***Intelligent Heart Attack Prevention***

***System***

***(IHAPS)***



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ABSTRACT

Cardiovascular diseases are the major causes of death in the world and every year lot of peoples die because the patient does not understand the problem and long enough to receive any medical help. Electrocardiogram (ECG) and Phono-cardiogram (PCG) is the useful early decision making supporting tool used by the world. IHAPS is using PCG signals for the early detection and prevention of cardiac arrest. The system first intelligently record the signals of the patient and ask the patient to tag a certain event signal whenever a new signal arrive the system will ask for tagging most of the signals belong to the same tagging list because of same routine but all of them have diﬀerent signal value after 14 days of learning the system generates the model of the patient’s heart signal by calculating the mean value of the signal’s PQRTS afterward each new signal is compared with these modeled signals on the bases of which problem is detected. The system consist of three modules the virtual patient which generates the heart signal the android application which will generates the alerts after comparing with models and it not only generate alerts for the patient but also for the doctors and patient’s relatives and the third module is the webserver which will keep the record of all the patients and provide support to the doctors to view the patient heart state when they receive the alert and multiple doctors throughout the world can discuss the patient heart condition these modules are interlinked with each other via a blue tooth and the internet. By this system the patient can understand his/her heart problem and works accordingly the new thing we have introduced in the system and that will shift the paradigm is DSS (Decision support system) that will aids the doctors for the early and eﬀective analysis of the heart Signal.

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**Part I**

Introduction

**1**

Introduction to the Heart

*In this chapter we will discuss the basic structure of heart, how heart works, when heart start glitches and types of heart attack.*

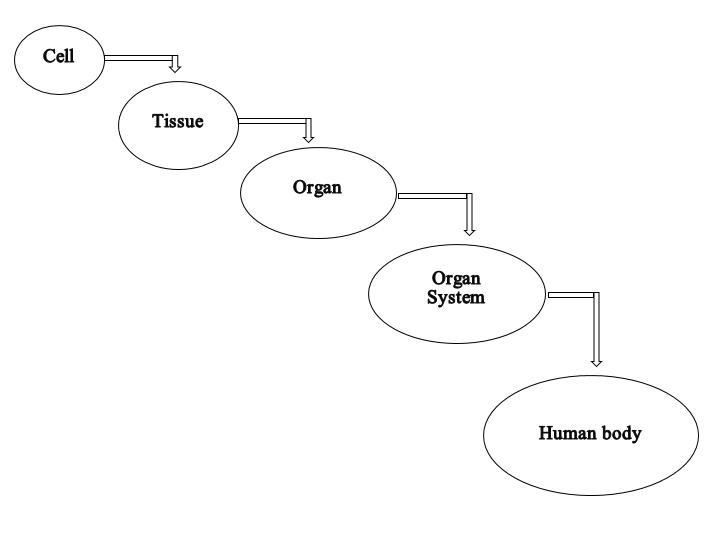
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| **1.1. The Heart** | **3** |

**1.1** The Heart

Allah Almighty has designed the human beings so beautifully that no one can designed such kind of creature. As everything has some building blocks the human body also has some building blocks. Cell is the basic building block of the human body and we have billions and even trillions of cells in our body these cell group together and form a tissues now when tissues are combined with each other the form organ on moving further organs form organ system and these organ system makes our whole body. The heart is one of the organ of the human organ system and that system is called respiratory system.



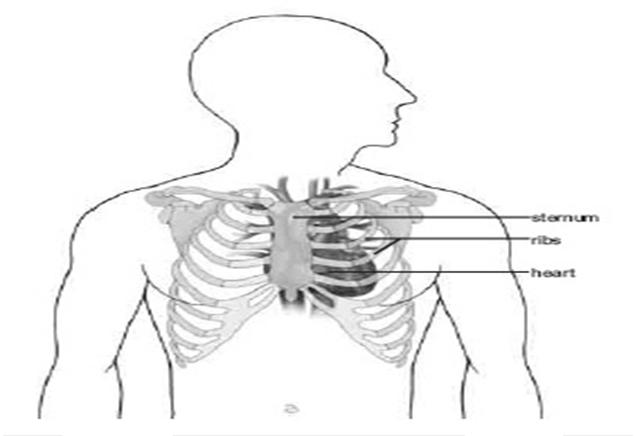
**Figure 1.1:** The Heart

The cardiovascular system delivers blood, nutrients, ions, gases, and heat throughout your body. That is its job, a transportation system. If you are running, it moves oxygen (O2) down to your legs, and moves lactic acid, that chemical that gives your muscles that burning sensation when worked hard, out of your legs. It moves heat from your body core to your toes, fingers, and head on a cold day. And it also distributes nutrients from your meals throughout your body, feeding your bones, nerves, organs, and tissues in your body.

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| **1.2. Position of the Heart** | **4** |

**1.2** Position of the Heart

According to biological point of view heart is located in the chest cavity at the back of the breastbone which is also known as sternum it is pointed directly towards the left and turned down the sternum.



**Figure 1.2:** Position of the Heart

**1.3** Structure of the heart

In this section we will discuss the structure of the heart we will discuss internal and external structure of the heart.

**1.3.1** External Structure of the heart

The heart is a hollow organ which is enclosed by the layers of the membrane most of the time they are two in number these membrane are called pericardium. The diﬀerence between these two layers is filled with the viscous fluid which helps in heart

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| **1.3. Structure of the heart** | **5** |

beat and remove the friction between two layers. At the lower end the outer membrane of pericardium is joined to a diaphragm. There are traverse and longitudinal furrows which ruptures the heart into the four chamber.

* The two upper chambers
* The atria
* The two lower chambers

The ventricles Coronary arteries and veins are clearly visible on the Furrows (grooves) if we towards the right atrium there are the superior vena cava and inferior vena cava and towards the left atrium there are four pulmonary veins.

From the upper central portion of the heart arise the pulmonary artery with a right and left branch and aorta with its branches.

**1.3.2** Internal structure of the heart

The muscles of the heart rift the heart internally into two main halves can be spoken as the left half and the right half. Now right and left halves are rifted further into two chambers the upper chambers are called arteries and the lower chambers are called ventricles the left half have left atrium and the left ventricle while the right half have Right atrium and the right ventricle.

These are the four chambers of the heart which are fenced by a thick muscular walls. The heart can also be rifted into upper and the bottom halves the bottom half has ventricles and the upper half has arteries.

**1.3.2.1** Left half

* It has left Atrium and left Ventricle.
* Responsible for the circulation of the oxygenated blood to all the organs including the heart itself.
* Circulation of blood to all parts of the body is known as greater or systematic circulation.

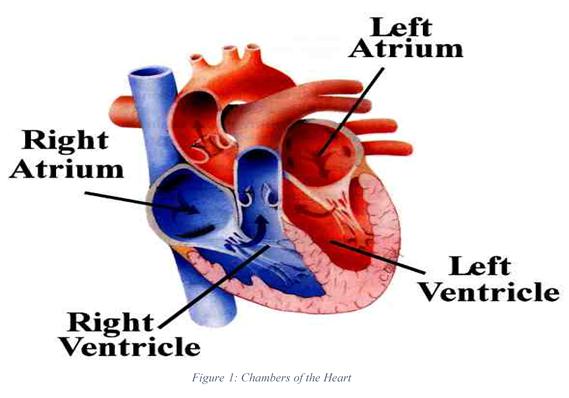
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| **1.3. Structure of the heart** | **6** |

**1.3.2.2** Right half

* It has right Atrium and right Ventricle.
* Responsible for the circulation of de-oxygenated blood to the lungs.
* Lungs can convert this blood to oxygenated form.rteries:
* They receive the blood entering to the heart.
* The wall called intertribal septum rift these arteries.
* Coronary sinus transports de-oxygenated blood from the ramparts of the heart.
* The semicircular valve avert the blood from flowing back when atrium contracts.

**1.3.3** Ventricles

* They pumps the blood out to the heart.
* The wall called interventricular septum rift these ventricles.



**Figure 1.3:** Internal structure of the heart

**1.3.4** Valves of the Heart

There are basically four valves of the heart as we have discussed them before in this section we will briefly discuss each valve of the heart.

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| **1.3. Structure of the heart** | **7** |

**1.3.4.1** Aortic semi-lunar valve

This valve is situated in the base of the aorta, blood is forced to flow from left ventricle into the aorta these valves also protects the blood returning to the ventricle during contraction.

Related valve problems include: Aortic regurgitation (also called aortic insuﬃciency), Aortic stenosis.

**1.3.4.2** The Tricuspid valve

This valve is situated in the base of the aorta, blood is forced to flow from left ventricle into the aorta these valves also protects the blood returning to the ventricle during contraction. Related valve problems include: Aortic regurgitation (also called aortic insuﬃciency), Aortic stenosis.

**1.3.4.3** Semi-lunar valve of pulmonary artery

This valve is situated in the base of the aorta, blood is forced to flow from left ventricle into the aorta these valves also protects the blood returning to the ventricle during contraction.

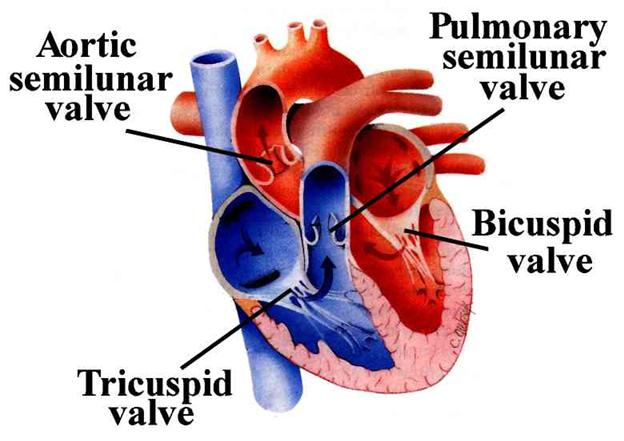
Related valve problems include: Aortic regurgitation (also called aortic insuﬃciency), Aortic stenosis.

**1.3.4.4** Bicuspid valve

This valve allows the blood to flow freely from the left atrium into the left ventricle but protects the blood to flow back to the left atrium when it contracts.

Related valve problems include: Mitral valve prolapse, Mitral valve regurgitation and Mitral valve stenosis.

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| **1.4. Signals generated by the heart** | **8** |

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**Figure 1.4:** Valves of the Heart

**1.4** Signals generated by the heart

There are basically four valves of the heart as we have discussed them before in this section we will briefly discuss each valve of the heart.

**1.4.1** Hearts Electric System

Beside the chambers and the valves our heart also has an electrical system. It is a bit like the electrical wiring in your home. The heart’s electrical system creates the signals that tell your heart when to beat. And your heartbeat is what pumps blood throughout your body. The heart’s electrical system is also called the cardiac conduction system.

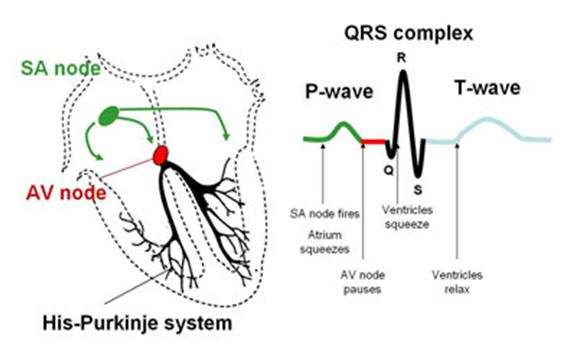
**1.4.2** Parts of the Electric System

Your heart’s electrical system includes three important parts.

* **S-A node (sinoatrial node):** known as the heart’s natural pacemaker, the S-A nodehas special cells that create the electricity that makes your heart beat.

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| **1.4. Signals generated by the heart** | **9** |

* **A-V node (atrioventricular node):** A-V node is the bridge between the atria andventricles.Electrical signals pass from the atria down to the ventricles through the A-V node.
* **His-Purkinje system :** His-Purkinje system carries the electrical signals throughoutthe ventricles to make them contract. The parts of the His-Purkinje system include.
  + His Bundle (the start of the system).
  + Right bundle branch.
  + Left bundle branch.
  + Purkinje fibers (the end of the system).



**Figure 1.5:** Parts of the Electric System

**1.4.3** Electric Signal and blood flow:

The S-A node normally produces 60-100 electrical signals per minute this is your heart rate, or pulse. With each pulse, signals from the S-A node follow a natural electrical pathway through your heart walls. The movement of the electrical signals causes your heart’s chambers to contract and relax.

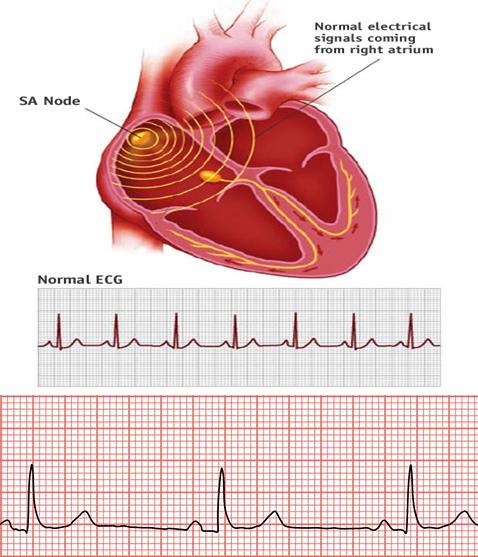
In a healthy heart, the chambers contract and relax in a coordinated way, or in rhythm.

When your heart beats in rhythm at a normal rate, it is called sinus rhythm.

When working well, your conduction system automatically responds to your body’s changing need for oxygen: When you climb stairs, carry heavy groceries, or take a walk, you need more oxygen; therefore, your heart beats at a faster heart rate.

When you are sitting or sleeping, you need less oxygen; therefore, your heart beats at a slower rate. Your conduction system senses your need for oxygen and responds

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| **1.5. Heart Attack** | **10** |

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**Figure 1.6:** Electric Signal and blood flow

with the proper heart rate. A problem in your heart’s electrical system can disrupt your heart’s normal rhythm. Any kind of abnormal rhythm or heart rate is called an arrhythmia. It is normal and healthy for your heartbeat to speed up or slow down during the day as your activity level changes. But it is not normal for your heart to beat out of rhythm. When your heart beats out of rhythm, it may not deliver enough blood to your body.

Learn more about diﬀerent types of arrhythmias such as atrial flutter and atrial fibrillation (fast heartbeats), and bradycardias (slow heartbeats).

**1.5** Heart Attack

In this section we will discuss the heart attack what basically this is we will also discuss diﬀerent kinds of heart attacks and will also talk about how the valves and the signals cause the heart attack.

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| **1.5. Heart Attack** | **11** |

**1.5.1** What is heart attack?

A heart attack, or myocardial infarction (MI), is permanent damage to the heart muscle. "Myo" means muscle, "cardial" refers to the heart, and "infarction" means death of tissue due to lack of blood supply.

So a heart attack occurs when blood flow to the heart is blocked. A blocked artery prevents oxygen-rich blood from reaching a section of the heart. If the blocked artery is not reopened quickly, the part of the heart normally nourished by that artery begins to die.

This is the type which is related to the structure of the heart so let’s find out what happened during and before the heart attack.



**Figure 1.7:** Heart Attack

**1.5.2** What happens during Heart attack?

The heart muscle requires a constant supply of oxygen-rich blood to nourish it. The coronary arteries provide the heart with this critical blood supply. If you have coronary artery disease, those arteries become narrow and blood cannot flow as well as they should? Fatty matter, calcium, proteins, and inflammatory cells build up within the arteries to form plaques of diﬀerent sizes. The plaque deposits are hard on the outside and soft and mushy on the inside.

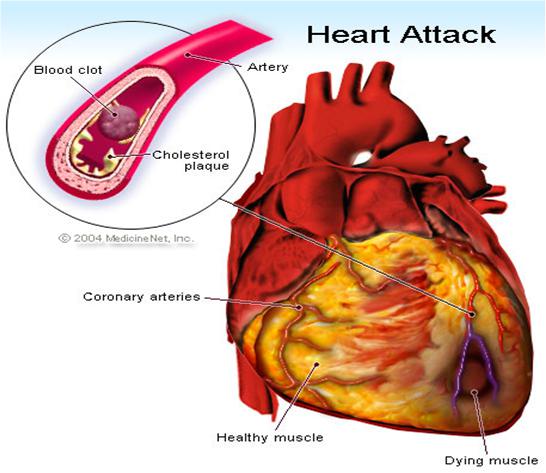
When the plaque is hard, the outer shell cracks (plaque rupture), platelets (disc-shaped particles in the blood that aid clotting) come to the area, and blood clots form around the plaque. If a blood clot totally blocks the artery, the heart muscle becomes "starved" for oxygen. Within a short time, death of heart muscle cells occurs, causing permanent

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| **1.5. Heart Attack** | **12** |

damage. This is a heart attack.

While it is unusual, a heart attack can also be caused by a spasm of a coronary artery. During a coronary spasm, the coronary arteries restrict or spasm on and oﬀ, reducing blood supply to the heart muscle (ischemia). It may occur at rest, and can even occur in people without significant coronary artery disease.

Each coronary artery supplies blood to a region of heart muscle. The amount of damage to the heart muscle depends on the size of the area supplied by the blocked artery and the time between injury and treatment.



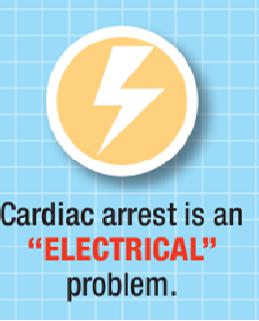
**Figure 1.8:** Heart Attack

Healing of the heart muscle begins soon after a heart attack and takes about eight weeks. Just like a skin wound, the heart’s wound heals and a scar will form in the damaged area. But, the new scar tissue does not contract. So, the heart’s pumping ability is lessened after a heart attack. The amount of lost pumping ability depends on the size and location of the scar.

**1.5.3** Cardiac Arrest

Cardiac arrest, also known as sudden cardiac arrest, is the abrupt loss of heart function in a person who may or may not have diagnosed heart disease. The time and mode of death are unexpected. It occurs instantly or shortly after symptoms appear. Cardiac arrest occurs when the heart malfunctions and stops beating unexpectedly. Cardiac arrest is triggered by an electrical malfunction in the heart that causes an irregular heartbeat (arrhythmia). With its pumping action disrupted, the heart cannot pump blood to the brain, lungs and other organs.

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| **1.6. Symptoms or Signs of the heart attack** | **13** |

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**Figure 1.9:** Cardiac Arrest

**1.5.4** Cardiac Attest and Heart Attack are same?

No. The term "heart attack" is often mistakenly used to describe cardiac arrest. While a heart attack may cause cardiac arrest and sudden death, the terms don’t mean the same thing. Heart attacks are caused by a blockage that stops blood flow to the heart. A heart attack (or myocardial infarction) refers to death of heart muscle tissue due to the loss of blood supply, not necessarily resulting in the death of the heart attack victim.

Cardiac arrest is caused when the heart’s electrical system malfunctions. In cardiac arrest death results when the heart suddenly stops working properly. This may be caused by abnormal, or irregular, heart rhythms (called arrhythmias). A common arrhythmia in cardiac arrest is ventricular fibrillation. This is when the heart’s lower chambers suddenly start beating chaotically and don’t pump blood. Death occurs within minutes after the heart stops. Cardiac arrest may be reversed if CPR (cardiopulmonary resuscitation) is performed and a defibrillator is used to shock the heart and restore a normal heart rhythm within a few minutes.

**1.6** Symptoms or Signs of the heart attack

Acting fast at the first sign of heart attack symptoms can save your life and limit damage to your heart. Treatment works best when it’s given right after symptoms occur.

Many people aren’t sure what’s wrong when they are having symptoms of a heart

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| **1.6. Symptoms or Signs of the heart attack** | **14** |

attack. Some of the most common warning symptoms of a heart attack for both men and women are.

**1.6.1** Chest pain or discomfort

Most heart attacks involve discomfort in the center or left side of the chest. The discomfort usually lasts more than a few minutes or goes away and comes back. It can feel like pressure, squeezing, fullness, or pain. It also can feel like heartburn or indigestion.

**1.6.2** Upper body discomfort

You may feel pain or discomfort in one or both arms, the back, shoulders, neck, jaw, or upper part of the stomach (above the belly button).

**1.6.3** Shortness of breath

This may be your only symptom, or it may occur before or along with chest pain or discomfort. It can occur when you are resting or doing a little bit of physical activity. Other possible symptoms of a heart attack include:

* Breaking out in a cold sweat..
* Feeling unusually tired for no reason, sometimes for days (especially if you are a woman).
* Nausea (feeling sick to the stomach) and vomiting.
* Light headedness or sudden dizziness.

Any sudden, new symptom or a change in the pattern of symptoms you already have (for example, if your symptoms become stronger or last longer than usual) Not all heart attacks begin with the sudden, crushing chest pain that often is shown on TV or in the movies, or other common symptoms such as chest discomfort. The symptoms of a heart attack can vary from person to person. Some people can have few symptoms and are surprised to learn they’ve had a heart attack. If you’ve already had a heart attack, your symptoms may not be the same for another one.

