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Information System Prediction of Room for Rent Price in Yogyakarta Region Based on Website Using Linear Regression Algorithm

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ABSTRACT

This development research was carried out to create a boarding house price prediction information system product that could help the problems of entrepreneurs and boarding house users regarding the determination of boarding prices. This development research was carried out to create a boarding house price prediction information system product that could help the problems of entrepreneurs and boarding house users regarding the determination of boarding prices. The research method used in this development research process is Research and Development with the Waterfall Model method. During the development process, tests were also carried out to determine the quality of the information system developed by referring to the ISO 25010:2011. The results of this research and development process are (1) Linear Regression algorithm as the best Machine Learning model that can make relevant and accurate predictions of boarding house rental prices. (2) A web-based boarding price prediction information system in the Yogyakarta Region was developed using the Waterfall development model and the Flask framework, which can automatically predict the relevant prices of the facilities selected by the user. (3) Test results on the Functional Suitability aspect ensure that all functions in the information system can run properly. The usability aspect produces 86.7% (Very Good category). The Performance Efficiency aspect produces a percentage of 100% (Very Good Performance), and fully loaded web page time is only 0.707 seconds (Good category). The reliability aspect results in a percentage of system resilience of 100% on sessions, pages, and hits in testing.

Keywords*:* information system, waterfall, ISO 25010, website

INTRODUCTION

Indonesia is one of the countries with the largest total population in the world today. According to data from BPS, the results of the Survei Penduduk Antar Sensus (SUPAS) conducted in 2015 projected that by 2030 the population of Indonesia would reach 294.1 million (BPS RI, 2018). Even now, Indonesia is ranked 4th order countries with the most population in the world (Worldometers, 2022).

Various regions in Indonesia have diverse population densities. This can happen because people generally look for places that are good in terms of the facilities and resources available in those places (Suhardi, 2009). Another factor that causes high and low diversity of population density in a place is the wide factor of an area, where the narrower an area, the level of population density will also increase (Pakpahan, 2019).

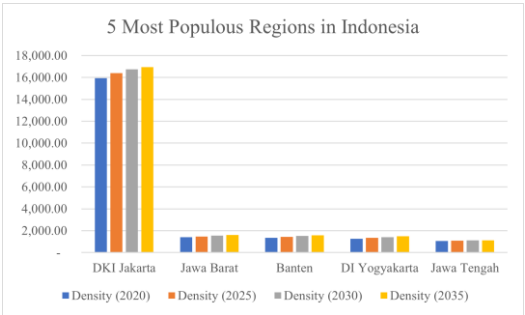

Figure 1. Five Most Populous Regions in Indonesia 2020 – 2035

From population density data in various regions in Indonesia, the Province of the Special Region of Yogyakarta is one of the areas with the highest population density in Indonesia.

The Province of the Special Region of Yogyakarta, known as a city of students, a city of culture, and a city of tourism, is a big tourist

attraction for migration. One of the goals of migrants who come to the Special Region of Yogyakarta Province is to study and work (Zubaidah et al, 2016), in addition to the good quality of education in Yogyakarta, the advancement of infrastructure and adequate transportation in the Special Region of Yogyakarta has led to many residents from outside the Special Region of Yogyakarta who migrate to improve the quality of life (Juningsih, 2015). Prihatin argues that migrants who flock to urbanize somewhere are one of the causes of an increase in population (Prihatin, 2015).

Few migrants, including students and workers who moved to the Special Region of Yogyakarta with migratory status, came from the lower middle class. Economic limitations in some circles of society, including students, college students, and workers, make boarding houses an alternative solution to affordable temporary housing.

Nowadays, along with the rapid development of technology, the use of technology, especially websites, has been used by boarding house seekers and boarding entrepreneurs in the process of boarding rental transactions in Yogyakarta. This was proven by a survey conducted by researchers, where as many as 44.7% of boarding house users stated that they had used online media while searching for boarding houses. Meanwhile, a survey on boarding houses found that 70% of boarding houses had used blended media in their marketing process. The increased utilization of website/online media technology in the boarding house transaction process is also evidenced by the news that researchers quoted from detik.com (Rahman, 2022), where in the first quarter of 2022, there was an increase in demand for boarding houses by 125% in Yogyakarta on the Mamikos.com platform.

However, the current process of using technology, especially websites, is still limited to using it for search and marketing of boarding houses. There is no utilization of website technology, especially machine learning, in determining boarding prices. At this time, the process of determining the price of boarding houses is still being carried out conventionally by boarding house entrepreneurs.

