UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF AN AUTOMATED MEDICAL DISPENSER REMINDER SYSTEM ARCHITECTURE

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Engineering Technology (Automation Industrial & Robotics) (Hons.)

by

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TAJUK: **Development of An Automated Medical Reminder System Architecture**

SESI PENGAJIAN: **2016/17 Semester 2**

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Date : 9 DISEMBER 2016

APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Electrical Engineering Technology (Automation Industrial & Robotics) with Honours. The member of the supervisory is as follow:

.....

(Project Supervisor)

ABSTRAK

Pada masa kini, masyarakat mungkin lupa untuk mengambil ubat-ubatan tepat pada masanya atau mereka lupa sekiranya telah mengambil ataupun belum. Oleh yang demikian, mereka terlepas untuk mengambil ubat pada waktu yang telah ditetapkan dengan dos ubat-ubatan yang berlebihan. Justeru itu, untuk menyelesaikan masalah ini, projek ini akan direka khusus untuk mereka. Projek ini adalah satu sistem elektronik yang boleh dipasang dalam kabinet untuk mengingati seseorang tentang pengambilan ubat-ubatan pada masa yang ditetapkan. ***"An Automated Medical Reminder System Architecture"*** adalah satu sistem keselamatan yang merangkumi dua bahagian iaitu pembangunan perisian dan pembangunan perkakasan. Kit ini boleh digunakan di hospital atau di rumah untuk digunakan kepada pesakit yang berusia untuk mendapatkan ubat-ubatan dan mengikut masa yang ditetapkan untuk mengambil ubat. Ia juga berguna kepada golongan yang sering lupa untuk mengambil ubat. Peranti ini akan mengingatkan mereka untuk mengambil ubat-ubatan mereka menggunakan loceng dan memilih ubat yang ditetapkan berdasarkan paparan LCD ubat yang perlu diambil.

ABSTRACT

The people might forget to take their medications on time or forget that they have already taken their medicines. Consequently, they miss doses of medicines or take overdose. To solve this problem, we designed and built an electronic system, which can be installed in medicine cabinet to keep track of a person's intake of medicines. **Development of An Automated Medical Reminder System Architecture** project is a security system that encompass two important parts which are development of software and development of hardware. This kit is used in hospital or in home to serve the patients and aged who get medicine. The server will record the time of taking medicine and according to the time to judge whether the aged take medicine in time. It is more useful for aged who always forget to take medicine. This device will remind them to take their medicines using a sound buzzer and choose their medicine based on LCD appeared. Moreover, this device also displays the name of the medicine to be taken at that time. This project expected to remind the user to take medicine on time and reduce drug addicted.

DEDICATION

Special thanks to my beloved parents

Special thanks to my supervisor

Special thanks to my colleagues

3 cm

ACKNOWLEDGEMENT

I would like to thankful to Allah S.W.T for giving me a chance to complete this project to success. While completing this project, there several individuals that keep giving me their support and advices to complete this project successfully. I would like to express my deepest gratefulness and appreciation to my Supervisor, Puan Intan Mastura Binti Saadon in all guidance, teaching, advices and time for me. Without her constant supervision. I may be not able to complete this project. Thank you for the advices, guides, tips and generous support that you have gave me. To my family that keep supporting me until finish this project. To my friends, my special gratitude and thank you for all the support and guidance. Also not forgotten to all lectures and people who helped me in completing this project whether it is directly or not. Without all the support and help, this project maybe cannot complete. Thank you.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

AC	-	Alternating Current
CE	-	Common Era
DC	-	Direct Current
EEPROM	-	Erasable Programmable Read-Only Memory
FTDI	-	Future Technology Devices International
GPS	-	Global Positioning System
IDE	-	Integrated Development Environment
I/O	-	Input Output
ISCP	-	In-Circuit Serial Programming
ISIS	-	Intelligent Schematic Input System
LCD	-	Liquid Crystal Display
LED	-	Light Emitting Diode
PDA	-	Personal Digital Assistant
PWM	-	Pulse Width Modulation
RAM	-	Random Access Memory
RTC	-	Real Time Clock
SCLK	-	Serial Clock
USB	-	Universal Serial Bus

CHAPTER 1

INTRODUCTION

1.1 Background

Medical reminder systems are for the category of patients involving all human beings-teachers, students, businessman, housewives, children and also all of us have busy hectic schedule. Today's in life is full of responsibilities and stress. So, people are prone to be diagnosed with diseases of different types and it is our duty to keep ourselves stays fit and healthy. If patient stays home then he or she might get someone to look after or remind them but when one is not at home, is out of the city or away from home then it is hard for the family members to call them and remind them their dosage timings every time. This project aims to design a medical reminder system by using an RTC clock for medicine intake. Besides that, hardware and software development are used to develop this project. The software development consists of the arduino for RTC clock command. The hardware development consists of arduino circuit, RTC clock, buzzer, relay module and solenoid.

1.2 Problem Statement

The reason why this project needs to be developed is to solve the forgotten people to take the medicine. This is because people so busy with their work without taking care about their health. When people know they not well, they just go to the hospital or clinic to take the medicine but do not eat them because they forget about that. Besides that, this project should be developed because to solve the forgotten people about the amount or doses of medicine that they should take. Sometimes, people always forget about the doses should their take. It can be overdoses if people take more than once. It also can be a drug addicted that it is dangerous and not healthy for life. This product can alert people with alarm to take the medicine and remind them with exact doses without take an overdose medicine. The automated medical system can makes people alert to take the medicine and easier for them to take their medicine.

1.3 Objective

The objectives of this project are:

i. To design a reminder system to alert users on the timing and dosage for medicine intake.

ii. To develop a prototype of a medicine dispenser.

1.4 Project Scope

This project is the process of alert the people to take the medicine when patient at home using a medical dispenser that can design an embedded system that can remind and take a correct dose of medicine.

i. Software development is using a Arduino ATmega and Proteus. Arduino connect to the RTC clock, LCD, solenoid and relay module to hardware development.

ii. Prototype development is design a mechanical part of the dispenser using a sketch up software and develops the prototype to be implemented with the electronic parts.

1.5 Project Significance

This project will be a significant in promoting for hospital users, homes that can makes great and better life. This project will be benefits for old folks, nurses, doctor and children to take dosage of medicine on time and not forget to take medicines.

1.6 Flowchart

Figure 1 below shows the flow of the project using a flowchart. In this project, the overall concept of the project starting when the sound of the buzzer will on it will alert the people it is time to take a medicine. When the alarm is sound, the LCD will appear the doses of the medicine for each medicine to remember the people. When people see the amount of the medicine, the people should push a button to take a medicine with correct dose. Medicine will out by using a solenoid that place at the end of the box. Then, people can eat the medicine through the medical dispenser.

