POLITEKNIK SULTAN SALAHUDDIN ABDUL AZIZ SHAH

PROJECT: FINAL REPORT

Project Title	AUTOMATIC MEDICINE REMINDER USING ARDUINO
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Course's Code	DEE40082
Supervisor Name	PUAN NOR KHARUL AINA BINTI MAT DIN

DECLARATION OF ORIGINALITY AND OWNERSHIP

TITLE : AUTOMATIC MEDICINE REMINDER USING ARDUINO
SESSION : 2 2021/2022

1. SITI NURSUHAILA BINTI MOHD JAFRI (08DEU20F1017)

I am a final year student of Diploma in Electronic Engineering (Medical), Department of Electrical Engineering, Politeknik Premier Sultan Salahuddin Abdul Aziz Shah, which is located Persiaran Usahawan, Politeknik Premier Sultan Salahuddin Abdul Aziz Shah, 40150 Shah Alam, Selangor.

2. I acknowledge that 'The Project above' and the intellectual property there in is the result of our original creation / creation without taking or impersonating any intellectual property from the other parties.

3. We agree to release the 'Project' intellectual property to 'The Polytechnics' to meet the requirements for awarding the Diploma in Electronic Engineering (Medical) to me.

Made and in truth that is recognized by;
a) SITI NURSUHAILA BINTI MOHD JAFRI (.....)
(Identification card No: 020527-06-0754)

In front of me, PUAN NOR KHARUL AINA BINTI MAT DIN (.....)
As a project supervisor, on the date: ……

APPROVAL PAGE FOR FINAL YEAR PROJECT

Submitted in partial full of requirements for diploma of Electronic Medical Engineering at Politeknik Premier Sultan Salahuddin Abdul Aziz Shah by :

Candidate: Siti Nursuhaila Binti Mohd Jafri

Department/Field of Concentration: Electrical Engineering Department

TITLE: Automatic Medicine Reminder Using Arduino

APPROVED:

_____ _____

Supervisor Project Signature

ACKNOWLEDGEMENTS

First and foremost, praises and thanks to the God, the Almighty, for His showers of blessings throughout my final year project to complete the project successfully.I am extremely grateful and remain indebted to my lecturer Puan Nor Kharul Aina Binti Mat Din for being a source of inspiration and for her constant support in the Design, Implementation and Evaluation of the project.

I'm also thankful for her constant constructive criticism and invaluable suggestions, which benefited me a lot while developing the project on "Automatic Medicine Reminder Using Arduino", she is very co-operative throughout this project work. Through this column, it would be my utmost pleasure to express my warm thanks for her encouragement, co-operation and consent without which I wouldn't be able to accomplish this project.

Many people, especially my classmates and lecturer, have made valuable comment suggestions on this proposal which gave me an inspiration to improve my project. I want to thank to all the people for their help directly and indirectly. I would like to express my gratitude towards my parents for their kind co-operation and encouragement which help me incompletion of this project. I would like to express my special gratitude and thank to industry persons for giving me such attention and time. My thanks and appreciations also go to our colleague in developing the project and people who have willingly helped me out with their abilities.

ABSRTACT

Researcher : Siti Nursuhaila Binti Mohd Jafri
Presentation Title : Automatic Medicine Reminder Using Arduino
Research focus : Biomedical Electronic Engineering
Studies : Politeknik Premier Sultan Salahuddin Abdul Aziz Shah
Student Level : Diploma

Abstract : Most of times patients may forget to take the medicines at proper time as per the specified in the prescription which may cause in late recovery from the disease/illness. It is necessary to take proper medicines in proper quantity at proper time. In this paper will introduce an Automatic Medicine Reminder using Arduino application for the patients. This application will remind their user to take proper medicines in proper quantity at proper time by automatically setting the reminders in the mobile. These reminders will be automatically set by the application as per the prescription. This reminder will remind their user patient that now it's time to take the medicine.

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CHAPTER 1

1.1 INTRODUCTION

Medication adherence is a growing concern throughout the healthcare industry with doctors, healthcare systems, and other stakeholders (insurance companies) since the elderly or senior patients' medication has a big issue of drugs misuse. It is very likely for them to forget to take their pills on time. Especially, those who take multiple medications at the same time. Medication management is medical treatment handled by medical therapist that aims to optimize therapeutic outcomes for patients. It is an important topic for treating the elderly who often take multiple medications simultaneously to treat different conditions and symptoms. Medications usually need to be taken in specific doses at set intervals. Missing doses or timing doses incorrectly can cause medical complications. Medication management can include everything from using devices that issue reminders to patients to take their medications to filling pill cases for patients and marking the lid of each compartment to indicate when the contents need to be taken. In this paper, we present a case study of medication reminder system that helps to alert patients who forget to take their medicines at prescribed time.

This medicine reminder is focused on patients who frequently take medications or vitamin supplements, or attendants who deal with the more seasoned or patients. Our Medicine reminder is programmable that enables medical caretakers or clients to remind to take pills, and the service times for every day. At the point when the pills time has been set, the medicine reminder will remind clients or patients to take pills utilizing sound, light and vibration. The warning of pills should be taken will be shown by an android application which is held by the patient. Contrasted and the conventional medicine reminder that requires clients or attendants to stack the crate each day or consistently. This shrewd medicine reminder would essentially discharge medical attendants or clients' weight on much of the time preloading pills for patients or clients and overlook the measurements which must be taken. The remarkable problem is that patients forget to take the proper medicines in proper proportion and in proper time.

Medication adherence, which refers to the degree or extent to which a patient takes the right medication at the right time according to a doctor's prescription, has recently emerged as a serious issue because many studies have reported that non-adherence may critically affect the patient, thereby raising medical costs. Medication non adherence is a common, complex, and costly problem that contributes to poor treatment outcomes and consumes health care resources. There can

be a lot of individuals out there who need constant help – may it be our elderly people, family members, the ones who have special needs. Elders are more affected by the timing of taking a certain drug than others, in order to prevent any dysfunction or illness timing is a must. But as with aging comes poor eye sight and poor memory, what if the patient has a dementia like Alzheimer.

Some people may forget to take the medicines at the correct time and can forget the medicines which they have to take. In order to eliminate the factors of always needed observation like nurses or taking a risk of a missed dose, we had to find an easy, portable and efficient solution. Medicine reminder already exist but most of them are either has limited use, doesn't fit for elder ages or even has a big size that makes it not suitable to take it with you anywhere. In order to make a really useful medicine reminder it had to be easily integrated with the recent sweeping smart technologies. While at the same time it had be fit for the elders and their limited knowledge and experience to implement the ease of use. Size and portability was also an important fact that we had to keep in mind. For it to be called smart, its connected through a wireless network, which enables it to be connected to the internet for future applications and integration, also its distinguished by the wide range field communication, and erase the need for any wires or wired connection which enables portability in the first place.

Through that same network its connected to the mobile phone, which with it you can set the timing interval for the dose and also notifies you by many ways when the dose time comes. Also, we added a buzzer with a LED to make a type of physical warning, so that it leaves you no choice but to remember the pill time and take it. The aim of this study is to build a Medicine Reminder. When the pill time has been set, the pillbox will remind clients or patients to take pills utilizing sound and light. The warning of pills should be taken will be shown by an android application which is held by the patient. Contrasted and the conventional pill box that requires clients or attendants to stack the crate each day or consistently. This model can aid in help elders to take their medication.

1.2 PROJECT BACKGROUND

This research introduce an application whose objective is to remind the patients of their dosage timings through buzzer ringing system so that they can stay fit and healthy. Through navigation they can search doctors and hospitals and contact details so that they can easily get proper treatment on time. This application focusses on the people who forget to take medicines on time. It allows users to set an alarm along with the fields of date, time and medicine description which will allow them to set alarm for multiple medicines at different time intervals.