The conventional pricing system will more or less affect the pros and cons of both the boarding house owner and the tenants. Losses will occur to the owner of the boarding house if the price is set too low, compared to a reasonable price, if it is based on the facilities provided. Vice versa, losses will occur to the tenants of the boarding house if the rental price is too high and does not match the facilities provided. Siliwangi, in his research, explained that in the period from 2017 to 2019, many students moved from boarding houses (Siliwangi, 2020). This was because the old boarding houses had minimal facilities, not worth the price set by the owners. This is also supported by a survey conducted by researchers of 47 respondents who use boarding houses in the Special Region of Yogyakarta, where the survey results show that 16 respondents said they were dissatisfied, and seven other respondents said they were unsure whether the facilities available at the boarding houses were worth the price they paid.

Seeing the urgency of the current increase in public demand for boarding houses, and also related to the problem of determining the price of boarding houses, relevant to the facilities provided. So, the authors make a system that can help boarding house owners to predict boarding house rental prices in accordance with the desired boarding house criteria in the Special Region of Yogyakarta Province, such as the area of the unit, location, and facilities provided. This research aims to assist prospective boarding house tenants in finding boarding prices that are within their budget and also help boarding house

owners who already have boarding houses to set rental prices according to the facilities provided.

METHODS

The type of research used in this research is Research and Development (R&D). This R&D method is used to produce a product and also to test the software quality of the product that has been developed.

The development model used in this study is the Waterfall development model, which consists of several stages, as shown in Figure 2 below.

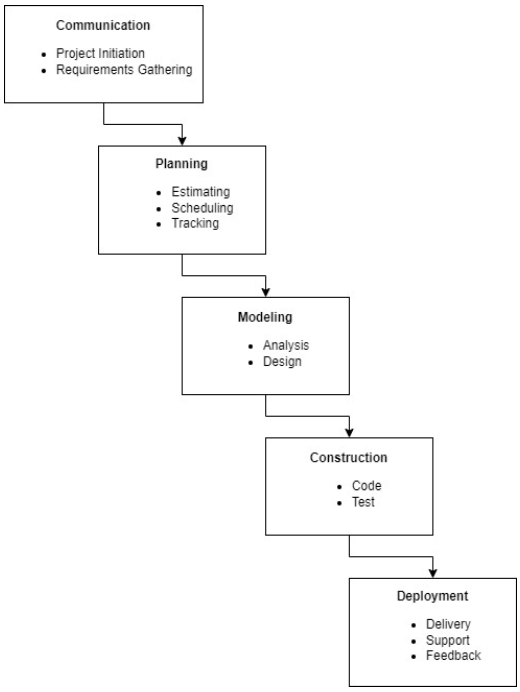

Figure 2. Waterfall Model
(Pressman & Maxim, 2014)

This research was carried out from November to December 2022. The research location for this research was carried out in the Province of the Special Region of Yogyakarta.

This research was conducted to develop an information system product where users will test this information system. Users, in this case, are boarding house users and owners throughout the Special Region of Yogyakarta, with a total of 60 respondents from the two categories of respondents.

Data, Instruments, and Data Collection Techniques

The method used in the process of collecting data for this research are:

1. Observation

   Observation is a data collection technique carried out by directly observing the research object[11]. This observation was carried out at several boarding houses in the Yogyakarta Region to find problems and to analyze the solutions that could be given.

2. Questionnaire

   The questionnaire is a data collection technique that is carried out by giving questions through a questionnaire sheet given to the respondents to answer[11]. The questionnaire given to these respondents contained several statements related to testing the software quality of the product being developed. Questionnaires were given to information system testers: development experts, and users.

Data Analysis Technique

The data analysis technique used in this research process is descriptive statistical data analysis. Descriptive statistics are statistics used for the analysis process by describing or describing the data that has been collected without intending to make generalizations (Sugiyono, 2017).

The scale used in the questionnaire distributed to respondents is the Likert scale and the Guttman scale. The Likert scale is used to measure opinions, attitudes, and perceptions of a person or group of people about social phenomena or events (Sugiyono, 2017).

Table 1. Guttman scale classification (Sugiyono, 2013).

