JURNAL TEKNOLOGI DAN OPEN SOURCE
Vol. 6, No. 1, June 2023, pp. 11~22
e-ISSN: 2622-1659, accredited Four Grade by Kemenristekdikti, Decree No: 36/E/KPT/2019
DOI: 10.36378/jtos.v6i1.2580

Application Of Sales Forecasting Using The Least Square Method In Web-Based Information Systems

Nurliana Nasution[1], Dadang Rukmana Sitompul[2], Walhidayat[3]
[12,3]Department of Computer Science, Lancang Kuning University, Indonesia

Article Info

Article history:

Received 10 03, 2022
Revised 12 26, 2022
Accepted 01 04, 2023

Keywords:

Sales forecasting,
Least square method,
Web base application,
Information system.

ABSTRACT

Technology has become an important role in life, causing the role of computers to be indispensable in various aspects. The presence of technology today is not only in the field of technology but computational methods are also developing. The use of the internet in the aspect of E-commerce (electronic commerce) also plays an important role in the business process cycle. Sales is a major aspect in supporting survival in an industry. Because the high level of sales in an industry / service can compensate let alone provide benefits for the industry. The LEAST Square method is used as an analytical tool for forecasting / predicting sales at the ABDS Store Pekanbaru store. The level of accuracy of the calculation will have an impact on the availability of stock in the store. This method is often used in finding the best parameters of a mathematical model that describes observational data. By using the least squares method, it is expected that the resulting mathematical model can provide a better description of the observation data.

Corresponding Author:

Nurliana Nasution
Department of Computer Science
UniversitasLancang kuning
Pekanbaru, Indonesia
Email: nurliana@unilak.ac.id

1. Introduction

Technology has become an important role in life, causing the role of computers to be indispensable in various aspects. The presence of technology today is not only in the field of technology but computational methods are also developing. Utilization of the internet in the aspect of E-commerce. The emergence of thousands of industries that offer their wares on the web and for some people E-commerce[1] is one solution in shopping, because buyers do not need to come to a place to buy goods. In order to implement the use of E-commerce, in this study the main goal is to share a reflection of how the sales system method is needed to experience industrial competition in the current era of globalization. the high level of sales in an industry so that it can compensate let alone be able to share profits for the industry. In order to increase sales and the effectiveness of a business, a website-based sales information system is needed as a marketing medium for a company. Sales information system is an information system that can organize a series of procedures and procedures designed to create, analyze, and disseminate and obtain data to support decision making regarding sales. The ABDS STORE store is a store engaged in the sale of sports clothing such as soccer jerseys, futsal clothes, badminton clothes and so on. This shop is located at Jalan Sekolah No. 4 Rumbai Pekanbaru.

The purpose of this research article is to create a web-based clothing sales information system at the ABDS STORE Store, Applying sales forecasting using the Least Square method in order to obtain sales prediction results that can be considered in maintaining stock availability, Research can help the process of

calculating future sales forecasts easily, quickly, and accurately. With the benefits achieved in accordance with the objectives described above.

Based on previous research studies, here are summarized several references relevant to the study raised: "Prediction System for Determining the Number of New Student Registrations at the Catur Insan Scholar University Using the Least Square Method" discusses in order to determine the priority or the number of new students to be accepted and For facilities with the most interest in the trend of study programs every year, the Least Square method is used to get a good calculation. [5]; "Forecasting PTPN Xi Sugar Factory PTPN Xi With The Least Square Method" is discussed about Forecasting sales using the Least Square method in order to predict the total yield of sugar production to achieve maximum conditions. [7][8].

The Least Square method is a method that can determine the data trend equation which consists of time series analysis with two cases, namely even data and odd data [3]. In this method we must determine the parameter x, if the parameter x has been formed and added up, the parameter must add up to 0 even though the historical data is odd and even. The formula for calculating sales forecasts is shown in the following equation:

Total smoothing calculation:

$$Y = a + bX$$

Calculation of lookup value a:

$$a = Y / N$$

Calculation of the search for the value of b:

$$b = XY / X2$$

Where,
X = Time Period
Y = Total Sales in Period X
a = Constant Number
b = Trendline Slope Coefficient
N = Number of periods

Forecasting/Forecasting: According to John E. Biegel in [6] Forecasting is the act of assessing the normal level of interest in an item or several items within a certain period of time in the future.[9][10]

2. Research Method

The research scheme is carried out in several stages which can be described in the following diagram:

