Procedia of Engineering and Life Science Vol. 6 2024
The 3rd International Scientific Meeting on Health Information Management (3rd ISMoHIM)
Asosiasi Perguruan Tinggi Rekam Medis dan Manajemen Informasi Kesehatan Indonesia - Universitas Muhammadiyah Sidoarjo

Implementation of The Waterfall Model in Designing a Prescription Abuse Prevention System with Patient Identification in Sleman Regency Pharmacies

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Abstract. Psychotropic drugs are used to treat psychiatric disorders, but they carry a risk of dependence. Prescription abuse includes using these medications without a prescription and attempting to obtain them illegally. Problems also arise from the improper use of patient cards and doctor's prescriptions. Currently, patient identification is managed separately by each pharmacy, allowing multiple drug purchases at different locations. Based on the preliminary study conducted, there is a need for an integrated recording system between pharmacies to prevent drug misuse, especially psychotropic substances. This requirement aligns with the competencies that must be possessed by medical recorders according to the Decree of the Minister of Health Number 312 of 2020. A medical recorder must be capable of designing health data standards that include data elements, data sets, databases, and the structure and content of health data, ensuring that the data can be used to support healthcare services. This research aims to conduct a needs analysis, design, and assessment for creating a psychotropic patient identification system. The methodology employed in this research follows a waterfall model approach in developing information systems. The stages of the waterfall model include needs analysis, design, implementation, testing, and evaluation. The System Usability Scale (SUS) questionnaire was applied in the testing and evaluation process to assess the level of system usability. The research findings indicate the necessity of an integrated patient identification system among pharmacies to prevent prescription misuse. It is hoped that this system design will serve as a planning model for the next phase. The system usability scale results show that the designed system is effective and acceptable.
Keywords: Design, Identification, Psychotropic, System

I. BACKGROUND

The misuse of prescriptions and medications includes non-medical misuse, which occurs when medications are used in a manner not intended by the prescriber or without a prescription, as well as medical misuse, which happens when medications are not used according to the prescription [1]. Prescription drug abuse has become the fastest-growing issue worldwide, requiring substantial efforts for control [2]. The misuse of prescription drugs affects the health and quality of life of the younger generation, making it a significant public health problem with substantial consequences [3]. Prescription misuse has long-term effects, including poor health, diminished quality of life, and personality disorders [4]. Prescriptions should only be issued by doctors, dentists, and veterinarians within their respective competencies and authorities. This regulation applies to psychotropic drugs which should only be available to patients with a doctor's prescription [5]. Psychotropic prescription drugs like opioids, sedatives, and stimulants are recognized for their potential for misuse [6]. There has been a significant recent global increase in the prescription of opiates/opioids [7]. Drug abuse may occur and is often associated with a calming effect [8]. The use of illicit drugs during adolescence is linked to criminal outcomes later in life [9].

There was an increase of 149 individuals with mental disabilities post-psychosis in Sleman Regency from 2020 to 2021, with 2,225 individuals in 2020 and 2,374 individuals in 2021 [10]. An ex-psychotic person is someone who has experienced disturbances in mental functioning, such as changes in thinking processes, emotions, anxiety levels, and psychomotor skills [11]. This indicates a high possibility of patients seeking psychiatric consultations with doctors and receiving prescriptions for psychotropic medications.

The community plays a crucial role in preventing medication misuse [12]. The misuse of psychotropic drugs in Yogyakarta involves using patient cards and doctor prescriptions. The method used is for one patient to have several doctor patient cards, allowing them to receive treatment from multiple doctors. This way, patients can obtain psychotropic drug prescriptions from various doctors, which can then be used to redeem the drugs [13]. This practice creates loopholes that

enable misuse, such as overuse, sharing with friends, or even selling to others. Distributing psychotropic drugs using doctor prescriptions is considered illegal [14].

