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Electronic Medical Record Management in Monitoring Loan and Return of Medical Records at Majalaya Hospital

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Abstract: This study aims to develop an electronic-based governance system for monitoring borrowing and returning medical record files at Majalaya Hospital. The Waterfall method was chosen as the main approach because the detailed and structured nature of this method allows planned and scheduled development. This approach also guarantees the quality of the resulting system, as each phase is completed in stages, avoiding over-reliance on a single stage. System development documentation is well organized, where each phase must be completed comprehensively before the next step can be carried out. One of the problems identified related to borrowing medical record files is the absence of an expedition book to record borrowing and returning. The existence of this expedition book is critical in monitoring the distribution of medical record files. Therefore, the authors designed a management system in accordance with the procedures for borrowing and returning medical record files. This system is expected to be able to efficiently monitor the distribution of medical records and organize borrowing and return processes more smoothly. With the existence of an effective monitoring mechanism, it is hoped that it can reduce potential problems that may occur when borrowing and returning medical records, even being able to deal with them proactively.

Keywords: Governance; Loans and Returns; Waterfall Method.

1. Introduction

Electronic Medical Records refer to a health documentation system built through an electronic platform, aiming to support the administration and management of medical information [1]. This system stores detailed patient demographic data, allergy records, medical history, and laboratory test results, sometimes also equipped with decision support facilities. This solution answers the needs of hospitals in overcoming the problem of large storage space, the risk of losing medical records, and limitations in accessing information. In this context, borrowing and returning medical records is crucial. Borrowing refers to borrowing medical record files for various purposes, such as research and referrals, which need to follow established procedures. On the other hand, returning medical records is an important step in patient file management, starting from the treatment unit to returning to the filing center within 24 hours [2].

Requests for borrowing medical records involve a routine process in which polyclinics and research doctors submit applications to the medical records unit. Filling in accurate and clear information, including the patient's name and medical record number, is the essence of this task. Return of medical record files in the inpatient unit is done when the patient is discharged from the hospital. In this case, the medical record file must be returned no later than 24 hours after the patient is allowed to go home [3]. However, from observations at the Majalaya Regional General Hospital, obstacles were found related to the lack of records in the form of expedition books for borrowing and returning medical record files, which had an impact on the lack of visibility of the medical record distribution process.

Efficient management of medical records has become a major challenge in the healthcare industry. Various studies have been conducted to overcome this problem, by integrating information technology and appropriate information systems. Guidelines for Hospital Medical Record Management in Indonesia [3] provide a basis for managing medical records, however, further innovation is needed to address ongoing needs. Wiranata (2022) designed a medical resume service information system with the aim of supporting BPJS file claims at dental and oral hospitals [4]. While Jamil *et al.* (2020) applied the Waterfall method to optimize the system for borrowing and returning medical record documents at the Puskesmas [5]. Furthermore, Hendayal *et al.* (2021) designed a special information system for managing inpatient medical records at hospitals [6], while Islamiati *et al.* (2021) focuses on the efficiency of borrowing medical record files in hospitals [7]. Web-based innovation was also proposed by Putri *et al.* (2022) to simplify the process of borrowing and returning medical records. Through a series of studies, these efforts are directed at improving medical record governance, increasing efficiency, and ensuring the accessibility of medical information with a more integrated approach [8].

The development of medical record management continues to progress through various recent studies. Nugraha *et al.* (2021) mentioned that to ensure the availability of medical records for inpatients [9], Ramadhanti *et al.* (2021) designed a retention information system that optimizes the accessibility of medical record files in the hospital environment [10]. Meanwhile, Radien's application in processing medical record data was discussed by Putri *et al.* (2021) using Microsoft Visual Studio 2010 [11]. Another approach in filling out outpatient medical resumes at a hospital is discussed by Hanifah *et al.* (2021) which describes the design of an information system to ensure the completeness of accurate and relevant data. This entire study reflects the enthusiasm to continue to improve the efficiency and accuracy of medical record management by utilizing the latest information technology [12].

This study has the main objective of increasing the efficiency of managing the process of borrowing and returning medical records. In this effort, an integrated approach will be implemented by combining electronic medical records with an optimal management system. The aim is to supervise and facilitate the distribution of medical records as well as the implementation of borrowing and returning them according to established guidelines. Through careful monitoring of the distribution flow of medical records, it is hoped that potential problems that may arise during the borrowing and returning process can be identified and dealt with more effectively.

2. Research Method

The author chose the Waterfall software development method because it offers a strong detail and structure, allowing for more directed planning and development schedules. This decision will have a positive impact on the quality of the resulting system, along with a phased approach that ensures each development phase is completed in detail. This approach avoids excessive focus on individual stages and promotes continuous implementation. In addition, the system development process is documented in a structured manner, with each phase having to be fully completed before moving on to the next phase. Thus, each phase or stage will have specific documentation that reflects the progress and results of each step [4].