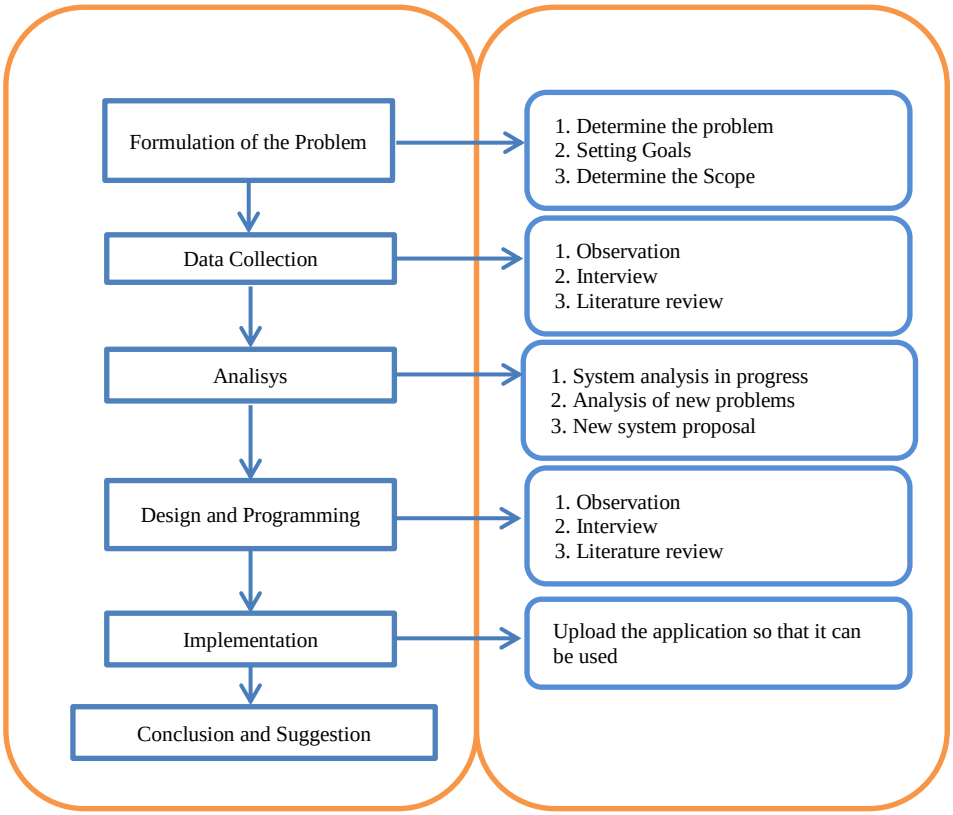

Figure 1. Research Method

Problem Formulation: At the stage of problem formulation, the writer determines the problems that occur in the research area. Then set the objectives of the research to be carried out and determine the scope of the research on the current system.
Data Collection: At the data collection stage, the researcher collects data from the research site by making observations in which the researcher analyzes the system that is being implemented by one of the workers at ABDS STORE. Then the researcher conducted an interview with the ABDS STORE Owner with several questions related to the system that was running. Furthermore, the researcher conducted a literature study to complete the data to be used in the study by collecting several references.[11][12][13]
Analysis: In this stage, the author analyzes the current system to find out the shortcomings and problems with the implementation of the input system in the ABDS STORE. Next to get the problems that occur, the author analyzes the existing problems to get problem solving. After finding the problem, the writer then proposes a new system design.
Design and Programming: At this stage the authors design a new system, design the database to be used, and design the interface of the website that will be created. After everything is designed, the writer starts to make the program to the testing stage of the program.
Implementation: At this stage the author implements the program that has been made to the research site.
Conclusions and Suggestions: The conclusion and suggestion stage is the last stage of the research. At this stage the authors provide conclusions and suggestions from the results of the research that has been made.

The data taken is sourced from Primary Data, namely data obtained directly from company leaders by conducting a direct interview with Mr. Abdus Shomad, SE as the Owner of ABDS STORE.

The data collection technique carried out by the research team in this study was an interview conducted directly with Mr. Abdus Shomad as the Owner of ABDS STORE, an interview was conducted to find out the existing problems, by asking several questions so that the data needed was obtained. Observation is carried out by analyzing the running system. Literature Studies, a method carried out by collecting data by reading or studying journals, scientific papers, and learning sites on the internet related to problems.[14]

Application Design Modeling Used: The method used in developing a clothing sales information system uses the Least Square Method while to visualize the design architecture using UML (Unified Modeling Language) modeling. The stages of the method and modeling that will be designed are as follows:

1. Scope Definition The initial stages carried out by the researcher are defining an existing problem with the aim of developing the application along with applying the scope of the limitations of the research.
2. Problem Analysis At this stage the researcher analyzes the problems that exist in the application that is currently running by gaining an understanding of an existing problem for application development at the research site.
3. Requirements Analysis At this stage the researcher conducts interviews and then observes by looking directly at the system being implemented. The researcher collects data that will be used in the system, then the researcher analyzes the system that will be developed.
4. Logical Design The design stage determines the application that is built in displaying the appearance to the user and the ease of using the application in the form of a web. In the use of data structures using the Array type.

3. Result and Discussion

The research framework discussed in the results and discussion section is a continuation of the main part of the research which explains the results of the stages which are informed in the form of a manuscript report. As for solving the problem can be done by carrying out the stages of the method that has been formulated. Starting with clarifying the problem analysis into several diagrams and prototype tables of the application framework, and continuing with moving the **leastsquare** algorithm into the application coding; and displayed in the sales forecast data report results for the next few months.[15][16]

3.1. Result

Based on the results of interviews with the ABDS owner for needs, data on product sales was obtained for the period April 2021 to April 2022 which can be seen in the following table:

Tabel 2. Product sales data

No	Month	sale
1	April	380
2	Mei	389
2	Juni	436
3	Juli	352
4	Agustus	430
5	September	372
6	Oktober	418
7	November	389
9	Desember	404
10	Januari	388
11	Februari	411
12	Maret	355
13	April	365

The purpose of building this new system is to build an information system that can assist in controlling product inventory. Some data is needed so that the system can produce optimal product inventory. The data needed for this system is sales data every month. From these data, calculations were carried out using the least squares method. From the results of these calculations will be obtained optimal stock requirements for orders in the next period. In addition, this system is also able to manage product price data and sales data. By using this system, product inventory can be controlled and monitored so that it does not exceed warehouse capacity.[17][18]

The tool used to build sales implementation uses the least squares method on a web-based information system (case study: ABDS STORE) using UML (Unified Modeling Language). The following is the result of the UML design. UML (Unified Modeling Language) diagram is a modeling language used to describe information systems as well as business processes. UML diagrams are widely used in the software development process because they can help understand the structure and interactions between components in the system to be created.[19][20]