Many individuals use psychotropic drugs without a doctor's approval [15]. Doctors cannot control the extent of drug possession among users due to multiple patient cards and visits to different doctors. This situation allows patients to have many prescriptions that can be redeemed at pharmacies. Additionally, pharmacies have limited in controlling the number of medication redemptions; as long as the prescription is valid and meets the requirements, the pharmacist will serve it [13].

One of the competency standards for a Health Information and Medical Recorder is health data and information management. A medical recorder must be able to design health data standards that include data elements, data sets, databases, and the structure and content of health data, ensuring that the data can be used to support healthcare services [16]. In solving a healthcare service data problem such as prescriptions, this ability can certainly be utilized by medical recorders, as prescriptions are also part of the medical records that must be maintained [17].

According to preliminary studies conducted by the author with the Health Office of Sleman Regency, patient identification is currently carried out according to the policies of each pharmacy, so there is no integrated system among pharmacies in a region. This allows repeated purchases at different pharmacies. So far, there is a check-and-recheck system through a pharmacist WhatsApp group, but it has not been effective in preventing patients from obtaining medications at multiple pharmacies. The Drug Control Officer of the Health Office of Sleman Regency stated that this issue is rare but still concerning. Therefore, a system for recording visits at pharmacies, especially for psychotropic cases, is needed. This system should be integrated with pharmacies in Sleman Regency to record every psychotropic drug purchase, preventing abnormal repeated purchases.

II. METHOD

In the development of the information system in this research, the author uses the waterfall model method. Each stage in this model must be carried out sequentially [18]. The author conducted a needs analysis by observing similar systems, interviewing pharmacists and Health Office staff, and conducting literature reviews on works related to this research topic. Additionally, the author designed the system using draw.io and Figma. Testing and evaluation were conducted using the System Usability Scale (SUS).

III. RESULTS AND DISCUSSION

A. Need Analysis

System requirements analysis is the initial stage that must be passed in design. Designing an information system necessitates an analysis of system requirements, encompassing aspects such as input specifications, hardware needs, and user requirements [19].

User requirements analysis stage plays an important role in creating an efficient system at the initial stage of system development [20]. The author carried out the needs analysis by conducting observations on similar applications, interviews and literature studies. The author did not find an application that was really similar to this design plan, because so far, according to interviews with pharmacists, the existing system is a local system for the pharmacy itself and focuses more on controlling drug stock and recording patients for each pharmacy. The author conducted interviews with Sleman District Health Service officers who are tasked with supervising pharmaceutical matters and also pharmacists. Apart from that, the author conducted literature studies in various journals and articles on related topics, thereby providing useful references for analyzing the design needs of this system.

1. Admin/Drug Supervisor

The admin of the this system is an officer from the Sleman District Health Service who is tasked with supervising pharmaceutical matters. The admin is tasked with verifying the accounts of pharmacists who register and accessing reporting on psychotropic purchases from all pharmacies. Apart from that, the admin also receives reports if there are patients who purchase medicines at more than one pharmacy. The features needed by the admin actor are registration, log in, pharmacist verification, registration, home page, history, visits, reporting, and managing patient data.

2. Pharmacist

Pharmacists are providers of pharmaceutical services who use this system to identify and record purchases of psychotropic drugs by patients. Pharmacists can register patients, view patient data, and view patient medication purchase

history. Pharmacists who are responsible for managing pharmacies are pharmacists who have obtained a Pharmacy License (SIA) [21]. In this system, pharmacists need features consisting of registration, log in, registration, homepage, history, visits and managing patient data.

B. Design

The design stage involves creating the system design based on the needs analysis results. Every design should start with a comprehension of the users it intends to serve [22].

1. Use Case Diagram

Unified Modeling Language (UML) is a collection of diagrams, structures, and procedures used for object-oriented program and application design modeling [23]. One component of UML is the Use Case Diagram, which describes interactions between one or more actors and the system being developed. Generally, use cases are used to identify the functions within an information system and determine who has access to these functions [24].