No	Category	Score
1	Yes	1
2	No	0

The technique for determining the score for testing the Functional Suitability aspect uses the following formula (ISO, 2011).

$$X = 1 - \frac{A}{B}$$

Information:

A = number of functions that are not functioning properly

B = number of functions evaluated

Table 2. Likert scale classification (Sugiyono, 2013)

No	Category	Score
1	Strongly Agree / Sangat Setuju (SS)	5
2	Agree / Setuju (S)	4
3	Doubtful / Ragu - Ragu (RG)	3
4	Disagree / Tidak Setuju (TS)	2
5	Strongly Disagree / Sangat Tidak Setuju (STS)	1

The technique for determining score intervals for testing the Usability aspect uses the following formula (ISO, 2011).

$$percentage\ (\%) = \frac{total\ score}{maximum\ score}\ x\ 100\%$$

The technique for determining score intervals for testing the Usability aspect uses the following formula.

$$Interval = \frac{100}{total\ score\ (Likert)}$$

$$Interval = \frac{100}{5}$$

$$Interval = 20$$

From the results of calculating these intervals, it can be concluded that the distance interval from the assessment percentage table is 20, so the interpretation of the percentage table can be seen in table 3.

Table 3. Percentage of assessment

No	Achievement percentage	Interpretation
1	0% - 19,99%	Very Not Good
2	20% - 39,99%	Not Good
3	40% - 59,99%	Enough
4	60% - 79,99%	Good
5	80% - 100%	Very Good

After obtaining the interval from the Usability score, the consistency/reliability calculation is carried out from the data obtained using Cronbach's Alpha reliability calculation with the rules of thumb stated by George & Mallery (George & Mallery, 2019) as seen in Table 4.

Table 4. Cronbach's Alpha Value

Cronbach's Alpha	Interpretasi
α ≥ 0.9	Excellent
0.9 > α ≥ 0.8	Good
0.8 > α ≥ 0.7	Acceptable
0.7 > α ≥ 0.6	Questionable
0.6 > α ≥ 0.5	Poor
0.5 > α	Unacceptable

RESULT AND DISCUSSION

This research has produced a product in the form of a web-based boarding house price prediction information system. This boarding house price prediction information system was developed using the waterfall development model, which consists of Communication, Planning, Modeling, Construction, and Deployment.

Communication

Communication activities are carried out using two methods: observation and filling out instruments in the form of questionnaires given to informants/respondents. Communication activities are carried out with users and boarding house owners in the Yogyakarta Region. This communication process aims to determine the problems users and boarding house owners face in determining the appropriate boarding price.

The results of this communication activity are as follows:

1. The process of determining the price of boarding houses that have been carried out so far still uses the conventional method, namely the estimated price of the owner or based on the prices of other boarding houses in the vicinity.
2. Prospective boarding house users have difficulty estimating the price of the boarding house they will occupy.
3. Boarding house owners have difficulty determining the price of their boarding house that is relevant to the facilities provided.

After successfully knowing the root of the existing problems, the researchers began to make product specifications. Detailed product specifications are as follows:

1. The product is in the form of a website-based information system to assist in the process of determining the price of boarding houses.
2. The information system developed is connected online so all users can access it through their respective devices.
3. There are several variables in the form of boarding facilities that the user can select to produce output in the form of relevant boarding prices according to the variable facilities selected by the user.

Planning

Planning is the process of preparing a schedule during ongoing product development. This scheduling process aims to guide developers so that the ongoing development process can run effectively and be completed on time according to estimates. Planning for the development of an information system for predicting the price of boarding houses in the Yogyakarta Region can be seen in Table 5.

Based on the information system development schedule table above, this boarding house price prediction information system is planned to be implemented for 66 days, or approximately two months.

Table 5. Development Planning Table

No	Activity	Duration
1.	Communication Process	7 days
2.	Needs Analysis	7 days
3.	UML design	7 days
4.	Construction	28 days
5.	Evaluation with users	1 days
6.	Improvement	14 days
7.	Evaluation with users	1 days
8.	Deployment	1 days

Modeling

At this Modeling stage, several processes are carried out in the context of information system development, such as planning the Unified Modeling Language (UML) design. The Use Case Diagrams, Activity Diagrams and Sequence Diagrams were created for the Unified Modeling Language (UML) design.

1. Use Case Diagram Design

   This boarding house price prediction information system has one actor: the user. The user himself is a website user who can carry out boarding price prediction activities by providing input from the variables provided.

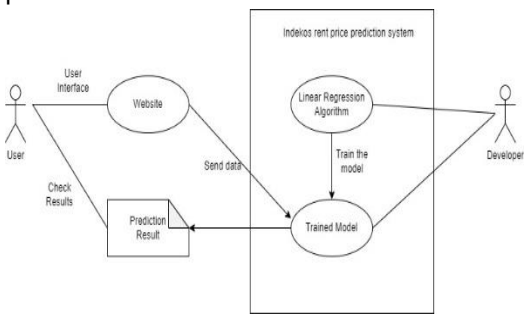

Figure 3. Use Case Diagram Design

2. Activity Diagram Design

   Based on the Use Case Diagram that has been designed above, an Activity Diagram can be produced. An activity diagram is useful for providing an overview of the dynamic activity of an information system.