**2**

Introduction to the Intelligent Heart Attack prevention System

*This chapter is about our System we will discuss the following thing in this chapter.*

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| **2.1. Why we have choose IHAPS as our Final Year Project?** | **16** |

**2.1** Why we have choose IHAPS as our Final Year Project?

Cardiovascular diseases are the major causes of deaths in the world more than 15 million people die every year in the world because of it and most of them are under 65 and with the passage of time these numbers of deaths are increasing.

Here is the research of statics. Keeping in mind these problems we have decided to develop a system that will help the patient against Heart attack.

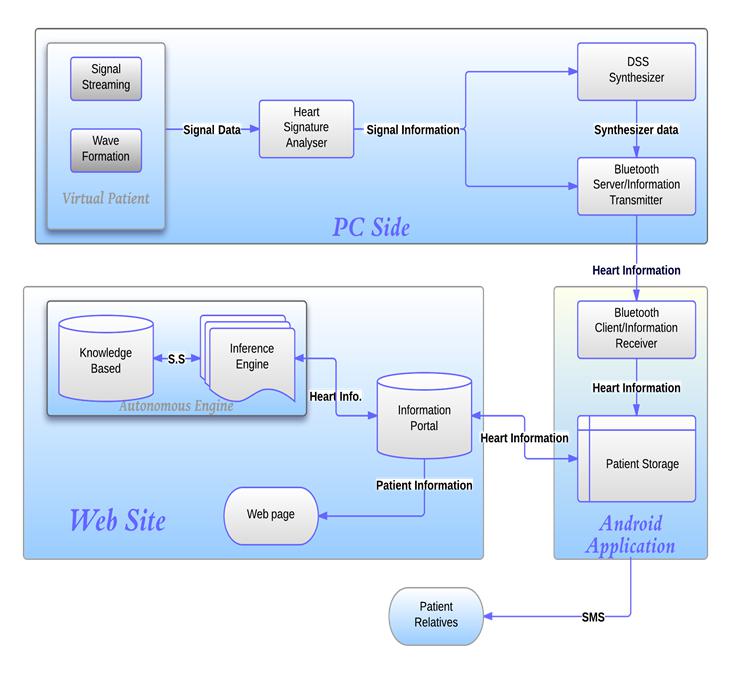
**2.2** What IHAPS basically is?

As we don’t have an actual patient so we have developed a virtual patient that will generate the signal these signal than pass through the analyzer and converted in use full information now we have peak value on the basis of which we can diagnose the problem. ECG/PCG signal need a large need large domain knowledge and to read them doctor need lot of time so we have change the paradigm by the introduction of the Decision support system Synthesizer which convert the heart signal into graphical notation now this data is sent to the Bluetooth server which basically transmit the heat information to the mobile client we android client is working to receive the signal as we have the patient’s tagged signals on the basics of which it generate an alarm and send the SMS to his/her relatives this alarm is for the patient himself and message for his relatives who are close to him here is the main working of the IHAPS through which we can prevent the patient from the cardiac arrest.

During the heart attack the patient has no knowledge that what’s going on patient can’t identify whether it is jaw pain or the malfunctioning of the heart and within no time the heart attack is predicted. Now all of the data is stored at the main server say patient all information and the heart information so we have develop and hosted a website where anyone having login say doctor and patient can view the heart signature the most important thing we have there is Inference engine and the Knowledge based where the signals got learned and tagged by the patient when the heart signature became mature these signal where sent to the Android application for eﬃcient decision. The “Intelligent Heart Attack Prevention System” will helps people to find the problem with the once heart which can cause heart Attack based on the user’s current condition and other specification. The software must become familiar with the regular activities of the patient and according to those regular activities it will prevent the user from the heart attack. The patient and the surrounding people must become warned when there is any situation which may cause heart attack we will warn the most nearest people by some alarm on their Android mobile phone. Furthermore, the software needs

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| **2.3. functions use to preventing from heart attack?** | **17** |

both Internet and GSM connection to inform the patient’s family members about this condition.



**Figure 2.1:** Ihaps Overview

**2.3** functions use to preventing from heart attack?

There are two major components which are greatly help full in the prevention of heart attack or cardiac arrest in this section we will discuss them in detail.

**2.3.1** The Mobile Application

People had made lot of systems for the prevention of heart attack but not even a single system is connected to the mobile application.

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| **2.3. functions use to preventing from heart attack?** | **18** |

As in cardiac arrest the electric signal of the heart starts malfunctioning and world have developed lot of modules that give the electric shock to the heart to again make the signal proper making such system was like re-inventing the wheel so we have developed android application that will alert the patient from the cardiac arrest.

**2.3.1.1** Registration of the patient

All the patients has to get register by installing the application to their mobiles and then fill up the registration form in which they have to provide information about his relatives and doctor i-e mobile number and their names for the verification hash codes will be sent to those persons mobile numbers.

**2.3.1.2** Login on the application

Now if the patient is registered after the login a service will run in mobile that will receive the heart information from the Bluetooth server wirelessly through the Bluetooth. These all records are not only saved in the user mobile database but also at main server database when this heart information which is in the form of PQRST peek value and the time interval between each value.

**2.3.1.3** Received Signal Information

This received signal in the android application will matched with the learned signal if it belongs to normal signal application will do nothing these all learned signals will be present in mobile database if it matches with the any abnormality it declare it a critical situation and will generate a message to its relatives and his mobile starts alarming to leave all type of work because you are moving towards the heart attack and relatives after receiving the message will came at the spot and take care of the patient by giving him prescribed medicine.

**2.3.1.4** The Login view

In the mobile login the patients can view their portal and can view the heart signal and the DSS pie charts.

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| **2.4. Relationship of components with each other** | | | **19** | |
|  |  | Web Inference Engine |  |  |
|  | **2.3.2** |  |  |

The web Inference engine is the basic learning section of the heart signature where the signature are stored in the knowledge based.

Basically all the heart information received by the android application has to be transmitted to the web server wirelessly through the wifi or any internet service i-e Edge, GPRS, 3G where it will pass through the inference engine this process takes 7-15 days for the learning and became intelligent when it became mature the webserver send these signal to the android application where it is first tagged in will used in the future for the prevention of the heart attack.

Most of the time some signals of the patients which generates it their daily routine not generate in the hospital in front of the doctor as we are storing all the signals in the web database so the doctor can view these signature at the website and can prescribe some new medicines which are necessarily required in such type of situations.

**2.4** Relationship of components with each other

This section will give an overview of the whole system. The system will be explained in its context to show how the system interacts with other systems and introduce the basic functionality of it. It will also describe what type of stakeholders that will use the system and what functionality is available for each type. At last, the constraints and assumptions for the system will be presented.

**2.4.1** Parts of the application

This system consists of three modular systems:

* **1st one is** Doctor’s Panel in windows side application.
* **2nd** one is mobile side Android application.
* **3rd** one is Website.

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| **2.4. Relationship of components with each other** | **20** |

**2.4.1.1** The Windows Application

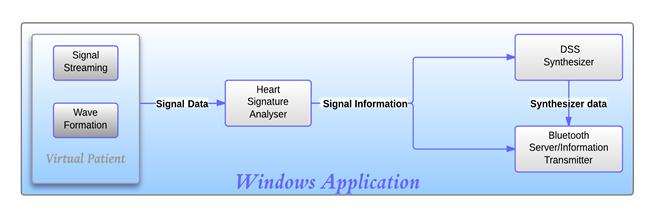
Our Windows application is further distributed into 4 modules.

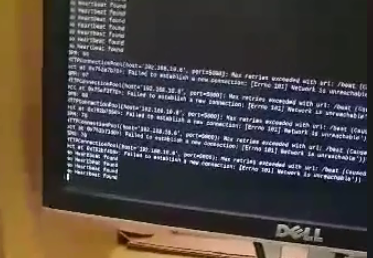
* Patient.
* Heart signal Analyzer.
* DSS Synthesizer.
* Server/Information Transmitter.

**Patient** As we don’t have the actual patient from where we can generate takethe heart signal so we have developed a virtual patient which is further categorized into two parts.

* Signal Streaming.

**Signal Streaming** The Signal Streaming component is used to visualized the signalwhen it is moving we can create a new signal and can insert it anywhere between the streaming signal, as heart is continuously beating and the most important part it at each beat it generate a signal here we are dealing with such signals.

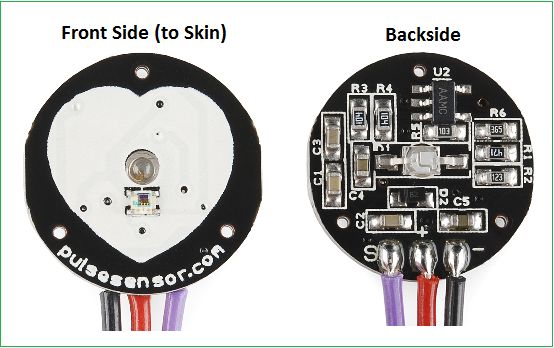




**Figure 2.4:** Signal Streaming

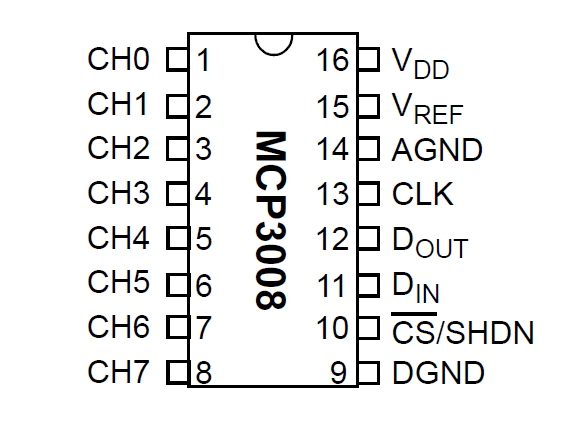
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| **2.4. Relationship of components with each other** | **22** |

**Heart Signal Analyzer** This components receives the raw data from the virtual clientand transform it in a use full information which in turns find out the peak value from the signature these values are very important in the formations of the heart disease. The main red line defines the R which is the base line in detection/analyzing of the PQST peaks and there values will be stored there in the text fields.



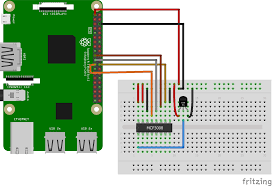
**Figure 2.6:** Heart Signal Analyzer

**Analog to Digital Converter MCP3008**  this is used in the hardware of our system which help to convert analog signals into digital signals.



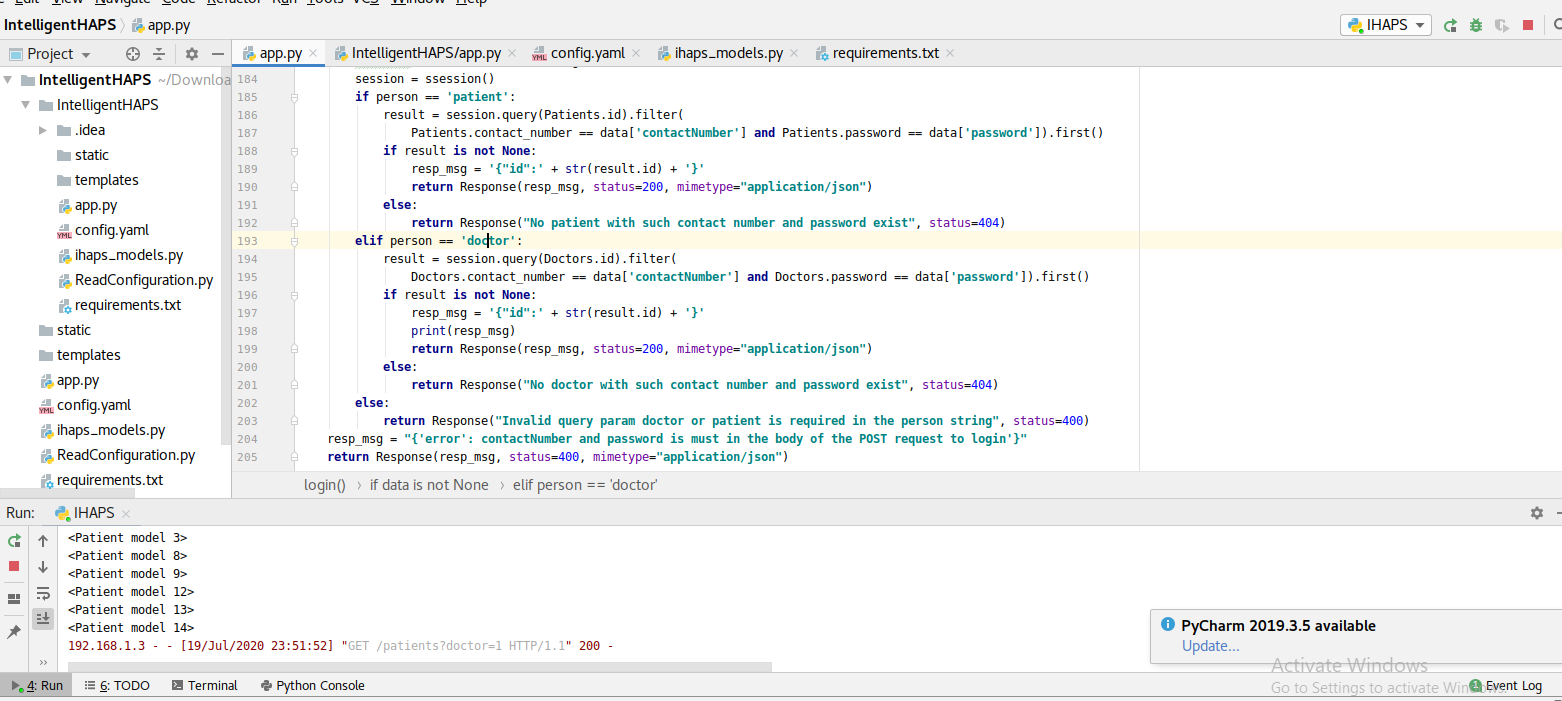
**Conactivity of the Hardware**

The hardware is connected like as afigure shown below

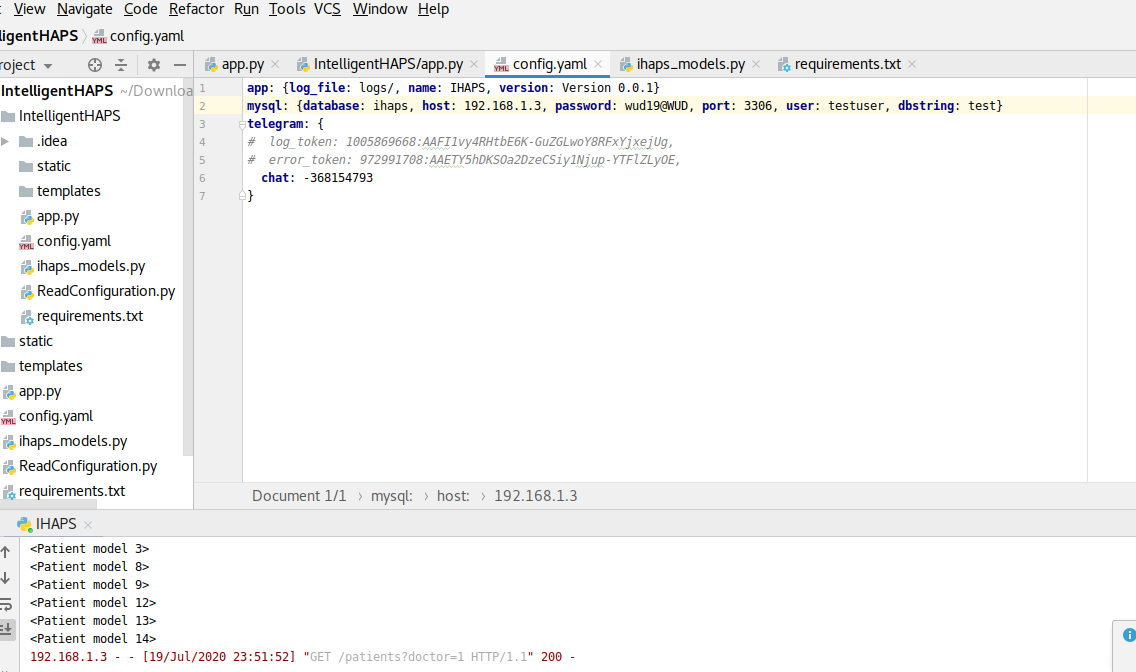


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**Server** Server is the core component which is written in Pythonprogramming language and is using native blue-cove 2.1.1 API’s this server first search the clients in the range and send the data to those devices on which IHAPS android application has been installed. We make a sensor of python language in PYCHARM tool in Linux.



**Discovering the devices** The first step of the server is todiscover the devices using the built in function of discovering agent paired devices with the specific url’s of both application and the website it also the discovered devices.

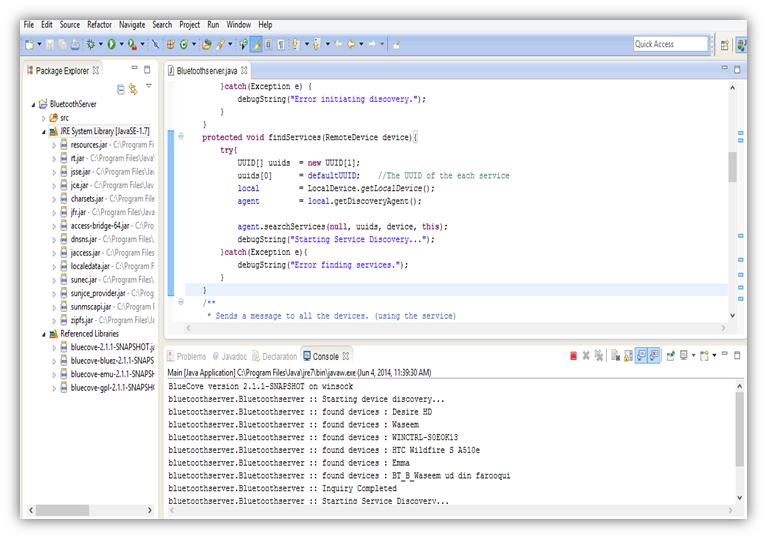


**Completion of Inquiry** When all the devices has been found the inquiry got completed.

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| **2.4. Relationship of components with each other** | **24** |

**Discovering the Services** Here services are the client devices which is in our case isandroid application this job is done with the help of UUID which is the serial port address and local agents if there are more than one services devices in the range it will transmit the information to all of them.

**Broadcasting the data** Now service record is identified here at the end the mainjob of transmitting the data or broadcasting the data to the clients has been done.



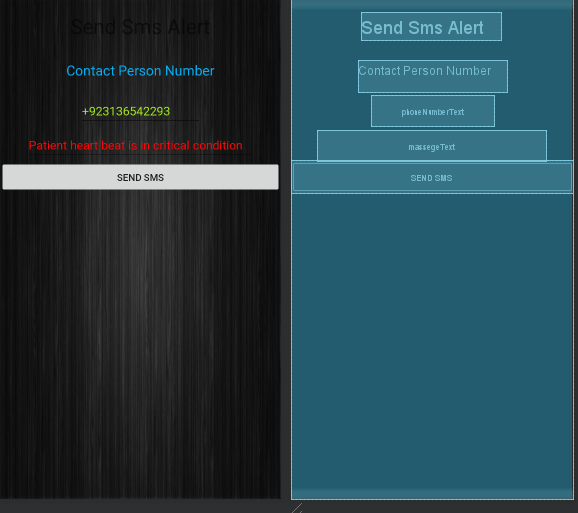
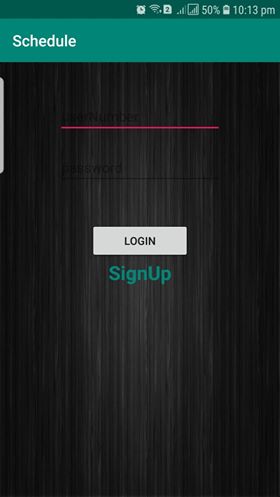
**Figure 2.8:**  Server

**2.4.1.2** The Mobile Application

The second module on which we are focusing upon is the Mobile application.

In this section we will discuss our mobile application what is it, how it is working and how it is transmitting and receiving the data. Basically the mobile application is developed to receive the data from the Windows application using Bluetooth, informing the patient and relatives who can handle the patient immediately and on the bases of problem level message the patient’s doctor as far as this time we are not making any video call to the doctor and we are dependent on the wifi or internet on the mobile phones for transmitting the data from application to the webserver.

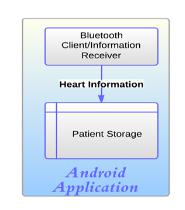
With the mobile application, the patient will be able to cure himself from the heart attack because by the mean of timely warning of the patient this system will be



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| **2.4. Relationship of components with each other** | **25** |

intended for patient diagnose and prescribe by the doctor. All this thing will be based on various healthy wave form of a patient that our system will request the patient to tag the 3 to 4 states it will go on the detection of the un-familiar waveform. There are several tagging criteria and it will be possible by taking the mean value of the all the signal that will be collected after the daily routines.

The mobile application is further broken down into two modules.



