(RESEARCH ARTICLE)

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Medical records information system based on prototyping model using automatic identifier NFC card

I Gede Sujana Eka Putra [*] and Ni Luh Putu Labasariyani

Department of Computer Informatics, Institute of Business and Technology, Indonesia.

Abstract

Radio Frequency Identification is a compact wireless technology that is superior and has been developed in the commercial and educational for example in automatic identification in the hospital patient registration. This research aims to improve patient registration services to be more practical during outpatient registration at hospitals. Currently, hospital outpatient registration is still carried out semi-computerized where patients come to the reception desk and then register by filling in a registration form. Next, the reception staff performs data entry from the registration form that has been filled in by the patient. If a lot of patients come, there will be a queue of patients because it takes quite a long time for the registration process. Based on the problems faced, this research carried out the development of a patient data management system using NFC cards which contain patient medical record number data. When a patient visits the hospital, the patient taps the medical record card and inputs the complaint and the doctor they are going to, then the patient gets a queue number for consultation, until the patient consults with a doctor and gets the medicine prescribed by the doctor through the use of the system. Testing the system by reading and writing data on the NFC card on the card reader/writer unit, the test results showed that the maximum reading distance for the NFC card was 7 cm with a reading angle relative to the NFC reader/writer with 30^0 can read the NFC card.

Keywords: Radio Frequency Identification (RFID); Registration; Medical Records; Hospitals; NFC Card

1 Introduction

Radio Frequency Identification is a compact wireless technology that is superior and has been developed in the commercial and educational for example in automatic identification in the hospital patient registration. Recording patient health history data is important in medical and health services and is known as medical record data. As long as the patient undergoes an examination or undergoes medical treatment by a doctor or medical agency, the patient's health status will be recorded as data in the patient's medical record. The patient's medical record data can be used as a reference for subsequent patient health examinations, as well as recorded evidence regarding the diagnosis of the patient's disease and the medical services received by the patient.

Most hospitals in Indonesia still use conventional systems for recording patient medical record archives. The conventional system for recording and archiving medical records has shortcomings, namely records that can be lost or damaged, it takes a long time to search for a patient's medical record due to records being stored that are not arranged in an orderly manner, very long waiting times for patients who require a quick response for immediate treatment.

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[*] Corresponding author: I Gede Sujana Eka Putra.

reception desk and then register by filling in a registration form. Next, the reception staff performs data entry from the registration form that has been filled in by the patient. If a lot of patients come, there will be a queue of patients because it takes quite a long time for the registration process.

This research proposes the development of a hospital patient medical record system using a radio frequency identifier, each patient has an NFC card which contains a medical record number. Patients who come in tap their NFC card into the reader and then can input complaints about the disease being consulted and the doctor they are going to. On the doctor's side, the system can display the patient's medical records to find out the patient's disease history, as supporting data for the doctor to be able to diagnose the patient's disease correctly. With the urgency of research through the use of RFID technology, patient service from the registration stage to receiving medicines can be carried out more efficiently and faster, practically and provide added value for hospitals.

The problem in this research is how to develop a hospital patient medical record system using radio frequency identifiers. The limitation of the problem in this research is that due to limited research time, the data used comes from secondary medical record data formats from the internet and the radio frequency used is an NFC card.

RFID (radio frequency identification) is a technology that combines the function of electromagnetic or electrostatic coupling in the radio frequency portion of the electromagnetic spectrum, to identify an object [1][2]. With the development of information technology that supports business processes, a mechanism for managing large amounts of daily transaction data is needed so that it can be processed quickly. Some transactions that implement an automatic system designed to make it easier for users to carry out transactions, for example, are Internet online payments, smart cards, radio frequency identification (RFID), mobile payments, financial technology, and others. In daily life, transactions such as payments still use manual methods using paper money and metal (cash). Now, cashless transactions have begun to be implemented, mechanisms for digitally exchanging transaction information, which can increase the accuracy and security of the transactions. Near Field Communication is a development of Radio Frequency Identification (RFID) technology which is used to communicate data using radio frequencies, where data can be stored on card media or the data can be read using an NFC reader device. NFC is used because there is a need for more efficient, accurate, safe, and practical data transmission. NFC can be used for digital transactions such as exchanging digital content by connecting an NFC card with a reading device/reader that uses NFC, and ticket purchasing applications by activating NFC on a cellphone. NFC has many functions such as being able to transfer data quickly and make purchase transactions without the need to use a credit or debit card which does not need to go through a complicated activation process [3].