3.1.1. Bussiness Process Model

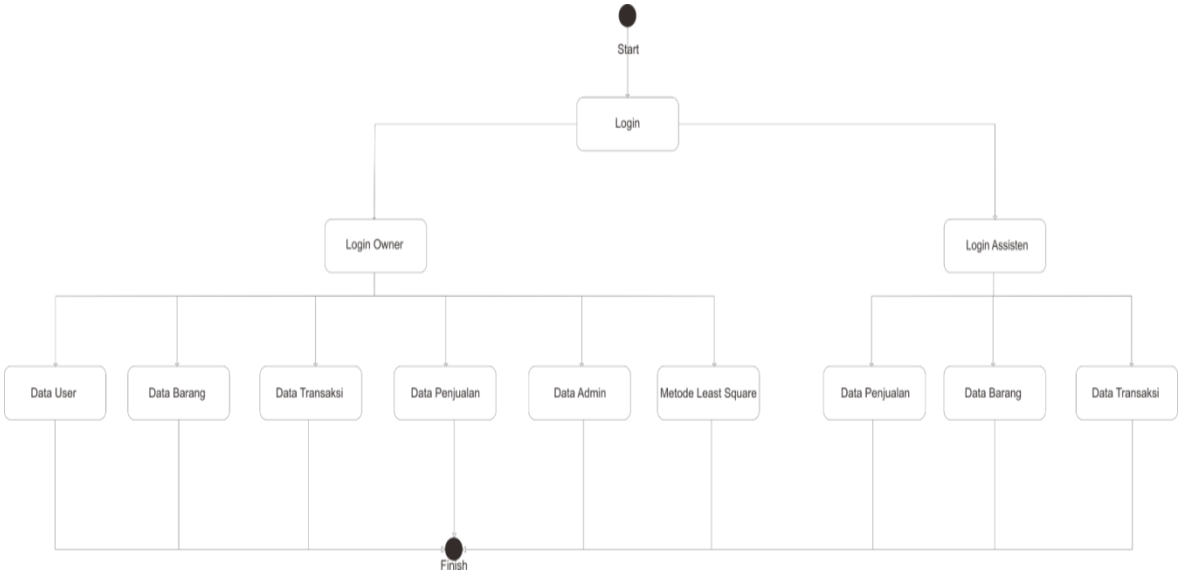

Figure 2. Bussiness Process Model

Figure 2, is a business process on a web-based information system, the function of this diagram is to briefly explain the application design that is made. How to use this application is that the Owner and Assistant log in first, if successful they will enter the system dashboard and can manage the application. Here the assistant

can only see sales data, transaction data, and also goods data. While the Owner has full rights to the application.[21]

3.1.2. Use Case Diagram.
one type of UML diagram used to describe the interaction between the system and the actors involved. This diagram consists of several elements, including:

1. Actor: an entity that interacts with the system, can be a human or another system
2. Use Case: is an action or function that can be performed by the system involved in interactions with actors
3. Relationship: is a line that connects the actor with the use case involved in the interaction

Use case diagrams are useful for describing business processes or systems that will be created so that they can help in understanding how the system works and how the system will be used by the actors involved.[22]

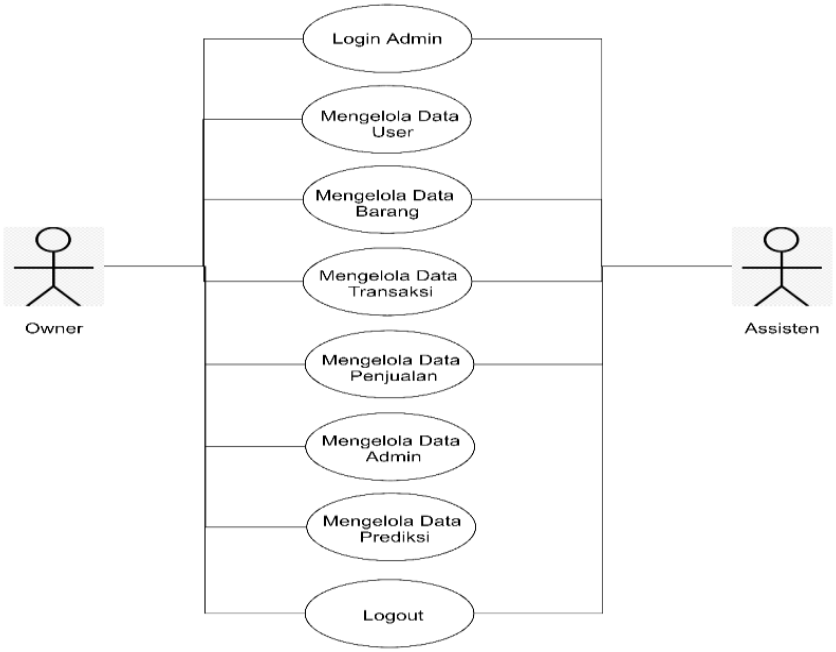

Figure 3. Use case Diagram

Scenario use case for Owner
Actor : Owner
Objective: Manage Web-Based Apparel Sales Information System Application
Overview : Owner can manage all data and menus that can be accessed to manage the application
Initial Conditions: Validated and Valid Login
Final Condition: The system displays a page after admin login and menus that can be accessed to manage applications

Scenario
System Response Actor Activities
1. Owner Login
2. The system will check the login account, and run the redirect process
3. System Displays the admin page and all accessible menus
4. The owner chooses the menu
5. Then the system will display the page according to the selected menu
6. Owner manages data (input, update, delete)
7. The system will process commands to save, modify, and delete data in the database
8. The system will display a message that the save, edit, and delete data were successful.
9. Owner Logout
10. The system issues an account and displays the initial login page.