**Figure 2.9:** The Mobile Application

* The Bluetooth client.
* The Actual Application.

1. **The Bluetooth client** The Bluetooth client is the basic receiver of the data forthe client we don’t require native API’s because android has a built-in API for the Bluetooth communication.

**Bluetooth Adapter** Bluetooth adapter is the core component of the Bluetoothreceiver so firstly we will make sure it must be not null it is null means the device has no Bluetooth feature, if the mobile has bluetooth adapter than our next task is to make it enable android has provide the intent feature which deals with the dialog and ask the user to make the bluetooth discoverable.

**Broadcast Receiver** We have broadcast transmitter in the bluetooth serverso that broadcast must be received by some receiver that will be our broadcast receiver it is necessary for receiving the data.

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| **2.4. Relationship of components with each other** | **26** |

**Accepted thread** As we are receiving the data it require the socket commu-nication and making the connecting with the server it takes some time that is very important for the android application if we run it on the main UI thread it will definitely crashes the application and crashing of the application means no communication we have make this communication a service which will be triggered when-ever server is transmitting the data and we assign is a new thread so not crashes the application.

**A sync-Task** A sync. Is abbreviated as Asynchronies task also known as background process its life cycle is diﬀerent from the activity it just require a trigger and can be run any time in the application so server can transmit the data any time so more we require is background task for receiving the data this data is than sent to the mobile database and from there to the webserver using http post protocol.

1. **The Actual Application** People had made lot of systems for the prevention ofheart attack but not even a single system is connected to the mobile.

As in cardiac arrest the electric signal of the heart starts malfunctioning and world have developed lot of modules that give the electric shock to the heart to again make the signal proper making such system was like re-inventing the wheel so we have developed android application that will alert the patient from the cardiac arrest.

**Registration of the patient** All the patients has to get register by installingthe application to their mobiles and then fill up the form in which they have to provide information about his relatives and doctor i-e mobile number and their names for the verification hash codes will be sent to those persons mobile numbers.

**Login on the application** Now if the patient is registered after the login aservice will run in mobile that will receive the heart information from the Bluetooth server wirelessly through the Bluetooth. These all records are not only saved in the user mobile database but also at main server database when this heart information which is in the form of PQRST peek value and the time interval between each value.

**Received Signal Information** This received signal in the android applicationwill matched with the learned signal if it belongs to normal signal application will do nothing these all learned signals will be present in mobile database if it matches with the any abnormality it declare it a critical situation and will generate a message to its relatives and his mobile starts alarming to leave all

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| **2.4. Relationship of components with each other** | **27** |

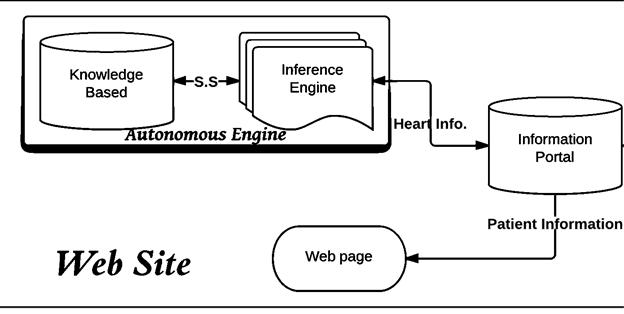
type of work because you are moving towards the heart attack and relatives after receiving the message will came at the spot and take care of the patient by giving him prescribed medicine.

**The Login view** In the mobile login the patients can view their portal and canview the heart signal and the DSS pie charts.

**Signal Information transmitter and mature signal receiver** In this moduleof the android application the mobile will transmit the signal-information to the webserver for the inference engine and the main data base storage this communication is done through the http protocol for this purpose we need an http client and http response as we have an idea of the http protocols the post function is require for the uploading the data and get function is required for downloading the data as we are receiving the mature signal from the database and get will only provide us the JSON and XML format data so all we required is to parse the data so we are parsing the data and make it as a useful information.

**2.4.1.3** Website

I this section we will discuss our website why we have develop it how it is working and how we are receiving the data through the website.



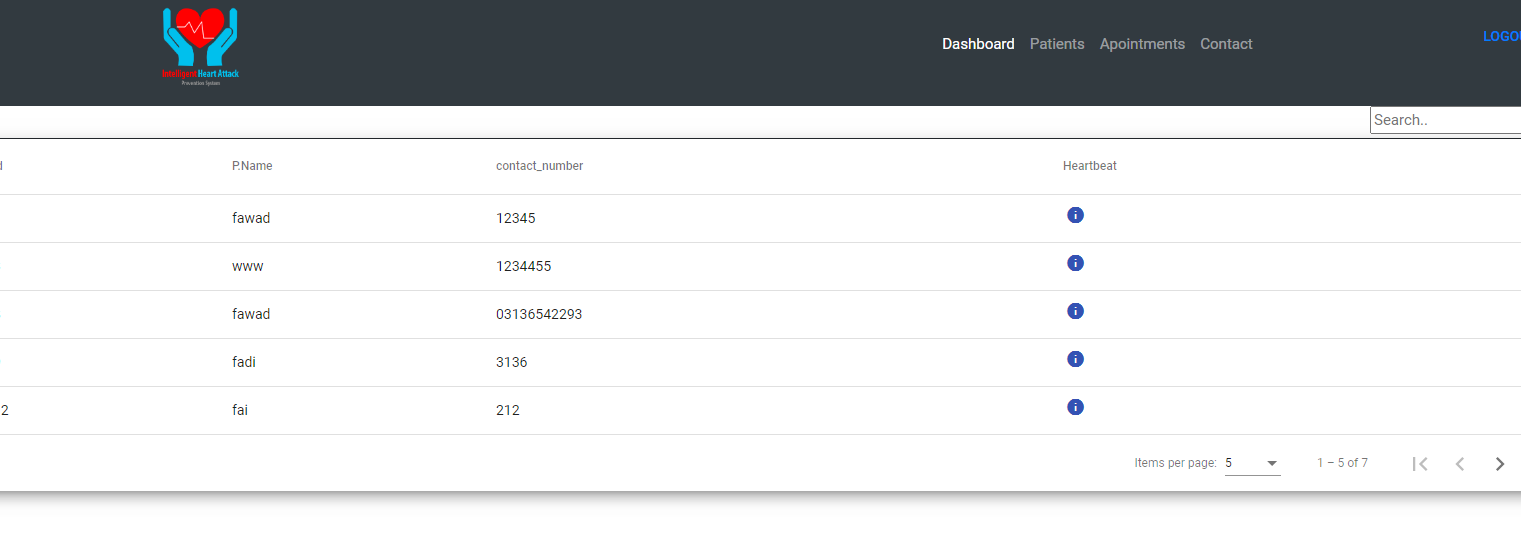
**Figure 2.10:** Website

* **Information Portal** It is the main database of the whole system all the informationabout all of the patients, doctors and once relatives is stored in this database if the patient change his mobile phone through his login all the data will be

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| **2.4. Relationship of components with each other** | **28** |

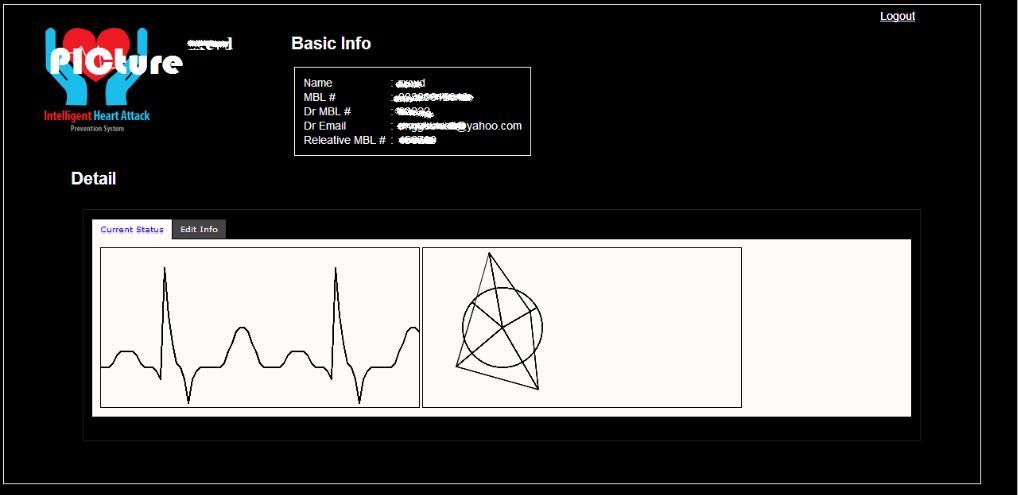
synchronize from web database to the patient mobile.

All the information of the heart signature will be there mobile application and the webpage all will communicate with this webserver.



**Figure 2.11:** Website

* **Web page** It is the user interface where the patient as well as the doctor can viewthe heart routine of the patient we have a separate place for viewing the bio data of the patient.



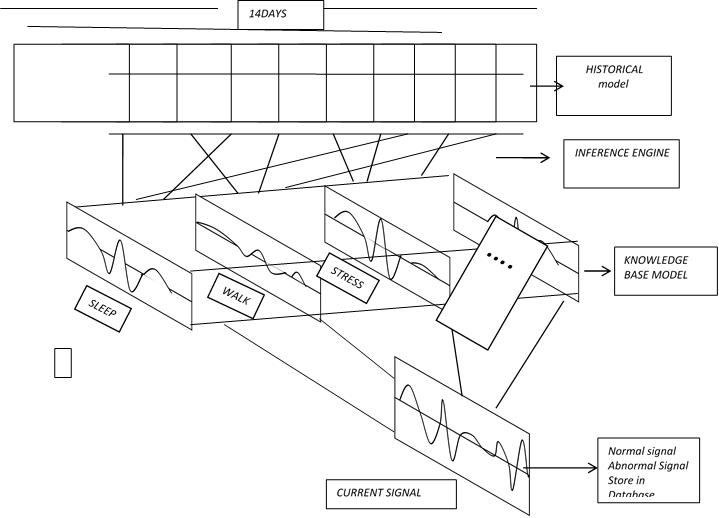
**Figure 2.12:** Website

* **Web Inference Engine** The web Inference engine is the basic learning section ofthe heart signature where the signature are stored in the knowledge based. Basically all the heart information received by the android application has to be transmitted to the web server wirelessly through the wifi or any internet service i-e Edge, GPRS, 3G where it will pass through the inference engine this process takes 7-15 days for the learning and became intelligent when it became mature the webserver send these signal to the android application where it is first tagged

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| **2.4. Relationship of components with each other** | **29** |

in will used in the future for the prevention of the heart attack.

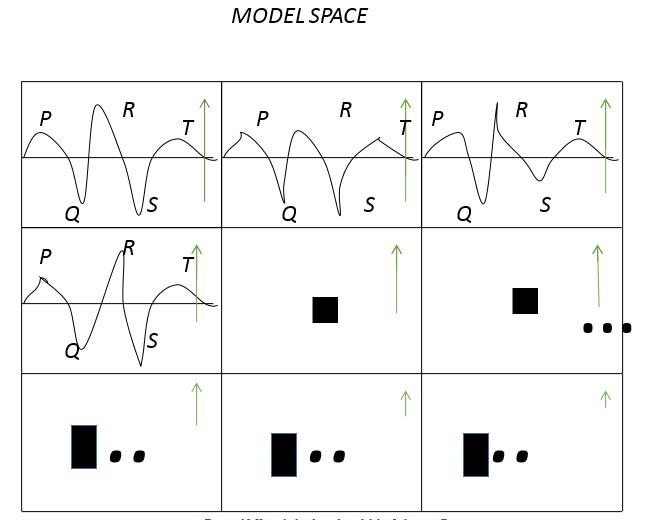
Most of the time some signals of the patients which generates it their daily routine not generate in the hospital in front of the doctor as we are storing all the signals in the web database so the doctor can view these signature at the website and can prescribe some new medicines which are necessarily required in such type of situations.



**Figure 2.13:** Web Inference Engine

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| **2.4. Relationship of components with each other** | **30** |

* **Knowledge Based** Knowledge based is an intelligent database where we will storethe data for the short span of time.Inference engine and the Knowledge based meet together and makes the system intelligent.



**Figure 2.14:** Web Inference Engine

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| **2.5. Future Works** | **31** |

**2.5** Future Works

Researchers have work lot but so far connectivity with the mobile and web application is not cater so far and because of some constraints we have not implemented the following thing which can be implemented to make it excellent system for the patients some of them are as follows.

* Implementation of system on the actual patient who is wearing the cardiogram devices which listen the heart beats.
* Video call to the doctor in critical time.
* Implementation of the Inference on Arduino microcontroller which will be connected to the patient.
* Implementation of the Inference on Arduino microcontroller which will be connected to the patient.
* Synchronization of the patient data on changing the mobile.
* Multiple signal view in one pie chart.

**Part II**

Requirement

**3**

Literature Review

*This chapter provides Literature Review*

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| **3.1. Introduction to the literature Review** | **34** |

**3.1** Introduction to the literature Review

Before starting project we have studying the specific knowledge of Heart Attack, its symptoms and diﬀerent devices for detection and diagnosis of heart attack. Various method has been investigated for heart disease but widely used and investigate two of them which are.

* ECG Electrocardiography
* PCG Phonocardiography

Only heart attack not include in heart diseases. In which include all disease that’s aﬀect the any disorder in heart ability to do function normally. Some various form of heart disease is coronary artery, congenital, arrhythmias and so on. But narrowing of coronary arteries is the most common form of heart disease.

**What is ECG?** The electrical activity is recorded by heart is ECG electrocardiography.It is used for heart disease investigation and transthoracic interpretation activity of heart with respect to time interval. It can detect heart signal by electrode which can be attached to the chest wall of body and display it to the external device which is called ECG machine.

**What is PCG?** Plotting and recording sounds as well as murmurs produce by heartwith high fidelity. Cardiac cycle technique is use for recording a sound of heart. PCG can record heart sound using a microphone attached on chest. It can detect those sound and murmurs which cannot be detected by ordinary stethoscope. The vibration created by sound thought to be a result closure to the heart values. Both of devices can reveal various physiological and abnormal behaviors of the heart behaviors of the heart.

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| **3.2. Towards Intelligent and Mobile Systems for Early** | | | **35** | |
|  |  | Towards Intelligent and Mobile Systems for Early |  |  |
|  | **3.2** |  |  |

Detection and Interpretation of Cardiological Syndromes

**Date of publication** December 2001

**Authors** P Rubel, F Gouaux, J Fayn, D Assanelli, A Cucet3, L Edenbrandt4 and CMalossi

**3.2.1** Abstract

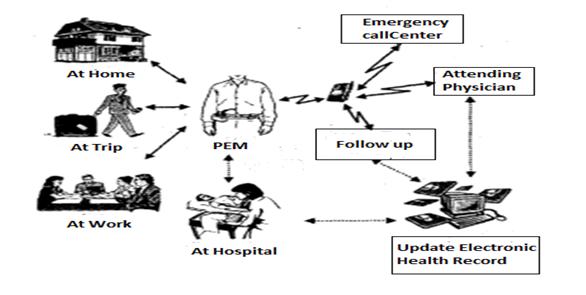
Personal, Intelligent and Mobile system for Early Detection and Interpretation of Cardio logical Syndromes is one of the main aim of European under the standard of IST-2000-26164 EPI-MEDICS project. According to his project the main goal is to design a those system which is easy to use, very aﬀordable powerful and embedded personal ECG monitor for detection and prevention of cardiac events and mobile is working as a doctor. The ability of this system is to record and store ECG from a pseudo orthogonal subset. The second main objective is to make a PEM device is intelligent, decision-making robust data processing and decision-making methods having auto-adaptive and auto-learning capabilities and this system also generate a diﬀerent alarm to forward a massage having record signal for Doctor. The last goal is to develop a tool for wireless communication between PEM device and health professional system and enhance the system accordingly to patent activity.

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| **3.2. Towards Intelligent and Mobile Systems for Early** | **36** |

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|  |  | TA Wireless ECG System for Continuous Event |  |  |
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Recording and Communication to a Clinical Alarm Station

**Date of publication** Proceedings of the 26th Annual International Conference of theIEEE EMBS San Francisco, CA, USA • September 1-5, 2004

**Authors**

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* E. Gunnarson(Hospital of Buskerud, Department of acute medicine, Drammen, Norwa)
* O. Hejlesen(Aalborg University, Department of Health Science and Technology, Aalborg, Denmark)

**3.3.1** Abstract

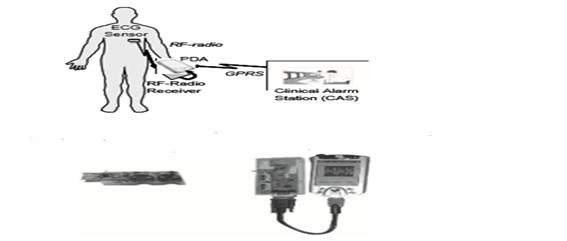
In wireless ECG system is designed especially for continuous monitoring of arrhythmia Diagnostic. The patient is wear device having ECG sensor, electronic electrode with wireless signal transmission for hand held device. ECG signal is continuously recorded by this device. Arrhythmia detector can detect abnormal signal or ECG activity. If abnormal signal is captured it can transmit alarm to remote CAS location and system can continuously record an event. Remote Electrocardiography diagnosis is possible due to telecommunication technology. These type of system can be divided into two mode.

* Real time mode
* Forward and store mode

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| **3.3. TA Wireless ECG System for Continuous Event** | **38** |

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| **3.4. Detection of cardiac abnormality from PCG signal** | | | **39** | |
|  |  | Detection of cardiac abnormality from PCG signal |  |  |
|  | **3.4** |  |  |

using LMS based least square SVM classifier

**Date of publication** November 2010

**Authors** Samit Ari, Koushik Hembram, Goutam Saha Department of Electronicsand Electrical Communication Engineering, Indian Institute of Technology, Kharagpur, Kharagpur 721 302 India

**3.4.1** Abstract

Auscultation, the technique of listening to heart sounds with a stethoscope can be used as a primary Detection system for diagnosing heart valve disorders. Phonocardiogram, the digital recording of heart Sounds is becoming increasingly popular as it is relatively inexpensive. In this paper, a technique to improve the performance of the Least Square Support Vector Machine (LSSVM) is proposed for classification of normal and abnormal heart sounds using wavelet based feature set. In the proposed technique, the Lagrange multiplier is modified based on Least Mean Square (LMS) algorithm, which in turn modifies the Weight vector to reduce the classification error.The basic idea is to enlarge the separating boundary sur-face, such that the reparability between the clusters is increased. The updated weight vector is used at the Time of testing. The performance of the proposed systems is evaluated on 64 diﬀerent recordings of heart Sounds comprising of normal and five diﬀerent pathological cases. It is found that the proposed technique Classifies the heart sounds with higher recognition accuracy than competing techniques.

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**3.5** Information technologies and Heart disease

Performing ECG analysis to record a relevant clinical information of patient have previously been stored and use this for feature perspective, Either on center databases or personal portable device such as EPI-MEDICS device or a Smartcard. The en-hancement of the system European programmer derive a several solution to improve a cardiac patient health information availability and sharing throughout the Europe. Within (EDIPE, a standard communication protocol for the ECG (SCP-ECG), a computer-based cardiology patient record for the follow- up of cardiac disease patients

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| **3.6. Heart Disease Diagnose using NN-based Decision support** | **42** |

has been designed. SCP-ECG, EDIPE and 14C and (CHRONICS, CHS are the new technology introduce by programmers in cardiac field. However these system are designed either a home or hospital for cardiac patient. But they require a new information technology infrastructure and medical service to take a decision for patient care. There is a two challenges faces

* Detect ischemic event as early as possible. Even the patient have not known about cardiac diseases.
* If necessary health care structures must involves without dely.

**3.6** Heart Disease Diagnose using NN-based Decision support

1. based system is used for prediction of heart disease. It is composed of two part: hardware and GUI software. In hardware sensor is used for collection of heart sound since stethoscope is collected a low amplitude level. Due to this microphone is inserted in stethoscope and sound card amplify the sound come from stethoscope. In software Matlab and NN tool box is implemented in GUI. It is collected data from two diﬀerent source. The sound is extract from Matlab using FFT function. To measure an accurate and eﬀective data we have done a series of experiments with number of diﬀerent number of sample. For the maturity of knowledge base NN train repeatedly and modifying parameter when it’s needed. When 98% classification accuracy, so result show accuracy and confidently say train sample and 92% classification accuracy means non-train samples.

**4**

Requirement Analysis

*This chapter provides Requirement Analysis*

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| **4.1. Purpose Of Document** | | | **44** | |
|  |  | Purpose Of Document |  |  |
|  | **4.1** |  |  |

The main purpose of this document is to give a detailed description of the requirements for the “Intelligent Heart Attack System” (IHAPS) software it will illustrate the purpose and complete declaration for the development of system. It will also explain system constraints, interface and interactions with other external applications.

**4.1.0.1** Document Convention

* References are mentioned throughout the document in square bracket (e.g. [1] )
* ’Heading 1’ is used for top level heading of main sections.
* ’Heading 2’ is used for sub-section heading.
* URL are Meta linked from the document. Ctrl-Click them to open hyperlink.