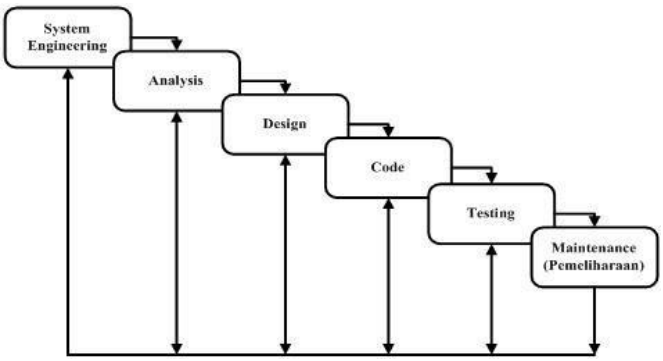


Figure 1. Waterfall Method

1) Needs Analysis
   At this stage, the system developer needs communication that aims to understand the software expected by the user and the limitations of the software. This information can usually be obtained through interviews, discussions or direct surveys.
2) Design
   At the stage of developing the system which is the stage of system requirements starting from the analysis stage then implemented into the design, this design is with a Flowmap, Context Diagram, DFD (Data Flow Diagram), ERD (Entity Relationship Diagram) for input and output design.
3) Implementation
   This is the design stage of the system that will be built, this stage provides a programming language for the designs we have made, the programming language is done using Visual Basic in Microsoft Visual Studio 2012 to produce applications that have been designed.

4) Integration and Testing
   All units developed in the implementation phase are integrated into the system after testing is carried out for each unit. After integration the entire system is tested to check for any failures or errors.
5) Maintenance
   The final stage in the waterfall method, the finished software, is run and carried out maintenance. Maintenance includes fixing errors that were not found in the previous step. Improved implementation of system units and increased system services as new requirements.

This research was conducted using data collection techniques through several stages:

1) Observation
   In this study the researcher made complete observations, namely observing, and knowing firsthand the running of the system being used. Medical record officers sometimes experience some difficulties in borrowing and returning medical records. One of the obstacles was the absence of organizing expedition books for borrowing and returning medical records, one of the factors that resulted in the non-monitoring of the distribution of medical records.
2) Interview
   In the interview process conducted, the authors used unstructured interviews, namely free interviews where researchers did not use systematic and complete interview guidelines to collect data.
3) Library Studies
   By using the data obtained by studying books, looking for references, from sources that are related to the writing of this research.

3. Result and Discussion

3.1 Results

1) Requirement

The first step in developing a system for borrowing and returning medical record files is requirements planning. This stage is carried out to collect and complete the data needed in making the system. Researchers collect relevant information regarding the needs of users of the loan and return system at Majalaya Hospital. At this stage, the information collected shows that the borrowing and returning process is still not fully computerized, and there is no loan form, out guide, and proof of transfer of medical files.

2) Interview

Sri Haryati	:	What is the procedure for borrowing medical record files at the Majalaya Regional General Hospital?
Deni A.Md RMIK	:	The person who will borrow the medical record document must report to the medical record officer, the medical record to be borrowed is taken from the storage shelf, and the officer inputs the medical record data to be borrowed on google spread sheets.
Sri Haryati	:	In your opinion, is the process of borrowing medical record files at this hospital in accordance with the Standard Operating Procedures?
Deni A.Md RMIK	:	Not yet, because we haven't provided a system for borrowing and returning medical record files.
Sri Haryati	:	What is the purpose of borrowing medical records for?
Deni A.Md RMIK	:	Only for certain purposes, for example, research and insurance.
Sri Haryati	:	What requirements must be attached in the process of returning medical record files?
Deni A.Md RMIK	:	Files are returned directly from the borrower according to what was borrowed from the start, therefore we need a system for borrowing and returning medical record files so that medical record files are well monitored, can provide loan receipts, and tracers.

3) Design

The design of this system is formed based on data that has been collected in the hospital. Therefore, software development is a must to ensure the readiness of the information system to be implemented. This design stage produces a clear picture of the proposed system, which has undergone a computerized process so that its use becomes more efficient. Transaction data will be input for the information system to be developed. This step includes making the following designs: flowmap, Data Flow Diagrams including Context Diagrams and level 1 DFD, Entity Relationship Diagrams (ERD), and preparation of database models to design inputs and outputs.