The Use Case Diagram for this system includes two actors: the pharmacist and the admin. The Use Case Diagram for the admin/drug supervisor actor shows that the actor can log in, register, verify pharmacist accounts, register buyers, view buyer data, manage buyer data, view pharmacist data, view drug purchase histories, manage drug purchase histories, view psychotropic drug management reports, view data of patients who purchase drugs from more than one pharmacy, and log out.

The Use Case Diagram for the pharmacist actor shows that the actor can log in, register, register buyers, view buyer data, manage buyer data, view pharmacist data, view drug purchase history, manage drug purchase history, and log out.

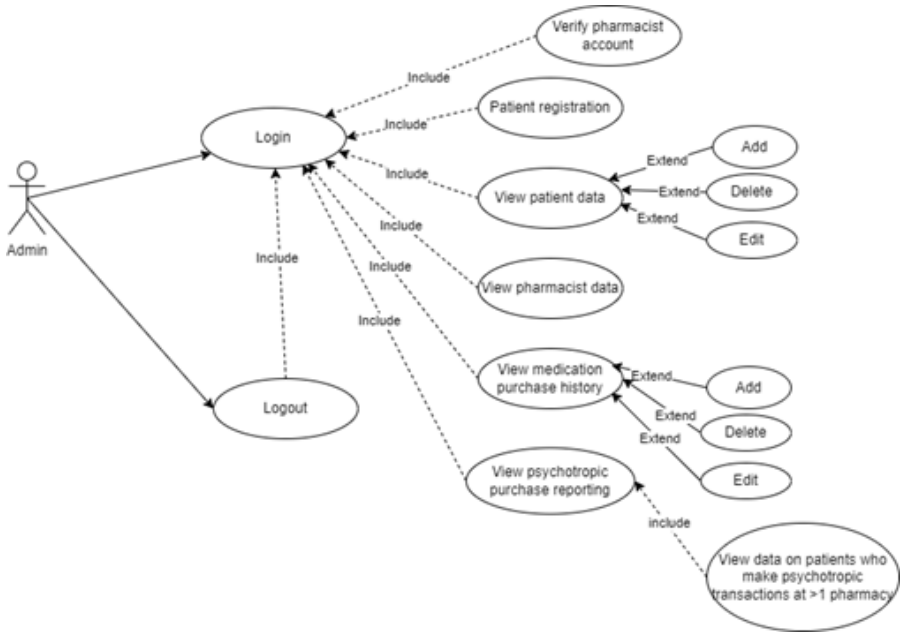

Figure 1. Admin Use Case Diagram

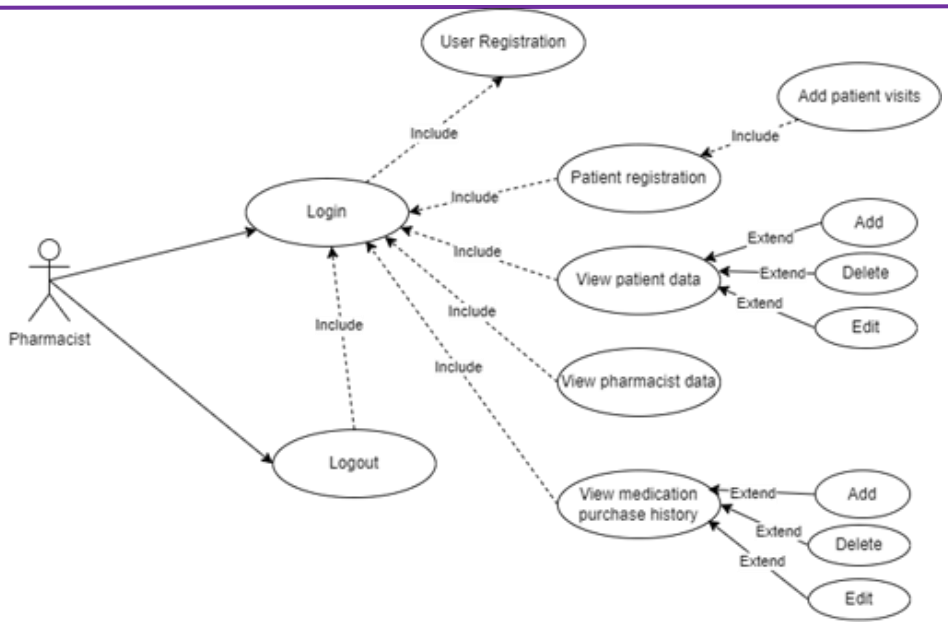

Figure 2. Pharmacist Use Case Diagram

2. User Interface design

User Interface (UI) is a discipline that explores the graphic design layout of a website or application interface [25]. UI focuses on the aesthetic aspects of a website or application's appearance. A UI designer's task involves organizing elements such as text, colors, lines, buttons, images, and all the components present in the web or application interface. In this design, the UI was created using Figma, a web-based collaborative platform designed for user interface design.

