:: IJEEIT ::
(International Journal of Electrical Engineering and Information Technology)
Volume 04 Number 01 March 2021
This work is licensed under a Creative Commons Attribution- ShareAlike 4.0 International License.
ISSN : 2615-2096 (ONLINE)
ISSN : 2615-2088 (PRINTED)

Decision Support System For Developing Application For Pharmaceutical Supplies Using The MMSL And Pareto Law Methods

Muchammad Aryo Puruhito
Faculty of Computer Science, Narotama University, Indonesia
aryo.puruhito12@gmail.com

Achmad Zakki Falani
Faculty of Computer Science, Narotama University, Indonesia
achmad.zakki@narotama.ac.id

ABSTRACT

This study discusses the design and manufacture of a decision support system for pharmaceutical supply needs using the MMSL and Pareto Law methods. The development of this decision support system aims to assist the planning process for pharmaceutical supply needs including: drugs and consumables, as well as to reduce the cost of pharmaceutical supplies. Problem analysis is done by observing and conducting feasibility studies of ongoing information systems, and analyzing problem findings. The data used for the main support of this decision support system is dummy data. The decision support system is made using the PHP and MySQL programming languages as the database and will be implemented based on a web base. The results of this study produce a web-based decision support system that can support the management of pharmaceutical supplies and provide accurate and effective reports.

Keywords : Decision Support System, Pharmaceutical Supplies, MMSL, Pareto Law.

1. Introduction

1.1. Background

Health facilities both hospitals, Puskesmas and clinics need to be supported by the availability of drugs and medical consumables in large quantities sufficient, to be able to provide health services to patients in need. Drug management and medical consumables need to be properly implemented, starting from planning, procurement, acceptance, storage, destruction, control, as well recording and reporting. Drug and ingredient planning consumables is important considering forty percent of the operating costs of a health facility used for the supply of drugs and consumables.

Planning for drug and consumable needs needs to be carried out based on accountable considerations, including the VEN method (vital, essential, and non-essential), consumption methods, epidemiological methods, as well as a combination of consumption and epidemiological methods by adjusting the available budget. The consumption method is preferred because it can be used to calculate estimates or forecast future needs based on past drug use history. Several methods of forecasting the need for drugs and consumables that are usually used include the Single Exponential Smoothing (SES) method, the ABC (Pareto law) method, the Forecast Error method, the MMSL method (maximum minimum stock level), and others.

Every health facility always faces the future of all its activities, therefore all health facilities need a vision to face a future that is full of impotence, so that the health facility can achieve success. One of the important things is to estimate or predict the amount of demand for pharmaceutical preparations in the future, because the highest percentage of income is the income of pharmaceutical preparations at each health facility.(Indarti, Satibi, and Yuniarti 2019)

The Purchasing Unit at each health facility must provide pharmaceutical preparations for clinical needs within the time specified by the Purchasing Unit. The Purchasing Unit must make plans in the needs of pharmaceutical preparations transactions, so as not to freely procure pharmaceutical preparations and the Purchasing party must calculate all procurement

This work is licensed under a Creative Commons Attribution- ShareAlike 4.0 International License.
ISSN : 2615-2096 (ONLINE)
ISSN : 2615-2088 (PRINTED)

requirements approved by the head of the Purchasing Unit or Logistics Manager, If the Purchasing Unit is free to procure, this results in pharmaceutical preparations will accumulate for a long time (stack).

Ministry of Health Decree No. 193 / Kab / B.VII / 71, Medicine is a substance or combination of ingredients intended to be used in determining diagnosis, preventing, reducing, eliminating, curing disease or symptoms of disease, injury or physical and physical disorders in humans or animals and to beautify or beautify the body or parts of the human body.(No.193/Kab/B.VIII/71 1971)

The correlation of the Pareto Law and MMSL methods will produce tools or tools for calculations that work behind the scenes of all menus, and will produce logistics management functions to produce efficient inventory planning, inventory planning control, purchasing quantity control (Q buy), controlling vendor selection, control of receipt and storage of supplies, control of distribution and use.

1.2. Formulation Of The Problem

Based on this background, the problem formulation is as follows :

1. Are the problems arising from planning the need for drugs and consumables using the MMSL method and Pareto law?
2. How to design and develop a web-based application integrated with the existing Clinical Management Information System, related to planning the need for drugs and consumables using the MMSL and Pareto methods?
3. Is the implementation of the developed web-based application able to provide a more efficient planning for drug and consumables needs?

