POLITEKNIK SULTAN SALAHUDDIN ABDUL AZIZ SHAH

PROJECT: FINAL PROPOSAL

Project Title	SMART HEALTHY CHAIR WITH IOT
Student Name	ABDUL HAKIM BIN KAHARUDDIN
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

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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) ABDUL HAKIM BIN KAHARUDDIN (..)
(Identification card No: 021118-10-1425)

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: ABDUL HAKIM BIN KAHARUDDIN

Department/Field of Concentration: Electrical Engineering Department

TITLE: Smart Healthy Chair With Iot

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 "Smart Healthy Chair With Iot",she is very co-operative throughout this project work. Through this column, it would be my utmostpleasure 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 **:** Abdul Hakim Bin Kaharuddin

Presentation Title : Smart Healthy Chair With Iot

Research focus **:** Biomedical Electronic Engineering

Studies **:** Politeknik Premier Sultan Salahuddin Abdul Aziz Shah

Student Level **:** Diploma

Abstract **:** Sitting is a common behavior of human body in daily life. It is found that poor sitting postures can link to pains and other complications for people in literature. In order to avoid the adverse effects of poor sitting behavior, we have developed a highly practical design of smart chair system in this paper, which is able to monitor the sitting behavior of human body accurately and non-invasively. The pressure patterns of eight standardized sitting postures of human subjects were acquired and transmitted to the computer for the automatic sitting posture recognition with the application of artificial neural network classifier. The experimental results showed that it can recognize eight sitting postures of human subjects with high accuracy. The sitting posture monitoring in the developed smart chair system can help or promote people to achieve and maintain healthy sitting behavior, and prevent or reduce the chronic disease caused by poor sitting behavior. These promising results suggested that the presented system is feasible for sitting behavior monitoring, which can find applications in many areas including healthcare services, human-computer interactions and intelligent environment.

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CHAPTER 1

1.1 INTRODUCTION

Sitting is one of the most commonly adopted postures of human being in daily life. People spend a long time on sitting in an office chair, car seat or lounge chair. The sitting behavior analysis becomes an important research topic recently in a variety of domains, such as biomedical engineering, public healthcare service and facility design. It has been suggested that poor sitting behaviour can cause a threat to human body by linking to various pains and other complications . Previous studies have showed that some common sitting postures of human body can lead to lumbar flexion and higher compressive forces in lumbar joints

In order to avoid the adverse effects of poor sitting behavior, the real-time monitoring of sitting posture has received particular attention and was used as a promising method in recent years. Research studies have been conducted using the pressure distribution measurement sheets placed on the seat pan and backrest to provide high resolution pressure data for posture recognition. It used principal component analysis to solve the problem of sitting posture classification. investigated the classification algorithms and found that Fisher-Rao's discriminant analysis can be applied for the application of sitting posture classification. Proposed a low-cost solution with reduced sensors to detect sitting postures by a near optimal sensor placement strategy with a classifier based on logistic regression. designed a textile-based sensing system for sitting posture monitoring and proposed an optimized strategy to compensate the signal to improve the classification accuracy.

Most of the research studies in literature showed great concern for static sitting postures. The long term goal of our project is to develop a monitoring system for both static and dynamic sitting postures with an interactive ergonomic chair. As a preliminary study, this paper focused on building a smart chair system for the classification of eight static standardized sitting postures using artificial neural network (ANN), which can be easily implemented for further improvement. The smart chair can be used for the monitoring of user's sitting postures and promote the user to improve sitting behavior.

The smart chair system developed in this study was constituted by pressure sensor array, data acquisition module and computational terminal. A 52 by 44 piezo-resistive sensor array shown in Figure 1 was used, with a thickness of 0.25mm, which is thin and flexible enough for the non-invasive application in this study. The sensor array was composed of two layers of polyester films, with the horizontal silver electrode strips and the other vertical on one layer. This orthogonal zebra pattern resulted in a network of silver strips with a resistive unit at each crossing of the sensor array. The resistive unit (circuit shown in Figure 1) is sensitive to pressure, with a resistance of more than 2MΩ at zero load and around 5KΩ at full load. For simplicity and efficiency, not all these 2288 sensing units were adopted, but 64 (8 by 8) evenly distributed sensing units in the sensor array were selected in this study to measure the pressure pattern at the body-seat interface, with each sensing unit around 4.5mm apart from the other.

