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Jabatan Pengajian Politeknik

LAPORAN AKHIR PROJEK
THE DEVELOPMENT OF OUT OF STRESS (O2S) FOR STRESS PATIENT

MUHAMMAD QAMARUL ANWAR BIN MOHD ZAKI	08DEU14F1003
MOHAMMAD FAIRUS BIN MD NOR	08DEU14F1005
MOHAMAD FAUZI BIN JAMIKON	08DEU14F1053
AHMAD RIBIIE BIN MOHD SAZALI	08DEU14F1013

DIPLOMA KEJURUTERAAN ELEKTRONIK (PERUBATAN)
JABATAN KEJURUTERAAN ELEKTRIK
POLITEKNIK SULTAN SALAHUDDIN ABDUL AZIZ SHAH, SHAH ALAM

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This Report Is Submitted In Partial Fulfillment Of The Requirements For Diploma Electronic Engineering (Medical)

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DECLARATION OF PROJECT

This project "OUT OF STRESS(O2S) have been presented and marked also verified as a condition and project report needed as format given.

Marked by:

1. **Name** : **DR.ZUNUWANAS BIN MOHAMAD**
   Signature :
   Date :

2. **Name** : **PN FARIZA BINTI ZAHARI**
   Signature :
   Date :

3. **Name** : **PN. MARIANA BINTI ROSDI**
   Signature :
   Date :

STUDENTS VERIFICATION

"We certified that the ideas, designed, and experimental work are from our own effort, except where otherwise indicated and acknowledged"

1. Signature :

   Name : MUHAMMAD QAMARUL ANWAR BIN MOHD ZAKI

   Matrix No : 08DEU14f1003

   Date : 14 MARCH 2017

2. Signature :

   Name : MOHAMMAD FAIRUS BIN MD NOR

   Matrix No : 08DEU14F1005

   Date : 14 MARCH 2017

3. Signature :

   Name : MOHAMAD FAUZI BIN JAMIKON

   Matrix No : 08DEU14F1053

   Date : 14 MARCH 2017

4. Signature :

   Name : AHMAD RIBIIE BIN MOHD SAZALI

   Matrix No : 08DEU14F1013

   Date : 14 MARCH 2017

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ABSTRACT

The developer of Out Of Stress(O2S) for stress patient is one of the product that can be used by the user or patient that always feel stress. This product allowed them to know their own condition, means in stress or not. This project designed measures heart rate and determine mental/emotional level. Pulse sensors is one of a technique of measuring heart rate reading. The project help to stabilize the blood flow in the body. This project to produce a portable stress indicator device used to measure stress levels and overcome the stress by using electromagnetic field as therapy. The circuit employs a sensitive pulse sensor to detect the pulse rate. Pulse sensor as a voltage converter, the output voltages based on the varying conductivity of the blood flow. When the values appeared, as it measured, the therapy of electromagnetic field will ON depend of the value measured. Copper coil as a main coil to produce the electromagnetic field and overcome the stress. Our recommendation for future, we want more accurate reading of pulse rate and good calculation of electromagnetic coil.

ABSTRAK

Produk *OUT OF STRESS(O2S)* merupakan salah satu product yang boleh digunakan oleh pengguna atau pesakit yang sering mengalami stress. Produk ini membolehkan mereka mengetahui keadaan mereka sendiri, dalam keadaan stress atau tidak. Projek ini direka untuk mengukur kadar denyutan jantung dan menentukan tahap mental/emosi. Pulse sensor merupakan salah satu cara untuk mendapatkan bacaan *heart rate*. Projek ini membantu untuk menstabilkan pengaliran darah dalam badan. Projek ini menghasilkan alat penunjuk stress yang digunakan untuk mengenal pasti tahap stress dan membantu untuk mengatasinya dengan menggunakan medan elektromagnet sebagai terapi. Litar ini menggunakan *pulse sensor* yg sensitive. Pulse sensor akan mengeluarkan bacaan dan paparkan pada paparan menunjukkan tahap stress. Terapi akan dimulakan iaitu dengan menghidupkan medan elektromagnet. Wayar kuprum digunakan sebagai bahan utama untuk menghasilkan medan elektromagnet dan mengatasi stress. Kami punya cadangan untuk penambah baikkan pada projek yang akan datang ialah mendapatkan bacaan denyutan nadi yang lebih tepat dan juga pengiraan yang tepat untuk menghasilkan elektromagnet.

CHAPTER 1

INTRODUCTION

1.1 Background of Study

Out of Stress(O2S) is a device that will show your emotional condition that you are in stress or not. If your condition in stress, the buzzer will turn ON for a while and the timer will start for three minutes. We need to switch ON the coil at our wrist by manually after the buzzer ON and the timer start to produce the electromagnetic field as therapy to reduce the stress level of the patient. The device will show your pulse rate and also stress reading when you are having stress on the display. It's also help peoples to control, manage the stress after the device detect you are stress and being help by the electromagnetic field therapy.

Heart rate, or pulse rate is one of the vital signs used to measure basic function of human body. Heart rate is the number of times one's heart beats per minutes. The method that has been used to measure heart rate in this project is widely known as pulse rate reading. The constructed device can be used to find out the heart rate of a person

and to analyze reading using existing software. Theoretically, any body part can be used to measure heart rate through the sensor of the device, although fingertips and earlobes are commonly targeted. In this way, we use it to get the measure of the stress level.

1.2 Problem Statement

i. Stress will give the big impact in life
ii. Don't have too much device that can overcome stress
iii. If stress can be manage by an individual, are this Out Of Stress(O2S) device can be usefull at this moment

1.3 Objective

i. To produce machine that can detect stress
ii. Help peoples overcome their stress
iii. To upgrade current machine that only detect stress

1.4 Project Scope

Out Of Stress(O2S) devices is used by the sress patient and user, the stress patient have many symptom that can we catagory. The category of stress patient can be measured by many ways of parameter. The category such as emotional, physical and cognitive. The stress involve each person and we need to be careful about it because this stress can effect our emotional and make the stress person react abnormal as always.

With the main purpose, we are expecting to produce a OUT OF STRESS (O2S) complete with LCD display screen for the stress level can be seen by its own tester. Which theory stated, stress can be detect from measuring the pulse rate.

We also want to elaborate the advantages of OUT OF STRESS (O2S). Peoples should know, with the OUT OF STRESS (O2S) device, they could know their stress condition, help them manage and release their stress. We also would do the trial of OUT OF STRESS (O2S) on some people with different condition. Which we will do the test on student before their going to do a presentation, a student before submit their exam paper, a businessman, during present their proposal into release the stress and learn how to manage the stress very well. The result obtained would be noted as our survey and become research to produce good information for the whole generation in the future.

1.5 Sampling Size and Sampling Technique

Out Of Stress(02S) device can have many sample size for the test of devices. The sample can be a student that having a presentation, spot quiz and test. The sample also can be outside people that having a big problem to face, but as student the simple sample for the test subject was among the student itself. The sample of student that we will used was gamer players because it easy for us to find the subject and test it by using our device.

For the sampling technique for Out Of Stress(O2S) devices, we used the pulse rate as the parameter to be measured. We choose the pulse rate because it one of the simple ways to know our heart beat. The pulse rate parameter also can be easy to be measured and not to have too much procedure to measured.

CHAPTER 2

LITERATURE REVIEW

2.1 Summary of Literature Review

Our project is to do an innovation of Emotional Stress Indicator (ESI) kit that allows you access your emotional pain to the new project. Our new project is Out of Stress(O2S). The device will tell and show your condition in stress or not on the display. It's also help peoples to control and manage the stress after the device detect you are stress.

The method we use to overcome the stress is by using a magnetic field. Some practitioners have theorized that magnet therapy may improve circulation, increase blood oxygen, alkalinize bodily fluids, decrease deposition of toxic materials in blood vessel walls (such as cholesterol plaques) or relax blood vessels through effects on cellular calcium channels. Other theories describe altered nerve impulses, reduced edema or fluid retention, increased endorphins, muscle relaxation, cell membrane effects or stimulation of acupoints.

2.2 Clinical

2.2.1 Stress

Stress is the feeling of being under too much mental or emotional pressure. Pressure turns into stress when you feel unable to cope. People have different ways of reacting to stress, so a situation that feels stressful to one person may be motivating to someone else.

All of the feelings, positive or negative, create physiological changes. Your skin heart rate, digestion, joints, muscle energy levels, the hair on your head, and countless cells and systems you don't even know about change with every emotion.[1]

Many of life's demands can cause stress, particularly work, relationships and money problems. And, when you feel stressed, it can get in the way of sorting out these demands, or can even affect everything you do.

Stress can be explained as an individual's body's way of responding to any kind of threat or demand or Stress is a reaction to a stimulus that disturbs our physical and mental equilibrium. When an individual feel threatened, nervous system responds by releasing a number of stress hormones including adrenaline and cortisol, which rouse the body for emergency reaction. In such cases heart pounds faster, blood pressure rises, muscles tighten, senses become sharper and breath quickens. These physical changes can increase an individual's strength and stamina, speed their reaction time, and enhance their focus. This is even known as the "fight or flight" response or mobilization stress response and it is your body's way of protecting you. [2]

Stress plays a major role in your immune system, and can impact your blood pressure, cholesterol levels, brain chemistry, blood sugar levels, and hormonal balance. It can even "break" your heart, and is increasingly being viewed as a cardiovascular risk marker. [1]

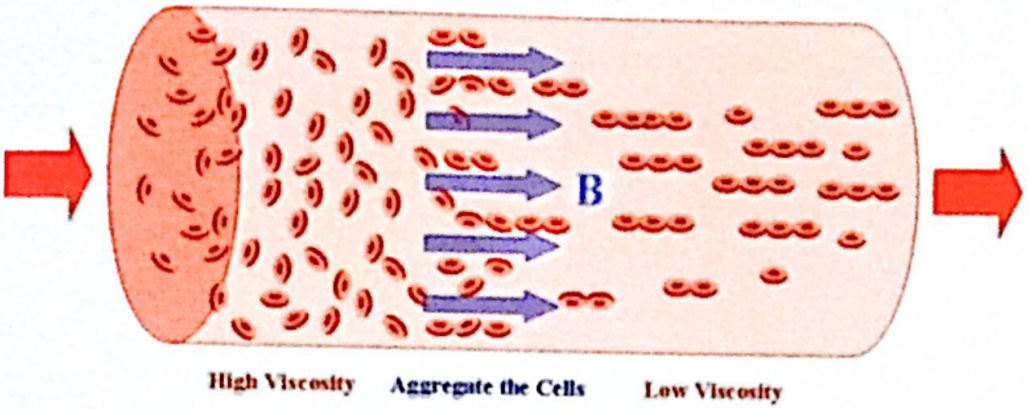
Stress doesn't only make a person feel awful emotionally. It can also exacerbate about any health condition you can think of. Studies have found several health problems related to stress. Stress seems to be worsened or increase the risk of conditions like heart disease, obesity, Alzheimer's disease, headache, diabetes, depression, accelerated aging, gastrointestinal problems, asthma and premature death.

