

Mobile Application for Monitoring of Addition of Drugs to Infusion Fluids

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ABSTRACT

One of the duties of nurses to patients is controlled drip infusion or Intra Venous Fluid Drip (IVFD) and administration of drugs to patients. Individuals who are in sore need of fluids and medications in the number and types of different according to the illness. The amount and type of fluid and drug therapy should be appropriate in order to achieve an optimal effect. Giving intravenous fluid therapy (intravenous fluid therapy) and medication also need regulation and supervision (monitoring). Giving the wrong fluids and medications can aggravate the patient's illness. Intravenous fluid therapy and medications to do with principle 6 correctly i.e. correct patient's name, type of fluid, dose, route of administration, time of administration, and documentation. Control and drug infusion in each patient directly and regularly needs to be done by a nurse in order to prevent the occurrence of errors in the administration of intravenous fluids or medications. However, the control and drug infusion directly to each patient will certainly spend a lot of time. Addition, the possibility of error is generally common. This error may cause harm to the patient and increases health care costs. The monitoring system on the amount of drip infusion is still done manually, both in terms of its use and recording. Monitoring infusion in hospitals still rely on nurses as the registrar and regulator of the amount of drip infusion in patients. Nurses should always observe the patient every hour and aided by the patient's family as a reminder when the infusion runs out. Calculations and fluid therapy settings still must be done manually. This paper proposed application that support nurses in order to facilitate activities associated with the management of fluid therapy and medications to patients by using mobile application.

Keywords : Drip Intravenous Fluid Therapy, Android, Rapid Application Development, UML

I. INTRODUCTION

The development of computer technology that are so rapidly have penetrated many sectors including health. Informatics medical and nursing informatics as part of health informatics is a multidisciplinary field of applied scope to focus the patient or client as the primary customer aimed in improving health care (Eden et al., 2016; Morr & Subereaze, 2010; Sadikin, Fanany, & Basaruddin, 2016; Sadikin & Wasito, 2013)

Opportunities application of information technology and communications are becoming increasingly widespread as the nursing field exposed to the public demands of a quality service so that nurses must provide direct care time (direct care) to patients. Technology helps to reduce documentation time and divert it to direct care. Technology and informatics can improve the effectiveness of nursing care, safety, client care and outcomes (Cohen, Coleman, &

Kangethe, 2016; Lluch, 2011; Tretiakov, Whiddett, & Hunter, 2017)

One form of patient care tasks is controlling the infusion of fluid droplets or Intra Venous Fluid Drip (IVFD) and administration of drugs to patients. Intra Venous Fluid Drip (IVFD) is the provision of a number of fluid and electrolytes into the body through a needle into a venous blood (veins) to replace lost fluids, electrolytes and nutrients that the body needs. With IVFD therapy greatly helped patients in certain circumstances in order to achieve a balance of fluids, electrolytes, nutrients and optimize the effects of the drug.

Individuals who are in need of fluids and medications with different amounts and types according to the disease. The amount and type of fluid and drug therapy should be appropriate in order to achieve an optimal effect. The design of the liquid is adjusted to a pathological condition.

Giving intravenous fluid therapy (intravenous fluid therapy) and medication needs regulation and supervision (monitoring) is appropriate. Giving the wrong fluids and medications can aggravate the patient's illness. Intravenous fluid therapy and medications to do with principle 6 correctly i.e. correct patient's name, type of fluid, dose, route of administration, time of administration, and documentation.

Control and drug infusion in each patient directly and regularly needs to be done by a nurse in order to prevent the occurrence of errors in the administration of intravenous fluids or medications the patient. However, the control and drug infusion directly to each patient will certainly spend a lot of time nurses. Addition, the possibility of error is generally common. This error may cause harm to the patient and increases health care costs.

The monitoring system on the amount of drip infusion is still done manually, both in terms of its use and recording. Monitoring infusion in hospitals still rely on nurses as the registrar and regulator of the amount of drip infusion for patients. Nurses should always observe the patient every hour and aided by the patient's family as a reminder when the infusion runs out. Calculations and fluid therapy settings still must be done manually, nurses usually write data on the patient's drug infusion and books, or written estimate timeout patient fluid infusion tube.

