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RFID based Medical Database System

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ABSTRACT

This paper present the medical database system which developed by using Radio Frequency Identification (RFID) system. The purpose is to improve and replace the traditional way of healthcare services which still using paper-data-recording system. This project also to facilitate the centralisation of patient records within the hospital environment. It is developed with the RFID system and web-based database of patient information. The project system functioning with data stored in the ID of patient card and the information web-based database will be administrating with Graphical User Interface (GUI). Overall this system requires RFID tag which is the patient ID card, RFID reader and computer in order to control the system work correctly.

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INTRODUCTION

Radio Frequency Identification (RFID) is a new technology that incorporates the use of electromagnetic or electrostatic coupling in the radio frequency portion of the electromagnetic spectrum to uniquely identify an object, animal, or person. An RFID system consists of three components which is the tag (transponder), the reader (interrogator) and the host computer (controller) (Parliamentary Office of Science and Technology, 2004).

The RFID tag consists of unique ID for each tag. The technology used in RFID has been around since the early 1920s. In our country, this technology already been used for several years in certain place such as in Highway using card 'Touch N Go' and our government also apply this technology by using RFID as I.C. (identification card). Some places, they prefer to used Barcode which is cheaper than RFID. Technology spread very fast. In few years later, there is not impossible if RFID will replace the barcode system in today's life.

There a many benefit offered from the RFID system such as no line of sight requirement, the tag can with stand harsh environment, long read range, portable database, multiple tag read/write, tracking people, items, and equipment in real time (Radio Frequency Identification Card Journal, 2011).

Table 1: Comparison of RFID with Other RF Technologies.

	RFID	Barcode	Smart Card
Line of Sight	Not required (in most cases)	Required	Required (exposed to reader)
Memory	Small	No memory	Large
Cost	Medium	Low	High
Range	Inches to 100's of feet	Inches to feet	Inches
Reusability	Yes	No	Yes
Read Rate	Multiple simultaneously	One at time	One at time
Security	Medium (authentication)	Very low (coding)	High (encryption)

RFID System Component:

The implementation of this project consists of RFID system and database programming. Radio frequency identification (RFID) is a technology that uses radio waves to transfer data from an electronic tag for the

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purpose of identifying an object (Gareth R.T. White *et al*, 2007). RFID system has three components in the system which is transponder or tag, reader and computer software.

RFID tag is a device that is used to holds the data that is transmitted when interrogate by RFID reader, which is also called transponder. It is a microchip combined with an antenna in compact package to allow it to attach with an object to be tracked. Several factors can affect the distance of tags readability. The identification frequency, antenna gain, orientation, polarization of the reader antenna and the transponder antenna, and also the placement of the tag on the object to be identified will all have an impact on the RFID system's read range. Basically, a RFID tag consists of a silicon integrated circuit (IC chip) connected to a small antenna (Amit Rawal, 2009).

Figure 1 shows the different types of RFID and the power needed. Different types of RFID will have different range and operational frequency for different purpose.

RFID readers are usually a microcontroller-based unit with a wound output coil, peak detector hardware, comparators, and firmware to control the unit (Intermec Technologies Corp., 2006). The overall function of an RFID reader is to provide the means of communicating with the tags and facilitating data transfer. Functions performed by the reader may include quite sophisticated signal conditioning, parity error checking and correction. Once the signal from a transponder has been correctly received and decoded, algorithms may be applied to decide whether the signal is a repeat transmission, and may then instruct the transponder to cease transmitting (http://www.vidtronix.com/RFIDTags.html, 2012). Table 2 shows the comparison between passive and active RFID tags.