1.1 PROJECT BACKGROUND

This research introduces an application whose objective is to ensure that the user sits in the correct body position when doing a job for a long period of time. patients about timing their doses through a buzzer ringing system so they can stay fit and healthy.. This app focuses on people who often sit for long periods of time. It allows users to set alarms along with date, time and medication description fields that allow them to set alarms ,they can set the program by using the apps that have been installed on their phone.

The The notification system will send a notification after the user's body position is not sitting in the correct position. Users can enable or disable notifications accordingly. It will send a message as selected by the user.

1.1 PROBLEM STATEMENT

- Nowadays, spinal diseases are increasing among the elderly in our country, this is because most of them sit in the wrong position when doing a job and because of that has resulted in them getting slip disc disease, with this Smart Healthy Chair can help the elderly to avoid getting slip disc disease.

1.2 PROJECT OBJECTIVE

- ✓ To prevent young people from getting Slipped disc disease.
- ✓ To study about slipped disc disease and the causes of why it occurs.
- ✓ To add Iot application to this design.

1.3 SCOPE OF PROJECT

This This project is specially designed for everyone, especially those aged between 25-50+. It is also suitable for those with spinal problems. It is able to help to always keep sitting in that position. That's right. Some people who sit for long periods of time are also encouraged to use this tool to help them become more alert. In addition, the patient category involves all human beings — teachers, students, businessmen, housewives, children and also we all have tight schedules. Life today is full of responsibilities and stress. Therefore, people are prone to various diseases and it is our duty to keep ourselves fit and healthy. By sitting in the correct body position and posture, can prevent us from getting other diseases, such as spinal diseases and slip discs, so take care of your posture so that life is healthier.

1.4 PROJECT SIGNIFICANCE

- This project is very important to help young and old who work in a sitting position like in an office. With the structure of this project is able to help reduce the risk of young people getting spinal diseases. Without Smart Healthy Chairs, young people may be neglected and not sit in the correct body position and this will result in long term illness. The Smart Chair serves as the best way to keep the body posture always in the right condition and able to avoid getting spinal diseases.

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: Gelaw THagos M

- https://www.mendeley.com/catalogue/7ff8d9ca-e821-361e-a579-4dd7c97fa98a/

- **Titles**: Posture Prediction for Healthy Sitting Using a Smart Chair
- **Objectives**: The aim of this study is to build Machine Learning models for classifying sitting posture of a person by analyzing data collected from a chair platted with two 32 by 32 pressure sensors at its seat and backrest.
- **Problem Statement**: The aim of this study is to build Machine Learning models for classifying sitting posture of a person by analyzing data collected from a chair platted with two 32 by 32 pressure sensors at its seat and backrest
- **Methodology**: Poor sitting habits have been identified as a risk factor to musculoskeletal disorders and lower back pain especially on the elderly, disabled people, and office workers. In the current computerized world, even while involved in leisure or work activity, people tend to spend most of their days sitting at computer desks.
- **Sensor Used:**

Models were built using five algorithms: Random Forest (RF), Gaussian Naïve Bayes, Logistic Regression, Support Vector Machine and Deep Neural Network (DNN).

