Design of Neonatus Information System Using V-Model Method to Support Electronic Medical Records

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Abstract: A description of the newborn information system at the Regional General Hospital of Occupational Health is the aim of this study. The data was gathered by observation, interviews, and a descriptive literature study as part of the qualitative research methodology. The V-Model technique with steps for validation, coding, and verification is used in the system development process. System development uses Microsoft Visual Studio 2012 for programming and Microsoft Access 2013 for data storage. Planning approaches include flowmap, context diagram, data flow diagram (DFD), entity relationship diagram (ERD), and data flow diagram (DFD). The findings of the study indicate that newborn certificates are still handled manually at the Regional General Hospital of Occupational Health, which results in a lengthier data entry time. In order to help staff process birth data and create newborn certificates more quickly and effectively, this research creates a design for a neonatal information system that handles patient, baby, doctor, and midwife data. In order to handle birth data reports reliably and promptly, this information system architecture includes a variety of report kinds, including reports to the health department, reports on births each month, and reports on babies by delivery mode. The purpose of this study is to support healthcare services in giving people high-quality treatment and excellent service.

Keywords – **Information Systems, Medical Records, Neonatus, V-Model**

INTRODUCTION

Modern technology will inevitably continue to grow at a quick and sophisticated pace. Countless new discoveries in the realms of information and technology have been made in recent years, as is evident by seeing the advancements in technology. The development of more advanced technological systems is undeniably good for people. Computerized technology is widely used to assist health information systems, which in turn boost efficacy and efficiency, especially in the health profession. Every organization, particularly those involved in healthcare, must quickly adopt computerized systems to keep up with the ever-increasing sophistication of these information systems. This transition will be facilitated by specialized units whose mission is to provide relevant data and information that stakeholders, both internal and external, can use to make informed decisions (Rinaldi et al., 2021). Hospitals are defined as healthcare institutions that offer a wide range of services to individuals, including inpatient, outpatient, emergency, rehabilitation, and medical support care. They also play an important role in medical education and training, as well as research and development in the field of health, according to the Regulation of the Minister of Health of the Republic of Indonesia Number 3 of 2020. Promotive, preventative, curative, and rehabilitative therapies are all part of comprehensive health care (Nisa et al., 2021).

This is the information age, and people everywhere—especially in the medical field—need to brush up on their expertise. Effective and efficient information collecting and analysis is essential for hospital administration in order to handle patient data. Good data frameworks may be established utilizing the internet or other applications with the use of data technology, eliminating the need for human data administration (Saputra et al., 2023).

Having a strong information system is essential for the smooth operation of the hospital, especially with the importance of medical records and other forms of electronic health data. The Republic of Indonesia's Minister of Health has defined "Electronic Medical Records" as those made utilizing electronic systems for record-keeping reasons, which is in line with this regulation (No. 24 of 2022). Because of this, medical professionals are able to better serve their patients. Processing data from medical records is an essential component of healthcare organizations' information systems (Imran et al., 2021). Information technology is essential for hospital medical record services because of the speed and accuracy of data processing and information. According to Rivatunisa et al. (2023), hospitals may improve patient privacy and security by implementing information systems that allow for systematic storage and administration of medical data. This, in turn, reduces the chance of data loss or damage.

According to Nurfadilah et al. (2021), a neonatal certificate is essentially a newborn's birth certificate. These certificates may be later utilized as administrative requirements for document processing. As part of the patient's medical history while they are in the hospital, the neonatal certificate includes information on the infant. Name, gender, parents' names, birthplace, date, medical history, physical description, names of attending midwife and assisting doctor, and any other information contained in the newborn certificate must be correct. Medical records personnel will handle this birth information.

Efficacy in performance is hindered since newborn certificates are still handwritten. The current technology age has rendered this manual technique obsolete due to its perceived inefficiency. The inefficiency stems from the fact that other people have a hard time reading the handwriting, which increases the likelihood of data processing errors. Hence, the researcher will develop a system for neonatal certificates to aid staff or midwives in documenting infant data in a way that minimizes the time needed to issue certificates while producing reliable data.

RESEARCH METHODOLOGY
To address research questions or test hypotheses, researchers use research methodologies, which include a systematic approach to data collection, analysis, and interpretation (Masri Singarimbun, 1995).

2.1 Data Collection Method
Using a descriptive approach to qualitative analysis, this system was designed. According to Saputra et al. (2023), qualitative research involves collecting data from interviews and observations made in the field. A study report exploring different situations is the end product of descriptive research (Yeti Sulastri et al., 2023).

