POLITEKNIK
Sultan Salahuddin Abdul Aziz Shah

FINAL PROJECT REPORT
SLEEP INDUCER MONITOR

DINIE QUSYAIRY BIN ZULKIPLI AMIN 08DEU14F1001
NURSABRINA BINTI RIZAL EDGAR 08DEU14F1021
KHAIRUL ANAS BIN KAMARUDIN 08DEU14F1041
MOHD ANIQUE AIMAN BIN MOHD ROZI 08DEU14F1087

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

16.67

SLEEP INDUCER MONITOR

DINIE QUSYAIRY BIN ZULKIPLI AMIN
08DEU14F1001

NURSABRINA BINTI RIZAL EDGAR
08DEU14F1021

KHAIRUL ANAS BIN KAMAUDIN
08DEU14F1041

MOHD ANIQUE AIMAN BIN MOHD ROZI
08DEU14F1087

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

Jabatan Kejuruteraan Elektrik
Politeknik Sultan Salahuddin Abdul Aziz Shah

DIS 2016

ENDORSEMENT

"I hereby acknowledge that i have read this report and I find that its contents meet the requirements in terms of scope and quality for the award of the Diploma in Electronic Engineering (Medical)"

Signature : .....

Name of Supervisor : DR. HJ. ZUNUWANAS BIN MOHAMAD

KETUA PROGRAM

IJAZAH SARJANA MUDA TEKNOLOGI KEJURUTERAAN ELEKTRONIK

(ELEKTRONIK PERUBATAN)

POLITEKNIK SULTAN SALAHUDDIN

ABDUL AZIZ SHAH

Date : 26/3/17

ENDORSEMENT

"I hereby acknowledge that i have read this report and I find that its contents meet the requirements in terms of scope and quality for the award of the Diploma in Electronic Engineering (Medical)"

Signature : .....

Name of Supervisor : .....

Date : .....

ENDORSEMENT

"I hereby acknowledge that i have read this report and I find that its contents meet the requirements in terms of scope and quality for the award of the Diploma in Electronic Engineering (Medical)"

Signature : .....

Name of Supervisor : DR. HJ. ZUNUWANAS BIN MOHAMAD

KETUA PROGRAM
IJAZAH SARJANA MUDA TEKNOLOGI KEJURUTERAAN ELEKTRONIK
(ELEKTRONIK PERUBATAN)
POLITEKNIK SULTAN SALAHUDDIN
ABDUL AZIZ SHAH

Date : 29/3/17

DECLARATION

"We hereby declare that the work in this report is our own except for quotation and summaries which have been duly acknowledge"

Signature : .....

Name : NURSABRINA RIZAL EDGAR

Registration No. : 08DEU14F1021

Date : 28/09/2017

Signature : .....

Name : KHAIRUL ANAS KAMARUDIN

Registration No. : 08DEU14F1041

Date : 28/09/2017

Signature : .....

Name : MOHD ANIQUE AIMAN MOHD ROSI

Registration No. : 08DEU114F1087

Date : 28/03/2017

Signature : .....

Name : DINIE QUSYAIRY ZULKIPLI AMIN

Registration No. : 08DEU111F1001

Date : 28/03/2017

ACKNOWLEDGEMENT

Firstly, we would like to praise our gratitude to Allah S.W.T. for giving us the strength during the development of the project. Individuals, lectures, practitioners, colleagues, and family members had helped us throughout the process of completing the project. They had been patience and understand upon my mistake, misinterpretation, and misdirection and had guided us back towards the right path.

We are heartily thankful to our supervisors Dr. Zunuwanas Bin Mohammad, Puan Fariza Binti Zahari and Puan Mariana Binti Rosdi whose encourage, guide and support from the initial to the final level, enabled us to develop and improve the understanding of the subject.

Lastly, we offer our regard and blessing to all of those who supported us in any aspect during the completion of the project.

ABSTRACT

There is nothing quite as pleasant as being able to relax completely whenever it is desired. In today's competitive world mental stress is acute problem. As a result insomnia is occurring. One of the insomnia symptoms is hypertension. In most of the cases people use heavy dose drug to get rid of this problem which is very harmful for human body. There is much adverse effect because in one stage people get addicted to this. In the recent time researchers are trying to solve this using electromagnetic field therapy. With the continuity of the previous researches, we have designed a circuit which creates and radiates an electromagnetic field through a radiator coil and create an environment helpful for sound sleep. The most basic component in this radiator or electrical coil is magnet wire. One of the interesting features of electrical coils is that their electro-magnetic properties are influenced by their physical dimensions. This project purposely designed which is called a Sleep Inducer Monitor. Sleep Inducer Monitor is an innovation of Non-invasive Blood Pressure (NiBP) monitor which we co-operate it with the Sleep Inducer device. The Sleep Inducer Monitor is a device where we can monitor our blood pressure level and at the same time it will generates a natural electromagnetic field which will help to put us to sleep. This natural electromagnetic field will create the same pattern of wave that creates in our brain during sleep. As we can conclude this product helps in fighting insomnia. Apart from this, it also supports relaxation, stress management and induces sleep easily.

ABSTRAK

Tiada yang lebih menyenangkan daripada dapat berehat sepenuhnya pada bila-bila masa yang diingini. Dalam dunia yang berdaya saing pada masa kini, tekanan mental adalah satu masalah yang sangat merbahaya. Ianya boleh menyebabkan seseorang itu mengalami insomnia. Insomnia pula akan menyebabkan tekanan darah tinggi. Dalam kebanyakan kes, pesakit akan mengambil ubat yang berdos tinggi untuk merawat penyakit ini tetapi ianya sangat merbahaya kepada badan manusia. Kesan yang paling teruk adalah pada satu tahap pesakit akan mula ketagih dengan ubat ini. Dalam kajian yang terbaru, penyelidik berusaha menyelesaikan masalah ini dengan menggunakan terapi medan electromagnet. Dengan berbekalkan kajian sebelum ini, kami telah mereka satu litar yang boleh menghasilkan dan memancarkan medan electromagnet melalui gegelung radiator dan mencipta satu persekitaran yang dapat membantu untuk tidur dengan nyenyak. Komponen asas dalam gegelung radiator tersebut ialah wayar magnet. Satu daripada ciri gegelung ini ialah electromagnet dipengaruhi oleh dimensi-dimensi fizikal mereka. Projek ini diberi nama "Sleep Inducer Monitor". Ianya adalah satu pembaharuan bagi "Non-invasive Blood Pressure (NiBP) Monitor" yang mana kami gabungkan dengan alat "Sleep Inducer". "Sleep Inducer Monitor" adalah satu alat dimana kita boleh mengawasi atau memantau tekanan darah kita dan pada masa yang sama ianya akan menjana atau menghasilkan medan electromagnet yang dapat membantu kita tidur. Medan ini akan menghasilkan corak gelombang yang sama yang terhasil di dalam otak kita semasa tidur. Kesimpulannya, produk ini dapat membantu mencegah dan merawat insomnia. Selain itu, ianya juga membantu dalam pengurusan tekanan, memberi keselesaan dan mendorong untuk tidur dengan lebih senang.

SLEEP INDUCER MONITOR

CHAPTER 1

INTRODUCTION

1.1 Background of study

Sleep Inducer Monitor is an innovation of Non-invasive Blood Pressure (NiBP) monitor which we co-operate it with the Sleep Inducer device. The Sleep Inducer Monitor is a device where we can monitor our blood pressure level and at the same time it will generates a natural electromagnetic field which will help to put us to sleep. This natural electromagnetic field will create the same pattern of wave that creates in our brain during sleep. This product helps in fighting insomnia. Apart from this, it also supports relaxation, stress management and induces sleep easily.

1.2 Problem statement

Nowadays, people want something that give easier to their life. Based on our observation, the problems that related to our project is chronic insomnia affects approximately 9% to 12% of the population and is more prevalent than heart disease, cancer, AIDS, neurologic disease, breathing problems, urinary problems, diabetes and gastrointestinal problems. Although insomnia is highly prevalent, it is not commonly viewed as a significant threat to health. However, research has shown that a strong relationship exists between insomnia, hypertension, depression and anxiety, where insomnia may be a risk factor.[1]

People who have insomnia often take sleeping pills. What they don't know is, the sleeping pills can interfere with normal breathing and can be dangerous in people who have certain chronic lung problems such as asthma , emphysema, or forms of chronic obstructive pulmonary disease (COPD). Common side effects of prescription sleeping pills such as Lunesta, Sonata, Ambien, Rozerem, and Halcion may include burning or tingling in the hands, arms, feet, or legs, changes in appetite, constipation, diarrhea, difficulty keeping balance, dizziness, daytime drowsiness, dry mouth or throat, headache, heartburn, impairment the next day, mental slowing or problems with attention or memory, stomach pain or tenderness, uncontrollable shaking of a part of the body, unusual dreams and weakness.

The problem that we have to deal is there are many ways to induced sleep such as by using radio waves, sound wave and light waves. But there are some disadvantages of this waves that make them inappropriate to be use in our project. The most striking disadvantage of sound waves is that they rely on a medium to move. Also the speed of sound waves reliant on the density of its medium, and the

quality of sound waves may be affected by disturbances in its surroundings. It loses energy as it travels (that's why sound is not easily heard over great distances), and can be cancelled out by higher energy waves (think about a soft voice being drowned out by loud music). Hence sound waves are not reliable modes of information transfer and have been replaced by electromagnetic waves.

1.3 Objective

Objective is the purpose you make this project and need to achieve as the result of the project. The objectives of this project are:

i. To create a Sleep Inducer device.
ii. To design a device which can monitor our blood pressure level; Non-invasive Blood Pressure (NiBP) monitor.
iii. To analyze the compatibility of the Sleep Inducer device and NiBP monitor.