The system design uses five colors: blue, yellow, red, light gray, and white. Light gray is used as the background color of the system interface. Additionally, there are sections in white, such as data entry fields, giving a simple and minimalist impression. Other colors used in the system design are dark blue, yellow, and red, which emphasize the background color.

The font used in the design is Poppins. This font has a modern and simple appearance. It is easy to read and suitable for both formal and informal settings.

a) Login an Registration Page

The login and registration page are the first page displayed when the system is opened. Users can log in if they have registered and their account has been verified by the admin. Logging in requires email and password information. Registration requires information such as email, STRA (pharmacist registration certificate) number, SIPA (pharmacist practice license) number, full name, pharmacy name, pharmacy address, and password

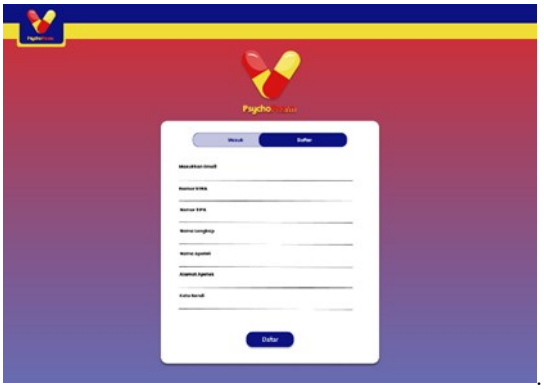

Figure 3. Registration Page

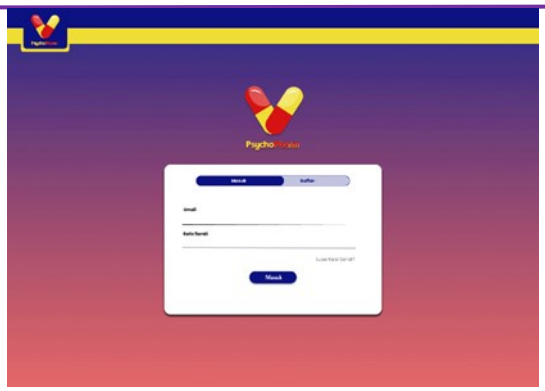

Figure 4. Login Page

b) Pharmacist Homepage

The pharmacist homepage appears after the pharmacist successfully logs into the system. There are three menus for pharmacists: registration, history, and account.

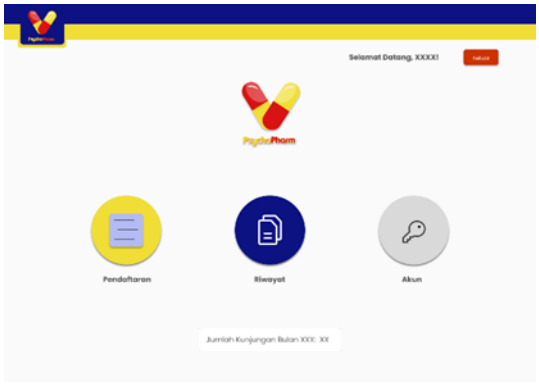

Figure 5. Pharmacist Homepage

c) Patient Registration Page

The registration page is used by pharmacists to add new patient data or add patient visit data. Before entering data, pharmacists must perform a patient search to prevent data duplication and ensure the patient is new. If the patient is already registered at another pharmacy, the system will provide a warning.