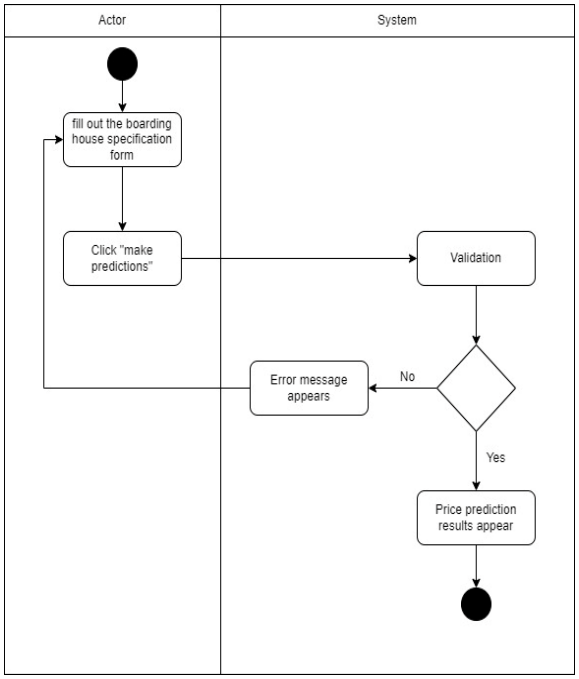

Figure 4. Activity Diagram Design

The design of the Activity Diagram above illustrates the process of predicting the price of boarding houses based on variable data entered by the user in the form provided on the website. The data in question is variable data used in the boarding price prediction information system, such as the variable type of boarding house, city, district, type of bathroom, room area, and others.

3. Sequence Diagram Design

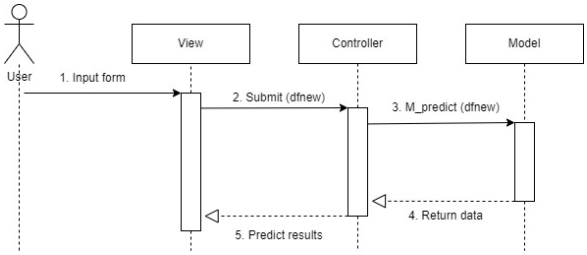

Figure 5. Sequence Diagram Design

Figure above is a sequence diagram for the boarding house price prediction process. In the initial process, the user will enter several variables (type of boarding house, city, district, room area, and others) in the prediction website view. After entering some of these variables, the data will be put into an array (dfnew), which the submit controller will process. The submit controller will then pass the data to the model (M_predict) to make price predictions using a linear regression model that has been trained with the data previously. After the model makes the price prediction, the model will return the predicted data to the controller. The controller will then display the price that has been predicted and will be displayed in the view.

A. Construction

1. Boarding House Data Collection/Scraping

The first stage was to collect data on boarding houses in the Special Region of Yogyakarta, this stage is carried out using the web scraping method on the largest boarding house advertising provider site in Indonesia, Mamikos.com. The results obtained from the web scraping process obtained as many as 3,790 data boarding houses (raw dataset) throughout the Special Region of Yogyakarta during the scraping period from 1 November to 10 November 2022.

Col0	Col1	Col2	Col3	Col4	Col5	Col6	Col7	Col8	Col9	Col10	Col11	Col12	Col13	Col14	Col15	Col16	Col17	Col18	Col19
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Putra	Sisa 3 kam	Kost	Apik	Kecamatan	WiFi		Kasur	Akses 24 J			Ajukan sev	4.5		Rp770.000	/ bulan				
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Putra	Sisa 1 kam	Kost	Singa	Ngaglik	WiFi	AC	Kasur	Akses 24 J							Rp2.250.0			/ bulan	
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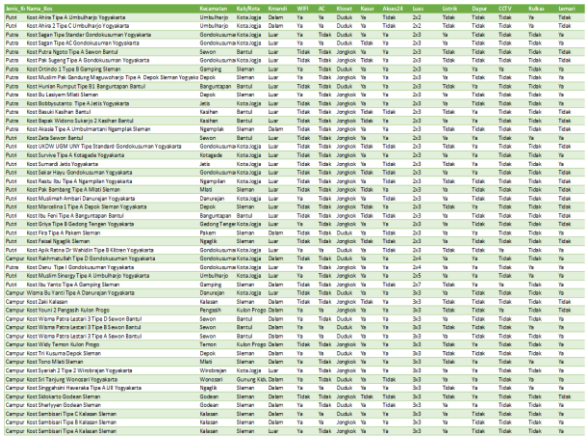
Figure 6. Raw Dataset

2. Data Preparation

This stage is carried out to clean up the "dirty" scraped dataset into a ready-to-use dataset for testing Machine Learning methods/algorithms. Several activities are

carried out, such as deleting columns/variables that are not needed in calculations, removing duplicate data, deleting data rows with incomplete variables, and adjusting data whose position does not match the column/variable.