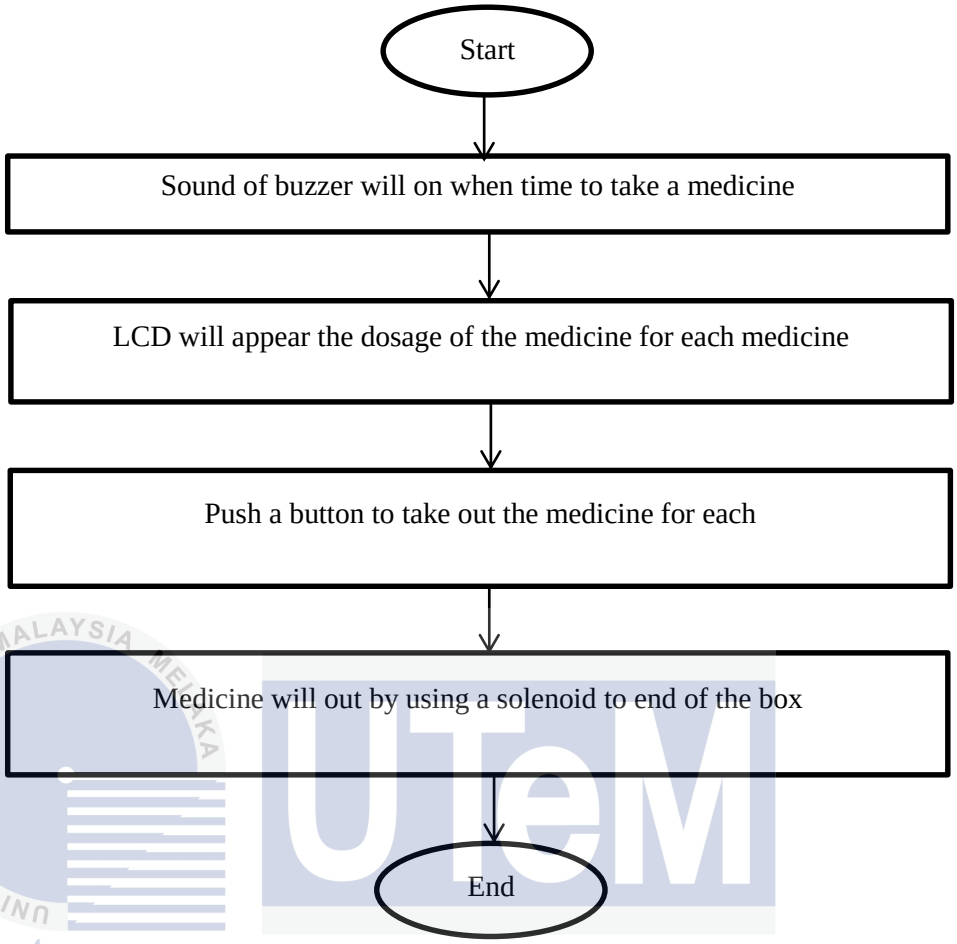

Figure 1.0 : Flowchart of Project

1.7 Thesis Outlines

There are three chapter in this thesis include of introduction of the project, literature review which is the works of others that related with this project and lastly the method that used to implement the knowledge into project.

Chapter 1 : In chapter 1, currently brief about general ideas of the project which are introduction, problem statement, target of the project, scope of project, project significant and thesis outlines.

Chapter 2 : In this chapter, basically study about literature review which is work that related with the project. It is important in order to obtain some knowledge about the project. Furthermore, this chapter include some explanation about software and hardware development and also about the main component in the project.

Chapter 3 : Chapter 3, will be discuss about methodology, which is consists flowchart of whole project and the description of component that will used to solve the problem statement.

1.8 Expected Result

This project will achieve the objective of the project, which are to design a system that will give the accurate dosage and take a medicine on time and to develop a prototype. This medical reminder box is proposed to be used by nurse, old folks and teenagers too to always alert them for take a medicine on time and right doses. By using this system, it can avoid from drug addicted and forget to take the medicine on time. This system is created and developed by using simple components that easy to get in any types of component store. It also comes in very small of product that easy to install at home and hospital so the expectation for this project is to be implement this medical reminder box for nurse, old folks and teenagers. With the creation of this system, hopefully peoples more responsible for ensuring to take their medicine on time and exact doses.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction Literature Review

This chapter will discuss about all related information and study about project to achieve the project aims. This chapter involves research and find the information about the concept of medical reminder system that has been done and related to this project Furthermore; this chapter also have more detail description about software and hardware use in this project. A study regarding all required components must be done in order to design the overall circuit. It is important to understand on how software and hardware were used in Adruino system.

2.2

There are some of journals that are almost related with Medical Reminder System Architecture. These journals are used as a reference to complete this project.

2.2.1 A Design of an Automated Patient Tracking and Medicine Dispensing Mobile Robot for Senior Citizens

According to Yasothaa Kalai Chelvam, Norshuhani Zamin (2014), they use a robotics application. The system built to support elderly living independently. In this project, they use a PIC microcontroller as a controller. They use 3 of touch sensor that can detect when pressed the button. IR sensor used for detect the beacon heading which will be attached to track the direction of the

patients. Another sensor is Ultrasonic sensor that detect proximity of obstacle enabling avoidance of collision. Dispenser is used for control the dispensing of the medicine. There are many differences method that been used in this project compared to my project. There will be some modification at microcontroller and put alarm system to alert the patient and will put the medical dispenser at one place only.

2.2.2 A Medication Calendar to Assist Old People with Drug Dose

According to Joel Palomino, Haruo Nakashima, Shunji Moromugi, Takakazu Ishimatsu (2012), this product used a manual calendar that has twenty eight pockets. The twenty eight pockets are divided into weekdays and four period at once time. Inside the pockets, there are bags to put the medicine with the doses. Each pocket has a reed switch as a sensor to detect the medicines. LCD display, four knobs, two switches is using in controller. At the end, the differences between this project is manual calendar will change as a automation calendar by using a RTC clock. Put the alarm for alert the patients and used a difference microcontroller and modified the design of the medical dispenser.

2.2.3 Medication Reminder And Healthcare – An Android Application

According to Deepti Ameta, Kalpana Mudaliar and Palak Patel (2015), this product used a smart phone. They used an Android application that automatic alarm ringing on smart phone. They focusses on doctor and patient interactions. Patients will not remember their dosage and timing while they can set an alarm on their dosage timings. The alarm can be set for multiple medicines and timings including date, time and medicine description. A notification will be sent to them through email or message inside the system preferably chosen by the patients. They can search doctor disease wise. The patients will get the contact details of doctors as per their availability. Also the users can see different articles related to medical fields and health care tips. The system focuses on easy navigation and good user interface.

2.3 Microcontroller

Arduino consists of two open sources which is open source hardware and open source software. It is also act as microcontroller that can sense control physical devices based on kits for building digital devices and interactive objects.

2.3.1 Arduino Uno

Atmega328 include at Arduino Uno microcontroller board. The board consists 14 digital input and output pins. There are 6 pins which is PWM outputs and analogue input. There are also consists 16 MHz crystal oscillator, USB connection, power jack, ICSP header and reset button on microcontroller board. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter.

2.4 RTC Clock

A real-time clock (RTC) is a computer clock (most often in the form of an integrated circuit) that keeps track of the current time. Although the term often refers to the devices in personal computers, servers and embedded systems, RTCs are present in almost any electronic device which needs to keep accurate time.

2.4.1 Purpose of RTC

Although keeping time can be done without an RTC, using one has benefits:

i. Low power consumption (important when running from alternate power)
ii. Frees the main system for time-critical tasks

iii. Sometimes more accurate than other methods

2.5 Linear Solenoid

Direct solenoid's fundamentally comprise of an electrical loop twisted around a round and hollow tube with a ferro-attractive actuator or "plunger" that is allowed to move or slide "IN" and "OUT" of the curls body. Solenoids can be utilized to electrically open entryways and hooks, open or close valves, move and work automated appendages and instruments, and even activate electrical switches just by empowering its curl.

2.6 Software Specification

There are three software will be utilized in this tasks. There are several different lists of software design principles:

i. Proteus 8.1 Professional.
ii. Adruino Software.

2.6.1 Proteus 8.1 Professional

In this project to design and simulate the related circuit designer used Proteus 8.1 Professional. It is also able to carry out an outline of the whole circuit for a microcontroller system. Intelligent Schematic Input System (ISIS) is used to obtain the output characteristic. It is widespread due to it is suitable with any types of microcontroller. Thus, it is easier for users to design and simulate the circuit. Figure 2.0 below shows the Proteus 8.1 Professional Software:

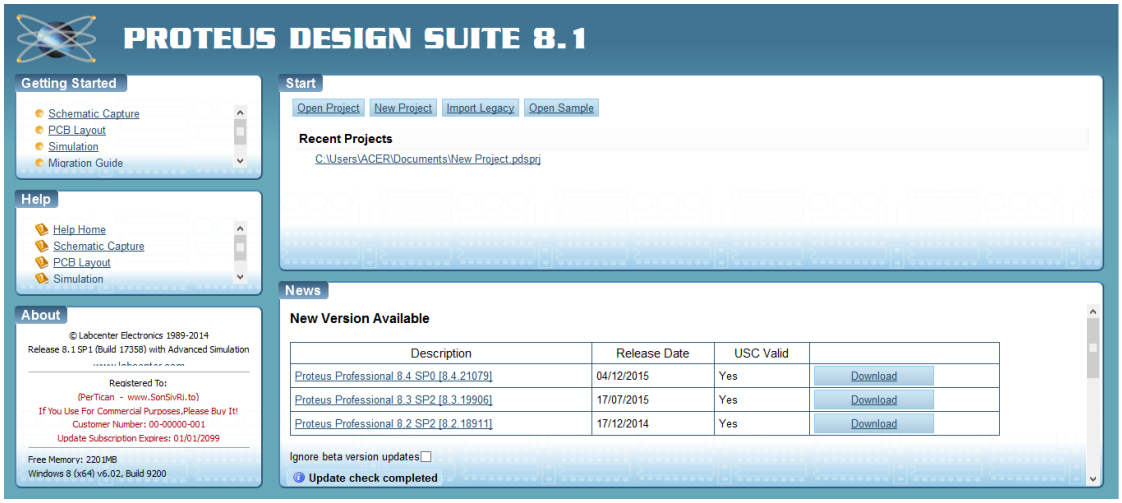

Figure 2.0 : Proteus 8.1 Professional Software

2.6.2 Arduino 1.6.8

Arduino 1.6.8 is open source Arduino Software (IDE). This software can write the code easier and upload it to the board. It can be used with any Arduino Board. This software contains a lot of functionality which is a text editor for write a code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. The Figure 2.1 above shows Arduino 1.6.8 Software.

