SECURE ENTRY MONITORING SYSTEM

GAN MAY HUI

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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This report is submitted in partial fulfillment of requirement for the award of
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DEDICATION

To GOD

ACKNOWLEDGMENT

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ABSTRACT

The constant flow and accuracy on the amount of hazardous yet expensive drug liquid inserted into the patients' artery play the critical factors in any pain therapy. If the syringe is not securely monitored, there is a high risk of patient, especially for those who are in coma condition, being injected an additional or unnecessary infusion when syringes are changed or when the infusions are restarted. With real time keyless entry monitoring and event captured backup, provision against accidental modification of settings, syringe theft or unauthorized replacement of syringe is further enhanced. In taking account on the patient health and safety, sufficient prove of records (the syringe pump cover entries, time and date with the persons' names) may help on cases analysis and investigation. Therefore, in this project, the event captured in Secure Entry Monitoring Main Board by PIC24FJ128GA010 is to be transferred to computer for data analysis through PIC18F4550 and USB flash drive. The backup of event captured from the main board is then displayed in graphical form for faulty cases inspection.

ABSTRAK

Memandangkan pengaliran malar suntikan dan ketepatan sukatan ubat/dadah yang berbahaya dan mahal merupakan faktor terpenting dalam terapi kesakitan, sekiranya alat suntikan yang mengawal kandungan dadah ke dalam arteri pesakit tidak dikunci, pesakit-pesakit, khususnya pesakit yang berada dalam keadaan koma, akan menghadapi risiko tinggi dalam menerima sukatan dadah yang berlebihan atau pengaliran ubat ke dalam arteri diberhentikan secara tidak sengaja atau sengaja tanpa kebenaran doktor yang merawat. Melainkan penutup alat suntikan dikunci dengan kunci mekanikal, project ini memperkenalkan cara pengawasan rapi buka/tutup penutup alat suntikan dalam masa nyata dengan menggunakan kata laluan dan disertakan dengan fasiliti simpanan aktiviti buka/tutup penutup ke dalam USB peranti storan. Dengan ini, data yang disimpan boleh dijadikan sebagai bukti analisis dan penyiasatan pada masa perlu. Oleh itu, projek ini program PIC24FJ128GA010 supaya data boleh dihantar ke komputar melalui PIC18F4550 dan USB peranti storan. Kemudian, data yang dibaca dari USB peranti storan dipamerkan dalam bentuk bar graf di komputer untuk proses analisis data.

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LIST OF ABBREVIATIONS

ALU	-	Arithmetic Logic Unit
BCD	-	Binary Coded Decimal
BSF	-	Bank Select Registers
CDC	-	Communication Device Class
COG	-	Chip On Glass
CS	-	Chip Select
EEPROM	-	Electrical Erasable Programmable Read Only Memory
FIFO	-	First In First Out
FRC	-	Frame Redundancy Check
FSR	-	File Select Register
FYP 1	-	Final Year Project 1
FYP 2	-	Final Year Project 2
HID	-	Human Interface Device
HOLD	-	Hold enable

IC	-	Integrated Circuit
ICSI	-	In Circuit Serial Programming
IDE	-	Integrated Development Environment
JVM	-	Java Virtual Machine
LCD	-	Liquid Crystal Display
LED	-	Light Emitting Diode
LHS	-	Left-Hand Side
MCLR	-	Master Clear
MCU	-	Microprocessor Control Unit
MIPS	-	Million of Instruction Per Second
MSD	-	Mass Storage Device
NPSA	-	National Patient Safety Agency
NRLS	-	National Reporting and Learning System
OTG	-	On The Go
PC	-	Program Counter
PCA	-	Patient Controlled Analgesia
PIC	-	Programmable Integrated Circuit
PMP	-	Parallel Master Port
PSP	-	Parallel Slave Peripheral
RCFGCAL	-	RTCC Calibration and Configuration Register
RCFGCAL	-	RTCCC Configuration & Calibration