2.1.1 Observation
The purpose of this step is to gather information by investigating the birth certificate issuance procedure in detail. The West Java Province Regional General Hospital of Occupational Health is where the observations are conducted.

2.1.2 Interview
At this point, we will conduct interviews with physicians, midwives, and professionals from the perinatology installation as well as the medical records department.

2.1.3 Literature Review
To do this, one must immerse oneself in literature, books, magazines, and online pieces that bolster hypotheses pertinent to the central issue at hand.

2.2 Development Method
This system was designed using the System Development Life Cycle (SDLC) in conjunction with the Advance V-Model development approach. Testing activities (acceptance testing, test cases, integration, regression, system, security, and deployment testing) and development activities (requirement analysis, requirement specification, design specification, and program specification) are shown in the Advance V-Model. One part of the testing and design process is black box testing, which involves running a battery of tests to see if the app achieves its objectives (Lobo et al., 2022).
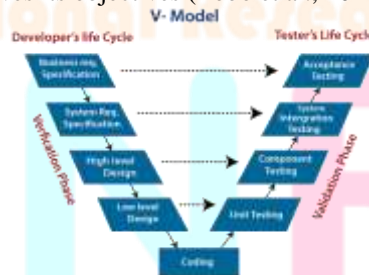
Figure 1. V-Model

Steps in the V-Model Methodology:

1. Requirement Analysis & Acceptance Testing
 - The outcome of Requirement Analysis is user requirement documentation, and Acceptance Testing analyzes whether the documentation can be used by the user.

2. System Design & System Testing
- System analysis begins designing user requirement systems referring to previously created documentation.

3. Architecture Design & Integration Testing
- The basis for selecting architecture used in each module, interfacial relationships.

4. Module Design & Unit Testing
- Designing is broken down into smaller modules.

5. Coding
- Programming each formed module.

Users are engaged in every step of the development cycle, as seen in Figure 1 of the V-Model, which places an emphasis on users. The V-Model is best understood by reading it from left to right, with user requirements at the top and user-validated systems at the bottom. Decomposition and definition operations, which complete the design and architecture of the system, are considered on the left side of the V-Model. According to Purbaningrat et al. (2023), the development framework integration and confirmation exercises are shown on the right side.

2.2.1 Flowmap

The patient's arrival and registration at the registration desk start the process flow of the newborn certificate system. After the patient's registration, their personal information will be kept in their medical records. The information on the patient's identification card will be used by the registration officer to register patients who have not been registered previously. Information about patients who have already registered will be taken straight from the database. Following the patient's delivery, the personnel at the perinatology installation will use this data to document the baby's birth. The newborn certificate and a report on the baby's birth will be generated by the perinatology installation using data collected during the delivery. A duplicate of the neonatal certificate and the birth report will be kept in the medical records system after they are produced.
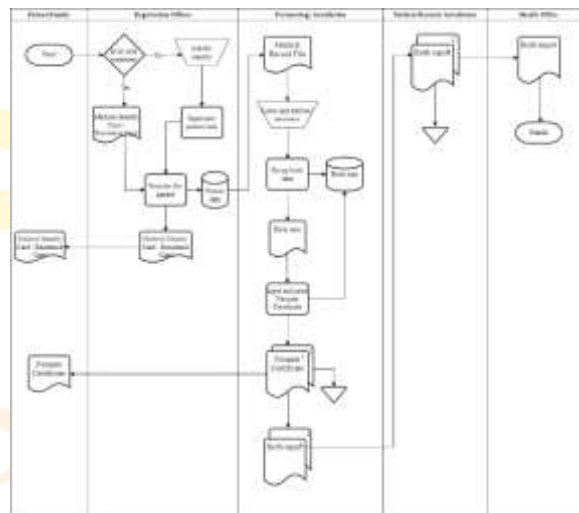
Figure 2. *Flowmap that was designed*

2.2.2 Diagram Context

Interactional charts, or diagram context, show how far a framework extends (Rinaldi et al., 2021). Patient IDs entered into the system will be handled by the registration department, according to the researchers' context diagram. The health office and the medical records department will get the neonatal certificate letters and birth reports that the perinatology installation uses this data to create.
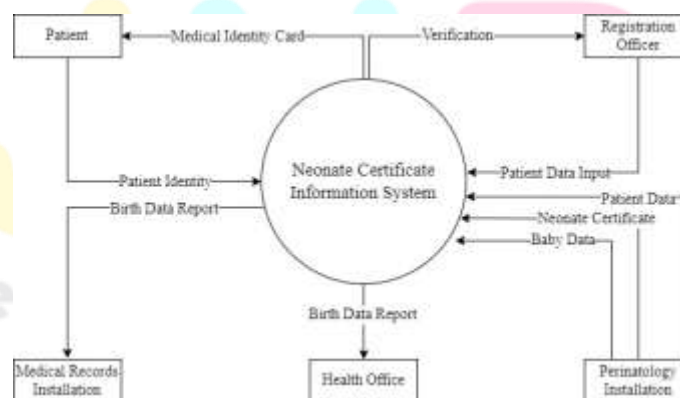
Figure 3. Diagram Context that was designed