**4.1.1** Intended Audience and Reading Suggestion

This document is intended for developers, project managers, marketing staﬀ, users, testers, and documentation writers. It is suggested to read according to sequence of the document, beginning with the overview sections and proceeding through the sections that are most pertinent to each reader type.

**4.1.2** Product Scope

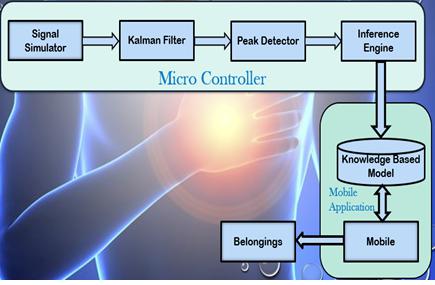
The “Intelligent Heart Attack Prevention System” is a Phonocardiogram based Heart Attack prevention system Auscultation helps people to find the problem with the once heart which can cause heart Attack based on the user’s current condition and other specification. The software must become familiar with the regular activities of the patient and according to those regular activities it will prevent the user from the heart attack. The patient and the surrounding people must become warned when there is any situation which may cause heart attack we will warn the most nearest people by some alarm on their Android mobile phone. Furthermore, the software needs

|  |  |
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| **4.2. Overall Description** | **45** |

both Internet and GSM connection to inform the patient’s family members about this condition.

**4.2** Overall Description

This section will give an overview of the whole system. The system will be explained in its context to show how the system interacts with other systems and introduce the basic functionality of it. It will also describe what type of stakeholders that will use



**Figure 4.1:** Overall Description

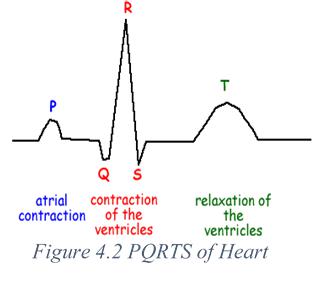
the system and what functionality is available for each type. At last, the constraints and assumptions for the system will be presented.

**4.2.1** Product Prospective

This system will consist of two parts: one mobile application (Android) and signal capturing and filtering device. The mobile application will be used to inform the people who can handle the patient immediately and on the bases of problem level call the patient’s doctor as far as this time we are considering it as a skype call and we are

|  |  |
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| **4.2. Overall Description** | **46** |

dependent on the wifi or internet on the mobile phones or tablets or computer/laptop of doctor and the patient while the Signal capturing device will be used for capturing and filtering the heart signal for the other noise i.e Rumbles, as we don’t have a patient yet so we will first make the signal generator device which will detect whether it is heart signal or not. The mobile application will need to communicate with the



**Figure 4.2:** Product Prospective

database of the mobile which can be sdcard or in application database, which in turn communicates with the people and doctor related to the patient, see Figure 4.2. The database will provide the mobile application with heart signal both problematic and the normal or the variation between signals, the functionality of the communicating with the doctor or the related family members is activated if and only if there is problematic signal. Since this is a data-centric product it will need some source from where we capture the signal and has to filter the signal for diﬀerent type of signals we will make a signal generator. For that, a microcontroller will be used. Both the mobile application and Microcontroller will communicate with the Bluetooth, however in slightly diﬀerent ways. The microcontroller will only store the signal to the database

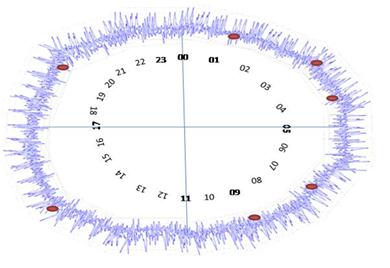
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| **4.2. Overall Description** | **47** |

taken by the generator while the mobile will use this data by comparing with the mean of the signal which will let the application know about the problem before cardiac arrest and we can use this data for showing the condition of the signal to the doctor.

**4.2.2** Product function

With the mobile application, the patient will be able to cure himself from the heart attack because by the mean of timely warning of the patient this system will be intended for patient diagnose and prescribe by the doctor. All this thing will be based on various healthy wave form of a patient that our system will request the patient to tag the 3 to 4 states it will go on the detection of the un-familiar waveform. There are several tagging criteria and it will be possible by taking the mean value of the all the signal that will be collected after the daily routines.

The signals can be viewed either by the value of PQRST in the mobile or can be viewed in the form of signal.



**Figure 4.3:** Product function

|  |  |
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| **4.2. Overall Description** | **48** |

**4.2.3** User Characteristics

There are three types of users that interact with the system: the patient whose heart signal will be captured and who will tag his daily routine, doctor will view the patient’s PQRTS for the future prescription or who will be called in case of emergency and at the patient’s specified person who will be called at any warning. There are some privileges about the data (signals)

* Only the doctor can change or view the signal
* Patients have to specify the people who will help him

**4.2.4** Constraints

The mobile application is constrained by the system and its type there will be no user interface because this application run in the background of the mobile phone. Since there are no active patients so we will generate the signal by our own.

Now the tagging of the signal is done using the mobile phone the mobile phone can generate the message to tag the event or their will be a pop-up dialog box which assist the patient to tag the event. We can say there will a user interface where the patient can change the wrong depicted event but when this event came in the mean the user cannot change it.

The user interface of the android has a scalability problem so we will just make for a regular screen resolution.

The Internet connection is also a constraint for the application. Since the application fetches data from the database and database from the microcontroller so the Bluetooth connection is required in both microcontroller and the android phone, it is crucial that there is an Internet connection for the application to function to call the patient belonging peoples.

Both the web microcontroller and the mobile application will be constrained by the capacity of the database. Since the database is shared between both application it may be forced to queue incoming requests and therefor increase the time it takes to fetch data.

**4.2.5** Assumption and Dependencies

One assumption about the system is that it will always be used on mobile phones that have enough performance. If the phone does not have enough hardware resources

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| **4.3. Specific Requirements** | **49** |

available for the application, for example the users might have allocated them with other applications, there may be scenarios where the application does not work as intended or even at all.

Another assumption is that the patient and its belonging components in all phones work in the same way. For the video call to the doctor we assume that Skype is installed in both patient and the doctor mobile and they are connected with the internet, and for messaging we assume that both have whatsapp installed. We have also an assumption that the mobile application is connected to the microcontroller through Bluetooth this can also be taken in a sense of dependency that we are dependent on the microcontroller for all the processing.

**4.2.6** Apportioning of requirements

In the case that the project is delayed, there are some requirements that could not be fulfil say calling the doctor on the Skype and it will all base on the time.

**4.3** Specific Requirements

This section contains all of the functional and quality requirements of the system. It gives a detailed description of the system and all its features.

**4.3.1** External Interface Requirements

This section provides a detailed description of all inputs into and outputs from the system. It also gives a description of the hardware, software and communication interfaces and provides basic prototypes of the user interface.

**4.3.1.1** User Interface

In initial stage user/patient of the mobile application should see the tagging page which will say the user to tag the event after wards when he/she opens the application to change the event it look like Figure 3.1, Afterwards the activity or the application run in the back ground of the patient as well as the other users.

|  |  |
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| **4.3. Specific Requirements** | **50** |

**4.3.1.2** Hardware Interface

Since signals are captured using a microcontroller or we can say it will be generated using the microcontroller which will be send to the mobile application and the mobile itself of android OS.

**4.3.1.3** Software Interface

The microcontroller communicates with the mobile application in order to send or to store signal. The communication between the database and the mobile consists of operation concerning both reading and modifying the data, while the communication between the database and the microcontroller consists of only writing operations.

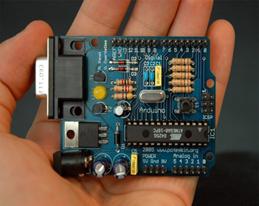


**Figure 4.4:** Product Prospective

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| **4.3. Specific Requirements** | **51** |

**4.3.1.4** Communication Interface

The communication between the diﬀerent parts of the system is important since they depend on each other. However, in what way the communication is achieved is not important for the system and is therefore handled by the underlying operating systems for both the mobile application and the microcontroller but we will focus on the Bluetooth for communication.



**Figure 4.5:** Product Prospective

**4.3.2** Functional Requirements

This section includes the requirements that specify all the fundamental actions of the software system.

**4.3.2.1** User class -The user

1. **Functional requirement 1.1** :ID: FR1

TITLE: Download mobile application

DESC: A user should be able to download the mobile application through either an application store or similar service on the mobile phone. The application should be free to download.

RAT: In order for a user to download the mobile application.

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| **4.3. Specific Requirements** | **52** |

DEP: None

1. **Functional requirement 1.2** :ID: FR2

TITLE: User tagging - Mobile application

DESC: Given that a patient has to tags the event regarding to the signals in mobile application, this will help in emergency or to evaluate the condition of the patient. The user must provide information, time and purpose of the event. RAT: In order for a patient to alert with the mobile application.

DEP: FR1

1. **Functional requirement 1.3** :ID: FR3

TITLE: Mobile application - Search

DESC: Given that a patient can search in the mobile application. The search options are Events, Related people, concern doctor, Prescribed Medicine. There should also be a free-text search option. A user should be able to select multiple search options in one search.

RAT: In order for a user to search.

DEP: FR1, FR2

1. **Functional Requirement 1.4** :

ID: FR4

TITLE: Signal from the generator – Signal from the generator will not always correct

DESC: As the main goal of the system is to filter the signal from each kind of signal the filter should examine only the heart signal so signal should be of every type and the filter microcontroller will judge and tell whether it is heart signal or not .

RAT: The way signal to be filtered.

DEP: None

1. **Functional Requirement 1.5** :ID: FR5

TITLE: Signal in database – Filtered signal should be move to the database

DESC: When the signal got captured it must be filtered say noise should be removed before sending it to the database.

RAT: The way signal is stored in database.

DEP: FR4

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| **4.4. Prioritization and the Release plan** | **53** |

1. **Functional Requirement 1.6** :ID: FR6

TITLE: Signal from database to mobile – whenever there is any updation in the database it should inform the mobile.

DESC: When the signal got store in the database it must be investigated for any abnormality so that we patient got prevented from cardiac arrest.

RAT: The way in which people are contacted or alerted.

DEP: FR1, FR3

**4.3.3** Non-Functional Requirement

This section will provide you the description about the non-functional requirements.

**4.3.3.1** Eﬃciency in Response time

The system must be highly eﬀective it must respond to the user within 10 sec to 1 min because the activity of cardiac arrest is taken after 5 to 10 mins.

**4.3.3.2** Robustness

The microcontroller must be highly robust so it can filter each type of heart signal having the eﬀect of PQRST.

**4.4** Prioritization and the Release plan

In order to get a view of how to divide the requirements into diﬀerent releases and what requirements should be included in which release, a prioritization of the requirements is needed. This section discusses the choice of prioritization methods and gives a suggestion of how the release plan for these requirements could look like.

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| **4.4. Prioritization and the Release plan** | | | **54** | |
|  |  | Choice of the prioritization method |  |  |
|  | **4.4.1** |  |  |

When prioritizing the requirements the ten most important ones were picked out first. This was done with a simple “1 to 10” ranking method, with one being “not important” and ten “very important”. Based on the elicitation meetings, and the perceived ideas of what was important to the diﬀerent stakeholders, a number was set for each requirement. The numbers were then summed up for each requirement and the ten with the highest score were chosen to be prioritized with the cost value approach.

Other methods for prioritization, such as the hundred-dollar test and the yes-no vote, were also considered. The hundred-dollar test is quite similar to the five-way priority scheme, since it also gives a wide range for ranking the requirements. However, it is more easily misused since someone could save all their money and put them on a requirement that they think is very important [3]. Others might not agree that this requirement is important but it might still get the most votes since one person cared about it.

**4.4.2** Release Plan

The requirements were divided into three releases based on the prioritization and their dependencies. The three diﬀerent releases were assembled so that each would work as a fully functional application. In the first release the requirements that build up the foundation of the application were included, together with the most highly prioritized requirements and their dependencies.

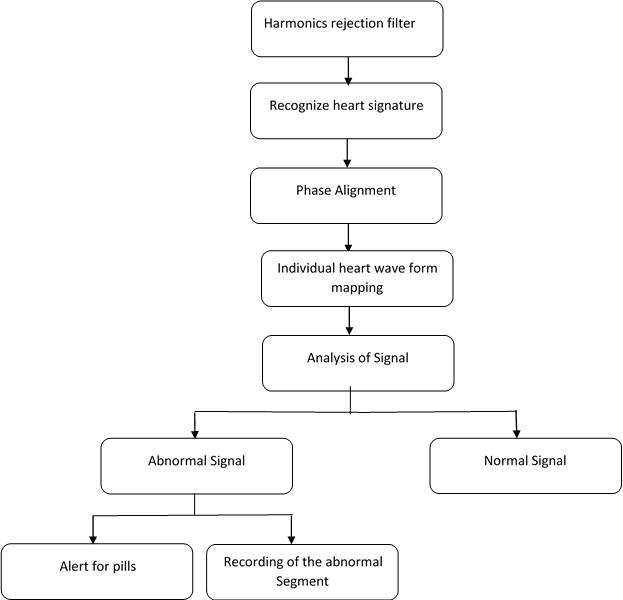
The second release also includes important requirements. However, these requirements are not vital for a functional application. They are more suited to act as additional features that can contribute to making the software product more attractive.

The third release includes the requirements that can be aﬀorded to discard if the project gets delayed or overruns the budget.

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| **4.5. Detail designs or flow diagrams** | | | **55** | |
|  |  | Detail designs or flow diagrams |  |  |
|  | **4.5** |  |  |

**4.5.1** Microcontroller

Microcontroller flow diagrams

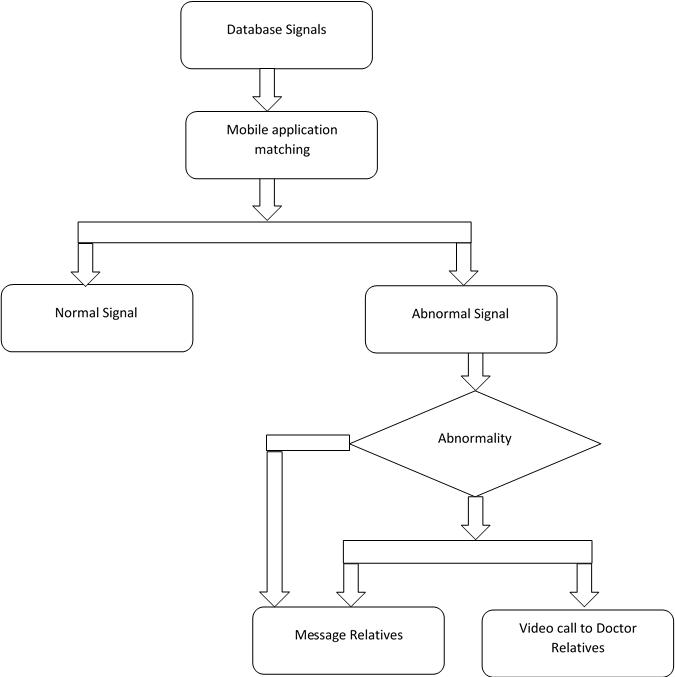


**Figure 4.6:** Microcontroller flow diagrams

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| **4.5. Detail designs or flow diagrams** | **56** |

**4.5.2** Mobile Application

Mobile Application flow diagrams



**Figure 4.7:** Mobile Application flow diagrams

**Part III**

Development

**5**

3. Design and Implementation

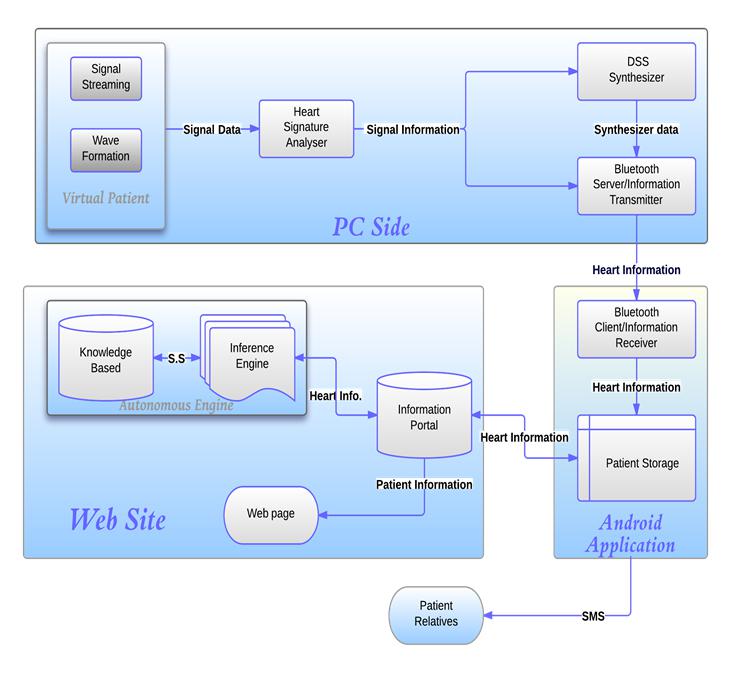
*In this chapter we will discuss the design and implementation in the design we will cover all the diagrams related to our project and in the implementation we will provide the snapshots of the project.*

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| **5.1.** | | **Block Diagram** | | **59** | |
|  |  |  | Block Diagram |  |  |
|  | **5.1** |  |  |  |

This is the basic flow and the block diagram of the project which is describing the modules as well as their interactions



**Figure 5.1:** Block Diagram

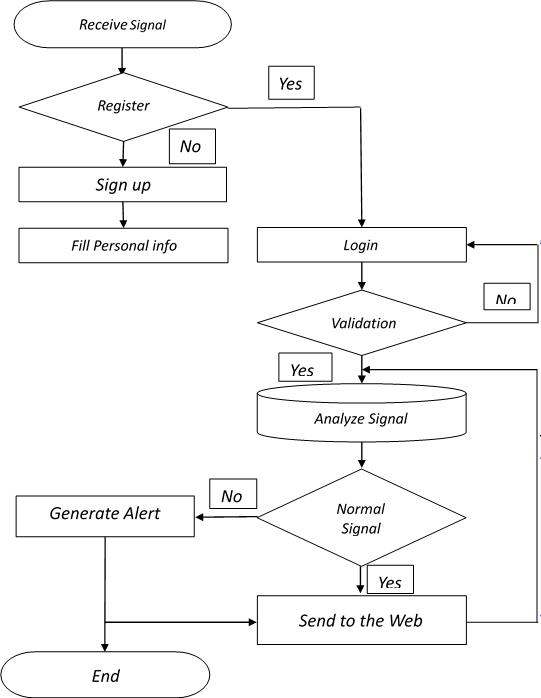
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| **5.2. Flow charts** | **60** |

**5.2** Flow charts

This section will show you the flowcharts of our project as we have 3 basic modules so we have flow chart for each of them.

