**Chapter I**

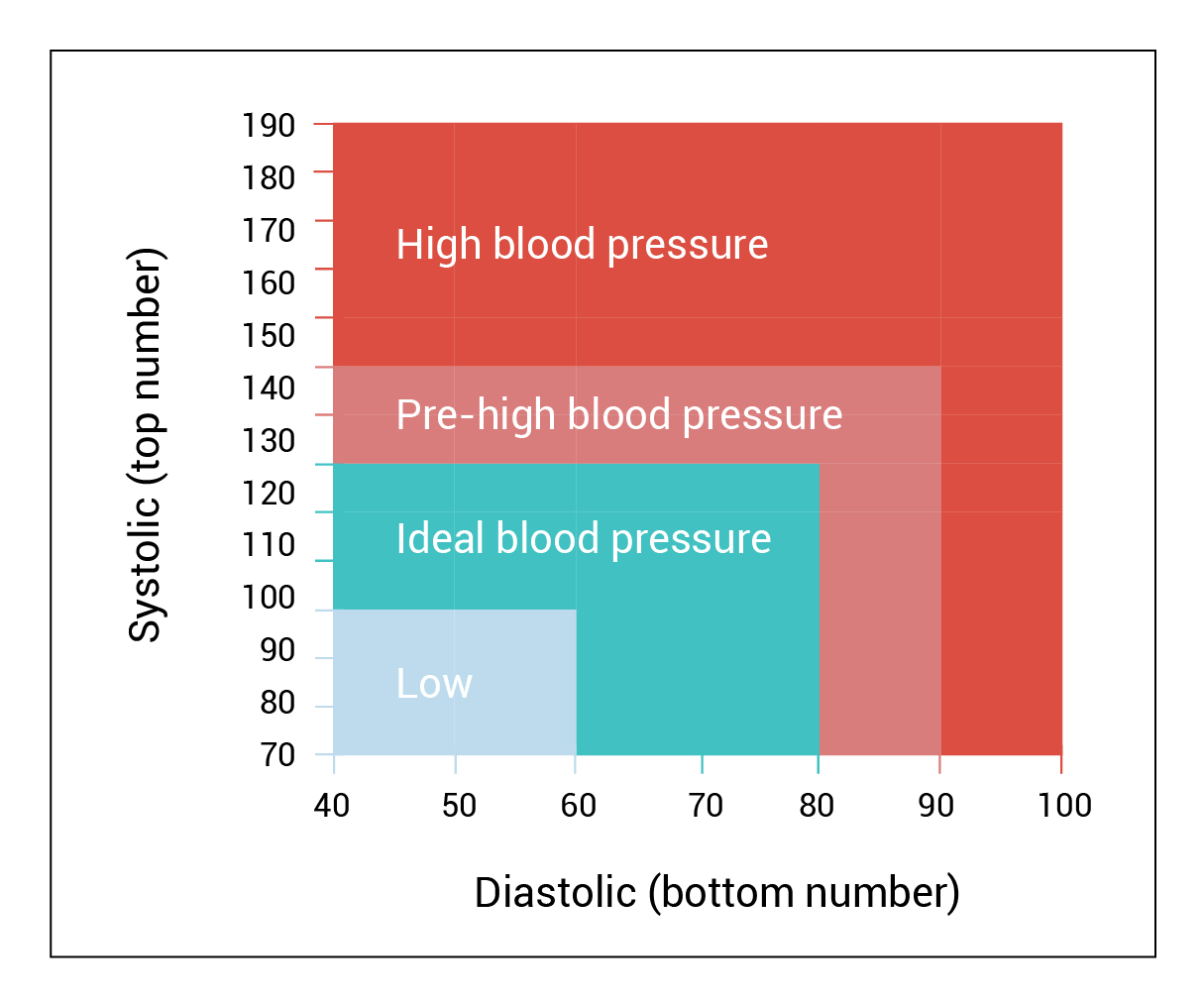
**INTRODUCTION**

One of the most important organs of the body is Heart. It consists of the atrium and ventricles. The heart is responsible for the pumping of blood through the network of arteries and veins called the cardiovascular system all over the body. The heart has four chambers:

* The right atrium receives blood from the veins and pumps it to the right ventricle.
* The right ventricle receives blood from the right atrium and pumps it to the lungs, where it is loaded with oxygen.
* The left atrium receives oxygenated blood from the lungs and pumps it to the left ventricle.
* The left ventricle (the strongest chamber) pumps oxygen-rich blood to the re1st of the body. The left ventricle’s vigorous contractions create our blood pressure.