2.2.3 *Data Flow Diagram* (DFD)

In order to identify the data involved in each interaction, the Data Flow Diagram (DFD) is used to depict the cycle that takes place inside the system that is to be built or designed using this model (Nurfadilah et al., 2021).
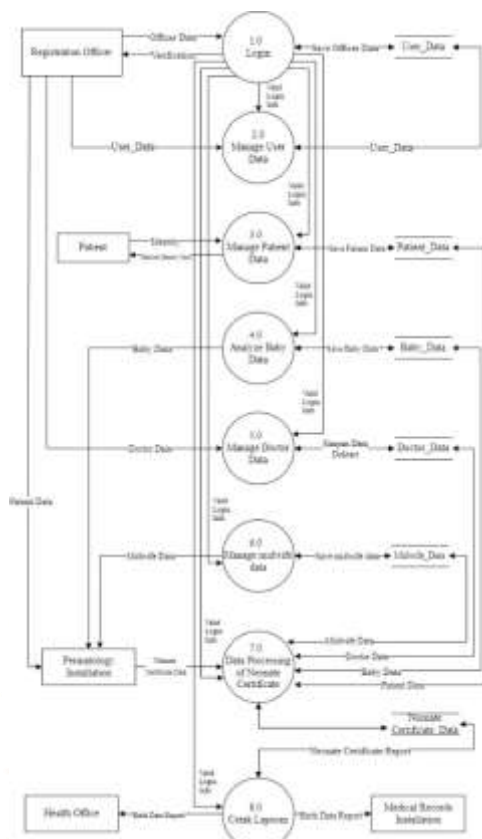
Figure 4. DFD that was designed

2.2.4 *Entity Relationship Diagram* **(ERD)**
A Data Flow Diagram (DFD) is a useful tool for modeling the internal processes of a system and determining which pieces of data are involved in each interaction (Nurfadilah et al., 2021).
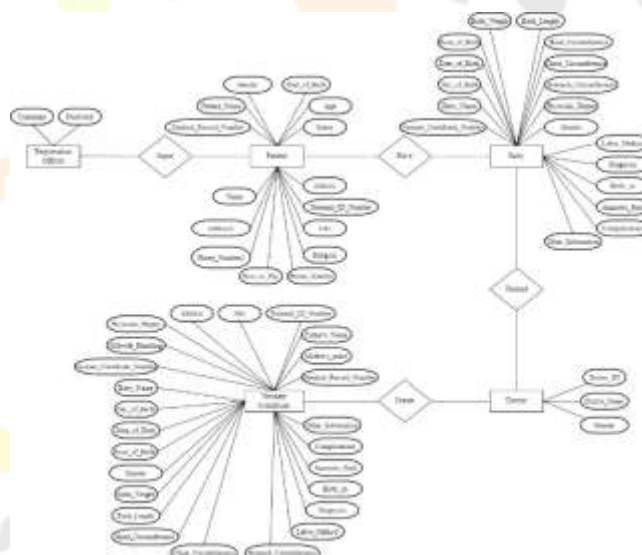
Figure 5. ERD that was designed

RESULT AND DISCUSSION
This system's architecture yields a summary of the physicians, midwives, and medical records staff who originally entered patient data by hand. The following is the newborn certificate design system that is established after the research:
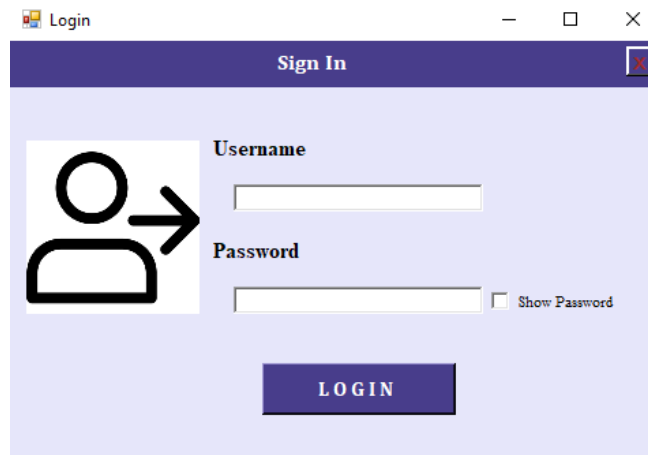
Figure 6. *Form Login*

At startup, the system will display the login form interface, as seen in Figure 6. Employees submit their login credentials at the login screen, which is the first glimpse of the system. Everyone on staff is responsible for keeping their login information secure to prevent unauthorized access. Data leakage or breaches of patient confidentiality may be minimized using this sort of protection.