To avoid such errors has been designed and manufactured devices used to regulate and monitor the flow rate infusion in patients. The device can be an attractive option in the infusion flow rate monitoring in developing countries with health resources (nurses) were limited, thus reducing workload from nurses. The device is set to use the drip volume of patients, the results of which can provide information and make it easier for nurses to know the condition of infusions on the LCD (Liquid Crystal Display). This device has an alarm that will sound if there is a drip out or stalled. However, this device does not manage the liquids to be achieved by a therapy. Calculations and setting fluid therapy remains to be done manually. The device also has not been efficiently used in all patient care rooms, because it takes a huge cost to buy a single device, and each of these devices can only be used by one-person patient only.

This paper proposed application that support nurses in order to facilitate activities associated with the management of fluid therapy and medications to patients by using mobile application.

One of the mobile device is a smartphone Android. Android is a piece of software for mobile devices that includes an operating system, middleware and core application released by Google. Android SDK (Software Development Kit) provides the tools and APIs (Application Programming Interface) which is

needed for developing applications on the Android platform using the Java programming language. Android was developed in the spirit of open source and makes it easy for developers to enhance creativity in the development of applications on top of it (Priya, Divya, Somasundaram, Hima, & Karthikeyan, 2012; Putra, Hidayat, & Noprisson, 2016; Singhal & Shukla, 2012).

The features available on smartphones android is capable of running a variety of applications making it easier for users to perform various activities of life. Based on these phenomenon researchers designed an information system for therapy and medication to patients IVFD based on Android and Web Application. For that investigators with the theme entitled Mobile Application for Monitoring of Addition of Drugs to Infusion Fluids.

II. METHODOLOGY

A. Data Collection

The data collection methods used in this discussion is to use three (3) ways: observation, interviews, and literature.

1) Observation

In this method, the researchers collected data and information is by reviewing and making observations directly to the field to an activity that is being carried out or running, to obtain information about the system requirements.

In this study, researchers conducted observations in the IMC Hospital Bintaro, South Tangerang. In observation of the things done are observing health care in a patient with a nurse and the infusion scheduling system that runs the hospital.

2) Interview

In the early stages of designing this application, first conducted interviews with relevant parties to obtain

information about the problem and the application needs to be designed.

3) Questionnaire

To find out how to respond to an application made, the authors conducted data collection by distributing questionnaires to some respondents that nurses IMC Hospital Bintaro. Data collection is done by using simple random sampling, where sampling a random member of the population.

B. Systems Development Method

Systems development methods that use is Rapid Application Development (RAD), which introduced James Martin in 1991, who has the following stages (Santoso, Arham, & Khudzaeva, 2016):

1) Term Planning Phase

In this stage side of the hospitals that nurses and writers meet to identify objectives and identify the application or system application needs arising from these goals.

2) Design Workshop

This phases are consisted of several sub stages, including:

1. The design process will take place within the system using UML diagrams.
2. The design process required specifications, by translating the processes that occur in this system in the form of a simple algorithm that will be implemented in the form of the program.
3. The design of the interface, the display drafted in the form of input-output that aims to facilitate communication between users with the system. Once formed, the design of the display screen made the construction phase.

3) Implementation Phase

Phase implementation is done by implementing a database, installing application on mobile device and application testing or blackbox testing.

III. RESULTS AND DISCUSSION

A. Planning Terms Phase

1) Analysis of Problems

Currently the process of intravenous fluids in the treatment of patients still using the manual method. Only a few spaces in intensive patients who have used electronic infusion devices.

Electronic infusion appliance has an alarm that will sound if there is a drip out or stalled. This tool to manage fluid to be achieved by a therapy. Calculations and setting fluid therapy remains to be done manually. The tool is also not efficient electronic infusion used in all patient care rooms, because it takes a high cost to buy the electronic infusion device, and every single electronic infusion device can only be used by one-person patient only.

For the treatment room that does not have an electronic infusion device (usually a standard patient room or the economy), the infusion still uses the manual method with a nurse should always observe the patient every hour. And aided by the patient's family as a reminder of when infusion exhausted. Calculations and fluid therapy settings still must be done manually, nurses usually write data on the patient's drug infusion and books, or written estimate timeout patient fluid infusion tube.