* Android application flowchart
* Webserver flow chart
* Virtual Patient flow chart

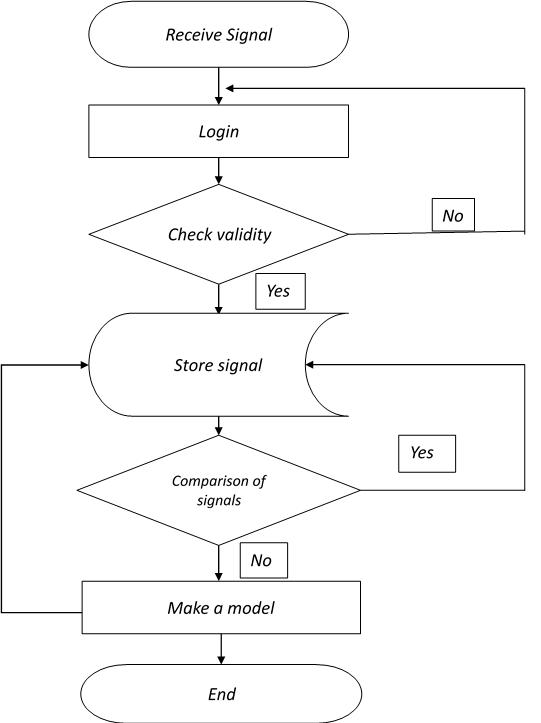
**5.2.1** Android application flowchart



**Figure 5.2:** Android application flowchart

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| **5.2. Flow charts** | **61** |

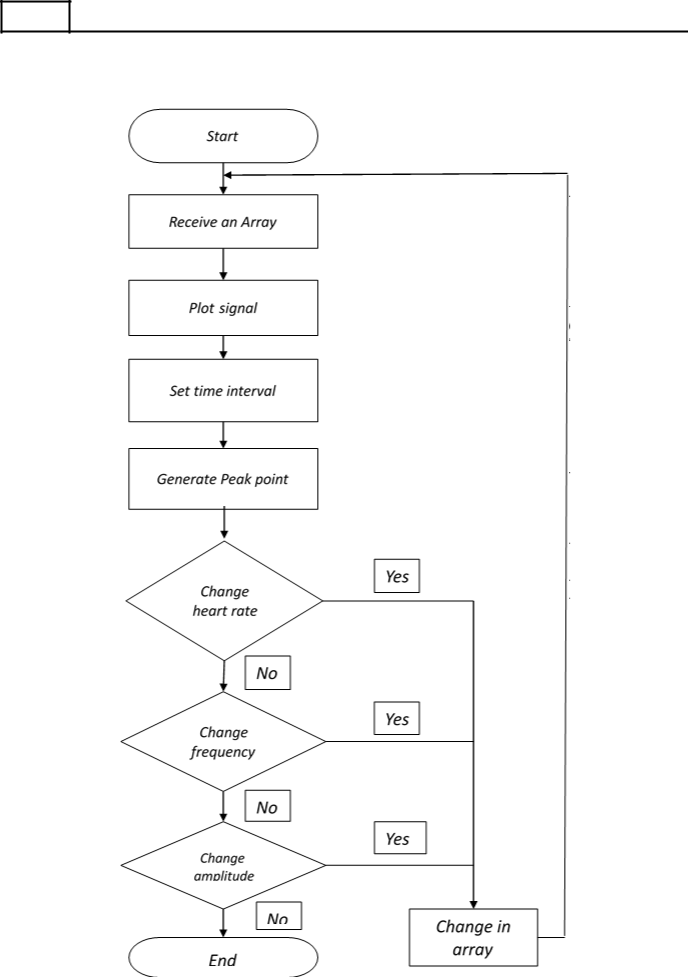
**5.2.2** Web server Flow chart



**Figure 5.3:** Web server Flow chart

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| **5.2. Flow charts** | **62** |

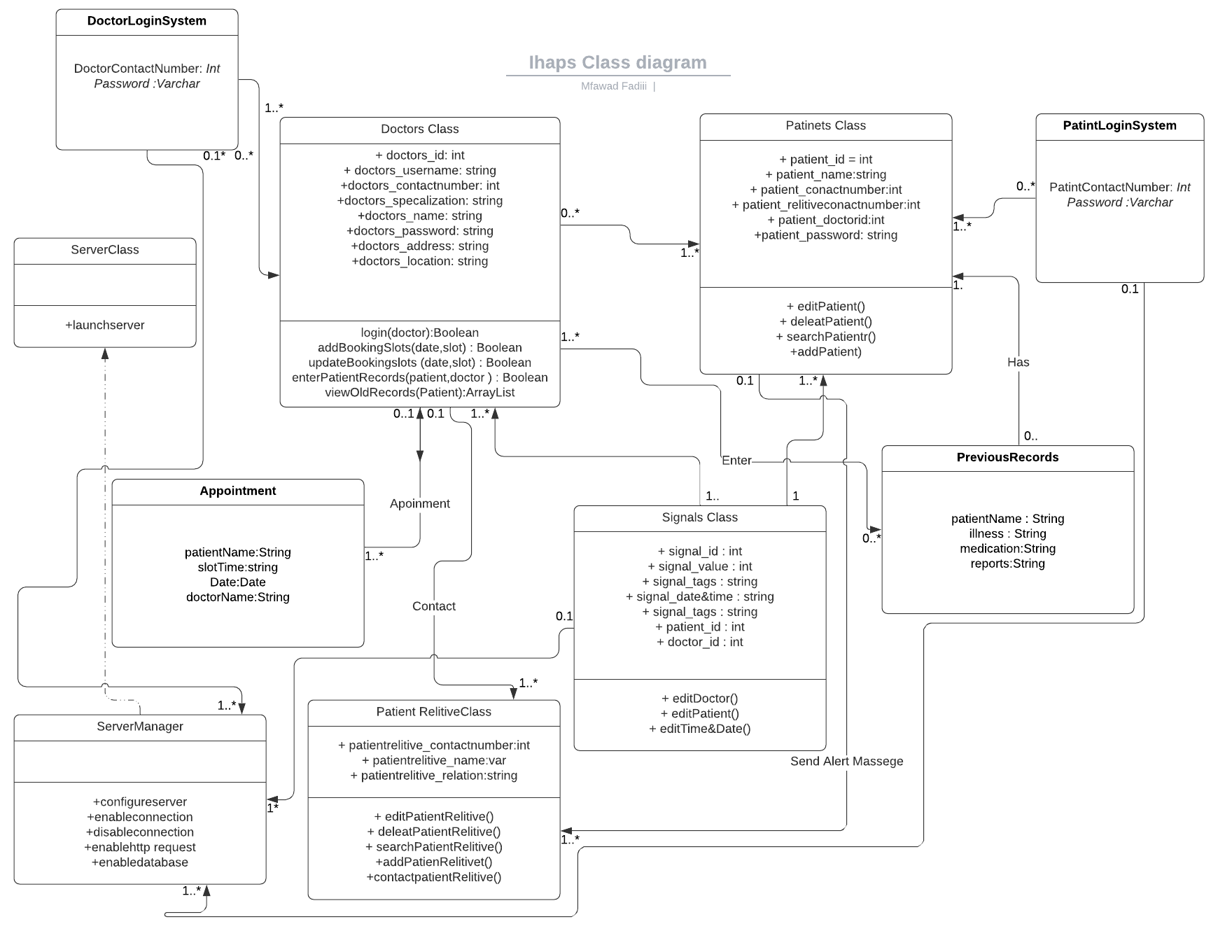
**5.2.3** Virtual Patient Flow chart



**Figure 5.4:** Virtual Patient Flow chart

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| **5.3.** | | **Data Flow diagrams** | | **63** | |
|  |  |  | Data Flow Diagram |  |  |
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Class Diagram



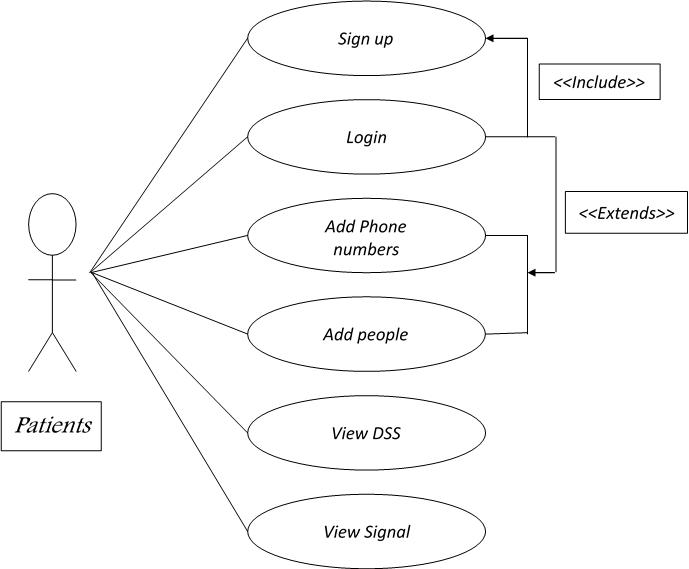
Class Diagram Of Ihaps

Use case diagrams

In this section we will define the pattern in which user is interacting with the system. As we have three main system so we are only assuming person as the actor of the use case.

* Android application use case
* Web server use case
* Virtual Patient use case

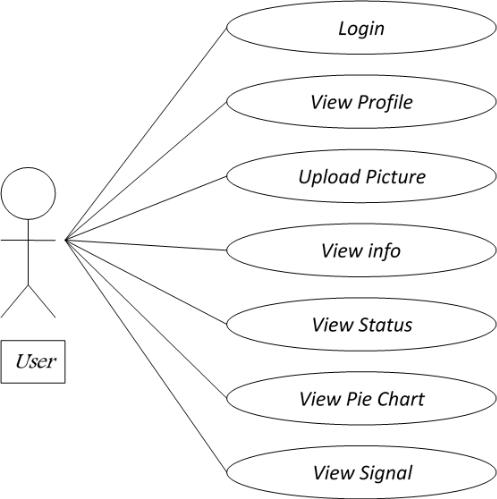
**5.3.1** Android application use case



**Figure 5.5:** Android application use case

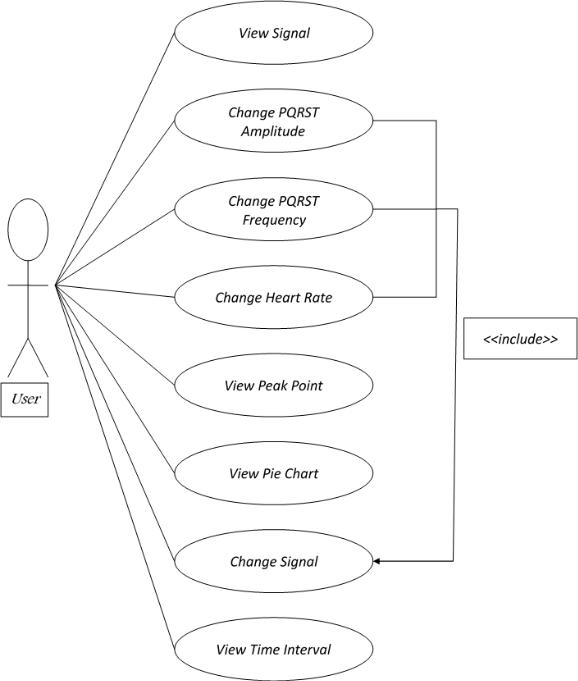
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| **5.3. Use case diagrams** | **64** |

**5.3.2** Web server use case



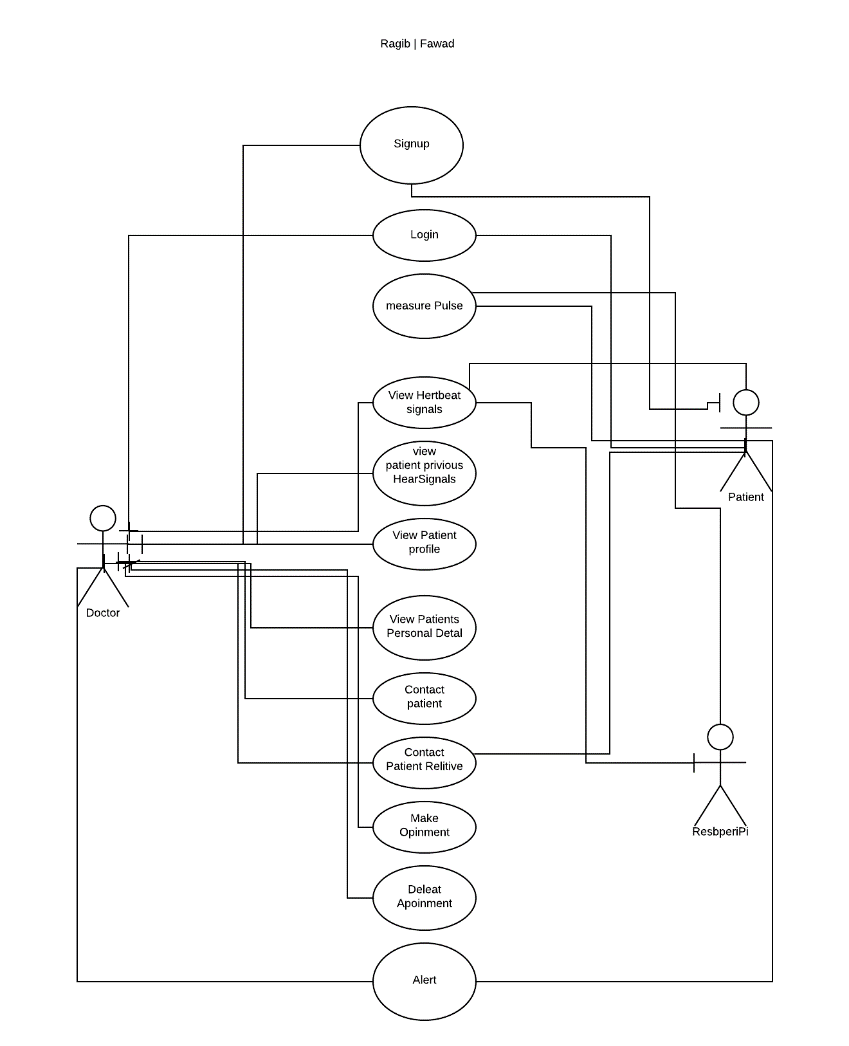
**Figure 5.6:** Web server use case

**5.3.3** Virtual Patient use case



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| **5.3. Use case diagrams** | **64** |

**5.3.2** Use case

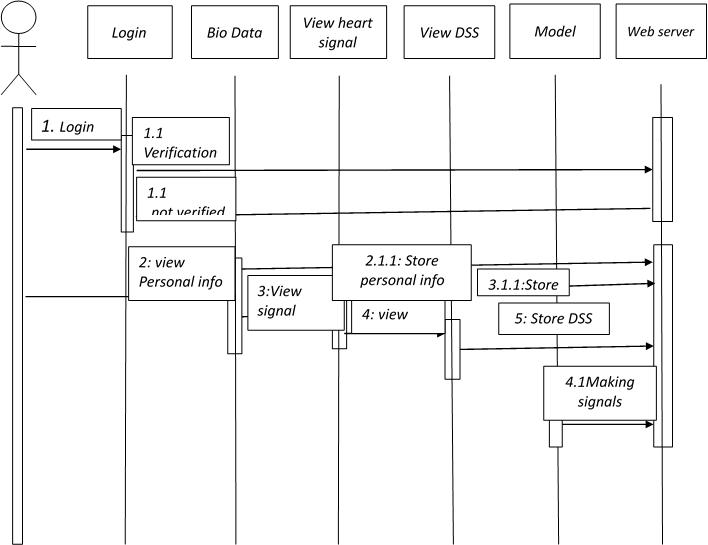
 **Figure 5.7 all**

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| --- | --- | --- | --- | --- | --- |
| **5.4.** | | **Interface / Interaction diagrams** | | **65** | |
|  |  |  | Interface / Interaction diagrams |  |  |
|  | **5.4** |  |  |  |

In this section we will discuss the interaction of the user with the system as we have 3 modules in the system so we have three main diagram and are as follows.

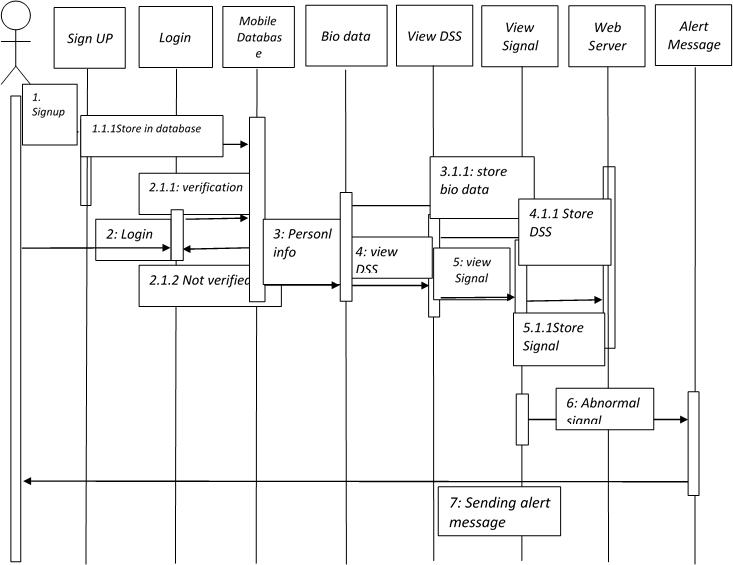
* Website Interaction
* Android Application Interaction
* Virtual patient Interaction

**5.4.1** Website Interaction



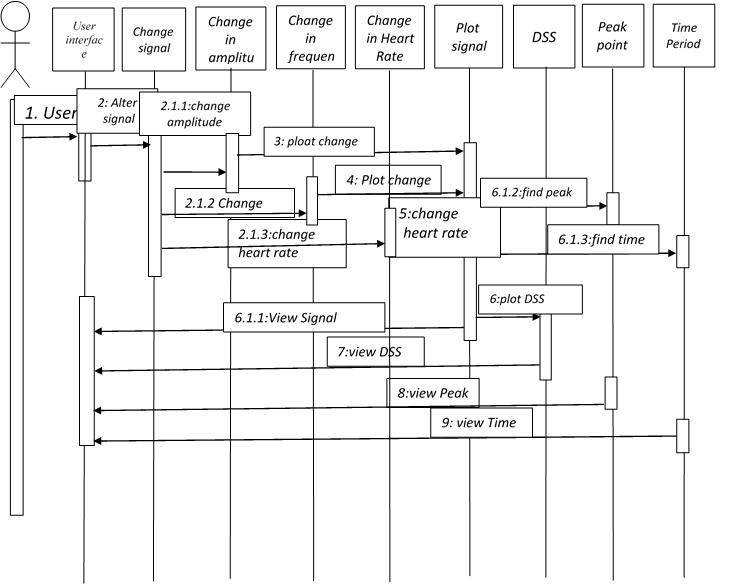
**Figure 5.8:** Website Interaction

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| **5.4. Interface / Interaction diagrams** | | | **66** | |
|  |  | Android Application Interaction |  |  |
|  | **5.4.2** |  |  |

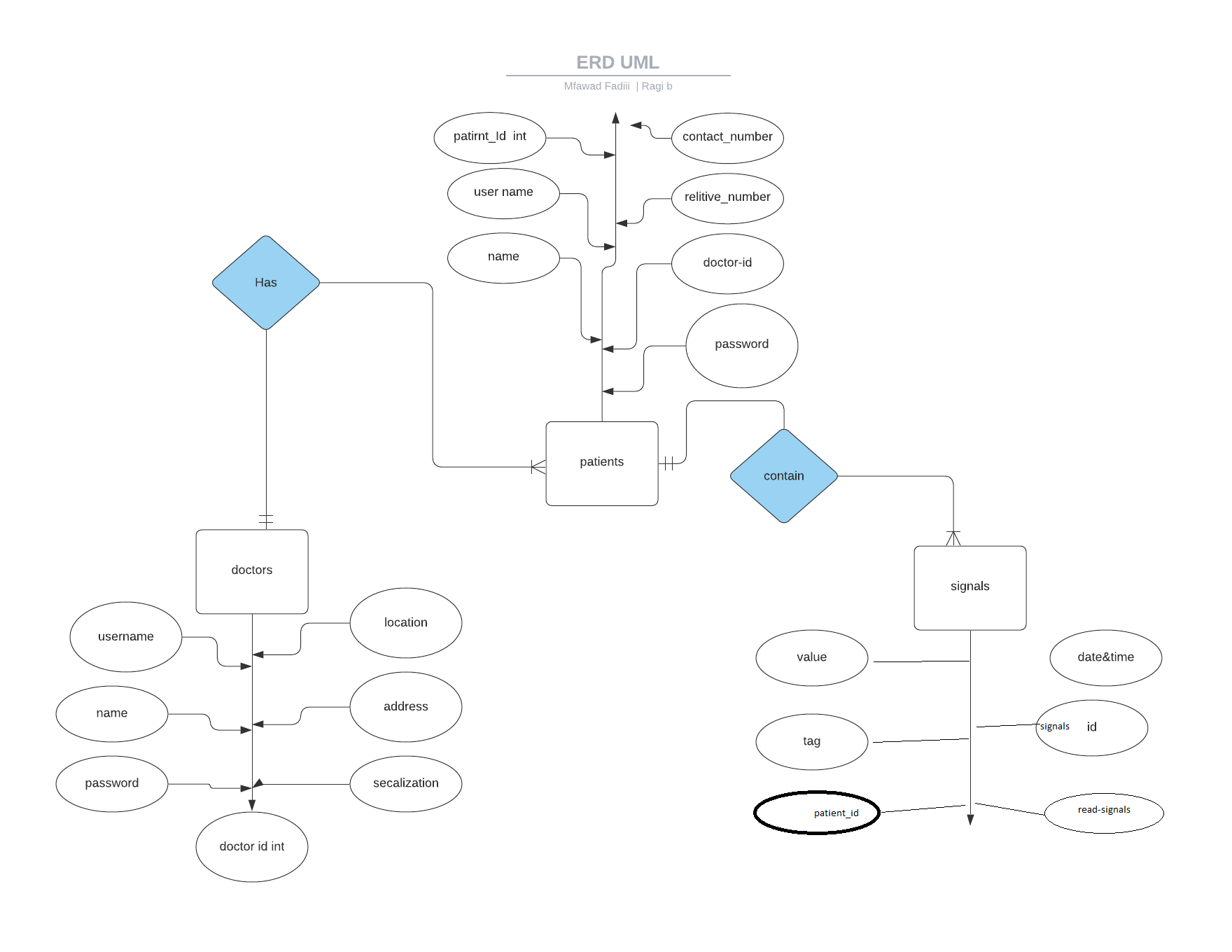


**Figure 5.9:** Android Application Interaction

**5.4.3** Virtual patient Interaction

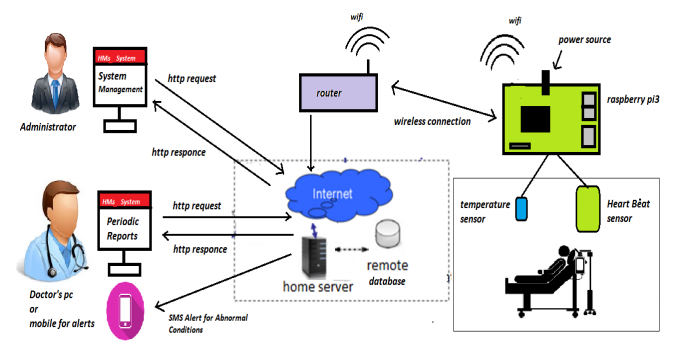


ERD Diagram



**Figure 6.0 Entity Relation Ship Diagram**

**Architecture Diagram**

****

**Figure 6.1 architecture diagram**

**6**

Codeing

*In this chapter we will present the testing technique we used to test or project*