1.3. Scope Of The Problem

1. A case study was conducted at the Grha Kumala Probolinggo Clinic;
2. The methods used are MMSL and Pareto Law;
3. The amount of data to be tested is 500 data on types of drugs and consumables;
4. Using the UML (Unified Modeling Language) design method research review.

1.4. Research Review

This research is expected to be able to identify problems arising from planning the use of drugs and consumables at the Main Inpatient Clinic of Grha Kumala. Furthermore, the concept of a logistics management system using the MMSL and Pareto law methods will be developed in the form of a web-based application. The final result to be achieved is in the form of efficient management of drug and consumable needs through planning the need for drugs and consumables using a web-based application of a decision support system for pharmaceutical inventory needs using the MMSL and Pareto law methods.

1.5. Benefits Of Research

For students, it will be useful in gaining knowledge in conceptual and practical thinking, for clinical management, helping the planning process for drug and consumable needs, as well as cost efficiency.

2. Literature Review

2.1. Decision Making

Precise decision making for developing business in information and technology era nowadays is highly demanded. Delay in making decision stimulates loss of business opportunity coupled with hamper the growth of business to become stagnant or even failed.(Alimudin, Fallani, and Arifin 2017) Decision making is the process of selecting alternative actions to achieve certain goals or objectives. Decision making is carried out with a systematic approach to problems through the process of collecting data into information and adding to the factors that need to be considered in decision making.(Aisyah 2019)

2.2. Decision Support System

The concept of a Decision Support System (DSS) or Decision Support System (DSS) was first expressed in the early 1970s by Michael S. Scott Morton with the term "Management

This work is licensed under a Creative Commons Attribution- ShareAlike 4.0 International License.
ISSN : 2615-2096 (ONLINE)
ISSN : 2615-2088 (PRINTED)

Decision System" which is a computer-based system, which helps decision makers by utilizing data and models for solving unstructured problems.(Saudara 2015)

Decision support system applications use data, provide an easy user interface, and can incorporate the thinking of decision makers. This system is more intended to support management in performing analytical work in situations that are less structured and with unclear criteria. Decision support systems are not intended to automate decision making, but, instead, provide interactive tools that allow decision makers to carry out various analyzes using available models.

1. Characteristics of a Decision Support System From the definition of a Decision Support System, characteristics can be determined, including:
   a) Supporting the decision making process, emphasizing management by perception
   b) The existence of a human / machine interface where the human (user) remains in control of the decision-making process
   c) Supporting decision making to discuss structured, semi-structured and unstructured problems
   d) Has the capacity for dialogue to obtain information as needed
   e) Having subsystems that are integrated in such a way that they can function as a unitary item
   f) Requires a comprehensive data structure that can serve the information needs of all levels of management
2. Purpose of a Decision Support System
   a) Assisting managers in making decisions on semistructured problems.
   b) Provide support for the manager's judgment rather than being intended to replace the manager's function
   c) Increasing the effectiveness of decisions taken by managers more than improving their efficiency.
   d) Computing Speed. Computers enable decision makers to do a lot of computation quickly at low costs.
   e) Increasing productivity, building a decision-making group, especially experts, very expensive costs.
   f) Quality support
   g) Competitiveness
   h) Overcoming cognitive limitations in processing and storage.(Mesran et al. 2018)
3. Decision Support System Information Support.
   To produce good decisions in a decision support system, it needs to be supported by quality information and facts, including:
   a) Accessibility
      This attribute is related to the ease of obtaining information, information will be more meaningful to the user if the information is easy to obtain, because it will be related to the activity of the information value.
   b) Completeness
      This attribute is related to the completeness of the content of the information, in this case the content is not only about volume but also conformity to the expectations of the user, so that this completeness is often difficult to measure quantitatively.
   c) Accuracy
      This attribute relates to the possible error rate in the execution of processing large amounts of data (volume). Two types of errors that occur frequently are those related to calculations.
   d) Accuracy
      This attribute is related to the suitability of the information generated with the needs of the user. As with completeness, accuracy is very difficult to measure quantitatively
   e) Timeliness

This work is licensed under a Creative Commons Attribution- ShareAlike 4.0 International License.
ISSN : 2615-2096 (ONLINE)
ISSN : 2615-2088 (PRINTED)

The quality of information is also largely determined by the timing of its delivery and actualization. For example, information related to daily planning would be very useful if it was submitted once every two days.

f) Clarity
This attribute relates to the form or format of delivering information. For a leader, information presented in the form of graphs, histograms, or pictures will usually be more meaningful than information in the form of long words.

g) Flexibility
This attribute relates to the degree of adaptation of the information generated to the needs of various decisions to be taken and to a group of different decision makers.