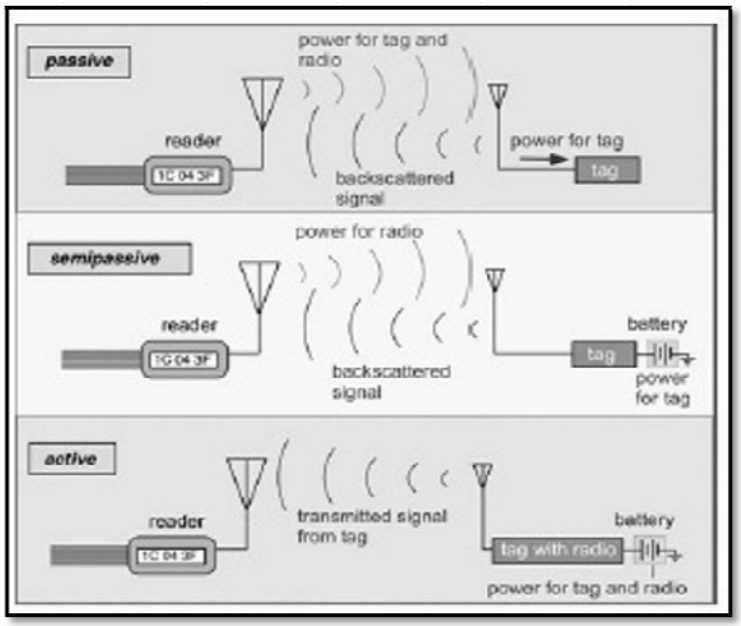

Fig. 1: Differences Type of Tags in Term of Power Supply [2].

Table 2: Primary Differences between Passive and Active RFID Tags.

	Passive RFID	Active RFID
Power Source	External (reader provided)	Internal (battery)
Tag Readability	Only within the area covered by the reader, typically up to 3 meters	Can provide signals over an extended range, typically up to 100 meters
Shelf Life	Very high, ideally does not expire over a life time	Limited to about 5 years, the life of a battery
Data Storage	Limited data storage, typically 128 bytes	Can store large amounts of data
Cost	Cheap	Expensive
Size	Smaller	Slightly bulky (due to battery)

Hardware and Software Implementation:

The systems structure is as patient's records are associated with a unique identifier. This identifier is stored on a transponder attached to the patient's ID card. Doctors, nurses and administration personnel are allowed access the database using PC enabled with a wireless network card. The RFID tag is read, and the identifier is passed over the wireless network to the centralised server. The server searches the database and dynamically generates a web page containing the relevant patient information.

Medical personnel are then be authorised to view and update the patient details. The information contained in the database comprises text and multimedia data. The structure of the system can be described as client-server architecture. The client code handles communication with the RFID reader and also handles the viewing of patient records. The server software deals with the storage and retrieval of patient information. The flow of this system is shown in figure 2 below.

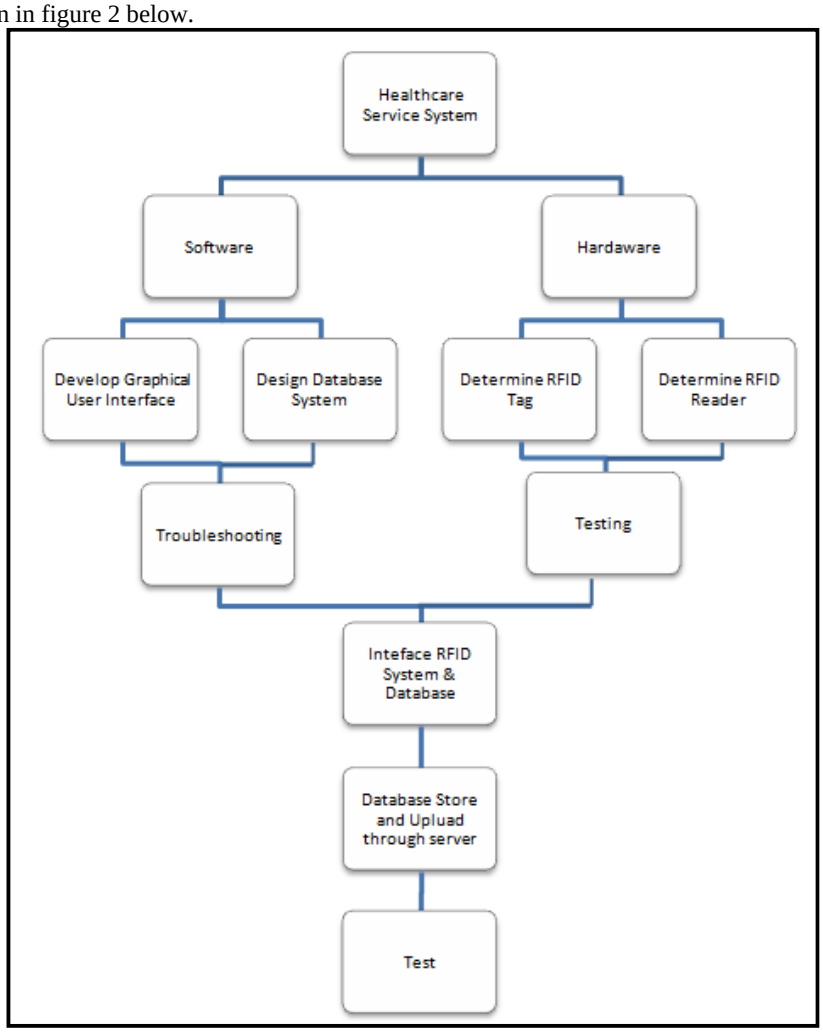

Fig. 2: Flow Development of the System.