2 Literature Review

2.1 State of The Art

Several previous studies related to research were carried out as follows: research from [4] developed a lecturer attendance information system to record lecturer attendance using radio frequency identification technology by implementing a near-field communication card (NFC Card). Application for recording and reading lecturer attendance data during lectures, by tapping the NFC Mi-fare card on the NFC reader/writer. The implementation of NFC cards is more practical for lecturers in taking lecture attendance and NFC cards can be scanned at a maximum distance of up to 7 cm with a reading angle of the card to the reader device with a range of 00 to 300. Previous research from [5] implemented RFID in the patient medical record queuing system in hospitals, aiming to reduce patient queuing time when processing medical records in outpatient registration at hospitals, RFID is used for unique patient codes. This unique code will display patient data automatically so that it does not require time to search for patient files which can increase patient queue time. Research from [6] discusses the medical record system and report preparation at Community Health Centers which is currently still manual and still uses bookkeeping media and takes up a lot of space so that patient service is less effective and efficient. Using a website as a tool in data processing can make it easier to process medical record data and create reports more easily and efficiently and can save the space provided. The development method uses waterfall methods which starts with analysis, design, code, testing, and maintenance. Research from [7] is based on the Saffira Sentra Medika Clinic which does not yet have an information system that can support business processes at the clinic. Currently, the process of collecting data, providing services, and recording patient medical records still uses written media, making it difficult for medical personnel to search for and sort patient data, medical records, and drug stock in the pharmacy because many reports are buried in the report archive room and have to be searched for one. by one. Information systems can help medical personnel in clinics store and process various kinds of data safely and in an organized manner. The system development methodology used is Waterfall. Another research from [8] examined the design of a lecture attendance application using NFC technology, an effort to facilitate the student attendance process, carried out by utilizing Android-based NFC (Near Field Communication) technology).

NFC technology on smartphones can detect the NFC chip on the card for the identification process of the card owner, students simply touch their identity card to the NFC tag detection device then the system will input attendance automatically connected to SIMAK. Other previous research from [3] examined the application of the role and use of near-field communication (NFC) technology to teaching and learning activities in higher education. The aim was to provide convenience in the teaching and learning process for students and lecturers by providing lecture material even though the internet network was down. (off). In general, in the presence of lecturers in teaching courses, lecturer attendance is recorded on the lecture attendance sheet, or via the campus web application which is accessed on the computer in class. Still, sometimes access to the server is disrupted so that the lecturer cannot use the web application due to not being able to connect to the server. To overcome this, NFC cards are implemented where during lectures the lecturer taps the card on the NFC reader device provided, and the lecturer's attendance data is recorded in the academic attendance information system. Data stored on an NFC card can be encrypted so it is safe and not easy to duplicate by other people. Other research from [9] concerns the design of radio frequency identification (RFID) for an ATmega 8535 microcontroller-based attendance system to read employee attendance information as an attendance application to store and create employee attendance reports. Maximum reading of tags by an RFID reader must be at a distance of <= 4cm which has a tag reading success rate of 100%. The time lag when reading the first tag and second tag by the RFID reader must be more than 2 seconds so that the tag can be read. Research from [10] developed a library application using RFID (Radio Frequency Identification) smartcards. As the collection of library materials in the Regional Library and Archives Agency of South Kalimantan Province increases, the need for information on library materials increases, and limitations in library service staff become a problem in library management. The library information system starts from member data collection, book data collection, book borrowing, book returns, giving library free letters, and making reports including member data reports, book data reports, book loan reports, book return reports, and fine receipt reports. This library application can maximize library services and minimize errors in data processing. Previous research from [11] designed a library application based on Radio Frequency Identification (RFID) which facilitates the transaction process in libraries. RFID is used to identify admin cards, member cards, and the identity of each book. The library application consists of 4 parts, namely admin menu, guest book, transaction menu, and alarm. The system designed carries out the login process by scanning the member's RFID card. The borrowing process involves scanning the books borrowed from readers. RFID is used as a security system in libraries, by placing an RFID reader at the exit of the library to check whether books are being taken out without going through the loan transaction process. Previous research from [12] on the application of RFID technology to filling in library visit data, connected an Arduino-based RFID reader with database reading. RFID technology for automating library visit data is a development of QR Code, with the advantage of being difficult to duplicate RFID cards with integrated Internet of Things (IoT) with practical data storage. Other research from [13] applies Radio Frequency Identification (RFID) technology to improve library services. Problems in libraries generally are the lack of optimal library services provided and the performance of human resources in libraries. With RFID, users carry out self-service to speed up the loan and return circulation process, so that the time required is efficient, which is equipped with training in using the system so that it can be used correctly. RFID consists of active and passive RFID. Active RFID labels have strong signals and can transmit data over long distances. Passive RFID labels rely on an RFID reader to transmit data over a short scanning distance and are cheaper to produce [14].