2.3. Unified Modelling Language (UML)

UML (Unified Modeling Language) is a language based on graphics / images for visualizing, specifying, building, and documenting a software development system based on OO (Object-Oriented). UML consists of grouping system diagrams as follows:

1. Model Use Case Diagram
Use Case Diagrams graphically depict the interactions between systems, external systems, and users. In other words, use case diagrams graphically describe who will use the system and in what way the user expects interaction with the system. Narrative use cases are used to textually describe the sequence of steps of each interaction.
2. Static Structure Diagram (Class Diagram)
Describe the structure of the system object. This diagram shows the class objects that make up the system and also the relationships between these object classes
3. Interaction Diagram (Sequence Diagram)
Graphically illustrates how objects interact with each other through messages in the sequence of a use case or operation. This diagram illustrates how messages are sent and received between objects and in what sequence or timing.
4. State Diagram / State Diagram (Activity Diagram)
Graphically used to describe a series of activity flows both business processes and use cases. Activity diagrams can also be used to model the actions that will be performed when an operation is executed, and model the results of these actions.(Tomyim and Pohthong 2016)

2.4. Forecasting

Forecasting is predicting or predicting a situation in the future based on the past and present conditions needed to determine when an event will occur, so that appropriate action can be taken. The forecasting function is the basis for capacity planning, budgeting, sales planning, production and inventory planning, resource planning, and raw material purchasing planning.(Ardi 2018)

2.5. Fuzzy Logic

Fuzzy logic theory was introduced by Lotfi A. Zadeh in 1962. Fuzzy logic can be used in various fields, such as in disease diagnosis systems (in medicine), marketing systems modeling, operations research (in economics), water quality control, prediction of existence. earthquakes, classification and pattern matching (in engineering). Fuzzy logic also plays a role in accommodating the uncertainty that often appears in the 20 environments in which the system is built. The emergence of this uncertainty can be caused by the lack of information provided or it can also be caused by the difficulty of a decision maker in providing a firm reference. This uncertainty can lie in the data or physical information both in alternatives and attributes, and also in the delivery provided by the decision maker.(Informatika, Informasi, and Malikussaleh n.d.)

2.6. The Time Series Method

Fuzzy time series is a method introduced by Song and Chissom (1993), which is a new concept for forecasting using Fuzzy logic, which is a time series forecasting problem that is able to provide explanations for cryptic data and is presented in linguistic values.(Putra G, Tiro, and Aidid 2019)

ISSN : 2615-2096 (ONLINE)
ISSN : 2615-2088 (PRINTED)

Following are the steps for applying the fuzzy time series :

1. Define the set of universes U and divide into intervals $u_1, u_2, \dots, u_n$ of equal length. The set of universe used is the percentage change in time series data i to $i + 1$.
2. Determine the density distribution of the percentage change in time series data by sorting the data into appropriate intervals. Next, determine the amount of data contained in each interval. Find the interval that has the largest amount of data and divide it into four sub-intervals of the same length. Then divide the interval that has the second largest amount of data into three sub-intervals with the same length. The interval with the third largest amount of data is divided into two sub-intervals with the same length. For other intervals, leave as before.
3. Define fuzzy A_i sets based on the interval formed and fuzzify the percentage change in the time series data. The fuzzy A_i set represents the linguistic variable of the percentage change in time series data. As in Chen and Hsu we use the triangular membership function to define fuzzy A_i sets, as shown in the next step.
4. Defuzzify data fuzzy by using the following forecasting formula :

$$t_j = \begin{cases} \dfrac{1.5}{\dfrac{1}{a_1} + \dfrac{0.5}{a_2}} & if\ j = 1 \\ \dfrac{2}{\dfrac{0.5}{a_{j-1}} + \dfrac{1}{a_j} + \dfrac{0.5}{a_{j+1}}}, & if\ 2 \le j \le n-1 \\ \dfrac{1.5}{\dfrac{0.5}{a_{n-1}} + \dfrac{1}{a_n}} & if\ j = n \end{cases}$$

Where $a_{j-1},\ a_j,\ a_{j+1}$ are the midpoints of sequential fuzzy intervals A_{j-1}, A_j, A_{j+1}. Shows the percentage change in the forecasted time series data. Furthermore, the percentage of forecasting results is used to determine the time series of forecasting data.

