Jurnal Scientia
Volume 13 , Number 03, 2024, DOI 10.58471/ scientia.v13i03
ESSN 2723-7486 (Online)
https://infor.seaninstitute.org/index.php/pendidikan

An Integrated Queue System With Fingerprint Recognition And Scoring Board In Bank

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ArticleInfo
Keywords:
fingerprint,
efficiency security,
technology

ABSTRACT
This paper described proposes an integrated queue system for banks, combining fingerprint recognition technology with a scoring board. The system aims to enhance customer service efficiency and security while optimizing queue management. By incorporating fingerprint recognition, customers can easily verify their identity without the need for physical documents or cards, streamlining the authentication process. Additionally, the scoring board provides real-time updates on queue status, allowing both customers and bank staff to monitor waiting times and prioritize service accordingly. The integration of these technologies offers a comprehensive solution to improve the overall banking experience, ensuring smoother operations and higher customer satisfaction. Therefore, the aim of this research is to create a school payment system that is packaged electronically by utilizing the internet network and fingerprint identification as the payment medium. This payment system was created by utilizing fingerprint technology that is embedded in each student's cellphone and is integrated with the internet as a data exchange route. The system flow starts from registering your fingerprint via a fingerprint scanner, logging in, topping up your balance, viewing and selecting the payment list, and finally making a payment by authenticating your fingerprint using a fingerprint reader. It is hoped that this research can ease the burden on treasurers and all students in terms of school payments, especially those within the Tanwirul Afkar Islamic Vocational School so that a payment system can be obtained that is faster, more flexible and safer to use.

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INTRODUCTION

In line with developments in knowledge, income, diversification of jobs and workplaces, society's demands for various services are also increasing. This is in line with economic law, that the trend in demand for the variety and quality of services is in line with developments in the quality of life and people's income. Banks are one of the services most widely used by society today. The development of banks is now receiving more attention from the public, especially in terms of the quality of services provided. Currently, the banking world is faced with the problem of developing their services which must follow emerging technological trends. This must be done to maintain the number of their customers and attract new customers. This is the author's consideration for developing a Queuing System with

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Fingerprint Recognition and Scoring Boards at Banks. Newly arriving customers simply scan their fingerprints and the system will automatically search for the customer's identity through the database. Then customers simply wait until the system calls the customer's name. This system will make the database search process easier and faster.

The queue system at this bank was built with the Borland Delphi 7 programming toolkit integrated with Fuzzy Pro Info's Fuzpro Fingerprint fingerprint recognition software and Indo TTS text to speech software and Microsoft SQL Server was used as a database device. The following are the research objectives in order to see the value and contribution expected from this research: Building a queuing system that is capable of managing queues at banks where the system is integrated with fingerprint recognition and is also equipped with a text to speech module so that you can call the customer's name to the teller. Apart from that, there is an additional module in the form of SMS which aims to provide information to customers regarding the number of queues currently occurring at the bank.

In its current development, computer technology and the Internet of Things (IoT) are also channeling innovation in the world of electronic payments. There are several electronic payments that we currently know in Indonesia, including: Gopay, OVO, Dana, LinkAja, Sukaku and many more. With electronic money, payments will be faster and more convenient because the money is already stored in the bank and when paying you don't need cash.

However, on the other hand, Electronic Money has huge weaknessesin terms of security, because transactions are carried out without going through an authentication process, either in the form of a PIN or other transaction authentication. Therefore, the author has the idea to create an Arduino-based payment transaction application using fingerprints and an Android smartphone as the medium. This fingerprint technology was discovered in the early 19th century by a scientist named Sir Francis Galton with his discovery called the 'Galton point' which is the basic basis of the fingerprint system.

E-Paymentor Electronic Pay is a payment system that uses internet network technology as the medium. In electronic payments, money is stored, processed and received in the form of digital information and the transfer process is initialized through electronic payment tools. The use of electronic networks is not something strange today. The use of electronic networks for trading began in the early 1970s in the financial sector.