2.2.2 SUBTOPIC LITERATURE REVIEW TOPIC 1

Paper 2: Huang MGibson IYang R

KnE Engineering (2017) 2(2) 274

https://www.mendeley.com/catalogue/87f07650-3128-3d94-87d2-0ef865ce7379/

- **Titles**: Smart Chair for Monitoring of Sitting Behavior
- **Objectives**:. Sitting is a common behavior of human body in daily life. It is found that poor sitting postures can link to pains and other complications for people in literature.
- **Problem Statement**: In order to avoid the adverse effects of poor sitting behavior, we have developed a highly practical design of smart chair system in this paper, which is able to monitor the sitting behavior of human body accurately and non-invasively.
- **Methodology**: Th In order to avoid the adverse effects of poor sitting behavior, the real-time monitoring of sitting posture has received particular attention and was used as a promising How to cite this article: Mengjie Huang, Ian Gibson, and Rui Yang, (2017), "Smart Chair for Monitoring of Sitting Behavior," in The International Conference on Design and Technology, KEG, pages 274–280. DOI 10.18502/keg.v2i2.626 Page 274 DesTech Conference Proceedings method in recent years
- **Sensor Used: The smart chair system developed in this study was constituted by pressure sensor array, data acquisition module and computational terminal. A 52 by 44 piezo-resistive sensor array shown in Figure 1 was used, with a thickness of 0.25mm, which is thin and flexible enough for the non-invasive application in this study. The sensor array was composed of two layers of polyester films, with the horizontal silver electrode strips and the other vertical on one layer**

2.2.3 SUBTOPIC LITERATURE REVIEW TOPIC 1

Paper 3: Ma CLi WGravina R et al.See more
IEEE Systems, Man, and Cybernetics Magazine (2020) 6(4) 6-14

https://www.mendeley.com/catalogue/d439af34-ae6b-3f22-96a7-d63de10e8322/

- **Titles**: Smart Cushion-Based Activity Recognition: Prompting Users to Maintain a Healthy Seated Posture
- **Objectives**:. To prompt users to maintain healthy sitting posture and to encourage them to have a short break after prolonged sitting, several studies focus on the detection, monitoring, and analysis of sitting postures.
- **Problem Statement**: In the emerging wearable world, a plethora of smart devices are being designed to facilitate our daily life. More activities, such as student learning, desk office work, or driving are requiring human beings to spend a significant portion of their daily life sitting on a chair. As a result, there is increasing interest in the development of technologies that monitor and support seated users.
- **Methodology**: The smart cushion, in particular, is a very promising device in this context because it is noninvasive and can be conveniently deployed on the seat or backrest, making an ordinary chair, sofa, or even a car seat suddenly smart. This article reviews our previous research studies and the results related to sitting posture recognition using the smart cushion.
- **Sensor Used: It is programmable which allows the user or customer to specify the correct number of seats and the correct number of seats.**

2.3 LITERATURE REVIEW TOPIC 2

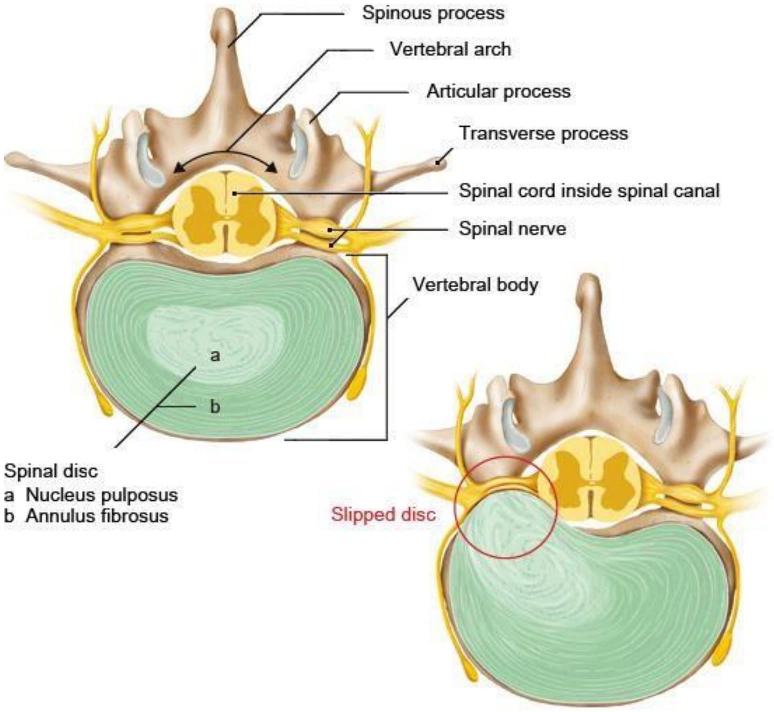
2.3.1 Research about Slipped Disc Disease.