2.7. The MMSL Method

MMSL (Maximum Minimum Stock Level) or commonly called MRP (Materials Resource Planning) is a method used as inventory control, so that there is no excess or shortage of inventory. The following is the concept of the MMSL (Minimum Maximum Stock Level) methodology:

1. Inventory models that are commonly used, and depending on the frequency of orders from suppliers, are:
   a) Annual Purchasing
   b) Scheduled Purchasing
   c) Perpetual Purchasing
2. Formula to determine Minimum and Maximum Stock Level
   a) Minimum Stock (S Min)

   $$\boldsymbol{Smin = (CA * LT) + SS}$$

   Where :
   LT = time waiting for orders (Lead Time)
   SS = Safety Stock
   CA = average consumption per day

   b) Safety Stock (SS)
   Safety Stock is an inventory reserve that must be provided to avoid shortages of goods or items, especially when meeting unpredictable and predictable customer demands.

   $$\boldsymbol{SS = LT * CA}$$

   Where :
   LT = time waiting for orders (Lead Time)

ISSN : 2615-2096 (ONLINE)
ISSN : 2615-2088 (PRINTED)

CA = Average consumption per day (Consumption Avarage)

c) d. Procurement Period, using months.
d) Stock Maximum (S Max)

$$Smax = Smin + (PP * CA)$$

Where :
S Min = Minimum Stock
PP = Procurement Period
CA = average consumption per day

2.8. The Pareto Law Method

Pareto analysis is referred to as ABC Analysis or Pareto Law which states 80/20 is a method used as logistics management to classify categories into three, namely A, B, and C. Category A is a category of Fast Moving goods with a total of 20% of items and has the investment value is around 80% of the total investment value, Category B is the Middle Moving category of goods with around 30% of the number of items and has an investment value of 15% of the total investment value, while Category C is the category of slow moving goods with a total of 50% of goods and has an investment value of about 5% of the total investment value. With this method, physical control planning, reliability of the procurement unit, and reduction of safety stock can be more efficient (Pavlik and Lukas 2017). Pareto analysis is implemented in several steps:

1. Defining Space Analysis (Defining Space Analysis)
2. Selection of activities or processes that we want to improve efficiency.
   a) Data Collection
   b) To analyze the needs required data collection to perform these functions.
3. Organize Data (Organize Data)
   a) The data will be sorted by frequency largest occurrence, largest scale or other criteria.
   b) Curve Formation (Cumulative curve)
      The curves are constructed in such a way that they cumulatively add up the individual data values and are plotted.
   c) Establishment of decision criteria)
      In this case, we can choose to use the strict Paretorule, which is 80/20 or we can choose to remove only 60% of the disagreement.
   d) Identifying the main causes
      From the left side of the chart, which is created from the data entered in the table, is worth 80% of the investment, the line on the incremental curve.
   e) Determination of remedial measures)
      These measures are designed to eliminate the causes that cause the most losses or, conversely, lead to increased profits

3. Research Metodology

This study uses historical pharmaceutical inventory data which is time series data so that past data records are used as a pattern to predict future drug needs. The steps in building this system include:

a) Observation and Literature Study
   In this stage, the preparation and collection of data related to goods data, pharmaceutical inventory data, and procurement data, activity data on the use of pharmaceutical supplies are carried out and search for references related to web technology for the manufacture of a Decision Support System.
b) System Design
   System design helps define the architecture and requirements of the overall system requirements, including making use case diagrams, class diagrams, squence diagrams, and activity diagrams.