Stress, depression and anxiety carry a high risk of suicide. More than 90% of people those who suicide has been diagnosed with illness such as clinical depression, and usually in combination with stress, anxiety or substance use disorders and other mental disorders. Suicide affects all age groups including children. Most of the people die by committing suicide than from automobile accidents. Most of the suicides are preventable but many who are at risk for attempting suicide never receives the treatment they need because of lack of access to care or lack of knowledge about their symptoms. Almost everyone who attempts suicide has symptoms that mental health treatment could relieve.

2.2.2 Blood Flow

Blood is a thick red liquid circulating in the blood vessels. It has a strong nourishing effect on the human body and serve as one of the basic substances constituting the human body. [3]

Figure 2.2.2 Blood Flow



If a person's blood becomes too thick it can damage blood vessels and increase the risk of heart attacks. But a Temple University physicist has discovered that he can thin the human blood by subjecting it to a magnetic field. Pulse electromagnetic field can affect the body at both microscopic and at overall levels. If the pulse electromagnetic field can be placed to influence a section of blood vessel carrying the fluid flow, then the flow at the place will be improved locally and there will be an improvement in the alignment of the molecules. [4]

From clinical experiments, we know that pulsating magnetic fields can reduce pain sensations almost immediately. This is due in part to the increase in the oxygen partial pressure in the terminal tissue and the increase in the local perfusion and velocity of the capillary blood flow alleviating the accumulation of metabolites due to small vascularization and blood flow[4]

Rongjia Tao, professor and chair of physics at Temple University, has pioneered the use of electric or magnetic fields to decrease the viscosity of oil in engines and pipelines. Now, he is using the same magnetic fields to thin human blood in the circulation system.

Because red blood cells contain iron, Tao has been able to reduce a person's blood viscosity by 20-30 percent by subjecting it to a magnetic field of 1.3 Tesla (about the same as an MRI) for about one minute. Tao and his collaborator tested numerous blood samples in a Temple lab and found that the magnetic field polarizes the red blood cells causing them to link together in short chains, streamlining the movement of the blood. Because these chains are larger than the single blood cells, they flow down the centre, reducing the friction against the walls of the blood vessels. The combined effects reduce the viscosity of the blood, helping it to flow more freely.

When the magnetic field was taken away, the blood's original viscosity state slowly returned, but over a period of several hours. "By selecting a suitable magnetic field strength and pulse duration, we will be able to control the size of the aggregated red-cell chains, hence to control the blood's viscosity," said Tao. "This method of magneto-rheology provides an effective way to control the blood viscosity within a selected range."

Currently, the only method for thinning blood is through drugs such as aspirin; however, these drugs often produce unwanted side effects. Tao said that the magnetic field method is not only safer, it is repeatable. The magnetic fields may be reapplied and the viscosity reduced again. He also added that the viscosity reduction does not affect the red blood cells' normal function. Tao said that further studies are needed and that he hopes to ultimately develop this technology into an acceptable therapy to prevent heart disease. Tao and his former graduate student, Ke "Colin" Huang, now a medical physics resident in the Department of Radiation Oncology at the University of Michigan, are publishing their findings in the journal *Physical Review E.*

2.3 Parameter of Stress

Measuring stress level independent of differences in people's personalities has been inherently difficult. There is no way to measure stress directly, but we can get an indication of the levels of stress in the body by measuring some of the physical affects in the body which are affected by stress Best way to measure stress is with medical equipment that measure:

i. Heart rate
ii. Blood pressure
iii. Breathing rate
iv. Muscle tension
v. Skin resistance

Most of the methods listed above are either expensive or inaccurate due to interference of factors other than stress. Thus a straight forward method and inexpensive for measuring emotional stress is highly required.

2.4 How Stress Affect to Your Heart, Muscles, Nervous System, Digestion, And Even Sexual Drive

It's remarkable how much of an influence the mind has over the body. We can make our bodies do incredible things with willpower, but on the other hand, depression, stress, and anxiety can also have quite a negative impact on our physiological well-being.

You might notice that when you're having an especially stressful day, you may develop a tension headache, have difficult eating or eat too much, or have an increased heart rate or heart palpitations. Whether or not you want to believe it, the mind and body are intertwined and affect one another significantly (which is why a holistic approach to medicine is important). Below, you will find how stress can penetrate various systems of your body, knocking you off balance and making your day even worse . This is why it's important to learn how to manage stress.

2.4.1 Muscular

If you've ever experienced a tension headache paired with neck pain, you know much stress can make your muscles contract and tense up. When we are stressed, our adrenalines goes up, making us more likely to jump or be anxious about looming danger. This is why our muscles reflexively react to stress by tensing up. As a way to protect us from injury.

Though it appears the body has good intentions, tense muscles can be quite painful if they last a while. Tension in the shoulders, neck, and head can cause migraines that will only compound your stress. If you ever feel like you've got too much going on, it might be a good to invest in a massage, get enough sleep, exercise, and drink plenty of water to help relax your muscles.

i. Invest in a massage
ii. Get enough sleep (at least 6-8 hours per day)
iii. Drink plenty of water (at least 8 litter per day)

2.4.2 Cardiovascular

As started before, acute stress (short term periods of stress, like work deadlines) cause an increase in stress hormones, known as adrenaline, noradrenaline, and cortisol. During these moments, heart rate increase and blood vessels dilate, increasing blood pressure.

Chronic stress, meanwhile, can ultimately cause damage to your cardiovascular system. "A constant stress experienced over a prolonged period of time, can contribute to long-term problems for heart and blood vessels" the American Physiological Association explains, "The consistent and ongoing increase in heart rate, and elevated levels of stress hormones and of blood pressure, can take a toll on the body," Ultimately, if can lead to hypertension, heart palpitations, heart attack, or stroke.

2.4.3 Respiratory System

When you get stressed or anxious, people often tell you to focus on your breathing. This is why meditation-based exercises like yoga – which pair stretching and strengthening your muscles with deep, focused breathing – are so good for alleviating chronic stress. The effect of stress on your respiratory system is especially worrisome for people who suffer from asthma or a lung disease, like emphysema. In some cases, stress actually leads to the development of asthma over time. If you find yourself breathing faster than normal, also known as hyperventilating and you should focus on taking a deep, slow breaths in order to avoid a panic attack that might compound your symptoms.

i. Take a deep slow breath in
ii. Doing an exercise
iii. Do not panic

2.4.4 Nervous System

The nervous system is a delicate balance of several features, there's the central nervous system which includes the spinal cord and brain, as well as the "peripheral division" which involves the autonomic(ANS) and somatic nervous system. The autonomic system, meanwhile, is divided into the sympathetic nervous system (SNS) and the parasympathetic nervous system (PNS). The SNS is responsible for creating the "fight or flight" response during stressful times, which braces the body to fight off a threat or danger. Essentially, the SNS is responsible for causing all the above changes to occur in your various bodily systems, from the release of stress hormones to an increased heart rate and digestive changes. This is why chronic stress can be such a long term drain. The constant up and down of stress responses can take a toll on your body.

2.4.5 Stomach And Digestion

Yes, stress does affect your digestive systems and your bowel movements. You might experience the nervous sensation of butterflies or even nausea. Muscles tension can be lead to sharp, long term pain in your abdomen, which you mighty in a panic state and confuse to be an ulcer or something much worse. The fact is, chronic stress can eventually cause ulcers; but is can also cause pain that feels like ulcers. One of those mind tricks that fuels anxiety and hypochondria that you must learn to avoid.

Stress can also impact what nutrients your digestive tract absorbs, and how fast food moves through your system. According to the APA, you might find that you have problems either with diarrhea or constipation depending on your level of stress.

So what can we take from all this?? The fact is, stress over a long period of time can truly take a toll on us and our immune systems, which ultimately leads to an increased chance of getting ill. Finding ways to reduce stress and exercise can save the problems that stress can induce.

2.5 Other Symptoms of Stress

2.5.1 Emotional Symptoms

i. Becoming easily agitated, frustrated and moody
ii. Feeling overwhelmed, like you are losing control or need to take control
iii. Having difficulty relaxing and quieting your mind
iv. Feeling bad about yourself (low self-esteem), lonely, worthless and depressed
v. Avoiding others.

2.5.2 Physical Symptoms

i. Low energy
ii. Headaches
iii. Upset stomach, including diarrhea, constipation and nausea
iv. Aches, pains, and tense muscles

v. Chest pain and rapid heartbeat
vi. Insomnia

2.5.3 Cognitive Symptoms

i. Constant worrying
ii. Racing thoughts
iii. Forgetfulness and disorganization
iv. Inability to focus
v. Poor judgement
vi. Being pessimistic or seeing only the negative side.

2.5.4 Behavioural Symptoms

i. Changes in appetite - either not eating or eating too much
ii. Procrastinating and avoiding responsibilities
iii. Increased use of alcohol, drugs or cigarettes
iv. Exhibiting more nervous behaviour, such as nail biting, fidgeting and pacing.