The notification system will send a notification after setting an alarm. The user can activate or deactivate the notification accordingly. It will be sent message as selected by the user. The patients can search doctor disease wise and area wise which will provide easy searching facility along with doctor's contact information, visiting place and availability time. Medication reminders help in decreasing medication dispensing errors and wrong dosages. The application is designed on Eclipse. It can be helpful in defence sector and emergency conditions (accidents) and can spread health care awareness. It is life-saving, money saving and time saving application which is easy to use and provides a good user interface.

1.3 PROBLEM STATEMENT

At hospitals, there are many patients and it is difficult to remind every patient to take medicine on time. The elderly when they come to senile they were difficult on remember times they should take the medication. Most of sick people need something just like alarm to them so that they have encourage to be more alert on something. When it comes to our loved ones, we always want to stay them healthy and fit. But what will happen if they get ill and forget to take medicine on time.

1.4 PROJECT OBJECTIVE

- ✓ To study the effectiveness of the Arduino application in this project.
- ✓ To design medicine reminder using Arduino.
- ✓ To develop a suitable function for elderly that easily use and easy to carry everywhere.

1.5 SCOPE OF PROJECT

This project is specially designed for the elderly between the ages of 65-90+. It is also suitable for those with Alzheimer's problem. It is able to help remember the time to take medicine to the senile. There are those who are late in life are also encouraged to use this tool to help them be more alert. Besides, the category of patients involve all human beings-teachers, students, businessmen, housewives, children and also all of us have a busy hectic schedule. Today's life is full of responsibilities and stress. So people are prone to diseases of different types and it is our duty to make ourselves stay fit and healthy. If the patient stays at home then he or she might get someone to look after him/her but when one is no at home, is out of the city or state away from home then it is hard for the family members to call them and remind them their dosage timings every time.

1.6 PROJECT SIGNIFICANCE

This project is very important to help the elderly nowadays who are less taken care of. With the structure of this project is able to help the elderly to take medicine on time. Without this Automatic Medicine Reminder, the elderly may be neglected and unattended when they take medication. Without supervision by the young they will not take at the right time. Medication reminders serve as a good way to stay on track and uphold an appropriate schedule. Ensuring that you or your loved one is properly taking their medications can help avoid unnecessary risk and serious illness. Another option is that when set, can sound an alarm or vibrate to remind patients to take their medications. The purpose of medicines information for patients is to allow people to make informed decisions about whether a medicine is right for them and to maximum the best use of those medicines after the decision has been made to take them.

CHAPTER 2

2.1 INTRODUCTION

In this chapter is significance it will cover a research of this project and information related the investigation. This part additionally will talk about a research that comparative with this undertaking. A few article and journals have been checked on furthermore, be references to this venture since it previously done to increase a few information. This section also is about anatomy research for developing this device.

2.2 LITERATURE REVIEW PAPER 1

2.2.1 SUBTOPIC LITERATURE REVIEW TOPIC 1

Paper 1: Aisyah Rahimi Hamimi Zakri Azira Khalil Malaysian Journal of Science Health & Technology (2021

https://www.mendeley.com/cat alogue/2cc8a6fd-5a78-3765- bc46-0202c4835322

- **Titles**: Development of Automatic Reminder System for Geriatric Medicine Intake.
- **Objectives**: In this study, an automated reminder system is developed as an improved community element, acting as a system that can help geriatric in taking their medicine on time, thus, boosting their health condition.
- **Problem Statement**: Geriatrics often forget to take their medicine, and this problem can be overcome by using an automatic reminder system.
- **Methodology**: Arduino UNO as the microcontroller, with the notification system, Blink Application, a buzzer, and a light-emitting diode (LED) system. To make this reminder system more versatile, the buzzer will alarm during the medicine intake time, giving information to the elderly on which medicine to take. When the time has reached to take medication, the buzzer will produce a sound.
- **Sensor Used:** Suppose the medicine box opens after the buzzer's sound and is detected by the passive infrared sensor (PIR sensor). In that case, the caretaker will receive a notification through the Blink application that the geriatric already took medicine. On the contrary, if the medicine box is not open after 3 minutes following the buzzer's sound, which indicates that the geriatric did not take their medicine, the system will not send a notification to their

caretakers on the status. This prototype is tested on ten users for its accuracy and effectiveness. It is believed that this system can provide geriatrics more alert in taking their medicine on time, enhancing their health status.

2.2.2 SUBTOPIC LITERATURE REVIEW TOPIC 1

Paper 2: International Journal of Innovative Technology and Exploring Engineering (2019)
https://www.mendeley.com/catalogue/6a1fd506-df0a-3587-bbc7-a2f7bca90c67/

- **Titles**: GSM Controlled Automatic Medicine Remainder System
- **Objectives**:. to take their pills through both sound what's more, visual alerts, showing the medicine timings, and showing the drug name. Develop more established, they depend more vigorously upon outside help for wellbeing evaluation and medicinal consideration. The present medicinal services foundation in later society is broadly viewed as lacking to address the issues of an undeniably more established populace.
- **Problem Statement**: Our parents and grandparents are often they forget to take their medications or take overdose of it, resulting in further health deterioration.
- **Methodology**: A mechanical methodology which makes a difference individuals age set up by ceaselessly giving medicinal information. The usage of Information and Communication Technologies in the drug stores in the course of the most recent decades has involved the likelihood of utilizing robotized choice emotionally supportive networks creating cautions to push drug specialists to distinguish drug related issues while apportioning medicines [1]. The old and debilitated are regularly endorsed a few prescriptions each with shifting times, for example, measurements sums and times to be taken.
- **Sensor Used:** This system includes the DS1307 Real Time Clock RTC module, L298N motor driver. The Automated Medication Reminder System (AMRS) will altogether enhance the pill take care of by administering to five extraordinary prescriptions, cautioning the client when to take their pills through both sound what's more, visual alerts, showing the medicine timings, and showing the drug names .

2.2.3 SUBTOPIC LITERATURE REVIEW TOPIC 1

Paper 3: Abdul Minaam D, Abd-EL Fattah "Future Computing and Informatics Journal"(2018)

Smart drugs:Improving healthcare ... preview & related info | Mendeley

- **Titles**: Smart drugs, improving healthcare using Smart Pill Box for Medicine Reminder and Monitoring System.
- **Objectives**:. This medication pill box is focused on patients who frequently take medications or vitamin supplements, or attendants who deal with the more seasoned or patients. Our smart pill box is programmable that enables medical caretakers or clients to determine the pill amount and timing to take pills, and the service times for every day. Our shrewd pills box contains nine separate sub-boxes.
- **Problem Statement**: Many medical errors are due to the fact that people in charge of patient or elder's medication have to deal with sorting huge amounts of pills each day. This paper consists on the conception, design and creation of a pillbox prototype intended to solve this deficiency in the medical area as it has the ability of sorting out the pills by itself as well as many other advanced features, with this device being intended to be used by hospitals or retirement homes.
- **Methodology**: At the point when the pill time has been set, the pillbox will remind clients or patients to take pills utilizing sound and light. The warning of pills should be taken will be shown by an android application which is held by the patient. Contrasted and the conventional pill box that requires clients or attendants to stack the crate each day or consistently. Our shrewd pill box would essentially discharge medical attendants or clients' weight on much of the time preloading pills for patients or clients and overlook the measurements which must be taken.
- **Sensor Used:** It's programmable that enables medical caretakers or clients to determine the pill amount and timing to take pills, and the service times for every day.

2.3 LITERATURE REVIEW TOPIC 2

2.3.1 RESEARCH ABOUT ALZHEIMER'S DISEASE

Alzheimer's disease (AD) is a neurodegenerative disease that usually starts slowly and progressively worsens. It is the cause of 60–70% of cases of dementia. The most common early symptom is difficulty in remembering recent events. As the disease advances, symptoms can include problems with language, disorientation (including easily getting lost), mood swings, loss of motivation, self-neglect, and behavioral issues. As a person's condition declines, they often withdraw from family and society. Gradually, bodily functions are lost, ultimately leading to death. Although the speed of progression can vary, the typical life expectancy following diagnosis is three to nine years.