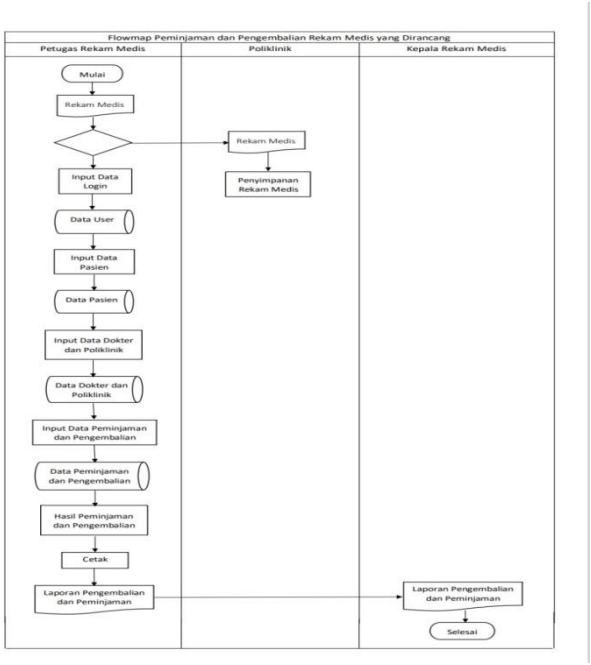


Figure 2. Flowmap Diagram

This diagram will visualize the workflow of the proposed system. This helps to understand how data and information will flow through the various components of the system, as well as identify the critical steps in the process.

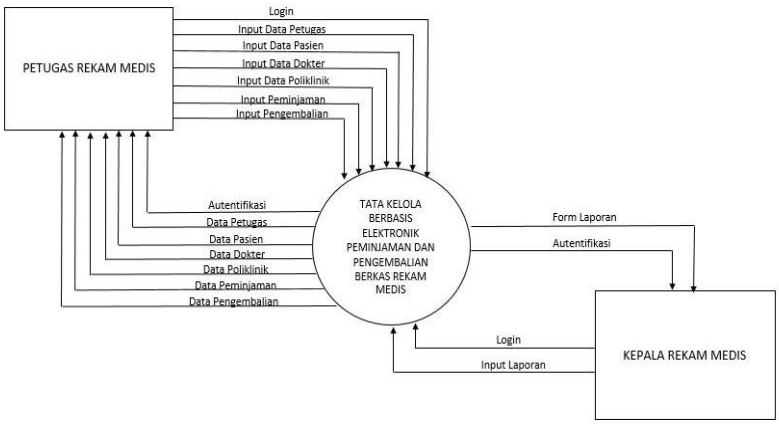


Figure 3. Context Diagram

This diagram will describe the relationship between the system to be developed and external entities, such as users, other hardware, or external systems. It provides a high-level view of how a system interacts with its environment. Figure 4 Data Flow Diagram (Data Flow Diagram) includes Context Diagram and DFD level 1. Context Diagram will show the main entities in the system and the flow of data between these entities. DFD level 1 will be more detailed by dividing the main entity into subprocesses and describing the flow of data between them.

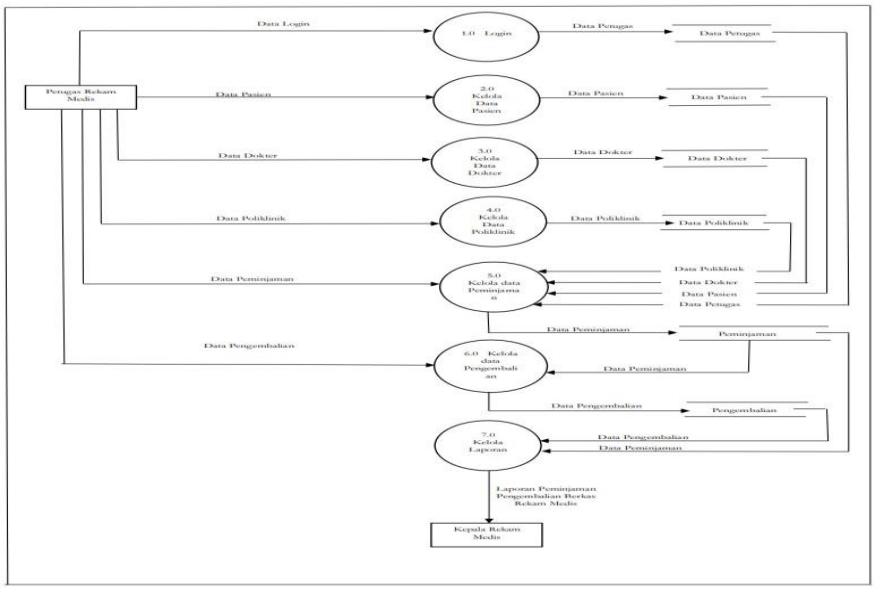


Figure 4. Data Flow Diagrams

Figure 5 Entity Relationship Diagram (ERD): ERD will visualize how the entities in the database are connected and related. This includes the tables in the database, the associated attributes, and the relationships between these entities. Figure 6 Relationship Scheme: This description will provide further detail on how the relationship between entities in the database is realized in the form of a relation schema. This will provide a more concrete view of the database structure to use.