2.6 Tips for Reducing and Managing Stress

People can learn to manage stress and lead happier, healthier lives. Here are some tips to help you keep stress at bay:

i. Keep a positive attitude.
ii. Accept that there are events that you cannot control.

iii. Be assertive instead of aggressive. Assert your feelings, opinions or beliefs instead of becoming angry, defensive or passive.

iv. Learn and practice relaxation techniques; try meditation, breathing exercises, yoga or t'ai chi.

v. Eat healthy, well-balanced meals.

vi. Learn to manage your time more effectively.

vii. Get enough rest and sleep. Your body needs time to recover from stressful events.

viii. Don't rely on alcohol, drugs or compulsive behaviours to reduce stress.

ix. Identify the sources of stress. Try to figure out what's causing your stress symptoms. Maybe you have too many commitments and feel fatigued and irritable. Once you identify the sources of stress, try to minimize these as much as possible.

x. Talk it out. Talk to a friend, family member or therapist if your stress level is too high. Getting your feelings out without others judging you is crucial for good mental health.

xi. Take time for yourself. Before you reach your breaking point, take time for solitude. Take time to nurture yourself, away from the cares and responsibilities of the world. Find time for inner strength and emotional healing.

xii. Set limits. Never hesitate to say 'no' before you take on too many commitments. Especially if you are balancing work and family, it's important to priorities. Saying 'no' can help bring your stress to a manageable level and give you more control over your life.

xiii. Exercise daily. Exercise is thought to increase the secretion of endorphins, naturally produced substances in the brain that induce feelings of peacefulness. Many studies show that exercise, along with the boosted endorphin levels, really does increase confidence and self-esteem and reduce tension. Exercise also acts as a displacement defense mechanism for those who are ' stressed out'. What does that mean? If you've ever walked for several miles, you know how hard it is to think of your problems when your mind is focused on walking.

xiv. Reduce your intake of alcohol, nicotine and caffeine

xv. Do something enjoy you every day

xvi. Get a massage

xvii. Watch a comedy

xviii. Stay away from the stress makers, either limit your communication with them or else drop their relationship entirely.

xix. Always ensure to complete things as soon as you get it "do it now, do it right" will make you feel great and confident enough to take up new challenges.

2.7 Magnetic and Electromagnetic Therapy

One of the most popular therapies of a variety of conditions in human and veterinary medicine is the application of magnetic field. Magnetic devices that radiate an unchanging magnetic field are available in a variety of configurations such as pads, bandages, and even magnetic mattresses. In spite of a lack of demonstrable mechanism of action, proponents of applying static magnetic field therapy to injured or painful tissues generally attribute their alleged effects to an increase in local blood circulation. Unfortunately, the scientific evidence in supporting this hypothesis is tenuous at best.[5]

A number of studies have investigated the effect of static magnetic field on blood flow. Studies commissioned by the makers of one type of magnetic pad showed that exposure of a highly concentrated saline solution in a glass capillary tube increased the flow of the solution. This study has been often cited by manufacturers of static magnetic devices as evidence that magnetic therapy can potentially affect the circulation of the blood. Although the mechanism for the increase in saline flow is not apparent, it certainly could not have been related to any dilatory effect om the walls of the glass capillary tube. The investigator who performed the study concluded that results of the experiments performed using highly concentrated saline in a glass tube should not be extrapolated to effects that would be expected with flowing blood.[6]

2.8 Component

2.8.1 Magnet Wire

Magnet wire or enameled wire is a copper or aluminium wire coated with a very thin layer of insulation. It is used in the construction of transformers, inductors, motors, speakers, hard disk head actuators, electromagnets, and other applications that require tight coils of insulated wire.

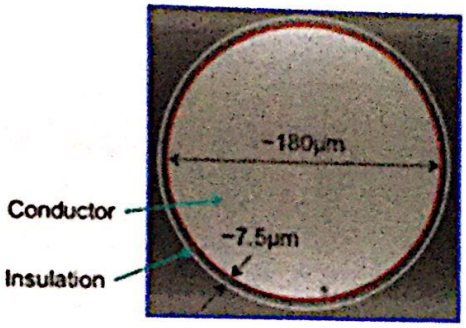
The wire itself is most often fully annealed, electrolytically refined copper. Aluminium magnet wire is sometimes used for large transformers and motors. The insulation is typically made of tough polymer film materials rather than enamel, as the name might suggest.

The most suitable materials for magnet wire applications are unalloyed pure metals, particularly copper. When factors such as chemical, physical, and mechanical property requirements are considered, copper is considered the first choice conductor for magnet wire.

Most often, magnet wire is composed of fully annealed, electrolytically refined copper to allow closer winding when making electromagnetic coils. High-purity oxygen-free copper grades are used for high-temperature applications in reducing atmospheres or in motors or generators cooled by hydrogen gas.

Like other wire, magnet wire is classified by diameter (AWG number, SWG or millimeters) or area (square millimeters), temperature class, and insulation class.

Figure 2.8.1 Cross-sectional view of AWG33 magnet wire taken using a scanning electron microscope



Breakdown voltage depends on the thickness of the covering, which can be of 3 types: Grade 1, Grade 2 and Grade 3. Higher grades have thicker insulation and thus higher breakdown voltages. The temperature class indicates the temperature of the wire at which it has a 20,000 hour service life. At lower temperatures the service life of the wire is longer (about a factor of 2 for every 10 °C lower temperature). Common temperature classes are 105 °C, 130 °C, 155 °C, 180 °C and 220 °C.

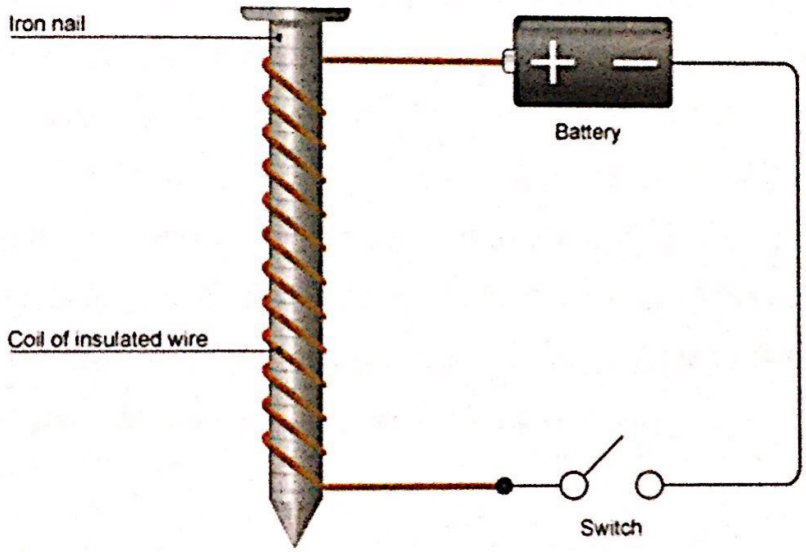
2.8.2 Electromagnetic Coil

When an electric current flows in a wire it creates a magnetic field around the wire. By winding the wire into a coil we can strengthen the magnetic field. Electromagnets are made from coils like this. Making an electromagnet stronger

We can make an electromagnet stronger by doing these things:

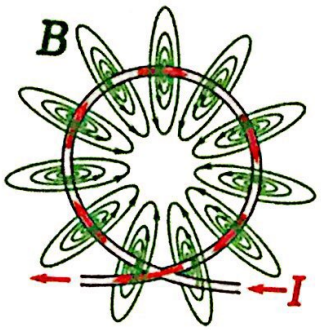
i. Wrapping the coil around an iron core
ii. Adding more turns to the coil
iii. Increasing the current flowing through the coil.

Figure 2.8.2(1) Electromagnetic Coil



The magnetic field around an electromagnet is just the same as the one around a bar magnet. It can, however, be reversed by turning the battery around. Unlike bar magnets, which are permanent magnets, the magnetism of electromagnets can be turned on and off just by closing or opening the switch.

Figure 2.8.2(2) **Electromagnetic Flux**



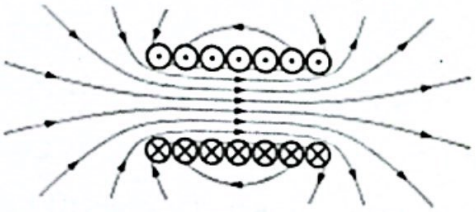
The magnetic field lines *(green)* of a current-carrying loop of wire pass through the center of the loop, concentrating the field there. An electromagnetic coil is an electrical conductor such as a wire in the shape of a coil, spiral or helix. Electromagnetic coils are used in electrical engineering, in applications where electric current interact with magnetic fields, in devices such as inductors, electromagnets, transformers, and sensor coils. Either an electric current is passed through the wire of the coil to generate a magnetic field, or conversely an external *time-varying* magnetic field through the interior of the coil generates an EMF (voltage) in the conductor.

A current through any conductor creates a circular magnetic field around the conductor due to Ampere's law. The advantage of using the coil shape is that it increases the strength of magnetic field produced by a given current. The magnetic fields generated by the separate turns of wire all pass through the center of the coil and add (superpose) to produce a strong field there. The more turns of wire, the stronger the field produced. Conversely, a *changing* external magnetic flux induces a voltage in a conductor such as a wire, due to Faraday's law of induction. The induced voltage can be increased by winding the wire into a coil, because the field lines intersect the circuit multiple times.

The direction of the magnetic field produced by a coil can be determined by the right hand grip rule. If the fingers of the right hand are wrapped around the magnetic core of a coil in the direction of conventional current through the wire, the thumb will point in the direction the magnetic field lines pass through the coil. The end of a magnetic core from which the field lines emerge is defined to be the North pole.

There are many different types of coils used in electric and electronic equipment.

Figure 2.8.2(3) Electromagnetic Flux



In a coil of multiple turns of wire the magnetic field of the turns adds in the center of the coil, creating a strong field. This drawing shows a cross section through the center of the coil. The crosses are wires in which current is moving into the page; the dots are wires in which current is emerging from the page.

Many electromagnetic coils have a magnetic core, a piece of ferromagnetic material like iron in the center to increase the magnetic field. The current through the coil magnetizes the iron, and the field of the magnetized material adds to the field produced by the wire. This is called a ferromagnetic-core or iron-core coil. A ferromagnetic core can increase the magnetic field of a coil by hundreds or thousands of times over what it would be without the core. A ferrite core coil is a variety of coil with a core made of ferrite, a ferrimagnetic ceramic compound. Ferrite coils have lower losses at high frequencies.

A coil without a ferromagnetic core is called an air-core coil. This includes coils wound on plastic or other nonmagnetic forms, as well as coils which actually have empty air space inside their windings.