The cause of Alzheimer's disease is poorly understood. There are many environmental and genetic risk factors associated with its development. The strongest genetic risk factor is from an allele of APOE. Other risk factors include a history of head injury, clinical depression, and high blood pressure. The disease process is largely associated with amyloid plaques, neurofibrillary tangles, and loss of neuronal connections in the brain. A probable diagnosis is based on the history of the illness and cognitive testing with medical imaging and blood tests to rule out other possible causes. Initial symptoms are often mistaken for normal aging. Examination of brain tissue is needed for a definite diagnosis, but this can only take place after death. Good nutrition, physical activity, and engaging socially are known to be of benefit generally in aging, and these may help in reducing the risk of cognitive decline and Alzheimer's; in 2019 clinical trials were underway to look at these possibilities. There are no medications or supplements that have been shown to decrease risk.

As of 2020, there were approximately 50 million people worldwide with Alzheimer's disease.[10] It most often begins in people over 65 years of age, although up to 10% of cases are early-onset affecting those in their 30s to mid-60s. It affects about 6% of people 65 years and olde, and women more often than men. The disease is named after German psychiatrist and pathologist Alois Alzheimer, who first described it in 1906. Alzheimer's financial burden on society is large, with an estimated global annual cost of US$1 trillion. Alzheimer's disease is currently ranked as the seventh leading cause of death in the United State.

People with Alzheimer's disease often need help taking their medicines. If the person lives alone, you may need to call and remind him or her or leave notes around the home. A pillbox

allows you to put pills for each day in one place. Some pillboxes come with alarms that remind a person to take the medicines. As Alzheimer's gets worse, you will need to keep track of the person's medicines. You also will need to make sure the person takes the medicines or give the medicines to him or her. Some people with Alzheimer's take medicines to treat behavior problems such as restlessness, anxiety, depression, trouble sleeping, and aggression. Experts agree that medicines to treat behavior problems should be used only after other strategies that don't use medicine have been tried. Talk with the person's doctor about which medicines are safest and most effective. With these types of medicines, it is important to use the lowest dose possible, watch for side effects such as confusion and falls and allow the medicine a few weeks to take effect.

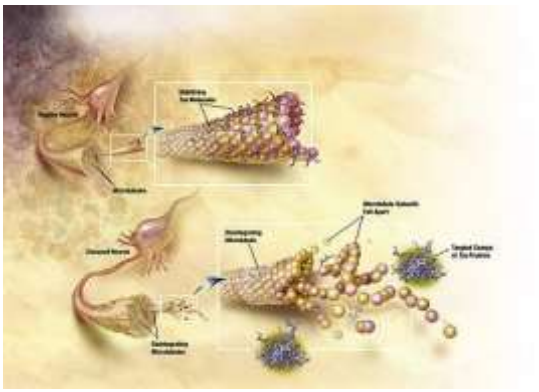

Figure 2.1 In Alzheimer's disease, changes in tau protein lead to the disintegration of microtubules in brain cells.

2.4 CHAPTER SUMMARY

This section focusing on two different section, which is one section is for gathers up all the information based on the journal which is “development of Automatic Reminder System for Geriatric Medicine Intake” about a review and about methodology of Arduino UNO as the microcontroller, with the notification system, Blink Application, a buzzer, and a light-emitting diode (LED) system. This section review both software and hardware of the project. Different components used in different journal help to differentiate which one is more suitable to use for projects. Besides, other section is for gathers up all the information based on the journal which is “GSM Controlled Automatic Medicine Remainder System” about a review and about to take their pills through both sound what's more, visual alerts, showing the medicine timings, and showing the drug name. Lastly, other section is for gathers up all the information based on the journal which is “Smart drugs, improving healthcare using Smart Pill Box for Medicine Reminder and Monitoring System” is about a review and about medication pill box that was focused on patients who frequently take medications or vitamin supplements, or attendants who deal with the more seasoned or patients. After that, the second section is research about Alzheimer’s disease to make sure that all the objectives for developing this device are relevant with fact about Automatic Medicine Reminder.

CHAPTER 3

3. METHODOLOGY

3.1 INTRODUCTION

Some patients are so occupied with their day-to-day activities that they just forget to take their medications. This is particularly true for old patients who have to take more than one medicine at more than one time in a day. Setting alarm clocks is a tedious task which patients are too lazy to set again and again. If asked about what time people have to take their medicines, many forget to answer the correct times or remember whether they have already taken the medicine in the day already. Elderly people specially face this problem because of their degrading memory and in severe cases, forget that they have already taken their prescription and retake the same medicine 2 or 3 times in the same duration. This may not be harmful for lighter medicines, but for some strong and concentrated medicines, it can have further harmful effects to the body. This is exactly where our medicine reminder system can help.

3.2 PROJECT DESIGN AND OVERVIEW

The project configuration is using a RTC DS3231 that is interfaced through I2C protocol with Arduino Uno. You can also use RTC IC DS1307 for reading the time with Arduino. RTC DS3231 also has inbuilt 32k memory which can be used to store additional data. RTC module is powered through the 3.3V pin of Arduino Uno. A 16x2 LCD display is interfaced using SPI. We have divided time slots into three modes. Mode 1 selects to take medicine once/day at 8am when user presses 1st push button. Mode 2 selects to take medicine twice/day at 8am and 8pm when user presses 2nd push button. Mode 3 selects to take medicine thrice/day at 8am, 2pm and 8pm if user presses 3rd push button. This will make this device portable because this device will be easy to use anywhere and anytime. In addition, this device is also friendly user where the device is simple and easy to use this is because the operations of this device is easy to learn by adults. After that, *"*Automatic Medicine reminder using Arduino*"* is convenient to use because the design of this device is simple and convince for other people to use it.

This project is using buzzer to remind the patients of their dosage timings through buzzer ringing system so that they can stay fit and healthy. This automatic medicine reminder using Arduino Uno for intended for semi-permanent installation in objects or exhibitions. When we set

up the date and time on the device, this application will remind their user to take proper medicines in proper quantity at proper time by automatically setting the reminders in the mobile. These

reminders will be automatically set by the application as per the prescription. Furthermore, it also have option to select three time slots (once/twice/thrice per day) and when time will reach it start alerting the patient by buzzing the buzzer.

3.2.1 BLOCK DIAGRAM OF THE PROJECT

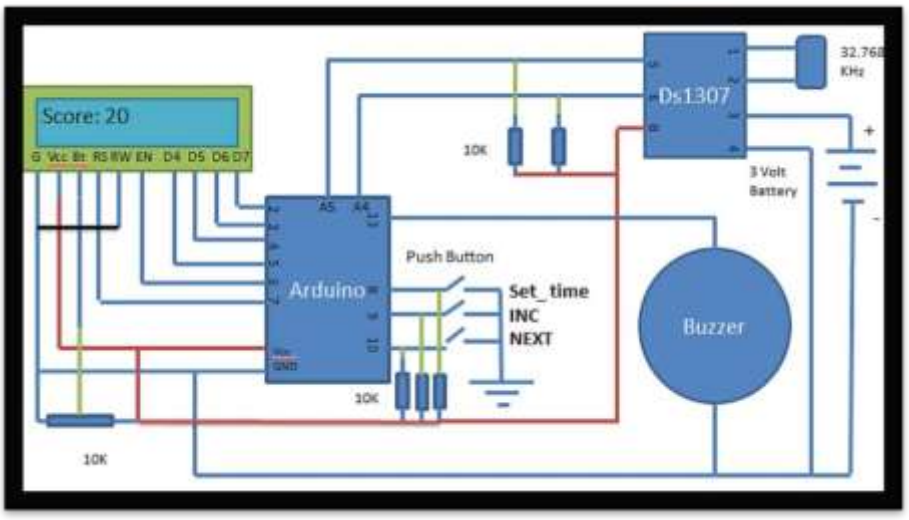

Figure 3.1 : Shows the block diagram of Automatic Medicine Reminder Using Arduino. We start this system real time clock runs the time on 16×2 LCD. And if we want to set alarm time for medication we have to press set_mad buttons which is connected with pin number 8 of arduino. After pressing this button LCD shows Set Time 1. And then we can selects the time as we want to set for medication by using INC and Next button which is connected to pin 9 and 10 respectively of arduino. After set time 1, LCD shows set Time 2. Now using previous process set the time again. And after second time set, LCD shows again set time 3. And set this time like previous. In this system “Group medicine” indication (take group 1 medicine, take group 2 medicine and take group 3 medicine) is used instead of medicine name. When any alarm occurs LCD indicates Group medicine 1, Group medicine 2, Group medicine 3.