In this project, the passive tag of Cytron Technologies model is used as the tag is inexpensive with internal memory. In addition, this model is used by most places which must same model with the RFID reader. For this project, internal memory inside tag is not required.

The advantage of this structure is that given an RFID tag number, we can use it as a key to search for the patient's personal records. We can also retrieve multiple medical details records: medical details from previous stays and the current stay. By extracting the stay session identifier from the medical details, we can then extract the nurses' observations relating to that stay from the database. Therefore all records can be accessed through one unique identifier, the RFID tag number.

Among of all RFID reader and product, Cytron Technologies RFID-IDR-232N reader is selected for the application of this project. This model is well known in the market and of course most places used this type of model for any application of RFID system. Cytron Technologies RFID-IDR-232N used frequency at 125 KHz and it is a readable reader. Frequency band common for the reader is low frequency which its frequency typical communication range is between 125 to 135 kHz in 20cm to 100cm maximum range.

The Cytron Technologies RFID-IDR-232N has small transponder antenna at 125 KHz and require only few turn that can be manufactured at very low cost. It also has very high performance proximity reader featuring medium range and small dimensions. The unit will run from any voltage from 5 to 18 Volts (DC). This model also ideally suited to a wide selection of applications particularly access control with its features of good read

range at 5 Volts. The Cytron Technologies RFID-IDR-232N can interface through 3 output format which are Weigend, Megstripe and 9.6K Baud Serial ASCII (RS232).

Database for this project is to record and store all patient data and information. Programming is done by using MS ACCESS which is Microsoft Access. There are tables need to be perform in the database. Each part of tables describes patient information, medical history and store patient ID, name and others. The database also will store all patients that come for taking healthcare service in a day.

Figure 3 and figure 4 shows the overall project flow chart and database module flow respectively.