2.8.3 Types of Coil

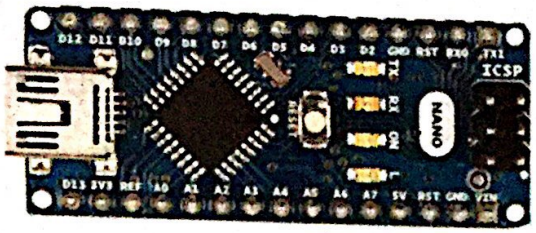
Coils can be classified by the frequency of the current they are designed to operate with:

Direct current or DC coils or electromagnets operate with a steady direct current in their windings. Audio-frequency or AF coils, inductors or transformers operate with alternating currents in the audio frequency range, less than 20 kHz. Radio-frequency or RF coils, inductors or transformers operate with alternating currents in the radio frequency range, above 20 kHz

2.8.4 Arduino Nano

The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328 (Arduino Nano 3.x). It has more or less the same functionality of the Arduino Duemilanove, but in a different package. It lacks only a DC power jack, and works with a Mini-B USB cable instead of a standard one.

Figure 2.8.4(1) Arduino Nano



Technical specs:

Table 2.8.4 Technical specs

Microcontroller	ATmega328
Architecture	AVR
Operating Voltage	5 V
Flash Memory	32 KB of which 2 KB used by bootloader
SRAM	2 KB
Clock Speed	16 MHz
Analog I/O Pins	8
EEPROM	1 KB
DC Current per I/O Pins	40 mA (I/O Pins)
Input Voltage	7-12 V
Digital I/O Pins	22

PWM Output	6
Power Consumption	19 mA
PCB Size	18 x 45 mm
Weight	7 g
Product Code	A000005

Advantages:

i. Ready to Use:

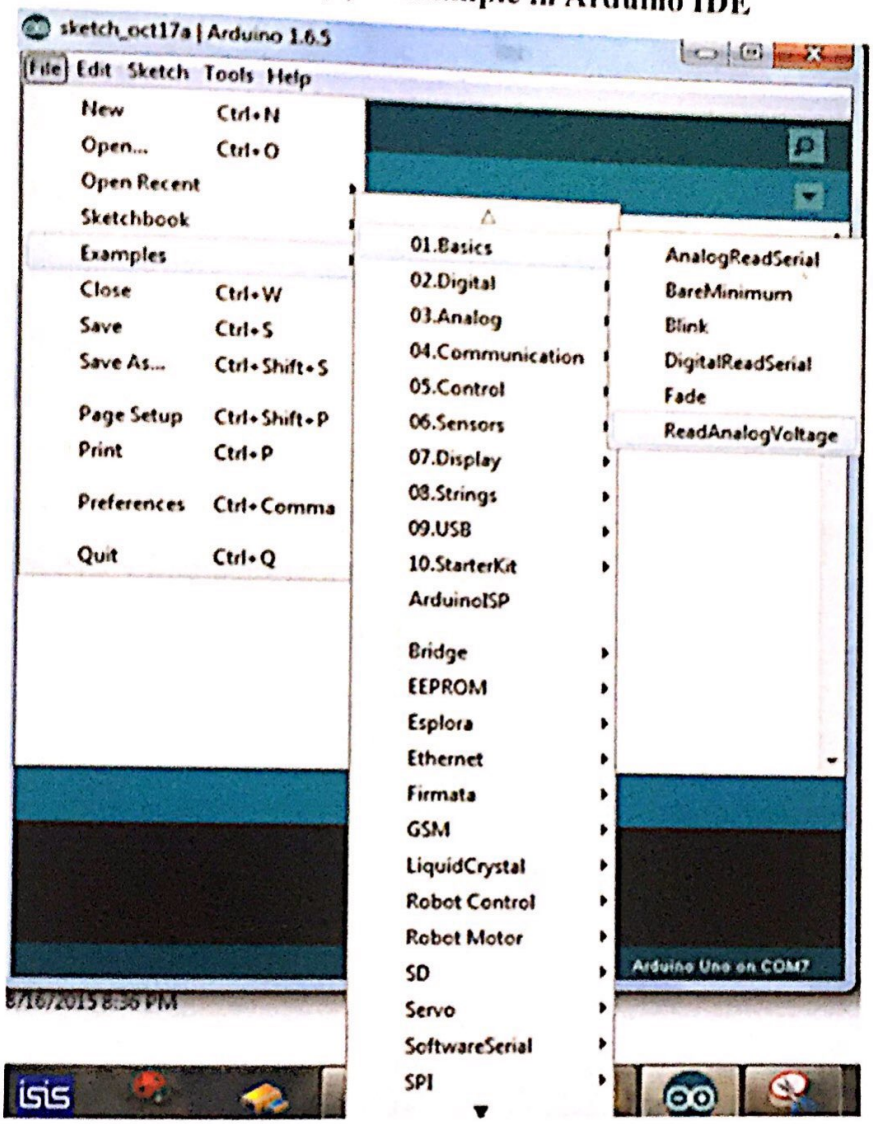
The biggest advantage of Arduino is its ready to use structure. As Arduino comes in a complete package form which includes the 5V regulator, a burner, an oscillator, a micro-controller, serial communication interface, LED and headers for the connections. You don't have to think about programmer connections for programming or any other interface. Just plug it into USB port of your computer and that's it. Your revolutionary idea is going to change the world after just few words of coding.

ii. Examples of codes:

Another big advantage of Arduino is its library of examples present inside the software of Arduino. I'll explain this advantage using an example of voltage measurement. For example if you want to measure voltage using ATmega8 micro-controller and want to display the output on computer screen then you have to go through the whole process. The process will start from learning the ADC's of micro-controller for measurement, went through the learning of serial communication for display and will end at USB - Serial converters. If you want to check this whole process click on the link below.

On the other hand, if you want to measure the voltage using Arduino. Just plug in your Arduino and open the Read Analog Voltage.

Figure 2.8.4(2) Example in Arduino IDE



The project is ready after putting some reasonable resistors and zener diode. You can easily see the voltage on the Serial terminal of Arduino.

iii. Effortless functions:

During coding of Arduino, you will notice some functions which make the life so easy. Another advantage of Arduino is its automatic unit conversion capability. You can say that during debugging you don't have to worry about the units conversions. Just use your all force on the main parts of your projects. You don't have to worry about side problems.

iv. Large community:

There are many forums present on the internet in which people are talking about the Arduino. Engineers, hobbyists and professionals are making their projects through Arduino. You can easily find help about everything. Moreover the Arduino website itself explains each and every functions of Arduino.

So, We should conclude the advantage of Arduino by saying that during working on different projects you just have to worry about your innovative idea. The remaining will handle by Arduino itself.

CHAPTER 3

METHODOLOGY

3.1 Introduction

Methodology can be the 'analysis of the principles of methods, rules, and postulates employed by a discipline', 'the systematic study of methods that are, can be, or have been applied within a discipline' or 'a particular procedure or set of procedures'.

Methodology includes a philosophically coherent collection of theories, concepts or ideas as they relate to a particular discipline or field of inquiry. Methodology refers to more than a simple set of methods, rather it refers to the rationale and the philosophical assumptions that underlie a particular study relative to the scientific method. This is why scholarly literature often includes a section on the methodology of the researchers.

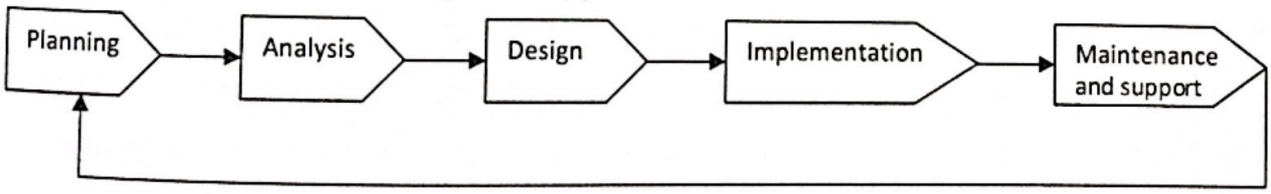
Each step of project is a process to complete the project. Every step must be followed one by one and must be done carefully. If some error occurs it can make a project probably could not operate or do not look neat and perfect.

Before the project finish, various process needs to be done according to proper procedures to ensure that projects do not have any problems. Among the measures the work done in preparing this project are:

i. Process of designing circuits
ii. Circuit board trace
iii. Soldering process in circuit board.
iv. Programming process in programes and so on

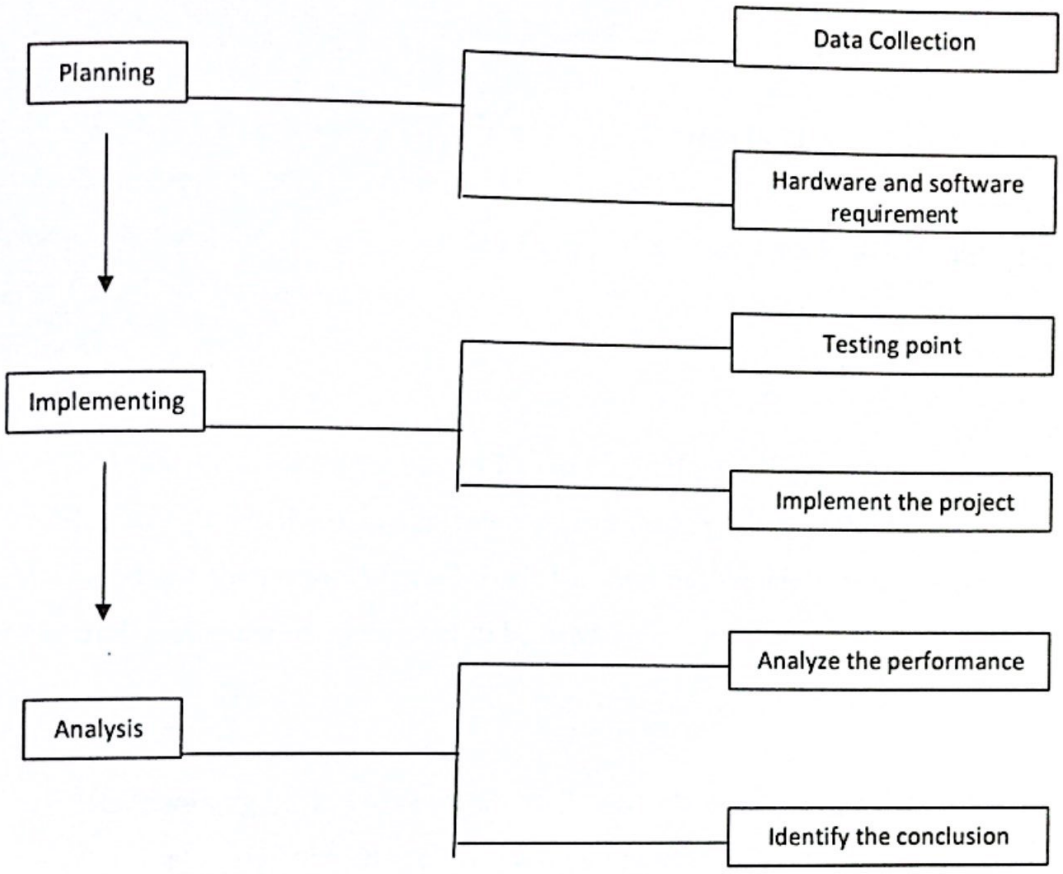
In order to evaluate this project, the methodology based on System Development Life Cycle (SDLC), generally three major step, which is planning, implementing and analysis.