Scenario using web system for Assistant

Actor : Assistant/Cashier
Objective: Manage Web-Based Apparel Sales Information System Application
Description : Assistants may only access goods data, transaction data, and sales data.
Initial Conditions: Validated and Valid Login
Final Condition: The system displays a page after admin login and menus that can be accessed to manage applications

Scenario
System Response Actor Activities
1. Login Assistant
2. The system will check the login account, and run the redirect process.
3. System Displays the admin page and all menus to be accessed.
4. The assistant selects the menu
5. Then the system will display the page according to the selected menu
6. Assiten manages data (input, update, delete)
7. The system will process commands to save, modify, and delete data in the database
8. The system will display a message that the save, edit, and delete data were successful.
9. Assistant Logout
10. The system issues an account and displays the initial login page.

3.1.3. Activity Diagram
The admin login activity diagram describes the flow of activities carried out by the admin so that he can access the features on the system. The actors who do this login are Owner and Assistant. Each Actor must have an email and password that has been registered in the system in order to be able to log in. Activity diagram is explained in the following figure 4.

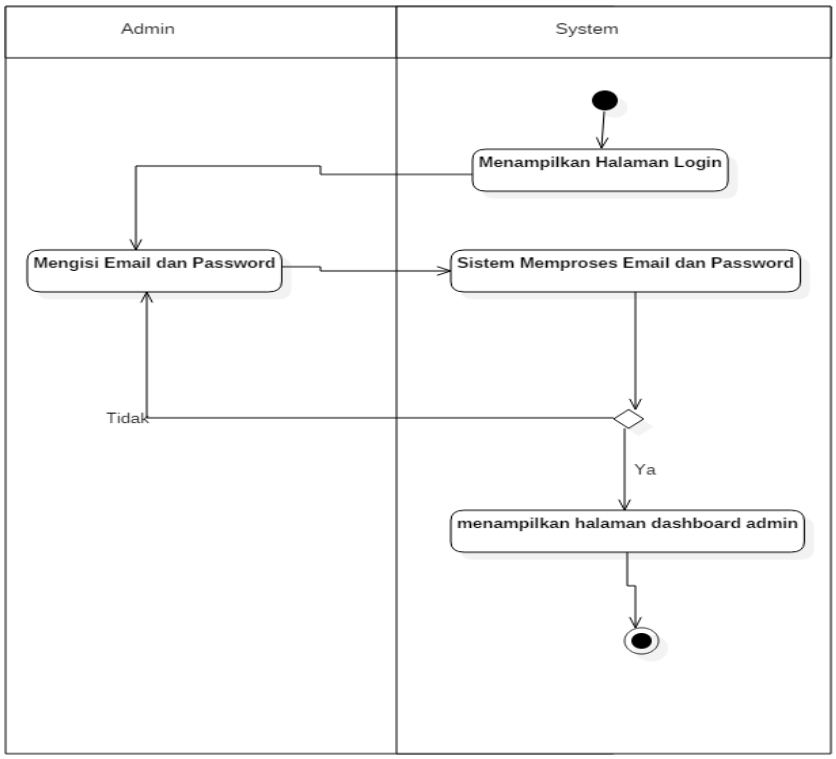

Figure 4. Activity diagram for login procress

Admin Activity Diagram Managing User Data
The activity diagram for managing user data illustrates the flow of the activity process for deleting user data, editing user data can only be done in the database and can only be done by the owner or admin.

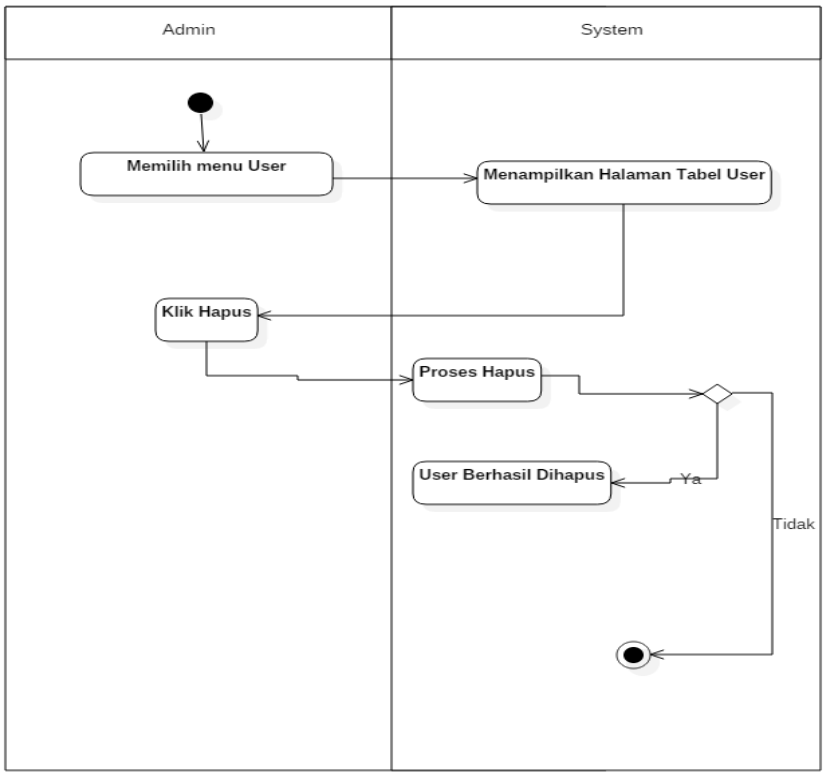

Figure 5. Activity Diagram when admin manage use accounts

3.1.4. Sequence Diagram

A sequential diagram is a type of UML diagram that is used to describe the interaction between objects in the system simultaneously. This diagram consists of several elements, including:

1. Objects: are entities involved in interactions with the system
2. Message: is a communication or request sent by one object to another object
3. Timing: is the time required to send or respond to messages sent

Sequential diagrams are useful for describing interactions between objects in the system from a time perspective, so they can help in understanding the flow of processes that occur in the system.[22][23]

Sequence Diagram Admin Deletes User Data

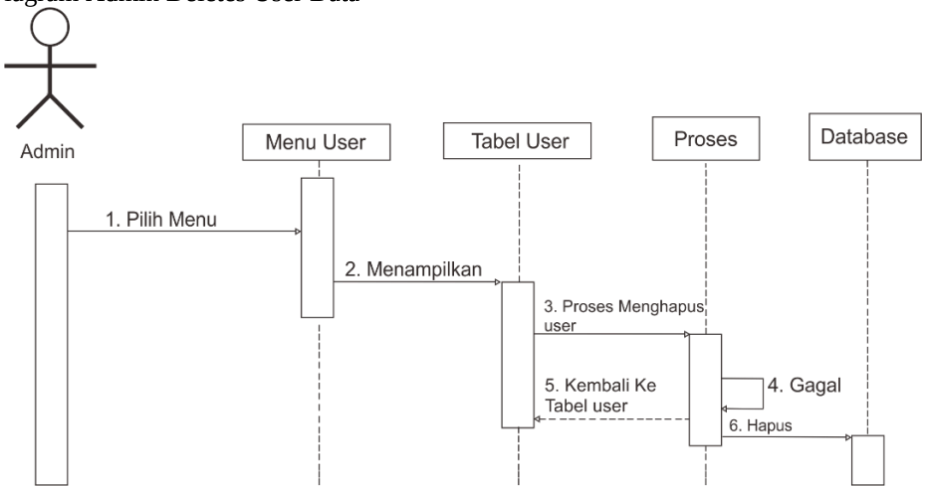

Figure 6. Admin Rules to modify user accounts

Admin selects the user menu and the system will display the user table. The admin deletes the user by deleting the user, the system will process the user deletion. If it fails, it will return to the user table menu and if successful, it will be deleted in the database.

3.1.5. Class Diagram

Class Diagram is the relationship between classes and an explanation of each class in the design model of a system, also shows the rules and responsibilities of entities that determine system behavior.[24] The following is a Class Diagram depiction of the Application of Sales Forecasting Using the Least Square Method in Web-Based Information Systems.[25]

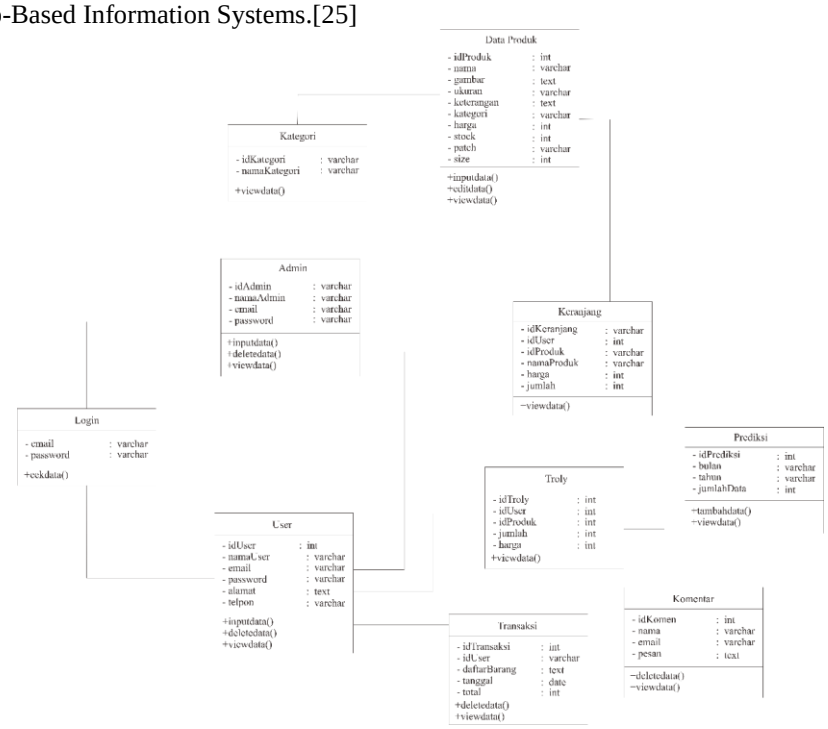

Figure 7. Class diagram for web app on ABDS Store

3.1.6. Interface Design.

The author designed an interface that makes it easy for users to use this application later. The following is the interface design that will be made for the implementation of sales forecasting using the least squares method on a web-based information system:

Item Table Page Design

Figure 7. Interface Design to item table

On the Goods Table Page Design, to view item data, you can add and edit data
User Comment Table Page Design