Many people have back pain that keeps on returning. Usually it is hard to say what the exact cause is. But if you have pain that radiates down your leg and into your foot, it may be a sign of a slipped spinal disc, or "herniated disc."The spinal discs are found between the vertebrae bones in the spine. They have an elastic casing made of cartilage and a gel-like center (nucleus pulposus). A slipped disc occurs if the spinal disc tissue pushes out, or "herniates," between the vertebrae. This herniated tissue may put pressure on the spinal nerves and irritate them.A slipped disc can be very unpleasant. But the good news is that the symptoms usually go away on their own within lessthan six weeks in most people with this problem. And not every slipped disc is painful.

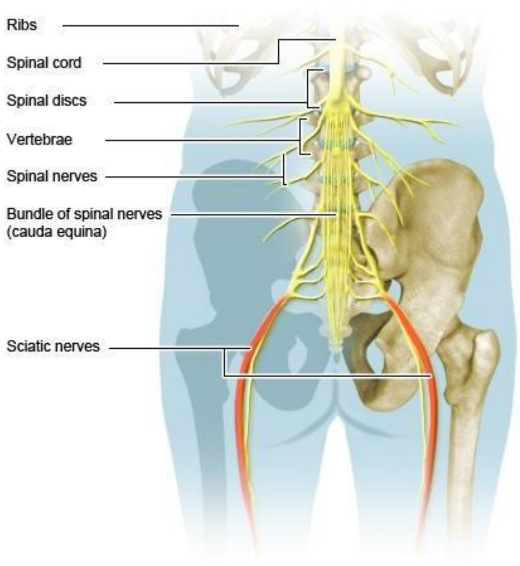
A slipped disc can cause very sudden and severe shooting pain. If it occurs in the neck area, the pain might radiate into the arms. Slipped discs in the lumbar (lower back) region are the main cause of sciatica. Sciatica is pain that radiates down one leg and into the foot. As well as the typical radiating pain, a slipped disc can also lead to pain in the low back region.In rare cases, numbness in the buttocks or signs of paralysis may develop in addition to the pain. These symptoms are signs of a more serious problem, like nerve damage. If it affects the function of the bladder or bowel, immediate treatment is needed. That is called "cauda equina syndrome" (CES), and is a medical emergency.But a slipped disc doesn't always lead to noticeable symptoms. This can be seen in studies in which adults who didn't have back pain were examined using magnetic resonance imaging (MRI): More than 50 out of 100 of them had a bulging (herniated) spinal disc. About 20 out of 100 had a spinal disc that was already quite damaged or even had tissue coming out of it, without causing any symptoms.

As of 2020, In most people, slipped discs are the result of wear and tear. Over the years, the spinal discs lose their elasticity: Fluid leaks out of them and they become brittle and cracked. These changes are a normal part of the aging process – which varies from person to person, though. Very rarely, an accident or severe injury might also cause damage to a spinal disc and leave it herniated.

Spinal discs act as shock absorbers between the vertebrae in our spine. If a spinal disc is no longer able to bear the strain, it can result in a slipped disc. The associated pain probably arises when part of the spinal disc pushes against a nerve in the spinal cord



When herniated disc tissue irritates a nerve root in the region of the lumbar spine (lower back), it often causes typical sciatic pain. The nerves that run through the spinal canal connect to the sciatic nerve at the pelvis. The sciatic nerve then runs down the legs. As well as being painful, an irritated sciatic nerve can also cause pins and needles and numbness.



Doctors categorize slipped discs by severity:

Prolapse: The disc bulges out between the vertebrae, but its outermost layer is still intact.
Extrusion: There is a tear in the outermost layer of the spinal disc, causing spinal disc tissue to spill out. But the tissue that has come out is still connected to the disc.
Sequestration: Spinal disc tissue has entered the spinal canal and is no longer directly attached to the disc.
These categories reveal little about what symptoms occur or how severe they might be. But knowing what type of slipped disc someone has is important for the choice of treatment and understanding how the condition might go on to develop.

It is estimated that 1 to 5% of all people will have back pain caused by a slipped disc at some point in their lives. Slipped discs are more common in people over the age of 30, and are about twice as common in men as they are in women.