This work is licensed under a Creative Commons Attribution- ShareAlike 4.0 International License.
ISSN : 2615-2096 (ONLINE)
ISSN : 2615-2088 (PRINTED)

c) Implementation of Coding, Testing and Evaluation
The results of the design are translated into a language that is understandable by the machine, using the PHP programming language as a server side programming language and a programming language on the front side, namely HTML, CSS, Javascript using the Jquery Framework and implemented on a web basis, and testing and evaluating the program until reached the usable stage. Meanwhile, the method used to predict the need for pharmaceutical supplies in the future period can be explained as follows:

1. Data Acquisition
Usage data were obtained from usage activities or requests from 26 patients, and the data were obtained from clinical dummy data carried out by case studies.
2. Fuzzy Time Series
Observation data based on various time series variations used are weekly, as a determination of the forecasting time period, and perform fuzzification.
3. Determine the Minimum and Maximum Stock Level (MMSL)
From the results of fuzzification, the minimum and maximum limits of stock levels are determined, which are used to determine when to buy and how much is the quantity of inventory purchases efficiently.
4. Determine the inventory category and the purchase price efficiently using the Pareto Law.
After the stock level and efficient buying limit are determined, the class will be divided into categories (A) fast moving with 50% of the total inventory and with a low rupiah value level of inventory, (B) middle moving with 30% of the total inventory and by the rate medium supply rupiah, and (C) slow moving with 20% of the total inventory and with a high rupiah supply rate, after classification, the calculation of the remaining classes will be carried out which is taken from the monthly average usage and multiplied by the unit price of the inventory value.

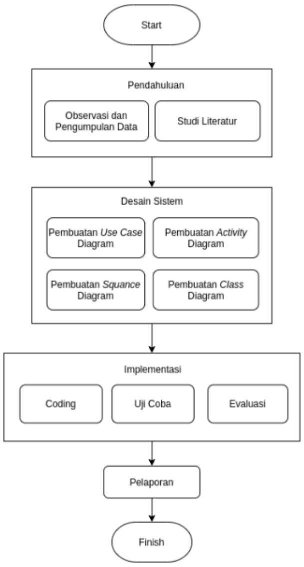

Figure 1. Research Methodology Flow.

4. Result and Discussion

At this stage, the process of making a decision support system begins with making usecase diagrams, sequence diagrams, and class diagrams, and ends with the implementation of decision support system coding.

4.1. System Design

4.1.1. Usecase Diagram

:: IJEEIT ::
(International Journal of Electrical Engineering and Information Technology)
Volume 04 Number 01 March 2021
This work is licensed under a Creative Commons Attribution- ShareAlike 4.0 International License.
ISSN : 2615-2096 (ONLINE)
ISSN : 2615-2088 (PRINTED)

In this usecase diagram describes the relationship of a decision support system with the actors or actors who use the system. This diagram shows what the system can do, especially such as showing system permissions. The image below shows the usecase of a decision support system consisting of 2 actors and 3 usecases.

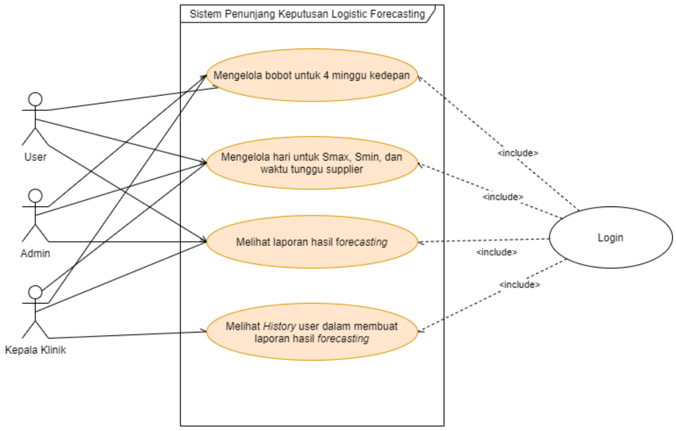

Figure 2. Usecase Diagram.

4.1.2. Sequence Diagram

In this sequence diagram, it explains the pages to be built and what methods are needed to run a scenario. The figure below shows a sequence diagram for the weight and day input scenarios.