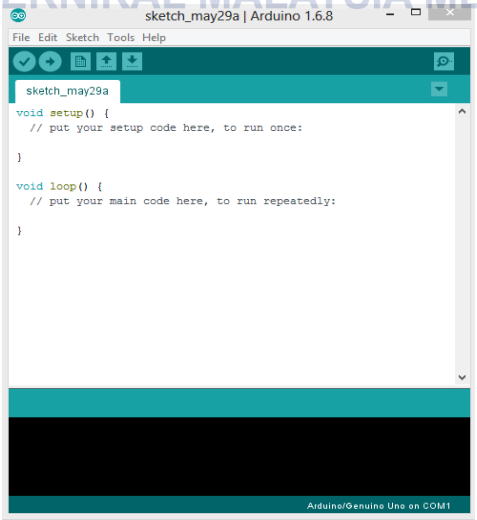

Figure 2.1 : Arduino Software

CHAPTER 3

METHODOLOGY

Methodology is the theoretical analysis of the methods applied to a field of study and used to explain how the project to be executed. This chapter targets is to determine and analysis about hardware and software combination. Besides that, it is also will address all the ways that will be implemented to resolve the problems. Additionally, methodology explain how something considered problem and certain techniques that used enables understand in more detail about the application of project.

3.1 Block Diagram

Figure 3.0 show the block diagram for this project that consists some of components. The main component of this project is microcontroller which is an Arduino Uno. Input of this microcontroller is solenoid and relay module. Solenoid and relay module will go through to the microcontroller as a controller. Controller will produce an output which is buzzer, and RTC clock. Then, the output will appear at the LCD.

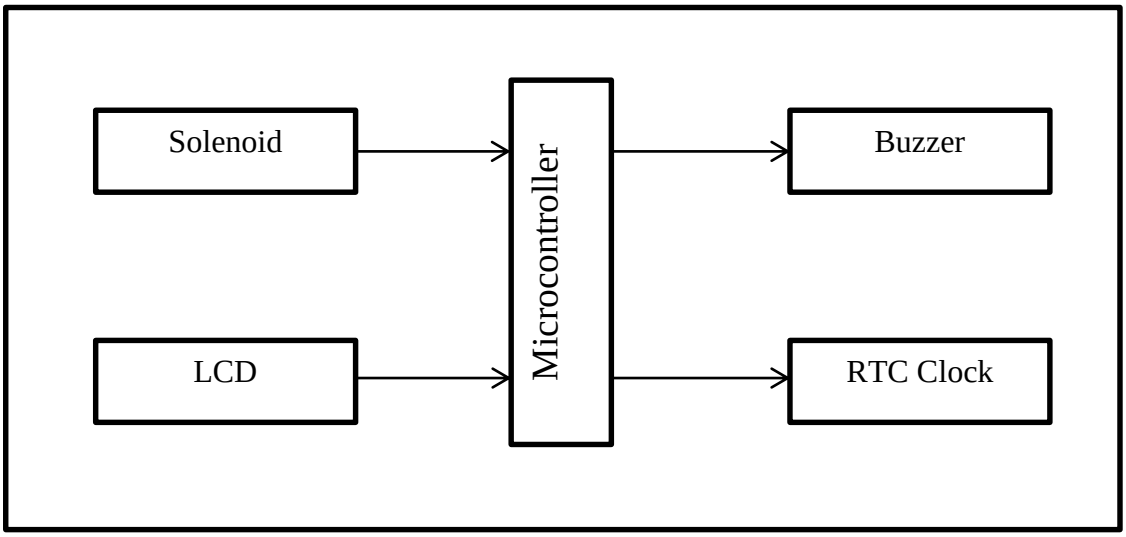

Figure 3.0 : Block Diagram

3.2 Flowchart of Project Development Description

The flowchart that shown in Figure 3.1 is the process of the all project will be done. After learned about previous project that related on this project by surfing internet and research, the information and understanding the project is obtained. From the beginning, planning and design is needed to get the idea. Then, study the software and hardware development. Proteus is used in this project for the software development for simulate all the circuit to obtain the result or output. For examples circuit for RTC clock, Adruino, Relay Module, Solenoid. Then, the simulation that successful simulate will implement into hardware development. First, start with the identify the component that fit with this project after that design the project based on the simulation circuit on Proteus. Then, test the whole hardware either it works according the simulation or not. If it is working accordingly the project continue to the real prototype development stage.

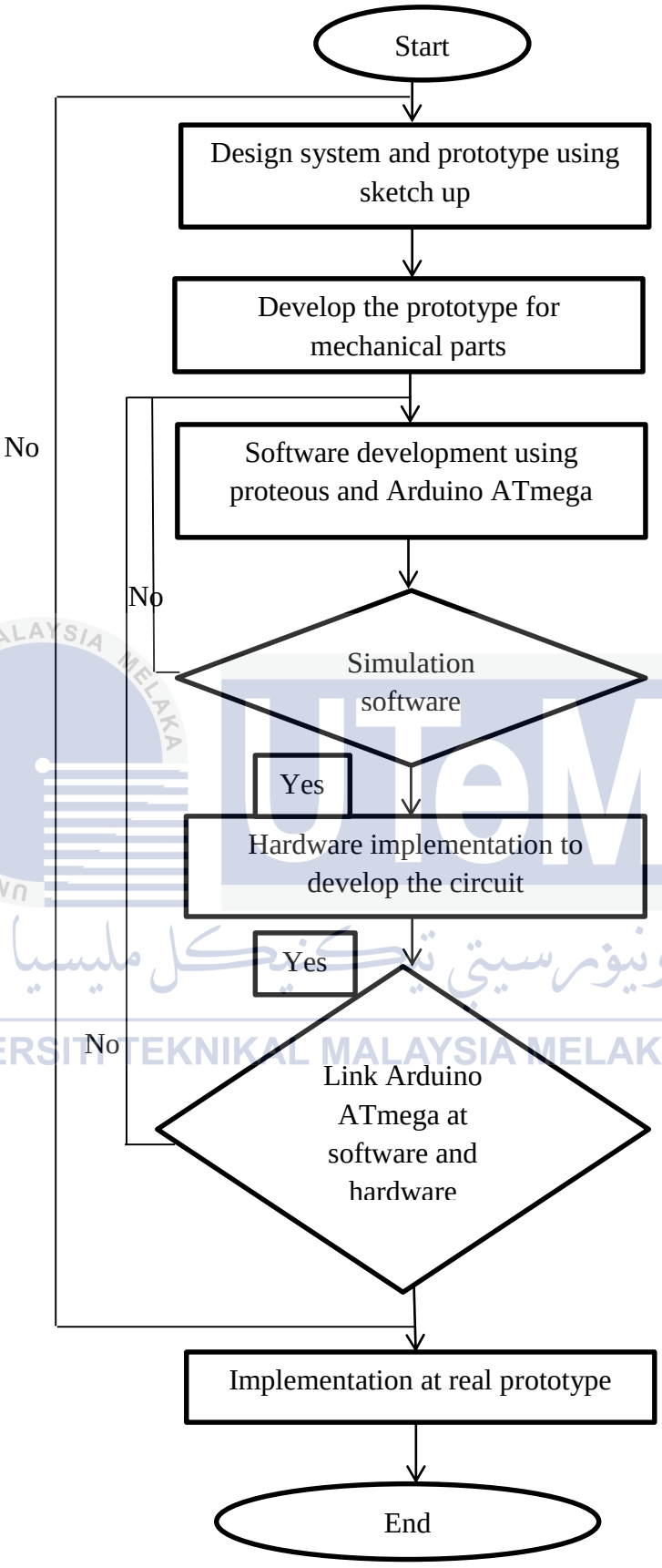

Figure 3.1 : Flowchart of project

3.3 Project Methodology

Stage 1: Study the operation of the circuit by do a literature review for the project.