Heart disease is one of the most common cause of death among Filipinos. “21 percent of Filipino adults are hypertensive,” said Dr. Dante Morales, President of the Philippine Society of Hypertension (PSH) during the National Hypertension Awareness celebration conducted at the Universidad De Manila on 19 May 2012.

Blood Pressure is the pressure circulating blood on the walls of blood vessels. Blood pressure is usually expressed in terms of the systolic pressure (maximum during one heart beat) over diastolic pressure (Minimum in between two heart beats) and is measured in millimeters of mercury (mmHg). Normal resting blood pressure in an adult is approximately 120 mmHg systolic, and 80 mmHg diastolic, abbreviated “120/80 mmHg”. Blood pressure has two states the low blood pressure also known as the hypotension and hypertension for the high blood pressure. Long term hypertension can affect the body it is a risk factor for many diseases, including heart disease, stroke, and kidney failure. Heart rate is one of the vital signs. It is the number of times per minute that the heart contracts or beats. The resting heart rate is the rate where you’re sitting or lying and when you’re calm it is said that the heart rate is normally between 60 (beats per minute) and 100 (beats per minute).



**Fig. I General Blood Pressure Chart**

Blood pressure and Pulse rate are interrelated components of the cardiovascular system and therefore, not mutually exclusively. One can affect another according to, ”Dr. Shelby-Lane. If the blood pressure is not monitored properly the arteries and the vital organs in the body will be damaged causes heart attack, stroke, heart failure, aneurysm or renal failure. Which means there is a need for the patients’ family members, friends and communities to involve in the care activities.

Monitoring of the blood pressure is important for the vital prevention and treatment of blood pressure related disease. Additionally, in very ill patient, accurate measurement of blood pressure is essential for monitoring cardiovascular homeostasis. The traditional way of measuring of blood pressure is with the use of cuff has a gauge on it that will read your blood pressure. Then the doctor or nurse will inflate the cuff to squeeze your arm.

After the cuff is inflated, the doctor or nurse will slowly let air out. While doing this, he or she will listen to your pulse with a stethoscope and watch the gauge. The gauge uses a scale called "millimeters of mercury” (mmHg) to measure the pressure in your blood vessels.

Blood pressure is measured using two numbers. The first number, called **systolic** blood pressure, measures the pressure in your blood vessels when your heart beats. The second number, called **diastolic** blood pressure, measures the pressure in your blood vessels when your heart rests between beats.

If the measurement reads 120 systolic and 80 diastolic, you would say "120 over 80" or write "120/80 mmHg."

A blood pressure less than 120/80 mmHg is normal. A blood pressure of 140/90 mmHg or more is too high. People with levels in between 120/80 and 140/90 have a condition called prehypertension, which means they are [at high risk for high blood pressure](https://www.cdc.gov/bloodpressure/risk_factors.htm). The chart below shows normal, at-risk, and high blood pressure levels based on the patient age.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Age** | **Hypotension (low blood pressure)** | | **Normal BP** | | **Prehypertension** | | **Hypertension Stage 1** | | **Hypertension Stage 2** | |
|  | S | D | S | D | S | D | S | D | S | D |
| 17-19 | < 90 | < 60 | <120 | <85 | <120 | <80 | <140 | <89 | <150 | <100 |
| 20-24 | < 90 | < 60 | <120 | <79 | <125 | <82 | <140 | <85 | <150 | <100 |
| 25-29 | < 90 | < 60 | <121 | <80 | <132 | <83 | <140 | <88 | <150 | <100 |
| 30 - 34 | < 90 | < 60 | <122 | <81 | <134 | <85 | <140 | <90 | <160 | <100 |
| 35 - 39 | < 90 | < 60 | <123 | <82 | <135 | <86 | <142 | <91 | <162 | <101 |
| 40 - 44 | < 90 | < 60 | <125 | <83 | <137 | <87 | <144 | <92 | <164 | <102 |
| 45 - 49 | < 90 | < 60 | <127 | <84 | <139 | <88 | <146 | <93 | <166 | <103 |
| 50 - 54 | < 90 | < 60 | <129 | <85 | <141 | <89 | <148 | <94 | <168 | <104 |
| 55 - 59 | < 90 | < 60 | <131 | <86 | <143 | <90 | <150 | <95 | <170 | <105 |
| 60+ | < 90 | < 60 | <134 | <87 | <146 | <91 | <153 | <96 | <173 | <106 |