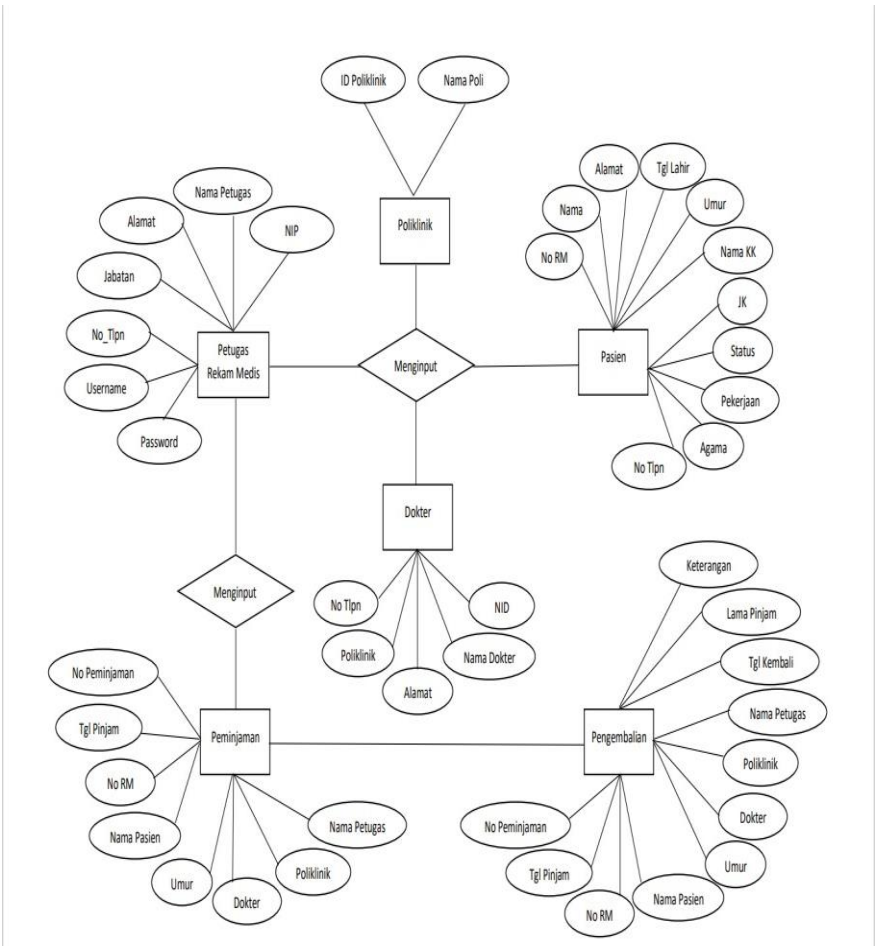


Figure 5. Entity Relationship Diagram

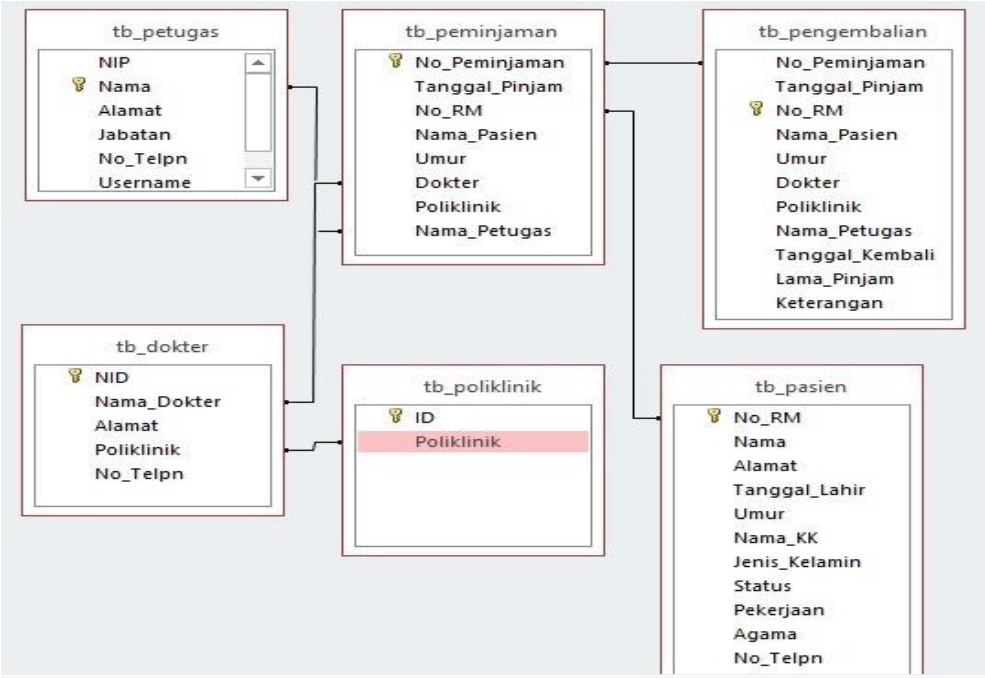


Figure 6. Relationship Scheme

4) Implementation

The implementation phase is a concrete step in realizing the design of a management system for borrowing and returning medical record files. At this stage, Microsoft Visual Studio 2012 is used as the main development environment, while Microsoft Access acts as a database that will store and manage all relevant data. Within the Visual Studio framework, developers can code and build system components according to pre-planned designs. The use of Microsoft Access as a database provides a structured and efficient framework for storing information related to borrowing and returning medical records, thereby ensuring the security, regularity and affordability of the data required by the system. Furthermore, this stage also involves the implementation of the previously designed system interface. The interface design is implemented with the user experience in mind, including informative data displays, intuitive action button functions, and other interactive elements for easy navigation. With this implementation stage, the design concept that was previously only an illustration will turn into a real system that functions according to plan. This allows the management system for borrowing and returning medical record files to be ready to be operated by personnel involved in the borrowing and returning process at Majalaya Hospital.