Figure 3.1(1) SLDC Phase



This final year project used three major steps to implement project starting from planning, implementing and testing. All the methods used for finding and analyzing data regarding the project related.

Figure 3.1(2) Steps of Methodology



3.2 Planning

To identify all the information and requirement such as hardware and software, planning must be done in the proper manner. The planning phase have two main elements namely data collection and the requirements of hardware and software.

3.2.1 Data Collection

Data collection is a stage in any area of study. At this stage I planned about the projects resources and requirements, literature studies and schedule to get more information in this study. All the materials are collected from journal, texts book and research papers gathered from libraries and Internet.

Within the data collection period I have found the study about the pulse rate and Electro Magnetic field(EMF) in the Internet and do some research about the project related. Once I got the project manual, I tried to find out the electronic component and other materials and some of equipment to be used.

While planning, I have done the research about the project related, which including with study about the electronic component such as capacitor, resistor, inductance, transistor and diode. The study is not just for the function of the component but the types of small circuit build by each component related.

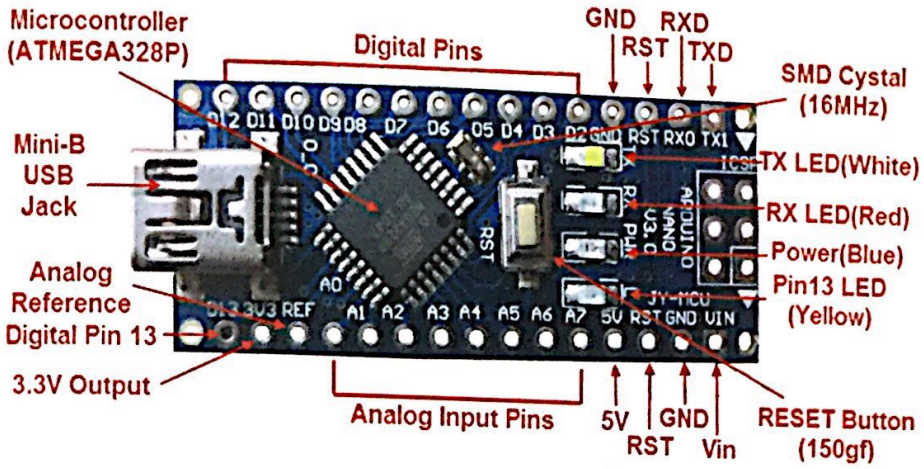
3.2.2 Hardware and Software Requirement

3.2.2.1 Hardware Requirement

Below is the list of the entire electronic components and the other material that will support to complete this project.

i. Arduino Nano

Figure 3.2.2.1(1) Arduino Nano

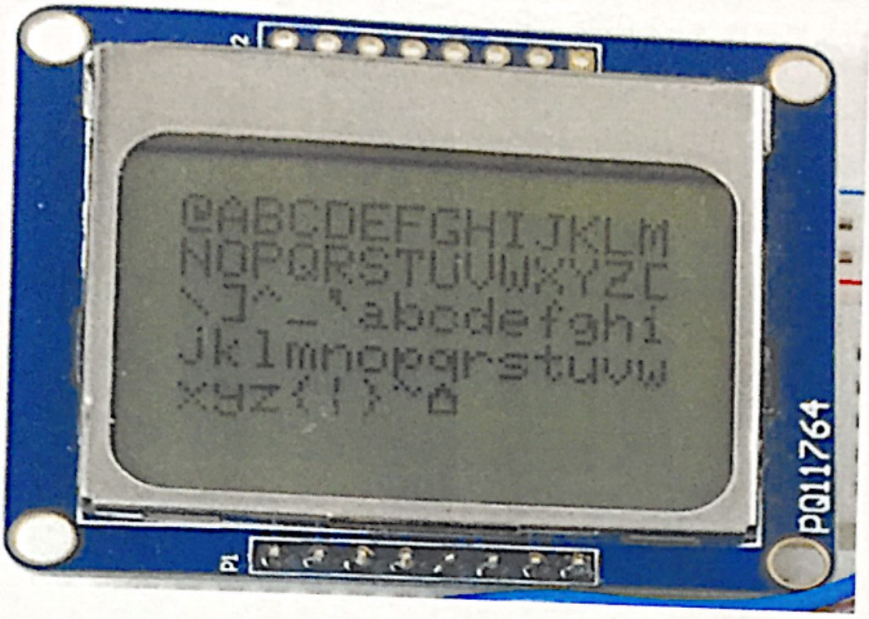


Arduino is a hardware and software company, project, and user community that designs and manufactures computer hardware, open-source software, and microcontroller-based kits for building digital devices and interactive objects that can sense and control physical devices.

The project is based on microcontroller board designs, produced by several vendors, using various microcontrollers. These systems provide sets of digital and analog input/output (I/O) pins that can interface to various expansion boards (termed shields) and other circuits. The boards feature serial communication interfaces, including Universal Serial Bus (USB) on some models, for loading programs from personal computers. For programming the microcontrollers, the Arduino project provides an integrated development environment (IDE) based on a programming language named Processing, which also supports the languages C and C++.

ii. Display

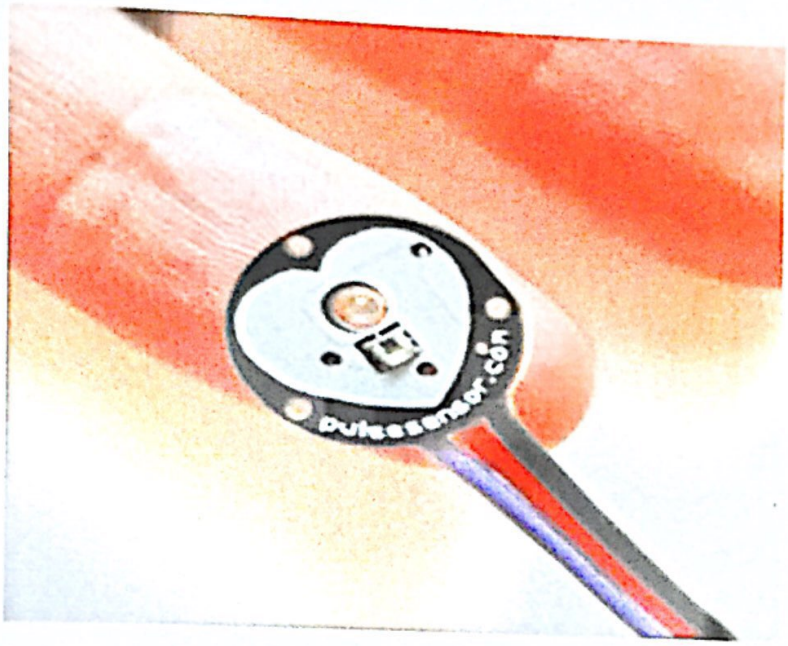
Figure 3.2.2.1(2) Nokia Lcd



The Nokia 5110 is a basic graphic LCD screen for lots of applications. It was originally intended for as a cell phone screen. This one is mounted on an easy to solder PCB. It uses the PCD8544 controller, which is the same used in the Nokia 3310 LCD. The PCD8544 is a low power CMOS LCD controller/driver, designed to drive a graphic display of 48 rows and 84 columns. All necessary functions for the display are provided in a single chip, including on-chip generation of LCD supply and bias voltages, resulting in a minimum of external components and low power consumption. The PCD8544 interfaces to microcontrollers through a serial bus interface.

iii. Pulse Sensor

Figure 3.2.2.1(3) Pulse Sensor



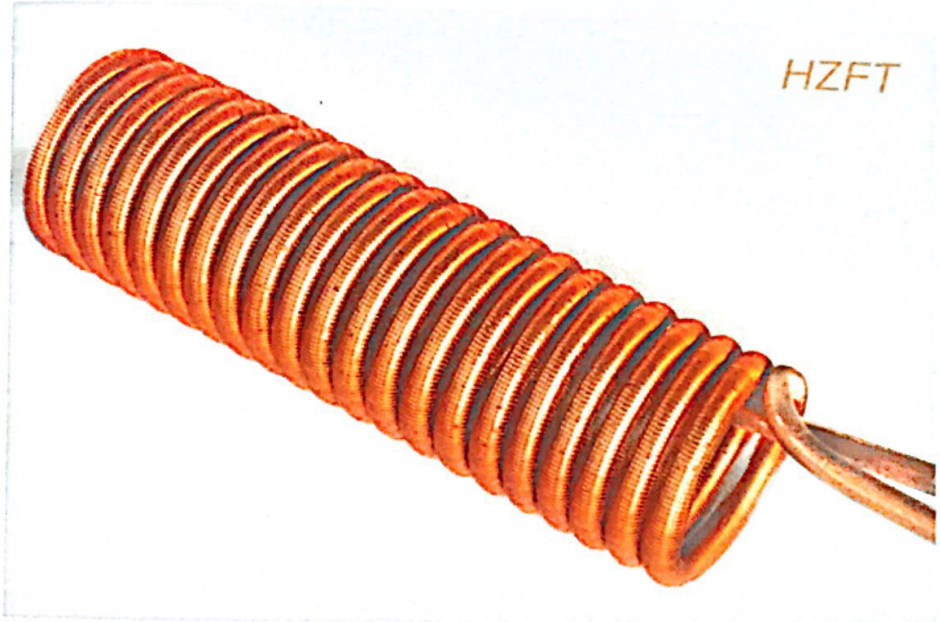
Heart rate data can be really useful whether you're designing an exercise routine, studying your activity or anxiety levels or just want your shirt to blink with your heart beat. The problem is that heart rate can be difficult to measure. Luckily, the Pulse Sensor Amped can solve that problem!