Pain and restricted movement caused by a slipped disc subside on their own within six weeks in about 90 out of 100 people with this problem. It is believed that, over time, the body gets rid of part of the prolapsed tissue or that it shifts position so that the nerves aren't irritated anymore.

A painful slipped disc can go on to develop in very different ways: The pain can start very suddenly, and then disappear again very quickly. Some people have permanent pain that lasts a long time, while others have it again and again.

If the symptoms last longer than six weeks, it is unlikely that they will go away on their own.

2.4 CHAPTER SUMMARY

This section focuses on two different sections, one section is to collect all the information based on the journal namely “Development of Smart Healthy Chair about review and about Arduino UNO methodology as microcontroller, with notification system, Blink Application, buzzer, and sensor, This section review both software and hardware of the project.The different components used in different journals help to distinguish which one is more suitable to be used for the project.In addition, the other part is to collect all the information based on the journal i.e. “GSM Smart Healthy Chair System” about review and whether they will go through both sounds what else, visual warnings, show medication time and show how many marks they sit in the correct position within a week. Finally, the other part is to gather all the information based on the journal i.e. “Smart Chairs.

CHAPTER 3

3. METHODOLOGY

3.1 INTRODUCTION

Some people are so busy with their daily activity work that they forget to sit in the right position when doing work. This is due to being too busy and working hours being too long for them to forget, especially for employees who are constantly working in a sitting room like an office. Setting an alarm clock is a tedious task for which the patient is too lazy to set it over and over again.

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 anywhereand anytime. In addition, this device is also friendly user where the device is simple and easy to usethis 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.

The project uses sensors and arduinos to remind patients of their body sitting position .dose through a buzzer ringing system so they can stay fit and healthy. This automated medical reminder uses the Arduino Uno for semi -permanent installation in objects or displays. When we set the date and time on the device, the app will remind the user via a notification on their phone so as to always sit in the correct position.

These reminders will be set automatically by the app according to the prescription. Furthermore, it also has the option to select three time slots (once/twice/three times a day) and when the time will arrive, start notifying the patient by sounding the buzzer and sending a notification on the phone.