Literature Review

Queuing System

In completing knowledge regarding research related to this thesis, we will present a number of presentations regarding a number of studies that have been carried out, namely research relating to Multi Channel Single Phase (M/M/S) queuing and queuing processes, which are as follows: Queuing System Customer service in banking. Customer queuing service is a queuing phenomenon in life daily, Queuing model for banking customer queuing systems: (FCFS/∞/∞). With exponential distribution for inter-arrival times and service times with three service points. Based on the optimum calculation of the number of services using two benchmarks, namely the average waiting time in the queue system (Ws) and the percentage of empty service time (X), the optimum number of ships in the queue system is

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obtained.

Application of Multi Channel Single Phase Model Queuing Theory in Optimizing Customer Payment Services at Smile Media Stationery.

This research aims to determine customer payment services using the Multi Channel Single Phase model queuing theory at Smile Media Stationery Jember. The data used by researchers is the number of customer arrivals and customer service time taken for 4 days, then the distribution suitability will be tested using Kolmogorov Smirnov using the SPSS application and will be assumed to be a queuing model.

The customer service model when there is a queue at the Smile Media Stationary cashier uses a Multi Channel Single Phase queue model structure with a queue model (M/M/C): (GD/∞/∞). The average waiting value for customers in the system is around 1.52 minutes or 91.2 seconds. The value of 91.2 seconds is not considered too long for customers to wait with a total of three customers waiting in the system.

Several things can be suggested regarding the application of the Multi Channel Single Phase queue model structure, namely that additional service facilities need to be opened if the queue exceeds 3 customers/minute, namely during peak hours (11.01 - 13.00 and 18.01 - 20.30). This is because the cost of adding facilities is smaller than the cost of waiting for customers. 3. Implementation of a Queuing System as an Effort to Optimize Services for Patients at the Medicine Collection Counter at the Cicurug Sukabumi Community Health Center, West Java (Ruswandi, 2006)

Literature Review and Theoretical Foundations of Understanding Applications

Application comes from the word application which means application, application, use. In terms of application, it is software that contains coding or commands which can be changed according to your wishes. (Syani & Werstantia, 2018: 88) An application can be said to be software that is ready to use carrying out instructions from the user, many applications are created to help with various needs, for example: making reports, printing and so on.

Fingerprints

Fingerprint is an electronic device that uses a scanning sensor to determine a person's fingerprints for identity verification purposes. Fingerprint sensors like this are used in several electronic devices such as smartphones, entrance doors, employee attendance devices and various kinds of equipment electronics that require a high level of security, and can only be accessed by certain people. Before the fingerprint sensor was discovered, data was previously secured using a password or ID, some also used patterns to secure data.

However, now thanks to the discovery of security methods using fingerprints, security methods using patterns and passwords are starting to be abandoned, because they are less personal. Previously, fingerprinting was only applied to electronic equipment such as to secure doors and for employee attendance. However, as time goes by, fingerprints have now been implemented to secure the data on each user's smartphone.

Meanwhile, in implementing employee attendance tools, Fingerprint is useful for minimizing employee fraud which could result in company losses. So with Fingerprint, every employees are responsible for their own presence in the office. Apart from that, applying

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Fingerprint to a door such as a safe also minimizes access, because with Fingerprint access to a safe door can only be opened by certain people, even just one person. So the safety of the goods inside can be guaranteed.

How Fingerprints Work

In simple terms, the way a fingerprint sensor works is by recording fingerprint data for the first time to be used as a reference. The fingerprint data will be stored in the database When someone wants to access a device that has a fingerprint sensor installed, it will be scanned again, then the fingerprint data from the results of the re-scanning will be checked to see whether it is the same as the fingerprint data electronics that require a high level of security, and can only be accessed by certain people. Before the fingerprint sensor was discovered, data was previously secured using a password or ID, some also used patterns to secure data.

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METHODO

System Block Diagram Figure 1 is a block diagram, where the figure explains the workflow of the registration system depicted.