1.4 Significant of study

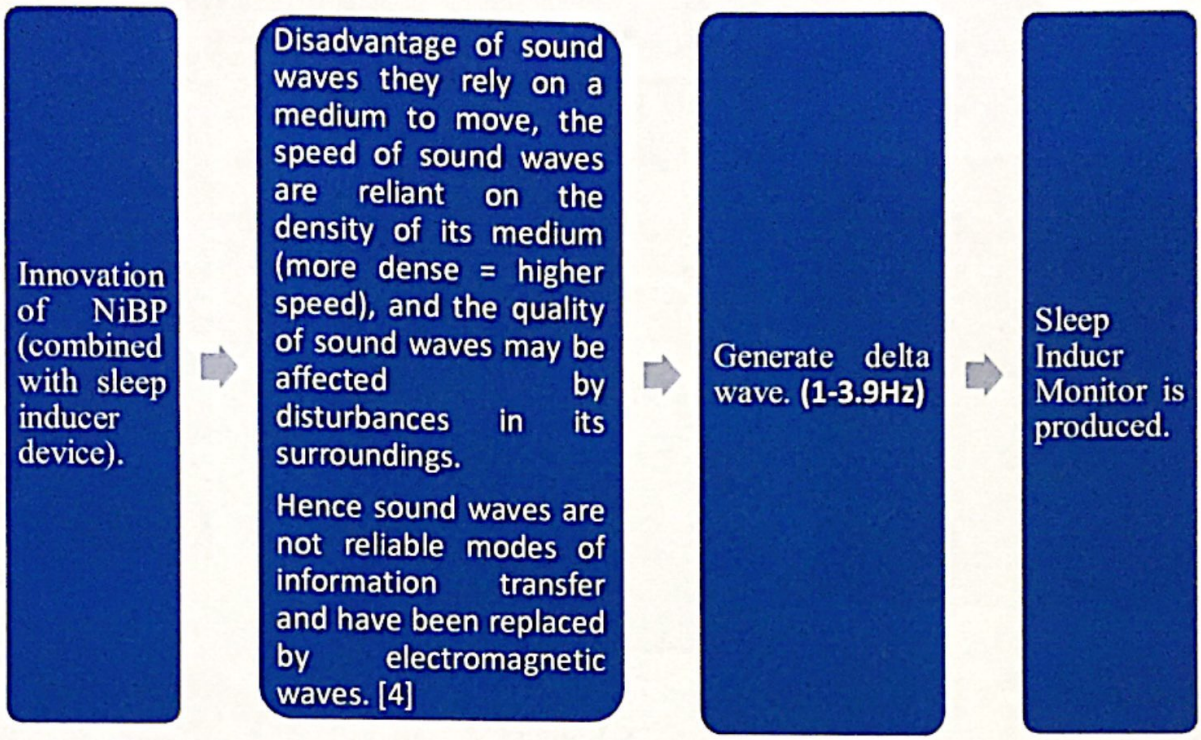


Figure 1.1

1.5 Theoritical of study

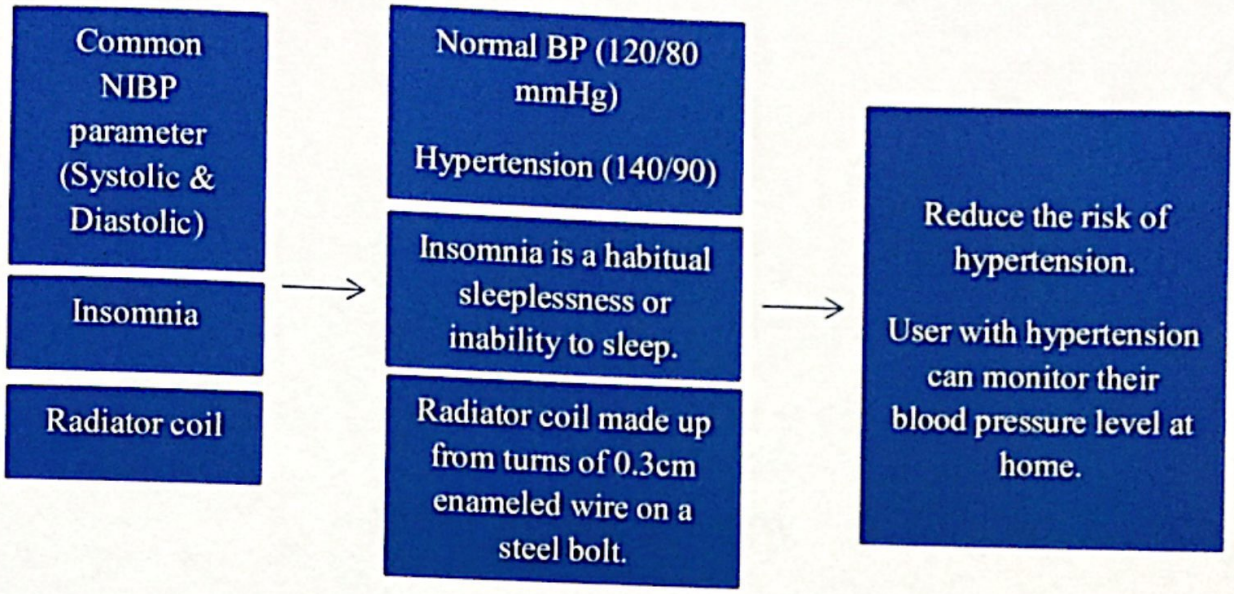


Figure 1.2

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Sleep Inducer Monitor a bi-functional device which is a combination of Sleep Inducer device and NiBP monitor. This device can monitor our blood pressure level (systolic and diastolic) and it will generate electromagnetic field which will produce the same pattern of waves that creates in brain during sleep. The NiBP will be functioning as same as the common NiBP monitor in the market but what we improve or innovate is when the NiBP detect high blood pressure level(hypertension) we will manually "ON" the Sleep Inducer circuit.

With the continuity of the previous researches, we have designed a circuit which creates and radiates an electromagnetic field through a radiator coil and create an environment helpful for sound sleep.

2.2 Insomnia

There is nothing quite as pleasant as being able to relax completely whenever it is desired. In today's competitive world mental stress is acute problem. As a result insomnia is occurring all over the world. Insomnia is habitual sleeplessness or inability to sleep.

All types of insomnia can lead to hypertension, drowsiness, poor concentration and the inability to feel refreshed and rested in the morning. The lack of restful sleep can affect our ability to carry out daily responsibilities. As a consequence, this can lead to hypertension, memory problems, depression, irritability and an increased risk of heart disease and automobile related accidents. In most of the cases people use heavy dose drug to get rid of this problem which is very harmful for human body. There is much adverse effect because in one stage people get addicted to this.

2.2.1 Regulation and triggering of sleep [2]

Sleep is a naturally recurring state characterized by reduced or absent consciousness, relatively suspended sensory activity and inactivity of nearly all voluntary muscles. Sleep is a heightened anabolic state, accentuating the growth and rejuvenation of the immune, nervous, skeletal and muscular systems. Sleep is often thought to help conserve energy, but decreases metabolism only about 5-10%. Sleep is actually triggered by the nervous system.

2.2.2 Condition of human brain during sleep [2]

When we close our eyes and relax, the predominant EEG pattern will be a slow oscillation between 7 and 12 hertz. This waveform is called the alpha rhythm, and is associated with a decreased level of attention. Opening our eyes and looking around causes the EEG to change to b=the beta rhythm, occurring between about 17 and 20 hertz. Other frequencies and waveforms are seen in children, different depths of sleep, and various brain disorders such as insomnia. Various stages of sleep:

Table 2.1: Different stages of REM sleep

STAGE NO.	1	2	3	4	REM
1	Light sleep.	Eye movement & muscle activity stop.	Brain produces very slow delta waves.	Brain produces only delta waves.	Heart, breath ingrates & blood pressure rise, while muscles of the chin, limbs, neck & torso are paralyzed.
2	Eye & muscle activity, along with brain activity, all decrease.	Brain waves slow down.	Deep sleep begins.	Sleeper may be disoriented if wakened.	Eye movement is quick & irregular & the sleeper begins to dreams

Table 2.2: Different stages of non-REM sleep

STAGE NO.	1	2	3
1	The transition of the brain wave from alpha to theta.	Sleep spindles ranging from 11 to 16 Hz (most commonly 12-14 Hz)	This stage called seep or slow-wave sleep. 20% delta waves ranging from 0.5-2 Hz & having a peak-to-peak amplitude >75μV.
2	This stage is referred to as somnolence or drowsy sleep.	Muscular activity decreases, & conscious awareness of the external environment disappears.	In this stage parasomnias such as night terrors, noctual enuresis, sleepwalking & somniloquy occur.
3	-	This stage occupies 45-55% of the total sleep in adults.	-

2.2.3 Categories of brain wave patterns [2]:

a) **Beta (14-30Hz)**

- Concentration, arousal, alertness, cognition
- Higher levels associated with anxiety, disease, feelings of spa ration, fight or flight

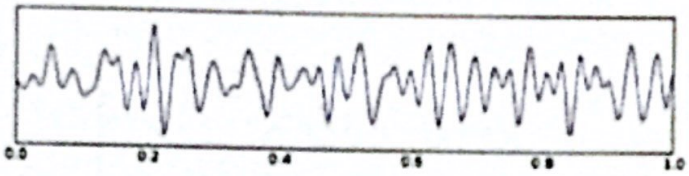


Figure 2.1: Beta wave

b) **Alpha (8-13.9Hz)**

- Relaxation, super learning, relaxed focus, light trance, increased serotonin production
- Pre-sleep, pre-working drowsiness, mediation, beginning of access to unconscious mind

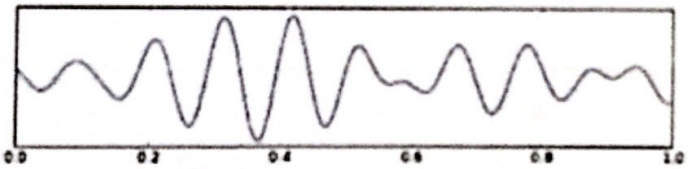


Figure 2.2: Alpha wave

c) **Theta (4-7.9Hz)**

- Dreaming sleep (REM sleep)
- Increased production of catechol amines (vital for learning and memory), increased creativity
- Integrative, emotional experiences, potential change in behaviour, increased retention of leamed materials
- Trance, deep mediation, access to unconscious mind

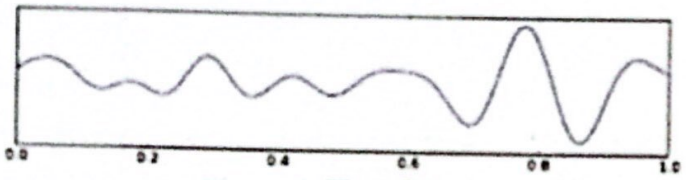


Figure 2.3: Theta wave

d) **Delta (1-3.9Hz)**

- Dreamless sleep
- Human growth hormone released
- Deep, trance-like, non-physical state, loss of body awareness
- Access to unconscious and collective unconscious mind

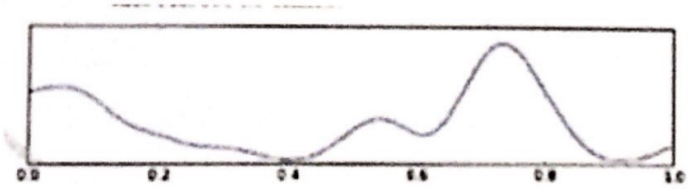


Figure 2.4: Delta wave

2.2.4 Different Stages of Insomnia

a) Insomnia types:

- Transient –lasts for less than a week
- Acute –inability to consistently sleep well for a period of less than a month
- Chronic –lasts for longer than a month

b) How insomnia occur

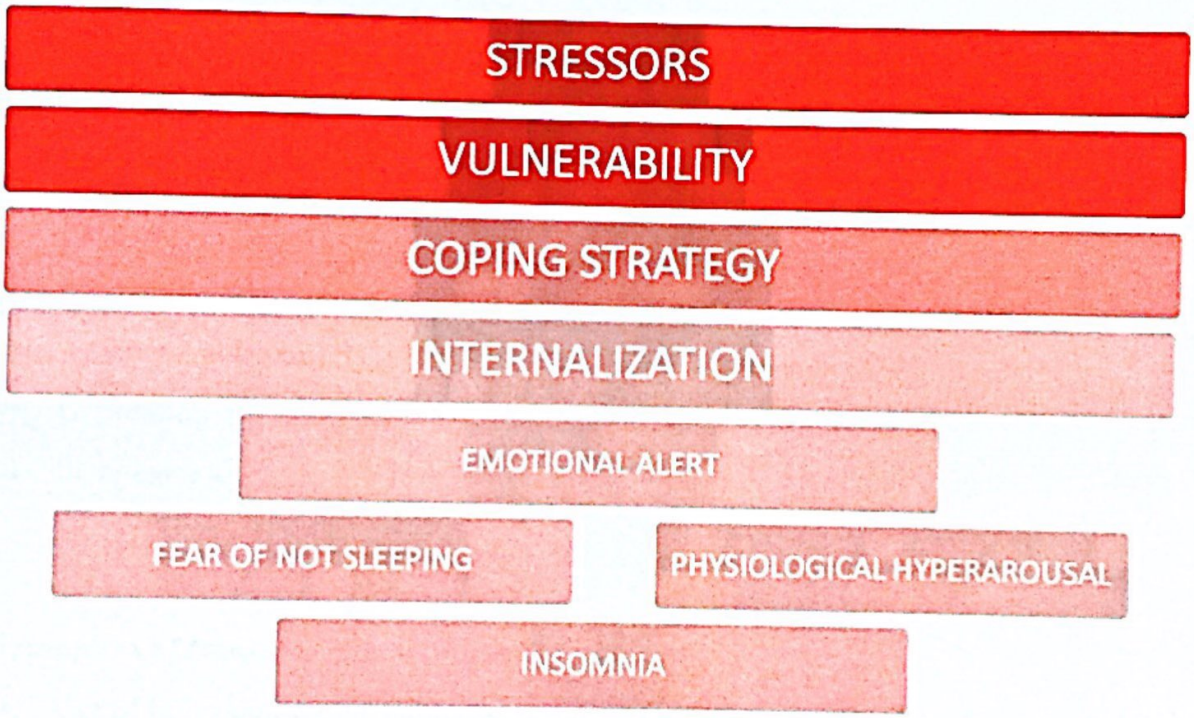


Figure 2.5: Insomnia process

c) Pattern of insomnia

- Initial –early (morning awakening)
- Middle –difficulty in sleeping through the night without waking up and difficulty in going back to sleep
- Terminal –difficulty in falling asleep