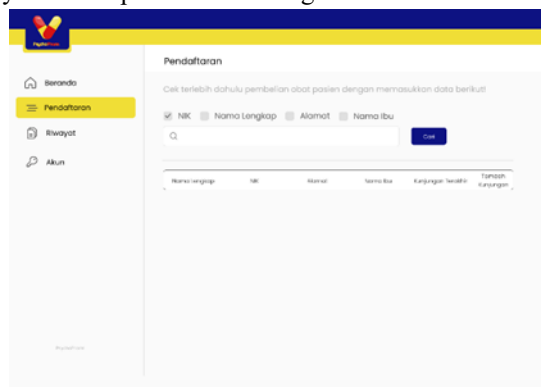

Figure 6. Patient Registration Page (1)

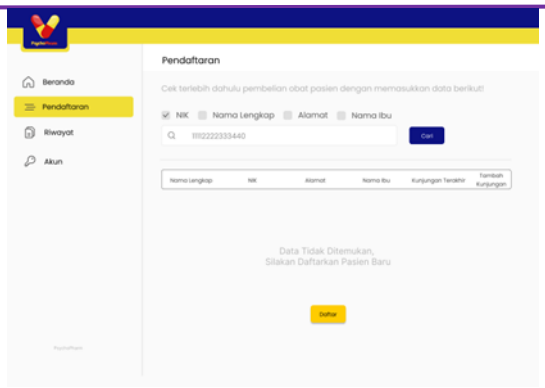

Figure 7. Patient Registration Page (2)

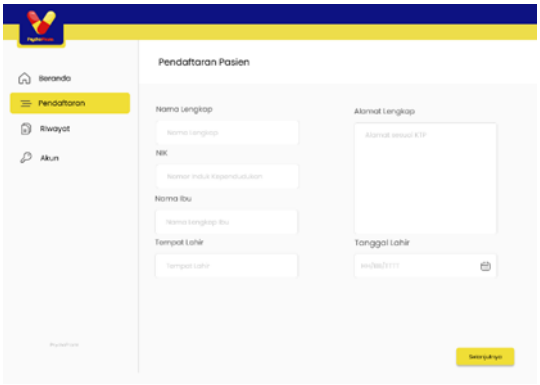

Figure 8. Patient Registration Page (3)

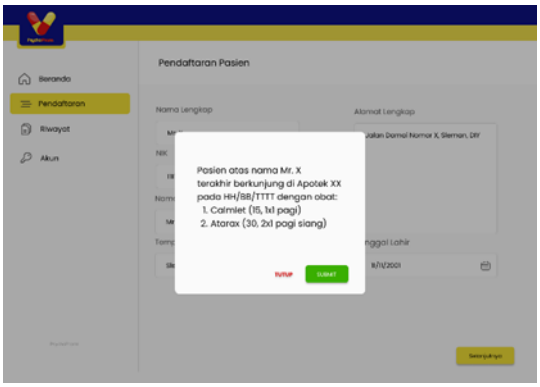

Figure 9. Warning Notification

d) Visit Page

The visit page contains data that must be filled in for each patient visit, whether the patient is new or existing.