**Fig. 1.2 Blood Pressure Chart by Age**

*S = Systolic Pressure*   
*D = Diastolic Pressure*

**Background of the Study**

The researcher became interested in picking this study because of their experiences in local health center. The doctors, nurses and barangay health workers are the one who is capable of reading the blood pressure. And when the patient need to know his/her blood pressure and pulse rate they must go to nearest health center or hospital but if there are so many patients it will take time to finish measuring everyone’s blood pressure while some other people practice reading their own or others blood pressure using the traditional way with the use of stethoscope and brachial pressure but sometimes error occur they misinterpreting because of the failure to identify the Korotkoff sounds that can lead to over and under estimation of the blood pressure.

High blood pressure (hypertension) can quietly damage your body for years before symptoms develop. Left uncontrolled, you may wind up with a disability, a poor quality of life or even a fatal heart attack. Roughly half the people with untreated hypertension die of heart disease related to poor blood flow (ischemic heart disease) and another third die of stroke.

In this study, we design a monitoring device that will allows the patient to measure their pulse rate and blood pressure. The system will notify the patient or the user if the system detects abnormalities such as low blood pressure, pre-high blood pressure and high blood pressure in the measurement. Different features will be added to the to the system that will be beneficiary to the user. The researchers will add a printing system that enables the user to print the measurement so that if the patient is monitored in home it can keep a better record to give to his/her doctor.

This study will gather the measurements and store the data in an organize way to see the record and monitor easily.

**OBJECTIVES**

The general objective of this study is to develop a system that measure and monitor the blood pressure, pulse rate.

1. To determine the sensors that will be used in the system.

2. To design a system that records the reading of blood pressure and pulse rate

3. To compare the result of the traditional way with the automated way of measuring blood pressure and pulse rate.

4. To test and evaluate the effectiveness and accuracy of the device.

**Significance of Study**

This study will be beneficial to the persons who have a high blood pressure or low blood pressure. This study will help to improve the accessibility of the device for the patient, so that the patient will able to monitor his/her blood pressure and pulse rate in a handy way anytime anywhere. This will also decrease the expenditures of the patient by consulting to the doctor or physician. This research will also lessen the risk of worsening the condition of the patient or user. One of the beneficial result this study is that to encourages the patient on being a health conscious by gaining responsibility to their own health, motivating for improved diet, physical activities and proper medication. This study could be a tool for keeping track of the user’s record.

**Scopes and Limitation**

This study includes creating a system that will only measure the blood pressure and pulse rate of the user for monitoring and keeping record. This study will use sensors to get the measurement of blood pressure and pulse rate. This study will also allow a multiple user so that other user can use the device without interfering the data of the other users. The application will allow the user to add his/her profile information for the betterment of keeping records.

The notification will be based on the age of the patient. If the system detects abnormalities in the result of measurements alert will be display on LCD with sound alarm so that the user will notify immediately in his/her condition.

This study also capable of printing the weekly and monthly reading of the blood pressure and pulse rate. The printing form will consist of the user’s name, age, the date and time the user conduct the reading, the result of the blood pressure and the pulse rate.

**Definition of Terms**

1. **Android** is an operating system for smartphones and other devices, developed by Android, Inc. and later purchased by Google.

2. **Blood Pressure** is the pressure of the blood in the circulatory system, often measured for diagnosis since it is closely related to the force and rate of the heartbeat and the diameter and elasticity of the arterial walls.