2.2.5 Symptoms and causes

a) **Night-time symptoms**

- Frequent episodes of waking up accompanied by difficulty in falling back to sleep
- Frequent difficulty falling asleep
- Waking too early in the morning with inability to fall back to sleep again
- Non-refreshing night time sleep
- Hypertension

b) **Day-time symptoms**

- Hypertension
- Fatigue
- Memory of attention impairment
- Anxiety and irritability
- Depression
- Sleepiness

c) **Symptoms of insomnia can be caused by:**

- Use of fluoroquinolone antibiotic drugs
- Life events such as fear, stress, anxiety, emotional or mental tension, work problems, financial stress, birth of a child and bereavement.

2.3 Blood pressure (systolic and diastolic)

Blood pressure is the pressure of your blood on the walls of your arteries as your heart pumps it around your body. It's a vital part of how your heart and circulation works. A blood pressure reading under 120/80mmHg is considered optimal. Readings over 120/80mmHg and up to 139/89mmHg are in the normal to high normal range.

Blood pressure that's high over a long time is one of the main risk factors for heart disease. As you get older, the chances of having persistently high blood pressure increases. It's very important to get your blood pressure checked regularly, and if it's persistently high it needs to be controlled. Uncontrolled high blood pressure can lead to a heart attack or stroke. It may also affect your kidneys. The medical name for high blood pressure over a long period of time is hypertension.

Table 2.3: Blood pressure stages

Blood Pressure Stages

Blood Pressure Category	Systolic mm Hg (upper #)		Diastolic mm Hg (lower #)
Low blood pressure (Hypotension)	less than 80	or	less than 60
Normal	80-120	and	60-80
Prehypertension	120-139	or	80-89
High Blood Pressure (Hypertension Stage 1)	140-159	or	90-99
High Blood Pressure (Hypertension Stage 2)	160 or higher	or	100 or higher
High Blood Pressure Crisis (Seek Emergency Care)	higher than 180	or	higher than 110

Source: American Heart Association

2.3.1 Systolic pressure

When your heart beats, it squeezes and pushes blood through your arteries to the rest of your body. This force creates pressure on those blood vessels, and that's your systolic blood pressure. A normal systolic pressure is below 120. A reading of 140 or more is high blood pressure (also called hypertension).

2.3.2 Diastolic pressure

The diastolic reading, or the bottom number, is the pressure in the arteries when the heart rests between beats. This is the time when the heart fills with blood and gets oxygen. A normal diastolic blood pressure is lower than 80. 90 or higher is high blood pressure.

2.3.3 Causes and symptoms

The exact causes of high blood pressure are often not clear. Your blood pressure may be strongly influenced by:

- family history
- eating patterns, including salty foods
- alcohol intake

- weight
- how much physical activity you do.

Some medicines can also raise blood pressure and you can't feel high blood pressure. There are usually no warning signs, so you can have it and not know. That's why it's important to get it checked.

2.4 Insomnia VS Hypertension

The study, which monitored 219 chronic insomniacs and 96 normal sleepers in a dedicated sleep laboratory, is published in the American Heart Association's journal Hypertension. The sleep-disordered people were classified with chronic insomnia if they had had difficulty sleeping for at least 6 months.

Completed in a specialist hospital unit in Chengdu, China, the study claims to be the first to investigate a link between high blood pressure (hypertension) and "insomnia with physiological hyper-arousal." This hyper-arousal was defined by long times taken to fall asleep in special monitoring tests. The researchers found:

- A higher risk of raised blood pressure in people with insomnia who took longer than 14 minutes to fall asleep during daytime nap tests
- The greater this hyper-arousal - the longer the time to start napping - the higher the risk of hypertension.

"Those insomniacs who were hyper-alert during the day, and unable to relax and fall asleep during the multiple sleep latency test, had the higher risk of hypertension," says Prof. Vgontzas.[3]

2.5 Electronics

2.5.1 CD4060B

a) Connection diagram

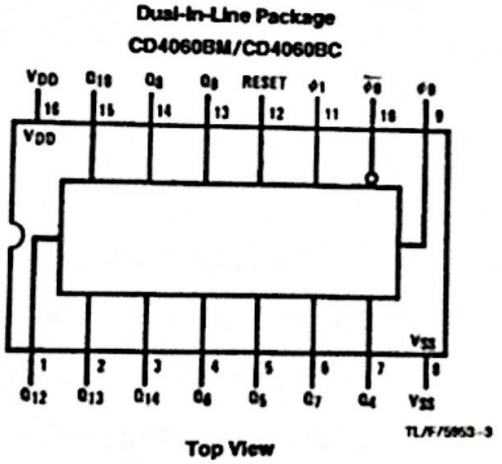


Figure 2.6: CD4060B connection diagram

b) Absolute maximum rating

- Supply Voltage (V_{DD}) -0.5V to +18V
- Input Voltage (V_{IN}) -0.5V to V_{DD} +0.5V

- Storage Temperature Range (T_S) -65°C to +150°C
- Package Dissipation (PD) Dual-In-Line 700 mW
- Small Outline 500 mW
- Lead Temperature (T_L) (Soldering, 10 seconds) 260°C

c) Recommended operating conditions

- Supply Voltage (V_{DD}) +3V to +15V
- Input Voltage (V_{IN}) 0V to V_{DD}
- Operating Temperature Range (T_A)
  - CD40XXBM -55°C to +125°C
  - CD40XXBC -40°C to +85°C

2.5.2 HEF4093B

a) HEF4093B is a quad two input NAND gate. Each input has a Schmitt trigger circuit. The gate switches at different points for positive-going and negative-going signals. The difference between the positive voltage (V_{T+}) and negative voltage (V_{T-}) is defined as hysteresis voltage (V_H).

b) Recommended operating conditions

- Voltage Supply (V_{DD}) 3V to 15V to V_{ss}
- Operating Tempereture Range:
  - Industrial -40 °C to +85 °C
  - Automaotive -40 °C to +125 °C

c) Pin configuration

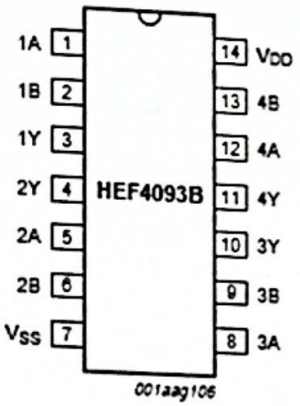


Figure 2.7: HEF4093B pin configuration

d) Functional diagram

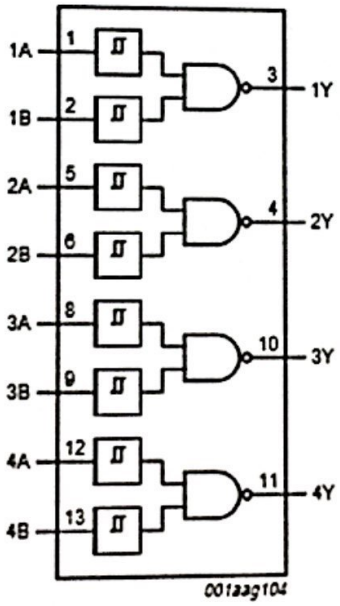


Figure 2.8: HEF4093B functional diagram

e) Logic diagram

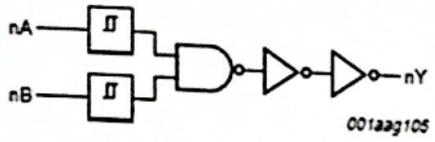


Figure 2.9: HEF4093B logic diagram

CHAPTER 3

METHODOLOGY

3.1 Introduction

This chapter will discuss about the method that has been used to solve the problem for developing sleep inducer monitor. The project will follow the method stage by stage. The method consists planning, designing of system, developing of software and testing to make development of software and testing to make the development of the project is systematically.

3.2 Planning

Basically all the successful works need to have a systematic plan to ensure all the duty were equally and all covered without any left. We divided the planning into two:

- Data collection
- Requirement of hardware and software

3.3 Implementing

3.3.1 Component

a) Valve actuator

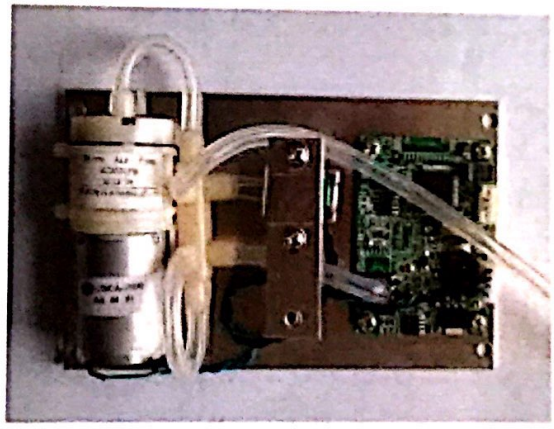


Figure 3.1: Valve actuator

Valve actuator is the mechanism for opening and closing a valve. Manually operated valves require someone in attendance to adjust them using a direct or geared mechanism attached to the valve stem. Power-operated actuators,

using gas pressure, hydraulic pressure or electricity, allow a valve to be adjusted remotely, or allow rapid operation of large valves.

Power-operated valve actuators may be the final elements of an automatic control loop which automatically regulates some flow, level or other process. Actuators may be only to open and close the valve, or may allow intermediate positioning; some valve actuators include switches or other ways to remotely indicate the position of the valve.

