE value indicates that the model's predictions are close to the actual values, while a large MAE value suggests significant prediction errors. By understanding MAE, we can ensure that the small chili price prediction model is functioning well and providing accurate results. The formula for Mean Absolute Error is as follows:

$$\mathrm{MAE} = \frac{1}{n}\sum_{i=1}^{n}|A_i - F_i| \quad (1)$$

Description:

- n is the sample size.
- Ai is the actual value of the iii-th data point.
- Fi is the forecasted value of the iii-th data point.

Since the MAE formula involves absolute values (| |), the MAE value will always be positive.

b. User Acceptance Testing (UAT) Questionnaire Using Likert Scale Method

Using the Likert scale method, User Acceptance Testing (UAT) aims to assess how well the small chili price prediction system, which uses the Gradient Boosting algorithm, is accepted and rated by users. During this process, a questionnaire is provided on various aspects of the system, such as prediction accuracy, ease of use, and interface usability. Respondents are asked to rate these statements using a Likert scale, which typically includes options ranging from “Strongly Disagree” to “Strongly Agree.” The questionnaire data is then analyzed to obtain an overall picture of user satisfaction. Each statement has an average score that provides insight into the system's strengths and weaknesses. The results of the analysis help the development team identify areas that need improvement or enhancement. For example, developers can make adjustments if feedback indicates dissatisfaction with prediction accuracy.

Table 3.4 Range of Scores

Score Range	Description
0 – 19,99 %	Very Poor
20- 39,99 %	Poor
40 – 59,99 %	Neutral
60 – 79,99 %	Acceptable
80 – 100 %	Very Good

c. Black Box Testing

Black box testing is a software testing method that examines the functionalities of the software without considering its internal structure or implementation. This method focuses on the input and output produced by the software, and black box testing involves checking the application's functionality without looking into the implementation details.

III. Results and Discussion

The result of this research is a Small Chili Price Prediction System, designed as a comprehensive solution to support various stakeholders, including farmers, consumers, as well as the Department of Agriculture of Soppeng Regency and the Department of Food Crops, Horticulture, Plantations, and Food Resilience of Soppeng Regency. This system aims to facilitate the prediction of future small chili prices, thereby providing significant benefits in planning and decision-making in the agricultural and food sectors.

A. Data Collection

The initial stage of this research involves collecting the necessary data for the development of the system. The data used in this study consists of historical small chili price data and historical small chili supply data. The historical small chili price data includes 2032 rows from 2018 to April 2024, while the historical small chili supply data includes 462 rows from 2018 to 2020. This data encompasses information on the year, month, week, day, price, and supply. Table 4.1 provides an overview of the data rows present in the dataset.

Table 4.1 Dataset Overview

Year	Month	Week	Day	Supply Amount	Price (IDR)
2018	Maret	1	1	117	25.000
2018	Maret	1	2	117	30.000
2018	Maret	2	1	117	30.000
2018	Maret	2	2	117	30.000
2018	Maret	3	1	117	30.000
2018	Maret	3	2	117	30.000
2018	Maret	4	1	117	30.000
2018	Maret	4	2	115	30.000
2018	Maret	5	1	115	30.000

B. System Design

The design of the system includes needs analysis, system architecture design, database design, and user interface design. The main goal of this design is to ensure that the developed system functions according to the desired specifications, is efficient, and is user-friendly.

1. Preprocessing

The obtained data is then processed in Microsoft Excel to check for and handle missing values. This can be done by either filling in the missing values with specific values or removing the rows with missing values. Data scaling is also performed to ensure that all features are on the same scale. This may involve normalizing or standardizing the data to improve the performance of the machine learning model.