Stage 2: Plan the flow of the project

Stage 3: This project divided into two parts which is hardware design and software design. The software development are using Sketch Up, Proteous and Arduino 1.6.8.

Stage 4: This project develop hardware which is Relay Module, pushbutton, LCD, buzzer

Stage 5: Testing and troubleshooting

Stage 6: Install in real prototype

3.4 Hardware Development

For the hardware development, there are circuit diagram for LCD and RTC clock. Besides that, this project also used pushbutton, relay module, solenoid and buzzer.

3.4.1 Sketch Up Design

Sketch Up is software that draws a 3D modelling on computer program. It program is for a wide range of drawing application such as interior design, engineering and etc. Sketch Up software is an open source so it is easy to use. The reason why used this software because it is the easiest way to draw in 3D. This software is friendly users and interactive. Figure 3.2 and Figure 3.3 shows the design of the medical dispenser box using Sketch Up software. This design consists of 3 storage of the medicine which box consists of relay module and solenoid with buzzer. Electronic box also put in the medical dispenser. All of this explanation is in

the inside of the box dispenser. The outer views of the medical dispenser have LCD and pushbutton.

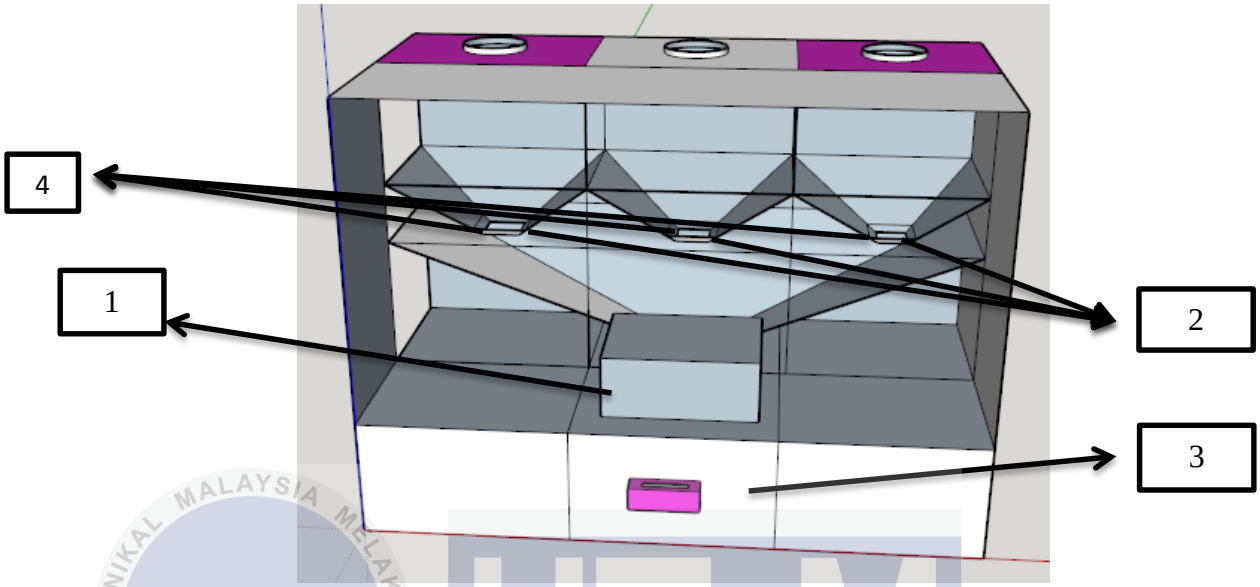

Figure 3.2 : Design of the Medical Dispenser

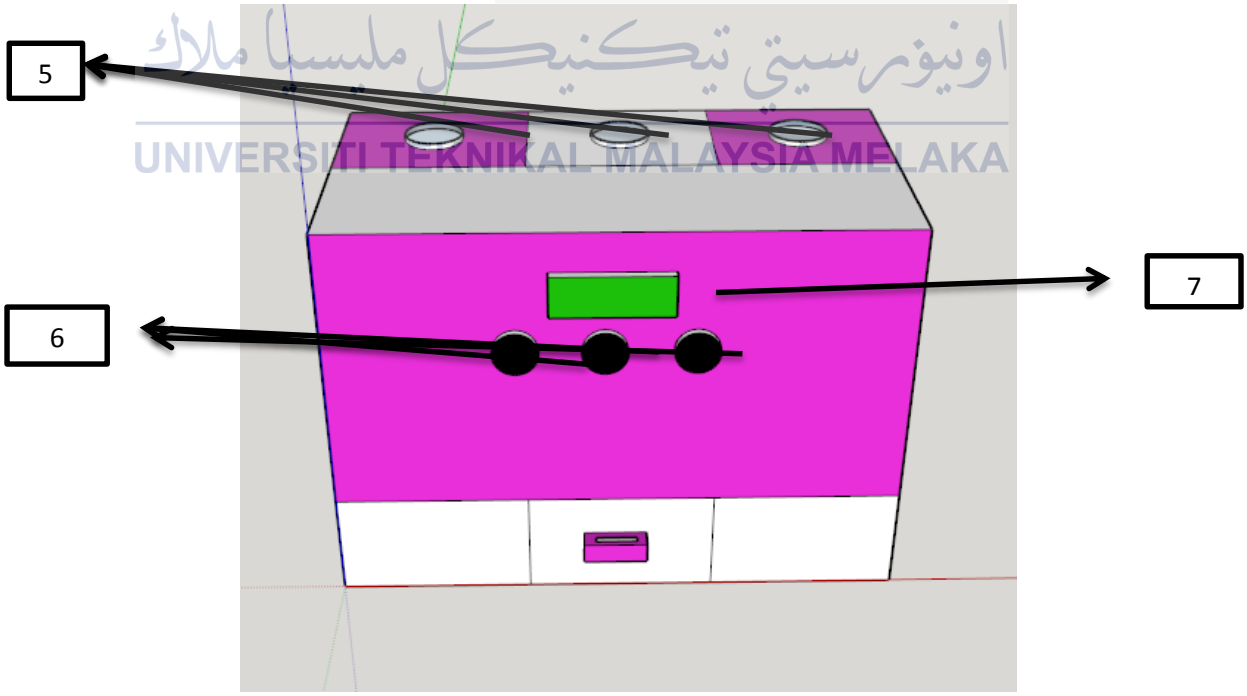

Figure 3.3 : Outer View of the Medical Dispenser

Label	Object
1	Electronic storage
2	Place of relay module
3	Medical dispenser
4	Place solenoid
5	3 Parts of Storage Medical
6	Pushbutton
7	LCD

Table 3.0 : Label of the Parts

3.4.2 Arduino Uno

Atmega328 include at Arduino Uno microcontroller board. The board consists 14 digital input and output pins. There are 6 pins which is PWM outputs and analogue input. There are also consists 16 MHz crystal oscillator, USB connection, power jack, ICSP header and reset button on microcontroller board. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter.

By using arduino as a controller because this microcontroller is ready to use. It is complete package which is including 5V regulator, an oscillator, interface and LED. Besides that, many professional, engineers making their project using arduino because it just plug it on the port.

3.4.2.1 Specification of Arduino

The Figure 3.4 below shows the label of the microcontroller Arduino Uno. The Arduino Uno board have a digital pins, analogue pins, power pins, USB interface, ICSP header and external power supply. Table 3.1 shows the specification of the Arduino Uno. This Arduino use a ATmega328 as a microcontroller. The operating voltage of the Arduino is 5V. The input voltage that recommended is 7-12V and the limit input voltage between 6-20V.