Table 1. Input Design

No	Name	Function	Attribute
1.	User Data	To login to the main menu of the loan and return system.	Usernames, passwords.
2.	Patient Data	Charging requirements.	No. RM, patient's name, address date of birth, gender, status, occupation, religion, no. Telephone.
3.	Doctor Data	As proof of hospital report.	Doctor ID, Doctor Name, Polyclinic, No. Telephone.
4.	Polyclinic Data	As proof of hospital report.	Polyclinic Code, Polyclinic Name.
5.	Loan Data	As proof of hospital report.	No. Rom, No. Borrow, borrow date, patient name, age, doctor, polyclinic, clerk.
6.	Return Data	As proof of hospital report.	No. RM, No. Borrow, Date of Borrowing, Name of Patient, Age, Date of Return, Length of Loan, Doctor, Polyclinic, Officer

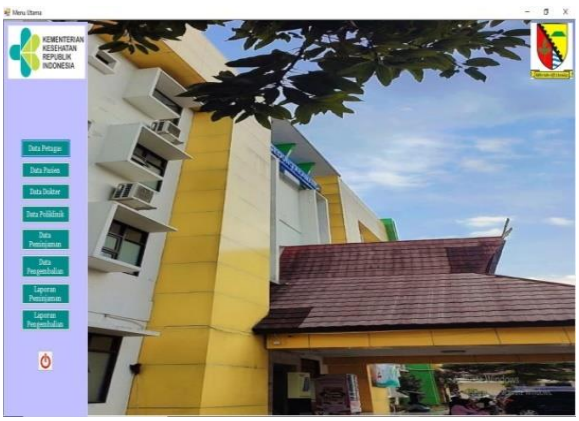
Table 2. Output Design

No	Name	Function	Attribute
1.	Loan and Return Data	Generate reports on loan reports per period, return reports per period, gender reports, long loan reports, and all patients.	No. RM, No. Borrow, Date of Borrowing, Name of Patient, Age, Date of Return, Length of Loan, Doctor, Polyclinic, Officer

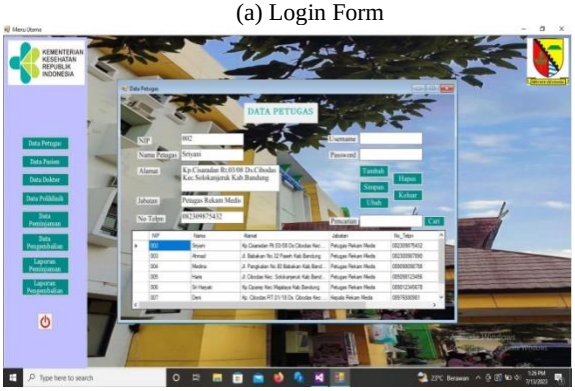
4) Interface Design

The Login Form, which is the initial entry for the officer to enter the system, can only be used for registered users (figure 7.a). Main page which contains the contents of a menu whose purpose is to enter the menu we are aiming at (figure 7.b). The officer form functions to identify officers who provide medical record loans to anyone who needs them (figure 7.c).