The electric actuator uses an electric motor to provide torque to operate a valve. They are quiet, non-toxic and energy efficient. However, electricity must be available, which is not always the case.

b) IC 4093

The general description about this IC is The IC4093 is a quad two-input NAND gate. Each input has a Schmitt trigger circuit. The gate switches at different points for positive-going and negative-going signals. The difference between the positive voltage (VT+) and the negative voltage (VT□) is defined as hysteresis voltage (VH). It operates over a recommended VDD power supply range of 3 V to 15 V referenced to VSS (usually ground). Unused inputs must be connected to VDD, VSS, or another input. Below is the diagram of IC4093:

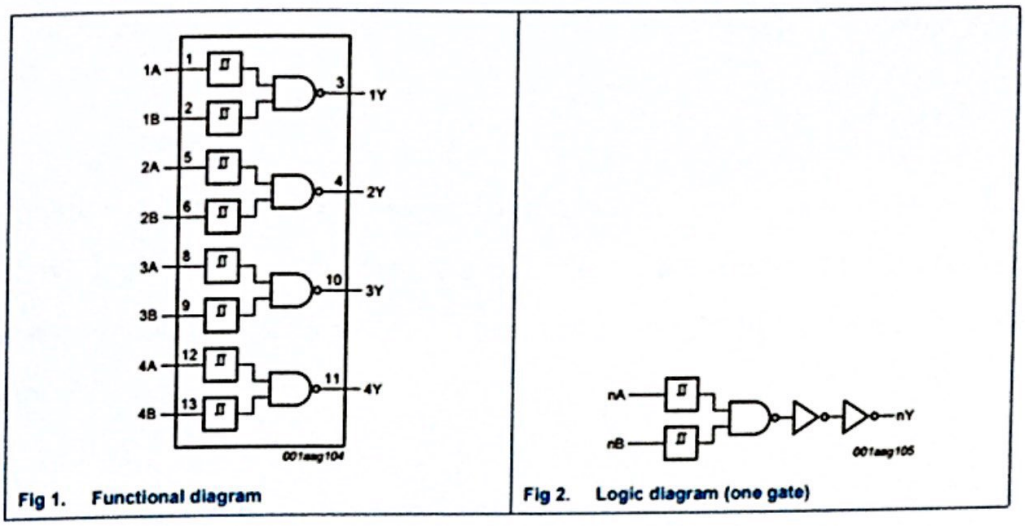


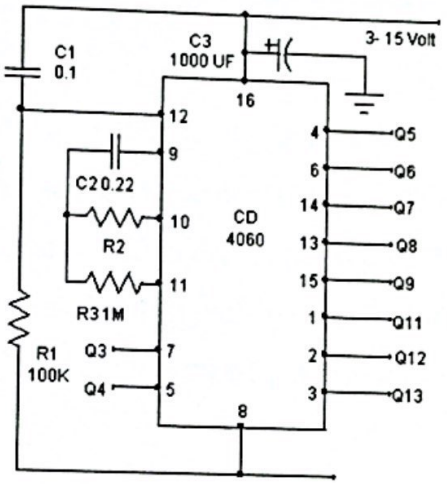
Fig 1. Functional diagram

Fig 2. Logic diagram (one gate)

Figure 3.2: HEF4093B

c) IC 4060

IC 4060 is an excellent integrated circuit for timing applications. Its ten active high outputs can give time delay from few seconds to hours. With a few components, it is easy to construct a simple but reliable time delay circuit.



Pin 12 Reset Pin 11 Clock Pin 10 Osc IN Pin 9 Osc OUT
Pin 16 Vcc Pin 8 Gnd Pins 1,2,3,4,5,6,7,13,14,15 Outputs

Timing cycle Ready Recknor

OP	Pin	R2 1M	R2 2.2M	R2 3.9M	R2 4.7M	R2 10M
Q3	7	4sec	9	17	21	44
Q4	5	8	19	34	42	1.4mt
Q5	4	17	38	1.13mt	1.4mt	2.5mt
Q6	6	35	1.2mt	2.26mt	2.6mt	5mt
Q7	14	1.1mt	2.5mt	4.52mt	5.6mt	11mt
Q8	13	2.3mt	5mt	9mt	11mt	23mt
Q9	15	4.6mt	10mt	18mt	22mt	47mt
Q11	1	18mt	40mt	1.12 hr	1.4hr	3.9hr
Q12	2	37mt	1.3hr	2.40hr	2.8hr	6.18hr
Q13	3	1.2hr	2.7hr	4hr	6.8hr	12hr

D.Mohan kumar

Figure 3.3: IC4060 pin configuration

IC 4060 is an Oscillator binary counter cum frequency divider. Its inbuilt oscillator is based on three inverters. The basic frequency of the internal oscillator is determined by the value of the capacitor connected to its pin 9 and that of the resistor in its pin 10. By increasing or decreasing the value of capacitor / resistor, time delay can be changed. Each output goes high after the completion of the timing cycle. To get maximum time period, output Q10 is omitted in the IC itself so that double time is available between Q9 and Q11.

Inside the IC, there is an oscillator and 14 series connected bistables (Ripple cascade arrangement). Internally the oscillator signal is applied to the first bistable which drives the second bistable and so on. Since each bistable divides its input signal by two, a total of fifteen signals are available, each of half the frequency of the previous one.

Ten of these fifteen signals are available on the output pins Q3-Q13.HEF 4060 is CMOS version which can operate at 3 volts while CD 4060 is high voltage type that can operate between 5 to 15 volts. It is necessary to add a capacitor close to pin 16 of IC so that minute voltage changes will not affect the timing cycle. Reset pin 12 resets the timing cycle once it is grounded. Outputs can give almost full supply voltage to drive light loads. Heavy loads such as relay can be operated through a driver transistor.

When the high output is connected to the pin 11(clock input) through a diode, oscillation stops and IC remains latched in high state till it resets. Pin 11 can be used to give clock pulses from an external source.

3.3.2 Schematic drawing

Proteus (PROcessor for TExt Easy to USe) allow to build schematic diagram and run simulation of the circuit to see either the circuit is functional or not. The proteus have a wide range of simulator models for popular micro-controllers and a set of animated models for related peripheral devices such as PIC and LCD displays, resistor, capacitor and more. Then, it can change the schematic diagram to PCB layout and make the circuit into 3D display. This proteus is very important in circuit designing and simulation of a circuit.

So, in our project, we are using the Proteus 8.1 Professional to build circuit of sleep inducer. The steps in the circuit diagram are:

i. We need to be emphasized are the position of symbols and components used in the schematic circuit. Once we know the entire production circuit, the circuit can be drawn using special software, namely Proteus 8.1 Professional

ii. Make sure that the connection of the component is correct to build a successful circuit.