The Pulse Sensor Amped is a plug-and-play heart-rate sensor for Arduino. It can be used by students, artists, athletes, makers, and game & mobile developers who want to easily incorporate live heart-rate data into their projects. It essentially combines a simple optical heart rate sensor with amplification and noise cancellation circuitry making it fast and easy to get reliable pulse readings. Also, it sips power with just 4mA current draw at 5V so it's great for mobile applications.

Simply clip the Pulse Sensor to your earlobe or finger tip and plug it into your 3 *or* 5 Volt Arduino and you're ready to read heart rate! The 24" cable on the Pulse Sensor is terminated with standard male headers so there's no soldering required. Of course Arduino example code is available as well as a Processing sketch for visualizing heart rate data.

iv. COIL

Figure 3.2.2.1(4) Coil



An electromagnetic coil is an electrical conductor such as a wire in the shape of a coil, spiral or helix. Electromagnetic coils are used in electrical engineering, in applications where electric currents interact with magnetic fields, in devices such as inductors, electromagnets, transformers, and sensor coils. Either an electric current is passed through the wire of the coil to generate a magnetic field, or conversely an external time-varying magnetic field through the interior of the coil generates an EMF (voltage) in the conductor.

A current through any conductor creates a circular magnetic field around the conductor due to Ampere's law. The advantage of using the coil shape is that it increases the strength of magnetic field produced by a given current. The magnetic fields generated by the separate turns of wire all pass through the center of the coil and add (superpose) to produce a strong field there. The more turns of wire, the stronger the field produced. Conversely, a changing external magnetic flux induces a voltage in a conductor such as a wire, due to Faraday's law of induction. The induced voltage can be increased by winding the wire into a coil, because the field lines intersect the circuit multiple times.

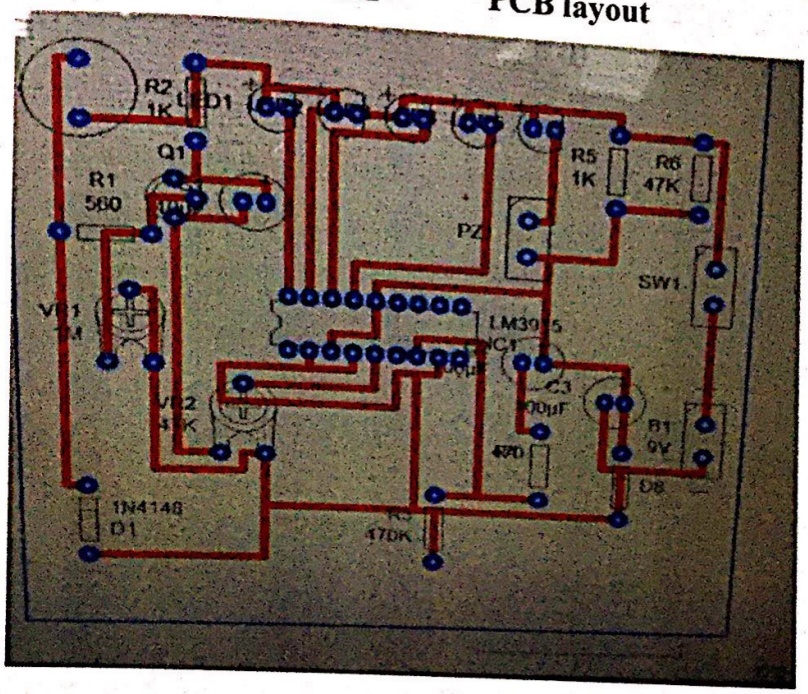
3.2.2.2 Software Requirement

For software requirement, I have choose Proteus 8 Professional Software. Proteus 8 Professional is a software tool suite used primarily for electronic design automation. The software is used mainly to create electronic prints for manufacturing of printed circuit boards, by electronic design engineers and electronic technicians to manufacture electronic schematics and diagrams, and for their simulation.

The name Proteus is a portmanteau, reflecting the software's origins: Proteus 8 Professional, since this software can do the simulation of the schematic diagram, waveform for the output and can perform the PCB layout for the further step of this project.

After the process of gathering all the related information about this final year project, a step of designing the circuit consist of pulse rate was done. Using the Proteus 8 Professional software, where several basics process of designing the circuit was done.

Figure 3.2.2.2 PCB layout



3.3 Implementing

3.3.1 Project Board Circuit (PCB)

When Proteus 8 Professional Software did the process of designing the electronic circuit diagram, the process of produce project board circuit (PCB) is followed. The layout diagram circuit from Proteus 8 Professional Software was produce by own. That the etching process.

3.3.2 Etching

Etching is a "subtractive" method used for the production of printed circuit boards. Acid is used to remove unwanted copper from a prefabricated laminate. This is done by applying a temporary mask that protects parts of the laminate from the acid and leaves the desired copper layer untouched. Etching is where the excess copper is removed to leave the individual tracks or traces as they are sometimes called. Buckets, bubble tanks, and spray machines lots of different ways to etch, but most firms currently use high pressure conveyerised spray equipment. Many different chemical solutions can be used to etch circuit boards. Ranging from slow controlled speed etches used for surface preparation to the faster etches used for etching the tracks. Some are best used in horizontal spray process equipment while others are best used in tanks.

Etching is the process of using acid to remove coppers that not need on the PCB (Printed Circuit Board). This acid is Acid Ferric Chloride III. Acid Ferric Chloride III is used to remove that coppers.

The steps of the etching process are:

i. Print the schematic onto transparent paper and cut it with the same size of PCB board.

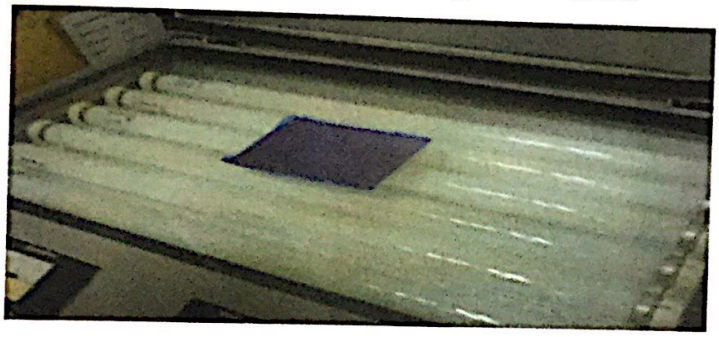
Figure 3.3.2(1) Transparent Paper That Have Cut

ii. Stick the schematic diagram on PCB board.

iii. Paste the etching circuit onto transparent paper with UV Board using expose machine. It's to make PCB paper joined with board.

iv. This process takes about 30 second.

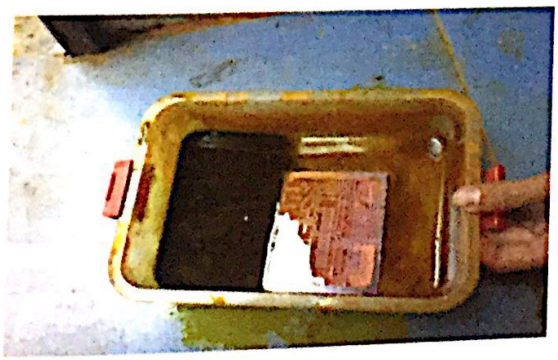
Figure 3.3.2(2) UV Expose Process



v. Dilute the acid with a little hot water and make sure that the mixture is not too liquid and too concentrated.

vi. Then, put the board into the mixed (Acid Ferric Chloride III + Hot water) to remove the useless copper.

Figure 3.3.2(3) Process To Remove Unused Chopper



vii. When PCB was soaked into this mix, we must always shake the container with the acid so that the unwanted copper will remove.

viii. After Acid remove unused copper, take the PCB to wash with clean water.

ix. Then, use sand paper to rub the lines colors. In addition, detergent powder can also be used to remove the ink. Next, just leave only the desired circuit PCB only.

3.3.3 Soldering Process

Soldering is defined as "the joining of metals by a fusion of alloys which have relatively low melting points". In other words, we use a metal that has a low melting point to adhere the surfaces to be soldered together. Soldering is more like gluing with molten metal than anything else. Soldering is also a must have skill for all sorts of electrical and electronics work. It is also a skill that must be taught correctly and developed with practice.

Steps to Solder:

i. Quickly remove the tip of the soldering iron from Heat up the soldering iron for five to 10 minutes, allowing the iron to reach maximum operating temperature. If the soldering iron has two temperature settings selectable with a switch, select lower temperature when soldering small electronic components to a board and select the higher temperature when soldering heavier wires. Apply a small amount of solder to the tip and rotate so the entire tip becomes lightly covered with a thin layer of solder. This is called "tinning" the tip.

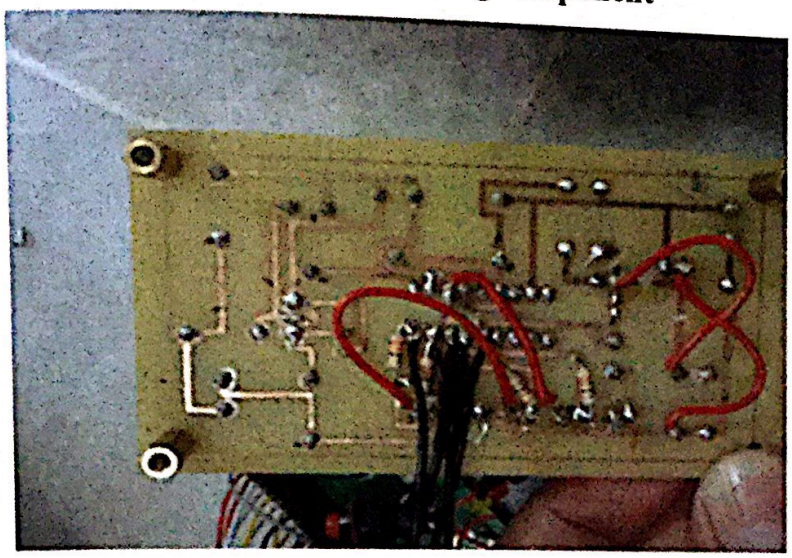
ii. Connect the two surfaces to be soldered together so the metal parts are touching. If soldering wires, simply twist the two wire ends together so they don't pull apart while being soldered. If soldering electronic components, simply seat the component wires into the holes of the circuit board where the component is to be placed.

iii. Touch the hot tip of the soldering iron to all metal parts touching together so they are evenly heated. Allow the surface to heat for just three to five seconds, then touch the tip of the solder to the heated metal objects, not directly to the tip of the soldering iron. Allow a small amount of solder to flow onto the metal components or wires until just enough solder has been applied to cover the entire surface of the wires or components.

iv. the soldered surface and wipe the tip of the iron on a wet sponge immediately to remove solder. Wiping the solder off the tip will prevent it from burning and forming a black coat on the soldering iron tip.

v. Allow the solder joint to cool for several minutes before applying power to the wires or the device soldered.