The final result of the dataset that has been cleaned and is ready to use is 1686 rows of boarding data. The "clean" data is then exported into CSV format to be processed and trained in the Machine Learning development stage.



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Putra	Kost Bobbysutanto Tipe A Jetis Yogyakarta	Jetis	Kota Jogja	Luar	Ya	Tidak	Jongkok	Ya	Ya	2x3	Ya	Tidak	Tidak	Tidak	Ya
Putra	Kost Basuki Kasihan Bantul	Kasihan	Bantul	Luar	Tidak	Tidak	Jongkok	Tidak	Tidak	2x3	Tidak	Ya	Tidak	Tidak	Tidak
Putra	Kost Bapak Widoms Sukanjo 2 Kasihan Bantul	Kasihan	Bantul	Luar	Tidak	Tidak	Jongkok	Tidak	Ya	2x3	Tidak	Ya	Tidak	Tidak	Tidak
Putra	Kost Akasia Tipe A Umbulmartani Ngemplak Sleman	Ngemplak	Sleman	Dalam	Tidak	Tidak	Jongkok	Ya	Ya	2x3	Tidak	Tidak	Tidak	Tidak	Tidak
Putri	Kost Zata Sewon Bantul	Sewon	Bantul	Luar	Tidak	Tidak	Jongkok	Ya	Ya	2x3	Ya	Ya	Tidak	Ya	Ya
Putri	Kost UKDW UGM UNY Tipe Standard Gondokusuman Yogyakarta	Gondokusuma	Kota Jogja	Luar	Tidak	Tidak	Jongkok	Tidak	Tidak	2x3	Tidak	Ya	Tidak	Tidak	Tidak
Putri	Kost Survive Tipe A Kotagede Yogyakarta	Kotagede	Kota Jogja	Luar	Tidak	Tidak	Jongkok	Ya	Ya	2x3	Ya	Ya	Tidak	Tidak	Ya
Putri	Kost Sumardi Jetis Yogyakarta	Jetis	Kota Jogja	Luar	Tidak	Tidak	Jongkok	Ya	Tidak	2x3	Tidak	Ya	Tidak	Tidak	Ya
Putri	Kost Sekar Hayu Gondokusuman Yogyakarta	Gondokusuma	Kota Jogja	Luar	Tidak	Tidak	Jongkok	Tidak	Tidak	2x3	Ya	Ya	Tidak	Tidak	Tidak
Putri	Kost Rastu Bu Tipe A Ngemplan Yogyakarta	Ngemplan	Kota Jogja	Luar	Tidak	Tidak	Jongkok	Ya	Tidak	2x3	Tidak	Tidak	Tidak	Tidak	Tidak
Putri	Kost Pak Bambang Tipe A Mlati Sleman	Mlati	Sleman	Luar	Tidak	Tidak	Jongkok	Tidak	Ya	2x3	Ya	Tidak	Tidak	Tidak	Tidak
Putri	Kost Muslimah Ambarl Danurejan Yogyakarta	Danurejan	Kota Jogja	Luar	Ya	Tidak	Jongkok	Ya	Tidak	2x3	Ya	Tidak	Tidak	Tidak	Tidak
Putri	Kost Mirnakhira 3 Tipe A Depok Sleman Yogyakarta	Depok	Sleman	Luar	Tidak	Tidak	Jongkok	Tidak	Ya	2x3	Tidak	Ya	Tidak	Tidak	Tidak
Putri	Kost Ibu Fani Tipe A Banguntapan Bantul	Banguntapan	Bantul	Luar	Tidak	Tidak	Jongkok	Tidak	Tidak	2x3	Ya	Tidak	Tidak	Tidak	Tidak
Putri	Kost Griya Tipe B Gedong Tengan Yogyakarta	Gedong Tengan	Kota Jogja	Luar	Ya	Tidak	Jongkok	Ya	Ya	2x3	Ya	Tidak	Tidak	Tidak	Tidak
Putri	Kost Fira Tipe A Pakem Sleman	Pakem	Sleman	Dalam	Tidak	Tidak	Duduk	Ya	Ya	Tidak	2x3	Ya	Tidak	Tidak	Ya
Putri	Kost Faisal Ngaglik Sleman	Ngaglik	Sleman	Luar	Tidak	Tidak	Jongkok	Tidak	Tidak	2x3	Ya	Tidak	Tidak	Tidak	Tidak
Putri	Kost Apik Rama Dr Wahidin Tipe B Kitiren Yogyakarta	Gondokusuma	Kota Jogja	Luar	Ya	Ya	Duduk	Ya	Tidak	2x3	Tidak	Ya	Tidak	Ya	Ya