2.2   Radio Frequency Identification

Information technology is a means to make it easier to implement automation. Automation systems help in implementing the security and accuracy of stored data. Systems with radio frequency identification provide a sense of security and comfort for users as a means of identifying themselves, for example, shopping centers and others. RFID (radio frequency identification) is a technology that combines the function of electromagnetic or electrostatic coupling in the radio frequency portion of the electromagnetic spectrum, to identify an object. RFID is used as a tool to automatically control a chain of activities. Previous research implemented RFID in a patient medical record queuing system in hospitals, aiming to reduce patient queuing time when processing medical records at outpatient registration in hospitals, where RFID was used for unique patient codes. This unique code will display patient data automatically so that it does not require time to search for patient files which can increase patient queue time [5]. This digital transaction system using RFID is more profitable than conventional transaction systems both in terms of effectiveness and security. The advantage is that you only need one card to access all digital transaction data compared to currently requiring many cards to access it. With one RFID card, it can make it easier for humans to access various digital data transactions [15]. RFID implements electromagnetic sensors that read tags via certain frequencies. Other research related to sensors is implementing motion sensors, temperature sensors, and sound sensors to automatically turn on the lights in the toilet and turn off the lights automatically when there is no one in the toilet. The research carried out was designing a lecturer identity identification system using NFC cards. (near field communication) by storing a little lecturer data into a radio frequency ID (RFID), using an RFID card and an NFC device to read the data on the RFID card. By storing encrypted data on an RFID card, the security of the login system is stronger and cannot be tracked by unauthorized parties logging into

the information system. System login is done by tapping the RFID card on the NFC device. If the data matches the previously stored data, then the system matches and displays the lecturer's data accurately.

- Active RFID labels require an electricity source in the production process so they are larger, transmit signals to the label reader, and are usually more accurate than passive RFID labels. Active RFID labels have a strong signal so they can be used in hard-to-reach environments such as water, or over long distances to transmit data.
- Passive RFID labels themselves do not use internal electricity and rely on an RFID reader to transmit data. Passive RFID labels are more suitable for use in warehouse environments where interference is rare and the distance is relatively short because passive RFID labels do not use internal resources so passive RFID labels are smaller and cheaper to produce.

The RFID Tag card used in this research uses RFID Mifare 1K, which is a semi-conductor card that works at a frequency of 13.56 MHz on cards and card readers. This card is used for public transportation, parking applications, identity cards, attendance systems, tickets, credit cards, toll cards, and many other applications. RFID (radio frequency identification) is a technology that combines the function of electromagnetic or electrostatic coupling in the radio frequency portion of the electromagnetic spectrum, to identify an object [1]. RFID is used as a tool to automatically control a chain of activities. With the development of information technology that supports business processes, a mechanism for managing large amounts of daily transaction data is needed so that it can be processed quickly. Several transactions implement an automatic system designed to make it easier for users to carry out transactions anytime and anywhere, such as Internet online payments, smart cards, radio frequency identification (RFID), mobile payments, financial technology, and others. In daily life, transactions such as payments still use manual methods using paper money and metal (cash). Now, cashless transactions have begun to be implemented, mechanisms for digitally exchanging transaction information, which can increase the accuracy and security of the transactions. Near Field Communication is the development of Radio Frequency Identification (RFID) technology which is used to communicate data using radio frequency, where the card media can store data or the data can be read using an NFC reader device. NFC is used because of the need for more efficient, accurate, safe, and practical data transmission [17]. Near Field Communication (NFC) technology can be used to carry out transactions, such as exchanging digital content by simply connecting an electronic device to an electronic device that has NFC technology with a touch, users can also buy any ticket just by activating NFC on their cellphone. NFC has many functions such as being able to transfer data quickly, and making purchase transactions without the need to use a credit or debit card, and is easy to implement because there is no need to go through a complicated activation process [3]. NFC Card can be seen in Figure 1.

Figure 1 NFC Card Mifare 1 K [20]

Near Field Communication is a development of Radio Frequency Identification (RFID) technology which is used to communicate data using radio frequencies, where data can be stored on card media or the data can be read using an NFC reader device [2][18]. NFC is used because of the need for more efficient, accurate, safe, and practical data transmission [19]. NFC can be used for digital transactions such as exchanging digital content by connecting an NFC card with a reading device/reader that uses NFC, and ticket purchasing applications by activating NFC on a cellphone. NFC has many functions such as being able to transfer data quickly and making purchase transactions without the need to use a credit or debit card which does not need to go through a complicated activation process [3]. Several previous studies related to research were carried out as follows: research from [4] developed a lecturer attendance information system to record lecturer attendance using radio frequency identification technology by implementing a near-field communication card (NFC Card). Application for recording and reading lecturer attendance data during lectures, by tapping the NFC Mi-fare card on the NFC reader/writer. The implementation of NFC cards is more practical for lecturers in taking lecture attendance and NFC cards can be scanned at a maximum distance of up to 7 cm with a reading angle of