Figure 3.3.3 soldering component



3.4 Checking

After the parts of mounting the components at PCB finished, I need to check the continuity track of the circuit. This part of job is to ensure that the operation of this circuit will run smoothly.

The tools related with the checking parts is multimeter and the continuity checking involve with every circuit tracks and the point of soldering. By using the buzzer multimeter, it's will alert the failed continuity. The failed continuity will recover with the solder again the lake of components related.

3.5 Analysis

The analysis stage is the final stage in this methodology where the two points will be done. The analysis is based on the performance of the circuit related where the output must be performed well and successful and the second is identifying the conclusion.

3.6 Components

The components for this project are based on the circuit diagram where all the components related have been ready at one of electronic component shop at seksyen 15, Shah Alam. The costing for the components as stated at the buying list and can see at below.

3.6.1 Component Used And Specification

Table 3.6.1 Component Used

No	Name of the Electronic Component/Device	Specifications	Quantity
1.	Arduino Board	NANO	1
2.	Pulse Sensor		1
3.	LCD	NOKIA 5110	1
4.	Power bank	5V DC 2A	1
5.	RELAY	-	1
6.	COIL	COPPER	200m

7.	ON OFF SWITCH		1
8.	CONNECTING WIRE	MULTICORE WIRE	
9.	Power supply	Drop voltage to 6V	1

3.6.2 Total Cost

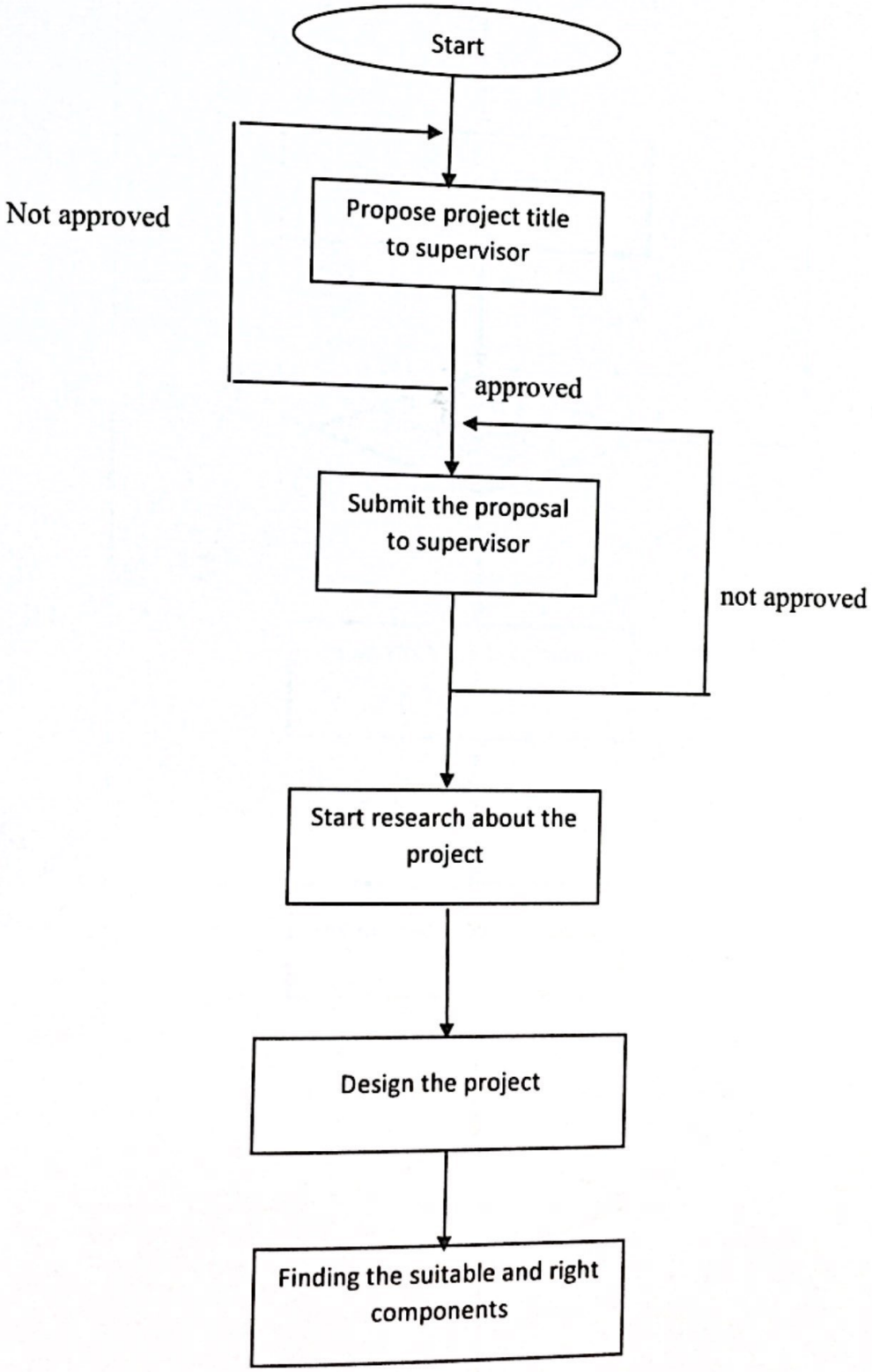
Table 3.6.2 Total Cost

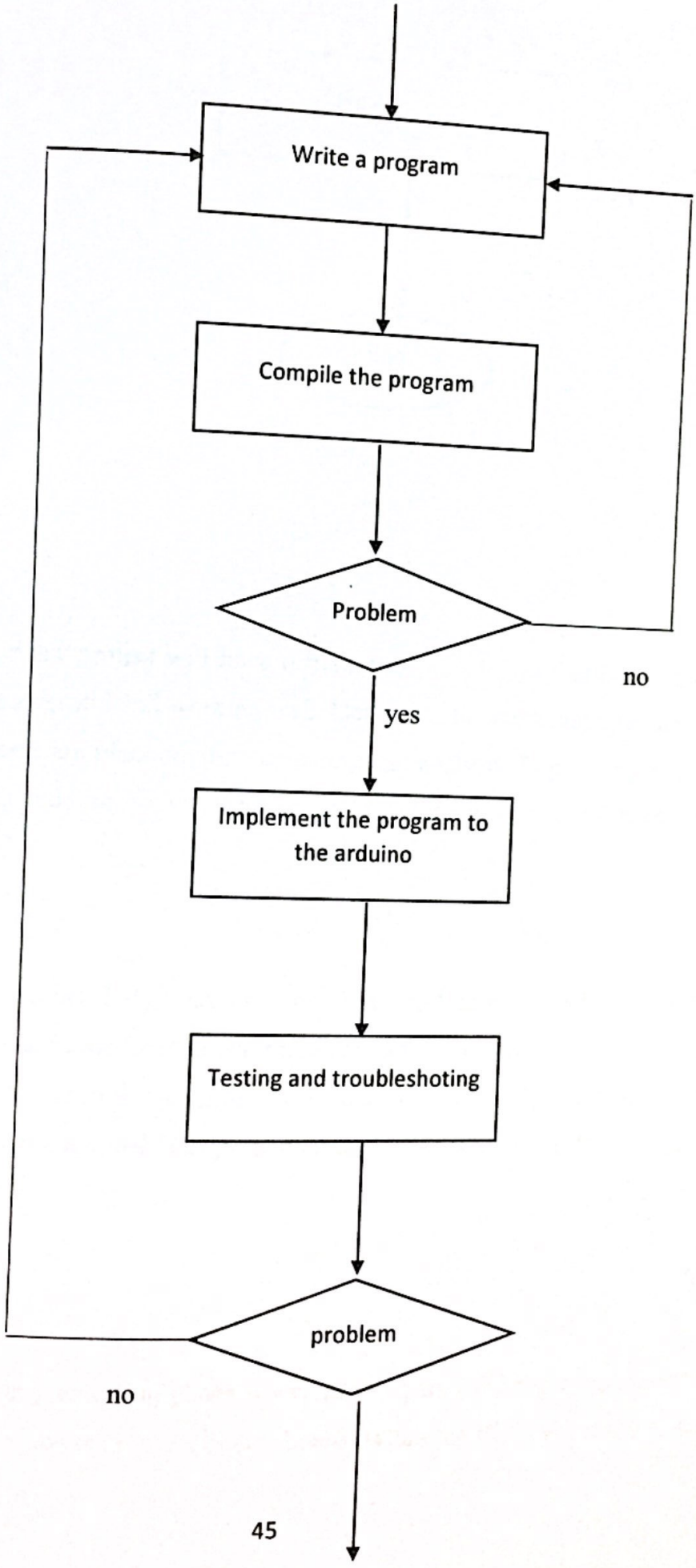
No	Name of the Electronic Component/Device	QUANTITY	Cost
1.	Arduino Board	1	RM60.00
2.	Pulse Sensor	1	RM120.00
3.	LCD	1	RM35.00
4.	Power bank	1	RM70.00
5.	RELAY	1	RM10.00
6.	COIL	1	RM150.00
7.	ON OFF SWITCH	1	RM2.00
8.	CONNECTING WIRE		RM3.00
9.	Power Supply	1	RM 20.00

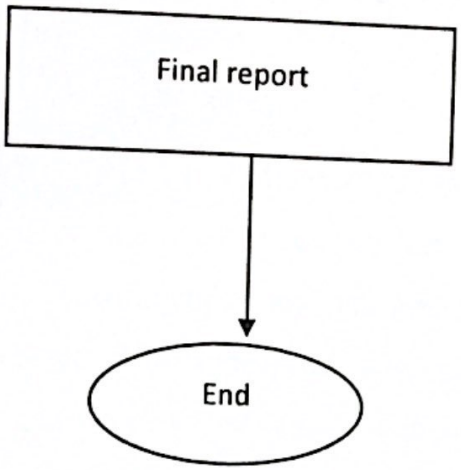
TOTAL COST= RM470.00

3.7 Flowchart of The Operation

Figure 3.7 flowchart of operation







3.8 Conclusion

As a conclusion, every project will have different methodologies that is being used to make the project successful and working well. Generally, the methodologies are divided into three parts, there are planning, implementing and analysis. In planning phase there are including with reading activity and some job of requirements of hardware and software to be used.