3. **C programming language** is a programming language that is ideal for developing firmware or portable applications. It is a [procedural language](https://simple.wikipedia.org/w/index.php?title=Procedural_language&action=edit&redlink=1), which means that people can write their [programs](https://simple.wikipedia.org/wiki/Computer_program) as a series of step-by-step instructions.

4. [**Database**](https://en.wikipedia.org/wiki/Database) is the collection of [schemas](https://en.wikipedia.org/wiki/Database_schema), [tables](https://en.wikipedia.org/wiki/Table_(database)), [queries](https://en.wikipedia.org/wiki/Query_language), reports, [views](https://en.wikipedia.org/wiki/View_(SQL)), and other objects. The data are typically organized to model aspects of reality in a way that supports [processes](https://en.wikipedia.org/wiki/Process_(computing)) requiring information, such as modelling the availability of rooms in hotels in a way that supports finding a hotel with vacancies.

5. **Diastolic Pressure** is the blood pressure after the contraction of the heart while the chambers of the heart refill with blood.

6. **Hardware** is a comprehensive term for all of the physical parts of a computer, as distinguished from the data it contains or operates on, and the software that provides instructions for the hardware to accomplish tasks.

7. **Heart rate** is the speed of the heartbeat measured by the number of contractions of the heart per minute (bpm).

8. **Java** is a widely used programming language expressly designed for use in the distributed environment of the internet.

9. **Microcontroller** is a computer present in a single integrated circuit which is dedicated to perform one task and execute one specific application. It contains memory, programmable input/output peripherals as well a processor.

10. **Sensor** is an [electronic component](https://en.wikipedia.org/wiki/Electronic_component), module, or subsystem whose purpose is to detect events or changes in its environment and send the information to other electronics, frequently a [computer processor](https://en.wikipedia.org/wiki/Computer_processor).

11. **Software** is that part of a [computer system](https://en.wikipedia.org/wiki/Computer_system) that consists of [data](https://en.wikipedia.org/wiki/Data_(computing)) or computer instructions, in contrast to the [physical hardware](https://en.wikipedia.org/wiki/Computer_hardware) from which the system is built.

12. **Sphygmomanometer** is an instrument for measuring blood pressure in the arteries, especially one consisting of a pressure gauge and a nylonor rubber cuff that wraps around the upper arm and inflates to constrict the arteries.

13. **System** is a set of detailed methods, procedures and routines created to carry out a specific activity, perform a duty, or solve a problem.  
14. **Systolic Pressure** is specifically the maximum arterial pressure during contraction of the left ventricle of the heart.

15. **Personal health record (PHR)** is a collection of health-related information that is documented and maintained by the individual it pertains to.

16. **Pulse rate** is a rhythmical throbbing of the arteries as blood is propelled through them, typically as felt in the wrists or neck.

17. **Raspberry Pi** is a low cost, credit card sized computer that plugs into a computer monitor or TV, and uses a standard keyboard and mouse originally designed for education.

**Chapter II**

**REVIEW OF LITERATURE AND STUDIES**

In this chapter the researchers gathered thorough information to present well the related literature and studies. The researchers think and analyze the concept of the research to form a conceptual framework to fully understand the research to be done.

**Related Literature**

**Blood pressure**

It is when your heart beats, it pumps blood throughout your body to give energy and oxygen one’s body need. When the blood moves, it pushes through the side of the blood vessels. The pressure of this pushing is your blood pressure. If your blood pressure is too high, it puts extra strain on your arteries and heart may cause heart attacks and strokes. Also if when your blood pressure to low it may lead to dizziness and weakness but also fainting and a risk of injury from falls. Blood pressure is determined both by the amount of blood your heart pumps and the amount of resistance to blood flow in your arteries. The more blood your heart pumps and the narrower your arteries, the higher your blood pressure. Blood pressure is characterized into two types High blood pressure and Low blood pressure.

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**Low Blood Pressure** (Hypotension)

The condition when the systolic blood pressure of less than 90 millimeter of mercury (mm Hg) or diastolic of less than 60 mm Hg is generally considered to be hypotension.