2) Analysis of Needs

At this stage of the analysis the authors find data and information according to the needs of the application is also designing the concept of the application and look for software that fits the making of the application. To complete the design of the system is then performed on the system to be created. Here is the design of systems that researchers are proposing:

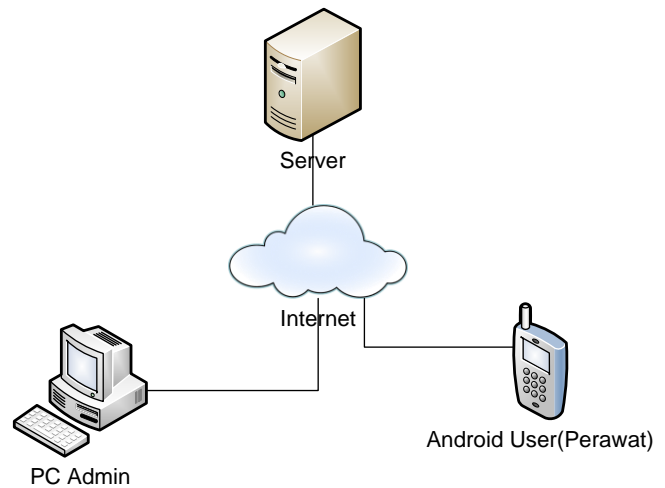


Figure 1. Block Diagram of System

Data about the patient's medication infusion saved in the database server. Admin access the database via a web browser on a computer. Admin can input, edit, delete the master data such as data nurses, patients, data of drugs, and the data room. Admin can view progress reports and drug infusion pa patient on a computer web browser.

Nurses access the data via android *smartphone*. Nurses can update the data on intravenous fluids and drugs used by the patient. Nurses are connected directly to the database server *in* real time, and the system alerts the nurse if the patient discharged infusion or patient should take medication.

The development of application is completed by using software including Java Development Kit (JDK 1.6), Pulsar Eclipse Helios, ADT version 0.9.9, Android 2.2 Froyo Platform SDK, Xampplite, Notepad + +, Operating System Windows 7 Ultimate 32-bit and hardware including computer with the following specifications Core 2 Duo Processor T6500 2:10 GHz, Memory 2 GB, 250 GB hard drive, monitor resolution 1280 x 800 pixels, android data cable for file transfer applications from your PC to Android devices, smartphone Android Platform 2.2 (Froyo) and above.

3) Objectives and Terms

Purpose of the application include:

1. Controlling accuracy IVFD and drug therapy patients.
2. Ensuring intravenous fluids and medications are given correctly in terms of the patient, the type of fluid / medication, dose, route of administration, and time of administration.
3. Inform the nurse if intravenous fluids will be exhausted or the time for the administration of drugs to patients.
4. Monitoring drug infusion and patients with the computerized documentation.

B. Design Phase

In designing this application program authors conducted using a UML design consisting of Use Case Diagram, Activity Diagram, Sequence Diagram. Then the authors performed data structure design, and user interface design.