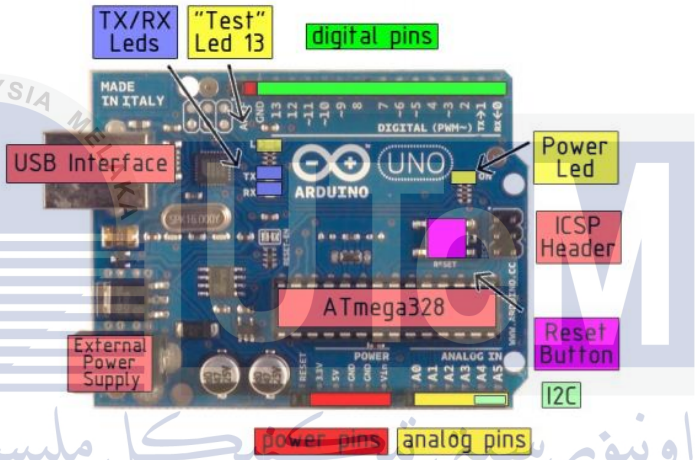

Figure 3.4 : Arduino Uno

Microcontroller	ATmega328
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limits)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
Analogue/ Input Pins	6
DC Current per I/O Pin	40 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB of which 0.5 KB used by boot loader
SRAM	2 KB
EEPROM	1 KB
Clock Speed	16 MHz

Table 3.1: Specification of Arduino

3.4.2.2 Comparison between Arduino Uno and Arduino Leonardo

All Arduino boards make them thing in like manner, they are programmed by using the Arduino IDE. This is the product that permits to compose plus to transfer code. Furthermore, it can be a great deal of contrasts. But there will be differences between each of Arduino board which may lead to advantages for this project. Table 3.2 shows comparisons between Arduino Leonardo and Arduino UNO.

	Arduino Leonardo	Arduino Uno
Microcontroller	ATmega32u4	ATmega328P
Operating voltage	5V	5V
Input Voltage	7-12V	7-12V
Input Limit Voltage	6-20V	6-20V
Digital I/O Pins	20	14

PWM Channels	7	6
Analog Input Channel	12	6
DC Current per I/O Pin	40mA	20mA
DC Current for 3.3V pin	50mA	50mA
Flash Memory	32Kb	32Kb
SRAM	2.5KB(ATMega32u4)	2KB(ATMega328P)
EEPROM	1KB(ATMega32u4)	1KB(ATMega328P)
Clock Speed	16MHz	16MHz
Length	68.6mm	68.6mm
Width	53.3mm	53.4mm
Weight	20g	25g

Table 3.2 : Comparison between Arduino Leonardo and Arduino UNO

Based on the table 3.2 above, we know that Arduino Uno uses ATmega328, while Arduino Leonardo uses ATmega32u4. The microcontroller on the Arduino Leonardo cannot be disengaged, it's mounted on Arduino board, while the microcontroller on the Arduino Uno can be effectively expelled. Some hardware engineers code the microcontroller on the Uno board and connect it on another board. Arduino Uno uses 14 I/O pins while Arduino Leonardo is capable of using 20 pins since it can use the Analog pins to be I/O too. Pulse Width Modulation is a technique used to get Analog signal results using digital signals. Arduino Uno utilizes 6 PWM pins while Arduino Leonardo utilizes 7 pins.

3.4.2.3 Power

To power on the Arduino Uno, it can use via micro USB connection or with an external power supply. The power source is selected automatically.

External power can be used either from it is an AC-to-DC connector (divider wart) or battery. By stopping a 2.1mm center positive attachment into the board's power jack the connector can be associated. Leads from abattery can be embedded in the Gnd and Vin pin headers of the POWER connector.

Supply of 6 to 20 volts can work on the board of the Arduino. If it is supplied under than 7V. nonetheless, the board might be precarious or unstable if the 5V pin supply under 5V. The voltage regulator may overheat and harm the board if utilize it more than 12V.

3.4.2.4 Connection of Arduino Atmega 328

Figure 3.5 below shows the basic simulation of the Arduino Atmega 328. Pins 1, 20, 21 will connect to the 5V operating voltage. At the pins 9 and 10 as input will connect with the capacitor 1 and 2.

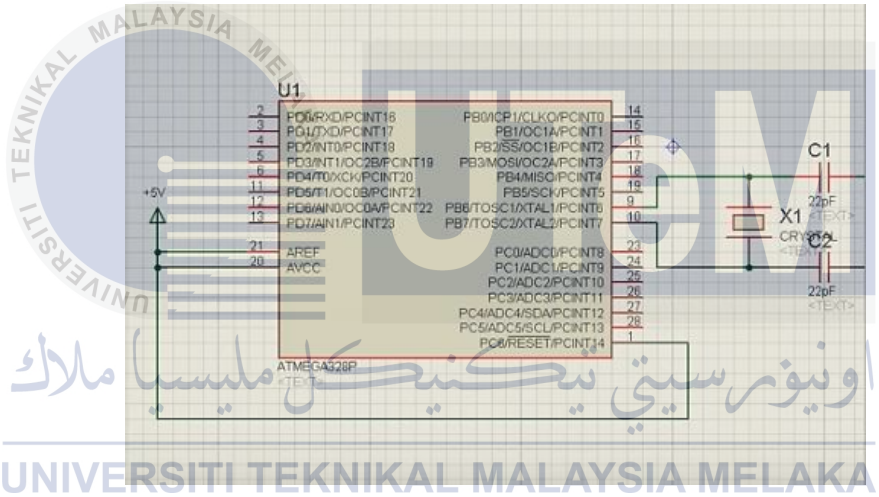

Figure 3.5 : Basic connection of Aduino Atmega 328

3.4.3 USB Micro B Cable

Universal Serial Bus (USB) is an effort to disentangle the association amongst PC and other gadgets. For it operating systems, its minimal effort of usage and its convenience it has turned out to be broadly mainstream.

In its unique detail, USB characterized just two connector sorts which is A or either B. Corrections to the determination and requests on makers have extended the

broadness of connectors utilized for USB gadgets. However the larger part of USB items still utilize these A and also B connector interface.

For Arduino Uno cable connection, we use USB Micro B cable. Perceived by the USB-IF, this connector can likewise be found on more up to date cell phones. For example, cellphones, GPS units, PDAs and digital cameras. Miniaturized scale USB B offers an association physically little in size to a USB Mini-b, while as yet supporting the fast exchange rate Mbps and On-The-Go highlights. The association can be effectively recognized by its dark shaded container and minimized 5 pin plan. Figure 3.6 shows USB Micro B cable.

Figure 3.6 USB Micro B cable

3.4.4 Jumper Wire Male-to-Male

A jump wire is an electrical wire that are short and have a solid tip at each end. It is commonly used when we want to interconnect with the sections in breadboard. Among others, its used to change electrical signs from wherever on the breadboard to the input or outputs pin of a Arduino or microcontroller.

To connect the jumper wires, the end connectors are embedded into the space gave in the breadboard that underneath the surface which it has a couple of sets of parallel plates that associate the opening in gathering of lines or segments relying upon the area. On the breadboard, the end connector are embedded without fastening in the specific openings that should be associated in the particular prototype. Figure 3.7 show example og the jumper wire male-to-male.

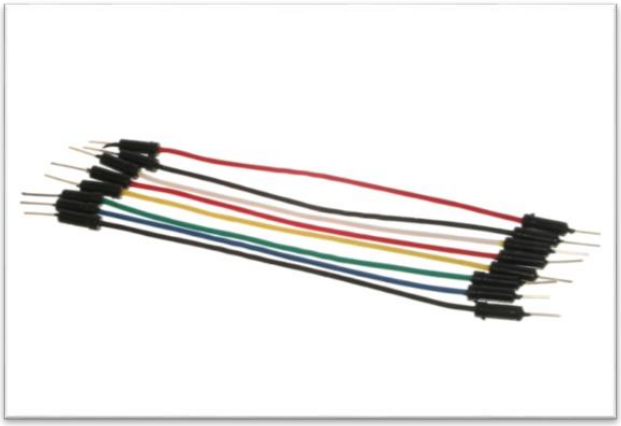

Figure 3.7 Jumper Wire Male-to-Male

3.4.5 RTC Clock (DS1302)

The DS1302 is a Real Time Clock Module with the battery to backup and easy to use. The DS 1302 chip uses a simple serial interface.