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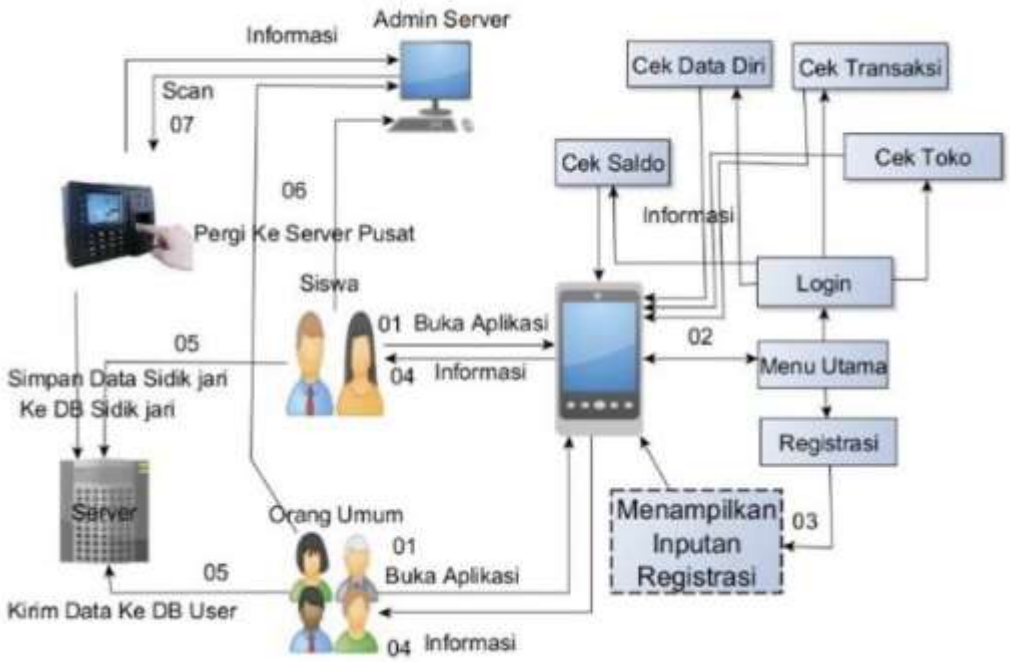

Figure 1. Block Diagram Cycles

Starting from entering the application, then selecting the registration menu, inputting personal data, then saving the data in the database. After that, go to the central server to register your fingerprint, input fingerprint data, then the data that has been successfully input is stored in the fingerprint database. Apart from the registration feature, after the user logs in there are several features that can be used, namely: check shop, check balance, check personal data, and check transactions.

Figure 2 is a use case of the fingerprint payment application system which is the research in this research, where in the use case there are 3 actors with different behavior/attributes including:

1. Users/Buyers/Students have attributes, login, check transactions, input data, scan fingerprints, and deposit (E-Moeney SMK). With these attributes, students can carry out payment activities properly through the application system that has been created.
2. Sellers/Staff have attributes, login, service transactions, input stock, and input student balances.
3. Server Admin: login, check user data (edit user data, edit SMK e-money data, save user data) and check transaction data.

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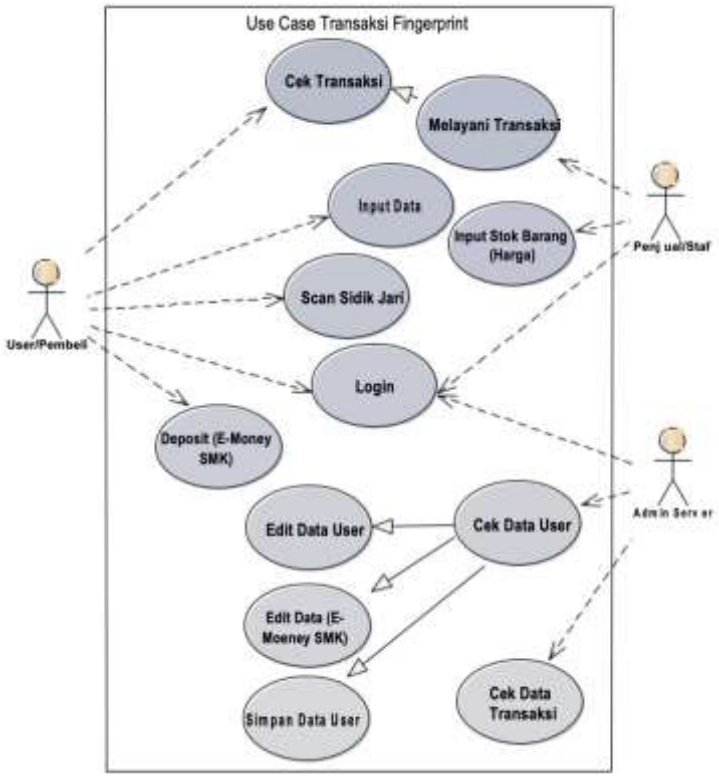

Figure 2. Use Case Diagram.