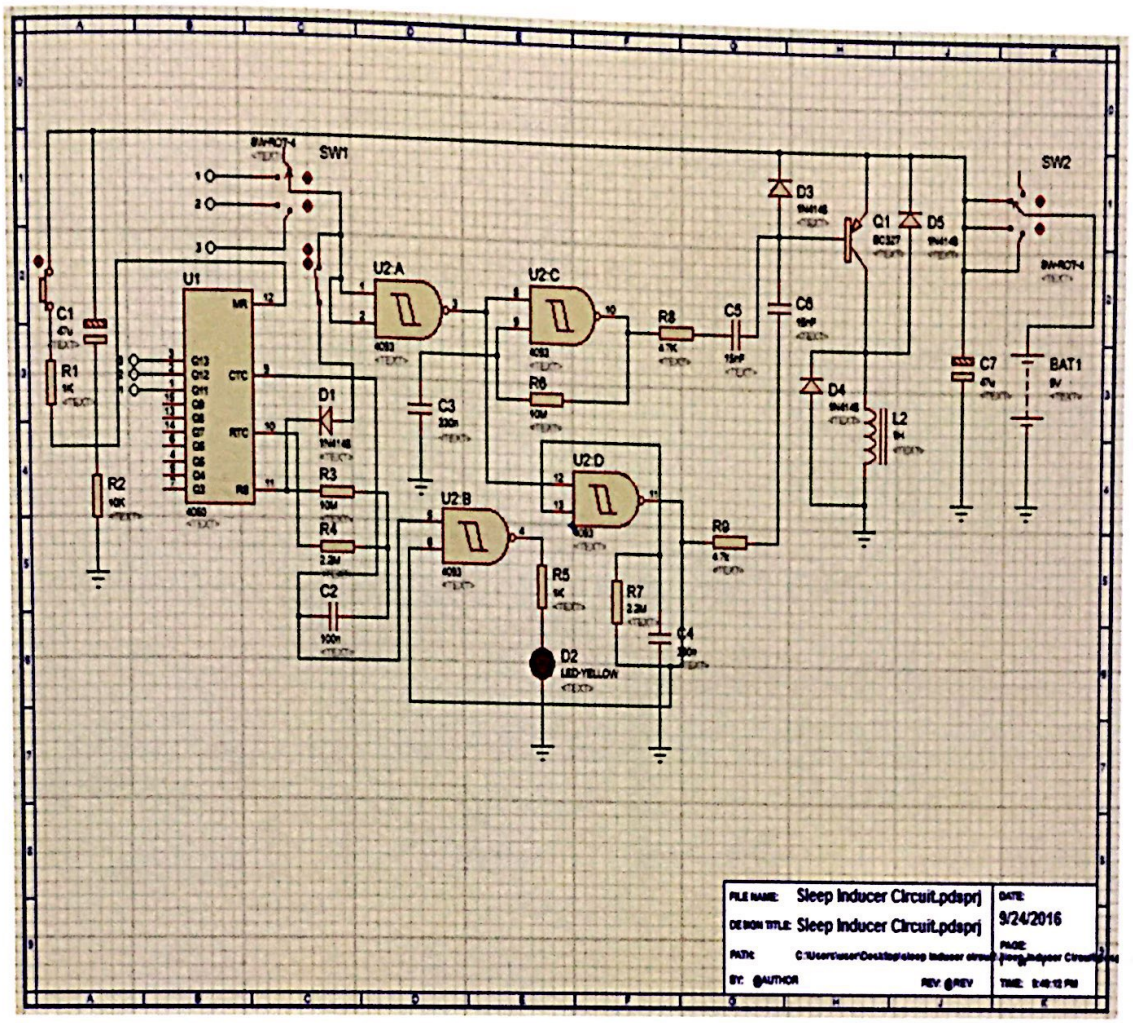


Figure 3.4: Proteus simulation of sleep inducer circuit

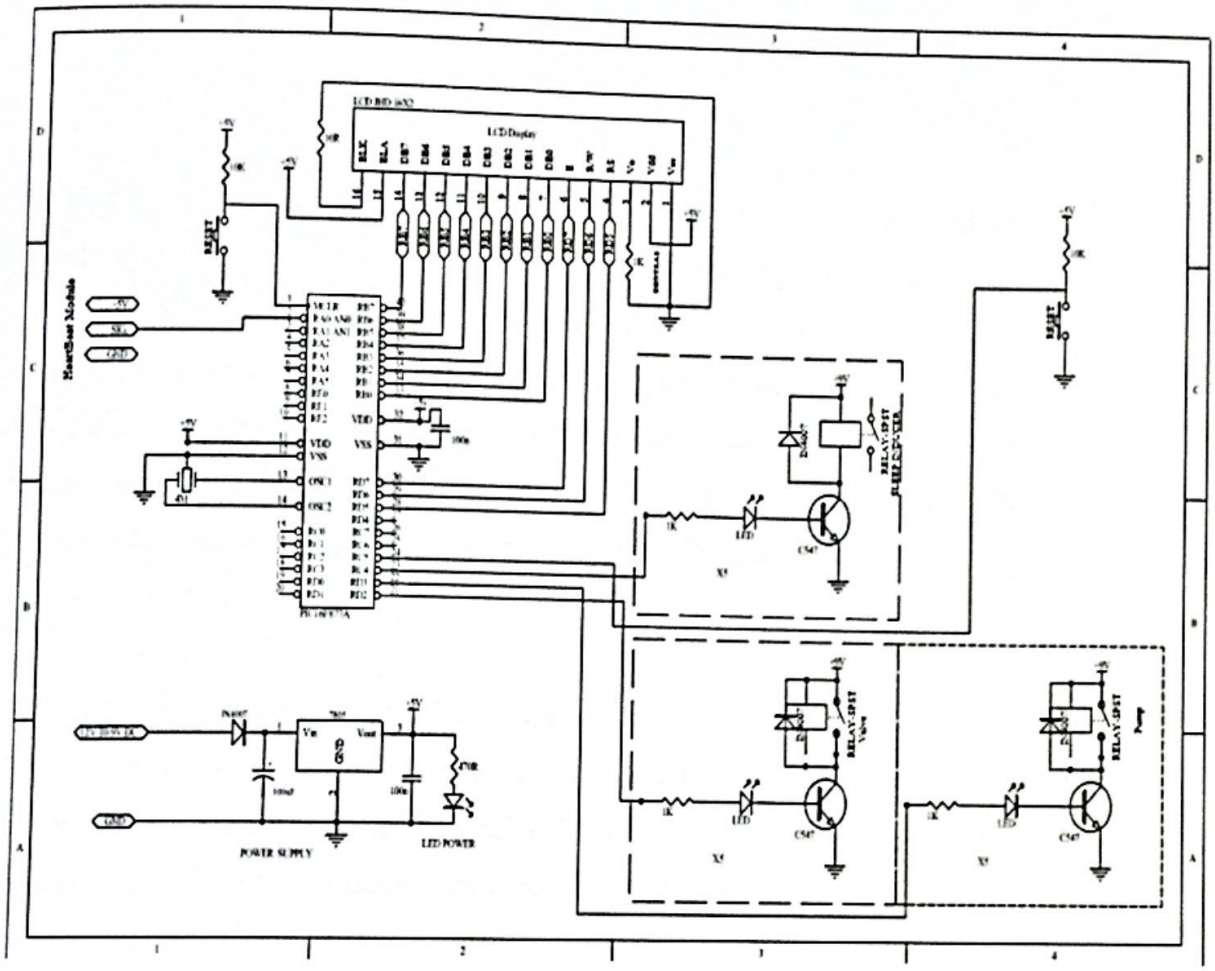


Figure 3.5: Proteus simulation of NiBP circuit

3.3.3 Etching, drilling and soldering process

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 for this project we are etching by doing manually.

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. The steps of the etching process are:

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

ii. Iron the printed OHB paper of schematic diagram on the PCB board. Make sure all the tracks of schematic diagram is paste nicely at the PCB board.

iii. Then, put the board into the mixed of Acid Ferric Chloride III and Hot water to remove the useless copper.

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

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

vi. Use sand paper to rub the lines colors and leaves only the track or trace of the circuit.

Meanwhile the drilling process start when the PCB board was punched using drilling machine. Hole is necessary to mount component (example: resistor, capacitor, relay, diode, and PIC base). Before drilling, a dot punch is used to mark the hole position. This serves as a shallow guide for the drill bit to align easily while drilling. Any other sharp pointed tool can be used to do the marking. Points/eye drill used must be appropriate to the hole to be punched which is 0.8mm and 1mm. The purpose of this process is to facilitate the installation work on the circuit components of the PCB. During drilling, do not be pressed too strong because it may cause eye drill broken up and dangerous for the people around. Hold the drill steady drill in straight slowly. The hole will be drilled with little force applied.

Legs of component were inserted into the drilled hole that has been completed. It is easier if started with the low component first. Components that are installed must be inspected prior to use multimeter to find out whether these components are in good condition or not. This process is quite important because we should insert the component correctly to avoid from circuit failure. Besides, some components have their own size of hole like diode, capacitor, relay and other else. After finished the inserting process, we check it once again with the schematic to make sure all the component were at the position or holes.

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. The steps of soldering are:

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

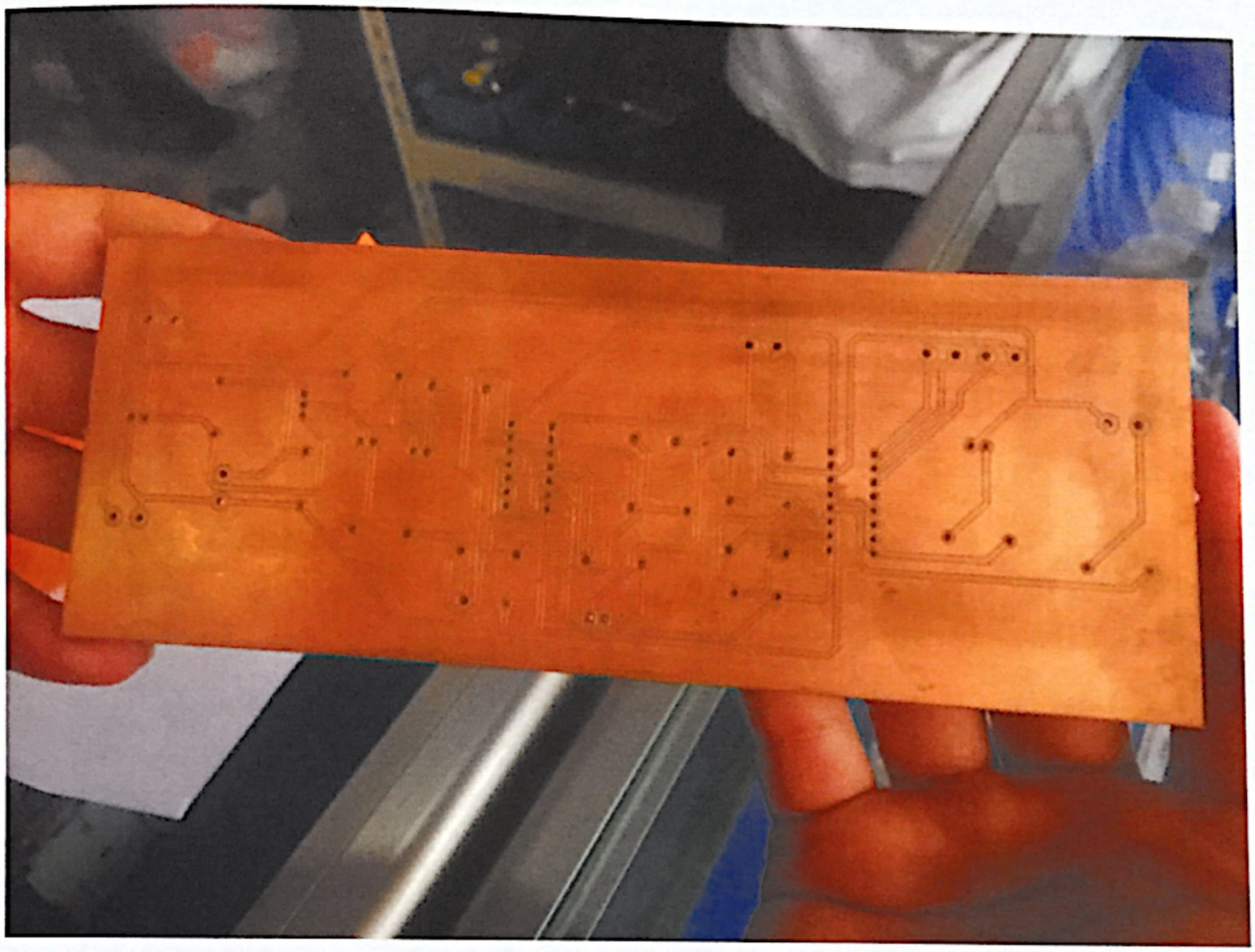


Figure 3.6: Circuit sleep inducer

3.3.4 Project testing

Figure 3.7: Testing process

An electrical coil is a relatively simple construction. The most basic component in it is magnet wire. It may also include a winding form (such as a bobbin or a toroid) and electrical termination to a connector of some type. One of the interesting features of electrical coils is that their electro-magnetic properties are influenced by their physical dimensions. Coils have both mechanical and electrical characteristics, and these elements are interrelated. This interrelation is integral to the design process and needs to be understood. It will be useful to discuss these characteristics briefly and to define the basic electrical measurements that can be made.

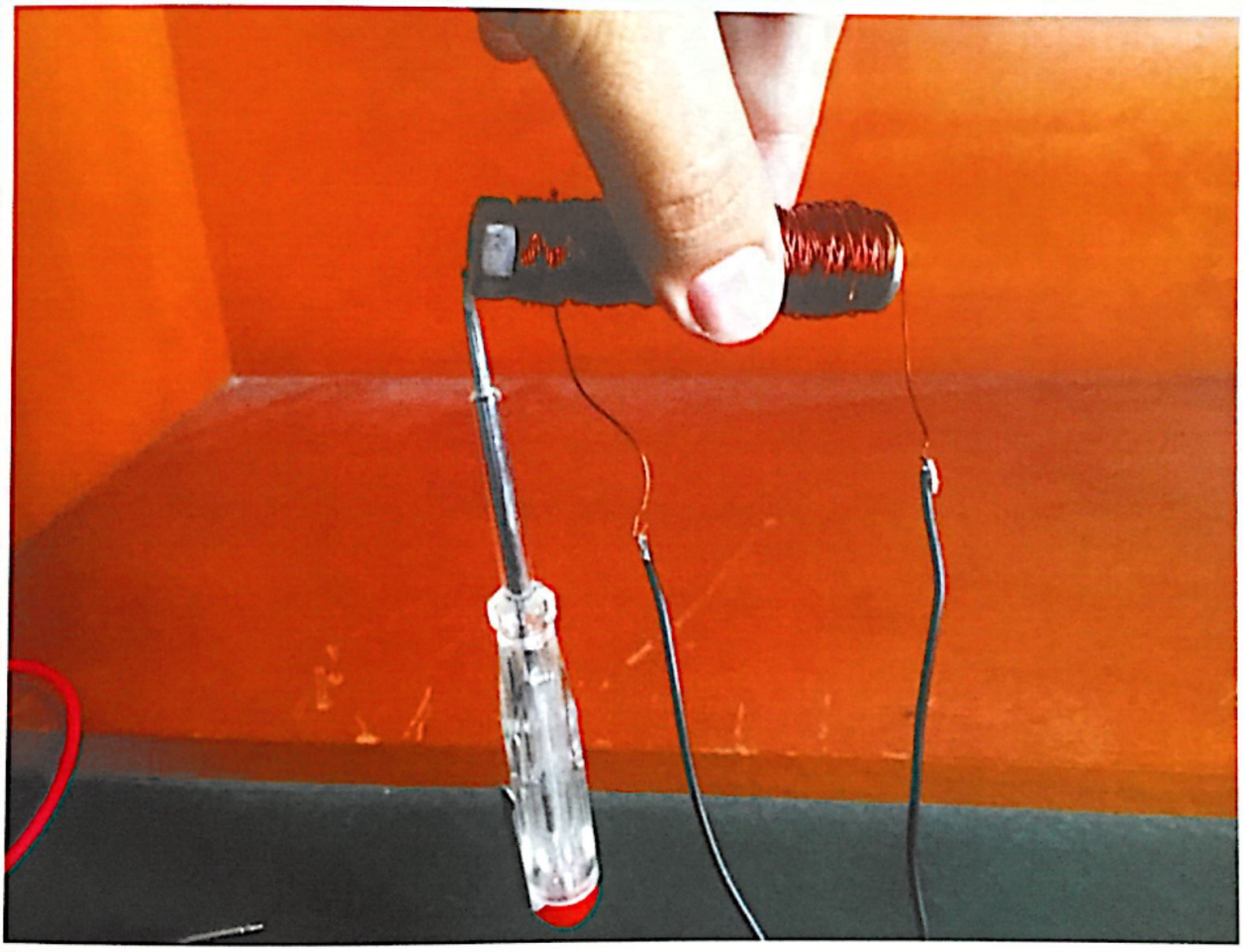
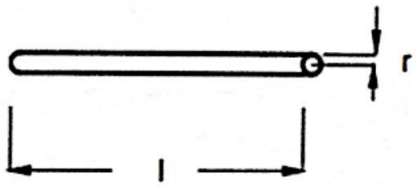


Figure 3.8: Testing coil

a) **Resistance (R)**

Resistance is one of the most basic electrical properties. The resistance value of a winding is determined by the length of wire used and its diameter or circular area. By using an ohmmeter to measure the electrical resistance of a coil, gross errors in wire size or turns count can be detected. Although this method is of limited accuracy, it is an easy and quick test. Because typical manufacturing tolerances of magnet wire diameters can be several percent, resistance variations can easily approach 10% for a given wire length. Typically, variations within a given wire spool will be minimized, but a lot to lot variations need to be monitored.