Campur	Kost Rakhmatullah Tipe D Gondokusuman Yogyakarta	Gondokusuma	Kota Jogja	Dalam	Tidak	Tidak	Duduk	Ya	Ya	2x4	Ya	Ya	Tidak	Ya	Ya
Putra	Kost Danu Tipe I Gondokusuman Yogyakarta	Gondokusuma	Kota Jogja	Luar	Ya	Tidak	Jongkok	Ya	Ya	2x4	Ya	Ya	Tidak	Ya	Ya
Putri	Kost Muslim Sinargi Tipe A Umbulharjo Yogyakarta	Umbulharjo	Kota Jogja	Luar	Ya	Tidak	Jongkok	Ya	Ya	2x5	Ya	Ya	Tidak	Ya	Ya
Putri	Kost Ibu Yanto Tipe A Gamping Sleman	Gamping	Sleman	Dalam	Tidak	Tidak	Jongkok	Ya	Tidak	2x7	Tidak	Ya	Ya	Tidak	Ya
Campur	Wisma Bu Yanti Tipe A Danurejan Yogyakarta	Danurejan	Kota Jogja	Luar	Tidak	Tidak	Duduk	Ya	Ya	3x3	Ya	Tidak	Tidak	Tidak	Ya
Campur	Kost Zain Kalasan	Kalasan	Sleman	Dalam	Tidak	Tidak	Jongkok	Tidak	Ya	3x3	Tidak	Tidak	Tidak	Tidak	Tidak
Campur	Kost Younri 2 Pengasih Kulon Progo	Pengasih	Kulon Progo	Dalam	Ya	Ya	Jongkok	Ya	Ya	3x3	Tidak	Ya	Tidak	Tidak	Tidak
Campur	Kost Wisma Putra Lestari 3 Tipe D Sewon Bantul	Sewon	Bantul	Dalam	Ya	Tidak	Duduk	Ya	Ya	3x3	Ya	Tidak	Tidak	Tidak	Ya
Campur	Kost Wisma Putra Lestari 3 Tipe B Sewon Bantul	Sewon	Bantul	Dalam	Ya	Ya	Duduk	Ya	Ya	3x3	Tidak	Tidak	Tidak	Ya	Ya
Campur	Kost Wisma Putra Lestari 3 Tipe A Sewon Bantul	Sewon	Bantul	Dalam	Ya	Ya	Duduk	Ya	Ya	3x3	Ya	Tidak	Tidak	Tidak	Ya
Campur	Kost Wally Temon Kulon Progo	Temon	Kulon Progo	Dalam	Tidak	Tidak	Jongkok	Ya	Ya	3x3	Tidak	Ya	Tidak	Tidak	Ya
Campur	Kost Tri Kusuma Depok Sleman	Depok	Sleman	Dalam	Ya	Ya	Duduk	Ya	Ya	3x3	Tidak	Tidak	Tidak	Tidak	Ya
Campur	Kost Tomo Mlati Sleman	Mlati	Sleman	Dalam	Ya	Tidak	Jongkok	Ya	Ya	3x3	Tidak	Ya	Tidak	Ya	Ya
Campur	Kost Syariah 2 Tipe 2 Wirobrajan Yogyakarta	Wirobrajan	Kota Jogja	Luar	Ya	Tidak	Jongkok	Ya	Ya	3x3	Ya	Ya	Tidak	Tidak	Ya
Campur	Kost Sri Tanjung Wonosari Yogyakarta	Wonosari	Gunung Kidu	Dalam	Ya	Tidak	Duduk	Ya	Tidak	3x3	Ya	Ya	Tidak	Ya	Ya
Campur	Kost Singgahsini Hawarela Tipe A Utl Yogyakarta	Ngaglik	Sleman	Dalam	Ya	Ya	Duduk	Ya	Ya	3x3	Tidak	Ya	Ya	Tidak	Ya
Campur	Kost Sabokarno Godean Sleman	Godean	Sleman	Dalam	Tidak	Tidak	Jongkok	Tidak	Tidak	3x3	Tidak	Ya	Tidak	Tidak	Tidak
Campur	Kost Sherfyyen Godean Sleman	Godean	Sleman	Dalam	Ya	Tidak	Duduk	Ya	Tidak	3x3	Ya	Ya	Tidak	Tidak	Ya
Campur	Kost Sambisari Tipe C Kalasan Sleman	Kalasan	Sleman	Dalam	Ya	Ya	Duduk	Ya	Ya	3x3	Ya	Tidak	Tidak	Tidak	Ya
Campur	Kost Sambisari Tipe B Kalasan Sleman	Kalasan	Sleman	Luar	Ya	Tidak	Jongkok	Ya	Ya	3x3	Ya	Tidak	Tidak	Tidak	Ya
Campur	Kost Sambisari Tipe A Kalasan Sleman	Kalasan	Sleman	Luar	Ya	Tidak	Jongkok	Ya	Ya	3x3	Ya	Tidak	Tidak	Tidak	Ya