Hypotension is the opposite of hypertension, which is high blood pressure. It is best understood as a physiological state, rather than a disease. Severely low blood pressure can deprive the brain and other vital organs of oxygen and nutrients, leading to a life-threatening condition called shock. Through often associated with shock, hypotension is not necessarily indicative of it. Low blood pressure can cause not only dizziness and weakness but also fainting and a risk of injury from falls. And severely low blood pressure from any cause can deprive your body of enough oxygen to carry out its normal functions, leading to damage to your heart and brain.

**High blood pressure** (Hypertension)

It is the condition which the amount of strain on blood artery walls is to high enough that it may eventually cause health problems. You can have high blood pressure (hypertension) for years without any symptoms. Even without symptoms, damage to blood vessels and your heart continues and can be detected. Uncontrolled high blood pressure increases your risk of serious health problems, including heart attack and stroke.

High blood pressure generally develops over many years, and it affects nearly everyone eventually. Fortunately, high blood pressure can be easily detected. And once you know you have high blood pressure, you can work with your doctor to control it.

**Pulse Rate/Heart Rate**

It is the speed of the heartbeat measured by the number of contractions of the heart per minute (bpm). The heart rate can vary according to the body's physical needs, including the need to absorb oxygen and excrete carbon dioxide. It is usually equal or close to the pulse measured at any peripheral point. Activities that can provoke change include physical exercise, sleep, anxiety, stress, illness, and ingestion of drugs.

**Sign and symptoms**

**Prevention**

You can take steps to prevent high and low blood pressure. These steps include keeping a healthy weight. Being a physically active and following a healthy eating plan that emphasizes fruits, vegetables and low-fat dairy products. Preparing foods with less salt and sodium. Drinking moderate and avoid smoking. Taking a complete

**Factors affecting the blood pressure**

According to [Dr. Hafeza Shaikh, DO](https://www.sharecare.com/doctor/dr-hafeza-shaikh), Cardiology (Cardiovascular Disease)

*“One factor that affects blood pressure is age. With age, sometimes the resistance and the amount of stiffness that the blood vessels and arteries have can change. This can lead to hypertension, or high blood pressure, over time. Other reasons that people get high blood pressure include a couple of rare diseases that may be inherited, or a person may be born with.”*

According to [Dr. Deborah Raines, MSN](https://www.sharecare.com/user/dr-deborah-raines), Nursing

“Blood pressure is affected by any event or behavior that alters the body’s cardiovascular system specifically: peripheral resistance, vessel elasticity or cardiac output

There are a number of factors that cause changes in the cardiovascular system and thereby affect blood pressure. Many of these factors have a short-term effect on blood pressure, but over time the effect may become long-term.

Some of the factors causing a short-term effect on blood pressure are

* Asleep or awake –
* Body position - lying down results in a low ing of BP while sitting or standing results in an increase in BP
* Emotional state - stress and anger increase BP while being relaxed decreases BP
* Temperature – blood pressure will tend to go up when a person is cold
* Sleep apnea - pauses in breathing while sleeping raise blood pressure
* Smoking – increases blood pressure
* Caffeine – increases blood pressure
* Alcohol – increases blood pressure
* Drugs – increases blood pressure

The last four items, sleep apnea, smoking, caffeine and alcohol over an extended period of time can cause the resting blood pressure to increase to the impact of these factors on the heart muscle and vascular resistance of the circulatory system.”

**Why monitoring of blood pressure is important?**

According to the SCIENTIFIC COMMITTEE ON EMERGING AND NEWLY IDENTIFIED HEALTH RISKS (SCENIHR):

“Raised blood pressure throughout its range is the most significant cause of death and disability in the world (Lopez et al. 2006). Accurate blood pressure measurement is therefore vital in the prevention and treatment of blood-pressure–related diseases. Additionally, in very ill patients, accurate measurement of blood pressure is essential for monitoring cardiovascular homeostasis.”

