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Design and Implementation of Automated Healthcare Software System for Outpatient Health Maintenance

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Abstract

Presented in this article is a software system that is aimed at automating health maintenance process for aged people. The system simulates health parameter such as body temperature, pressure weight and height of patients. The generated parameters are used to compute the Body Mass Index (BMI) of the patient. These parameters are sent online to a remote central database of the health institution (hospital) using it. Doctors assigned to particular patients can access the information and advice the patients on what to do. The system is developed using web technology.

Keywords: Automated, BMI, Healthcare, Sensor, Software Prototyping

1. Introduction

Certain health casualties would be prevented if they were discovered and managed in good time. Moreover, many persons are too busy that they have no time to seek medical attention, even when their health show signs of impairment. Worst still is care of sudden breakdown of organs of the body like heart failure, rise in blood pressure, etc. These are cases that do not just mature but develop gradually before eventually reaching chronic state that can lead to death.

Few medical facilities available in many developing countries are over populated and for this reason many out-patients go to the hospitals only to spend a greater part of their day without being able to get the desired attention.

The need to use the present state of the art technology such as the internet or intranet to access medical care is long overdue. Healthcare monitoring without automation in this age whereby we have high rate of ever increasing health conditions will only place the health of the world at great risk.

The aim of this paper is to develop an Automated Healthcare Software System that simulates Body Sensors for capturing human body temperature, blood pressure body weight and height. These information will be cataloged as patient's medical history in a database for doctor's response. The advantage is that as soon as doctors respond to patients' case, the result can be received in real-time by the patient for appropriate action.

2. Related Works

According to [4], there has been exponential increase in health care cost in the last decade. Patients have to make frequent visit to the doctors to get their vital signs measure. And every time they visit they have to keep their previous records with themselves. Every age group has to go to hospital for a routine checkup and keep the records with themselves.

[7] Proposed a system architecture for smart healthcare based on an advanced Wireless Sensor Network (WSN). The authors presented the advantages, objectives and the status of the design through an experimental living room constructed at the University of Virginia. They implemented a system that uses wireless sensor network to monitor health of patients and the location of the patient. A database system was developed for storing results

Research on the system was still ongoing, and hence there no success story yet as to the strength of the system.

The authors in [8] proposed future design of smart health care systems to include smart and intelligent devices. They surveyed existing technologies with a finding that having the internet and electronic recording keeping,

intelligent Medicare can be achieved by adding smartness to telemedicine through the use of sensors.

The authors in [12] proposed a system which mainly aimed at making room for quicker and quality health assistance to patients at locations that are physically too remote/rural areas using modernized communication. By putting cloud computing with their system it was able to monitor health data at any comfortable places or devices. However, they are still planning to add features like fall detection for elders and similar parameters in order to fully incorporate this into Remote Monitoring System.

A real-time heart disease monitoring system which extracts the ECG signal from the patient, sends it through the Internet and stores it into a hospital server was presented by [13]. This system also processes the ECG using MATLAB to alerts the doctor and hospital staff by sending email and SMS message on detection of abnormality. It also provides online information about the patient status such as the patient's heart beat rate, ECG, patient history and provides new reading every 30 minutes which is made possible by implementing an application based on Android platform.

[16], [17] and [18] on the other hand did research on the importance of body mass index of all ages including children, elderly people as well as pregnant women as this will help a lot in monitoring the underlying increase in health risk due to excess weight of an individual.

So far, the trend of various researches progressed from an era when there was no such technology to this period when the global communities are already embracing smart telemedicine. However, most of the papers reviewed only ended up with proposals, without actualizing the real system. A host of others also did not maximize the use of today's technology such as the internet. Hence the need for this present research, which intends to channel effort towards developing a system that will monitor patient's health parameter and transmit same to a physician, while maintaining privacy of such information. This system also has a great advantage of monitoring the patient's body mass index which is an adequate measure for monitoring the underlying increase in health risk due to excess weight of an individual. The user of such system may remain in the comfort of their homes and be receiving Medical reports of his/her health through the internet and will only visit medical center at critical conditions.

3. Methodology

The methodology used was the modelling and software prototyping.

3.1. System Modelling

The Unified Modeling Language (UML) was used to model the system graphically before translating to desired source coding language. Figure 1, Figure 2 and Figure 3 show the models realized from the design model.