the card to the reader device with a range of 0^0 to 30^0. Previous research from [5] implemented RFID in the patient medical record queuing system in hospitals, aiming to reduce patient queuing time when processing medical records in outpatient registration at hospitals, RFID is used for unique patient codes. This unique code will display patient data automatically so that it does not require time to search for patient files which can increase patient queue time. Another research from [8] examined the design of a lecture attendance application using NFC technology, an effort to facilitate the student attendance process, carried out by utilizing Android-based NFC (Near Field Communication) technology). NFC technology on smartphones can detect the NFC chip on the card for the identification process of the card owner, students simply touch their identity card to the NFC tag detection device then the system will input attendance automatically connected to SIMAK. Other previous research from [3] examined the application of the role and use of near-field communication (NFC) technology to teaching and learning activities in higher education. The aim was to provide convenience in the teaching and learning process for students and lecturers by providing lecture material even though the internet network was down (off). In general, in the presence of lecturers in teaching courses, lecturer attendance is recorded on the lecture attendance sheet, or via the campus web application which is accessed on the computer in class. Still, sometimes access to the server is disrupted so that the lecturer cannot use the web application due to not being able to connect to the server. To overcome this, NFC cards are implemented where during lectures the lecturer taps the card on the NFC reader device provided, and the lecturer's attendance data is recorded in the academic attendance information system. Data stored on an NFC card can be encrypted so it is safe and not easy to duplicate by other people. Other research from [9] concerns the design of radio frequency identification (RFID) for an ATmega 8535 microcontroller-based attendance system to read employee attendance information as an attendance application to store and create employee attendance reports. Maximum reading of tags by an RFID reader must be at a distance of <= 4cm which has a tag reading success rate of 100%. The time lag when reading the first tag and second tag by the RFID reader must be more than 2 seconds so that the tag can be read. Research from [10] developed a library application using RFID (Radio Frequency Identification) smartcards. As the collection of library materials in the Regional Library and Archives Agency of South Kalimantan Province increases, the need for information on library materials increases, and limitations in library service staff become a problem in library management. The library information system starts from member data collection, book data collection, book borrowing, book returns, giving library free letters, and making reports including member data reports, book data reports, book loan reports, book return reports, and fine receipt reports. This library application can maximize library services and minimize errors in data processing. Previous research from [11] designed a library application based on Radio Frequency Identification (RFID) which facilitates the transaction process in libraries. RFID is used as an identity admin card, member card, and also the identity of each book. The library application consists of 4 parts, namely admin menu, guest book, transaction menu, and alarm. The system designed carries out the login process by scanning the member's RFID card. The borrowing process involves scanning the books borrowed from readers. 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With RFID, users carry out self-service to speed up the loan and return circulation process, so that the time needed is efficient, and equipped with training in using the system so that it can be used correctly. RFID consists of active and passive RFID. Active RFID labels have strong signals and can transmit data over long distances. Passive RFID labels rely on RFID readers to transmit data over short scanning distances, and their production costs are cheaper [14][16].

3 Material and Method

The research method is a research stage that must be determined before research to be carried out clearly and systematically to achieve research objectives.

3.1 The Research Stages

The flow of this research begins with conducting literature studies and literature related to how NFC cards work, practicing making programs/coding on how to store data on NFC cards, and how to read data from NFC cards. Apart from that, we studied the process flow of patient registration activities, patient's complaints, and selecting a doctor. The next stage is a system analysis which consists of determining the programming language used. It is planned to use the .Net C# programming language because this programming language is very compatible with integration with digital devices and supports libraries and APIs for reading digital tools to be connected to the system. The next stage is to analyze the hardware requirements needed, for example, NFC reader/writer equipment NFC cards, and label printers

to print QR Code labels. The NFC card used is a Mifare 1K card because this card is quite cheap and practical. Continue with the design of the hospital registration system database which consists of a database for master data, and a database for registration transaction data recording complaints and selecting doctors. After designing the database, it continued with designing the patient registration system interface. The results of the analysis and design are used as a basis for system development, and in the system development stage, system testing is carried out to find out whether the system can run well, the recorded data is correct and can be scanned properly, also testing the sensitivity of the NFC card when read with NFC. reader. Process flow and research stages can be seen in Figure 2.

Figure 2 Process Flow and Research Stages

The data collection technique was carried out through direct observation and analysis of the flow of library patient registration and data recorded during registration, recording complaints, and selecting a doctor. This flow is used in the analysis and system design stages. System analysis and design are carried out using Context Diagrams and Data Flow Diagrams (DFD). At this stage, system interface design is also carried out. The system interface design consists of patient master data, patient complaints, treating doctors, disease diagnosis, therapy, and medication given. All data is stored in the patient's medical record.