(a) Login Form



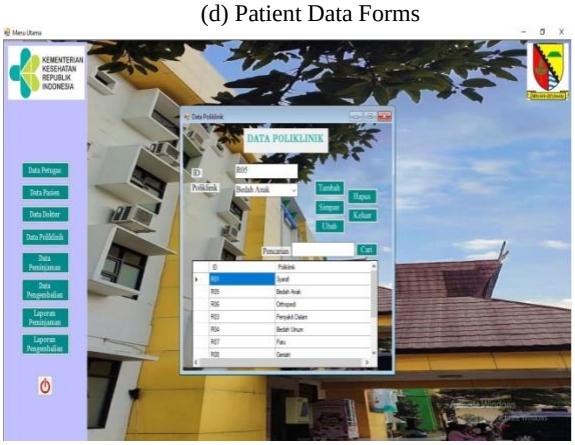
(b) Main Menu



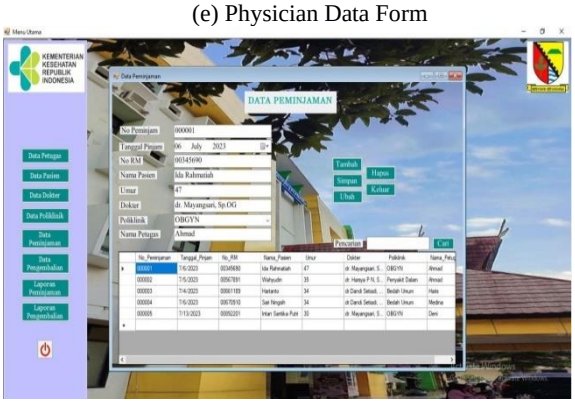
(c) Officer Data Form

(d) Patient Data Forms

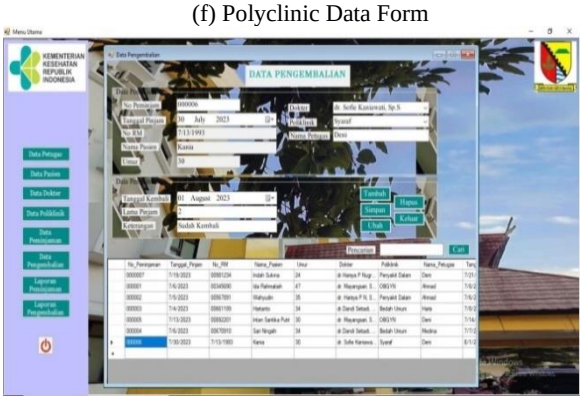
(e) Physician Data Form



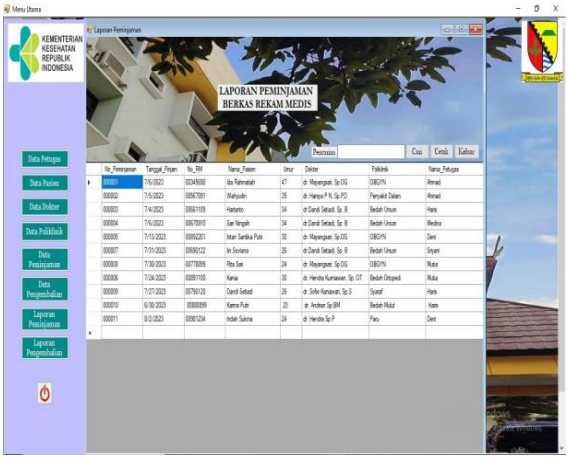
(f) Polyclinic Data Form



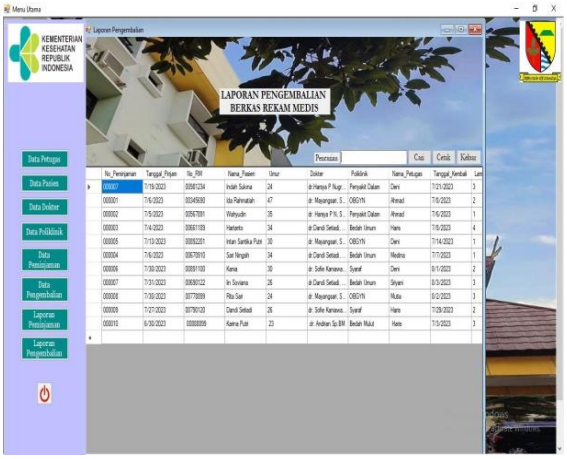
(g) Loan Form



(h) Return Form



(i) Loan Report Form



(j) Return Report

Figure 7. User Interface Display

The Patient Data Form (Figure 7.d) functions to manage new patient data with the aim of integrating it with the next system, especially in the lending process. This aims to increase efficiency and speed in service. On the other hand, the Physician Data Form (Figure 7.e) contains information about specialist doctors who are responsible for patient care. This information is important to maintain the quality of care provided to patients, as well as to ensure that patients receive treatment according to their needs. The Polyclinic Form (Figure 7.f) contains information about various polyclinics serving patients during the treatment process. This information helps direct patients to services that suit their condition and health needs. Loan Data (Figure 7.g) has an important role in managing information related to borrowing Medical Record Files. This form also prints a loan receipt which will later be included in the tracer or out guide as a sign that the medical record file is being borrowed. Furthermore, Data for Return of Medical Record Files (Figure 7.h) replaces the expedition book function by recording all stages from borrowing to returning. This data is the basis for making reports on borrowing and returning Medical Record Files. The Loan Report Form (Figure 7.i) is used to generate reports based on the data collected during the process of borrowing medical record files. Meanwhile, the Return Report Form (Figure 7.j) presents the medical record file data that has been returned by the borrower. Through these various features, the system can effectively manage patients, doctor, polyclinic information, as well as optimize the process of borrowing and returning medical record files. By utilizing these features, Majalaya Hospital can increase efficiency in tracking and managing patient health data, as well as organizing borrowing and returning medical record files.

