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Patient Health Monitoring using IoT and Disease Prediction using Data Mining

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Abstract - *It might have happened so many times that you or someone yours need doctors help immediately, but they are not available due to some reason .This paper introduces a wireless health monitoring system using IOT and disease Prediction using data mining that can monitor a human 24x7. This system consists of a two part. First Part - Controlling and data processing is done through the Arduino Uno board, all the sensors are connected to Arduino UNO. Through this system, we can measure ECG, heartbeat, BP, and body temperature sensor. Through sensors, it is possible to measure all these values .All these analog sensors can be connected to Arduino through any of the six analog pins. These values are then used for detecting any critical situation. In the case of a critical situation, an alert can be given as a message. Data from sensors is uploaded to the ThingSpeak periodically without any interruption. If the internet is available. Here ESP8266 wifi module is used for connecting Arduino to the internet .Second part - The Health Prediction system is an end user support and line consultation project. Here we propose a system that allows users to get instant guidance on their health issues through an intelligent health care system online. The system is fed with various symptoms and the disease/illness associated with those systems. The system allows user to share their symptoms and issues. It then processes user's symptoms to check for various illnesses that could be associated with it. Here we use some intelligent data mining techniques to guess the most accurate illness that could be associated with patient's symptoms.*

Key Words: IOT, Arduino Uno, Temperature sensor LM -35, Heartbeat and ECG sensor, Data Mining

1. INTRODUCTION

Health is one of the global challenges for humanity. In the last decade the healthcare has drawn considerable amount of attention. A Patient Health Monitoring System is an extension of a hospital medical system where a patient's vital body state can be monitored remotely. Traditionally the detection systems were only found in hospitals and were characterized by huge and complex circuitry which required high power consumption. Continuous advances in the semiconductor technology industry have led to sensors and microcontrollers that are smaller in size, faster in operation, low in power consumption and affordable in cost.

According to research, we found that approximately 2000 people died monthly due to the only carelessness of their health. This is because they do not have time for themselves and forget about their health management due to a heavy workload. The reason behind to make this project .the growing world of technology and people forget their health check up which is needed to be done monthly or quarterly. As we all know that internet of things make our life easier. So, we have decided to make an internet of things based healthcare project for people who provide them all the personal information about their health on their mobile and they can check their all historical health data. The best part of this project is that it can be used by everyone and make our health management easier than available systems. It provides a solution for measurement of body parameters like ECG, Temperature, Moisture, and Heartbeat. This system also generates an alert when it required that means at the time of any critical conditions and notifications about the medicines, location change, conditions etc.

For disease Prediction, Here we use some intelligent data mining techniques to guess the most accurate illness that could be associated with patient's symptoms. In doctor module when doctor login to the system doctor can view his patient details and the report of that patient. Doctor can view details about the patient search what patient searched for according to their prediction. Doctor can view his personal details. Admin can add new disease details by specifying the type and symptoms of the disease into the database. Based on the name of the disease and symptom the data mining algorithm works. Admin can view various disease and symptoms stored in database. This system will provide proper guidance when the user specifies the symptoms of his illness.

2. PROBLEM STATEMENT

Medical facilities in rural areas are of major concerned due to lack of transportations, infrastructure facilities and non-availability of medical faculties. Hence to overcome these difficulties a smart real-time embedded based medical healthcare system has to be designed which continuously monitors the patient's health, alerts concerned persons over

web for health degradations so that medication is possible to provide in stipulated time.

When a patient is in critical illness, timely monitoring of vital sign parameters and providing with the required treatment is very important. In many cases the patient may be alone, caretakers and concerned doctors are faraway for him. Under this condition, the patient may reach critical condition or even die. In order to draw the attention of concerned and provide them necessary treatment.

3. LITERETURE REVIEW

[1]Jorge Gomez: developed a personal health diagnosis based on the symptoms of the patient. A huge amount of collected data is used to analyze the disease and risk of the patients. Franca discussed that the innovations of the new generation systems are the development of continuous monitoring features for the patient and the improvement of workflows and productivity of medical personal. He also emphasized the various wireless technologies and the advantages of using those technologies Sneha N.Malokar 1, Samadhan D. Mali 2: developed a wearable sensor system to monitor the movements of the patients. The system was calibrated to a threshold level less than 5% with the aim of minimizing the error rate of the captured data proposed a detection system to monitor the movements of patients which recognizes a fall and automatically sends a request for help to the caretakers.