2. Implementation of Gradient Boosting Model

The Gradient Boosting model, gradient_boosting_model9.pkl, stores the trained Gradient Boosting model using the available dataset. It contains important information such as model coefficients and the decision tree structure that forms the ensemble model, including decision rules and splits at each node of the tree. Additionally, this file also stores the hyperparameter values used during the training process, such as the number of trees, learning rate, and maximum tree depth, all of which play a role in determining the model's performance. Furthermore, the file includes the predicted values necessary for processing new data, as well as the list of input features used during training. With all this information, the gradient_boosting_model9.pkl file allows the model to be reused on new data for small chili price prediction without needing to retrain, thus facilitating the model's application in real-world scenarios. Figure 4.1 shows saving the model to a file using pickle.

```
with open('gradient_boosting_model9.pkl', 'wb') as f:
    pickle.dump(model, f)
```

Figure 4 Saving the Model to a File Using Pickle

3. Flask API Implementation

The Flask API is used as an interface between users and the small chili price prediction system. Flask, as a web framework for Python, enables the development of simple and efficient web applications. In this system, the Flask API functions to receive input data from users in JSON format through the /predict endpoint. This data is then processed to match the format and structure used during the model's training. After preprocessing, the trained Gradient Boosting model will be used to predict the small chili price. The prediction results are then sent back to the user in an easily understandable format, such as "10,000 rupiah." By using Flask API, the system can be widely accessed and allows for easy interaction between users and the prediction system, facilitating the delivery of more accurate and real-time small chili price information. The implementation is shown in Figure 4.2.

```
model_path = 'gradient_boosting_model9.pkl'
loaded_model = load_model(model_path)

@app.route('/predict', methods=['POST'])
def predict():
    data = request.get_json()

    data_prediksi = pd.DataFrame(data)

    # Melakukan preprocessing data
    data_prediksi_processed = preprocess_data(data_prediksi, loaded_model)

    # Melakukan prediksi harga
    harga_prediksi = predict_price(loaded_model, data_prediksi_processed)

    # Format hasil prediksi
    harga_prediksi_formatted = format_price(harga_prediksi)

    return jsonify({'predicted_price': harga_prediksi_formatted})
```

Figure 5 Flask API Implementation for Small Chili Price Prediction

C. System Implementation

The following is the interface of the Small Chili Price Prediction System Website Using Gradient Boosting Algorithm:

a. User Dashboard Page

The user dashboard page is specifically designed to present various important and relevant information about small chili in Soppeng Regency. On this page, users can find the latest news, updates, and other important information related to small chili. The purpose of this page is to provide users with comprehensive insights so that they are always up-to-date and can make better decisions based on the available data, as shown in Figure 6.

Figure 6 User Dashboard Page

b. Prediction Page

The prediction page is accessible to all residents of Soppeng Regency for forecasting future small chili prices. On this page, users are asked to input several key variables, including year, month, week, day, supply amount, and whether there are any significant holidays in the month. After users provide all the required information, the system processes the data and displays the predicted small chili price based on the input given. This page is designed to offer easy access and understanding to the public, allowing them to make more accurate and informative price forecasts, as shown in Figure 7.

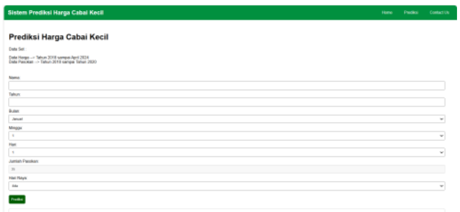

Figure 7 Prediction Page

c. Contact Us Page

The Contact Us page is designed to be accessible to all residents of Soppeng Regency. This page provides a facility for users to send messages, feedback, or suggestions to the relevant departments handling the agriculture sector, particularly related to small chili. Through this page, the public can communicate directly with the authorities, enabling better interaction and contributing to the improvement of services and management of small chili farming in Soppeng Regency, as shown in Figure 8.

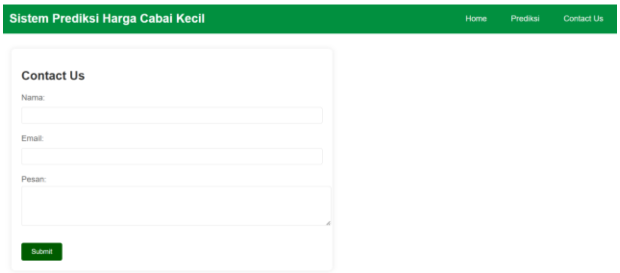

Figure 8 Contact Us Page

D. System Testing

a. MAE (Mean Absolute Error) Testing

The MAE (Mean Absolute Error) testing of the system is shown in Figure 9 and the test results are displayed in Figure 10.

```
mae = mean_absolute_error(y_test, y_pred)
print("Mean Absolute Error:", mae)
```