3.2   System Design

The design of the system interface consists of patient master data, patient complaints, treating doctors, disease diagnoses, therapies, and drugs given and then all data is stored in the patient's medical record. Business flow of system as seen in Figure 3.
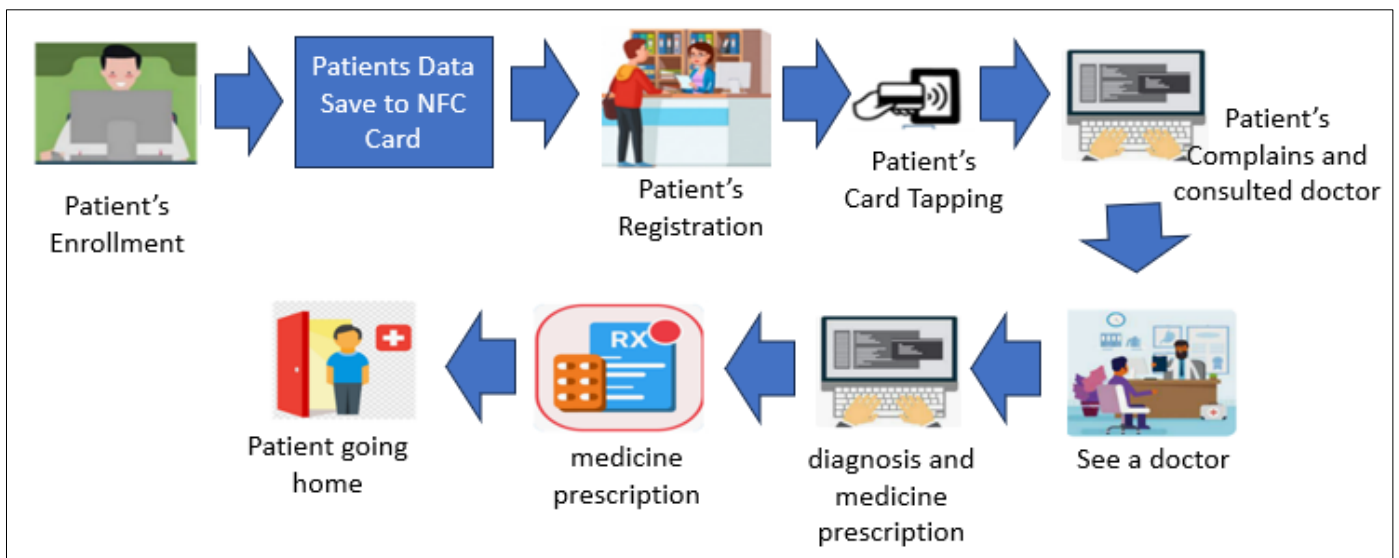
Figure 3 Flow of Patient Registration to Receipt of Medicine

Figure 3 explains the flow of patient registration, and doctor's treatment until the patient receives the medicine. If the patient is new, the patient registration process is carried out. Patient data is recorded in the system and a medical record number is obtained, then the data is stored on the NFC card. Patients who have registered with the system can register to receive medical treatment. This registration involves tapping the patient's card on a card reader. Next, the receptionist records the patient's complaint, the doctor they are referring to, and the method of payment. After the registration process is complete, the patient then queues to receive doctor's treatment. After the doctor's treatment, the results of the patient's diagnosis are recorded in the system, and the drug prescription given to the patient is also recorded. This data becomes the patient's medical record data which is stored in the system. The next stage is that the patient takes the medicine at the pharmacy and the patient can go home to rest. Based on the flow above, at the stage

when the doctor examines the patient, the doctor can view the patient's medical examination history and disease history in the system, as medical record data, to help the doctor analyze the symptoms experienced by the patient and diagnose the disease the patient is suffering from.
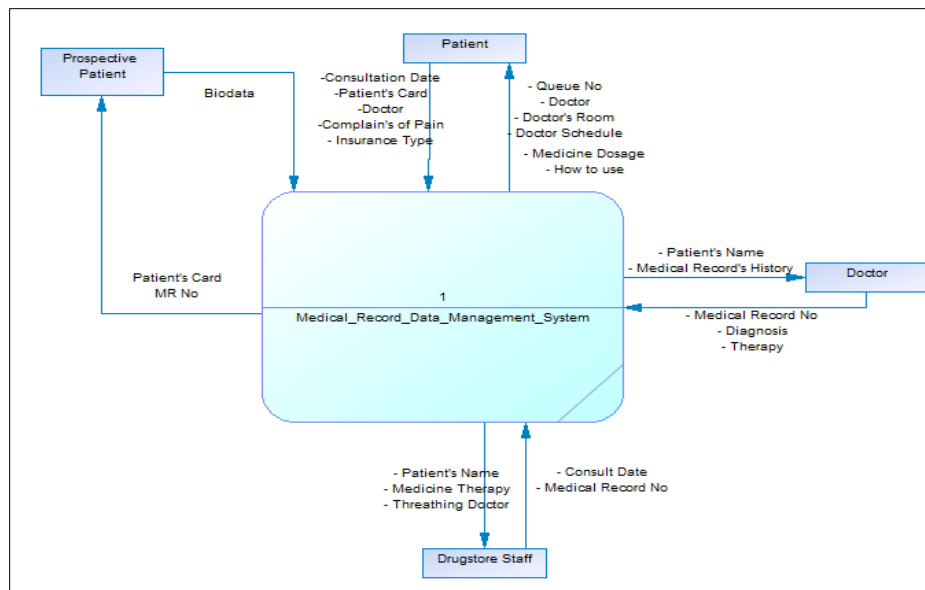
Figure 4 Context Diagram