[Dr. Mehmet Oz, MD](https://www.sharecare.com/user/dr-mehmet-oz), Cardiology (Cardiovascular Disease), **said**

“You should get your blood pressure checked regularly because high blood pressure is a silent killer. There are often no symptoms of this potentially deadly condition. So, while you’re going about your day, high blood pressure could be damaging your arteries, your heart, and other organs. The nasty consequences of leaving high blood pressure untreated include stroke, kidney damage, and even erectile dysfunction.”  
He also added “Your risk of high blood pressure increases with age. If you smoke, are obese, are physically inactive, or have diabetes or high cholesterol, you may also be at an increased risk. The good news is that a blood pressure test is quick and painless and can be done at most any doctor’s office, hospital, or clinic. You may also be a candidate for using a home monitoring device. Talk with your doctor about checking your blood pressure at home.”

**REVIEW OF RELATED STUDIES**

According to their research Lui J, G. Balodis1 , Z. Markovics, J. Lauznis and Dr. Joseph Cafazzo the study of android-based monitoring system with uncontrolled hypertension will get their blood pressure (BP) under control. The patient will merely checked their BP at home even there are no guiding of physician. This technology will be very useful and will provide the needs of the patient. This is a hot topic because of the mobility and that sense of connection between patient and the provider.

The usual way of getting the blood pressure by wearing the ambulatory blood pressure device and they have to remember or write down the measured BP. The solution to this problem is to develop a system that a patient’s blood pressure is measured automatically and transferred to the android devices over wireless network. In this device we need a server that collect the data that will be transfer real time information via wi-fi connection. The BP measurement are will be saved into the database that we will operate. The person that have the software device can be also observed and analyse the data through the server.

**The Design of Smart Sphygmomanometer based on Android Mobile Device**

A research done by Gaoxu Deng, Chen Deng, and Yiming Wang designed the intelligent wearable device based on Android phones. Mainly introduces the design and implementation of hardware and software of the Android mobile phones and STM32 as the core, individual blood pressure and heart rate control and measurement. Implements of the Android WiFi control of blood pressure, blood pressure measurement and abnormal warning s a good way to meet the demand for the hypertension patients on blood pressure measurement, has the characteristics of high performance, low cost and low power consumption.

**Detecting Vital Signs with Wearable Wireless Sensors**

Tuba Yilmaz , Robert Foster and Yang Hao designed wearable monitoring systems can provide continuous physiological data, as well as better information regarding the general health of individuals. Thus, such vital-sign monitoring systems will reduce health-care costs by disease prevention and enhance the quality of life with disease management. In this paper, recent progress in non-invasive monitoring technologies for chronic disease management is reviewed. In particular, devices and techniques for monitoring blood pressure, blood glucose levels, cardiac activity and respiratory activity are discussed; in addition, on-body propagation issues for multiple sensors are presented.

**Mobile personal health care system for patients with diabetes**

Fuchao Zhou propose a personal diabetes monitoring system which integrates wearable sensors, 3G mobile phone, smart home technologies and Google sheet to facilitate the management of chronic disease - diabetes. The system utilizes wearable sensors and 3G cellular phone to automatically collect physical signs, such as blood glucose level, blood pressure and exercise data like heart rate, breathing rate and skin temperature. It allows users, especially seniors with diabetes, to conveniently record daily test results and track long term health condition changes regardless of their locations. It does so without having to ask users to manually input them into the system. The system also utilizes Google sheet to manage Personal Health Records (PHRs), which not only bridges the gaps between patients and different healthcare providers but enabling accesses to patients’ PHRs anywhere and anytime by taking advantage of the universal accessibility of Google sheet. The system further integrates with GPS, Google Search and Google Map functionalities to facilitate the user to find all hospitals near to his/her current location including address, phone number, directions to the selected hospital and street view of the selected hospital.

**A Remote Patient Monitoring System using Android Mobile Devices**

According to Alex Cors Bardolet aim of his thesis is to validate the use of mobile applications for taking care of the health of patients in a preventive way. First of all, the results of a research of the actual state of art are presented. With this results, a proposition is done. This preposition includes the acquisition and realization of some sensors, the realization of a mobile

application and the programming of a server application. The sensors used includes a ex profeso breath rate sensor and a commercial thermistor used for human temperature measures. All this sensors will be connected trough a device that handles the power and communication. After

that, an Android application have been done to control this device and show the results of the measures. The value of the measures are sent to a remote server in order to store information.