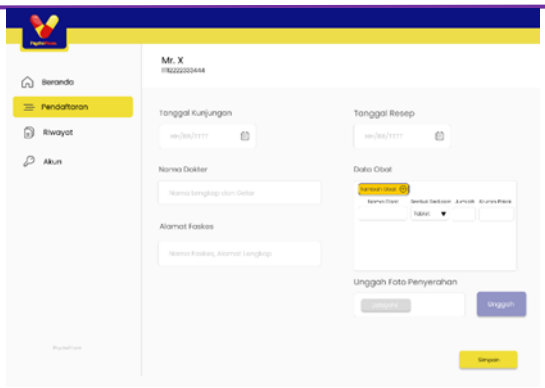

Figure 10. Visit Page

e) History Page

The history page is used by users to check the psychotropic drug purchase history of patients. The history page contains actions that lead to more detailed patient data, including patient activity status and a photo taken when the drug was handed over. The next action allows users to edit patient data.

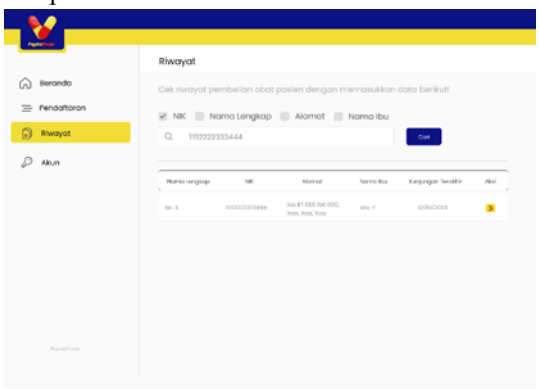

Figure 11. History Page

f) Pharmacist Profile

The pharmacist profile menu contains data about pharmacists, because this system can only be accessed by pharmacists and admins. The pharmacist profile contains data regarding full name, STRA (pharmacist registration certificate) number, SIPA (pharmacist practice license) number, email, pharmacy name, and pharmacy address.

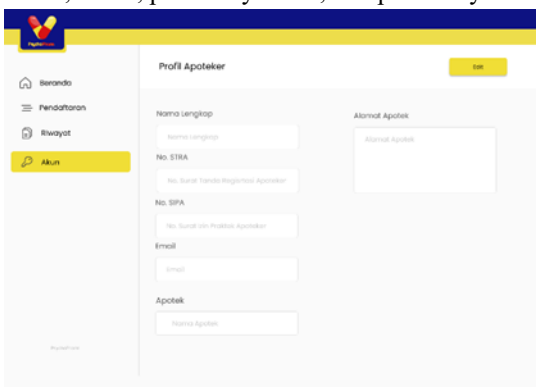

Figure 12. Pharmacist Profile

g) Admin Homepage

The admin homepage appears after the pharmacist successfully logs into the system. Unlike the pharmacist, the

admin has four menus: registration, history, reporting, and account verification. The registration and history menu has the same display as the pharmacist display in Figures 6-11.

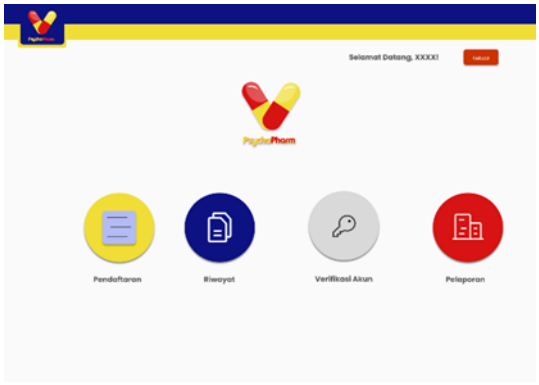

Figure 13. Admin Homepage

h) Reporting

Reporting is a menu accessible only by admins. It displays the number of visits per pharmacy, per month, and patients who make purchases at more than one pharmacy.