3.2.2 FLOWCHART OF THE PROJECT

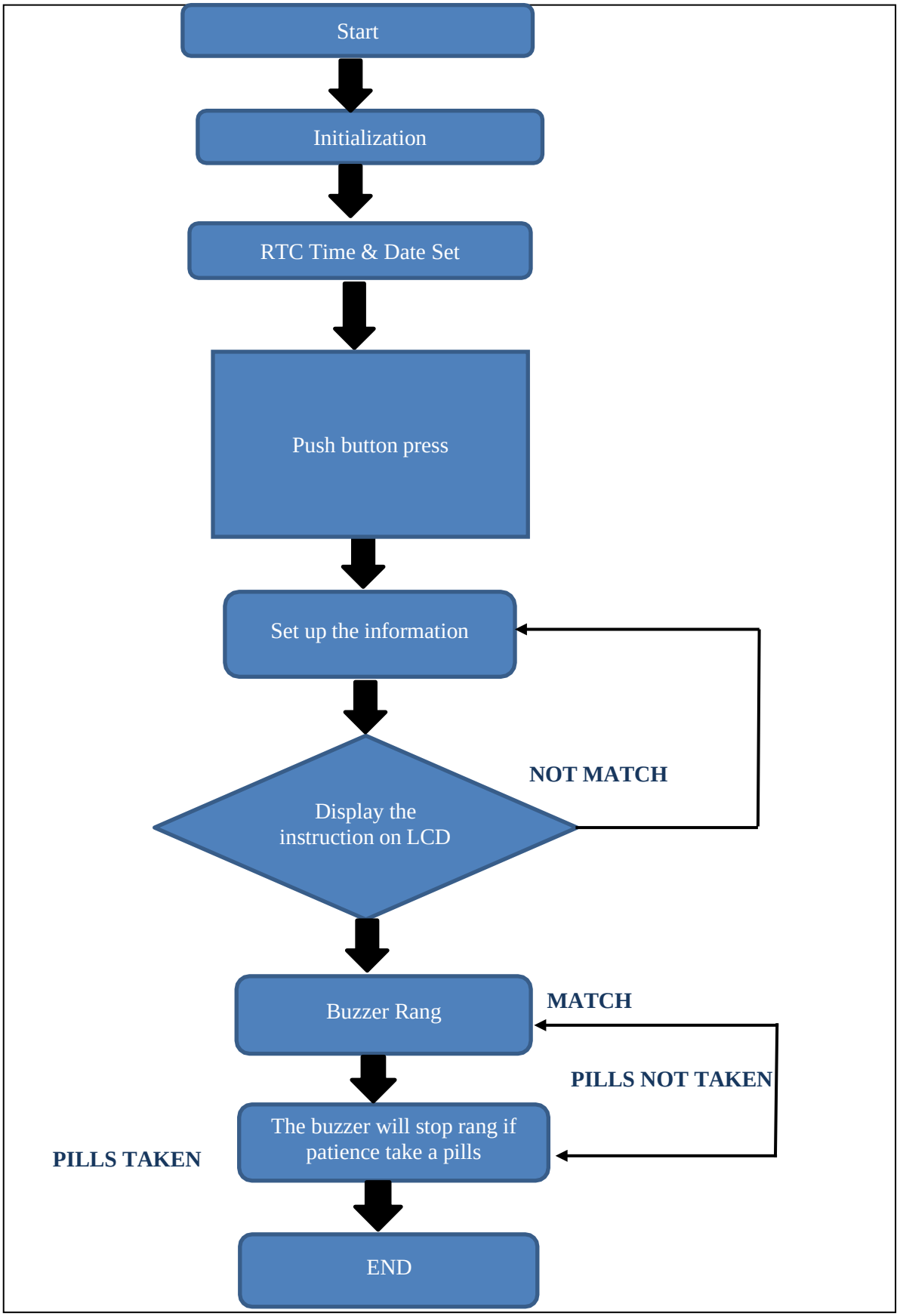

Figure 3.2 : As shown in flowchart when time & date are set through push buttons, devise will continuously compare the real time & set time. If the time is matched, LED will blink & buzzer

will ring. It then senses the box is opened by the user or not. If box is opened, LED & buzzer stops and if it is not opened, LED will continuously blinks & buzzer will continuously rings.

3.2.3 PROJECT DESCRIPTION

In this system we have used Arduino for controlling the whole system. Working of this project is very simple. In this system ds1307 real time clock chip is used for running the time accurate and to prevent the time after light failure by using 3 volt li-on battery connected with this real time clock chip at pin number 3. SDA and SCK pin of real time clock chip is directly connected with SDA and SCK pin of Arduino (A5 and A4) respectively. These two pins should be pull-up using 10K resistor.

When we start this system real time clock runs the time on 16×2 LCD. And if we want to set alarm time for medication we have to press set_mad buttons which is connected with pin number 8 of arduino. After pressing this button LCD shows Set Time 1. And then we can selects the time as we want to set for medication by using INC and Next button which is connected to pin 9 and 10 respectively of arduino. After set time 1, LCD shows set Time 2. Now using previous process set the time again. And after second time set, LCD shows again set time 3. And set this time like previous. In this system "Group medicine" indication (take group 1 medicine, take group 2 medicine and take group 3 medicine) is used instead of medicine name. When any alarm occurs LCD indicates Group medicine 1, Group medicine 2, Group medicine 3.

Medication alarm time is also feed in arduino's internal eeprom to save from lose data after light failure. And real time is continuously checked with saved Arduino's internal eeprom time. If any match occurs. LCD shows medication group name and buzzer starts beeping continuously. Buzzer is directly connected with pin number 13 of arduino for medication time indication.16×2 LCD's data pin D4, D3, D2, D2 are connected with pin5, 4, 3, 2 of arduino. And command pin RS and EN is directly connected with pin 7, 6 of arduino. RWpin of LCD is directly connected with ground.

3.3 PROJECT HARDWARE

3.3.1 SCHEMATIC CIRCUIT

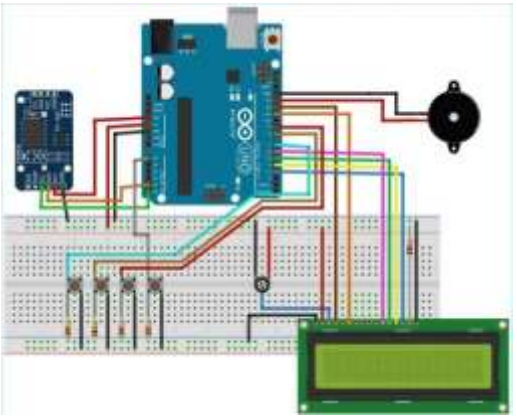

Figure 3.3: Shows the schematic circuit.

3.3.2 DESCRIPTION OF MAIN COMPONENT

1. Arduino Uno

Figure 3.4: Arduino Uno.

This project used Arduino for controlling the whole system because it's working of this project is very simple. In this system ds1307 real time clock chip is used for running the time accurate and to prevent the time after light failure by using 3 volt li-on battery connected with this real time clock chip at pin number 3. SDA and SCK pin of real time clock chip is directly connected with SDA and SCK pin of Arduino (A5 and A4) respectively. These two pins should be pull-up using 10K resistor.