1) Designing UML

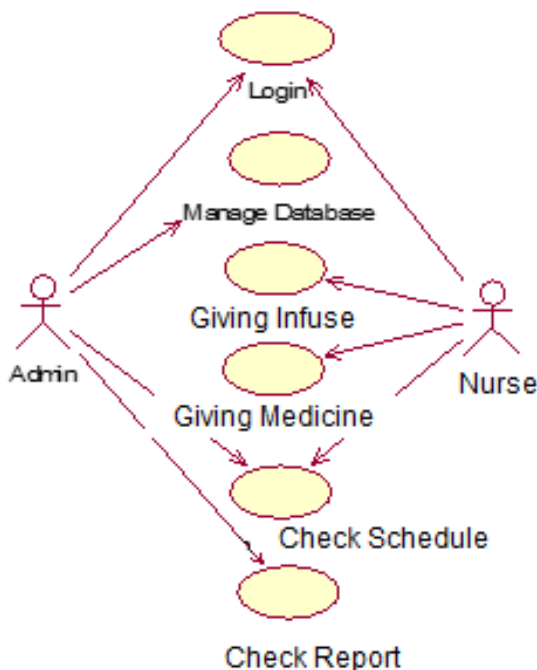


Figure 2. Main Use Case Diagram for Mobile Application

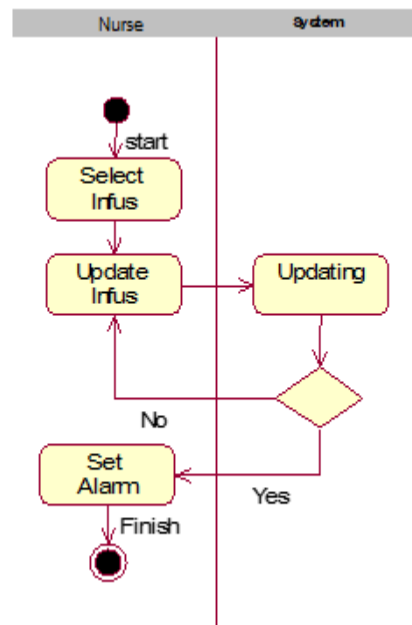


Figure 3. Activity Diagrams for Addition of Drugs to Infusion Fluids

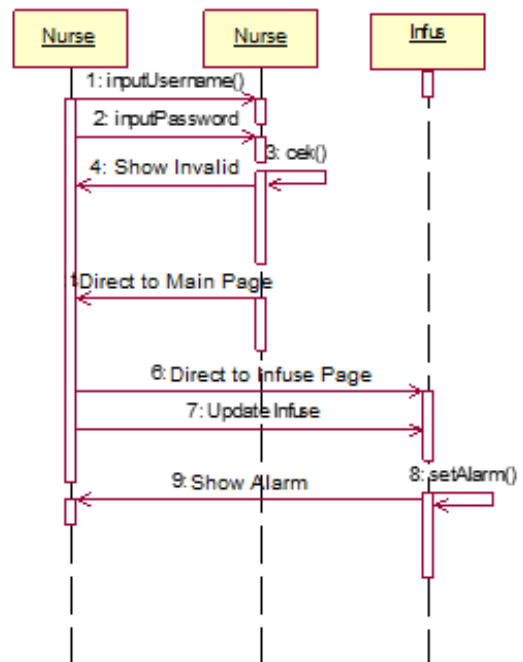


Figure 4. Sequence Diagram for Addition of Drugs to Infusion Fluids

2) Designing Database

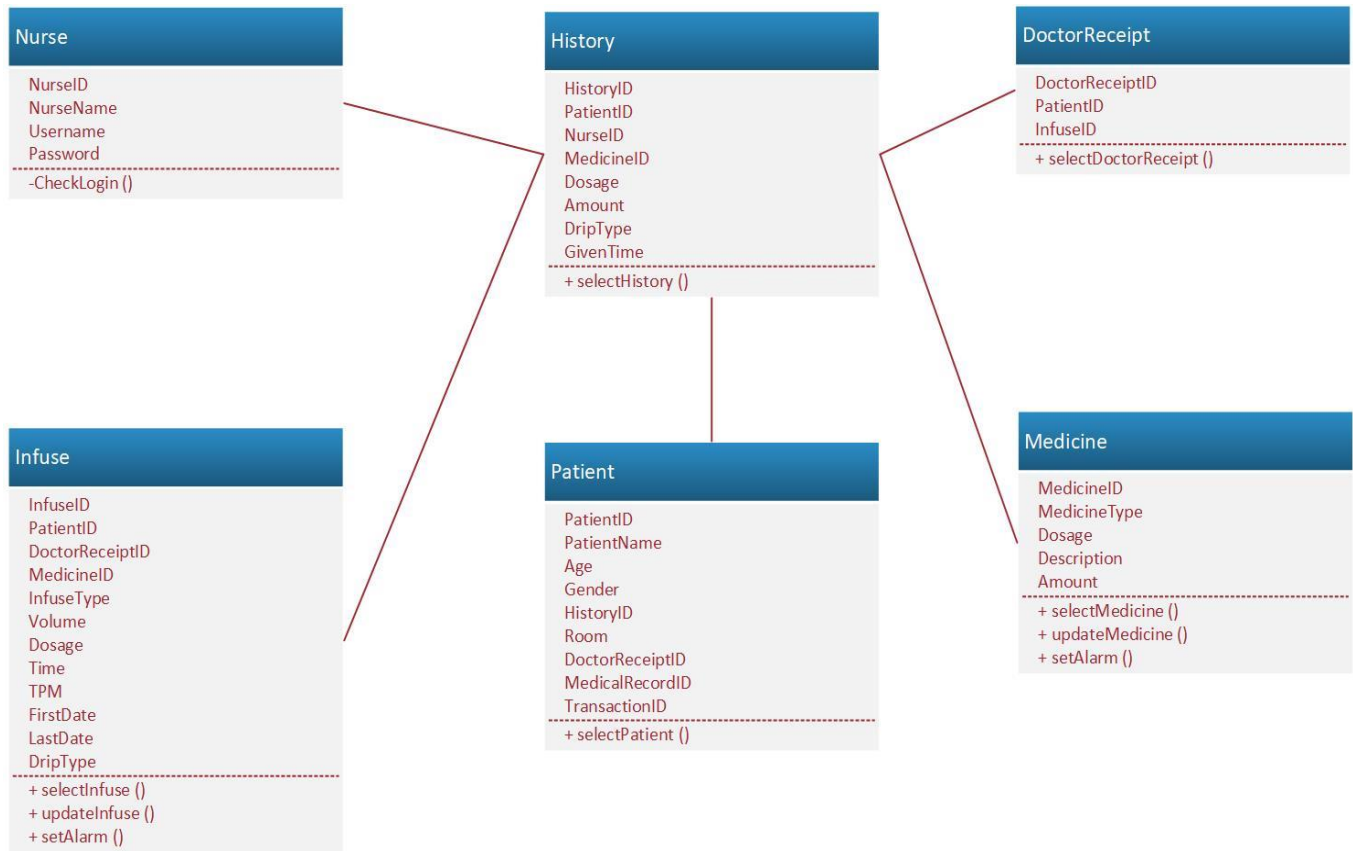


Figure 5. Class Diagram for Mobile Application

3) Designing the User Interface

4) Coding



Figure 6. Display Design Tab Infusion, Drug and Patient Data

At this stage, researchers performed the coding phase of the design results that have been previously defined to be an application program. Making these applications use multiple tools or software such as the Java Development Kit (JDK 1.6) as the JAVA platform, Pulsar Eclipse Helios, Android Development Tools (ADT) version 0.9.9, Android SDK Platform 2.2 Froyo update, Xampplite, and Notepad + +.

Overview of designing applications using Eclipse is as follows 1) Installing the Java Development Kit 1.6 2) Installing Eclipse. Eclipse is a portable software so installation simply extract the files to a computer hard drive Elipse.zip. After that run Eclipse application and specify a directory on your computer workspace.