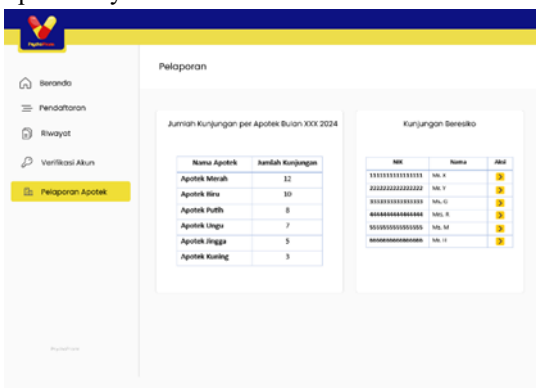

Figure 14. Reporting

i) Pharmacist Account Verification

Pharmacist account verification is also a menu accessible only by admins. This menu is to limit access to the system, ensuring it is only accessible by pharmacists, especially those responsible for the pharmacy, and to prevent data misuse.

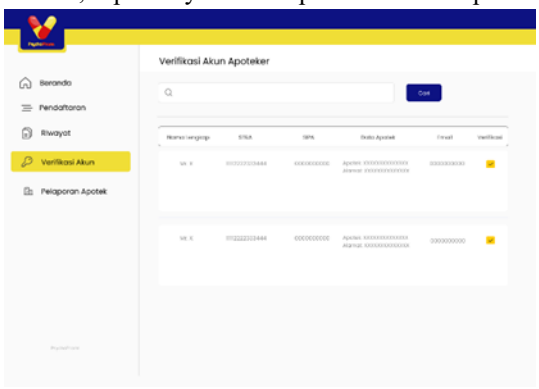

Figure 15. Pharmacist Account Verification

C. Implementation

The implementation of the needs analysis and design was done by creating a program using code written in Visual Studio Code (VS Code). VS Code is a text editor that can be used on various platforms like Linux, Windows, and Mac [26].

VS Code supports programming languages such as JavaScript and TypeScript, which were used in this design. Apart from that, this design uses a database from the Superbase free plan which is limited to 500 megabytes.

D. Testing and Evaluation

The System Usability Scale (SUS) is an evaluation procedure used to assess various products and services, including hardware, software, mobile devices, systems, and mobile applications [27]. Usability is a quality attribute that evaluates the ease of use of user interfaces [28]. Testing was conducted on 8 pharmacists at pharmacies that distribute psychotropic drugs and 1 employee from the Sleman District Health Office responsible for pharmaceutical oversight.

Table 1. System Usability Scale (SUS) Result

Name	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Total	Score
R1	4	4	5	2	4	2	5	2	4	3	29	72.5
R2	5	2	4	2	5	3	4	1	2	3	29	72.5
R3	5	1	5	3	5	1	5	1	5	3	36	90
R4	4	1	5	1	4	1	4	2	4	2	34	85
R5	5	1	4	1	4	1	4	2	4	2	34	85
R6	5	1	4	2	5	1	4	1	5	2	36	90
R7	4	2	4	1	4	2	5	2	5	1	34	85
R8	5	1	5	1	5	1	4	1	5	2	38	95
R9	4	1	4	2	4	2	4	2	4	2	31	77.5
											Average Score	83.61

The System Usability Scale (SUS) results showed a score of 83.61, indicating that the score is above average and the system is well-received.

IV. CONCLUSIONS AND SUGGESTIONS

Based on the research conducted, it can be concluded that a system is needed to prevent the misuse of psychotropic drugs with a doctor's prescription. The needs analysis was performed based on a literature review of scientific papers on the related topic, observations of information systems implemented in pharmacies, and interviews with officials from the Sleman District Health Office responsible for pharmaceutical oversight.

The SUS calculation results showed a score of 83.61, indicating that the system is well-accepted. This system design is expected to serve as a model for the next stage of development. Apart from that, this design uses a database from the Superbase free plan which is limited to 500 megabytes, so it is hoped that there will be an update to the database if the system is to be developed to a wider stage.

V. ACKNOWLEDGMENT

This research was successfully carried out thanks to cooperation and support from various parties. Therefore, researchers would like to thank the Health Information and Services Department of the Vocational School, Gadjah Mada University, the Sleman District Health Service, as well as fellow students of the Bachelor of Applied Health Information Management at the Vocational School, Universitas Gadjah Mada.

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