Figure 7. *Form* Main Menu

Neonatal Certificate (SKN) design system primary menu interface is shown in Figure 7. Information on patients, babies, doctors, midwives, SKNs (Neonatal Certificates), and newborn reports are all included on this website.
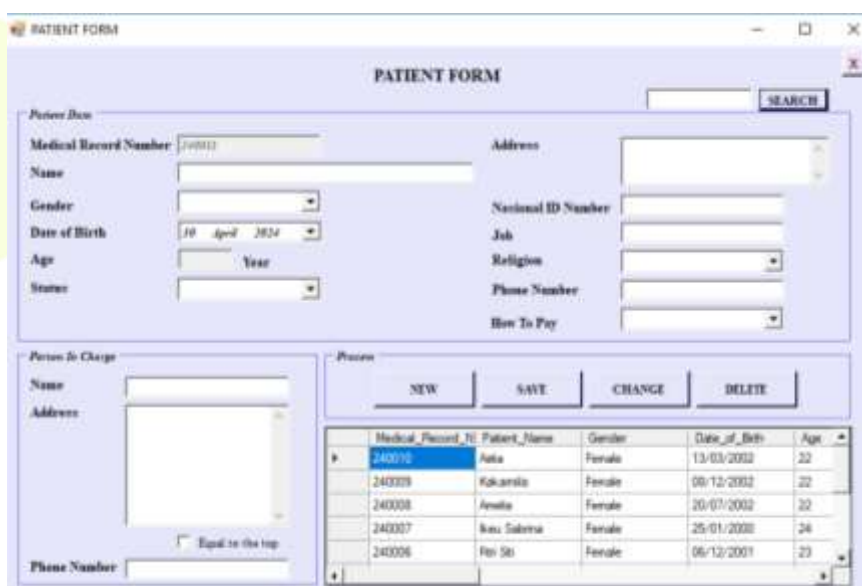
Figure 8. *Form* Patients Data

Figure 8 shows the patient data form interface, which is used to fill in the data of patients who will undergo delivery. This data is inputted by registration personnel at the hospital.

Figure 9 . *Form* Babys Data

Figure 9 displays the baby data form interface, used to input data of newborn babies, which is entered by personnel in the perinatology installation.

Figure 10. *Form* Doctors Data

Figure 10 presents the doctor data form interface, which serves to display doctor data, add doctor data, and view saved doctor data.

Figure 11. *Form* Midwife Data

Figure 11 shows the midwife data form interface, which is used to display midwife data, add midwife data, and view saved midwife data.

Figure 12. *Form* "Neonatus Certificate Data"

Figure 12 depicts the Neonatus Certificate data form interface. This form includes features to add baby data and patient data so that personnel can directly print the Neonatal Certificate.

Figure 13. *Form Reports*

Figure 13 shows the Neonatal Certificate report interface, which will display various types of reports including reports to the health department, monthly reports, and reports on babies by mode of delivery.

The result of the conducted research is the creation of a neonatal certificate containing accurate and appropriate data through the design system created using Microsoft Visual Studio 2012. Below is an image of the design result of the neonatal certificate system.

Figure 14. Neonatus Certificate

The display of newborn baby reports using the report page in the application that has been created.

Figure 15. The Display of Newborn Baby Reports to the Health Office (DinKes)

Figure 16. The Display of Newborn Baby Reports Per Month

Figure 17. The Display of Newborn Baby Reports Per Mode of Delivery

CONCLUSION

Hospitals still use a manual procedure to create neonatal certificates and generate reports for infants, which means extra time spent entering data. The development process of neonatal certificates is made easier with the help of Microsoft Visual Studio 2012 and the V-Model method. Microsoft Access 2013 is used as a secure data storage location, and searches for data and reports for newborns are made easier still. This system can efficiently and effectively create neonatal certificates because of its architecture, which also allows for correct management of birth data with few mistakes.

RECOMMENDATIONS

It is advised to hold system-related social events prior to and after the launch to ensure that users are well-informed about the system's features and how to utilize them appropriately for their jobs. On a regular basis, it's wise to think about ways to make the system more secure so that only authorized users may access it.

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