2. RTC DS3231

Figure 3.5: Real Time Clock.

RTC DS3231 also has inbuilt 32k memory which can be used to store additional data. RTC module is powered through the 3.3V pin of Arduino uno. A 16x2 LCD display is interfaced using SPI. A buzzer is used to alert and remind that it's time to take medicine.

3. 16x2 LCD

Figure 3.6: LCD 12 x 6.

Display The LCD screen is set to cycle in three screens. The 1st screen shows massage as “Stay Healthy, Get Well Soon”. The second screen is a help screen which tells to press select push button to select any one time-slot to remind (once/twice/thrice in a day). The time slot is changeable in program and can be configured accordingly. Right now we have fixed this into three durations i.e. 8am, 2pm, and 8pm.

4. Buzzer

Figure 3.7: Buzzer

Along with this a buzzer rings to alert the patient. LEDs are also used to indicate from which box the medicine is to be taken. They are placed near the boxes as indicators. After one event, the LCD displays the time for the next medicine and indicates from which box it is to be taken.

3.3.3 Circuit Operation

The Pill Reminder Alarm is powered using 5V supply. When it first boots up, it shows a welcome massage as “Welcome to Circuit Digest”. The LCD screen is set to cycle in three screens. The 1st screen shows massage as “Stay Healthy, Get Well Soon”. The second screen is a help screen which tells to press select push button to select any one time-slot to remind (once/twice/thrice in a day). The time slot is changeable in program and can be configured accordingly. Right now we have fixed this into three durations i.e. 8am, 2pm, and 8pm.

We have divided time slots into three modes. Mode 1 selects to take medicine once/day at 8am when user presses 1st push button. Mode 2 selects to take medicine twice/day at 8am and 8pm when user presses 2nd push button. Mode 3 selects to take medicine thrice/day at 8am, 2pm and 8pm if user presses 3rd push button.

We can also add a feature to snooze the buzzer for 10 minutes (not included in this project). When user selects desired slots by pressing push buttons, the user input is recorded and the time is taken from RTC. When time is matched with selected time slot then the buzzer starts buzzing. User can stop the buzzer by pressing STOP button. The same process continues for the next slot reminder. Complete process is shown in the Video given at the end of this aricle.

Figure 3.8: Coding Arduino Uno. This coding put in Arduino Uno to program the Automatic Medicine Reminder to schedule time for the patient. It also for LCD to display the message.

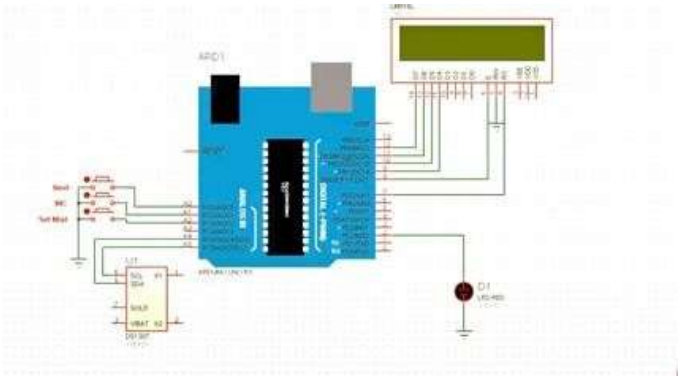

Figure 3.9: Show the circuit of simulation of project.

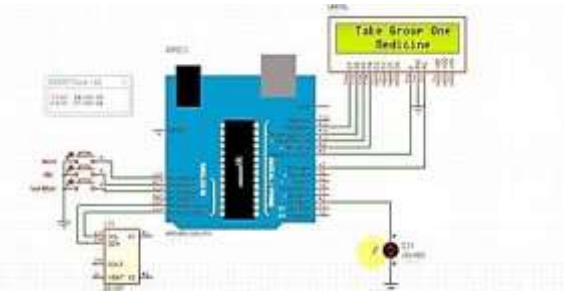

Figure 3.10: Simulation Circuit Start.

For simulation in Proteus, we use Arduino Uno, resistor 10k, LCD 12x6, ground 5V and RTC DS3231.

3.4 PROJECT SOFTWARE

3.4.1 PROTEUS 8 PROFESSIONAL SOFTWARE

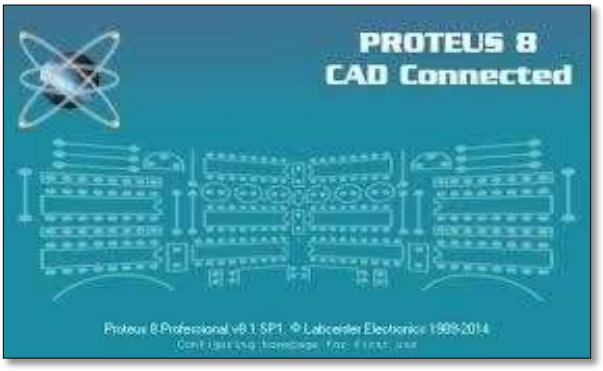

Figure 3.11: Proteus 8 Professional Software

Shows the Proteus Professional software which used to draw a schematic, PCB layout, code and evaluate the schematic. To drawing a schematic Proteus is the easier software to be used. This software also can be designing a PCB very easy

3.4.2 ARDUINO SOFTWARE

Figure 3.12: Arduino Software

Shows the Arduino Software, this product utilized a simplified version of C++ and making it simpler to learn with the program of the product. To utilize the Arduino pins, the users need to characterize which pin is being to be utilize

3.4.3 PROTEUS SOFTWARE

Figure 3.13: Tinkercad is a free-of-charge, online 3D modeling program that runs in a web browser. Since it became available in 2011 it has become a popular platform for creating models for 3D printing as well as an entry-level introduction to constructive solid geometry in schools.

3.5 Prototype Development

3.5.1 Mechanical Design/Product Layout

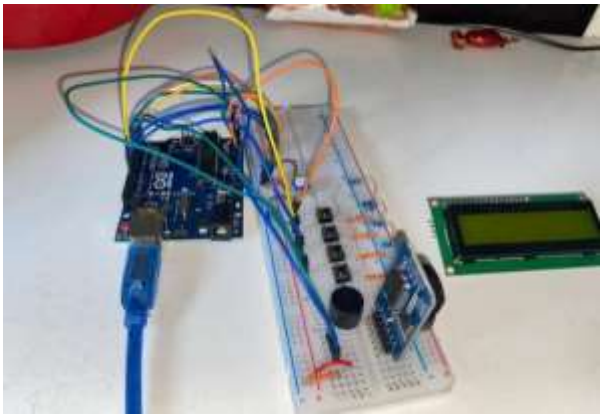

Figure 3.14 Project Prototype. Show the connection on the breadboard. This is the example for automatic medicine reminder that will be produce. It is comfortable and easy to brings anywhere.

3.4. Summary

Increasing medication adherence through a reminder system is one of the most common types of behavioural intervention: it targets and is helpful for patients who forget to take their medication unintentionally. Based on the above analysis, mobile phones, in-home electronic devices and portable devices used to communicate reminder messages have been shown to be useful in improving medication adherence and achieve a high user satisfaction, as summarised. Based on the three different types of reminder systems identified, we can see that electronic reminder technology has evolved in several parallel streams over the past 10 years. Simple text messages are now moving towards interactivity through interactive voice response messages. Mobile phone apps are also becoming increasingly popular as an effective and convenient way of dose reminding.

4 RESULTS AND DISCUSSION

4.1 Introduction

After done with our discussion and planning on our fabrication on this project 1. In this chapter 4 we have made a calculation on how ability that our product can help for those users who regularly take medicines as our target user for this product. We also have a 3-D view on our project to get your more understanding about its mechanism. Besides that each of us made an analysis on this project one of the analysis is manufacturing cost analysis we find the best and cheap price but with high quality for the material to build this project so we can save our budget and get a low cost tools with good quality.