Figure 9 Script for Calculating Mean Absolute Error

```
[Running] python -u "d:\tampilan\tampilan\testing.py"
Mean Absolute Error: 2730.8333851700227
```

Figure 10 Mean Absolute Error Calculation Results

Based on the results obtained in Figures 4.7 and 4.8, the prediction error of the model, measured using the Mean Absolute Error (MAE), is 2730.83. With an actual average value of 28485.56, this MAE value represents 9.59% of the actual average value. This calculation can be explained as follows:

Percentage of MAE relative to the average actual value:

$$\left(\frac{2730.83}{28485.56}\right) x\ 100\ =\ 9{,}59\%$$

Additionally, with the maximum observed value being 55,000, the MAE value can also be expressed as 4.97% of the maximum value. The calculation to obtain this value is as follows:

Percentage of MAE relative to the maximum value:

$$\left(\frac{2730.83}{55000}\right) x\ 100\ =\ 4{,}97\%$$

From the calculations above, it can be concluded that the model has a relatively low error rate, both compared to the average actual value and the observed maximum value. This indicates that the model is accurate in making predictions [16].

b. Blackbox Testing

The blackbox testing for the user interface is shown in Table 4.4, which includes features, test types, expected results, and actual results.

Table 4.4 Blackbox Testing for User Interface

No.	Feature	Test Type	Expected Result	Result
1	Landing Page	Opening the website link	Website opens and displays the main page.	Success
2	Home Menu	Clicking the home button	Displays the main page with images of small chili and latest news.	Success
3	Latest News Menu	Clicking the "Read More" button	Redirects to the news website page.	Success
4	Prediction Menu	Clicking the Prediction button	Displays the form for predicting small chili prices.	Success
5	Prediction Button	Clicking the Prediction button	Displays the predicted price of small chili in rupiah and saves to the admin database.	Success
6	Contact Us Menu	Clicking the Contact Us button	Displays the contact us form for message input.	Success
7	Submit Button	Clicking the Submit button	Sends the contact us form submission to the admin database.	Success

c. User Acceptance Testing Questionnaire Evaluation

The results of the User Acceptance Testing questionnaire, conducted with 30 respondents consisting of farmers, traders, housewives, and related government employees, have been collected. The results of this questionnaire are then presented in the following table:

Table 4.5 Questionnaire Calculation

	Descriptiom	**Weight (N)**	**Frequency (F)**	**F xN**
Ease of Finding Information	Very Easy	5	7	35
	Easy	4	21	84
	Adequate	3	2	6
	Difficult	2	0	0
	Very Difficult	1	0	0
			30	125
	Accuracy			83,33%
Clarity of Display	Very Clear	5	9	45
	Clear	4	20	80
	Adequate	3	1	3
	Not Clear	2	0	0
	Not Clear at All	1	0	0
			30	128
	Accuracy			85,33%
System Speed	Very Fast	5	13	65
	Fast	4	16	64
	Adequate	3	1	3
	Slow	2	0	0
	Very Slow	1	0	0
			30	132
	Accuracy			88%
Prediction Accuracy	Very Accurate	5	10	50
	Accurate	4	19	76
	Adequately Accurate	3	1	3
	Less Accurate	2	0	0
	Not Accurate	1	0	0
			30	129
	Accuracy			86%
Satisfaction	Very Satisfied	5	14	70
	Satisfied	4	15	60
	Adequate	3	1	3
	Less Satisfied	2	0	0
	Not Satisfied	1	0	0
			30	133
	Accuracy			88,67%
	86,27%			

Based on the average percentage obtained from the questionnaire calculation table, which is 86.27%, the system can be considered "Very Feasible."

IV. Conclusion

The conclusions from this research are as follows:

1. The development of the agricultural department's application to predict small chili prices has been successfully completed using various tools, including PHP programming language, CSS for styling, and phpMyAdmin for managing the MySQL database.
2. The application of the Gradient Boosting algorithm to improve the accuracy of small chili price predictions has been successfully implemented, with an average Mean Absolute Error of 9.59% relative to the actual value and an average Mean Absolute Error of 4.97% relative to the maximum value.

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