5) Testing

Testing this software using Black box testing. This technique will be used in a test case to address multiple requirements so that the contents of this sequence can represent a test step that specifically addresses each requirement. The testing of the medical management information system at Majalaya Hospital is described as follows:

Table 3. Testing

No	Test Class	Examiner Scenario	Expected results	Information
1.	Login	In the login form, type your username and password, then click login.	If the username and password match then a successful login will appear. Meanwhile, if an account is entered incorrectly, an error will occur to the main menu.	Accordance
2.	Add Officer Data	To add officer data, you can go through the officer data form, click add, then click the save button.	Officer data is stored in the database.	Accordance
3.	Adding Patient Data	To add patient data, you can go through the patient data form. Input patient data and save.	Patient data is stored in the database.	Accordance
4.	Adding Doctor Data	To add doctor data, you can go through the doctor data form, enter doctor data and save it.	The doctor's data is stored in the database.	Accordance
5.	Adding Polyclinic data	To add polyclinic data, you can go through the polyclinic data	The doctor's data is stored in the database.	Accordance

		form, input the polyclinic data then save it.		
6.	Add Loan Data	To add borrower data, you can go through the borrower data form, input the borrower's data then save it.	The doctor's data is stored in the database.	Accordance
7.	Added return data	To add retrieval data, you can go through the retrieval data form, input retrieval data then save.	The doctor's data is stored in the database.	Accordance

6) Maintenance

The system for borrowing medical record files at Majalaya Hospital is based on the results of identification of analysis needs, it is known that the data needed by Majalaya Hospital is in accordance with the medical record file borrowing system. Designing system and software design, carried out by making flowcharts, data flow diagrams (DFD), and Entity Relationship diagrams (ERD). Making programs using the Mcirosoft Visual Studio 2012 programming application. Conducting tests carried out by trials using Black Box.

3.2 Discussion

The resulting discussion of the development of the medical record return and check system at Majalaya Hospital includes several important steps described. The first step is requirements planning (requirements planning). At this stage, researchers collect and enrich the data needed to build the system. The collected information shows that the process of borrowing and returning medical records has not been fully computerized. Important items such as loan application forms, exit instructions and proof of transfer of medical records are still missing. Stakeholder interviews are also an important part of the system development process. The conversation with Sri Haryati and Deni A.Md RMIK provides a clearer picture of the procedure for borrowing and returning medical records at Majalaya Hospital. Deni A.Md RMIK said the lending process does not follow standard operating procedures and is not fully computerized. Borrowing medical records is usually done for research and insurance purposes. The system design phase is the result of processing the collected data. This step covers various aspects such as flow diagrams, data flow diagrams (DFDs) including context diagrams and level 1 DFDs, entity relationship diagrams (ERDs), as well as base preparation. data. These diagrams help visualize the system's workflow, the relationship between the system and external entities, and the database structure that will be used. Implementation is an important step in perfecting the system design. Microsoft Visual Studio 2012 is used as the primary development environment and Microsoft Access as the database. The implementation of the designed system interface is also carried out at this stage, with an emphasis on the user's intuitive experience. Software testing uses Black Box testing, with multiple test scenarios. Tests are performed to ensure that various system features work as expected. The test results show that the system works well and is suitable for development goals. The maintenance phase includes identifying need analysis, system design, programming using Microsoft Visual Studio 2012 and testing with Black Box. This system is designed according to the needs of Majalaya Hospital and has the steps described above. With the existence of a computer system to borrow and return medical records, Majalaya Hospital can effectively increase patient data tracking, physician management and polyclinic coordination. This system also allows better management of the process of borrowing and returning medical records as well as generating the necessary reports for the operation of the hospital. With the implementation of this technology, Majalaya Hospital is able to maximize patient service and minimize the risk of errors and irregularities in the medical records management process.

4. Related Work

The literature review conducted in this study involved several previous studies that were relevant to the development of a system for borrowing and returning medical record files. In a study by Yudhi Yanuar and Fifi Indah Setiawati (2022), an information system has been developed that is specifically focused on the process of borrowing and returning inpatient medical records, which utilizes the Microsoft Visual Studio 2010 platform at Cianjur Hospital. This research provides in-depth insight into the application of technology in efforts to advance medical record management in hospitals [2]. In the realm of medical record information management, Muhammad Renaldy Wiranata & Cahyadi Agustin (2022) have explored the design of an information system related to medical resume services, using Microsoft Visual Studio 2010 at the Dental and Oral Hospital. A clear connection between management of medical record information and this research is an essential aspect that is emphasized [4]. An analysis of the use of the waterfall method in developing an information system for borrowing and returning medical record documents is presented by Jamil & Nurmalika (2020). The methodological approach adopted in this study has great potential to provide valuable guidance in the development of such systems, with an emphasis on stability and quality factors [5]. In a study by Hendayal, Haini dwijuliani, Yuda Syahidin, and Meira Hidayati (2021), a specific information system was designed for borrowing and returning inpatient

medical records at RSIA Humana Prima Bandung. This research provides valuable perspectives regarding the use of technology in managing medical records, especially in the context of inpatient care [6]. Another important reference is research by Nilam Islamiati, Yuda Syahidin, and Meira Hidayati (2021), who designed a similar information system for borrowing medical record files at Majalengka Hospital [7]. The clear link between this research and our research focus emphasizes the importance of these references in forming a solid basis and guide in developing a system for borrowing and returning medical record files.