RESULT

Application from the User side

The application from the user side can be used to log in and out, view absence history information, and open settings. When it is first opened, the user must register first, and once registered, the user only needs to carry out fingerprint authentication every time they want to enter the application.

In serving customers, namely in the transaction process, PT. Bank Rakyat Indonesia (Persero) Tbk. The Pallangga Unit Sub-Branch Office, Gowa Regency uses the Multiple Channel Query System queue model or multiple line queue model. Where there are 2 tellers who can serve customers, but the phase that a customer goes through to make a transaction via a teller is only once.

The length of time required by each teller to serve one customer to another is random. Length of service time for the type of transaction carried out by the customer. In an effort to maintain the level of productivity in the PT transaction process. Bank Rakyat Indonesia (Persero) Tbk. The Pallangga Unit Sub-Branch Office, Gowa Regency determines that the maximum service time for each teller is 3 minutes. The service discipline applied is First Come First Served (FCFS). Where customers who come first to take a queue number will receive service first.

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Customer Arrival Rate and Telle Service Level

The arrival rate is the number of customers who come to receive service from a teller, expressed in terms of the number of customers (people) in a certain time period. The customer arrival rate is assumed to follow a Poisson distribution. The Poisson process itself means that the arrival of other customers does not depend on time (it is not limited). Meanwhile, the teller service level is the service time provided to serve customers.

Customer arrival data was obtained by observing the number of customers entering the queue system at PT. Bank Rakyat Indonesia (Persero) Tbk. Pallangga Unit Sub-Branch Office, Gowa Regency. Observations were carried out for 10 working days starting April 24 2018 and carried out from 08.00 – 15.00, the number of customers was recorded at one hour intervals.

At PT. Bank Rakyat Indonesia (Persero) Tbk. The Pallangga Unit Sub-Branch Office, Gowa Regency, has 2 tellers provided to serve customers who want to make deposit, withdrawal and money transfer transactions. The large number of customers who want to make transactions often creates long queues so that customers need a long time to queue. Therefore, the author can analyze the queuing system currently used by PT. Bank Rakyat Indonesia (Persero) Tbk. The analysis of the queuing system with the multiple lane model or M/M/s which has been explained is as follows:

M = number of open paths

ג = average number of arrivals per unit time

μ = number of people served per unit time on each line

Table 1. Teller Queue System

Periode Waktu (Jam)	Kinerja Sistem Antrian					
	P0	L_s	W_s	L_q	W_q	P
08.00 – 09.00	0,159	3,052	0,105	1,602	0,055	0,725
09.00 – 10.00	0,320	1,460	0,069	0,41	0,019	0,525
10.00 – 11.00	0,290	1,576	0,072	0,476	0,022	0,55
11.00 – 12.00	0,356	1,227	0,064	0,277	0,014	0,475
12.00 – 13.00	0,403	1,037	0,061	0,187	0,011	0,425
13.00 – 14.00	0,403	1,037	0,061	0,187	0,011	0,425
14.00 – 15.00	0,212	2,250	0,086	0,95	0,036	0,65

From the table above it can be seen that:

1. Teller utilization rate or teller busyness level (p)
   The busy working hours for tellers are 08.00 – 09.00 at 0.725 or 72%.
2. Average number of customers in queue (Lq)

The average number of customers in the longest queue occurred in the period 08.00 – 09.00 where the average number of customers queuing was 1,602 people. Meanwhile, the average number of customers in the shortest queue occurred in the periods 12.00 – 13.00 and 13.00 – 14.00 as many as 0.187 people.

1. Average number of customers in the queue system (Ls)

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The longest average number of customers waiting in the system occurred in the period 08.00 – 09.00 where the number of customers was 3,052 people. Meanwhile, the average number of customers waiting in the shortest system occurred in the periods 12.00 – 13.00 and 13.00 – 14.00 as many as 1,037 people.

2. Average time spent by a customer waiting in queue (Wq)
   The longest time required for customers to queue is 3.31 minutes and the shortest time is 0.66 minutes in the time period 12.00 – 13.00 and 13.00 – 14.00
3. Average time spent by a customer in the system (Ws) The longest time a person spent in the system was 6.31 minutes in the 08.00 – 09.00 time period and the shortest time was 3.66 minutes in the 12.00 – 13.00 and 13.00 – 14.00 time periods.