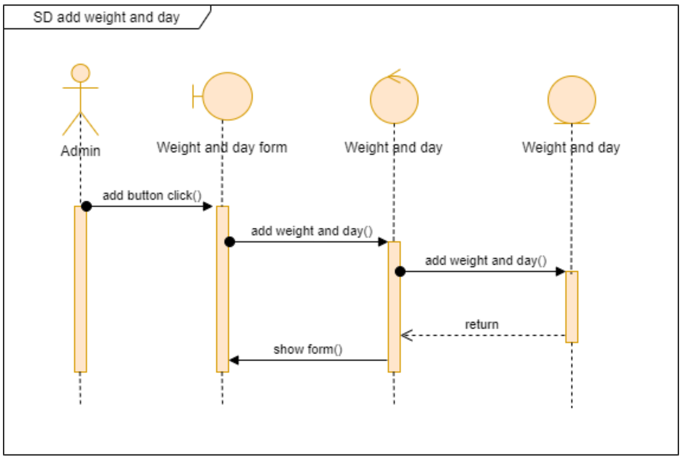

Figure 3. Sequence Diagram.

4.1.3. Class Diagram

In this class diagram, it describes Instance variables that store data from each class while methods store behavior in the class that will appear as lines of code in the program. The image below shows the class diagram that is built consisting of 8 classes, namely Drug Data, Drug Stock Data, User Data, Unit Data, Order Data, Acceptance Data, Forecasting, and History Forcasting Data.

:: IJEEIT ::
(International Journal of Electrical Engineering and Information Technology)
Volume 04 Number 01 March 2021
This work is licensed under a Creative Commons Attribution- ShareAlike 4.0 International License.
ISSN : 2615-2096 (ONLINE)
ISSN : 2615-2088 (PRINTED)

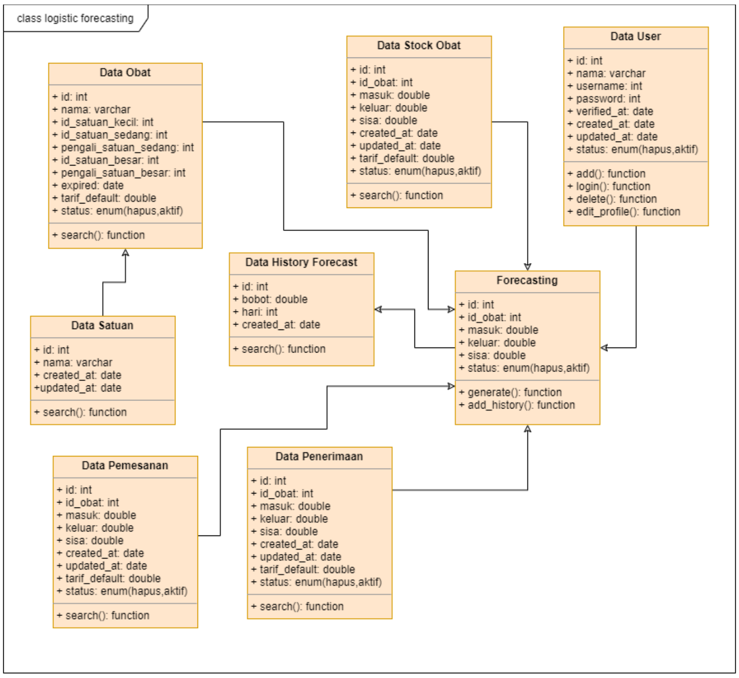

Figure 4. Class Diagram.

4.1.4. Implementation and Coding

After the system requirements design stage, the next stages are the implementation and coding stages. There are 3 menus, namely (1) dashboard menu; (2) master data menu which has submenu of drug data, stock card data, unit data, order data, acceptance data, user data, and historical forecasting data; (3) forecasting menu. Before using the system, the user must first log in to the login page, then the dashboard page to the input page, and the output page as shown in the following figure :

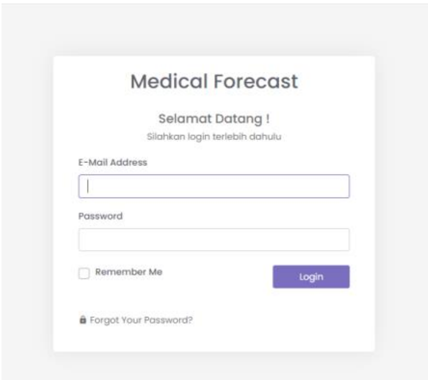

Figure 5. Login Page.