4.2 Results and Analysis

The product that we produce is medicine reminder using arduino. The working mechanism of this special tools is starting with an adjustment on the potentiometer according to make adjustment on the lcd display and also the buzzer connection. In this Medicine Reminder Project, RTC DS3231 is interfaced through I2C protocol with Arduino Uno. RTC DS3231 also has inbuilt 32k memory which can be used to store additional data. RTC module is powered through the 3.3V pin of Arduino uno. A 16x2 LCD display is interfaced using SPI. A buzzer is used to alert and remind that it's time to take medicine. Four push buttons are used where each has distinct select feature. The first push button is used for reminding to take medicine once per day. The second push button is used to remind twice per day and the third push button is used to remind thrice per day. The fourth push button is used to stop the buzzer when user has heard the alert.

The cost of this project is RM 178.00 based on table 4.2 above there are the list of the material that we need to build this project. The minimum cost that we guess is about RM 350 to build this project but the total price for all the material to build this project is only RM 178.00 we expect it more that RM 178.00. The cost is affordable and we are able to find the material at online website such as Lazada and Shopee, the price is cheaper and the quality is very good. This makes four of us easy to buy the material and save our money because we are still students. This cost can save money and can build this medicine reminder more than one and this is one of benefits for us. we can build this project more than one and makes this project can be continue without any cost problems. We also can use the extra money to improve the project if there is a lack or problem to the project. With this cost to build this project it also can save cost of any service center out there to buy this project with this affordable cost.

4.2.1 Estimated cost

No	Material	Function	Price
1.	Arduino Uno	Easy-to-use programmable open-source microcontroller board that can be integrated into a variety of electronic projects.	RM50.00
2.	DS3231 RTC	Extremely accurate I²C real-time clock (RTC) with an integrated temperature-compensated crystal oscillator (TCXO) and crystal	RM10.00
3.	LCD 2x16	It can display 16 characters per line and there are 2 such lines	RM15.00
4.	Buzzer	An audio signaling device, which may be mechanical, electromechanical, or piezoelectric (piezo for short).	RM12.00
5.	Breadboard	Used for building temporary circuits. It is useful to designers because it allows components to be removed and replaced easily.	RM30.00
6.	Jumper	Acts as a switch by closing (or opening) an electrical circuit. Jumpers can be added or removed to change the function or performance of a PC component.	RM20.00
7.	Potentiometer	To control electrical devices such as volume controls on audio equipment.	RM8.00
8.	Pin header	This connector is widely used in PCB circuit boards in electronics, electrical appliances, and meters.	RM10.00
10.	Casing	To place the project connection inside.	RM10.00
11.	Push button	To switch something either on or off, however, there are different types of push button switches and each different type has a different function.	RM13.00
TOTAL			RM178.00

Table 4.2 show the price of the project component.

4.2.2 Gant Chart

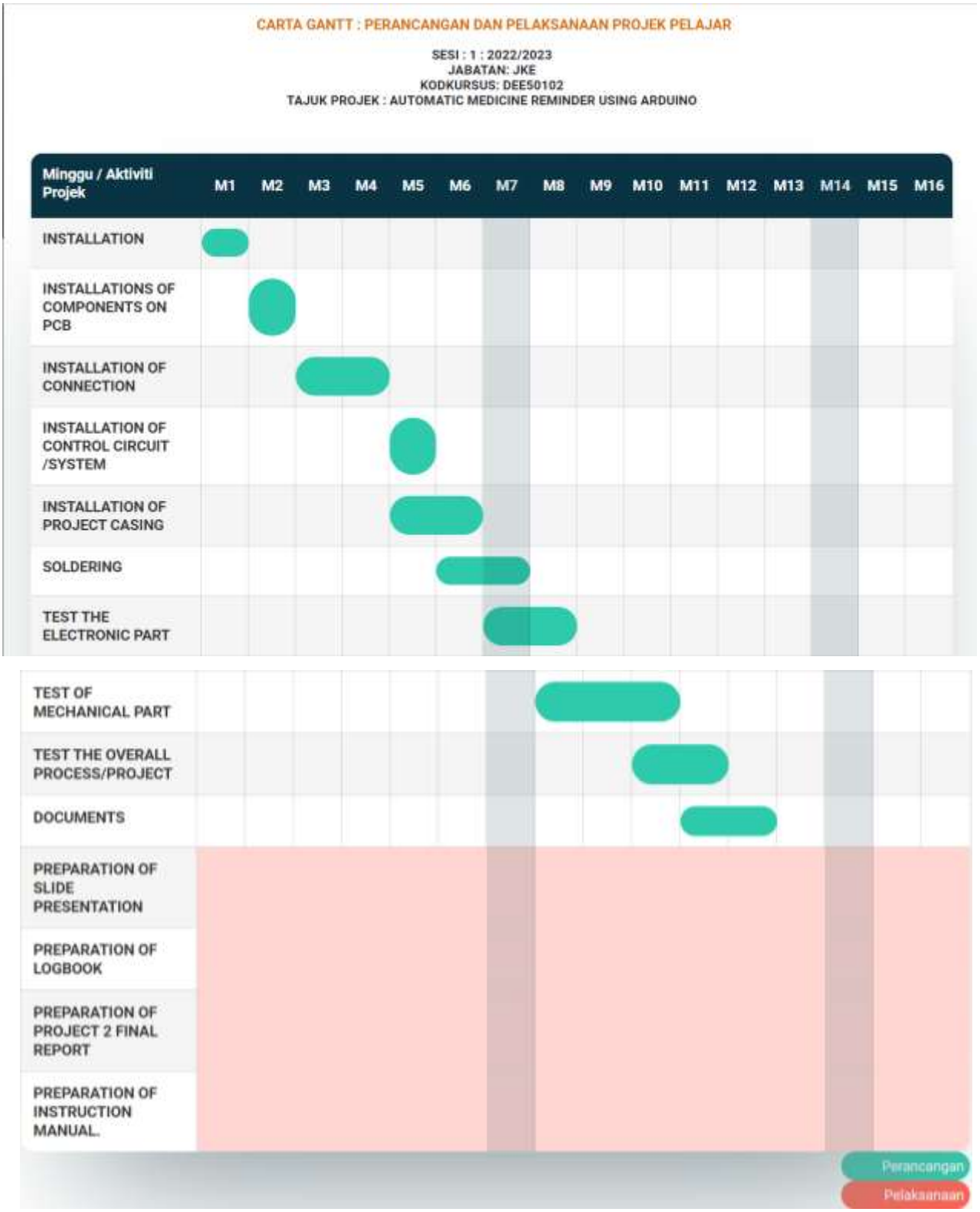

Table 4.3 show the price of the project component.

4.2.3 Advantage

1.	Cost efficient	Our product cost is affordable compare to other product available in market.
2.	User friendly	User can set time table of medicine by himself
3.	Highly reliable:	Good in quality and performance; able to be trusted for patients & old age people
4.	Provide comfort and health	Comfortable for old age people and provide healthy life for patients who are regularly take medicines.
5.	Long-Lasting	The product can be used for long time.
6.	Easy to use and manufacture	It is very easy to use and manufacture.
7.	Accurate resul	Alarm will ring at proper time which is set by user previously
8.	Easy to maintain	It need less Maintenance. It is one time investment afterwards it can be used continuously

4.3 Discussion

4.4 Chapter Summary

In this chapter 4, we have made our project as useful for the patient who needs this and all related users. We conclude result that our project is useful for those people who are taking pills regularly, prescription of medicine is very long and hard to remember for those users. Our product is so useful that it can cure those patients illness and there will no need of taking care of these types of patients so caregiver has no tension about their health and they will live healthy and tension free life.