5. Conclusion

Based on the results of research conducted at the Majalaya Regional General Hospital, several problems were found related to the process of borrowing and returning medical records. One of the main obstacles was the failure to organize expedition books for recording, borrowing, and returning medical record files, which resulted in a lack of monitoring of the distribution of medical records. To overcome this, it is necessary to develop a more structured system for borrowing and returning medical record files. The initial stage of developing this system is requirement planning, where the process of collecting and enriching the necessary data is carried out to complete the information that will be used in making the system. Utilization of the VB.NET programming language is the basis for producing a system for borrowing and returning medical record files that suit the user's needs.

References

[1] Indonesia, Kementerian Kesehatan (2022). Peraturan Menteri Kesehatan Nomor 24 Tahun 2022 tentang Rekam Medis. Kementerian Kesehatan.

[2] Yanuar, Y., & Setiawati, F. I. (2022). PERANCANGAN SISTEM INFORMASI PEMINJAMAN DAN PENGEMBALIAN REKAM MEDIS RAWAT INAP MENGGUNAKAN MICROSOFT VISUAL STUDIO 2010 DI RSUD CIANJUR. *Jurnal Teknologi dan Informasi*, *4*(1), 1-12.

[3] Direktorat Jenderal Pelayanan Medik. (2006). Pedoman Pengelolaan Rekam Medis Rumah Sakit di Indonesia Rev.II. Jakarta: DepKes RI.

[4] Wiranata, M. R. (2022). PERANCANGAN SISTEM INFORMASI PELAYANAN RESUME MEDIS DEMI MENUNJANG KLAIM BERKAS BPJS MENGGUNAKAN MICROSOFT VISUAL STUDIO 2010 DI RUMAH SAKIT GIGI DAN MULUT. *INFOKES (Informasi Kesehatan)*, *6*(1), 89-97. DOI: https://doi.org/10.56689/infokes.v6i1.834.

[5] Jamil, N. M., Muna, N., Wijayanti, R. A., & Wicaksono, A. P. (2020). Sistem Informasi Peminjaman dan Pengembalian Dokumen Rekam Medis Menggunakan Metode Waterfall (Studi Kasus Puskesmas Banjarsengon). *J-REMI: Jurnal Rekam Medik Dan Informasi Kesehatan*, *1*(2), 94-103. DOI: https://doi.org/10.25047/j-remi.v1i2.2241.

[6] Hendayal, H. D., Syahidin, Y., & Hidayati, M. (2021). Perancangan Sistem Informasi Peminjaman dan Pengembalian Rekam Medis Rawat Inap di RSIA Humana Prima Bandung. *Cerdika: Jurnal Ilmiah Indonesia*, *1*(11), 1497-1515. DOI: https://doi.org/10.59141/cerdika.v1i11.219.

[7] Islamiati, N., Syahidin, Y., & Hidayati, M. (2021). Perancangan Sistem Informasi Peminjaman Berkas Rekam Medis Di Rsud Majalengka. *Bianglala Informatika*, *9*(2), 73-78. DOI: https://doi.org/10.31294/bi.v9i2.10897.

[8] Putri, T. N., Syahidin, Y., & Wahab, S. (2022). Perancangan Sistem Informasi Peminjaman dan Pengembalian Rekam Medis Menggunakan Microsoft Visual Studio dan Framework CI Berbasis Web. *Jurnal Pendidikan Tambusai*, *6*(2), 14462-14470.

[9] Nugraha, M., Setiawan, D., Putra, H., & Ardianto, E. T. Kesehatan, J., Jember, PN, Medis, R., & Sakit, R.(2021). J-REMI: Jurnal Rekam Medik Dan Informasi Kesehatan J-REMI: Jurnal Rekam Medik Dan Informasi Kesehatan. *Jurnal Rekam Medik Dan Informasi Kesehatan*, *2*(2), 271-278.

[10] Ramadhanti, H., Syahidin, Y., & Sonia, D. (2021). Disain Sistem Informasi Retensi Rekam Medis Pasien Rawat Inap. *Explore: Jurnal Sistem Informasi dan Telematika*, *12*(2), 90-100. DOI: https://doi.org/10.36448/jsit.v12i2.2044.

[11] Putri, S. H., Syahidin, Y., & Hidayati, M. (2021). Aplikasi Radien untuk Pengolahan Data Rekam Medis dengan Microsoft Visual Studio 2010. *Expert J. Manaj. Sist. Inf. dan Teknol*, *11*(2). DOI: https://doi.org/10.36448/expert.v11i2.2110.

[12] Hanifah, N., Reihan, S. A., Syahidin, Y., & Hidayati, M. (2021). Perancangan Sistem Informasi Kelengkapan Pengisian Resume Medis Rawat Jalan di Rumah Sakit. *Expert J. Manaj. Sist. Inf. dan Teknol*, *11*(2). DOI: https://doi.org/10.36448/expert.v11i2.2109.