The authors of [2] address the IOT concepts that are the implementation and integration of technologies, wired sensor, and wireless sensor, tracking technologies, identification, communication solutions and the promising paradigm. The main goal of this paper is the activities performed in the various fields like information science, telecommunication, electronics the survey on this paper improves the communication protocols, identification sensors and tracking sensors.

The authors of [3] give you the idea about BAN and how the remote medical monitoring will become the standard procedure for managing certain conditions. The more computational capability about the data hub telehealth the available and public switched telephone network. The main purpose of this paper is it offers you to know about the secure mobile computing system and how energy is the primary concern in wireless nature and how authentication is essential what are the system issues and challenges to be faced and how to avoid the faults.

The authors of [4] and [5] addresses the problems faced by using the wireless communication technologies it is the survey on wireless technology and how it can be applied to the smart hospitals monitoring system it contributes the support for continuous monitoring of patient health even from remotely places. It explains the development and workflow distinct monitoring of healthcare services. The inquiry of this paper deals with the advantages, drawbacks, the present new technologies, show definitions, the results and solution for future systems.

Shreyasha Chaudhary at [6] monitors the vital health parameters and transmits the data through a wireless communication, which is further transferred to a network via a Wi-Fi module.

Afef Mdhaffar at [7] present a new IOT-based health monitoring approach in which collected medical sensor data is sent to an analysis module via low-cost, low-power and secure communication links provided by a LoRaWAN network infrastructure.

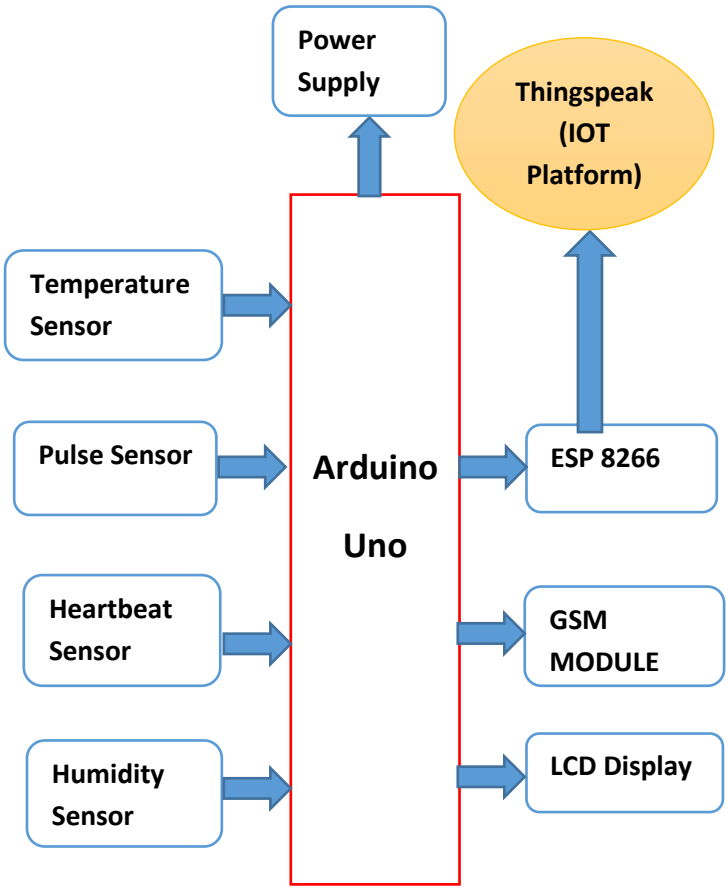


Fig 1 : Illustrates block diagram of IOT based health monitoring system

A. Temperature Sensor

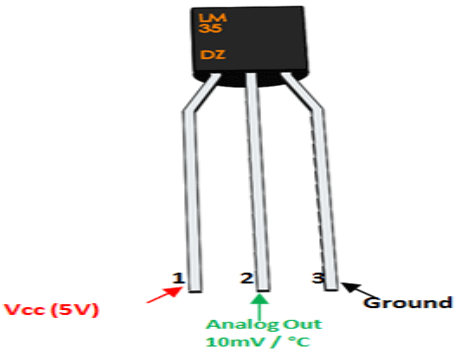
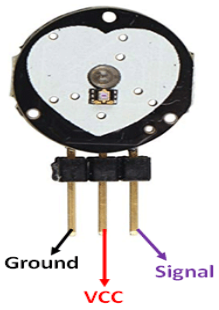