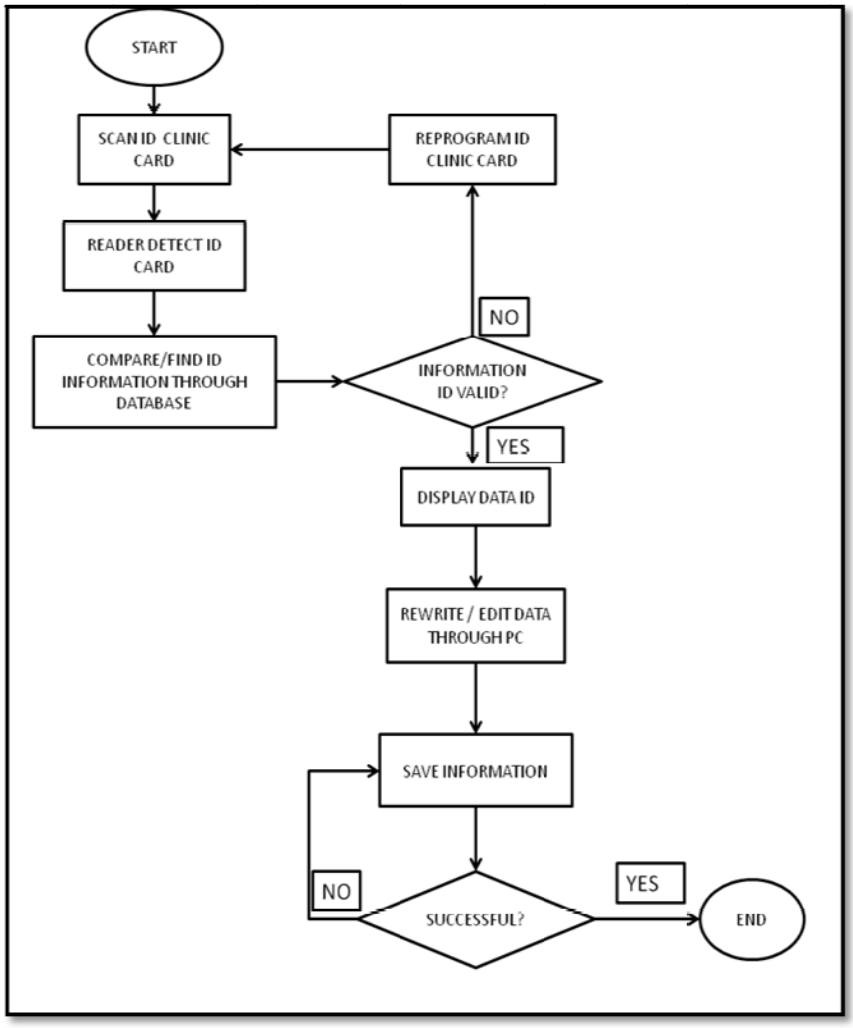

Fig. 3: The Overall Project Flowchart.

In order to connect micro controller to a modem or a pc to modem a serial port is used. Serial is a very common protocol for device communication that is standard on almost every PC. Most computers include two RS-232 based serial ports. Serial is also a common communication protocol that is used by many devices for instrumentation; numerous GPIB-compatible devices also come with an RS-232 port. Furthermore, serial communication can be used for data acquisition in conjunction with a remote sampling device.

The concept of serial communication is simple. The serial port sends and receives bytes of information one bit at a time. Although this is slower than parallel communication, which allows the transmission of an entire byte at once, it is simpler and can be used over longer distances. For example, the IEEE 488 specifications for parallel communication state that the cabling between equipment can be no more than 20 meters total, with no more than 2 meters between any two devices. Serial, however, can extend as much as 1200 meters.

Typically, serial is used to transmit ASCII data. Communication is completed using 3 transmission lines: (1) Ground, (2) Transmit, and (3) Receive. Since serial is asynchronous, the port is able to transmit data on one line while receiving data on another. Other lines are available for handshaking, but are not required. The

important serial characteristics are baud rate, data bits, stop bits, and parity. For two ports to communicate, these parameters must match.

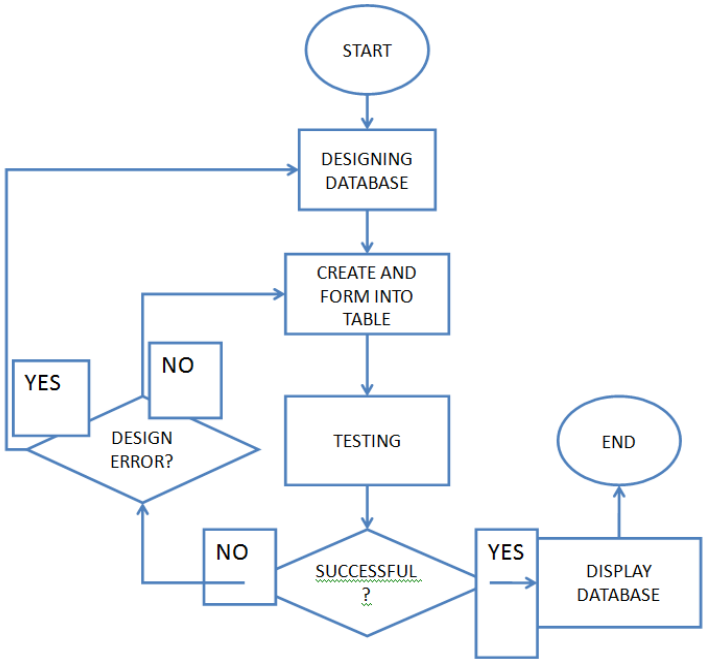

Fig. 4: Flowchart for Database Module.

RESULT AND DISCUSSION

The project result an efficient and systematic of system for both doctor and patient. The RFID system would assist patient by giving simplicity with only bring the patient ID card that was given once their registered at the healthcare services. Moreover, database module would also assist doctor or any medical department in order to record or updating daily patient report. They can store all patient data and information as much as he can without worrying any data missing or misplace.

For this reason, it is usually only possible to use frequency ranges that have been reserved specifically for short range devices. The complete set of RFID reader, tag card and the system are shown in figure 5 below while the main frame of the system is shown in figure 6. The medical database fully integrates with the RFID reader result the successful in implement this project.

Fig. 5: Complete RFID set and database system.

Fig. 6: Main form of the medical system.