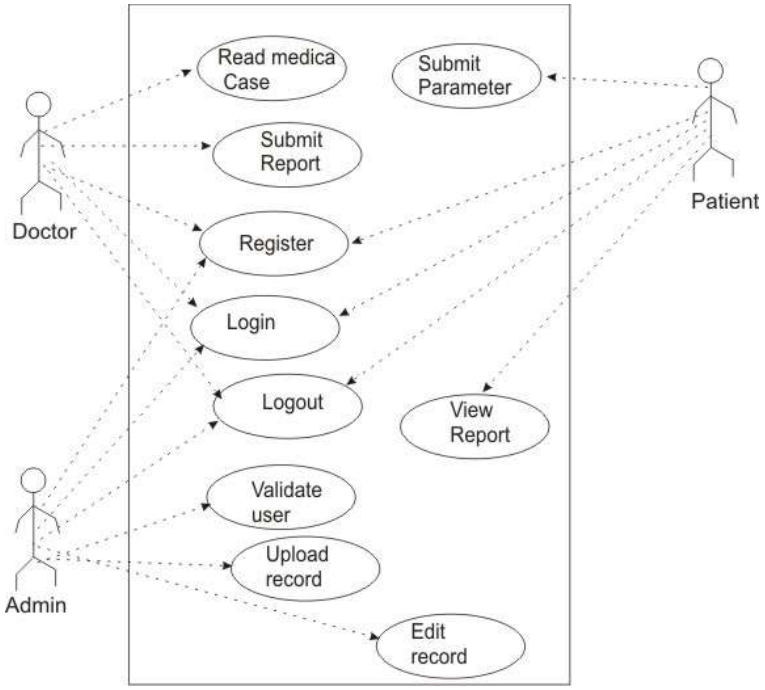

Figure 1 Use Case Diagram

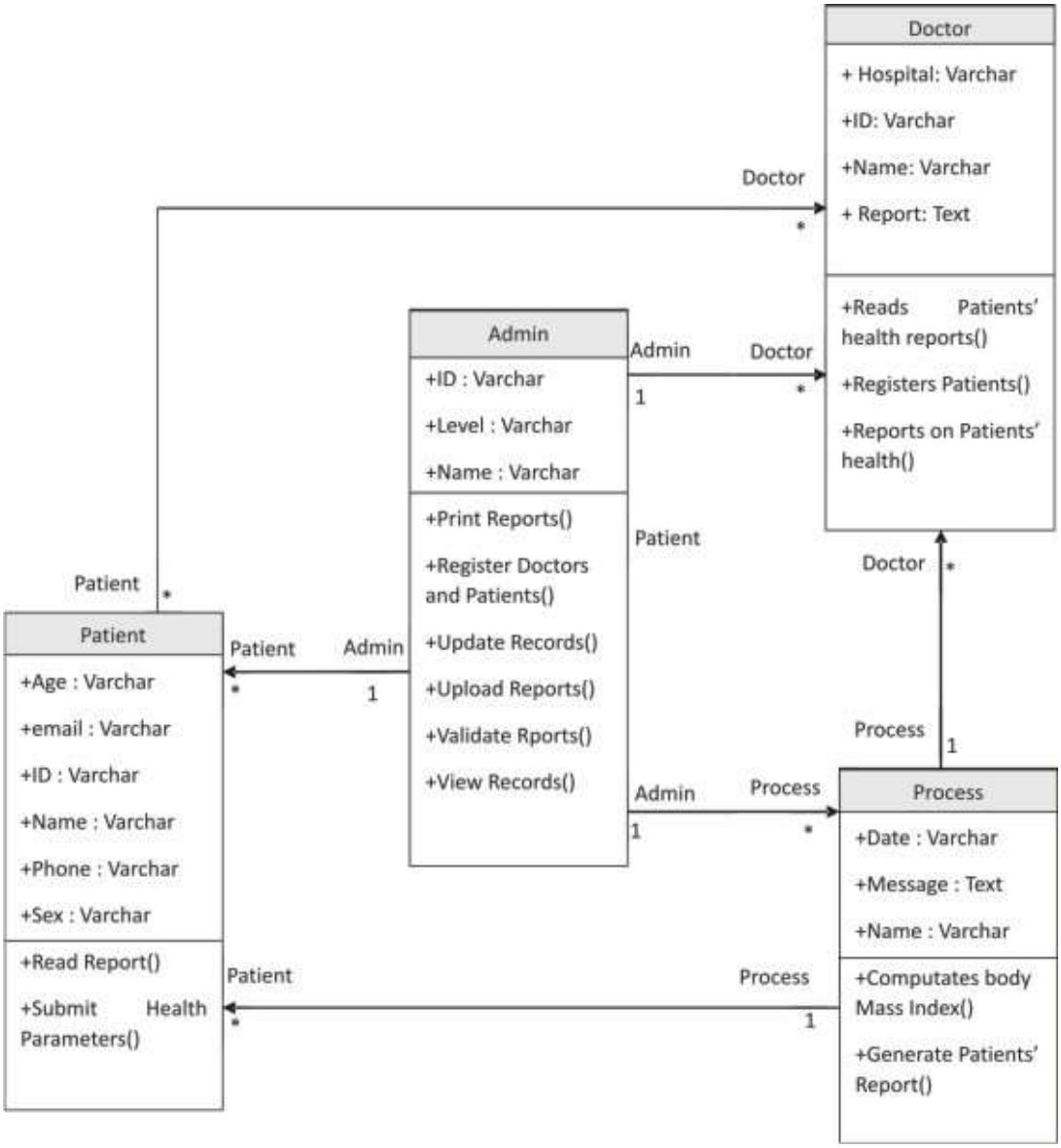

Figure 2 Class Diagram

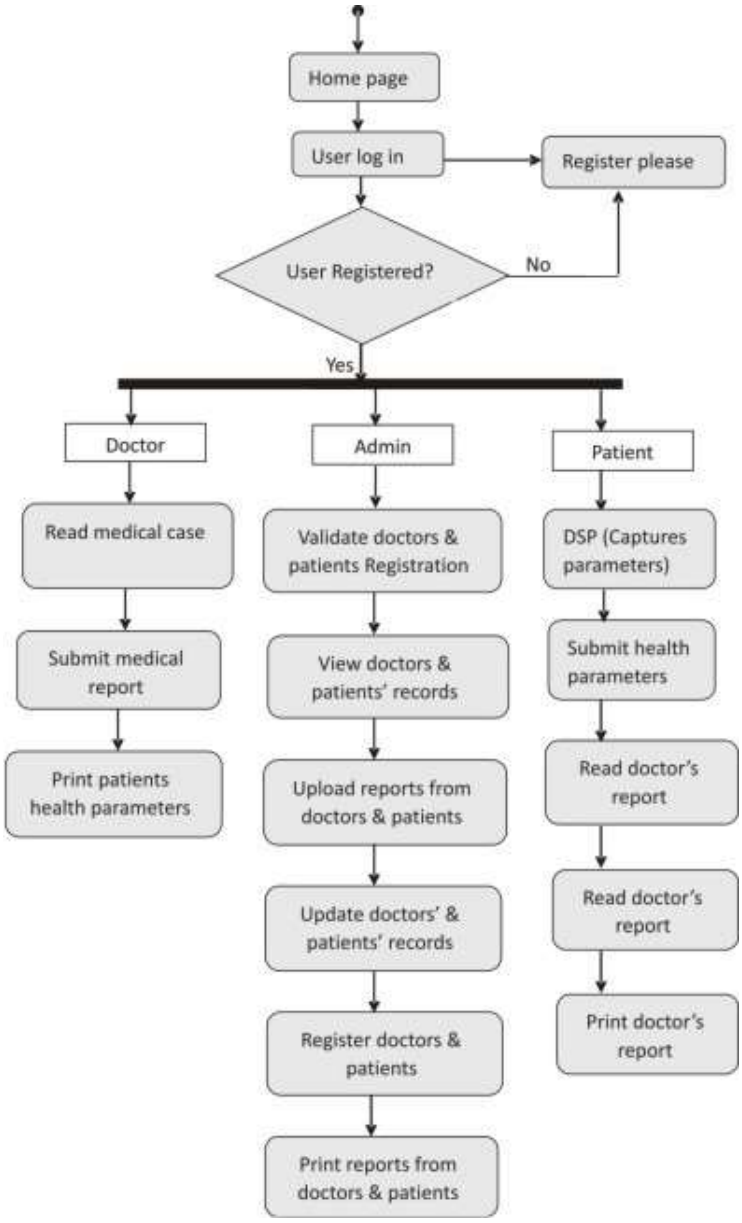

Figure 3 Activity Diagram

The case diagram shows the various user interaction with the system, the class diagram shows the model of the static structure of the system by showing the system classes, their attributes, operations and the relationship amongst the objects, while the activity diagram illustrates the dynamic nature of a system by modeling the flow of control from activity to activity.

The primary goal of the implementation is to write the source code and also that conforms with the specifications. Basically in this research, PHP, MySQL, JavaScript, Jquery, CSS and HTML