Figure 4 shows the context diagram of the medical record data management system. It consists of 4 external entities they are prospective patients, patients, doctors, and drugstore staff.

Figure 5 shows the Data Flow Diagram (DFD) level 1. The DFD level 1 consists of 3 processes, they are registration, enrollment for consultation, doctor consultation, and receipt of medication.
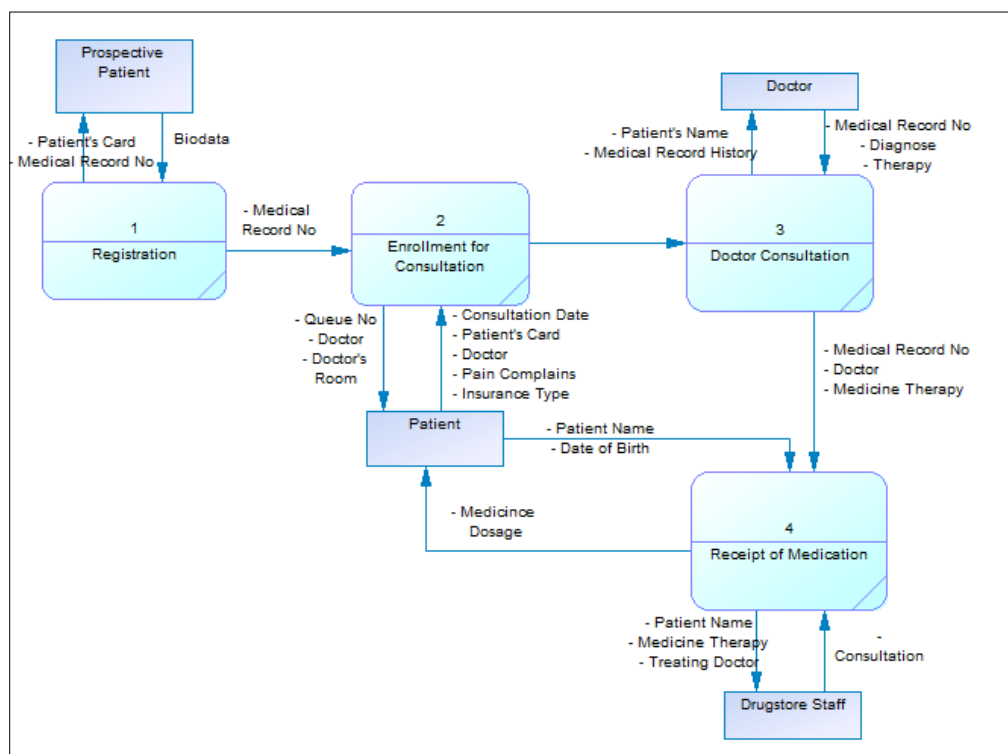
Figure 5 Data Flow Diagram Level 1

3.3 Development Model

This information system is built using prototype model system development. This development model is built, tested, and reworked until an acceptable prototype is achieved. It also creates a base to produce the final system or software. It works best in scenarios where the project's requirements are not known in detail. It is an iterative, trial-and-error method that takes place between the developer and the client[21].
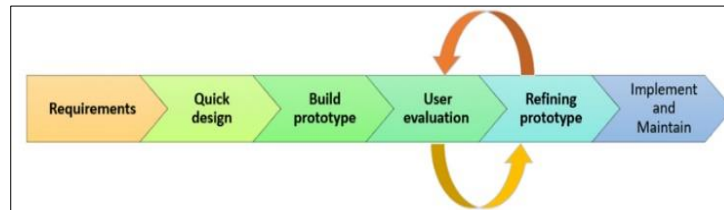

Figure 6 Prototyping Model Phase[21]

Figure 6 shows the prototyping model phase. The prototyping model has 6 system development life cycle phases, they are requirements gathering and analysis, quick design, building a prototype, initial evaluation, refining prototype, implementing product, and maintenance. The prototype was developed under evolutionary prototyping where it was incrementally refined based on customer feedback until it was finally accepted to save time as well as effort.