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| **6.1.** | | **virtual patient** | | **68** | |
|  |  |  | virtual patient |  |  |
|  | **6.1** |  |  |  |

**6.1.1** Variables used

int[] a;

int x1 = 0;

int y1 = 200;

int io = 64;

int c = 0;

int pos;

private int xPos = 0, YPos = 0, xPos1 = 0; // freq

int pq = 0;

int pqprev;

int rfreq = 0;

int rfreqprev;

int sfreq = 0;

int sfreqprev;

int tfreq = 0;

int tfreqprev;

int qfreq = 0;

int qfreqprev;

int prevHeartRate;

//pie

int whcircle = 130;

int center = 0;

int radius;

int start = 80;

int rang = 260;

int sang = 330;

int tang = 60;

int pang = 140;

int qang = 220;

int r = 20;

int sx = 35;

int sy = 0;

int tx = 20;

int ty = 0;

int px = 20;

int py = 0;

int qx = 40;

int qy = 0;

int rx = 10;

int ry = 0;

// frequncy

int frepq = 10;

int freqr=5;

int frers=5;

int frest=10;

int fretp=12;

//interval

double[] tsintervalue = { 0.15, 0.25, 0.40 };

double[] pintervalue = { 0.18, 0.36, 0.45 };

double[] qrsintervalue = { 0.10, 0.23, 0.45 };

//p amplitude

int prevP = 0;

int prevQ = 0;

int prevR = 0;

int prevS = 0;

int prevT = 0;

//p attributes

int pioo = 1;

//q attributes

int qioo = 1;

//r attributes

int rioo = 1;

//s attributes

int sioo = 1;

//p attributes

int tioo = 1;

**6.1.2** DSS code

private double DegreeToRadian

(double angle)

{

return Math.PI \* angle / 180.0;

}

private double findX(int angle)

{

return (radius \* (Math.Cos

(DegreeToRadian(angle))));

}

private double findY(int angle)

{

return (radius \* (Math.Sin

(DegreeToRadian(angle))));

}

private double findslope

(double x, double y)

{

return y / x;}

private double findEqu(double

slope, int x)

{

return slope \* x;

}

public void owalchart()

{

pictureBox2.Refresh();

g = pictureBox2.CreateGraphics(); pen1.Color = Color.Blue; g.DrawEllipse(pen1, start, start,

whcircle, whcircle);

|  |  |
| --- | --- |
| **6.1. virtual patient** | **69** |

pen1.Color = Color.Yellow; g.DrawLine(pen1, center + (int) findX(sang), center + (int)findY(sang),

center, center);

g.DrawLine(pen1, center + (int)

findX(qang), center + (int)findY(qang),

center, center);

pen1.Color = Color.Black;

g.DrawLine(pen1, center + (int)findX (rang) - rx, center + (int)findY(rang)

* + ry, center, center); g.DrawLine(pen1, center + (int)findX (sang), center + (int)findY(sang), center + (sx), center + sy); g.DrawLine(pen1, center + (int)findX (tang) + tx, center + (int)findY(tang)

+ ty, center, center); g.DrawLine(pen1, center + (int)findX (pang) - px, center + (int)findY(pang)

* + py, center, center); g.DrawLine(pen1, center + (int)findX (qang), center + (int)findY(qang),

center - qx, center - qy); pen1.Color = Color.Yellow; g.DrawLine(pen1, center + (int)findX (rang), center + (int)findY(rang),

center, center); g.DrawLine(pen1, center + (int)findX (tang), center + (int)findY(tang),

center, center); g.DrawLine(pen1, center + (int)findX (pang), center + (int)findY(pang),

center, center); pen1.Color = Color.Red; g.DrawLine(pen1, center + (int)findX (rang) - rx, center + (int)findY(rang)

* + ry, center + (sx), center + sy);

g.DrawLine(pen1, center + (sx), center

* sy, center + (int)findX(tang) + tx, center + (int)findY(tang) + ty); g.DrawLine(pen1, center + (int)findX (tang) + tx, center + (int)findY(tang)

+ ty, center + (int)findX(pang) - px, center + (int)findY(pang) - py);

g.DrawLine(pen1, center + (int)findX (pang) - px, center + (int)findY(pang)

* + py, center - qx, center - qy);

g.DrawLine(pen1, center + (int)findX (rang) - rx, center + (int)findY(rang)

* + ry, center - qx, center - qy);}

**6.1.3** signal generation code

void plotSignal(Graphics temp){ int ww = 6;

for (int i = 0; i < a.Length; i++){ if (a[i] >= 0 && a[i] < 129){ if (a[i] == 64){

if (a[i] == io){

y1 = 200;

temp.DrawLine(pen1, x1, y1, x1

* ww, y1); io = a[i];

x1 = x1 + ww;} if (a[i] < io){ c = io - a[i]; io = a[i]; temp.DrawLine(pen1, x1, y1, x1

* ww, y1 + (ww \* c));

x1 = x1 + ww;

y1 = y1 + (ww \* c);}

if (a[i] > io){

c = a[i] - io;

io = a[i];

temp.DrawLine(pen1, x1, y1, x1

* ww, y1 - (ww \* c));

x1 = x1 + ww;

y1 = y1 + (ww \* c);}} if (a[i] > 64){

if (a[i] == io){ io = a[i]; temp.DrawLine(pen1, x1, y1, x1

* (ww - pq), y1);

x1 = x1 + (ww - pq);}

if (io < 64){

c = a[i] - io;

io = a[i];

temp.DrawLine(pen1, x1, y1, x1

* ww, y1 - (ww \* c));

x1 = x1 + ww;

y1 = y1 - (ww \* c);} if (io < a[i]){

c = a[i] - io; io = a[i];

if (i >= 28 && i <= 38){ temp.DrawLine(pen1, x1, y1, x1

* (ww - tfreq), y1 - (ww \* c));

x1 = x1 + (ww - tfreq);} else{ temp.DrawLine(pen1, x1, y1,

x1 + (ww), y1 - (ww \* c));

x1 = x1 + (ww);}

y1 = y1 - (ww \* c);} if (io > a[i])

{

c = io - a[i]; io = a[i];

if (i >= 16 && i <= 20){ temp.DrawLine(pen1, x1, y1,

x1 + (ww - rfreq), y1 + (ww \* c)); x1 = x1 + (ww - rfreq);}

else

if (i >= 28 && i <= 38){ temp.DrawLine(pen1, x1, y1,

x1 + (ww - tfreq), y1 + (ww \* c)); x1 = x1 + (ww - tfreq);}

else{

temp.DrawLine(pen1, x1, y1, x1 + (ww), y1 + (ww \* c));

x1 = x1 + (ww);}

y1 = y1 + (ww \* c);}} if (a[i] < 64){

if (a[i] == io){

|  |  |
| --- | --- |
| **6.1. virtual patient** | **70** |

io = a[i];

temp.DrawLine(pen1, x1, y1,

x1 + (ww - pq), y1);

x1 = x1 + (ww - pq);

}

if (io > 64){

c = io - a[i];

io = a[i];

temp.DrawLine(pen1, x1, y1,

x1 + ww, y1 + (ww \* c));

x1 = x1 + ww;

y1 = y1 + ww \* c;}

if (io < a[i]){

c = a[i] - io;

io = a[i];

temp.DrawLine(pen1, x1, y1,

x1 + (ww - sfreq), y1 - (ww \* c));

x1 = x1 + (ww - sfreq);

y1 = y1 - ww \* c;}

if (io > a[i]){

c = io - a[i];

io = a[i];

temp.DrawLine(pen1, x1, y1,

x1 + ww, y1 + (ww \* c));

x1 = x1 + ww;

y1 = y1 + (ww \* c);}}}}}

**6.1.4** Peak point detection

public void peakpoint(){

int higP = 0;

int highQ = 0;

int higR = 0;

int higS = 64;

int higT = 0;

int perr = 0;

int jjj = 0;

int hiq = 0;

for (int i = 0; i < a.Length; i++){

perr = a[i];

if (a[i] > 0 && a[i] < 128){

if (a[i] > 64){

if (a[i] == a[i + 1] && jjj

== 0){

higP = a[i];

jjj = 1;}

if (a[i] == a[i + 1]){

higT = a[i];}

if (higR < a[i]){

higR = a[i];}}

if (a[i] < 64){

if (higS > a[i]){

higS = a[i];}

if (a[i + 1] > 64 && hiq ==

0){

highQ = a[i];}}}}

textBox1.Text = higP.ToString(); textBox2.Text = highQ.ToString();

textBox3.Text = higR.ToString(); textBox4.Text = higS.ToString(); textBox5.Text = higT.ToString(); string aw = higP.ToString() + ","

+ highQ.ToString() + "," + higR.ToString() + "," + higS.ToString() + "," +higT. ToString() +","+ frepq+"," + freqr+","

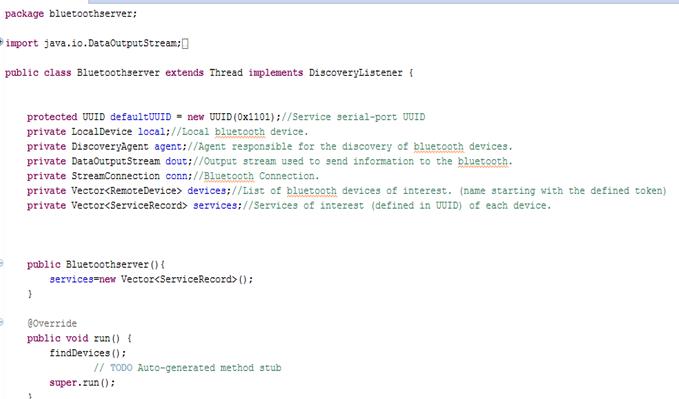
* frers +","+ frest+"," + fretp; System.IO.File.WriteAllText (@"E:\Test.txt", aw);}

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **6.2.** | | **Android application** | | **71** | |
|  |  |  | Android application |  |  |
|  | **6.2** |  |  |  |

The Implementation in the form of the code is as follow

**6.2.1** Bluetooth server coding

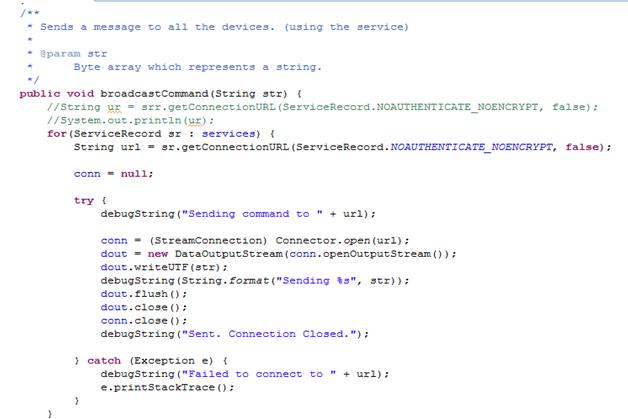
**6.2.1.1** Bluetooth Server class



**Figure 6.1:** Bluetooth Server class

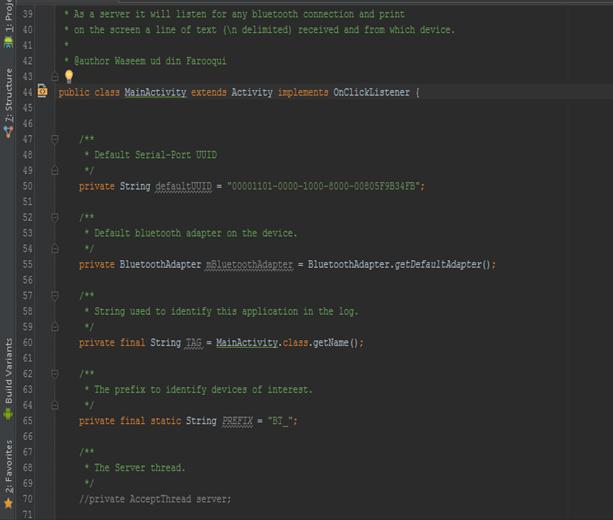
|  |  |
| --- | --- |
| **6.2. Android application** | **72** |

**6.2.1.2** Broad cast the message



**Figure 6.2:** Broad cast the message

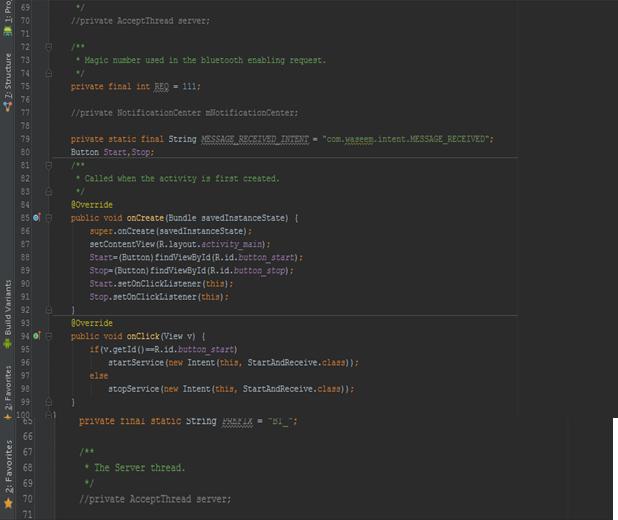
**6.2.1.3** Bluetooth Client Activity



**Figure 6.3:** Bluetooth Client Activity

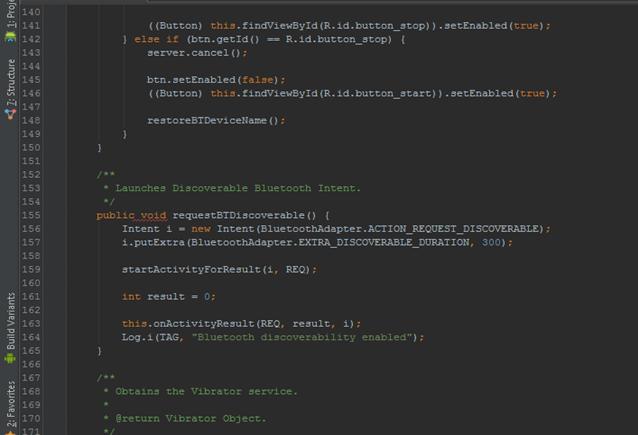
|  |  |
| --- | --- |
| **6.2. Android application** | **73** |

* **Oncreate function**



**Figure 6.4:** Oncreate function

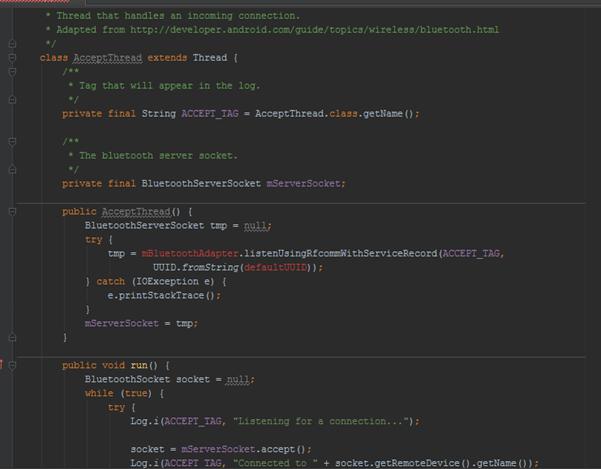
* **Making Bluetooth discoverable**



**Figure 6.5:** Making Bluetooth discoverable

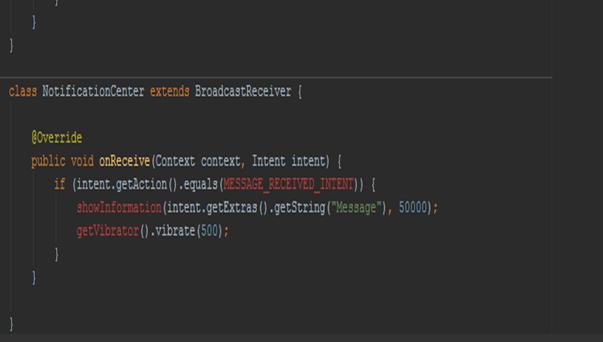
|  |  |
| --- | --- |
| **6.2. Android application** | **74** |

* **Thread for the socket connection**



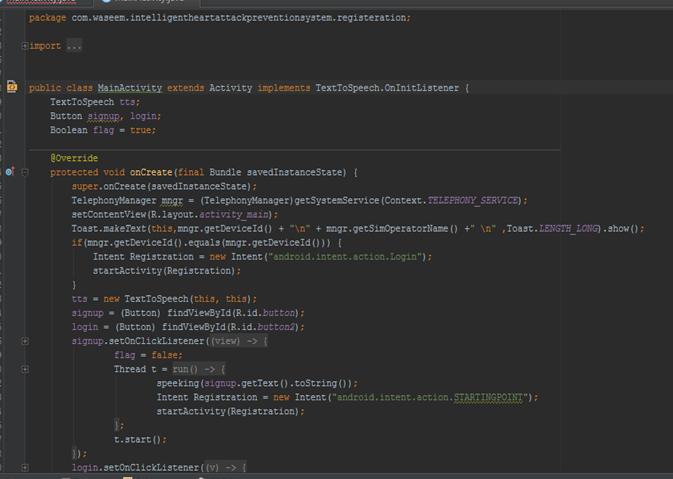
**Figure 6.6:** Thread for the socket connection

* **Broad cast receiver**



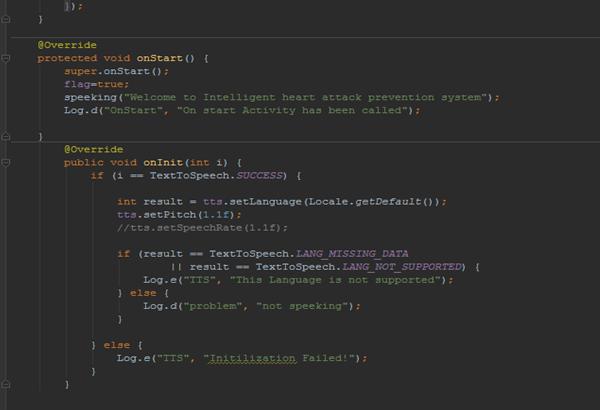
**Figure 6.7:** Broad cast receiver

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **6.2. Android application** | | | **75** | |
|  |  | Main activity for the login window on the android |  |  |
|  | **6.2.2** |  |  |



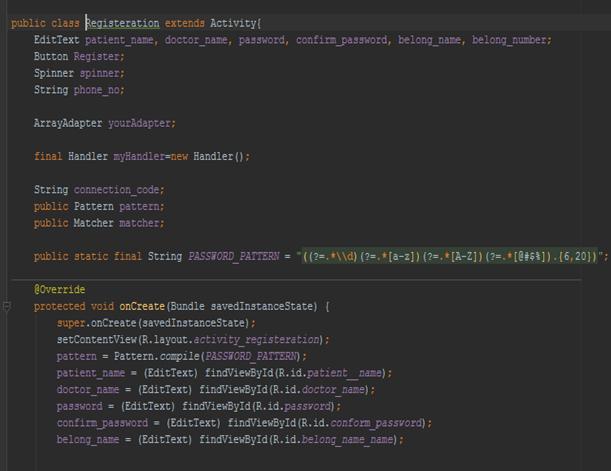
**Figure 6.8:** Main activity for the login window on the android

**6.2.2.1** Working Functions



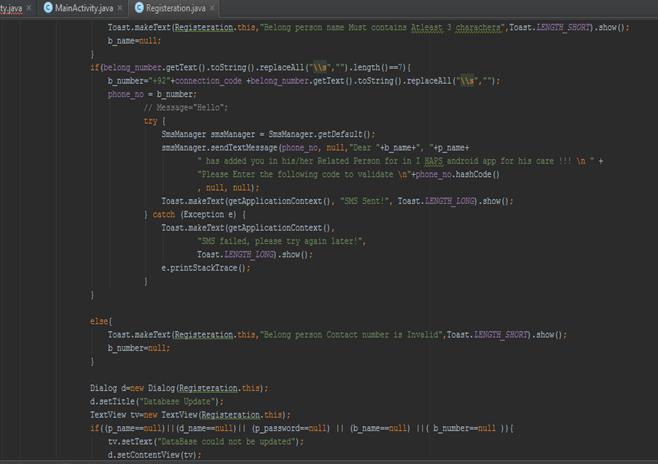
**Figure 6.9:** Main activity for the login window on the android

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **6.2. Android application** | | | **76** | |
|  |  | The client registration function |  |  |
|  | **6.2.3** |  |  |



**Figure 6.10:** The client registration function

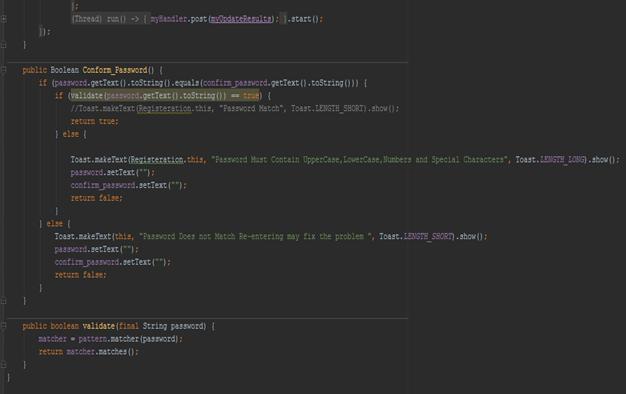
**6.2.3.1** Sending SMS and moving the data to the database



**Figure 6.11:** Sending SMS and moving the data to the database

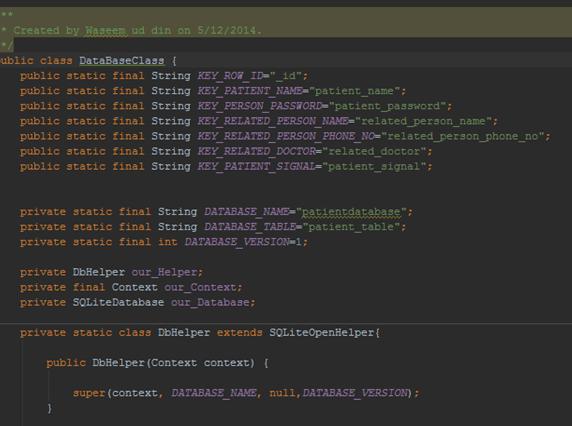
|  |  |
| --- | --- |
| **6.2. Android application** | **77** |

**6.2.3.2** Password validation function



**Figure 6.12:** Password validation function

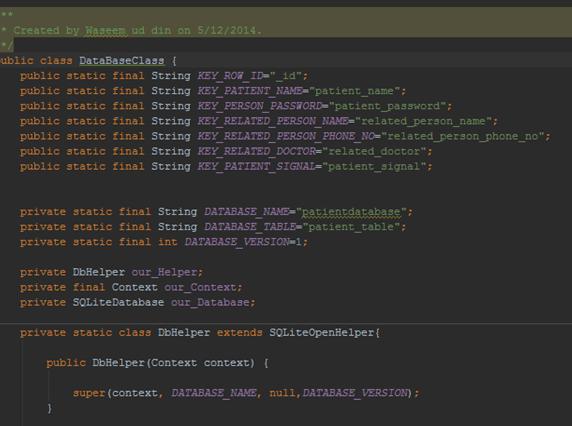
**6.2.4** Data base class



**Figure 6.13:** Data base class

|  |  |
| --- | --- |
| **6.2. Android application** | **78** |

**6.2.4.1** Data base entry and movement



**Figure 6.14:** Data base entry and movement

|  |  |
| --- | --- |
| **6.3. Website code** | **79** |

**6.3** Website code

Website is developed in codeigniter . Which is a powerful PHP framework using Model–view–controller (MVC)software architectural pattern.