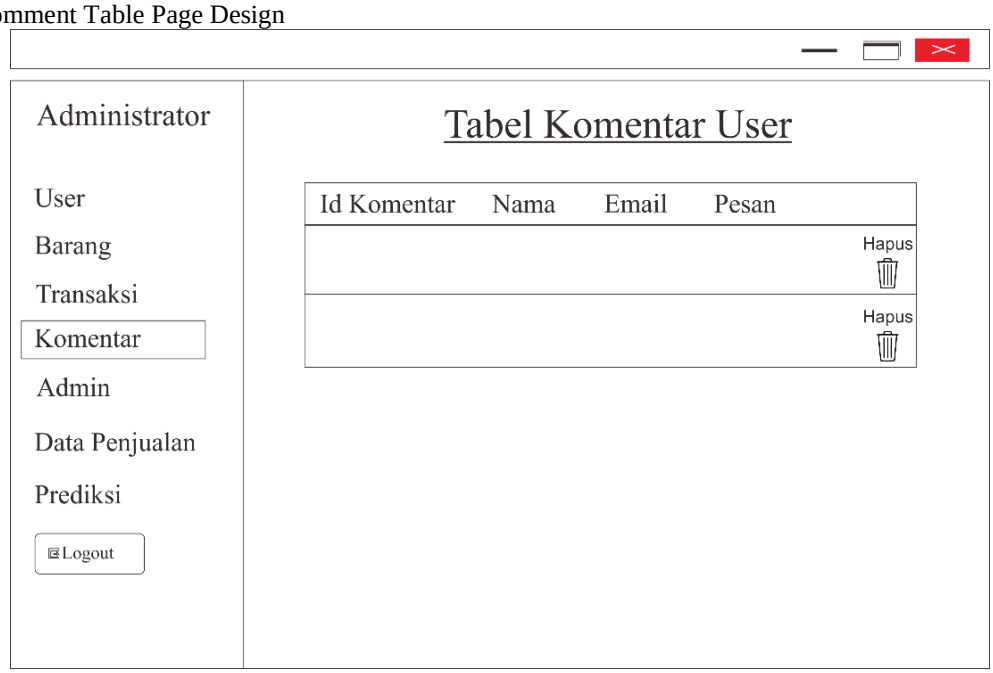

Figure 8. Interface design form User comments

In the design of the user comments table page, the user comments table contains the comment id, name, email, and message and there is a delete button in the form of a trash can image

3.2. Discussion

As a comparison of the usefulness of the designed system, the implementation of the system is made to realize the implementation of the applicable business processes. and in this case the system that has been designed is applied to the LEAST SQUARE method to be able to determine the trend equation of the data which consists of time series analysis with two cases, namely even data and odd data based on predetermined parameters.

System Implementation.

Is the stage of implementing a system that is carried out according to the results of the previous system design stage. At this stage, the application of sales forecasting uses the least squares method on a web-based information system.

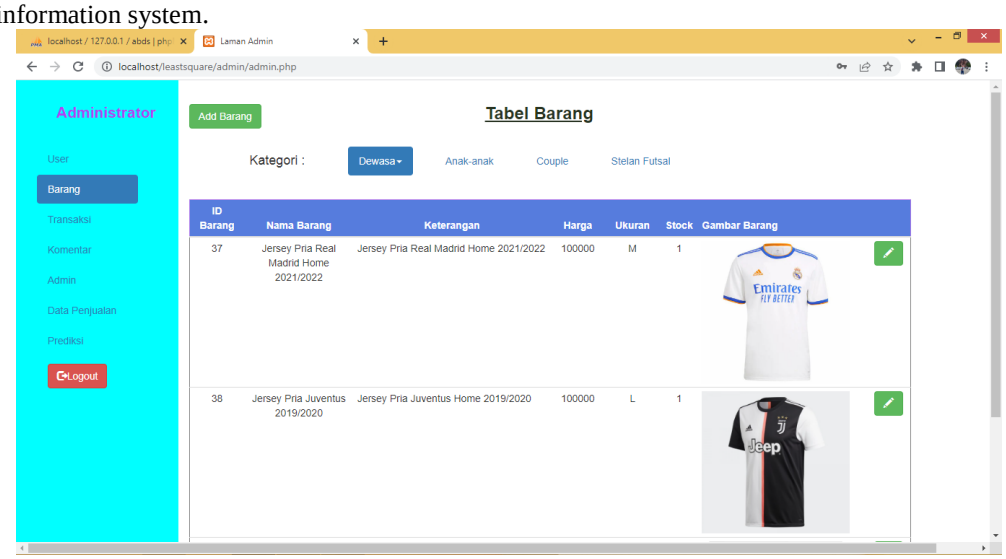

Figure 9. application view of product ABD Store.

In the implementation of the admin goods table page, it contains information about the goods that have been input by the admin, the admin can also add and edit items on the goods table page and in the goods table there are also several categories, namely, Adult Men, Adult Women, Children, Couples and also Stelan futsal (shown as figure 9, above).

The next stage in the system implementation section, is designing a form that applies the LEAST SQUARE method. that is to predict in the following year and month, as shown in figure 10.