The RTC consists minutes, seconds, hours, day, date, month and year information. Date will automatically adjust at the end of the month including for leap year. Clock can operates in 24 hour or 12 hour format with an active low AM/PM indicator. The programmable square wave output are provide with two programmable time of alarm.

The Figure 3.8 below shows RTC DS1302. In this project, RTC will use to set the date and time for continuously. The date and time will use for the people to take the medicine. It will show the time at the LCD.

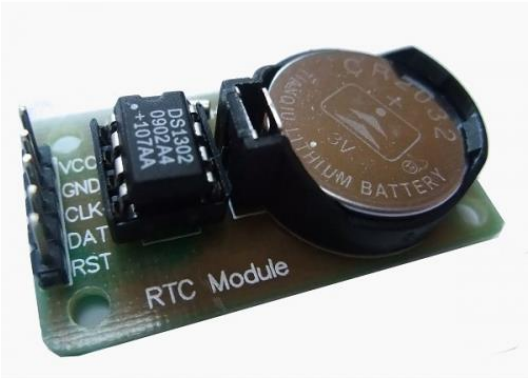

Figure 3.8 : RTC Clock DS1302

3.4.5.1 Connection of RTC Clock DS3231

The DS1302 can be easily connected to the Arduino. There are three pins that needed for the interface, CE, I/O, SCLK and VCC2 should connected to +5V. The VCC1 for battery and rechargeable battery. A crystal of 32.768kHz should be connected to X1 and X2. The Figure 3.9 shows connection of RTC DS1302.

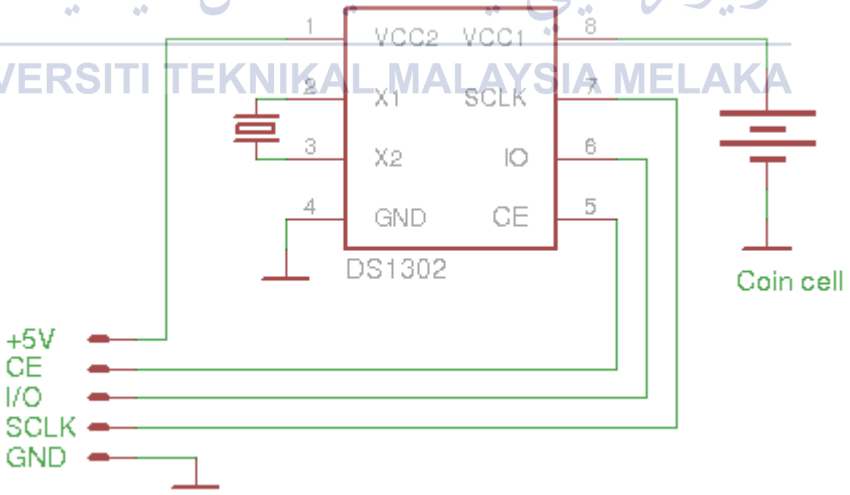

Figure 3.9 : Connection RTC DS3231

3.4.5.2 RAM

The chips have 31 bytes of ram. When the Arduino is off and the battery gets empty, the data will lost. To store the data, the EEPROM section of the AVR chip, the microprocessor used in the Arduino is a much better choice.

3.4.5.3 Features

There are the features of the Real Time Clock Module DS1302 :

- Real-Time Clock Counts Seconds, Minutes, Hours, Date of the Month, Month, Day of the Week, and Year with Leap-Year Compensation Valid Up to 2100
- Serial I/O for Minimum Pin Count
- 2.0V to 5.5V Full Operation
- Uses Less than 300nA at 2.0V
- Single-Byte or Multiple-Byte (Burst Mode) Data Transfer for Read or Write of Clock or RAM Data
- Board Size: 44mm x 24mm

3.4.6 Buzzer as Indicator

Buzzer is a device that in the form of a sound signal and are commonly used in electronic appliances such as mobile phones and home appliances such as a microwave oven. The buzzer operates when the button is pressed on the circuit. Due to that, the current will flow in the coil where it will attract the armature to produce sound. Figure 3.10 below shows the buzzer use in this project.

Figure 3.10 : Buzzer

3.4.7 Liquid Crystal Display

Liquid Crystal Display is known as LCD, whereby it is used for electronic display as a module screen and the screen has a wider application. The screen commonly used in a variety of circuits and appliance. A very basic module is commonly used to display screen 16 x 2. This LCD consists 16 characters that can display in each of the 2 rows of the 16x2 LCD. The total of 80 characters can be displayed at any time.

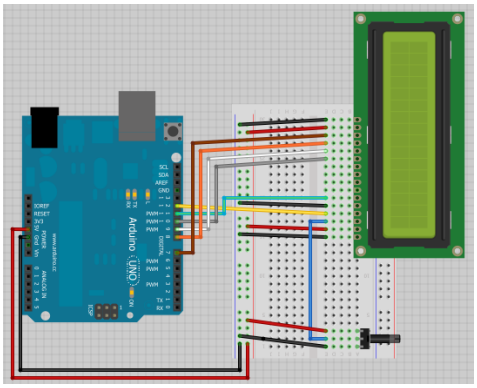

Figure 3.11 : Connection of 16x2 LCD to Arduino Uno

This project use a 16x2 LCD because there are many info that want to display such as time, doses and which medicines people needs to eat. Figure 3.11 shows the basic connection of LCD 16x2.

3.4.8 Linear Solenoid

Direct solenoid's fundamentally comprise of an electrical loop twisted around a tube shaped tube with a ferro-attractive actuator or "plunger" that is allowed to move or slide "IN" and "OUT" of the curls body. Solenoids can be utilized to electrically open entryways and hooks, open or close valves, move and work automated appendages and systems, and even incite electrical switches just by stimulating its curl.

Solenoids are accessible in an assortment of arrangements with the more basic sorts being the straight solenoid otherwise called the direct electromechanical actuator, (LEMA) and the rotating solenoid.

Both sorts of solenoid, straight and rotational are accessible as either a holding (persistently empowered) or as a locking sort (ON-OFF heartbeat) with the hooking sorts being utilized as a part of either invigorated or power-off applications. Straight solenoids can likewise be intended for relative movement control were the plunger position is corresponding to the power input.

At the point when electrical current courses through a transmitter it creates an attractive field, and the bearing of this attractive field concerning its North and South Poles is controlled by the heading of the present stream inside the wire. This curl of wire turns into an "Electromagnet" with its own particular north and south shafts precisely the same as that for a lasting sort magnet. Figure 3.12 demonstrate the direct solenoid that utilization in this venture. This venture utilize the straight solenoid to open the distributor of the pharmaceutical to the medicinal gadget.