**6.3.1** Controllers

**6.3.1.1** Main Controller

<?php if ( ! defined(’BASEPATH’))

exit(’No direct script access allowed’);

class Welcome extends CI\_Controller{

public function index(){

$this->load->helper(’url’);

$this->load->helper(’form’);

$this->load->view(’welcome\_message’);}}

**6.3.1.2** Login Controller

<?php

class Login extends CI\_Controller {

function \_\_construct(){

parent::\_\_construct();

$this->load->helper(’url’);

$this->load->library(’session’);

$this->load->model(’user\_model’);}

function index(){

$this->load->library(’form\_validation’);

$this->form\_validation->set\_rules

(’username’, ’username’, ’required’);

$this->form\_validation->set\_rules

(’pass’, ’Password ’, ’required’);

if ($this->form\_validation->run() == true ){

$username=$this->input->post(’username’);

$password=$this->input->post(’pass’);

$result=$this->user\_model->login

($username,$password);

if($result){

$sess\_array = array();

foreach($result as $row){

$sess\_array = array(

’id’ => $row->id,

’status’ => $row->status,

’flag’ => $row->flag,

’name’ => $row->name,

’logged\_in’ => TRUE,); }

$this->user\_model->create\_session

($sess\_array);

redirect(’Login/loadpage’);}

else{

echo ’invalid input’;}}

else {

echo ’error’;}}

function loadpage(){

if($this->session->userdata(’logged\_in’))

{

$session\_data = $this->session->userdata (’logged\_in’);

$data[’flag’] = $this->session->userdata(’flag’);

$data[’username’] =$this->session->userdata(’name’); $data[’img’] =$this->session->userdata(’img’).’.jpg’; if($data[’flag’]=="user")

{redirect(’profile’,’refresh’); }}

else{redirect(’welcome’, ’refresh’);}}

function logout(){

$this->user\_model->destory\_session();

redirect(’welcome’, ’refresh’);}}

**6.3.1.3** Profile

<?php if ( ! defined(’BASEPATH’))

exit(’No direct script access allowed’);

class profile extends CI\_Controller {

public function index() {

$this->load->library(’session’);

$this->load->helper(’url’);

if($this->session->userdata(’logged\_in’)){

$this->load->model(’user\_model’);

$this->load->helper(’form’);

$query = $this->user\_model->more(

$this->session->userdata(’id’));

$query1 = $this->user\_model->basic(

$this->session->userdata(’id’));

$data[’did’]=$query1[’id’];

$data[’flg’]=$query1[’flag’];

$data[’rel’] = $query[’relative\_num’];

$data[’docN’] = $query[’doc\_num’];

$data[’pass’] = $query1[’password’];

|  |  |
| --- | --- |
| **6.3. Website code** | **80** |

$data[’docE’] = $query[’doc\_email’];

$data[’mbl’] =$query1[’mbl\_num’];

$data[’username’] =$query1[’name’];

$data[’img’] =$query1[’img’];

if($query1[’status’]==’yes’){

$data[’status’]=’checked’; }

else {

$data[’status’]=’’; }

$this->load->view(’user\_profile’,$data);}

else

{

redirect(’welcome’, ’refresh’);

}}

public function userUpdate(){

$this->load->model(’user\_model’);

$this->user\_model->basic\_update();

$this->user\_model->more\_update();

redirect(’profile’, ’refresh’);}}

|  |  |
| --- | --- |
| **6.3. Website code** | **81** |

**6.3.2** Models

**6.3.2.1** User Model

<?php if ( ! defined(’BASEPATH’)) exit(’No direct script access allowed’); class user\_model extends CI\_Model { public function \_\_construct(){ parent::\_\_construct();}

public function login($username, $password)

{$this->load->database();

$this -> db -> select(’id, mbl\_num , password, status , flag ,name ,img’); $this -> db -> from(’user’);

$this -> db -> where(’mbl\_num’, $username); $this -> db -> where(’password’, $password); $this -> db -> limit(1);

$query = $this -> db -> get(); if($query -> num\_rows() == 1) { return $query->result(); } else{

return false;}}

public function more($id){

$this->load->database();

$query = $this->db->get\_where(’patient’, array(’id’=>$id));

return $query->row\_array();}

public function basic($id){

$this->load->database();

$query = $this->db->get\_where(’user’ ,array(’id’=>$id));

return $query->row\_array();}

public function create\_session($sec\_data){ $this->session->set\_userdata($sec\_data);} public function destory\_session(){ $this->session->sess\_destroy();} public function loggedin (){

return (bool)

$this->session->userdata(’loggedin’);}

function basic\_update(){

$this->load->database();

if($this->input->post(’stat’)==’on’){

$sta=’yes’;}

else {

$sta=’on’;}

$config[’upload\_path’] = ’./assets/images/’; $config[’allowed\_types’] = ’gif|jpg|png’; $this->load->library(’upload’, $config); $query = $this->user\_model->basic( $this->input->post(’id’));

if (!$this->upload->do\_upload()){ echo $this->upload->display\_errors(); $data1[’img’]=$query[’img’];} else{

$data1 = $this->upload->data(); $data1[’img’]=’assets/images/’ .$data1[’orig\_name’];}

$data = array(

’id’ => $this->input->post(’id’),

’mbl\_num’ => $this->input->post(’mbl’), ’password’ => $this->input->post(’pass’), ’status’ => $sta,

’flag’ => $this->input->post(’flag’),

’name’ => $this->input->post(’name’),

’img’ => $data1[’img’],);

$this->db->where(’id’,

$this->input->post(’id’));

$this->db->update(’user’,$data); }

function more\_update(){

$this->load->database();

$data = array(

’relative\_num’ => $this->input->post(’rel’),

’doc\_num’ => $this->input->post(’docnum’),

’doc\_email’ => $this->input->post(’docemail’),);

$this->db->where(’id’,$this->input->post(’id’)); $this->db->update(’patient’,$data); }} ?>

**6.3.2.2** Main Model

<?php

class main\_model extends CI\_Model{

function main\_model(){

parent::\_\_construct();

$this->load->helper(’url’);}

function general(){

$this->load->library(’MyMenu’);

$menu = new MyMenu;

$data[’base’]= $this->config->item(’base\_url’); $data[’css’]= $this->config->item(’css’); return $data;}}?>

**7**

Testing of the System

*In this chapter we will present the testing technique we used to test or project*

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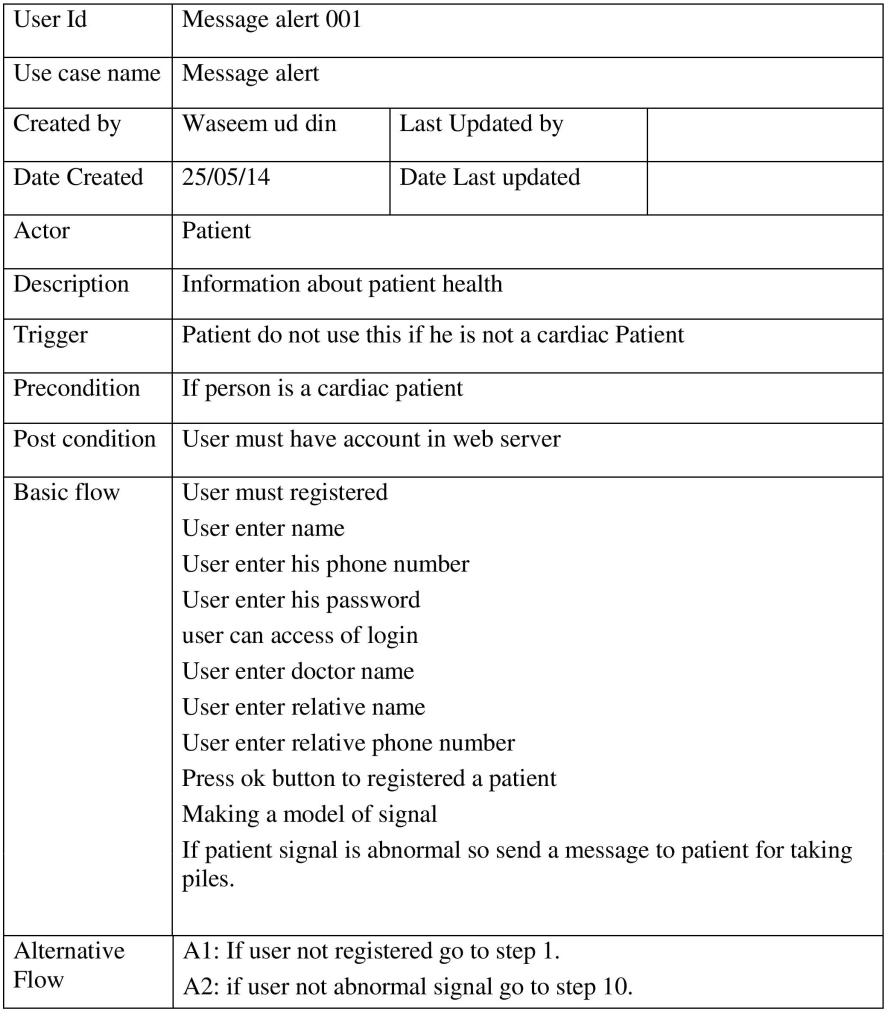
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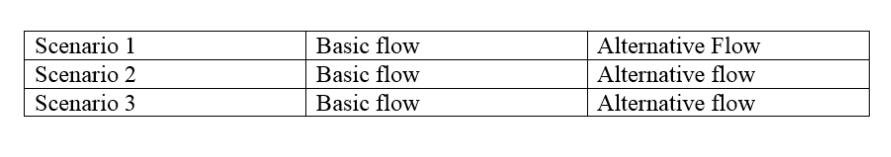
|  |  |
| --- | --- |
| **7.1. Android Device test case** | **83** |

**7.1** Android Device test case



**Figure 7.1:** Android Device test case

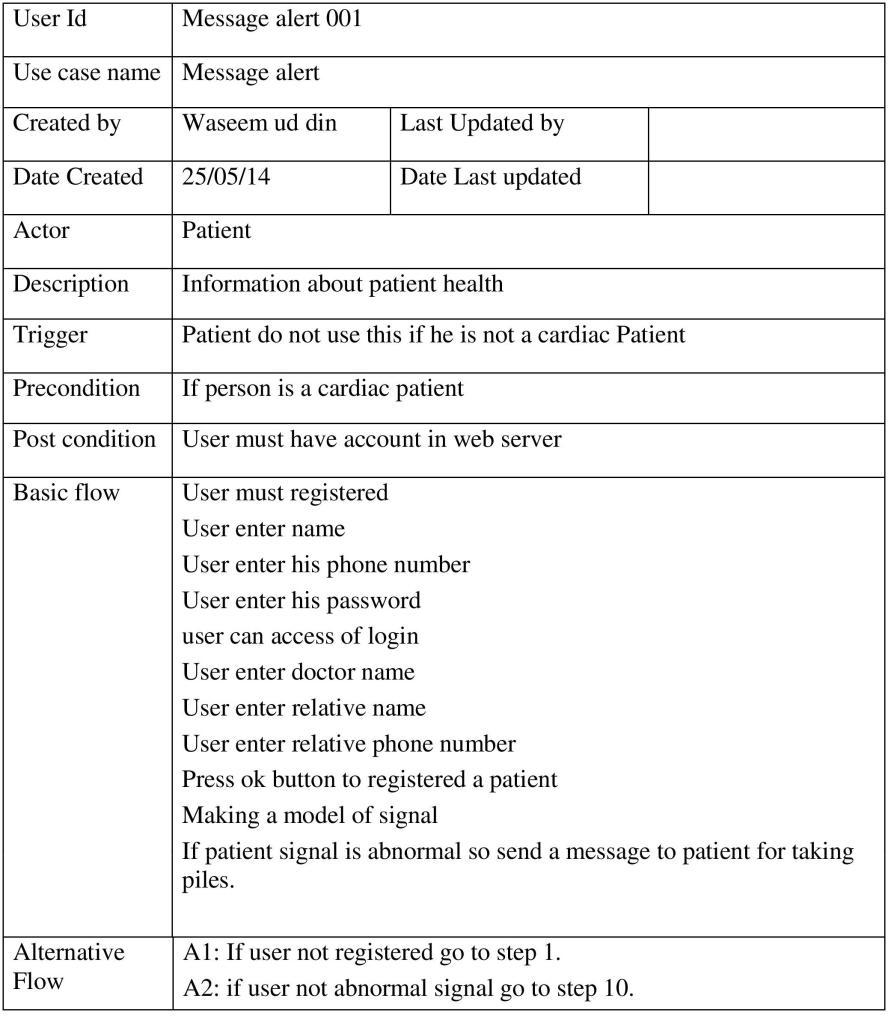
**7.1.0.3** Use case scenario



**Figure 7.2:** Use case scenario

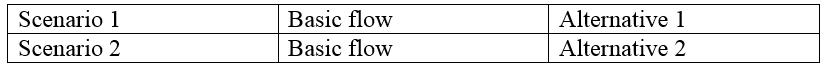
|  |  |
| --- | --- |
| **7.2. Website test case** | **84** |

**7.2** Website test case



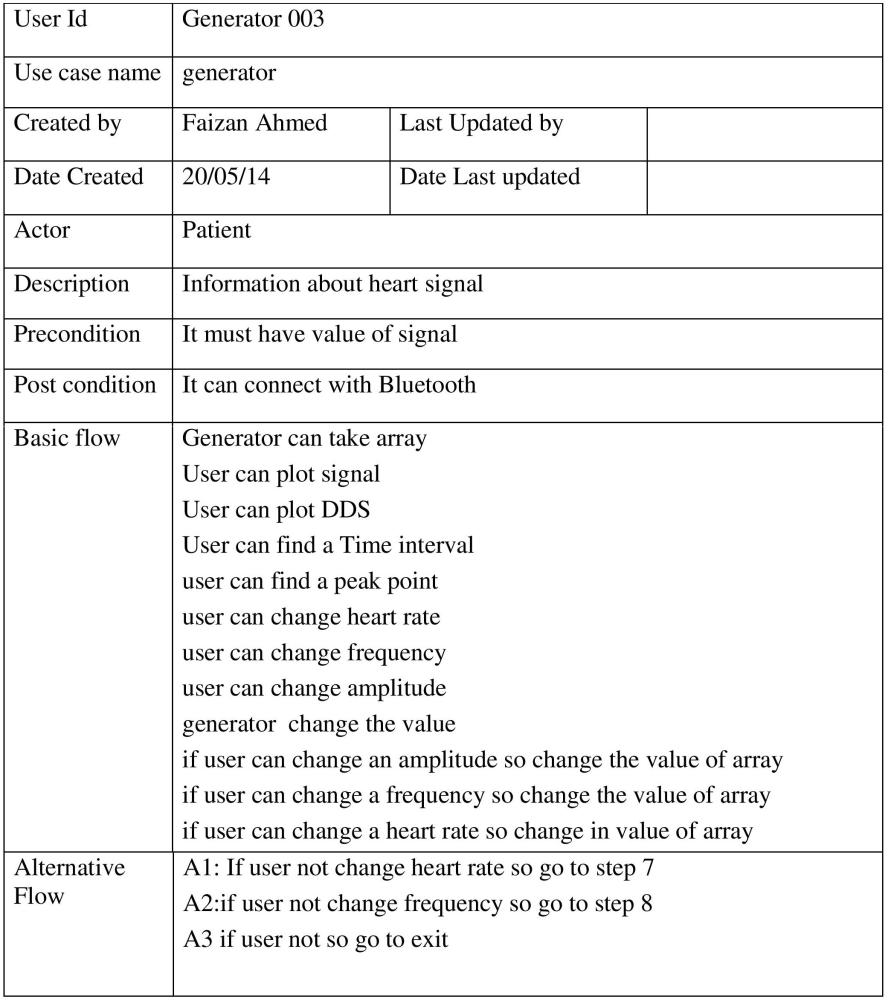
**Figure 7.3:** Android Device test case

**7.2.0.4** Use case scenario



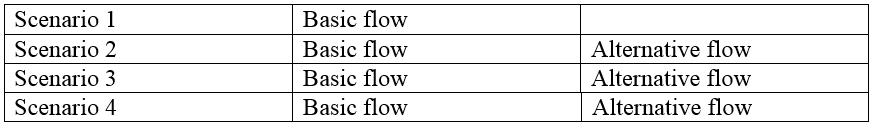
**Figure 7.4:** Use case scenario

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **7.3. Windows Application test cases** | | | **85** | |
|  |  | Windows Application test cases |  |  |
|  | **7.3** |  |  |



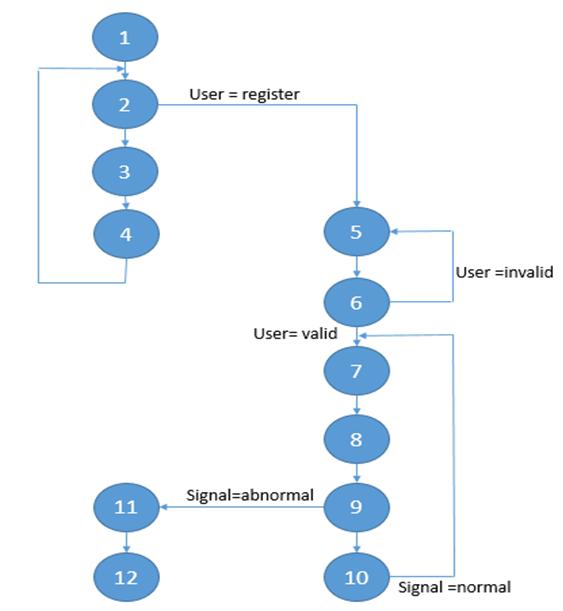
**Figure 7.5:** Windows Application test cases

**7.3.0.5** Use case scenario



**Figure 7.6:** Use case scenario

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **7.4. Test path for the Mobile application** | | | **86** | |
|  |  | Test path for the Mobile application |  |  |
|  | **7.4** |  |  |



**Figure 7.7:** Use case scenario

**7.4.0.6** Independent path

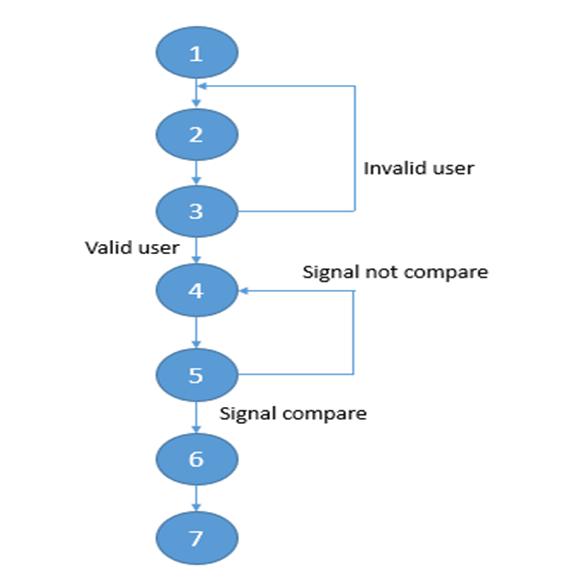
1,2,3,4,2,5,6,7,8,9,10,11,12

1, 2, 5, 6......