3.2.1 BLOCK DIAGRAM OF THE PROJECT

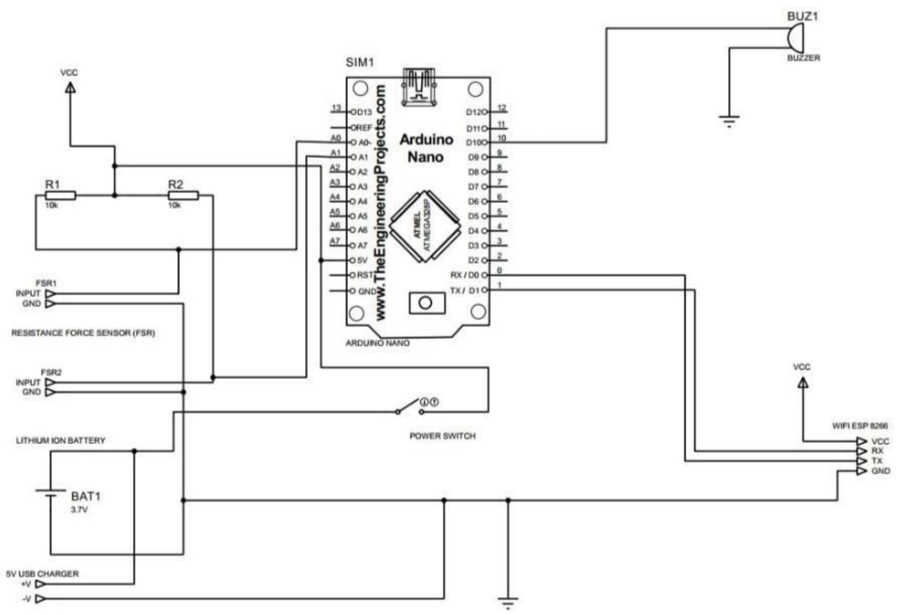
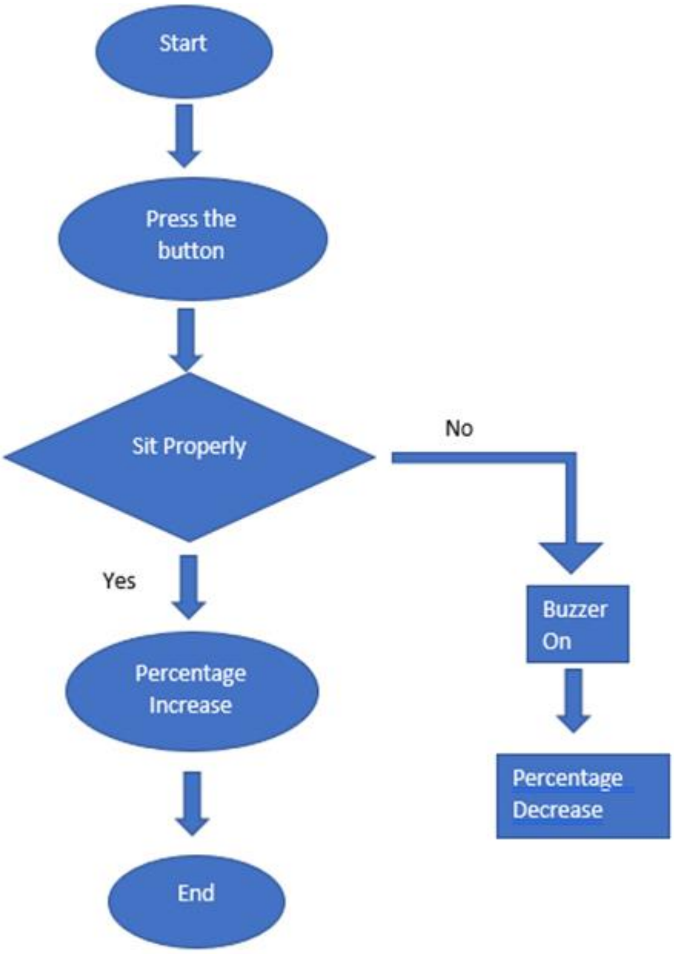


Figure 3.1 : Shows the block diagram of Smart Healthy Chair .

3.2.2 FLOWCHART OF THE PROJECT



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

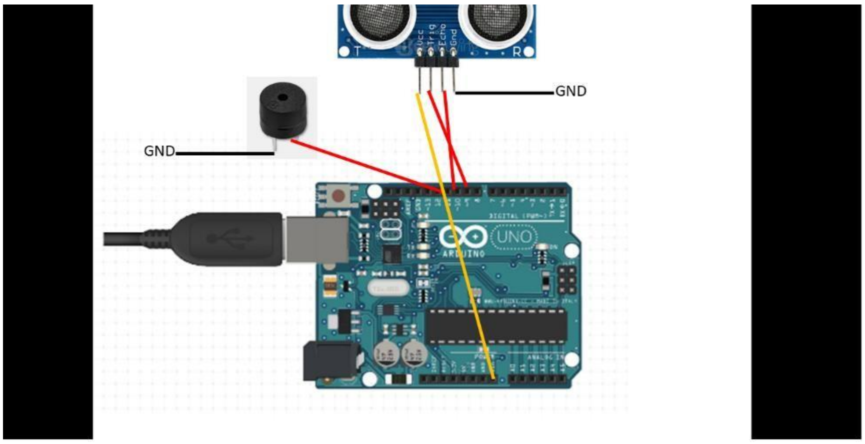


Figure 3.3: Shows the schematic circuit.

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. Ultrasonic sensor-HC-SR04(generic)

Figure 3.6: Ultrasonic sensor-HC-SR04

The HC-SR04 ultrasonic sensor uses SONAR to determine the distance of an object just like the bats do. It offers excellent non-contact range detection with high accuracy and stable readings in an easy-to-use package from 2 cm to 400 cm or 1” to 13 feet.