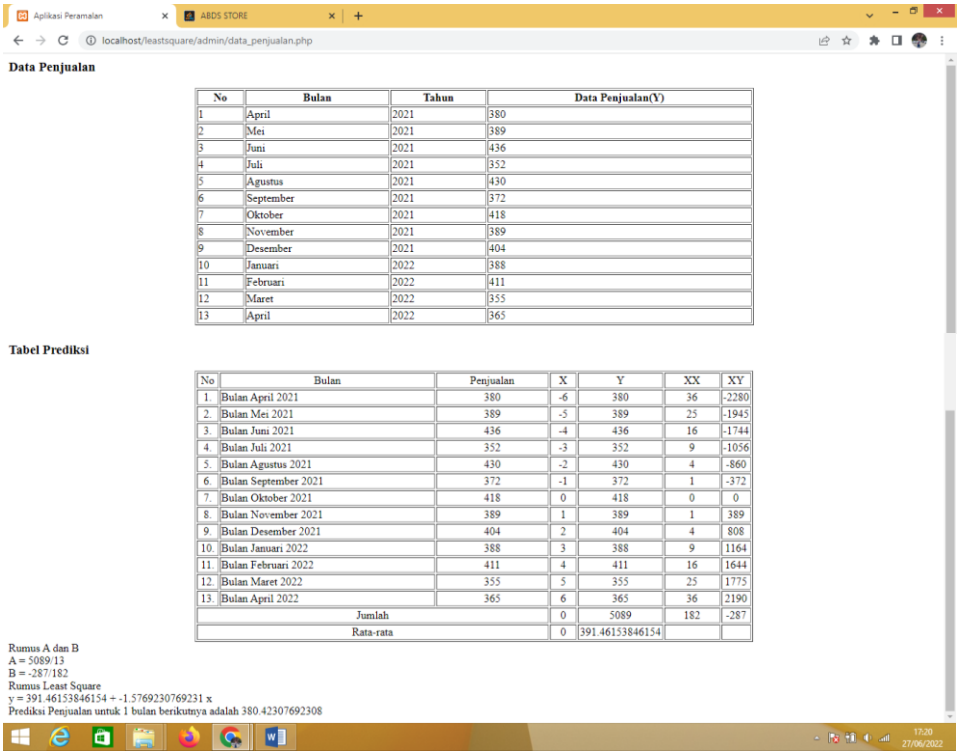

Figure 10. Implementation appication to prediction.

4. Conclusion

The conclusions drawn from the research that has been done are:

With the Application of Sales Forecasting Using the Least Square Method in a Web-Based Sales Information System (Case Study: ABDS STORE) this can make it easier for owners to manage products in order to maintain stock availability. The result of forecasting in May 2022 was 380.423076692308, June 2022 was 378.84615384615, July 2022 was 377.26923076923, August 2022 was 375.69230769231, in September 2022 december is 369.38461538462, january 2023 is 367.80769230769, february 2023 is 366.23076923077. The least square method in its application to web-based information systems (case study: ABDS STORE) produces the number of forecasts from May 2022 to February 2023 where the number of forecasts decreases each month. Application of Sales Forecasting Using the Least Square Method in a Web-Based Sales Information System (Case Study: ABDS STORE) has several stages carried out including the proposed system, interface design, and system implementation.

The suggestions from this research are:

It is hoped that this Web-Based Information System can provide more complete features in ABDS STORE. The process of predicting the amount of sales stock inventory can use different methods or the least square method can be combined with other prediction methods.

Acknowledgement

Thanks to all those who have helped us in completing this research, to the dean of the faculty of computer science, and ladies and gentlemen who have provided data so that this research can run smoothly

References

[1] R. M. Fauzi dan D. I. Mulyana, "IMPLEMENTASI DATA MINING MENGGUNAKAN METODE LEAST SQUARE UNTUK MEMPREDIKSI PENJUALAN LAMPU LED PADA PT. SUMBER DINAMIKA SOLUSITAMA," Volume 1, Number 8, August 2021 , pp. 907-919, 2021.

[2] F. A. Setiawan dan D. Arifianto, "PERAMALAN HASIL GILING PTPN XI PABRIK GULA DJATIROTO DENGAN METODE LEAST SQUARE," Jurusan Teknilk Informatika, Fakultas Teknik, Universitas Muhammadiyah Jember, pp. 1-5, 2017.

[3] H. Muhadzdzab, M. Asfi dan T. E. Putri, "Sistem Prediksi untuk Menentukan Jumlah Pendaftaran Mahasiswa Baru pada Unversitas Catur Insan Cendekia Menggunakan Metode Least Square," Jurnal Informatika Universitas Pamulang Vol. 5, No. 3, September 2020 (350-355), pp. 350-355, 2020.

[4] D. Suwardiyanto, M. N. Shodiq, D. H. Kusuma dan T. O. Sari, "Sistem Prediksi Kebutuhan Obat di Puskesmas Menggunakan Metode Least Square," Jurnal Informatika: Jurnal Pengembangan IT (JPIT), Vol.04, No.01, Januari 2019 , pp. 75-80, 2019.

[5] J. S. Widjaya, D. A. R dan S. R. Puspita Sari , "Sistem Prediksi Jumlah Pasien Covid-19 Menggunakan Metode Trend Least Square Berbasis Web," SISTEMASI: Jurnal Sistem Informasi Volume 10, Nomor 1, Januari 2021: 39-51 , pp. 39-51, 2021.

[6] M. D. Danianty, C. Suhery dan R. Hidayati, "PREDIKSI JUMLAH KEBUTUHAN OBAT MENGGUNAKAN METODE LEAST SQUARE BERBASIS WEBSITE (STUDI KASUS: UPTD PUSKESMAS PONTIANAK SELATAN)," Coding : Jurnal Komputer dan Aplikasi, Volume 08, No. 02 (2020), hal 33-42 , pp. 33-42, 2020.

[7] M. Hatta dan A. F. Fitri, "SISTEM PREDIKSI PERSEDIAAN STOK DARAH DENGAN METODE LEAST SQUARE PADA UNIT TRANSFUSI DARAH STUDI KASUS PMI KOTA CIREBON," Jurnal Ilmiah Ilmu Komputer Fakultas Ilmu Komputer Universitas AL Asyariah Mandar Vol. 6, No.1, Bulan April 2020 , pp. 19-23, 2020.

[8] Y. Siagian, "IMPLEMENTASI METODE LEAST SQUARE UNTUK PERAMALAN PERTUMBUHAN PENDUDUK PADA KABUPATEN ASAHAN," STMIK Royal – AMIK Royal, hlm. 375 – 380, pp. 375-380, 2018.