CHAPTER 5
5.1 Introduction

Many Medication Reminder Systems have been developed on different platforms. Many of these systems require special hardware devices to remind the patients about the medicine in-take timings. Purchasing new hardware devices becomes costly and more time and money consuming. So in the given work an attempt has been made to implement a system which is economical, easily accessible and improves medication adherence. Medication non-adherence reduces the effectiveness of a treatment and imposes a financial burden on health care systems. The patients will get the schedule of medicine in-take time with medicine description, starting and ending date of medicine, notification through message or email, automatic alarm ringing system and navigation system. The scheduled reminder will not suggest any kind of medicine which is not prescribed by the doctor that will assure the safety of the patient and also will avoid wrong dosages.

Most people require medicines in their daily lives that were not available a few years ago, and the reason for this is that This means that the number of diseases is increasing. So sooner or later, many people come into contact with these diseases. Some Diseases are temporary diseases, while many are permanent life-threatening diseases. Life-threatening diseases get mixed in with the human body in such a way that they can never leave, and they grow at a rapid rate. Human life expectancy has decreased. Because of such diseases, we need to take medicines regularly and in large amounts to overcome them or live a better life. We must follow the advice of a doctor who instructs us on how to take desired pills in the desired manner so that patients do not experience problems such as forgetting them pills to take at the appropriate time, and when the doctor changes the medication prescription, patients must remember the new schedule of medicine.

This problem of forgetting to take pills at the right time, taking wrong medicines, and accidentally taking expired. Medicine causes health problems in patients, which leads to an unhealthy lifestyle. Our project is to make an Arduino-Uno-based smart medicine box, which uses a real-time clock. Our project's new and anticipated feature is that our system is intelligent enough that the patient has taken medicine or not, and thus the patient can’t postpone the time at which he needs to take pills. It is mandatory for the patient.to take pills from the box at the right time; otherwise, our systems continue to make a loud sound until the medicine is taken out from the box. This notification feature extends the patient's life, so it is not available in any device, which is the case necessity for present days.

5.2 Conclusion

Based on our product, we assume that the device helps in keeping track of regular medical activities and reduces manual supervision and human effort. With simple circuitry and effort, the simple and inexpensive device is a boon for the young and the elderly, providing a simple solution for mothers caring for their adolescents and caregivers caring for the elderly and suffering. It can find use in every household or hospital that has a medical supervision issue and can be marketed to us as a cost-effective solution. The goal of our project is to provide a healthy and tension-free life to those users who are taking pills regularly and to provide this product at an affordable cost as well. Our project is also reusable by exchanging those other medicine boxes that have only an alerting system and are non-usable or unaffordable compared to our product days.

The proposed model is easy to use and easily installed by the user. With this model anyone can guide the patient to take their medicine at the right time. We consider the system to be effective part of the remote medical care. It provides the possibility for distant supervision of patent medication. It also allowed to alert the supervisor or other persons that have access to the mobile app, which is the part of the system. Therefore, the supervisor person does not need to be in the close contact with the patient, that is they and the patient can be in different rooms.

5.3 Recommendation

If there are some elders in the home that need medication, the supervision can be done by adding a GSM module with a Bluetooth module to get alert messages directly to the respective mobile. With this model, the system can be used by the elder people who are living alone. This model has the capacity to store one day’s worth of all tablets and timings. It notifies the patient about the medication details when the time comes. He/she can just take the medicine according to the LCD display. This model can upgrade the Bluetooth connection to enable the user to get the details directly to their phone in addition to the LCD display. During system testing, patients were observed to be able to use three or four medications. Given that the user for patient. For instance, when the use of a microcontroller became limited because its capacity was three or four medication. Such situations could be avoided by inserting memory and changing the code on the microcontroller. This would entail creating a model of the code and memory that contains the information that could be transferred from one patient to another mulit-patient.

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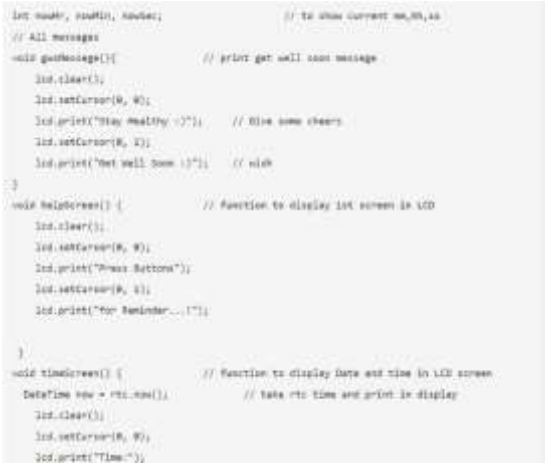
APPENDICES

Appendix 1: Program Coding

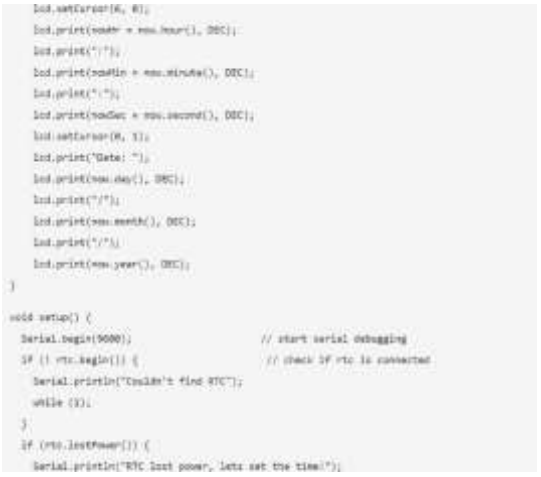
```
//Medicine Reminder using Arduino Uno
// Reminds to take medicine at 8am, 2pm, 8pm
/*  The circuit:
   LCD RS pin to digital pin 12
   LCD Enable pin to digital pin 11
   LCD D4 pin to digital pin 5
   LCD D5 pin to digital pin 4
   LCD D6 pin to digital pin 3
   LCD D7 pin to digital pin 2
   LCD R/W pin to ground
   LCD VSS pin to ground
   LCD VCC pin to 5V
   10K resistor:
   ends to +5V and ground
   wiper to LCD VO pin (pin 3)*/
#include <LiquidCrystal.h>
#include <Wire.h>
#include <RTClib.h>
#include <EEPROM.h>
int pushVal = 0;
int val;
```

```
int val;
int val2;
int addr = 0;
RTC_DS3231 rtc;
const int rs = 12, en = 11, d4 = 5, d5 = 4, d6 = 3, d7 = 2;                // lcd pins
LiquidCrystal lcd(rs, en, d4, d5, d6, d7);
#define getWellsoon 0
#define HELP_SCREEN 1
#define TIME_SCREEN 2
//bool pushPressed;                                  //flag to keep track of push button state
int pushpressed = 0;
const int ledPin =  LED_BUILTIN;                          // buzzer and led pin
int ledState = LOW;
int Signal = 0;

int Buzz = 13;
int push1state, push2state, push3state, stopinState = 0;     //
int push1Flag, push2Flag, Push3Flag = false;             // push button flags
int push1pin = 9;
int push2pin = 8;
int push3pin = 7;
int stopPin = A0;
int screens = 0;              // screen to show
```

```
int push3pin = 7;
int stopPin = A0;
int screens = 0;              // screen to show
int maxScreen = 2;            // screen count
bool isScreenChanged = true;
long previousMillis = 0;
long interval = 500;                   // buzzing interval
unsigned long currentMillis;
long previousMillisLCD = 0;    // for LCD screen update
long intervalLCD = 2000;          // Screen cycling interval
unsigned long currentMillisLCD;
//   Set Reminder Change Time
int buzz8amHH = 8;          //    HH - hours         ##Set these for reminder time in 24hr
int buzz8amMM = 00;          //    MM - Minute
int buzz8amSS = 00;          //    SS - Seconds
int buzz2pmHH = 14;          //    HH - hours
int buzz2pmMM = 00;          //    MM - Minute
int buzz2pmSS = 00;          //    SS - Seconds
int buzz8pmHH = 20;          //    HH - hours
int buzz8pmMM = 00;          //    MM - Minute
int buzz8pmSS = 00;          //    SS - Seconds
```