3.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

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

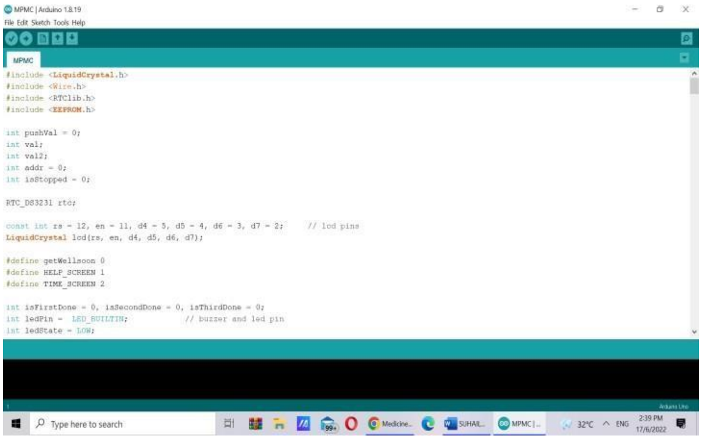


Figure 3.8: Coding Arduino Uno. This coding put in Arduino Uno to program the Smart Healthy Chair to schedule time for the patient. It also for LCD to display the message.

3.4 PROJECT SOFTWARE

3.4.1 PROTEUS 8 PROFESSIONAL SOFTWARE

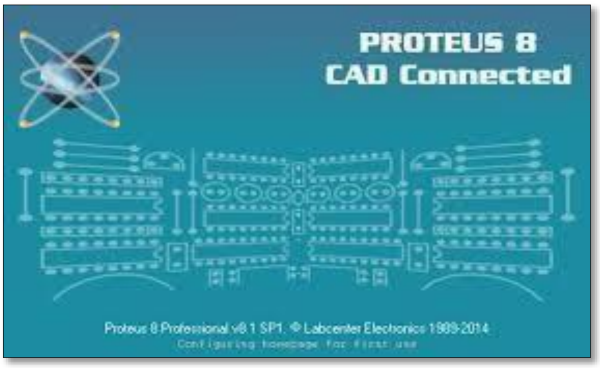


Figure 3.11: Proteus 8 Professional Software

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 easiersoftware to be used. This software also can be designing a PCB very easy

3.4.2 ARDUINO SOFTWARE

Figure 3.12: Arduino Software

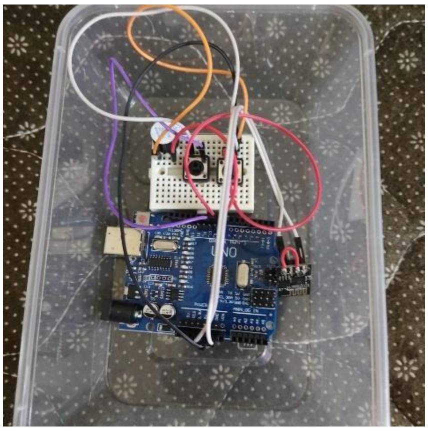
Shows the Arduino Software, this product utilized a simplified version of C++ and making it simpler to learn with the program of the product. To utilize the Arduino pins, the users need to characterize which pin is being to be utilize

3.4.3 TINKERCAD 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



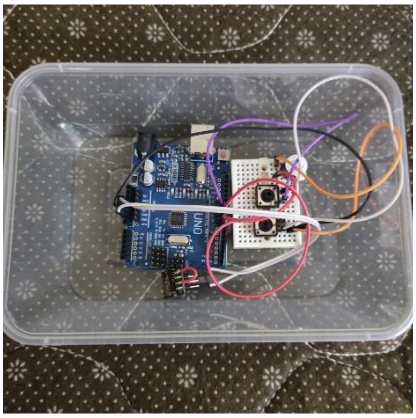


Figure 3.14 Project Prototype. Show the connection on the breadboard. This is the example for Smart Healthy Chair that will be produce.

3.4. Summary

The goal of this project is to minimize health problems by worrying the person to correct his or her posture. The project is based on an ultrasonic sensor mounted on the back of a chair. The sensor will continuously measure the distance to the back of the person sitting.I Based on the above analysis, cell phones, home electronic devices and mobile devices used to deliver reminder messages have proven useful. Based on the three types of reminder systems identified, we can see that electronic reminder technology has evolved in several parallel streams over the past 10 years. Short text messages are now moving towards interactivity through interactive voice response messages. Mobile phone apps are also becoming increasingly popular as an effective and easy way to remind users.