were used to design a user friendly interface (UFI) because they are the more appropriate and most preferable programming language used for designing web applications. The system was designed to have multi-user level security.

3.2 Software Prototyping

The implementation was divided into three main modules as shown in figure 4.

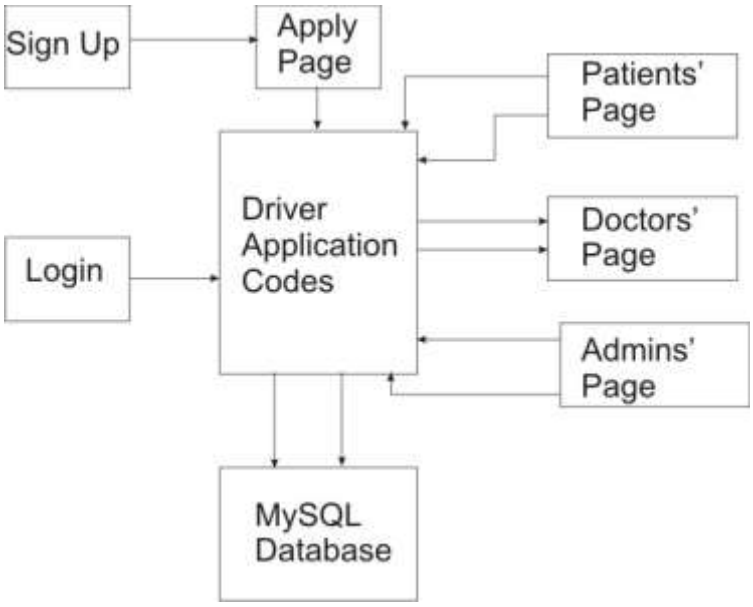

Figure 4 Block Diagram overview of the Implementation

The models represented in this block are

1. User Interfaces
2. Driver Application
3. Database

1. User Interfaces

The user interface pages represent the front end interface through which the users are able to access the functions for the system. These pages include the Login Page, Sign up Page, Patient Page, Admin Page and Doctors' Page.

The user interface pages were all implemented using HTML tags, CSS and a few JavaScript codes that allow different forms of input and outputs, such as textfield, drop down boxes, tables, etc.

2. Driver Application Codes

This module implements the backend or server side scripting that helps to interact with the other components of the system. This module would not execute without the server. The driver application was implemented using php codes and hosted on wamp local server.

3 MySQL Database

The database module has direct interface with the driver application. Information from the other modules are store in the database and are retrieved when required via the driver application. Again, this action would not happen without the server.