[9] I. Firstiano, S. Achmadi dan F. S. Wahyuni, "FORECASTING OMZET MENGGUNAKAN METODE LEAST SQUARE," Vol. 4 No. 2, September 2020 , pp. 176-182, 2020.

[10] E. A. Andrian dan E. S. Dasawaty, "PERANCANGAN SISTEM FORECASTING VOLUME PENJUALAN PRODUK RIBBON BARCODE MENGGUNAKAN METODE LEAST SQUARE PADA BINTANG BARKODE," Jurnal Informatika dan Bisnis, 10(2), pp. 1-11, 2021.

[11] A. Khamid dan D. F. Suyatno, "Rancang Bangun Sistem Informasi Peramalan Penjualan pada Songkok Palapa Gresik dengan menggunakan Metode Time-Series Berbasis Website," JEISBI: Volume 02 Number 02, 2021, pp. 94-104, 2021.

[12] S. Rodiyah, "Implementasi Metode Least Square Dalam Memprediksi Patty Cash di Jank-Jank Wings Blitar," J. OF INISTA, VOL. 3, NO. 1, PP.013-022, NOV 2020, pp. 1-10, 2020.

[13] P. Y. Saputra, I. D. Wijaya dan S. M. Anshori, "SISTEM PERAMALAN PENJUALAN SEPEDA MOTOR YAMAHA DI SENTRAL YAMAHA MALANG DENGAN METODE LEAST SQUARE," JURNAL AGHINYA STIESNU BENGKULU Volume 3 No 2 Juli-Desember 2020, pp. 196-207, 2020.

[14] A. Ridwan, A. Faisol dan F. S. Wahyuni, "PENERAPAN METODE LEAST SQUARE UNTUK PREDIKSI PENJUALAN BERBASIS WEB PADA DONI SPORT MALANG," JATI (Jurnal Mahasiswa Teknik Informatika) Vol. 4 No. 1, Maret 2020 , pp. 129-136, 2020.

[15] S. Nugroho dan S. , "PENERAPAN METODE LEAST SQUARE UNTUK SISTEM PERAMALAN PENJUALAN BERBASIS WEBSITE (STUDI KASUS : OJAN SPORT YOGYAKARTA)," Program Studi Informatika, Fakultas Teknologi Informasi dan Elektro Universitas Teknologi Yogykarta , pp. 1-10, 2020.

[16] M. Rahmawita dan I. Fazri, "APLIKASI PERAMALAN PENJUALAN OBAT MENGGUNAKAN METODE LEAST SQUAREDI RUMAH SAKIT BHAYANGKARA," Jurnal Ilmiah Rekayasa dan Manajemen Sistem Informasi, Vol. 4, No. 2, Agustus 2018, pp. 201-208, 2018.

[17] N. Iriadi dan . A. U. Indrasari, "SISTEM INFORMASI PENJUALAN BERBASIS WEB PADA CV. BAMBU JAYA JAKARTA," Sentra Penelitian Engineering dan Edukasi – Volume 9 No 3 - 2017 , pp. 34-39, 2017.

[18] D. Ardiansyah, W. Walim, D. Gunawan dan E. Fitriani, "RANCANG BANGUN SISTEM INFORMASI PENJUALAN PERLENGKAPAN TIDUR (SIPPAT) BERBASIS WEB PADA FORTUN BAROKAH KARAWAN," Jurnal Inkofar * Volume 1 No. 1 Juli 2019 , pp. 68-79, 2019.

[19] K. Afnisari, H. dan N. Merlina, "SISTEM INFORMASI PENJUALAN BUKU BERBASIS WEB PADA TOKO BUKU AS-SALAM BEKASI MENGGUNAKAN PHP & MYSQL," Vol. IX No.1 Maret 2013 Pilar Nusa Mandiri , pp. 79-86, 2013.

[20] J. Nahar, "MENENTUKAN PERSEDIAAN BERAS DENGAN MENGGUNAKAN MODEL ECONOMIC ORDER QUANTITY (EOQ) BERDASARKAN RAMALAN PERMINTAAN PADA TAHUN 2012," Prosiding Seminar Nasional Sains dan Teknologi Nuklir PTNBR - BATAN Bandung, 04 Juli 2013, pp. 619-623, 2013.

[21] Noviandi, S. A.Noviantika, B. Irawan," Clustering Villages Based on Distance and Accessibility to Health Facilities Using the K-Means Method:, Jurnal Teknologi dan Open Source,Vol.5 No.1 Mounth June 2022, pp. 35 – 42, 2022.

[22] H. S.Surya, B. G.Millenio, Junadhi, S. D.Putri," Evaluation of User Experience Information Systems Using Heuristic Evaluation (Case Study of STMIK Amik Riau Student Portal)", Jurnal Teknologi dan Open Source Vol. 4 No.2 Mounth December 2020,pp. 180-188.

[23] M. S.Aziz, "Web-Based Lawyer Information System Design At Nurhadisigitlaw Office", Jurnal Teknologi dan Open Source Vol. 4 No.1 Mounth June 2021, pp. 71-77.

[24] H. Nopriandi, N. W. Al Hafiz," Sistem Pendukung Keputusan Pemilihan Dosen Berprestasi Di Lingkungan Fakultas Tarbiyah Dan Keguruan Menggunakan Fuzzy Multiple Attribut Decision Making (FMADM)", Jurnal Teknologi dan Open Source Vol. 2 No.2 Mounth December 2019, pp. 33-44.

[25] D. Laraswati, A. Supriyatna," The Use Of Waterfall Model In Application Design Web-Based Maryam Department Store", Jurnal Teknologi dan Open Source Vol. 4 No.1 Mounth June 2021,pp. 37-47.