From the results of calculations using queuing system analysis which is currently applied at PT. Bank Rakyat Indonesia (Persero) Tbk. Pallangga Unit Sub-Branch Office, Gowa Regency, concluded that the performance of the teller section was not very good because in this case the customer waiting time was long (Wq) in the queue is 0.055 hours or 3.31 minutes and the average number of customers in the queue is the largest (Ls) as many as 3,052 people occurred in the time period 08.00 – 09.00. And sometimes there are customer transactions that must be approved by superiors (Approval), this can result in customers who are in the queue system waiting too long. Therefore, to maintain this performance, in the time period where the number of customer arrivals is high, especially in the time period 08.00 – 09.00, PT. Bank Rakyat Indonesia (Persero) Tbk. The Pallangga Unit Sub-Branch Office must be careful in managing the performance of the queuing system. This is very important if there is an addition of one teller to serve customer transactions, it can improve the performance of the queuing system for tellers, so that it does not create long queues and customers do not need a long time to arrive. queue.

Table 2. queue analysis if there is an increase in the number of tellers using the data

Periode Waktu (Jam)	Kinerja Sistem Antrian					
	P0	L_s	W_s	L_q	W_q	P
08.00 – 09.00	0,224	1,656	0,057	0,206	0,007	0,483
09.00 – 10.00	0,345	1,105	0,053	0,055	0,003	0,35
10.00 – 11.00	0,327	1,166	0,053	0,066	0,003	0,37
11.00 – 12.00	0,383	0,987	0,052	0,037	0,002	0,32
12.00 – 13.00	0,425	0,874	0,051	0,024	0,001	0,28
13.00 – 14.00	0,425	0,874	0,051	0,024	0,001	0,28
14.00 – 15.00	0,264	1,430	0,055	0,13	0,005	0,43

From the calculation results by adding one teller which will be the researcher's income at PT. Bank Rakyat Indonesia (Persero) Tbk. It can be concluded from the Pallangga Unit Sub-Branch Office, Gowa Regency, that the performance of the queuing system in the teller section will be good. By increasing the number of tellers, the performance of the queuing system can be obtained with the calculation results shown in table 4.7, namely the average number of customers in the largest queue (Ls) 1,656 people in the time period 08.00 – 09.00. Long customer waiting time (Wq) in the queue has been reduced to 0.007 hours or

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0.43 minutes.

Based on the description above, it is known that implementing a queuing system by increasing the number of tellers can help optimize the transaction process that occurs at PT. Bank Rakyat Indonesia (Persero) Tbk. Pallangga Unit Sub-Branch Office, Gowa Regency. Thus, the hypothesis states that: "It is suspected that the implementation of a queuing system in the transaction process at PT. Bank Rakyat Indonesia (Persero) Tbk. The Pallangga Unit Sub-Branch Office, Gowa Regency is not yet optimal" and is declared "acceptable".

CONCLUSION

Based on the discussion, the research results can be concluded that: The type of queuing system applied to the PT transaction process. Bank Rakyat Indonesia (Persero) Sub-Branch Office is a type of queue with a Multiple Channel Query System or M/M/s model where there are several tellers who can serve customers but the stage that the customer passes through to make a transaction via the teller is only once. The results of the calculation of the performance of the queuing system currently implemented at PT. Bank Rakyat Indonesia (Persero) Tbk. with 2 fingerprint tellers has long customer waiting times (Wq) in the queue is 0.055 hours or 3.31 minutes and the average number of customers in the queue is the largest (Ls) as many as 3,052 people and this occurred in the time period 08.00– 09.00. This shows the performance of the queuing system in the PT transaction process. Bank Rakyat Indonesia (Persero) Tbk. s not yet optimal. Meanwhile, the results of the calculation by adding 1 number of tellers to 3 can be obtained from the performance of the queuing system with the calculation results being the average number of customers in the largest queue (Ls) 1,656 people in the time period 08.00 – 09.00. Long customer waiting time (Wq) in the queue has been reduced to 0.007 hours or 0.43 minutes. Thus it can be concluded that there is

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