In reading activity I do research through several sources such as text books, journal, paper references, the Internet and more sources due to get the information about the project related. While in the requirements of hardware and software to be use I was study and find out the functional and operational of the hardware and software related.

Next step is implementing phase where in this part I did the appointment with third party due to produce the project circuit board. When the PCB was ready to mount

the electronic components, the process of construction circuit is followed. The process of checking, testing and tuning are followed due to complete a part of implementing.

Finally, in analysis phase, the project was come out with the operations of Pulse Rate circuit. It was looking at the combination of electronic circuits that are Arduino Nano, pulse sensor and copper coil. The functions and the operations of the circuits related are very important to be analyzed. With appropriate steps and methodology, any process of completing the project can be managed wisely and will be make a good result.

CHAPTER 4

RESULT AND DISCUSSION

4.1 Introduction

Result and discussion is a research to get the analysis information about the project. In this chapter we will discusses on the result, findings and the assessment from the analysis conducted in this project.

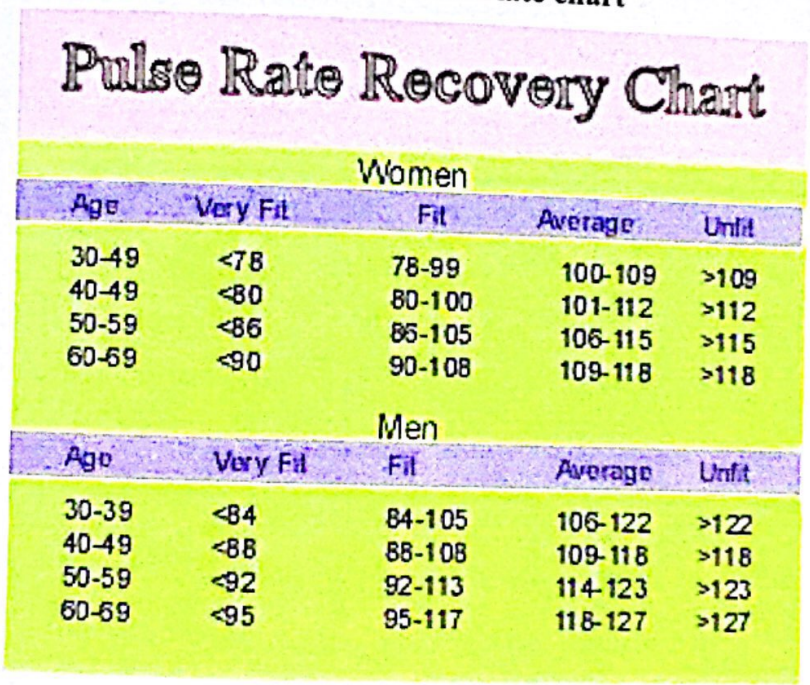
After the development of the Out Of Stress(O2S), this project will be analysed to measure the effectiveness and to ensure the objectives of the project successfully achieved. Throughout the analysis stage, strengths and weakness of the Out Of Stress (O2S) is identified.

Generally, there are three aspects stressed in the analysis, which are the behaviour, ability and sensitivities of the Out Of Stress(O2S) device.

4.2 Pulse rate

Pulse rate is one of the vital signs used to measure basic function of human body. The pulse is how many times a minute that our arteries expand and contract in response to the heart. This pulse rate is exactly equal to the heartbeat, the rate of heart contractions, because these heart contractions cause the increases in blood pressure and the pulse in the arteries. Taking the pulse, therefore, is a direct measure of heart rate. It is quick and easy to check the pulse has a straightforward guide on finding a pulse and using it to record a heart rate.

Figure 4.2 Pulse Rate chart



Pulse Rate Recovery Chart

Women

Age	Very Fit	Fit	Average	Unfit
30-49	<78	78-99	100-109	>109
40-49	<80	80-100	101-112	>112
50-59	<86	86-105	106-115	>115
60-69	<90	90-108	109-118	>118

Men

Age	Very Fit	Fit	Average	Unfit
30-39	<84	84-105	106-122	>122
40-49	<88	88-108	109-118	>118
50-59	<92	92-113	114-123	>123
60-69	<95	95-117	118-127	>127

4.3 Treatment Duration

The significant issue is the treatment duration. In the systematic reviews (see Colbert et al, 2008 for details) the treatment durations varied from 3 minutes at the lower end of the scale right through to a continuous application for 6 months! Some treatments

were delivered on a 'one off' basis, others several times a week, and others daily or indeed, continuously over a period of days, weeks or months. In this project we used 3 min for one week as the treatment duration for the outcome of the Out Of Stress(02S) devices.

4.4 Pulse Rate Test Reading

The pulse rate reading of device OUT OF STRESS(O2S) being compare to the Non-invasive blood pressure(NIBP). This compare to see the accurate of the pulse rate reading and the effectiveness of the pulse sensors.

Non-invensive blood pressure(NIBP)

Table 4.4(1)

Number of test	Time (minutes)	Pulse rate			
1	1	78	76	78	78
2	1	74	75	76	76

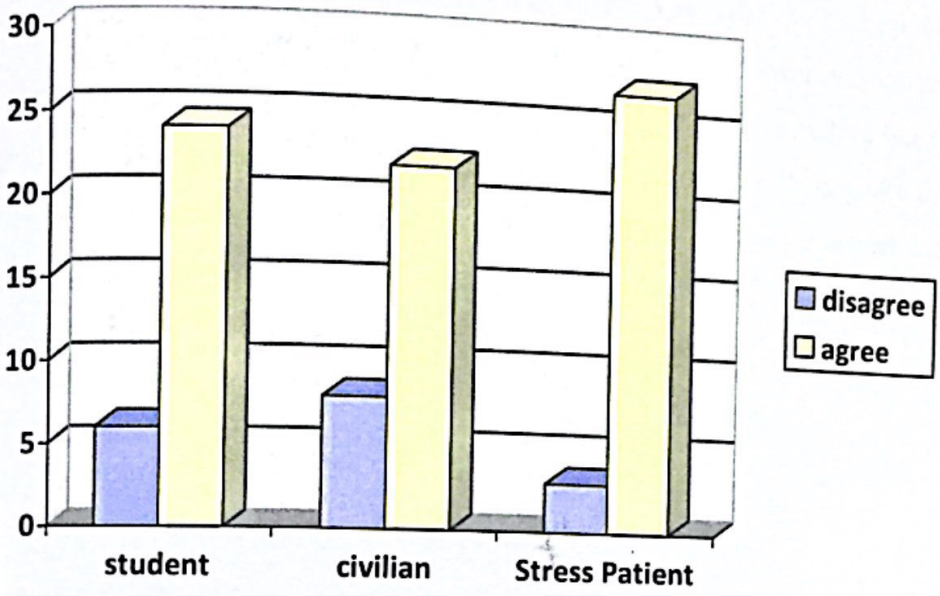
Out of stress(O2S)

Table 4.4(2)

Number of test	Time (minutes)	Pulse rate			
1	1	87	96	102	98
2	1	98	84	110	123

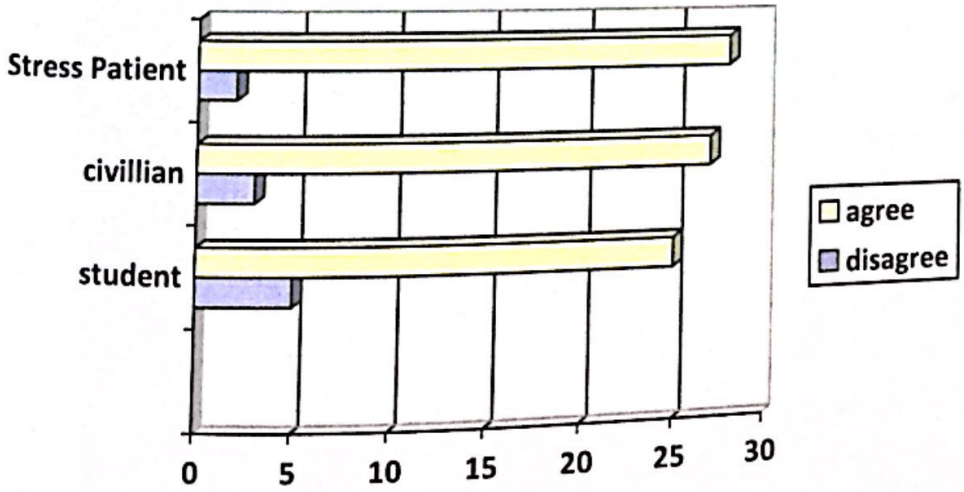
4.5 Evaluation Test Referring to Comfortableness

Figure 4.5



4.6 Evaluation Test Referring to Effective of Pulse Rate

Table 4.6



4.7 Conclusion

During do the evaluation test and test pulse rate reading, the device Out Of Stress(O2S) being aggreed to be used. Most our survey like the electromagnetic field and the used of stress detected by using pulse rate. The heat (warm condition) that produce from the electromagnetic field was the most like by the people because it's feel good placed on wrist. But the problem occour in the device to measure the pulse rate. The sensor not accuracy to get the reading, the reading being unstable and not accurate as we expected.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

We can conclude that OUT OF STRESS(O2S) devices not working well because the pulse rate reading still not stable and accurate like a real machine of measuring the pulse rate. The magnetic field also cannot being attach too long to the patient because the electromagnetic field will produce heat as well and the therapy need long time to get good result. From our research and journal that we use, the magnetic field can increase the blood flow and calm down the pulse rate reading for the stress patient. This device can be used to help and manage the stress of the patient through the electromagnetic therapy. The electromagnetic field will attract the iron, this causes movement within the blood stream and the increased activity of the blood flow.

5.2 Recommendation

Our recommendation for our project, need more sensitive sensor that can detect more accurate pulse rate and give a stable reading of pulse rate that will maintain in certain reading. The display also need more research because the LCD Nokia 1550 that we use cannot being continuously used for a long time, so we recommend to use the simple LCD display. For the electromagnetic field, need to have a good research about the coil (length, diameter, area).

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