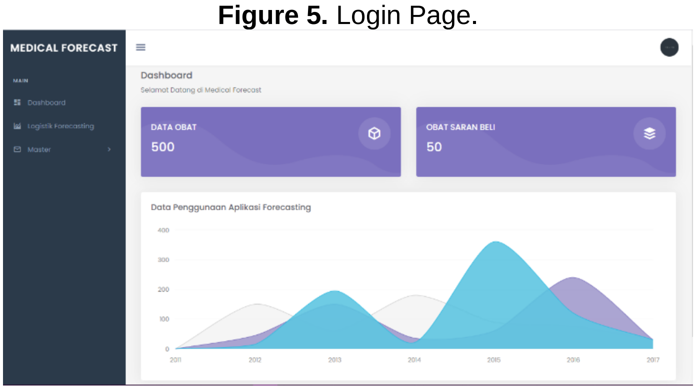

Figure 6. Dashboard Page.

This work is licensed under a Creative Commons Attribution- ShareAlike 4.0 International License.
ISSN : 2615-2096 (ONLINE)
ISSN : 2615-2088 (PRINTED)

In the logistical forecasting menu, the decision support system will calculate automatically based on the weight and days entered by the user. The algorithm for making the forecasting process is as follows :
After putting into fuzzification, the minimum and maximum limits of stock levels are determined, here is the algorithm stage :

a) Determine the average Forecasting at week 5 with the formula (Week 1 Real Usage Data * Week 1 Weight to Week 4 * Week Weight 4);
b) Determine the Maximum Stock for Week 5 by means (Average Forecasting * Days for the maximum stock that has been determined by the user / 7);
c) Determine Minimum Stock for Week 5 by means of (Forecasting average * Days for minimum stock that has been determined by the user / 7);
d) Determine Reorder Points for Week 5 by means of (Average Forecasting * Days for ROP determined by the user / 7);
e) Determine the Lead Time for Week 5 by means of (Average Forecasting * Days for the Lead Time determined by the user / 7);
f) The system can determine the total quantity to be purchased, namely if the remaining 4th week stock is less than the ROP, then calculate (Maximum Stock - Remaining Stock Week 4 - Lead Time), if not give 0;
g) Make a notification on the system when to buy, that is, if the remaining 4th week stock is less than the minimum stock, then display the notification "There are several drugs BUY ADVICE".

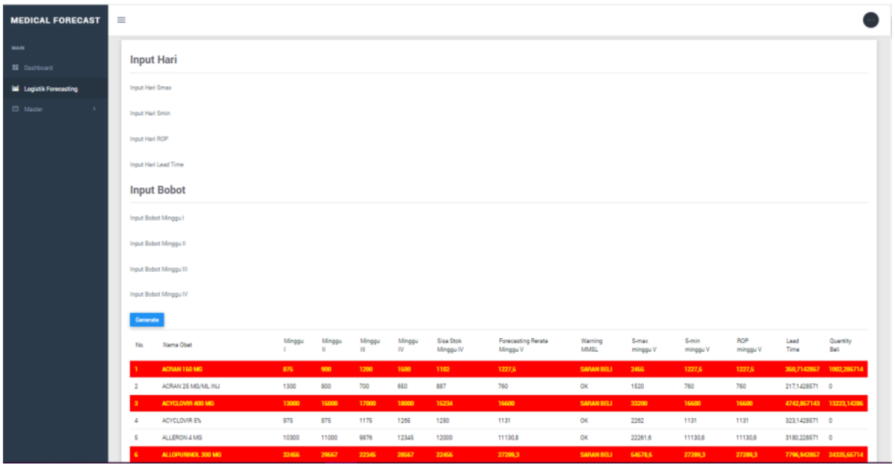

Figure 7. Forecasting Page.