4 Result

4.1 Information System User Interface

The patient medical record information system consists of several menus, namely new patient registration, doctor consultation registration, diagnosis and action, pharmacy, and patient medical record history. The display of the patient medical record information system is shown in Figure 7.
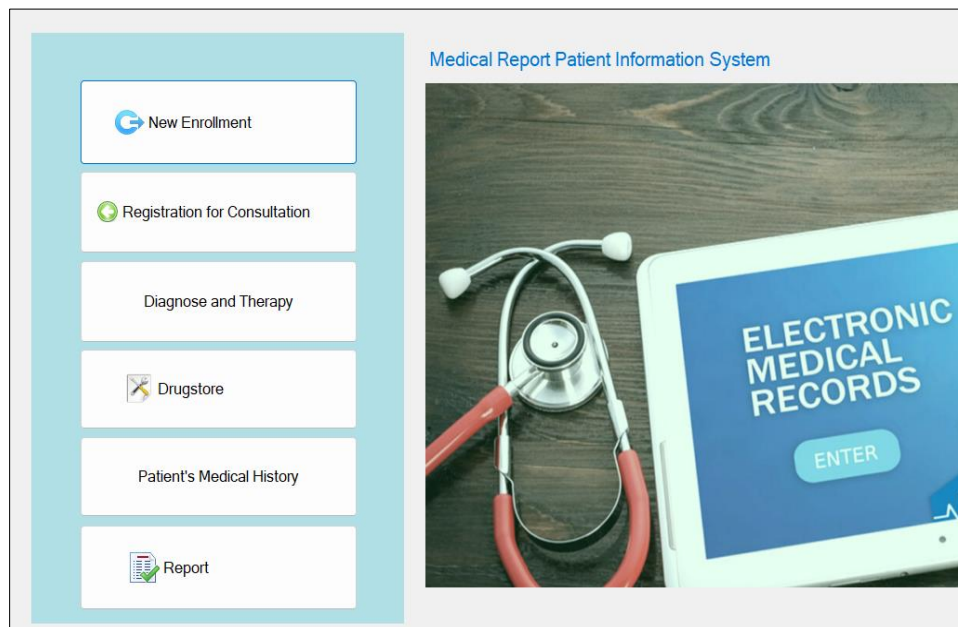
Figure 7 Medical Record Information System Menu User Interface

The new patient registration module is used to register new patients seeking consultation at the health center facility. Patient data consists of ID number, patient name, address, telephone number, date of birth, and medical record number. The patient data will then be stored on the NFC Card as a patient card that is carried by the patient when seeking treatment and consulting a doctor. The new patient registration module can be seen in Figure 8.

Figure 8 Display of New Patient Registration Module

The doctor consult registration module is used to serve registered patients who consult a doctor (for treatment). The patient hands over the card to the receptionist staff and the staff taps the NFC card on the card reader device so that the patient's data will appear on the module. Then the staff inputs the type of service (general, private health insurance, or national health insurance), patient complaints, and the intended doctor. This module will issue a printed-out patient registration receipt for patient queue number data to the intended doctor. The consultation module for registration to doctors can be seen in Figure 9.

Figure 9 Display of the Consult to Doctor Registration Module

The diagnosis and action modules are used by doctors to record the results of patient examinations in the form of disease diagnoses and drug prescription therapy actions that will be given to patients. The doctor selects the patient's registration number and then the system displays patient data, namely the patient's name, medical record number, and patient complaints. The doctor then examines the patient to diagnose the patient's disease based on the symptoms present. Furthermore, doctors prescribe drugs as therapy for patients. The data is entered in the diagnosis and action module. The diagnostic and action modules are shown in Figure 10.

Figure 10 Display of the Diagnostics and Actions Module

The Medicine Retrieval Module is used by pharmacy staff to view therapy information given by doctors to patients, by inputting the patient's registration number. The pharmacy staff prepares the medicine given by the patient and then gives the medicine to the patient. Pharmacy staff record the medicines given to patients in the Medicine Retrieval module. The medicine retrieval module is shown in Figure 11.