3.3 Results

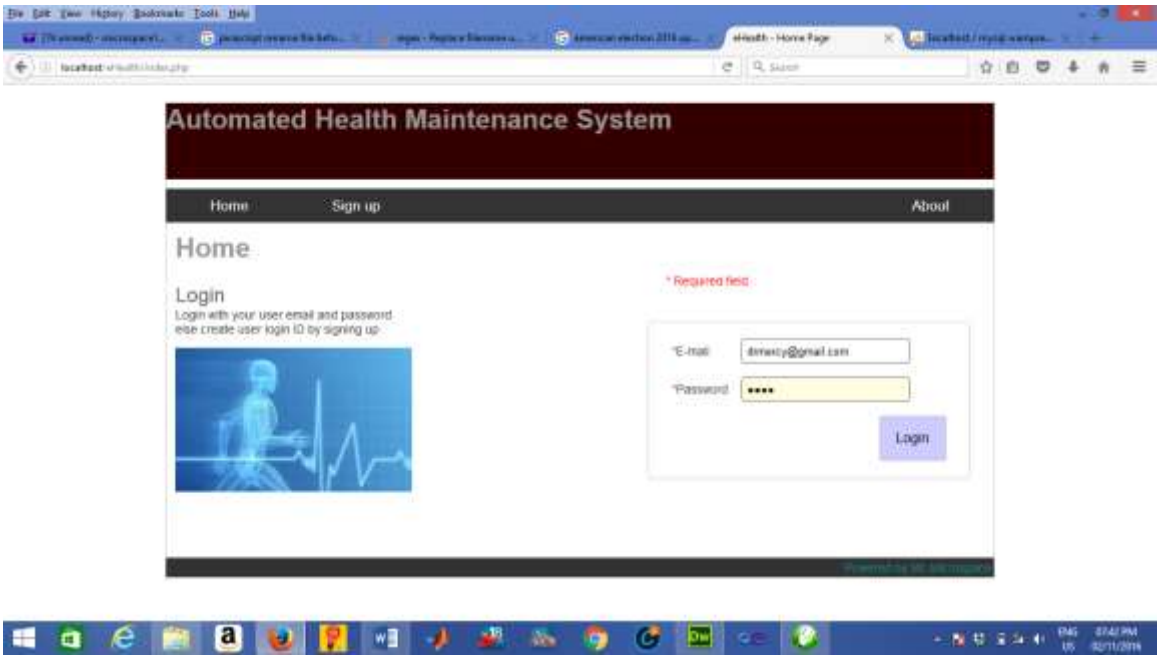

Figure 5 Home Page/Login page

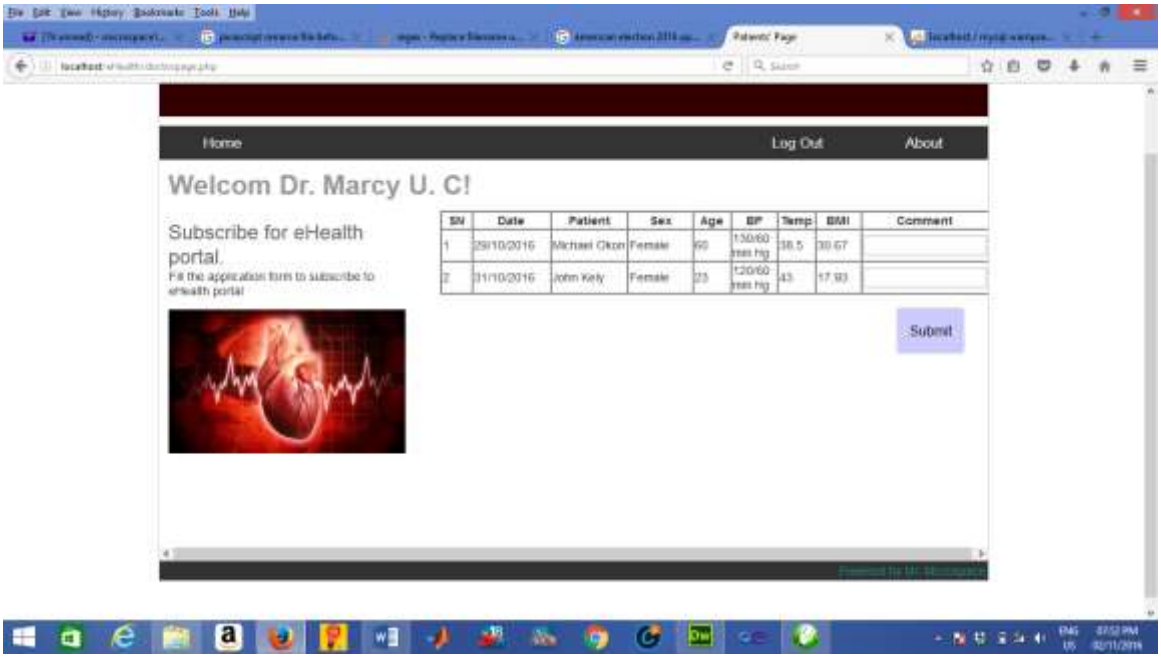

Figure 6 Doctor's page

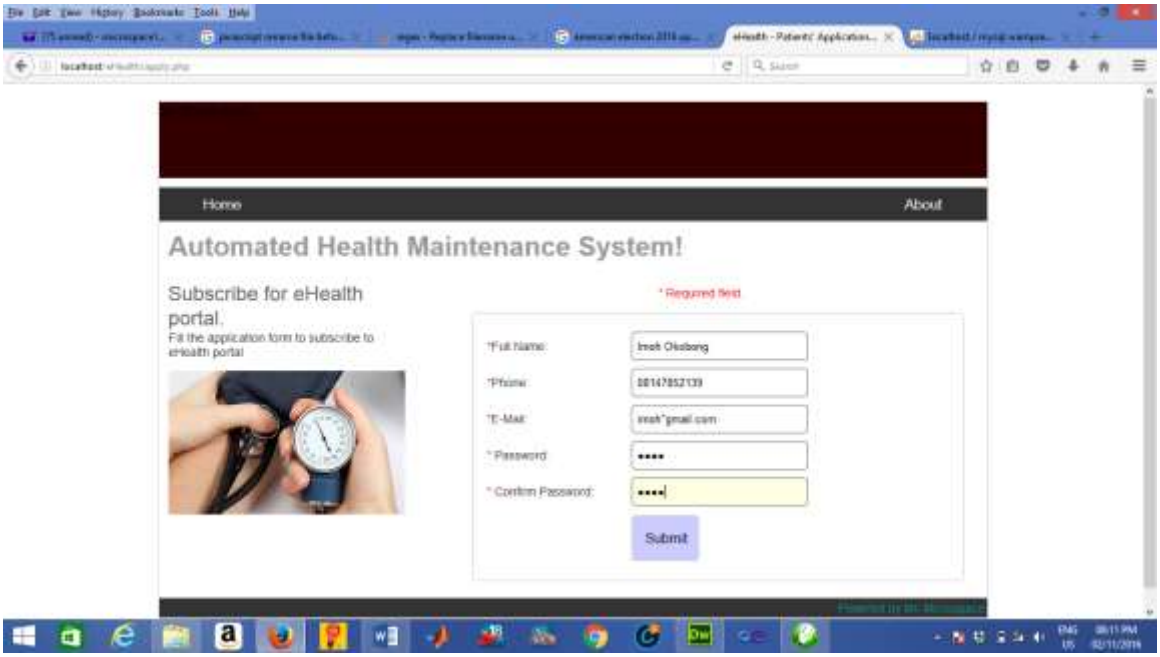

Figure 7 Sign Up page

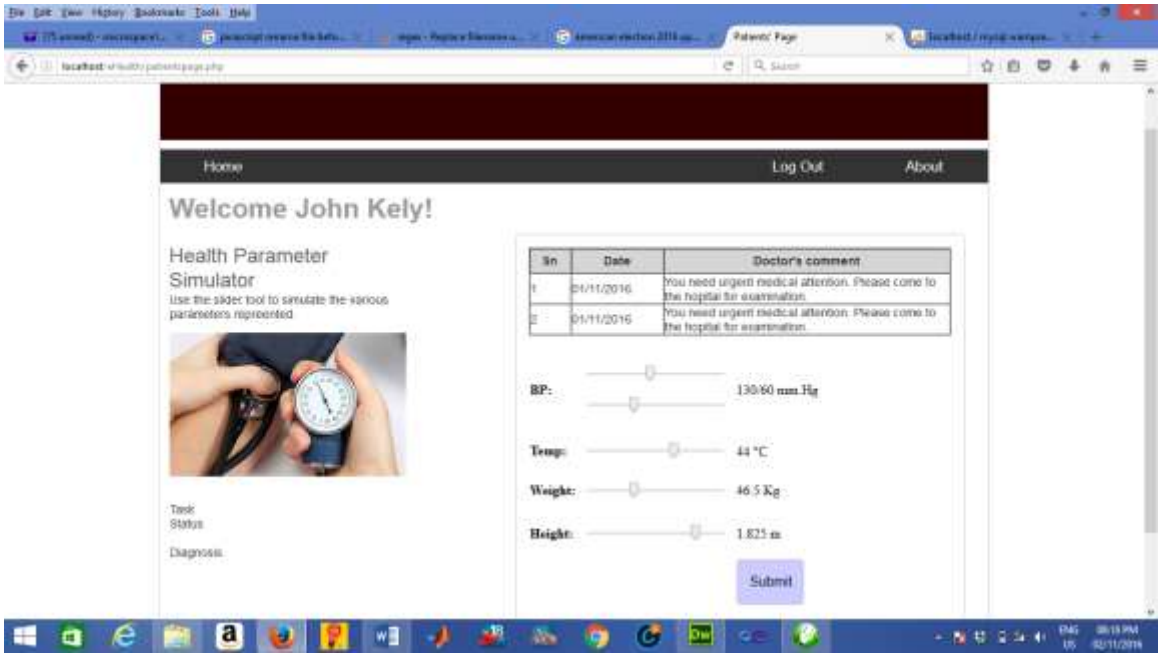

Figure 8 Patients Page

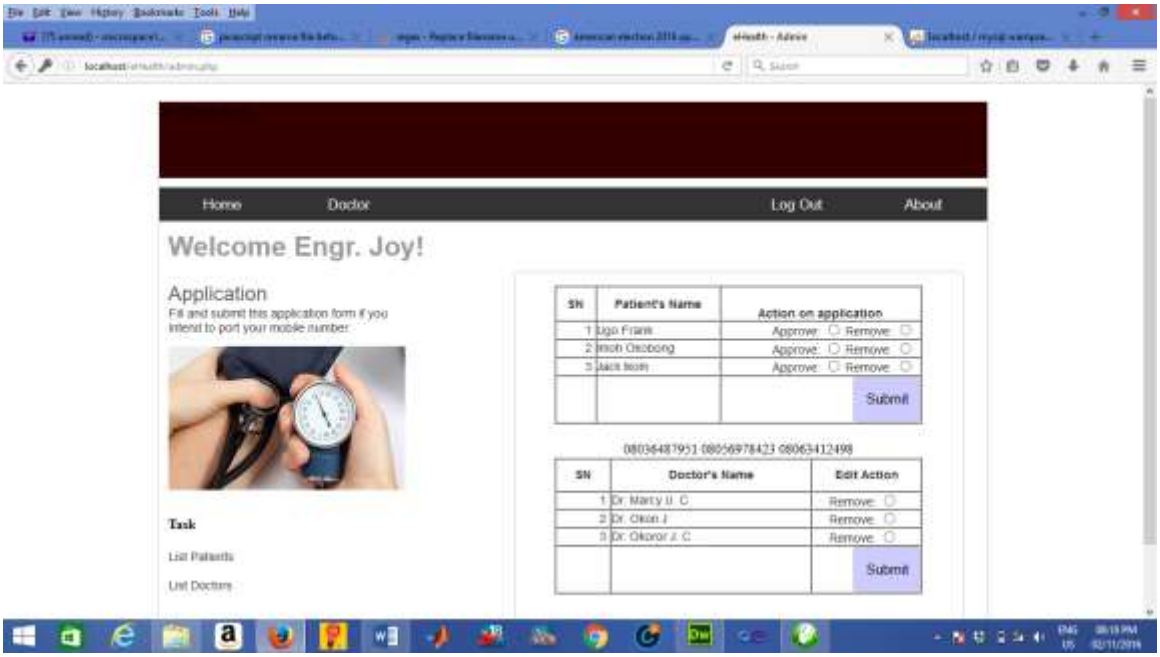

Figure 9 Admin Page

5. *Conclusion*

Automated healthcare system was achieved in this project. It is a system where patients stay in the comfort of their homes to submit their body parameters to the hospital database, which grants doctors access to the patients' medical history. The information is used to advise the patients. The screen shots shown in chapter four are the results obtained when the system was tested.

Many old persons do not find it easy to frequent the hospital for health maintenance. Yet they need doctor advice frequently. This system is therefore recommended to various health institutions for use in their out-patient departments. It is recommended that anyone wishing to deploy this system should do so using Mozilla Firefox, Google Chrome or Internet Explorer 9.0 or above. It is also recommended that government should encourage the use of modern technology in health care delivery, thereby championing the course the development of such technology locally to suit our needs.

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