$R \cong \text{length} / \pi r^2$ (area)

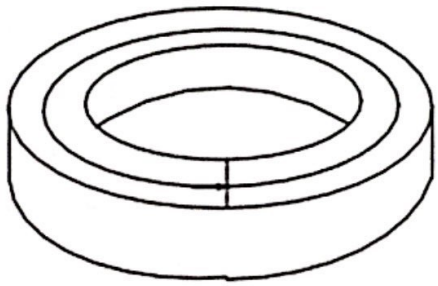
Figure 3.9: Resistance

Although magnet wire is typically made of copper, other materials are also available and will have different resistance values for a given size and length. Each material offers its own resistance values and thermal coefficients. For example, copper's resistance will increase .4% for each degree Centigrade in temperature increase. To compensate for this, temperature must be considered when making resistance measurements. As temperature rises, resistance also rises, increasing electrical losses and causing further heat built up. This phenomenon is a primary cause of coil

failure. For this reason, heat dissipation should always be considered in good product design.

b) Toroidal coil

Although we have been considering the most basic coil type, the solenoid coil, these same principles also apply to toroidal coil construction. In the toroid, the length dimension of a solenoid coil becomes the mean diameter of the toroidal core. By closing the magnetic path of the coil upon itself, its efficiency is again increased.



Length ≅ π x Diameter

Figure 3.10: Toroidal coil

Because core permeabilities are typically measured in 1,000's of μ as compared to a value of 1 for air, the magnetic efficiency of a coil is dramatically increased when it is coupled to a core. This holds true for both solenoid and toroidal types of construction, but toroids offer a particularly efficient geometry. By providing a closed magnetic circuit, the flux path is optimized.

c) Dielectric tests

The end use of a coil should be considered when designing a production testing program. There is little point in testing for qualities that are not relevant to the end product. For the simplest coil assemblies, it is possible that a functional test of the finished product is the most effective way to monitor quality. Perhaps only resistance or continuity need be checked. It is typically easier to make this test after a coil winding has been terminated to electrical contacts. In more complex assemblies, such as transformers or motors, more extensive testing must be done.

Much time and effort can be saved by detecting winding faults before additional assembly is done. There are a number of failures that can arise in the application of a coil to actual work. Virtually all of them are related to the coil dielectric breakdown. The shorted turns condition is probably the most common cause of coil failure. It occurs when the insulation resistance, or dielectric, fails within a winding, allowing a secondary, or parasitic, current path

Although a single shorted turn may not have an immediate effect on a coil's performance, the point of dielectric failure will become a source of heat built up. This localized heat buildup will cause further insulation breakdown. There are several ways of detecting this condition. IEM produces a Shorted Turns Tester that will detect shorted turns without making electrical contact with the coil. It is a non-stress test.

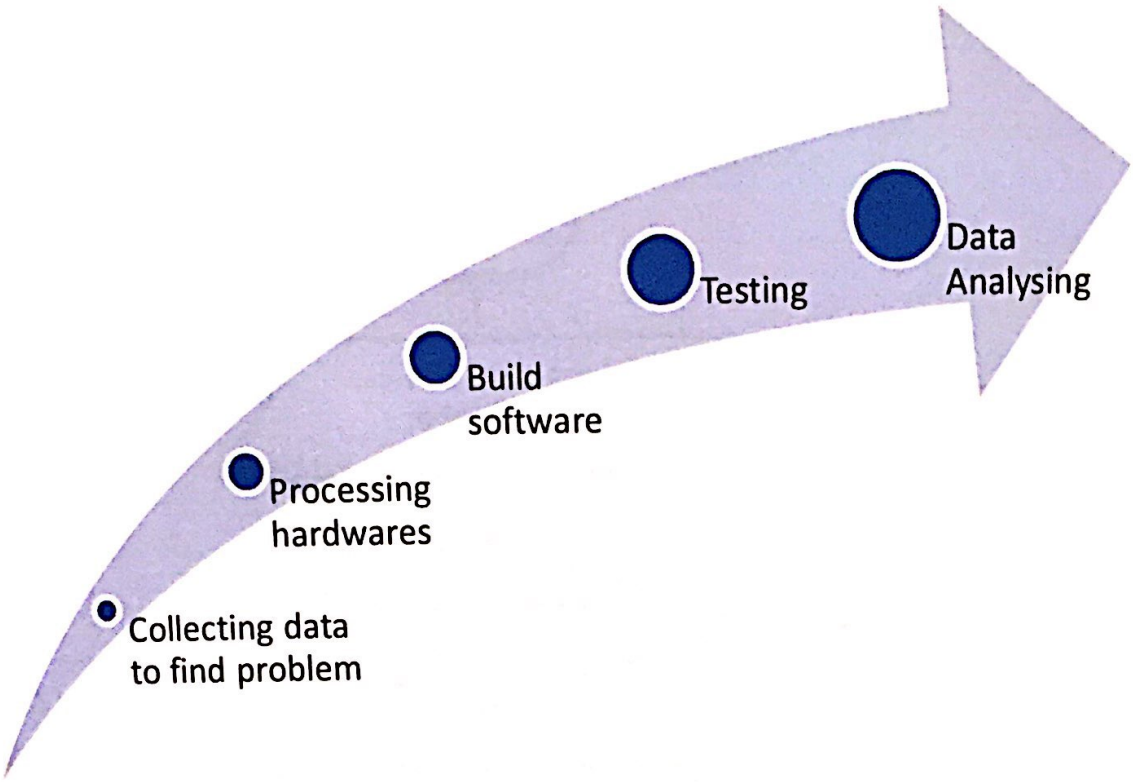
By generating a magnetic field that will inductively couple with a coil under test, the STT-4 uses a high Q circuit to detect shorted turns within a coil. When there is a shorted turns condition, current will flow within the shorted turn, loading the drive circuit. Although this is a non-contact test, there are some limitations. The coil must be an air core, solenoid type, and the short must be of low resistance. The advantage of this test is that it can be performed quickly since it does not require the stripping of wire or electrical contact. It is often performed after encapsulation or molding processes when internal thermal stresses can cause insulation failure.

d) Ratios and turns count

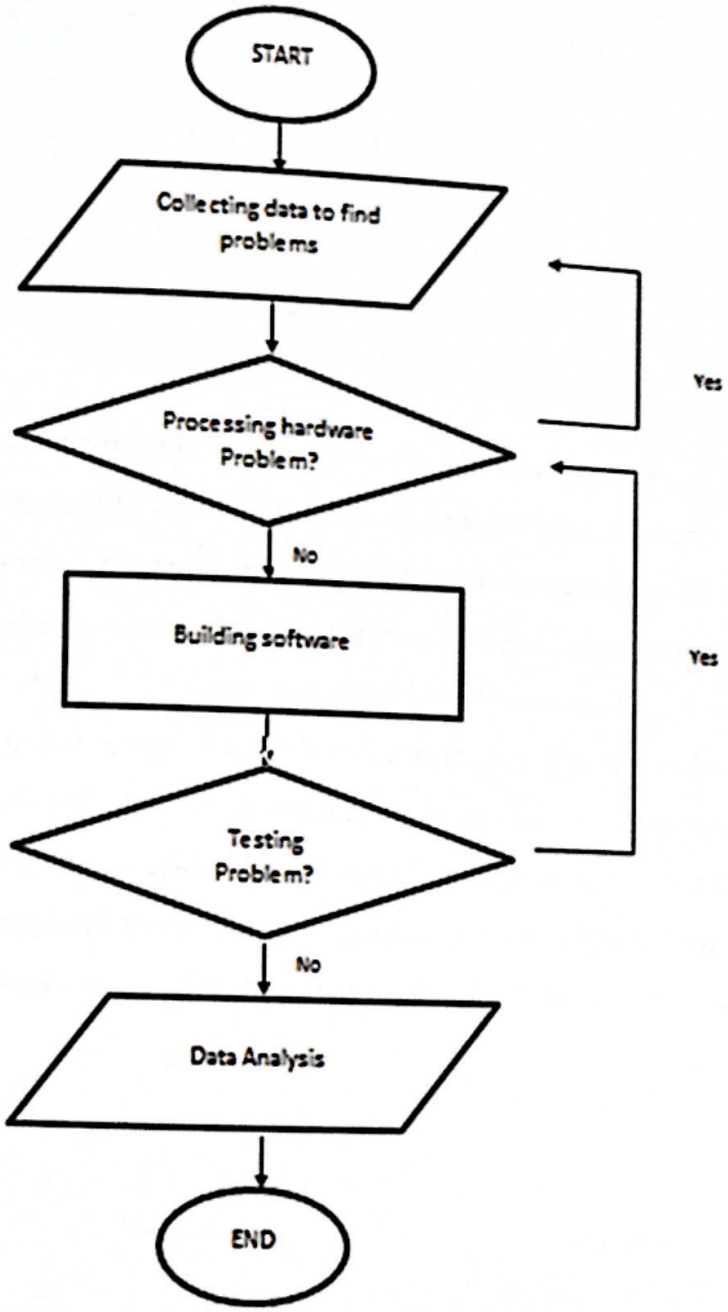
Winding ratios are important to proper performance. For this reason, accurate turn counts are important. Transformers are often constructed with multiple taps, and it can be difficult to keep these various windings in proper phase and order. 10 can be very helpful, particularly in low volume production where manual equipment is being used, to verify turns count before further assembly work is done. Automated line setups also need to be verified before and during production runs.

One method is to measure transformer ratios. In E and I type bobbin transformers this requires that a core be installed in order to properly couple the windings to each other. By putting a known current into one winding, corresponding voltages induced in secondary windings can be measured and verified to be of the proper ratio and polarity. Of course, this procedure requires that the primary winding being energized is also of the proper turns count.

3.4 Timeline



3.5 Flowchart methodology



CHAPTER 4

DATA ANALYSIS

4.1 Introduction

Data and information need to be proven so that the result can be compared between theoretical and measured value. For our Sleep Inducer Monitor, components such as battery, NiBP monitor, display, radiator coil and motor needs to be observed. It is important to make analysis and record the result. A good product must be presented together with very useful information especially for users. Therefore, it would be easier for user to use our product. In other means, it is a process of evaluating data using analytical and logical reasoning to examine each component of the component of the data provided. This form of analysis is just one of the many steps that must be completed when conducting a research experiment. Data from, various sources is gathered, reviewed and the analyzed to form of finding or conclusion.