The most important part in developing the system is the interfacing both part which is the RFID system and the GUI. The main architecture is that the GUI is responsible for managing and handling the received data from RFID reader. The GUI application that is running shows which patient is performing healthcare check up or other matter. Database is build to stores the records of patient information such as the patient ID, status, medical details and others.

In this project, patient ID card is used to identify each patient in performing healthcare service. Each ID card has its own code or identification and RFID reader is used to read the code. The problem of same code wouldn't happen because each patient card builds with its own microchip on the card. There is a form were created to check whether the patient already registered with this application.

Fig. 7: Inserting Patient Data Form.

In this project, database is used to save and store the ID patient information for make comparison later. This database also will used to display on interface. In order to build this database, Microsoft Access software is used. Few details need to build so that it can fill with the information or patient data. Moreover, the information then will used to integrate with the GUI. The type and quantity of table was depending on the application of this project. Figure 8 depict the database created in table of the patient personal details and medical details using Microsoft Access.

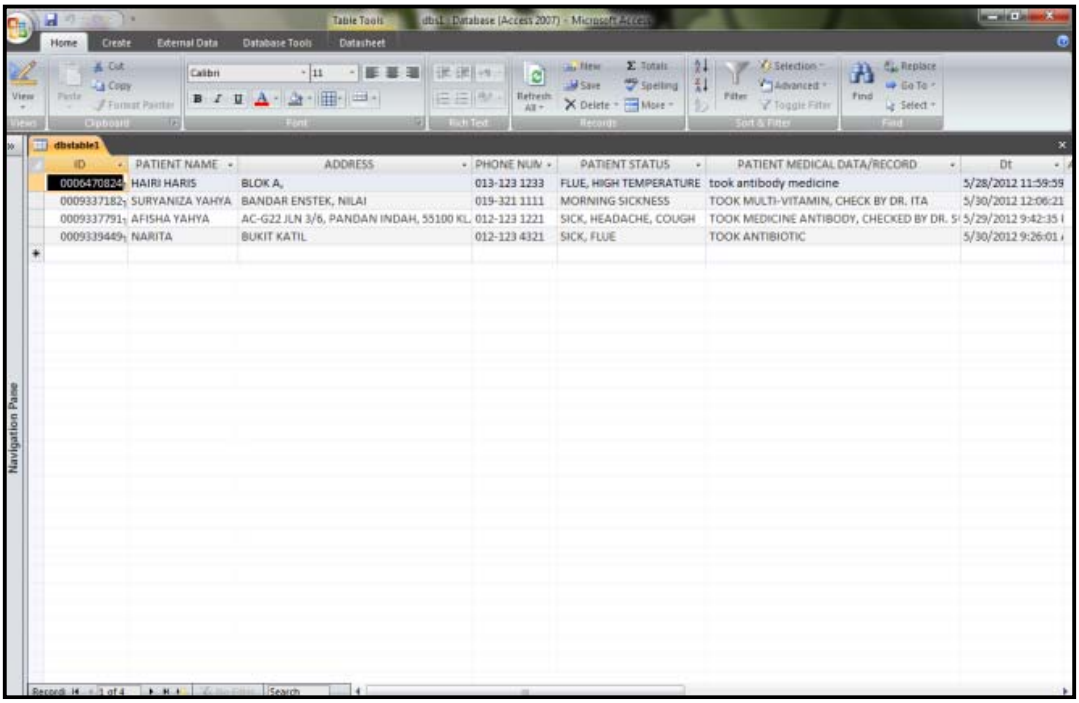

Fig. 8: Patient Information Store to Database using MS ACCESS.

When all patient data information is store through the database, a form of GUI is created to view and display through the system. The patient information details displayed when patient ID card is scan to the RFID reader and the reader integrated with the database. Next all information about patient details and medical history displayed through the system in form of table. The patient information is displayed follow through table so that is easy and systematically for doctor to view all patient data.