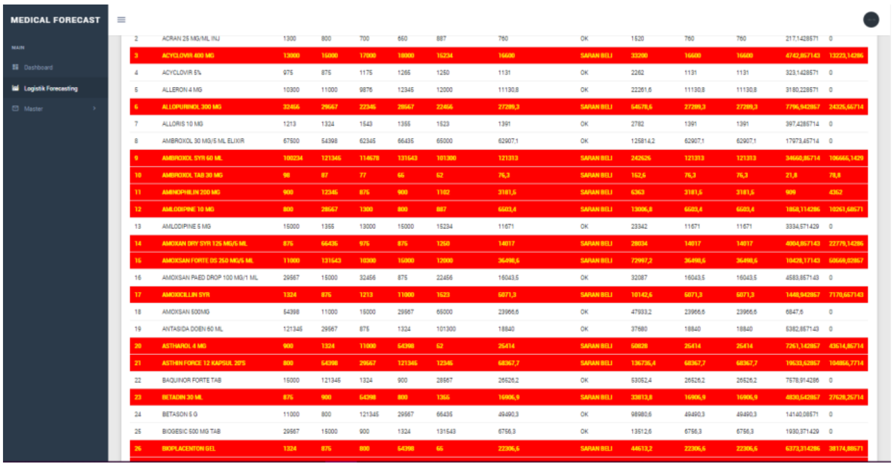

Figure 8. Result Forecasting

This work is licensed under a Creative Commons Attribution- ShareAlike 4.0 International License.
ISSN : 2615-2096 (ONLINE)
ISSN : 2615-2088 (PRINTED)

5. Conclusions and Suggestions

5.1. Conclusion

From the results of the decision support system testing, a conclusion is found, that is, a lot of invalid data originating from user errors that have not been normalized so that the decision support system has not been able to produce values that match predictions.

5.2. Suggestion

It is necessary to do a deeper review of the results that have been achieved so that the use of the Pareto Law and MMSL methods can be more accurate, both in terms of data normalization and data validity.

Bibliography

Aisyah, Siti. 2019. "Jurnal Teknovasi APLIKASI SISTEM PENDUKUNG KEPUTUSAN ANALISIS KELAYAKAN PADA PERUSAHAAN LEASING Siti Aisyah Program Studi Sistem Informasi Fakultas Teknoogi Dan Ilmu Komputer Universitas Prima Indonesia Jurnal Teknovasi ISSN : 2540-8389." *Jurnal Teknovasi* 06(1):1–16.

Alimudin, Arasy, Achmad Zaki Fallani, and Bustomi Arifin. 2017. "Strategic Decision Making Based on Information Systems for Improving the Competitiveness of Small and Medium Enterprises in the Trade Sector of the City Tourism and Trade." (August 2014):0–4.

Ardi, R. 2018. "Forecasting Produksi PT Pupuk Kujang Untuk Mengatasi Penumpukan Persediaan Produk Jadi." 01(2):143–59.

Indarti, Titik Rahayu, Satibi Satibi, and Endang Yuniarti. 2019. "Pengendalian Persediaan Obat Dengan Minimum-Maximum Stock Level Di Instalasi Farmasi RSUP Dr. Sardjito Yogyakarta." *JURNAL MANAJEMEN DAN PELAYANAN FARMASI (Journal of Management and Pharmacy Practice)* 9(3):192.

Informatika, Teknik, Sistem Informasi, and Universitas Malikussaleh. n.d. "IMPLEMENTASI FUZZY TIME SERIES PADA PERAMALAN PENJUALAN TABUNG GAS." 1–25.

Mesran, Mesran, Swandi Dedi Arnold Pardede, Arahman Harahap, and Andysah Putera Utama Siahaan. 2018. "Sistem Pendukung Keputusan Pemilihan Peserta Jaminan Kesehatan Masyarakat (Jamkesmas) Menerapkan Metode MOORA." *Jurnal Media Informatika Budidarma* 2(2):16–22.

No.193/Kab/B.VIII/71, Kep. MenKes RI. 1971. "Mengin8al : 1." (193).

Pavlik, Lukas and Ludek Lukas. 2017. "Parete Analysis as a Tool for the Identification of Assets within the Organization Providing Insurance against Cyber Risk." *ICMT 2017 - 6th International Conference on Military Technologies* 361–65.

Putra G, Aditio, Muhammad Arif Tiro, and Muhammad Kasim Aidid. 2019. "Metode Boostrap Dan Jackknife Dalam Mengestimasi Parameter Regresi Linear Ganda (Kasus: Data Kemiskinan Kota Makassar Tahun 2017)." *VARIANSI: Journal of Statistics and Its Application on Teaching and Research* 1(2):32.

Saudara, Sumber. 2015. "SISTEM PENDUKUNG KEPUTUSAN UNTUK FORECASTING PENJUALAN DI TOKO SUMBER SAUDARA." 275–80.

Tomyim, Jessada and Amnart Pohthong. 2016. "Requirements Change Management Based on Object-Oriented Software Engineering with Unified Modeling Language." *Proceedings of the IEEE International Conference on Software Engineering and Service Sciences, ICSESS* 0:7–10.