RHS	-	Right-Hand Side
RTCC	-	Real Time Clock and Calendar
RTCVAL	-	RTCC Value Register
SCK	-	Serial Clock
SEE	-	Serial EEPROM
SI	-	Serial Input
SO	-	Serial Output
SPI	-	Serial Peripheral Interface
TBLAT	-	Table latch
TBPTR	-	Table Pointer
USB	-	Universal Synchronous Bus
UART	-	Universal Asynchronous Receiver/Transmitter
WP	-	Write Protect
WREG	-	Working Register

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CHAPTER I

INTRODUCTION

1.1 PROJECT BACKGROUND

Patient Controlled Analgesia (PCA) meets the needs of acute and chronic pain management therapies. One of the equipments used in the therapies is a syringe pump. In the syringe pump, a syringe filled with hazardous but expensive drug liquid is inserted into the slot on the plunger carriage. Syringes must be used in caution because any disconnection would pose a high risk to the patients or users. If the syringe is not securely monitored, there is a possibility of patients, especially for those who are in coma condition, being given an additional or unnecessary infusion when syringes are changed or when the infusions are restarted [1].

In UK, incidents have been reported to the National Reporting and Learning System (NRLS) concerning patients receiving unsafe doses of opioid medicine, where a dose or formulation was incorrect, based on the patient's previous dose. Not only this, National Patient Safety Agency (NPSA) was aware of two deaths and eighty two other incidents up to June 2008 where wrong infusion fluid was attached to patient's arterial line [20].

In fact, every member of the team has a great responsibility to minimize the risk. Doctors and nurses have to confirm the clinical reason for inserting this line and to check that the intended dose and volume are safe for the individual patient. Whereas, computer and electronics engineer can help to improve on the bedside syringe pump safety features. Therefore, security improvement is to be done in this project.

1.2 PROJECT PROBLEM STATEMENTS AND OBJECTIVES

After the filled syringe is inserted into the syringe pump, the plunger carriage must be locked. Instead of using a mechanical key as shown in Figure 1.1, this project implements the keyless entry monitoring system by using secure password to lock and unlock the slot plunger for provision against accidental modification of settings and to prevent syringe theft or unauthorized replacement of syringe.

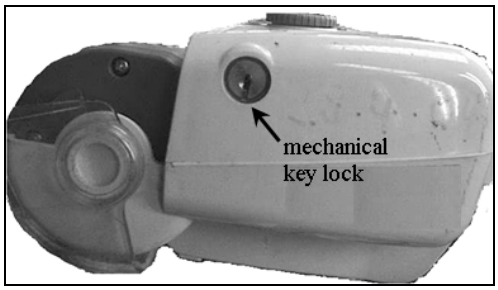

Figure 1.1: Ordinary Mechanical Key Lock Of PCA Syringe Pump

Source: By courtesy of Hospital Sultanah Aminah, Johor, Malaysia

The second objective of this project is to record the syringe pump entries time with the password, date and time. While users highly expect their security systems to give unlimited protection on their personal safety and properties, most security main board is often destroyed by knowledgeable intruders. If the previous data captured by the main board is not backed up, loss of data may prove the inefficiency of a security system.

Thus, another objective of this project is to produce an efficient security system in which USB feature is build in the Secure Entry Monitoring main board. With the peripheral connected, the data captured in Secure Entry Monitoring main board can be transferred to computer easily for further data analysis and investigation. In other words, data can be stored in the main board, USB flash drive and computer.

In fact, most of the existing PCA syringe pumps are already equipped with the LCD display and buttons/keypad (buttons arranged in matrix form), as shown in the literature review in section 2.1 in Chapter II. Therefore, minimum cost is needed to upgrade the existing product to implement the project's objectives because this project is making use of the of the features available (LCD display and buttons/ keypad).

1.3 PROJECT SCOPE

Since security systems are growing ever more popular, various kinds of security systems are available in diverse applications such as residential, business and working area. In this project, the Secure Entry Monitoring System (SEMS) will contribute to not only the business and working field, but also to the medical line. In the former area, this secure monitoring system can be implemented in houses, offices and banks. For the latter, PCA syringe pump is one of the suitable applications.

This project involves hardware, firmware and software. There are seven major parts for programming, as shown below:

1. LCD display
2. Real Time Clock and Calendar
3. Hex keypad
4. Data capture