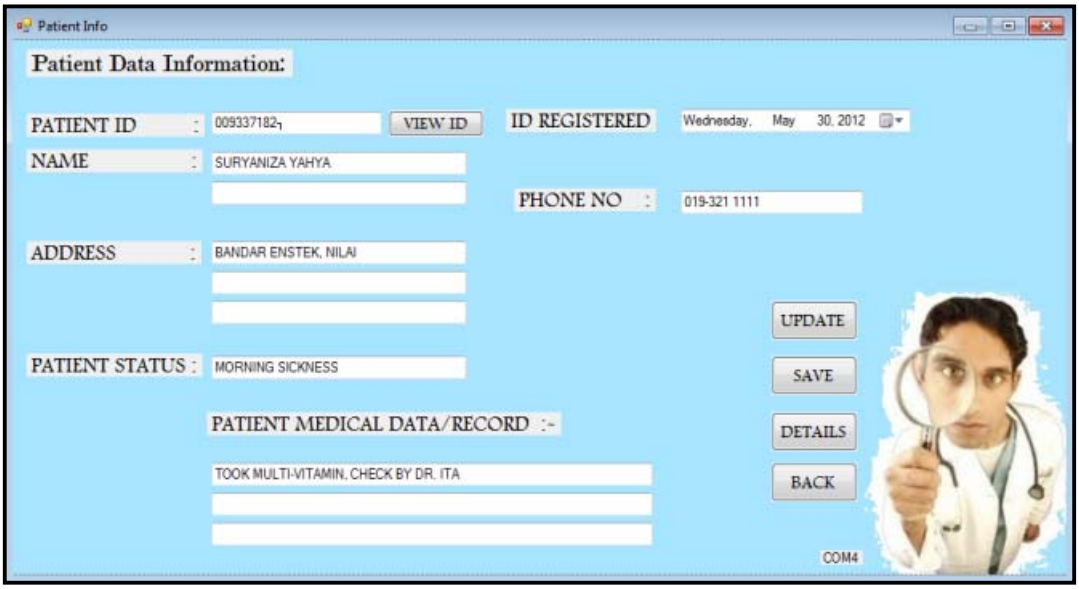

Fig. 9: Form to access patient information.

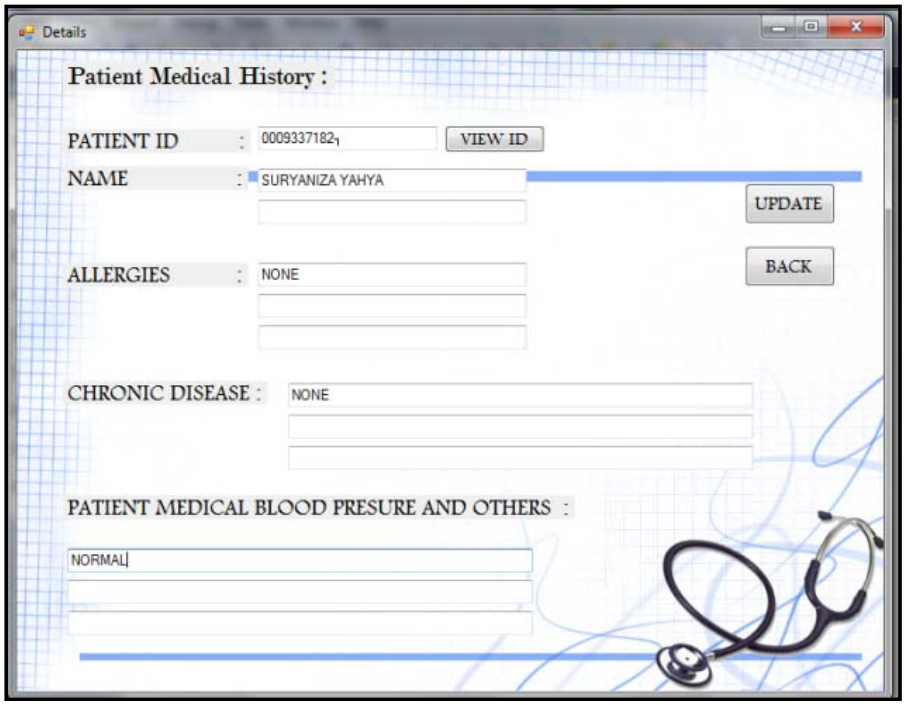

Fig. 10: Details Patient Medical History.

Conclusion:

Generally, these projects complete the certain objective within the scope of project is presented, and can be implemented directly to real life but with little modification to be configured so that it can be more suitable for all users. With RFID technology, the system has ability to differentiate the user identity through an ID card. The system development needs to follow precisely the design flow that has been made in order to follow plan and time schedule. Rather than that, database that contains patient information and medical history can be access through other medical centre or clinic for any further treatment of the patient. Overall, this project is successfully finish and working correctly with all the designing the interface and also creating and designing database.

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