Figure 11 Display of the Medicine Retrieval Module

The Medical Record History module is used by doctors and admin staff to view patient medical records and patient treatment history, to provide sufficient data for disease diagnosis and appropriate drug therapy for patients. To find the patient's RM data, the officer can type the patient's RM number then the system searches for the patient's medical record data. If the data exists, then the data will be displayed on the medical record data list in the form of a history of medical records of patient treatment. The history of the patient's medical records can be used by doctors to help diagnose the patient's illness and find out the history of therapy and medications the patient has taken. The patient medical record history module is shown in Figure 12.
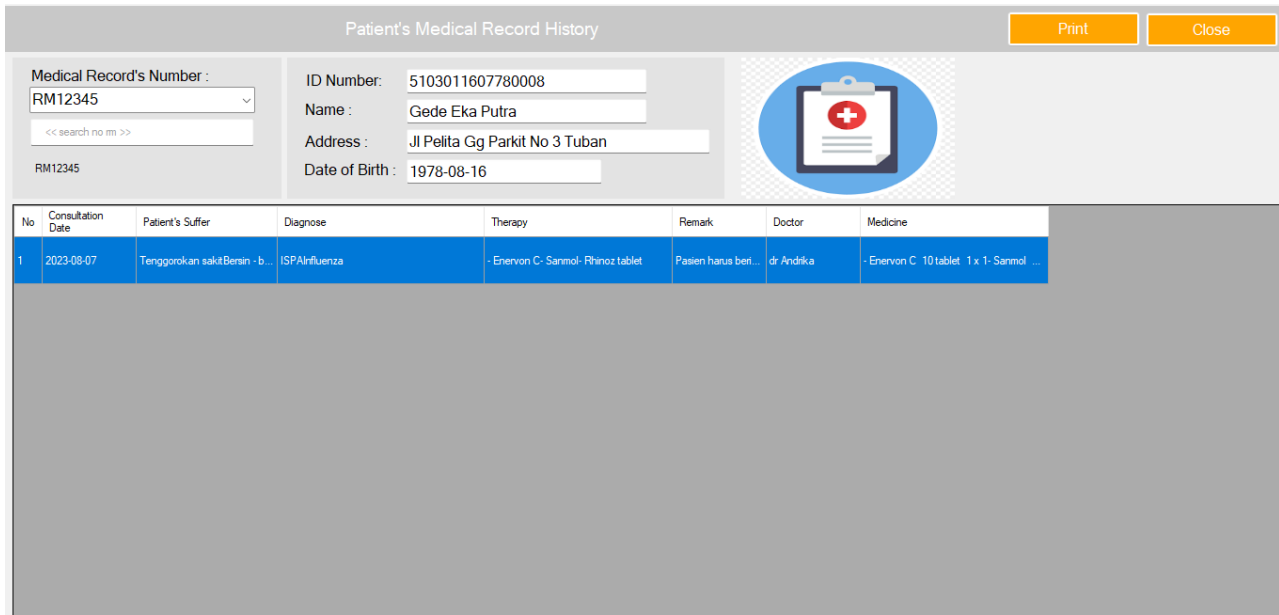
Figure 12 Display of the Patient Medical Record History Module

The patient's medical record history can be printed by clicking the print button. The display of the patient's medical record report is shown in Figure 13.

Figure 13 Display of Patient Medical Record History Report

5   Discussion

The discussion includes system testing which is carried out by testing data stored in to NFC card. Test results show that the data can be stored properly in an NFC card. The contents of the NFC card data can be verified in the verification module. Tests were also performed the data of the patient could be read by the reader device. Tests were also carried out on the sensitivity of reading and recording data on NFC cards to reader devices. NFC cards have a maximum distance to read or write data from NFC reader/writer devices. The NFC reader/writer device can read NFC cards at a maximum distance of 7 cm in an upright position and cannot read from the side. Test results for reading/writing NFC cards to NFC reader/writer devices are shown in Table 1.

Table 1 NFC Card Reading and Writing Test Results

Tapping Distance (cm)	Position	Could Be Read?	Could Be Written?
0 cm	Stick	Yes	Yes
1 cm	Perpendicular	Yes	Yes
2 cm	Perpendicular	Yes	Yes
3 cm	Perpendicular	Yes	Yes
4 cm	Perpendicular	Yes	Yes
5 cm	Perpendicular	Yes	Yes
6 cm	Perpendicular	Yes	Yes
7 cm	Perpendicular	Yes	Yes
8 cm	Perpendicular	No	No
1 cm	Sideways	No	No
7 cm	Sideways	No	No

From the test results in Table 1 it can be seen that testing the card by reading and writing data on an NFC reader/writer device, the maximum distance test results from reading an NFC tag card are up to 7 cm with a reading angle relative to NFC reader/writer with angle range from 0^0 to 30^0 degrees can read NFC Card.

6   Conclusion

Based on the research that has been done, the conclusions from this study are system development stages consist of literature study, observation and data collection, system and database design, user interface design, system development, and system testing. Testing the card by reading and writing data on an NFC reader/writer device, the maximum distance test results from reading an NFC tag card are up to 7 cm with a reading angle relative to the NFC reader/writer with an angle range from 0^0 to 30^0 can read NFC Card. The use of the NFC card implemented in the patient medical record management system improves services to patients and is more practical in registration and administration for treatment at health facilities.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest is to be disclosed.

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