1, 2, 5, 6, 7, 8, 9, 11, 12

1, 2, 5, 6, 7, 8, 9, 10....

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **7.5. Test path for Web application** | | | **87** | |
|  |  | Test path for Web application |  |  |
|  | **7.5** |  |  |



**Figure 7.8:** Use case scenario

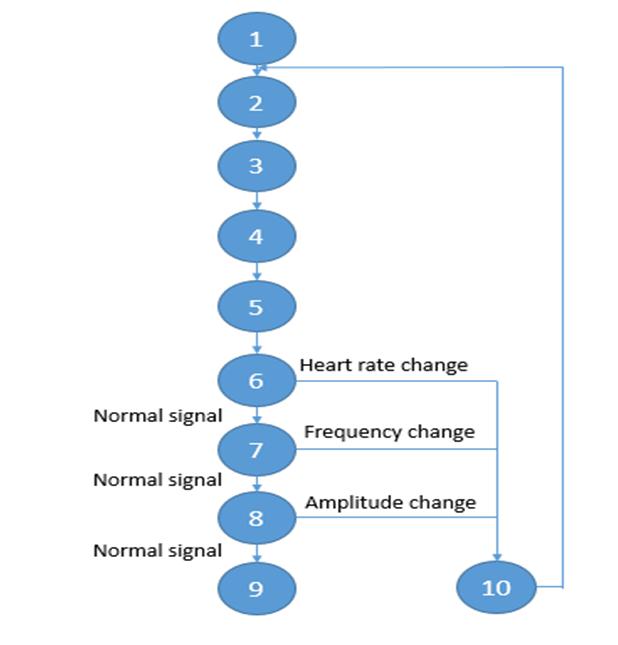
**7.5.0.7** Independent path

1,2,3,4,5,6,7

1, 2, 3...

1, 2, 3, 4, 5...

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **7.6. Test path for the Virtual Patient** | | | **88** | |
|  |  | Test path for the Virtual Patient |  |  |
|  | **7.6** |  |  |



**Figure 7.9:** Use case scenario

**7.6.0.8** Independent path

1,2,3,4,5,6,7,8,9

1, 2, 3, 4, 5, 6, 10...

1, 2, 3, 4, 5, 6, 7, 10...

1, 2, 3, 4, 5, 6, 7, 8, 10...

**Conclusion**

* The main goal is to design a those system which are easy to use very affordable powerful and embedded personal ECG monitor for detection and prevention of cardiac events and a mobile is working as a doctor.
* Cardiovascular disease is the leading cause of death in the developing World.
* More than a million heart attacks occur every year, and 1/3 of those are fatal because most patients deny or don't recognize heart attack symptoms and don't get to the hospital in enough time.
* Signals are captured using a microcontroller or we can say it will be generated using the microcontroller which will be send to the mobile application and the mobile itself of android OS.
* So for that purpose we are using a Raspberry Pi for getting custom data of heart beat we had search a lot and in the end comes to know t is possible to measure pulse / heart rates.
* With a small module – the Raspberry Pi pulse sensor – we can easily measure our own pulse and thus monitor permanently your health condition.
* The ability of this system is to record and store ECG from pseudo orthogonal subset.
* The second main objective to make a PEM device is Intelligent, decision –making robust data processing and decision-making methods having auto-adaptive and auto learning capabilities and this signal for doctor.
* The last objective is to develop a tool for wireless communication between PEM device and health professional system and enhance the system accordingly to patent activity.
* Hence we can make peoples aware about the heart signals and problems
* The world Really needs such devices that helps the patients as well as the doctors in diagnosing the heart state efficiently.
* Being a Software Engineer we want to work for our society and this society really need us.

**7**

Appendix

*In this chapter we will present the Appendix*

**Project Proposal Request**

1. **PROJECT TITLE**

**Intelligent Heart Attack Prevention System**

**“I HAPS”**

## Project Advisor

Sir Abrar Ahmad

**Group Members**

## I, M Fawad Farooqui introduce myself as a final year student of the undergraduate program in Computer Science at University of South Asia.

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As students in the final year of undergraduate study in Computer Science at University of South Asia, I look to graduate study to enhance my knowledge and skills and make contribution to my areas of interest.

## Motivation for Graduation:

Having studied at an institute where emphasis is laid on research, we developed a strong liking towards research and development. My research interests include in development/design. Hence, we wish to continue our work done at this institute and make some valuable contribution to these developing fields of research. We believe it will also serve to give direction to our goal of a career as research professionals at an academic or commercial, research-oriented organization.

**Project Abstract**

Cardiovascular diseases are the major causes of death in the world and every year lot of peoples die because the patient does not understand the problem and long enough to receive any medical help. Electrocardiogram (ECG) and Phono-cardiogram (PCG) is the useful early decision making supporting tool used by the world. IHAPS is using PCG signals for the early detection and prevention of cardiac arrest. The system first intelligently record the signals of the patient and ask the patient to tag a certain event signal whenever a new signal arrive the system will ask for tagging most of the signals belong to the same tagging list because of same routine but all of them have different signal value after 14 days of learning the system generates the model of the patient’s heart signal by calculating the mean value of the signal’s PQRTS afterward each new signal is compared with these modeled signals on the bases of which problem is detected. The system consist of three modules the virtual patient which generates the heart signal the **Android Application** which will generates the alerts after comparing with models and it not only generate alerts for the patient but also for the doctors and patient’s relatives and the third module is the **web-server** which will keep the record of all the patients and provide support to the doctors to view the patient heart state when they receive the alert and multiple doctors throughout the world can discuss the patient heart condition these modules are interlinked with each other via a **Simulator** (blue tooth) and the internet. By this system the patient can understand his/her heart problem and works accordingly the new thing we have introduced in the system and that will shift the paradigm is DSS (Decision support system) that will aids the doctors for the early and effective analysis of the heart Signal.

## Objectives

* The main goal is to design a those system which are easy to use very affordable powerful and embedded personal ECG monitor for detection and prevention of cardiac events and a mobile is working as a doctor.
* The ability of this system is to record and store ECG from pseudo orthogonal subset.
* The second main objective to make a PEM device is Intelligent, decision –making robust data processing and decision-making methods having auto-adaptive and auto learning capabilities and this signal for doctor.
* The last objective is to develop a tool for wireless communication between PEM device and health professional system and enhance the system accordingly to patent activity.

## Brief abbreviated version

“Intelligent Heart Attack System” (IHAPS) software is the web and android Application based software that is used to check the PCG signals of the hurt it measure the hurt signals and provide good and best treatment as soon as possible. Cardiovascular disease is the leading cause of death in the developing World. More than a million heart attacks occur every year, and 1/3 of those are fatal because most patients deny or don't recognize heart attack symptoms and don't get to the hospital in enough time.

**Project Back Ground**

People currently have suffering from the heart attack and 1/3 of those are fatal because most patients deny or don't recognize heart attack symptoms and don't get to the hospital in enough time. The specialist is not available there or they have to do all checkups again and again if the previous doctor is not available who knows the condition of the patent as before. The wasted lot of time of time and money of the peoples.

Peoples uses there old medicine which are used for different purpose without acknowledgment of their side effects because they do not know the condition of their heart signals they used the extra or less dose of their medicine. There are no system available which can check there heart beat signals 24/7 and reported it to the doctors panel and patient can in touch with a specialist via application and get the alert on serious condition.

**The Problem**

Cardiovascular diseases are the major causes of deaths in the world more than 15 million people die every year in the world because of it and most of them are under 65 and with the passage of time these numbers of deaths are increasing. There is no device and application is available which can be deduct the human heart signal 24 hours and get it reported to the doctor and the patient and get a first aid on time or proper treatment. Patient waste lot of time and money in medical test. Patient sometimes makes mistakes on judging there medical dieses they took the old medical treatment which has been took by any other person of the same dieses this may cause the big problem in their body. Other big problem is the treatment they want on that time is not available and patient lose his/her life due to delay in treatment. There are some online systems that give the service of providing medical test but there calculation are not nearly equal to the accurate one and they cannot show the actual condition of the heart signal to the doctors and even cannot generate the alert to the user whenever there heart beat gets a problem this increase the risk time consumption and the delay in treatment too.

**Why We Choose IHAP’S?**

Cardiovascular diseases are the major causes of death in the world more than 15 million people die every year in the world because of it and most of them are under 65 and with the passage of time these numbers of deaths are increasing.

Keeping in mind these problems we have decided to develop a system that will develop a system that will help the patient against heart attack.

**Project Description**

## Project Objectives:

The main objective of this project is to minimize the loss of the life of the peoples which are just lose due to the delay in treatment and proper medical treatment suggested by the doctor this may also help the doctor and a patent to stay touch with each other at any time. Once heart which can cause heart Attack based on the user’s current condition and other specification so to provide batter and best treatment a new information technology infrastructure and medical service is required to take a decision for patient care

## Project Aims

Here are the basic requirements set out for the project:

* Design and develop ECG signal(Heart Waves) generator .
* Design and develop DSS (Decision Support System).
* Wirelessly sending ECG signal from PC to Android device and from Android device to IHAPS

website/web server via Bluetooth and Wi-Fi.

* Mobile phone alerts and signal state investigation.
* Prescription of doctor by viewing the patients heart variations on the website.
* Generation of message to related people in critical situation.

## Product Scope

The “Intelligent Heart Attack Prevention System” is a Phonocardiogram based Heart Attack prevention system **Auscultation** (1) helps people to find the problem with the once heart which can cause heart Attack based on the user’s current condition and other specification. The software must become familiar with the regular activities of the patient and according to those regular activities it will prevent the user from the heart attack. The patient and the surrounding people must become warned when there is any situation which may cause heart attack we will warn the most nearest people by some alarm on their Android mobile phone. Furthermore, the software needs both Internet and GSM connection to inform the patient’s family members about this condition.

1. Is the term for listening to the internal sounds of the body, usually using a stethoscope. Auscultation is performed for the purposes of examining the circulatory system and respiratory system (heart sounds and breath sounds), as well as the gastrointestinal system (bowel sounds).

**Deliverables**

* Enables the Doctor and the patent to interact with each other 24/7 and give a suggestion in case of emergency directly instead of wasting time for travelling to ward hospital/ Clinic
* Allow the doctor can change or view the signal Patients have to specify the people who will help him.

The system is basically based on one major module: **Software.**

## Deliverable 1: Software Module

The software module contain a web based application and a mobile application. The main software technologies for this project are following:

* PHP/.Net language for developing web application.
* SQL Server and some other like HTML, CSS etc.
* Also, some tools will be used like Sublime text, XAMPP, IntelliJ IDEA etc.

## Primary Actors:

**Doctor**

* Can view the condition
* Can Recommend the treatment
* Can check the history
* Can Manage Registered Patent
* Can Sign in
* Can Add the Patent
* Can send alerts
* Can handle requests of people who want some suggestion in different situation

**Patent**

* Can Register itself
* Can See the alert
* Can Sign In
* Can Tag its daily bases routine
* Can Request for suggestion

**Web based System**

* Can Get values from user
* Can See the condition of heart Signal
* Can suggest the treatment

# Other Deliverables:

## Project/Product Feasibility Report

* Technical Feasibility
* Operational Feasibility
* Economic Feasibility
* Schedule Feasibility
* Specification Feasibility
* Information Feasibility
* Motivational Feasibility
* Legal & Ethical Feasibility

## Requirement Specification

Describing all requirements of IHAP’S

## Vision Document

Vision document will describes a compelling future state for the Product/Project

## Risk List

Document containing possible risks, impacts and responses. It will also contain Risk Assessment Matrix.

## Costing

Project product costing by Functional Point Analysis

## Use Case Diagrams

It will elaborate understanding about the system

## System Sequence Diagrams

It will define system flow

## Software Quality Assurance Plan

Test cases document that will be used for testing after completion of development

## User Manual

To guide and support end user

## Lesson Learnt

In this deliverable we will define what we have learnt from this Project.

**Project Vision:**

The “Intelligent Heart Attack Prevention System” aims to prevents the patent from the heart attack again. Our efforts are focused on improving the cardiovascular health of individuals and communities through the computer science studies. The bold vision fuels efforts to investigate new protocol and treatment designed to save the lives.

**Product Features:**

* To allow user to directly show there heart beat signals rather than moving first for check up then move toward doctors at different places.
* To allow user to connect with panel of doctors online rather than the wasting time of moving toward hospital for first aid.
* To minimize the wasting of time in test and waiting for reports.
* To give accurate measure of every second of the user heart beat.
* Showing him alert when got in trouble of heart beat.
* To give both doctor and patient professional environment.
* To allow user a batter and good life without any risk.
* Show the notification of medicine timing walk timing every day.
* Stay connected with the panel of doctors 24Hours.

**Process Model And Why?**

We will used the **Incremental Model** for this project. Because Incremental development is based on the idea of developing an initial implementation, exposing this to user feedback, and evolving it through several versions until an acceptable system has been developed.

The activities of a process are not separated but interleaved with feedback involved across those activities.

We have studying the specific knowledge of Heart Attack, its symptoms and different devices for detection and diagnosis of heart attack. Various method has been investigated for heart disease but widely used and investigate two of them which are.

• ECG Electrocardiography

• PCG Phonocardiography

Only heart attack not include in heart diseases. In which include all disease that’s affect the any disorder in heart ability to do function normally. Some various form of heart disease is coronary artery, congenital, arrhythmias and so on. But narrowing of coronary arteries is the most common form of heart disease.

So that’s why by taking feedback again and again we chose the incremental model. To make it batter to perfect.

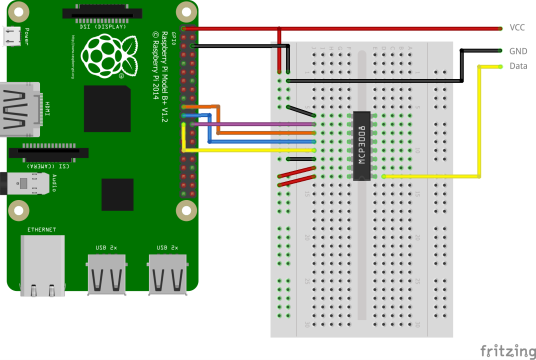
**Hardware Used In the IHATP’S:-**Since signals are captured using a microcontroller or wecan say it will be generated using the microcontrollerwhich will be send to the mobile application and themobile itself of android OS. The microcontroller communicates with the mobile application in order to send or to store signal. The communication between the database and the mobile consists of operation concerning both reading and modifying the data, while the communication between the database and the microcontroller consists of only writing operations.

So for that purpose we are using a **Raspberry Pi** for getting custom data of heart beat we had search a lot and in the end comes to know t is possible to measure pulse / heart rates. With a small module – the Raspberry Pi pulse sensor – you can easily measure your own pulse and thus monitor permanently your health condition. This sensor can also be used in mobile Raspberry Pi applications.

**How Will it works:-**

Since this sensor has also been designed for the Arduino, it does not provide a digitally readable signal. In order to be able to read the analogue signal, an ADC such as the MCP3008 is required. It doesn’t matter which channel of the ADC you are using, as long as you adjust it later in the code.

The positive pole of the pulse sensor is connected to 3.3V from the Raspberry Pi, as well as Minus to Ground. I have connected the signal / data pin (marked with an “S”) to channel 0 of the MCP3008

****

**Uniqueness**

We had checked different devices for detection and diagnosis of heart attack. But none of them provide the diagnoses properly. In our application the patient will be able to cure himself from the heart attack

because by the mean of timely warning of the patient this system will be intended for patient diagnose and prescribe by the doctor. All this thing will be based on various healthy wave form of a patient that our system will request the patient to tag the 3 to 4 states it will go on the detection of the un-familiar waveform. There are several tagging criteria and it will be possible by taking the mean value of the all the signal that will be collected after the daily routines.

**Assumption and Dependencies**

One assumption about the system is that it will always be used on mobile phones that have enough performance. If the phone does not have enough hardware resources available for the application, for example the users might have allocated them with other applications, there may be scenarios where the application does not work as intended or even at all.

Another assumption is that the patient and its belonging components in all phones work in the same way. For the video call to the doctor we assume that Skype is installed in both patient and the doctor mobile and they are connected with the internet, and for messaging we assume that both have whatsapp installed.

We have also an assumption that the mobile application is connected to the microcontroller through Bluetooth this can also be taken in a sense of dependency that we are dependent on the microcontroller for all the processing.

**Organization**

After meeting with Doctors, several patents and various application showed that there is no such platform available which provides such a application which provide alert and connected to a doctors when heart beat of a patent get interrupted.

Even when the technology today is more than good enough in medical field to make the measurement or check the condition of hearts beat in a seconds but there is no any of these can check the heart signals 24/7 and connected it to the doctors we will provide these facilities to the patent and to the doctors through the use of Artificial Intelligence.

Project methodology:

Incremental model

**Target End users:**

Doctor, patents

**Type of project:**

Development (Object Oriented)

**Scope of the System**

IHAP’S (Intelligence heart Attack Prevention System) is divided into three phases.

**Phase I: Requirement Gathering and Analysis**

Phase I includes following points:

* System Need
* Requirements gathering and prioritization
* Cost Estimation

**Phase II: Design and Planning**

Phase II involves following points:

* Modules Identification
* Use cases
* Domain Model

**Phase III: Development and Testing**

Phase III covers following points:

* Software Assembling
* Database Designing
* Applications Development
* Web Development
* Simulator(Bluetooth) Development
* Integration
* Testing

**Basic Spec Overview**

**Specific Requirement**

This section provides a detailed description of all inputs into and outputs from the system. It

also gives a description of the hardware, software and communication interfaces and provides

basic prototypes of the user interface.

**User Interface**

In initial stage user/patient of the mobile application should see the tagging page which will say the user to tag the event after wards when he/she opens the application to change the event. Afterwards the activity or the application run in the back ground of the patient as well as the other users.

**Hardware Interface**

Since signals are captured using a microcontroller or we can say it will be generated using the microcontroller which will be send to the mobile application and the mobile itself of android OS.

**Software Interface**

The microcontroller communicates with the mobile application in order to send or to store signal.

The communication between the database and the mobile consists of operation concerning both

reading and modifying the data, while the communication between the database and the microcontroller consists of only writing operations.

**Communication Interface**

The communication between the different parts of the system is important since they depend on

each other. However, in what way the communication is achieved is not important for the system and is therefore handled by the underlying operating systems for both the mobile application and the microcontroller but we will focus on the Bluetooth for communication.

**Software Components**

. The specifications are as follows:

* A computing unit with Win 7/8/10
* Intellij IDEA
* Android Studio
* Framework Codeigniter/.NET
* MS Word
* SQL database
* Browser
* All the software tools and technologies are free and readily available.

# Tools and technologies

* MS Project
* MS Office
* PHP/.Net for developing web Application
* XAMPP server
* SQL
* Android Studio
* Sublime text
* Intellij IDEA

## Target Platform

The application will be compatible for the following platforms:

* Web Browsers (Windows / Mac/ Linux)
* Android Device

## Hardware and Software Specification

Since signals are captured using a microcontroller or we can say it will be generated using the microcontroller which will be send to the mobile application and the mobile itself of android OS.

Simulator Blue tooth device is used for Demo

A Computing Unit and Mobile device (Mac, Android, Windows)

NO PLAGIARISM AND FAIR PLAY DECLARATION

*We the group members of the FYP titled “IHAP’S” understand the meaning and consequences of the act of plagiarism in academic works and we do solemnly declare and promise not to indulge ourselves directly or indirectly in any acts of plagiarism and/or use or misuse of any work done by other parties, or any activities that are considered miss-appropriate by the project advisers/supervisors and/or considered to be illegal by the regulations of any kind; unless of course permitted by our project adviser/supervisor that is within legal bounds and is/are deemed necessary by them.*

*Our project and product(s) are unique, bear quality and are not a repetition or copy of any previous project(s).We declare that we will produce work that is genuine, innovative and reflective of all the study that we had as the students of university of south Asia.*

*We promise to follow the schedule during which we shall seek feedback and maintain a liaison with our adviser. We understand that any foul-play or infringement on our part will result in the cancellation of our project and possibly other penalties may be imposed upon us.*

*Our project efforts and the end-product are safe, harmless and helpful to humans and society.*

SIGNED.

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