Figure 7. Clean Dataset

3. Machine Learning Model training and testing

At this stage, four machine learning models were tested: Linear Regression, Logistic Regression, Gaussian Naïve Bayes, Support Vector Regression (SVR), and the last is the Random Forest algorithm/method. The five algorithms are then tested using a test dataset to determine the best model when viewed from the metrics value of each algorithm (R2 Score, MAE, and MAPE).

1. Linear Regression

Detailed score metrics of the Linear Regression method test results.

Table 6. Metrics Score Linear Regression

R2 Score	0.6348172132007266
MAE	156590.3454843796
MAPE	19.58%

2. Logistic Regression

Detailed score metrics of the Logistic Regression method test results:

Table 7. Metrics Score Logistic Regression

R2 Score	0.4779990568174691
MAE	185270.78622327792
MAPE	18.25%

3. Gaussian Naïve Bayes

Detailed score metrics of the Gaussian Naïve Bayes method test results:

Table 8. Metrics Score Gaussian Naïve Bayes

R2 Score	-0.021808228596910118
MAE	254560.567695962
MAPE	35.66%

4. Support Vector Regression (SVR)

Detailed score metrics of the Support Vector Regression (SVR) method test results:

Table 9. Metrics Score Support Vector Regression (SVR)

R2 Score	-0.09309993546610262
MAE	272395.0514487443
RMSE	32.08%

5. Random Forest

Detailed score metrics of the Random Forest method test results:

Table 10. Metrics Score Random Forest

R2 Score	0.521401169258743
MAE	179967.93586698337
MAPE	0.74%

After the four algorithms/methods have been tested and evaluated in the form of comparisons, can conclude that the Linear Regression algorithm is the best compared to

the other four algorithms in predicting boarding prices. Furthermore, the Linear Regression algorithm/method is exported into a "Pickle" file which can then be implemented into a website so that the wider community can access it.

```
#export model Linear Regression untuk di deploy
import pickle
pickle.dump(base_modeltestLin,open('modelLin.pkl','wb'))
```

Figure 8. Export Model

6. Program Implementation

Implementation of the program on this website-based boarding house price information system uses a Python framework, namely the Flask framework, and for display, uses the Tailwind template to make it easier for developers to develop an information system for predicting boarding prices. The entire program that has been compiled is then deployed with machine learning models that have been exported, to the "Herokuapp" platform.

The software used in developing this information system is Visual Studio Code for compiling website/information system program code and Google Collab for creating and testing machine learning models. The following is a snippet of the program's source code from the Controller, Model, and View.

The following is the display of the website page resulting from implementing the program code.

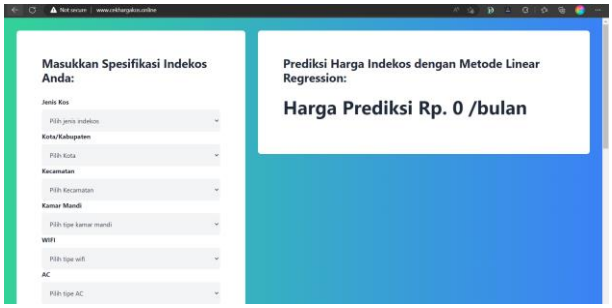

Figure 9. Default view

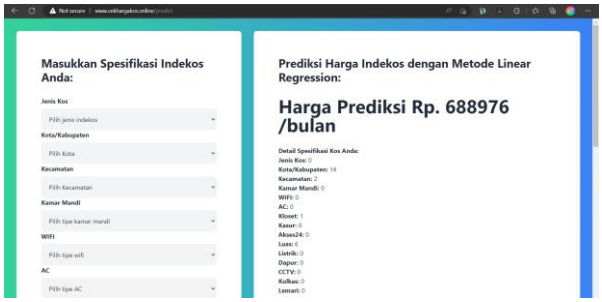

Figure 10. Predict view

7. System Testing

The last stage of the construction process is the testing phase. This testing phase is carried out to find out whether the information system that has been developed is feasible or not to be used by the wider community. For details of the tests that have been carried out, see the discussion below.

a. Functional Suitability Aspect

Functional Suitability testing is carried out by experts/practitioners in the IT field who already understand software development related to Functional Suitability testing of the Boarding House Price Prediction System, whether it is running correctly or not. The results of the Functional Suitability test can be seen in Table 11.