At the end, some indications are pointed about how this project could be further developed after discussing the prototype with several professionals of the medicine.

**Design of Wireless Mobile Monitoring of Blood Pressure for underserved in China by Using Short Messaging Service**

A research done by Jiang, Zhuangzhi, Jun, and Prabhu, aims to provide an affordable medical service for community residents by designing an interactive medical monitoring system. This system consists of three units: 1) Smart sensor unit, which is wearable on patient’s arm in order to register the required BP and transfer it by SMS module. 2）The server unit, which enables medical staff in the CHC/P to remotely observe patient’s BP condition through a computer within an existing network. At the same time, the server unit can be connected to the big hospitals through existing internet, and the specialists in big hospitals will give some advises if needed. 3) The terminal unit, which allows Patient/User to access and query the medical bio-data recorded in the server as well as for the information notification (such as alarming function). BP measurement methodology is based on Oscillometric method.

In this design, the terminal unit can be a mobile phone, a Personal Digital Assistant (PDA) or a computer with an SMS receiver. The server will not send a message unless the BP value is abnormal, so it will not affect user’s normal life.

**Abnormal Heart Rate Detection Device Warning via Mobile Phone Network**

A reseach done by Adisorn Sirikham(2010), created a device designed to send rate of heartbeat and warning signal via mobile phone network when 13 abnormal heart rate is detected. The hardware system consists of 3 main parts. The first is heartbeat signal receiving part which detects cardiac electrical signal on the skin. The second part is processing unit part that computes heart rate by using the data from the first part. And the last part is warning sender part that sends heart rate and warning signal to patient’s physician or relative when the system found that the heart rate is abnormal.

**MICROCONTROLLER BASED HEART RATE MONITOR USING FINGERTIP SENSOR**

According to LIENA ELRAYAH ABDELKHAIR KHAIRELSEED presented the design and development of an integrated device for measuring heart rate using fingertip to improve estimating the heart rate. As heart related diseases are increasing day by day, the need for an accurate and affordable heart rate measuring device or heart monitor is essential to ensure quality of health. However, most heart rate measuring tools and environments are expensive and do not follow ergonomics. Our proposed Heart Rate Measuring (HRM) device is economical and user friendly and uses optical technology to detect the flow of blood through index finger.

The goal of this thesis is design low-cost device which measures the heart rate of the subject by clipping sensors on one of the fingers and then displaying the result on a text based LCD. Miniaturized heart rates monitor system based on a microcontroller. It offers the advantage of portability over tape-based recording systems. The thesis explains how a single-chip microcontroller can be used to analyze heart beat rate signals in realtime. the Hardware and software design are oriented towards a single-chip microcontroller-based system, hence minimizing the size. The important feature of this project is the use of Fourier transforms to compute heart rate on real-time. It then processes to provide the information of bradycardia and tachycardia of heart rates and notified the user if the heart rate exceed the maximum allowable. It will be shown that the device meets diverse and conflicting requirements, including reliability, minimum loading effects, and low battery power consumption.

Qualitative and quantitative performance evaluation of the device on real signals shows accuracy in heart rate estimation, even under intense of physical activity. We compared the performance of HRM device with Electrocardiogram signal represent in oscilloscope and manual pulse measurement of heartbeat.

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| --- | --- |
| |  | | --- | | **Conceptual Framework of the Study**  Process  Input  Output     * Automated Blood Pressure and Pulse Rate Monitoring System with Printing Capability * Documentation * Planning and Designing of the system * Gathering of materials and selection of software to be use * Circuit Construction * Programming * Assembling and interfacing * Testing and evaluation * Concept about Blood Pressure and Pulse Rate * Information about thesis design * Consideration of materials and software to be use * Knowledge about microprocessor * Knowledge about the sensor programming | |
|  |
|  |
|  |

Inputs are the concepts about blood pressure and heart rate and information about the thesis that will contribute to the development of the system, consideration of materials and software to be use made by the researchers was based on the knowledge gain by the researchers including the knowledge in the sensors and microcontroller. In the process state planning and designing of the system and gathering of the materials and selecting of best software application are determined for programming of the software part of the system. On the other hand, circuit construction is for the hardware part of the system and assembling and interfacing is for the individual components of the system will able to communicate to each other. Afterwards, testing and evaluation are done for to see if the system is able to comply to the desired function of the whole system. And for the last, monitoring of the blood pressure and the heart with along with the proper documentation will be the final output.