4.2 Evaluation test referring to idea of innovation

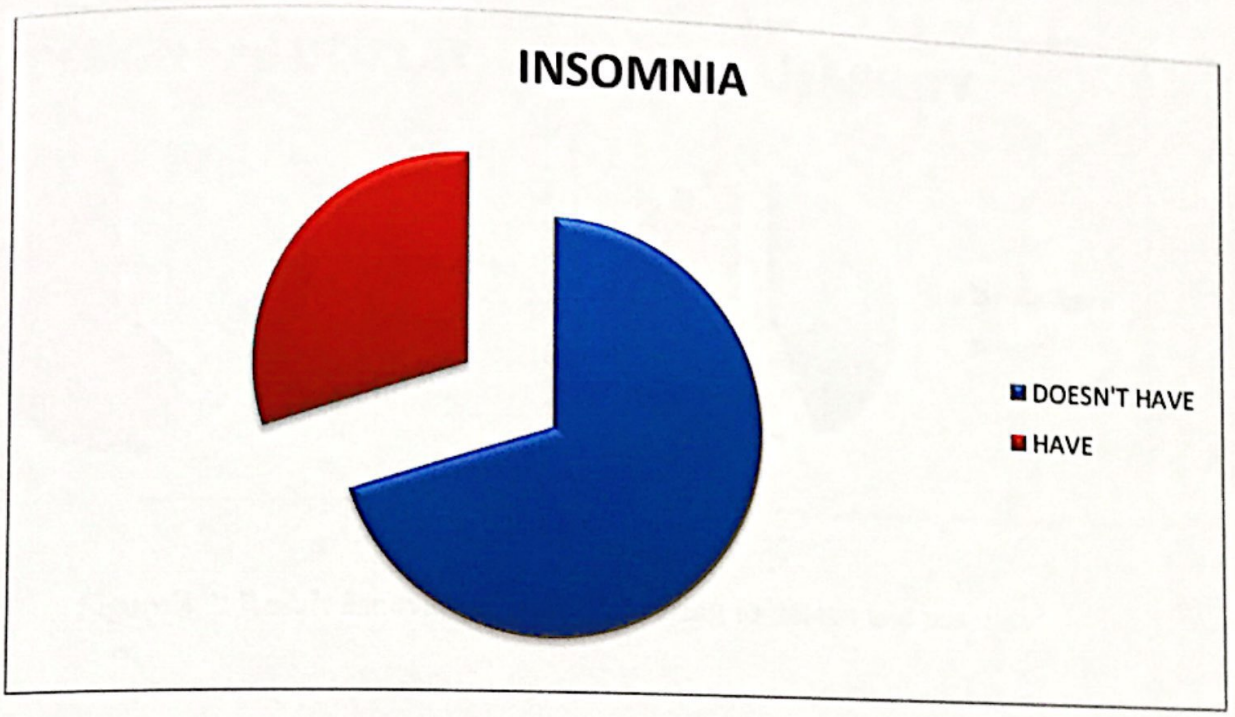


Figure 4.1: Result for the evaluation test referring to idea of innovation

When we do the survey, 30% of people that we asked have a difficulty to fall asleep and have a sleep disorder which also called insomnia. Also when we asked whether this Sleep Inducer Monitor is necessary to be produce or create, only 20% of them said it is unnecessary meanwhile the others (80%) said it is necessary because it will reduce the consumption of sleeping pills and it is convenient to the users.

4.3 Evaluation test referring to design and usability

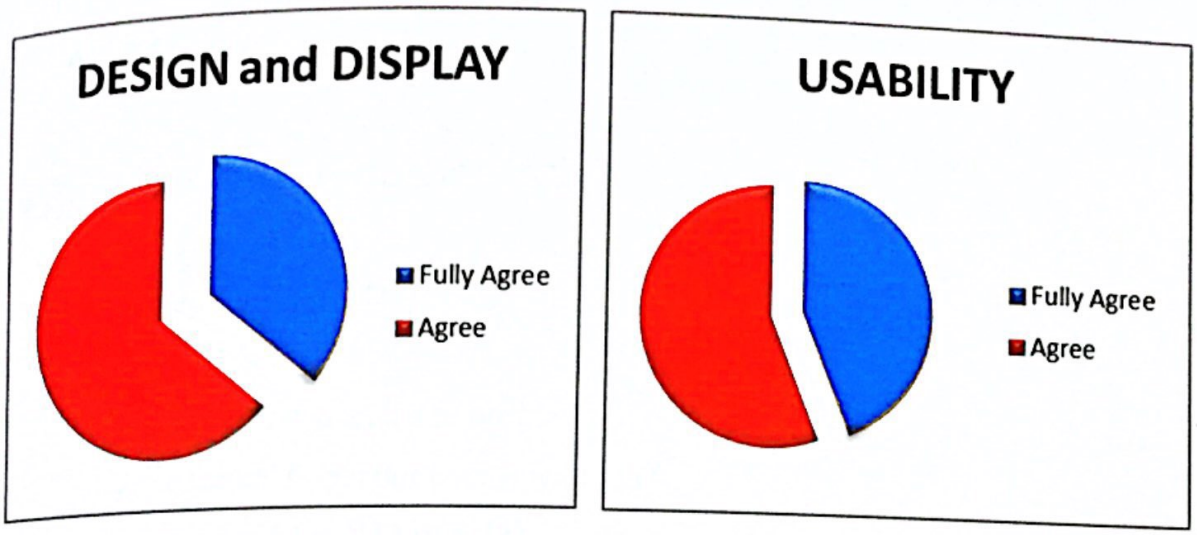


Figure 4.2: Result for evaluation test referring to design and usability

Based on our survey, most of the people that answer the questionnaire satisfied with our product design and it usability. They agreed that this product is not cumbersome and easy to be use. Other than that, they agreed that this product functions were well integrated.

They also stated that this device take a reasonable amount of time to completed the task. Also, almost 90% of them would recommend this product to someone else they know. This proved that this product can enter the market successfully.

4.4 Wave shape analysis

4.4.1 IC 4060

Operation time, t = 2.5*2n*R4*C2

n= Output number (On),

2.5 = Multiplier,

R4 = Resistor connected to oscillator pin 10,

C2 = External Capacitor connected to in 9,

Consider pin 1 i.e. O11 (n = 11),

R4 = 2.2 MΩ,

C2 = 100nF

So, t = (2.5*211*2.2*106*100*10-9) sec.

= 1126.4 sec.

≈18 min.

Similarly, for output pin 2 (O12) & pin 3(O13) operation time are 36 minutes and 72 minutes respectively.

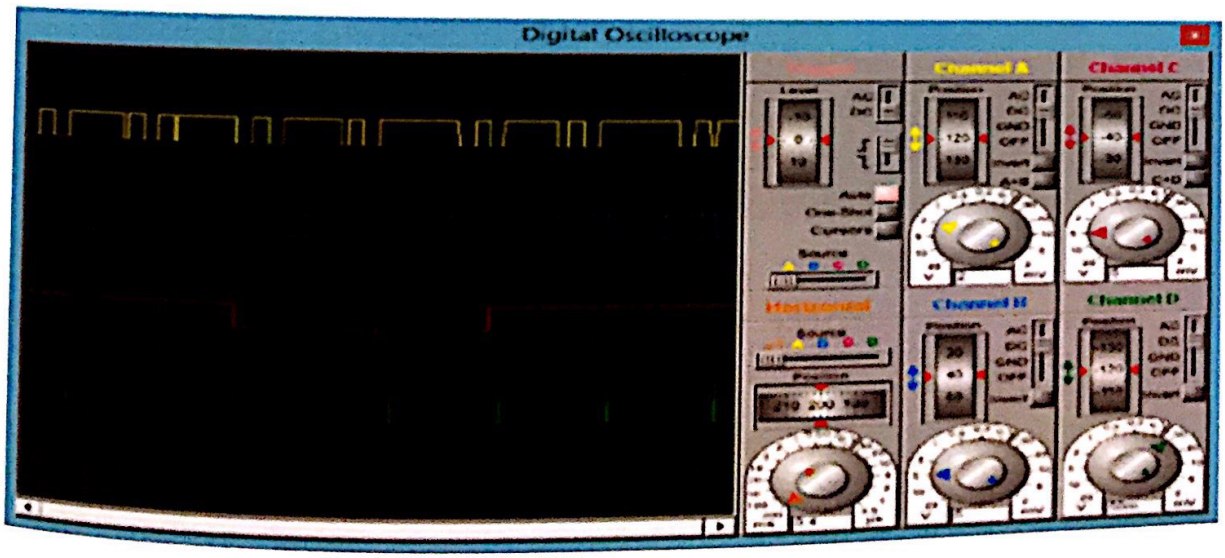


Figure 4.3: Waveform using Proteus simulation

4.4.2 IC4093

Our target is to generate delta wave. Here is a sample of typical delta wave. But, it is not exactly same. Its shape may differ a little but its frequency is limited to the range of 0-5 Hz.

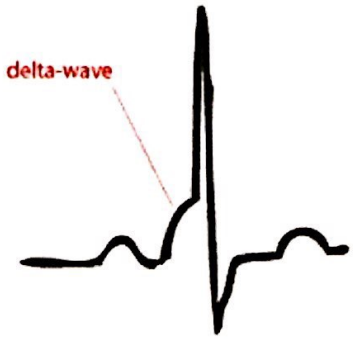


Figure 4.4: Standard delta wave

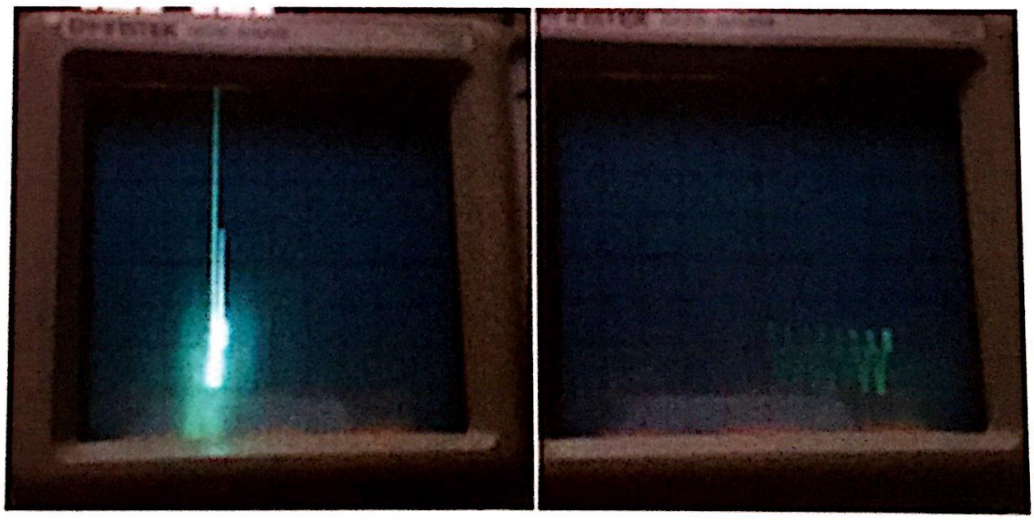


Figure 4.5: Wave obtained from circuit

This wave is almost similar to our target wave shown in Figure 4.4 above.

4.5 Power calculation

Table 4.1: Comparison between simulation in proteus and practical

Output taken from	Voltage (volts)		Frequency (Hz)	
	Proteus	Practical	Proteus	Practical
Pin 10	5.00	6.00	1.28	3.00
Pin 11	5.50	7.40	5.00	3.06
Base	9.00	8.70	2.46	3.00
Collector (with coil)	8.80	8.82	2.42	2.54
Collector (without coil)	0.09	0.32	2.36	2.50

Pin 10 & 11 belongs to IC 4093 and collector & base belongs to transistor. Measured current is 0.35mA at collector.