Table 11. The results of testing the Functional Suitability aspect

No	Statement	Expected results	Success	
			Yes	No
1	The function opens the homepage	Displays the main page of the website.	3	
2	Function to predict	The system successfully predicts and displays the results.	3	
3	The function displays error notifications	The system successfully displays an error notification when there is an empty input.	3	

The results obtained from the Functional Suitability testing that has been carried out can be concluded that all the functions tested have been running well and as expected.

b. Usability Aspect

The second test, namely in the Usability aspect, was carried out by giving questionnaires to 60 respondents consisting of 30 boarding house users and 30 boarding house owners in Yogyakarta.

$$percentage(\%) = \frac{total\ score}{\max score}\ x\ 100\%$$

$$percentage(\%) = \frac{7803}{9000}\ x\ 100\%$$

$$percentage(\%) = 86{,}7\%$$

The percentage results obtained from testing the feasibility of the system in the Usability aspect is 86.7%, so it can be concluded that the Boarding House Price Prediction Information System meets the Usability standard with the "Very good" interpretation category.

Reliability Statistics

Cronbach's Alpha	N of Items
.939	30

Figure 11. Usability Consistency Results

The results of the Cronbach Alpha consistency calculations get a value of 0.939 or "Excellent" interpretation.

c. Performance Efficiency Aspect

Based on testing on the Performance Efficiency aspect, it can be obtained that Performance gets a page load time of 777 milliseconds or 0.77 seconds. From this test it is also confirmed that this information system has fulfilled the Performance Efficiency testing aspect, because it has a load time of only 0.77 seconds and is still under 10 seconds which is a good website load standard according to Nielsen (2010).

Table 12. Performance Efficiency test results

Metrics	Results	Explanation
Performance	100%	Good
Structure	100%	Good
Largest Contentful Paint	686 ms	Good
Fully Loaded Time	777 ms	Good

d. Reliability Aspect

Table 13. Reliability aspect test results

Category	Success	Fail	Percentage
Session	8245	0	100%
Page	8250	0	100%
Hits	33010	0	100%

From this test, ensure that this information system meets the Reliability aspect, because it has an overall score of 100%, above the minimum standard of Reliability testing, which is 95% according to Asthana & Olivieri (2009).

Deployment

The deployment process for this information system is carried out by deploying the program code that has been compiled during the construction process onto the Herokuapp hosting platform. During the deployment process, the domain was changed from https://jogjaboardinghouse.herokuapp.com/ to https://www.cekhargakos.online to make it easier for users to remember the address/domain of this information system.

After the deployment process, the information system can be accessed publicly by users from various places. Various devices can

also access this information system used both mobile and desktop by utilizing the browser on each device.

CONCLUSION

Based on the results of the development research and discussion that has been carried out, the researcher can conclude that: (1) This information system for predicting boarding prices in the Yogyakarta Region uses the Waterfall Model development method and the Flask framework in its development process. This information system has successfully overcome the problems that have existed so far in determining boarding prices which still use conventional methods in Yogyakarta. The resulting final product is a website that predicts boarding prices that can be run via a browser on each user's device. (2) This information system for predicting the price of boarding houses in the Yogyakarta Region has met the ISO 25010:2011 standard in Functional Suitability testing. In the Functionality test, the system obtains x = 1, or it can be said that the functions in the information system have been running 100% as planned. (3) This information system for predicting boarding houses in the Yogyakarta Region has met the ISO 25010:2011 standard in the aspect of Usability testing. In the Usability aspect, the system obtains a percentage of 86.70%, which is in the "Very Good" category when viewed from the Usability interval table. (4) This information system for predicting the price of boarding houses in the Yogyakarta Region has met the ISO 25010:2011 standard in Performance Efficiency testing. For the Performance Efficiency aspect, the system obtains a page load average of 0.77 seconds, already fulfilling the Performance Efficiency testing aspect, which is a maximum of 10 seconds. (5) This information system for predicting boarding houses in the Yogyakarta Region has met ISO 25010:2011 standards in reliability testing. The system has fulfilled the Reliability aspect with a percentage of 100% for the stress test with 20 virtual users, has fulfilled the Reliability testing aspect according to Telcordia, which is a minimum of 95%.

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