4 EXPECTED RESULTS

smart chair system was built in this paper to detect sitting posture of human body. The experimental result showed that the overall classification rate of eight sitting postures is high using ANN classifier. The developed smart chair system is able to monitor the sitting behavior of human body and help in advocating better sitting habits of users. In the future, more subjects will be involved for experiments. Meanwhile, the influence of hip location on the pressure pattern recognition will be considered in future to further improve the classification rate of sitting postures.

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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 F
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 mm,hh,ss
// All messeges
void gwsMessege(){              // print get well soon messege
    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!");
```

```
  if (rtc.lostPower()) {
    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, 10, 7, 59, 30));                // manual time set
  lcd.begin(16, 2);
  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print("Welcome To");                                     // print a messege at startu
  lcd.setCursor(0, 1);
  lcd.print("Circuit Digest");
  delay(1000);
  pinMode(push1pin, INPUT);                                    // define push button pins ty
  pinMode(push2pin, INPUT);
  pinMode(push3pin, INPUT);
  pinMode(stopPin, INPUT);
  pinMode(ledPin, OUTPUT);
  delay(200);
  Serial.println(EEPROM.read(addr));
  val2 = EEPROM.read(addr);                         // read previosuly saved value of push b
  switch (val2) {
    case 1:
      Serial.println("Set for 1/day");
```

```
  switch (val2) {
    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 uzzing at 8am
  }
  else if (pushVal == 2) {                          // if push button 2 pressed then re
    at8am();
    at8pm();                                        //function to start uzzing at 8mm
  }
  else if (pushVal == 3) {                          // if push button 3 pressed then re
    at8am();
    at2pm();                                         //function to start uzzing at 8mm
    at8pm();
  }

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

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

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

```
    push2state = 0;
    push3state = 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) {
    push2state = 0;
    push1state = 0;
    push3state = 0;
//    pushPressed = true;
    EEPROM.write(addr, 2);
```

```
    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) {
    push3state = 0;
    push1state = 0;
    push2state = 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();
  }
}
```

```
//Dynamic Innovator
const int trigPin = 9;
const int echoPin = 10;
const int buzzer = 11;
const int ledPin = 13;

// defines variables
long duration;
int distance;
int safetyDistance;


void setup() {
pinMode(trigPin, OUTPUT); // Sets the trigPin as an Output
pinMode(echoPin, INPUT); // Sets the echoPin as an Input
pinMode(buzzer, OUTPUT);
pinMode(ledPin, OUTPUT);
Serial.begin(9600); // Starts the serial communication
}


void loop() {
// Clears the trigPin
digitalWrite(trigPin, LOW);
delayMicroseconds(2);

// Sets the trigPin on HIGH state for 10 micro seconds
digitalWrite(trigPin, HIGH);
delayMicroseconds(10);
digitalWrite(trigPin, LOW);

// Reads the echoPin, returns the sound wave travel time in microseconds
duration = pulseIn(echoPin, HIGH);

```

```
void loop() {
// Clears the trigPin
digitalWrite(trigPin, LOW);
delayMicroseconds(2);

// Sets the trigPin on HIGH state for 10 micro seconds
digitalWrite(trigPin, HIGH);
delayMicroseconds(10);
digitalWrite(trigPin, LOW);

// Reads the echoPin, returns the sound wave travel time in microseconds
duration = pulseIn(echoPin, HIGH);

// Calculating the distance
distance= duration*0.034/2;

safetyDistance = distance;
if (safetyDistance >= 30
){ // Enter the Distance
  digitalWrite(buzzer, HIGH);
  digitalWrite(ledPin, HIGH);
}
else{
  digitalWrite(buzzer, LOW);
  digitalWrite(ledPin, LOW);
}

// Prints the distance on the Serial Monitor
Serial.print("Distance: ");
Serial.println(distance);
}
```