4.5.1 Power calculation using simulation:

P=0.35*10^-3*8.8=3.08mW (without coil)

P=0.35*10^-3*0.09=31.5μW (with coil)

4.5.2 Power calculation using oscilloscope (practical):

P=8.82*0.35*10^-3=3.09mW (without coil)

P=0.397*0.35*10^-3=139 μW (with coil)

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

Sleep Inducer Monitor is an innovation of Non-invasive Blood Pressure (NiBP) monitor which we co-operate it with the Sleep Inducer device. This device can monitor our blood pressure level (systolic and diastolic) and it will generate electromagnetic field which will produce the same pattern of waves that creates in brain during sleep. The NiBP will be functioning as same as the common NiBP monitor in the market but what we improve or innovate is when the NiBP detect high blood pressure level(hypertension) we will manually "ON" the Sleep Inducer circuit.

We come up with this idea of innovation from the research that been completed in a specialist hospital unit in Chengdu, China where the researchers found that a higher risk of raised blood pressure in people with insomnia who took longer than 14 minutes to fall asleep during daytime nap tests and the greater this hyper-arousal, the longer the time to start napping and the higher the risk of hypertension.[3]

Our product generated delta wave (0-5Hz) which based on the theory discussed above through which it is possible to fight against insomnia. Furthermore, this product provides an extra function which is we can monitor our blood pressure level at anytime we desired. Besides that, based on observation, most people agree that these two functions in the Sleep Inducer Monitor were well integrated.

5.2 Recommendation

From what we have done, there are some suggestions and improvements that should we have made at the beginning of our project.

i. Built an adapter that suitable for both sleep inducer and NiBP circuit.
ii. Improve the design of the product casing (more colour).

REFERENCE

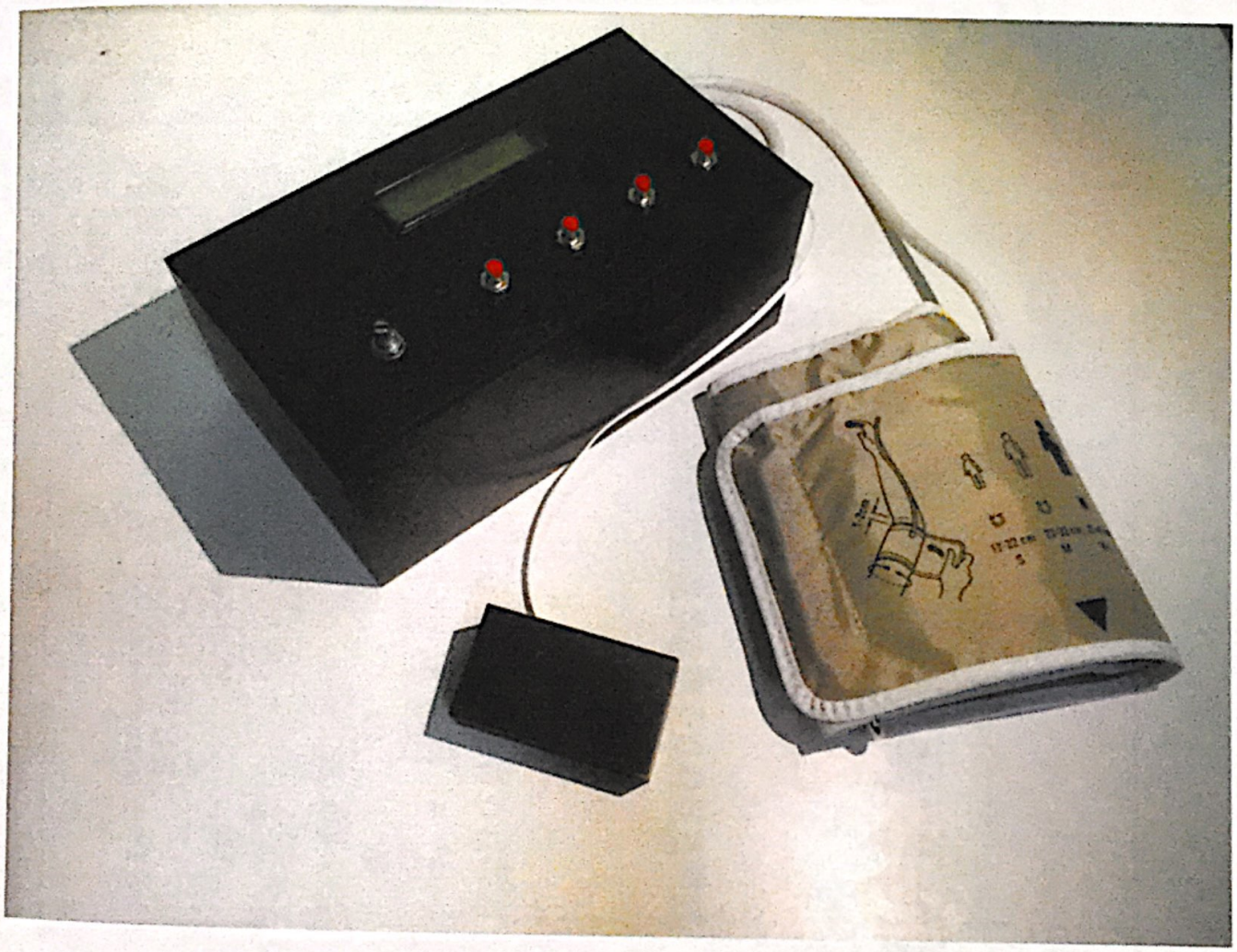
[1] Daniel J. Taylor, PhD ; Kenneth L. Lichstein, PhD ; H. Heith Durrence, PhD ; Brant W. Reidel, PhD ; Andrew J. Bush, PhD " Epidemiology of Insomnia, Depression, and Anxiety"
https://pdfs.semanticscholar.org/dbe0/01c83d7aed0c3b5357df5ca7dad8a503d75f .pdf

[2] Md. Mahadi Hasan, Sourav Dev, Arif Ahammad "Analysis, Design and Implementation of a Biomedical Sleep Inducer" Electrical & Electronic Engineering, Chittagong University of Engineering & Technology

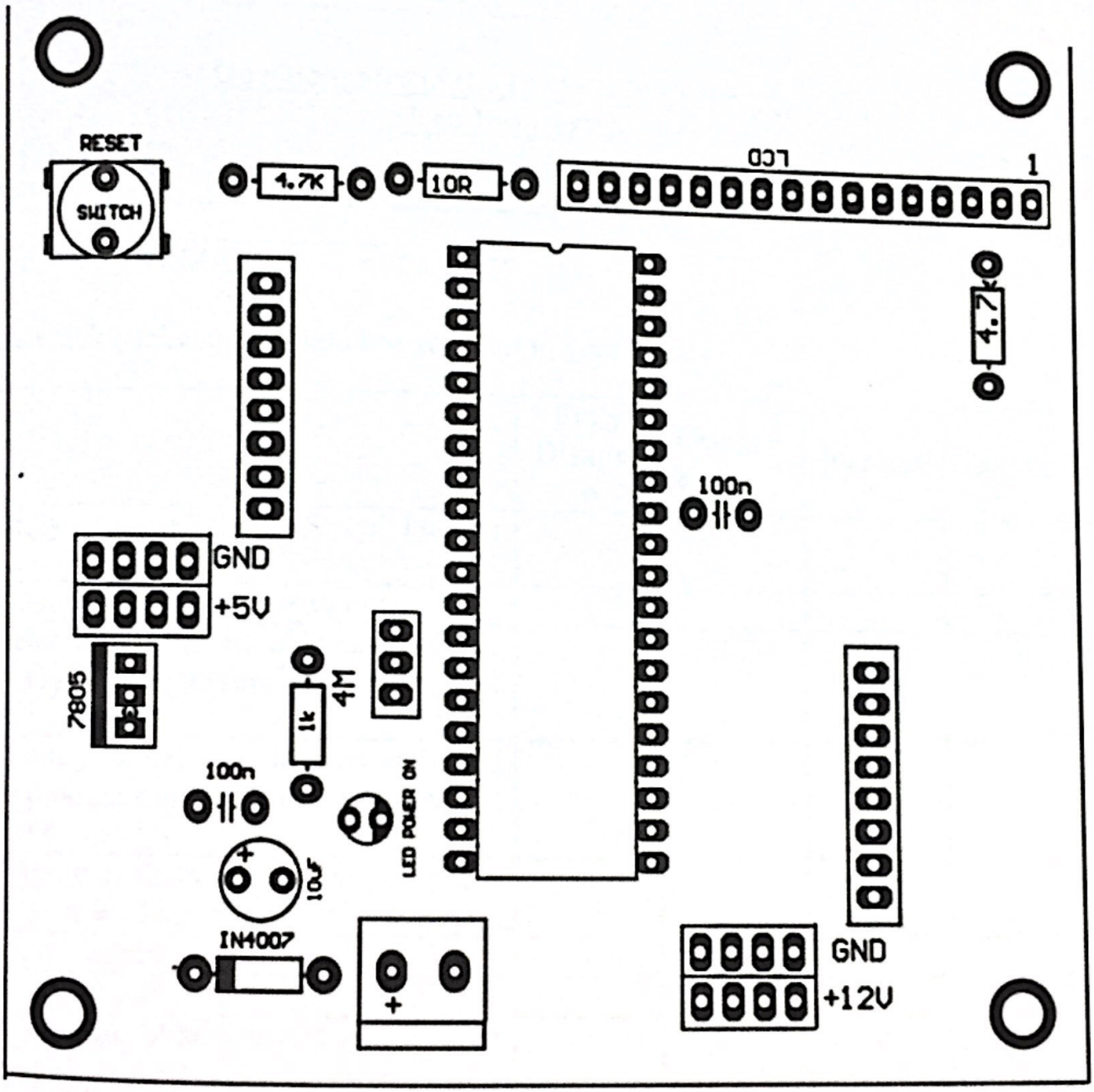
[3] Markus MacGill (2015) "High blood pressure linked to the 'hyper state of chronic insomnia"
http://www.mideastclinics.com/healthNews/33475/AJ5/High-blood-pressure-linked-to-the-'hyper'-state-of-chronic-insomnia.html#.WMeasG_yvIU

[4] "What are some disadvantages of sound waves?" https://answers.yahoo.com/question/index?qid=20071211042734AAzaBQM

APPENDIX



Final product



Component layout for NiBP

POLITEKNIK SULTAN SALAHUDDIN ABDUL AZIZ SHAH

POLITEKNIK
Sultan Salahuddin Abdul Aziz Shah
Jabatan Pengajian Politeknik

Questionnaire of the Usability and Design of the Sleep Inducer Monitor

Name : _____
Age : _____
Gender : □MALE □FEMALE

Please tick (/) the appropriate box relevant to your choice

	Fully Disagree	Disagree	Neutral	Agree	Fully Agree
1. I generally satisfied with Sleep Inducer Monitor.					
2. Sleep Inducer Monitor is easy to use.					
3. It is useful for me to be able to check or monitor my blood pressure level by myself at home.					
4. I would imagine that most insomniac would find this product some kind of a requirement to have at home.					
5. I found the two functions in Sleep Inducer Monitor were well integrated.					
6. The display was simple but well organized.					
7. The design was compact.					
8. It took a reasonable amount of time to complete task.					
9. I found Sleep Inducer Monitor very cumbersome to use.					
10. I am likely going to recommend Sleep Inducer Monitor to someone else.					

Would you suggest an improvement that can be done on this Sleep Inducer Monitor that you would find helpful?

_____

_____