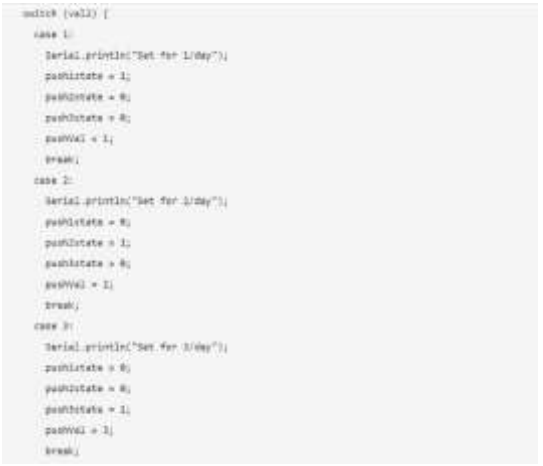


```
int nowHr, nowMin, nowSec;                  // to show current hm,Mn,ss
// All messages
void goodMessage(){             // print get well soon message
    lcd.clear();
    lcd.setCursor(0, 0);
    lcd.print("Stay Healthy :)");     // Give some cheers
    lcd.setCursor(0, 1);
    lcd.print("Get well Soon :)");    // wish
}
void HelpScreen() {             // Function to display 1st screen in LCD
    lcd.clear();
    lcd.setCursor(0, 0);
    lcd.print("Press Buttons");
    lcd.setCursor(0, 1);
    lcd.print("for Reminder...!");

 }
void timeScreen() {             // Function to display Date and time in LCD screen
  DateTime now = rtc.now();           // take rtc time and print in display
    lcd.clear();
    lcd.setCursor(0, 0);
    lcd.print("Time:");
```



```
    lcd.setCursor(6, 0);
    lcd.print(nowHr = now.hour(), DEC);
    lcd.print(":");
    lcd.print(nowMin = now.minute(), DEC);
    lcd.print(":");
    lcd.print(nowSec = now.second(), DEC);
    lcd.setCursor(0, 1);
    lcd.print("Date: ");
    lcd.print(now.day(), DEC);
    lcd.print("/");
    lcd.print(now.month(), DEC);
    lcd.print("/");
    lcd.print(now.year(), DEC);
}

void setup() {
  Serial.begin(9600);                   // start serial debugging
  if (! rtc.begin()) {                  // check if rtc is connected
    Serial.println("Couldn't find RTC");
    while (1);
  }
  if (rtc.lostPower()) {
    Serial.println("RTC lost power, lets set the time!");
```

```
    Serial.println("RTC lost power, lets set the time!");
  }
//    rtc.adjust(DateTime(F(__DATE__), F(__TIME__)));          // uncomment this to set th
  rtc.adjust(DateTime(2019, 1, 18, 7, 58, 30));             // manual time set
  lcd.begin(16, 2);
  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print("Welcome To");                                  // print a message at starti
  lcd.setCursor(0, 1);
  lcd.print("Circuit Digest");
  delay(1000);
  pinMode(pushpin, INPUT);                                  // define push button pins to
  pinMode(pushpin, INPUT);
  pinMode(pushpin, INPUT);
  pinMode(stopPin, INPUT);
  pinMode(ledPin, OUTPUT);
  delay(200);
  Serial.println(EEPROM.read(addr));
  val2 = EEPROM.read(addr);                         // read previously saved value of push b
  switch (val2) {
    case 1:
```



```
  switch (val1) {
    case 1:
      Serial.println("Set for 1/day");
      push1state = 1;
      push2state = 0;
      push3state = 0;
      pushVal = 1;
      break;
    case 2:
      Serial.println("Set for 2/day");
      push1state = 0;
      push2state = 1;
      push3state = 0;
      pushVal = 2;
      break;
    case 3:
      Serial.println("Set for 3/day");
      push1state = 0;
      push2state = 0;
      push3state = 1;
      pushVal = 3;
      break;
```

```
      break;
  }
}
void loop() {
  push1();                                  //call to set once/day
  push2();                                  //call to set twice/day
  push3();                                  //call to set thrice/day
    if (pushVal == 1) {                     // if push button 1 pressed then re
    at8am();                                //function to start using at 8am
  }
  else if (pushVal == 2) {                  // if push button 1 pressed then re
    at8am();
    at8pm();                                //function to start using at 8am
  }
  else if (pushVal == 3) {                  // if push button 1 pressed then re
    at8am();
    at2pm();                                 //function to start using at 8am
    at8pm();
  }

  currentMillisLCD = millis();              // start millis for LCD screen swit
```

```
  }
  else if (pushVal == 3) {                  // if push button 3 pressed then resi
    at8am();
    at2pm();                                //function to start using at 8am
    at8pm();
  }

  currentMillisLCD = millis();              // start millis for LCD screen switch
  push1state = digitalRead(push1pin);       // start reading all push button pins
  push2state = digitalRead(push2pin);
  push3state = digitalRead(push3pin);
  stop1state = digitalRead(stopPin);

  stopPins();                                // call to stop buzzing
  changeScreen();                            // screen cycle function
}
// push buttons
void push1() {                // function to set reminder once/day
  if (push1state == 1) {
    push1state = 0;
    push2state = 0;
    push3state = 0;
```

```
    push1state = 0;
    push2state = 0;
//    pushPressed = true;
    EEPROM.write(addr, 1);
    Serial.print("Push1 written : "); Serial.println(EEPROM.read(addr));  // for debugging
    pushVal = 1;                                          //save the state of push butto
    lcd.clear();
    lcd.setCursor(0, 0);
    lcd.print("Reminder set ");
    lcd.setCursor(0, 1);
    lcd.print("for Once/day !");
    delay(1200);
    lcd.clear();
  }
}
void push2() {                    //Function to set reminder twice/day
  if (push2state == 1) {
    push1state = 0;
    push3state = 0;
    push4state = 0;
//    pushPressed = true;
    EEPROM.write(addr, 2);
```

```
    Serial.print("Push2 written : "); Serial.println(EEPROM.read(addr));
    pushVal = 2;
    lcd.clear();
    lcd.setCursor(0, 0);
    lcd.print("Reminder set ");
    lcd.setCursor(0, 1);
    lcd.print("for Twice/day !");
    delay(1200);
    lcd.clear();
  }
}
void push3() {                  //Function to set reminder thrice/day
  if (push3state == 1) {
    push1state = 0;
    push2state = 0;
    push4state = 0;
//    pushPressed = true;
    EEPROM.write(addr, 3);
    Serial.print("Push3 written : "); Serial.println(EEPROM.read(addr));
    pushVal = 3;
    lcd.clear();
```

```
    lcd.setCursor(0, 0);
    lcd.print("Reminder set ");
    lcd.setCursor(0, 1);
    lcd.print("for Thrice/day !");
    delay(1200);
    lcd.clear();
  }
}
void stopPins() {                 //Function to stop buzzing when user pushes stop push b
  if (stopinState == 1) {
//    stopinState = 0;
//    pushPressed = true;
    pushpressed = 1;
    lcd.clear();
    lcd.setCursor(0, 0);
    lcd.print("Take medicine  ");
    lcd.setCursor(0, 1);
    lcd.print("with Warm Water");
    delay(1200);
    lcd.clear();
  }
}
```

```
}
//Screen Cycling
void changeScreen() {                //function for Screen Cycling
  // Start switching screen every defined intervalLCD
  if (currentMillisLCD - previousMillisLCD > intervalLCD)           // save the last time
  {
    previousMillisLCD = currentMillisLCD;
    screens++;
    if (screens > maxScreen) {
      screens = 0;  // all screens over -> start from 1st
    }
    isScreenChanged = true;
  }
  // Start displaying current screen
  if (isScreenChanged)   // only update the screen if the screen is changed.
  {
    isScreenChanged = false; // reset for next iteration
    switch (screens)
    {
```