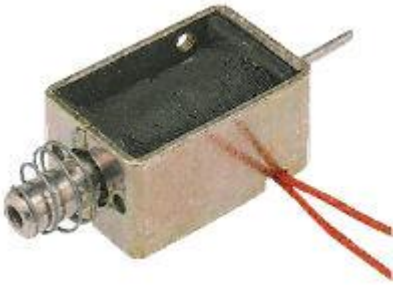

Figure 3.12 : Solenoid

3.4.8.1 Linear Solenoid Construction

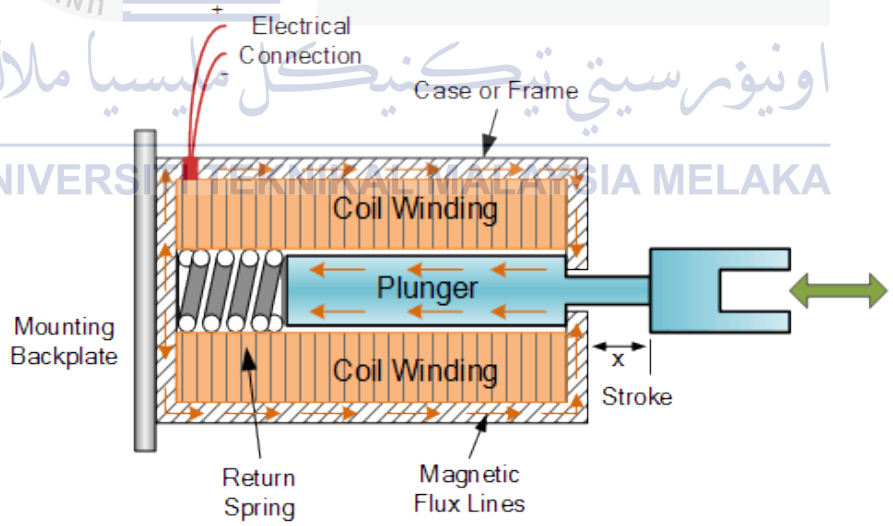

Figure 3.13 Pull Type Solenoid Construction

This sort of solenoid is for the most part called a Linear Solenoid because of the straight directional development and activity of the plunger. Straight solenoids are accessible in two fundamental arrangements called a "Draw sort" as it pulls the associated stack towards itself when stimulated, and the "Push-sort" that demonstration the other way pushing it far from itself when invigorated. Both push and force sorts are by and large developed the same with the distinction being in the area of the arrival spring and plan of the plunger.

3.4.9 Relay Module

A Relay is an electrically worked switch. Many transfers utilize an electromagnet to mechanically work the switch and give electrical detachment between two circuits. In this venture there is no genuine need to confine one circuit from the other, however we will utilize an Arduino UNO to control the hand-off. We will build up a straightforward circuit to show and recognize the NO (Normally open) and NC (Normally shut) terminals of the transfer. Figure 3.14 shows the relay module.

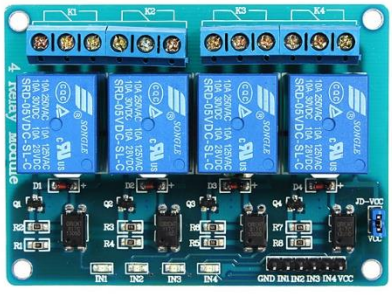

Figure 3.14 Relay Module

In this project the relay module is used for trigger a pushbutton to trigger the solenoid. Solenoid will retract or extract form pushbutton and trigger by relay module.

CHAPTER 4

RESULT AND ANALYSIS

4.1 Introduction

This chapter discuss about the whole process of completing the project are explained and the result of this project. All the components, equipment and software used in this project will be discussed in this chapter respectively. The analysis will cover based on the method and final result achieved. Otherwise, analysis based on all objectives and scope that had been mention before. The effectiveness of the system will focus on timing, suitability and efficiently. From the result, the capability of this medical dispenser was defined to make sure people take a medicine on time.

4.2 Hardware Development

The Figure 4.0 below shows a design of new medical dispenser according to the solenoid data and also the counter of the timer from the literature review in chapter 2 before this.

There are a few mechanisms that added to the new design to make it as an ideal medical dispenser. Without, the mechanisms, the design cannot be a reminder medical dispenser. New features of the medical dispenser can make people more comfortable and not forget to take a medicines.

Figure 4.0 Box of Dispenser

4.3 Analysis The Project

Based on the experience using the medical dispenser, the medical dispenser cannot provide the sense of time and alert people to take a medicines. It just provide the day in a week. So that, people will forget to take a medicines not with a correct dosage and time.

4.3.1 Expected Result

Based on the project and research before, we have an expected result that we have setting. Expected result for reference that will used when the project done to analyze the project. If the project does not properly run, we should do more analysis for project run same or nearest with the expected result. Table 4.0 shows the expected result that will expect the project run.

Time/ Type of Medicines	Type A (Delay,s)	Type B (Delay,s)	Type C (Delay,s)
8.00 am	10 s	10 s	10 s
2.00 pm	10 s	10 s	10 s
8.00 pm	10 s	10 s	10 s

Table 4.0 Expected Result for Medicines Dispense

The expected result above shows the time delay for every medicines dispense. The time delay expected is 10 seconds.

4.3.2 Analysis The Medical Dispenser

After done this project, we do some analysis to the project. We do some analysis for compare to the expected result that we expected. The analysis in Table 4.1 shows the analysis for 3 days.

Type	Day 1 (Delay)			Day 2 (Delay)			Day 3 (Delay)			Average
	8 am	12 pm	8 pm	8 am	12 pm	8 pm	8 am	12 pm	8 pm	
A	4 s	5 s	7 s	7 s	8 s	6 s	8 s	7 s	9 s	6.78 s
B	4 s	5 s	6 s	7 s	5 s	5 s	7 s	6 s	8 s	5.90 s
C	4 s	5 s	6 s	5 s	6 s	8 s	7 s	7 s	7s	6.33 s

Table 4.1 Result of The Project

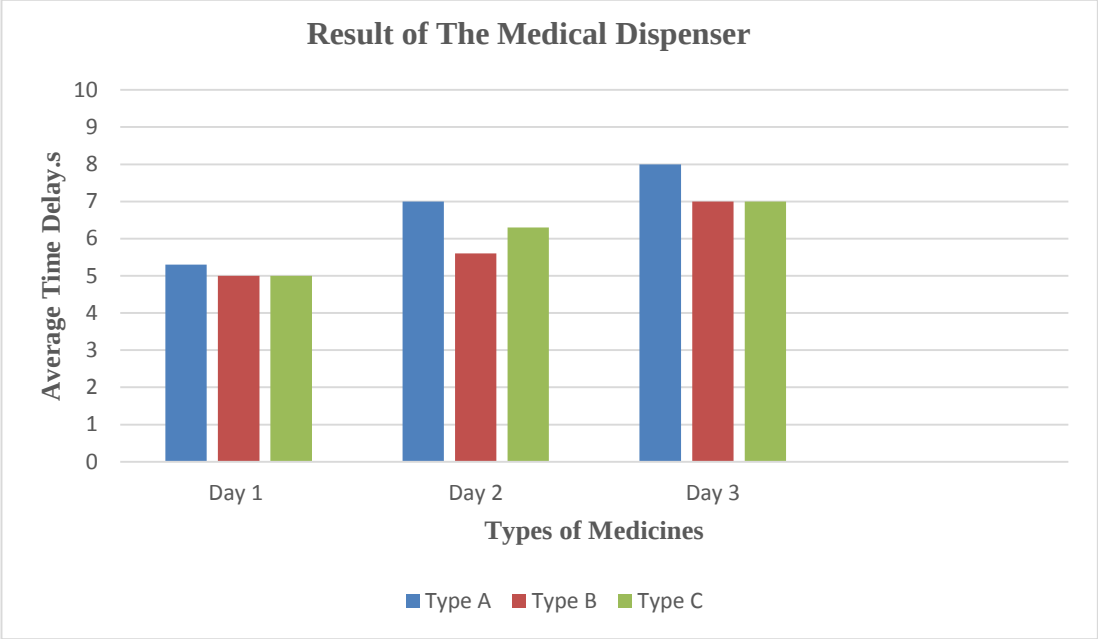

Figure 4.1 Graph of the Result Medical Dispenser

The result shows the average time delay for three types of the medical dispense is below 10 seconds. Therefore, the medical dispenser is successfully developed to aid patients with regular medication intake especially elderly. Based on the result, the system is able to dispense medicines according to its setting or expected result with minimal delay of 10 seconds.

CHAPTER 5

CONCLUSION

5.1 Introduction

This chapter will discuss about conclusion and the suggestion future work to improve the development of the system in the future. This part also discuss a little bit about limitation of this project and some idea or suggestions that can be adopted to improve this project. There are also suggestions on future work to upgraded in terms of the development of the system. It also stresses the significance and potential application from the research output.

5.2 Summary of the Project

As the conclusion, this project is focused on the design and implemented of the medical reminder system was successful. The medical dispenser was developing same like planning. There are many steps needs to be taken and planned to create a good performance of this project. Based on this final project, I could learn and understand about how to develop a medical dispenser and how importance of this project in our daily life. After this, this project should continue improve by comments from people that design for what people do well and design against what people do not do well.