**Chapter III**

**METHODOLOGY**

This chapter describes the procedure used in developing the design and in development of the required program needed to make the prototype functional.

**Research Locale**

The Blood Pressure and Heart Rate Monitoring System will be conducted in Lucban, Quezon where this study was built. The researchers decided to conduct this study in this location for easier testing of the system with the help of chosen respondents.

**Respondents**

The respondents of the study are the registered nurses, they will check if the output of the device will be the same to their measurement using the traditional reading of blood pressure.

And for the evaluation the researchers will ask teens, parents, and adults who are experiencing a High and Low Blood Pressure to use the device of this study and ask their experience in using the device. The evaluators will answer set of questionnaires that the researchers provided.

**Research Design**

This study uses an applied type of research. Applied Research as defined, is used to find solutions to everyday problems, and develop innovation technologies. It defines the different parameters considered in constructing the device. Material, tools and components that will be used in the design were further studied to come up at its functionality. Designing the schematic diagram of the required circuitries are strongly considered in order to materialize the desired prototype.

**RESEARCH INSTRUMENT**

This are the sources to accomplish the specific terms of our thesis the android based motion sensing system for hip rehabilitation. With the help of this research instrument the researches gathered information with the use of the following.

1. **University Library Books**
2. **Textbooks**

The textbooks discuss the different uses and functions of the information that we needed to develop the system.

1. **Thesis**

The researchers are required to read some unpublished thesis from the university to guide and provide additional information.

1. **Internet Articles**

Internet articles is important to a research because it support the fundamental needs of the project. The internet provides useful and more detailed information about the data you are searching. It confirms and strengthens the researches to develop the system.

1. **Internet Research**

The researches use the World Wide Web to have a global information that is related to the design project. It has an information that suits every detail and the data that connect to the study.

1. **Consultation**

Consultation were done with the professionals and acknowledge people in the field of rehabilitation. The researchers were able to identify and gather additional data to improve the design of the prototype.

**PROCEDURES/ DATA COLLECTION**

**Planning**

Choosing the right software application to program the system, choosing the right operating system for the raspberry pi, choosing the right and efficient components, and the beneficiaries are the factors that the researchers considered for building the system. The researcher creates hypothesis and concept that would resolve the problem.

**Designing**

Designing of the system for blood pressure and heart rate monitoring. Designing of the device including the connections of the whole system. Designing of the GUI for the application. The researchers created a flow chart for easier understanding on how the whole system will work.

**Gathering Materials**

The researchers have considered the availability, cost and the quality of different materials that is needed for the whole system. The researchers chose appropriate materials carefully so that the system will not compromised its quality.

**Circuit Construction**

After designing the circuit diagram, researchers started to work on printing the circuit design on PCB. Proper wiring of the system and connections of all circuits to the microcontroller.

**Programming**

After gathering of the materials and making a circuit the researchers proceed to the software development. Creating the algorithm for the device. Creating a program for the software application. Compiling and debugging of the code. Testing of the program.

**Assembling**

After creating the program for the software, the researchers assemble all the materials needed for the system. Then the researchers test the circuit connection if it is working. And lastly, building the case for the prototype and connecting the software to the hardware part**.** Assembling all the components needed will lead to the finished project that the researchers will test.

**Testing**

To determine if both device and application of the study works properly, the researchers conduct a series of testing if the device read the blood pressure and heart rate of the user and compare the result of the blood pressure gathered from the device and from the traditional method. The researchers also tested the software application if the process in the system flowchart is followed.

**Evaluation**

The researchers determine the people who will use the system. The researchers will ask the user of the experience in using the system via questionnaires. The questionnaires contain set of questions that will allow the researchers to know if the device of the study is convenient to use, the design of the UI and the program is user-friendly.