Figure 7. Home Screen for Eclipse

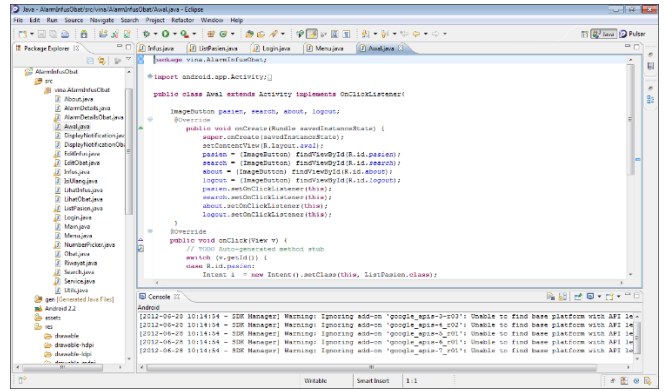


Figure 10. Source Code Applications on Eclipse

3) Installing Android Development Kit (ADT) in Eclipse

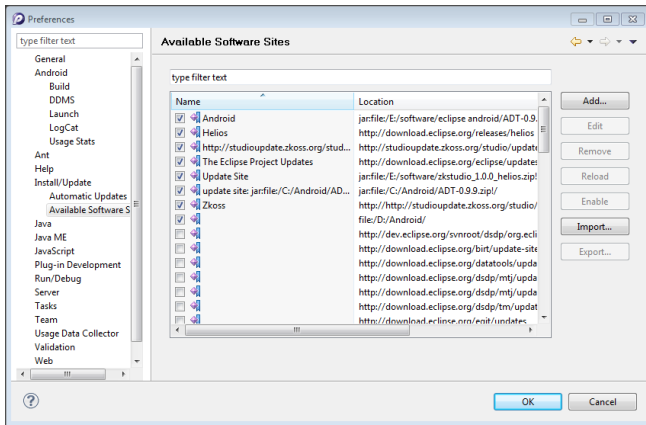


Figure 8. Install ADT Page

4) Installing the Android SDK into Eclipse

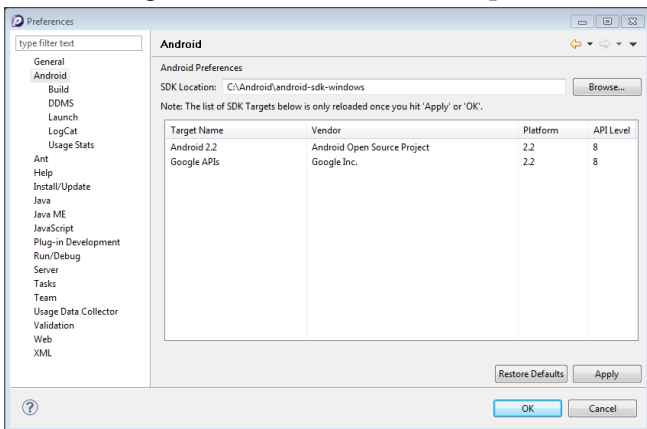


Figure 9. Installing SDK

Following the steps above, the process of encoding the program can be implemented.

B. Implementation Phase

Before the program is implemented, then the program must be free of errors. Program errors that may occur because of a typing error, an error process, or logic errors. In the implementation phase, we analyze the need for support becomes very important. This system can work well, if able to run well on the hardware. Additionally, needs analysis of software must also be suitable with program implementation phase. In the process of implementation, there are several steps taken, namely:

1. Writing a program code (*coding*), this is done by using android apps, the Android Developer Tools (ADT), the Android SDK (Software Development Kit), Notepad + +, and Xampplite.
2. Packaging process using the facilities provided by the Android SDK.
3. Test the program using *android smartphone device* and on the *web browser*. Well as *debugging* or program if needed repairs.

1) Database Implementation

Perform database implementation on the terms of the data acquired in the hospital. Installing the database and backend system (dashboard) performed on the server hosting <http://infusobat.hostoi.com/infusobat/>.

2) Implementation on Mobile Device

The implementation was done on several android devices, which are required at this stage are:

1. Smartphone Android Platform 2.2 (Froyo) and above, in this case the author uses the Samsung Galaxy Wonder Platform Android 2.3 (Gingerbread).
2. File an application in the form. Apk
3. Android Data Cable for file transfer applications from your PC to Android devices.

In this implementation to be done first is to transfer the application file extension. Apk file from your PC to your Android device, and then install the android smartphone by opening the file. Apk that has been found on the android device.

3) Interface Implementation

Implementation is a stage where the system is ready operated on the actual stage, so it will be known whether the system has been made strictly in accordance with the plan.

4) Application Blackbox Testing

The final stage in the implementation phase, the writer did a blackbox application testing is to determine the function specified and where the product is designed to do something, the test can be performed to show that the functions are fully operational. Here the researchers will conduct application testing based on use case is designed in the design phase of the workshop and to the native application will be installed on some Android device from various brands and some of the android operating system level.

IV. CONCLUSION

From the discussions that have been described, it can be concluded that:

1. Application monitoring systems intravenous fluids and medications for patients, is designed application on *android smartphone* and web applications.
2. This application can help nurses to controlling the infusion and medication patients.

This application is able to help lighten the work of nurses in the service and reduce the error likelihood happens in controlling intravenous fluids and medications to patients.

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