This project also learned about how importance the dosage that could people take with the right time. When people take too many medicines it will effects their healthy. When they take the medicines with correct time and dosage, they can prevent their healthy correctly and live comfortable. For analyze the best time for the people take a medicine, we learned how to use RTC clock with buzzer. From that, we know how to get a better time to take a medicines.

Other than that, from this project I could learn and understand about how to use Arduino as a controller and how solenoid work. The Arduino controller as the brain and I can program to the solenoid and RTC clock. I had learned about how to connect and coding the RTC clock and solenoid with the Arduino. It tough for me to suits the solenoid with the hardware.

The communication medium of this project is by using a buzzer and RTC clock to send data. The used of the RTC clock and buzzer is to alert the human to take a medicines**.**

5.3 Achievement of Objective

This project is successfully achieved the objective as stated in the chapter 1. This project has done to develop an automated medical reminder system architecture with alert system for medicines taken prevention. RTC analysis is the method to analyze the best time to take a medicine and alert the people to take a medicine. This project perform very well during this research conduct. In this project, we successes to develop medical dispenser using a suitable solenoid to sort a medicine. It can trigger by using relay module. Relay module will trigger to pushbutton and solenoid will open to medicine go out to dispenser.

This experiment shows the effect of the RTC coding. RTC problem when they did not count the time at the LCD and Arduino coding. Finally we able to test the RTC to LCD and test the relay module to trigger the solenoid. We can find the count of the RTC and trigger the solenoid. Then, people can reminds to them to take a medicines.

5.4 Limitation

In this part, the RTC clock has a few limitation which is the time cannot count when supply off. Coding of this time very difficult to count every second of the time. It is very complicated to do this coding for this dispenser.

The largest challenge is to find the motor for the medicine dispenser. The motor for the dispenser plays a critical role to dispense the medicines and must adjust to give a very suitable hole for medicines out. When the hole to big, almost all medicines will go out. If the hole too small, the medicines cannot go out. The hole must be suitable for medicine going out from the dispenser. Design of the dispenser also should be suit for the solenoid open for the medicines. Design of hardware also must be suitable for the solenoid.

Next, the design of the hardware. Design of hardware must be suitable to put electronics part and the dispenser of the medicines. Medicines should go out properly with the correct dosses. Electronics part must be suitable with the hardware.

5.5 Future Work

Hopefully, this project will be continued in the future. Maybe, with different interest and more part will be covered such as mechanical part and electronics part. This project still need but improve the dispenser part and timer. This project has high potential to be patent and will be a part of medical dispenser that has in market today and will be using in the hospitals.

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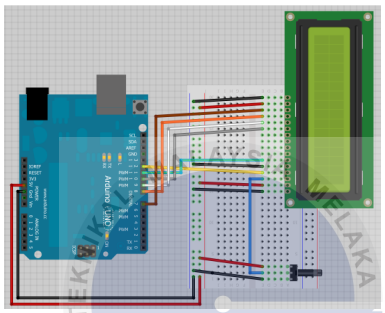
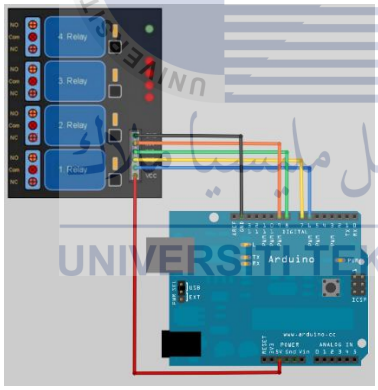
APPENDICES

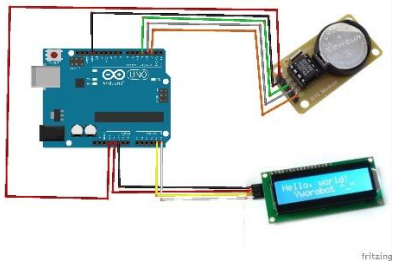
A. Connection of Components



Connection LCD



Connection Relay Module



Connection RTC Clock and LCD

B. Coding of the Circuit

Real Time Clock Code

```
#include <virtuabotixRTC.h>

// Creation of the Real Time Clock Object

//SCLK -> 6, I/O -> 7, CE -> 8

virtuabotixRTC myRTC(6, 7, 8);

void setup() {

Serial.begin(9600);

// Set the current date, and time in the following format:

// seconds, minutes, hours, day of the week, day of the month, month, year

myRTC.setDS1302Time(00, 59, 23, 6, 10, 1, 2014);

}

void loop() {

// This allows for the update of variables for time or accessing the individual elements.

myRTC.updateTime();

 ubat();

// Start printing elements as individuals

Serial.print("Current Date / Time: ");

Serial.print(myRTC.dayofmonth);

Serial.print("/");

Serial.print(myRTC.month);

Serial.print("/");
```

```
Serial.print(myRTC.year);

Serial.print(" ");

Serial.print(myRTC.hours);

Serial.print(":");

Serial.print(myRTC.minutes);

Serial.print(":");

Serial.println(myRTC.seconds);

// Delay so the program doesn't print non-stop

delay( 5000);

}

 void ubat
```

Real Circuit Code

```
#include <virtuabotixRTC.h>

#include <LiquidCrystal.h>

LiquidCrystal lcd(12, 11, 5, 4, 3, 2);

// Creation of the Real Time Clock Object

//SCLK -> 6, I/O -> 7, CE -> 8

virtuabotixRTC myRTC(6, 7, 8);

int ubat1;

int ubat2;

int ubat3;

int makanubat;


#define RELAY1 9   // Connect Digital Pin 9 on Arduino to CH1 on Relay Module

#define RELAY2 10

#define RELAY3 13

void setup() {

Serial.begin(9600);


 pinMode(RELAY1, OUTPUT);

   digitalWrite(RELAY1,LOW);

  pinMode(RELAY2, OUTPUT);

   digitalWrite(RELAY2,LOW);
```

```
  pinMode(RELAY3, OUTPUT);
    digitalWrite(RELAY3,LOW);
    lcd.begin(16, 2);
// Set the current date, and time in the following format:
// seconds, minutes, hours, day of the week, day of the month, month, year
myRTC.setDS1302Time(00, 22, 2, 6, 9, 12, 2016);
}

void loop() {
// This allows for the update of variables for time or accessing the individual elements.
myRTC.updateTime();

// Start printing elements as individuals
lcd.print("Date:");
lcd.print(myRTC.dayofmonth);
lcd.print("/");
lcd.print(myRTC.month);
lcd.print("/");
lcd.print(myRTC.year);
lcd.setCursor(0,1);
lcd.print("Time:");
lcd.print(myRTC.hours);
```

```
lcd.print(":");

lcd.print(myRTC.minutes);

lcd.print(":");

lcd.print(myRTC.seconds);


// Delay so the program doesn't print non-stop

delay(1000);

 lcd.clear();


if(((myRTC.hours) == 2) && ((myRTC.minutes) == 23) && ((myRTC.seconds) >= 10) && ((myRTC.seconds) <= 20))

 {

        delay(1000);

        digitalWrite(RELAY1, HIGH);  //motor on

        lcd.setCursor(5, 0);

       lcd.print("UBAT 1");

        delay(10000);

        lcd.clear();

 }


else if(((myRTC.hours) == 2) && ((myRTC.minutes) == 25) && ((myRTC.seconds) >= 10) && ((myRTC.seconds) <= 20))
```

```
        {
         delay(1000);
           digitalWrite(RELAY2, HIGH);  //motor on
          lcd.setCursor(5, 0);
           lcd.print("UBAT 2");
            delay(10000);
           lcd.clear();
        }

else    if(((myRTC.hours) == 2) && ((myRTC.minutes) == 27) &&
((myRTC.seconds) >= 10) && ((myRTC.seconds) <= 20))
        {
          delay(1000);
           digitalWrite(RELAY3, HIGH);  //motor on
           lcd.setCursor(5, 0);
            lcd.print("UBAT 3");
            delay(10000);
          lcd.clear();
        }

else
{
```

```
    digitalWrite(RELAY1, LOW);  //motor off
    digitalWrite(RELAY2, LOW);
    digitalWrite(RELAY3, LOW);
    lcd.clear();
}


    }
```