Fig. Temperature Sensor

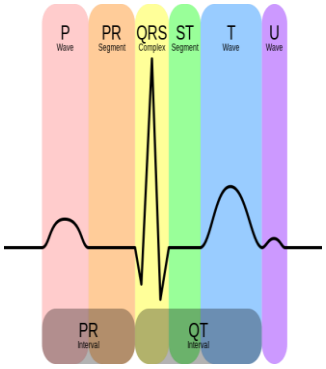
Temperature sensor is a device which is designed specifically to measure the temperature of a human body. LM35 is a high quality IC temperature sensor with its output (fair in amount, related to/properly sized, related to) the temperature (in Ã, Â°C). With LM35, the temperature can be measured more (in a way that's close to the truth or true number) than with (device that changes resistance as temperature changes). It also possesses low self-heating and does not cause more than 0.1 Ã, Â°C temperature rise in still air. The operating temperature range is from -55Ã, Â°C to 150Ã, Â°C The LM35's low output impedance, linear output, and exact built-in (a (change to make better/related to changing something) for (quality of being very close to the truth or true number)) make connecting/communicating to readout or control circuitry especially easy. Commonly human body temperature, also known as normothermia or euthermia, is the typical temperature range found in humans. The usual human body temperature range is usually stated as 36.5-37.5 Â°C (97.7-99.5 Â°F).

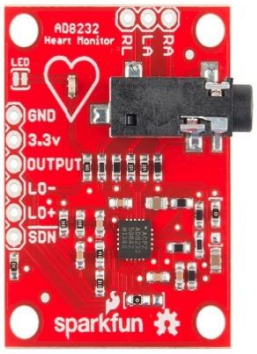
B. Pulse Sensor

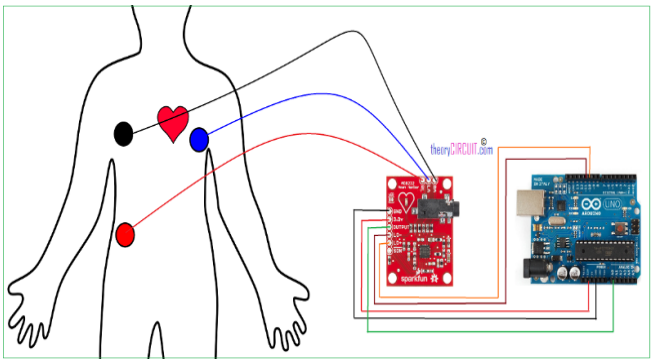


The working of the Pulse/Heart beat sensor is very simple. The sensor has two sides, on one side the LED is placed along with an ambient light sensor and on the other side we have some circuitry. This circuitry is responsible for the amplification and noise cancellation work. The LED on the front side of the sensor is placed over a vein in our human body. This can either be your Finger tip or you ear tips, but it should be placed directly on top of a vein. Pulse Sensor is a plug-and-play heart-rate sensor for Arduino compatibles. It can be used by students, artists, athletes, makers, and game & mobile developers who want to easily incorporate live heartrate data into their projects.

C. ECG (Electrocardiography)



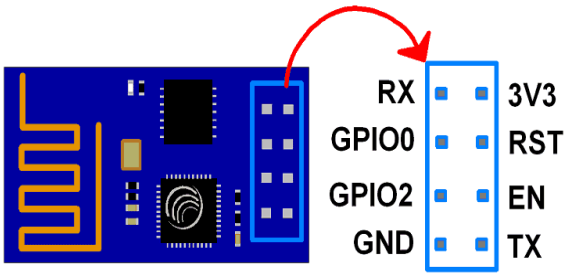




Electrocardiography (ECG or EKG) is the method of recording the electrical activity of heart over a period of time using the electrodes placed on the skin. This ECG wave has two sections as PR interval and QT interval, by using the AD8232 IC we can get noise less information. The simple and easy to use breakout board for heart rate monitoring from Spark fun. This board measures electrical activity of heart through the Electrode pads placed on the skin. By Interfacing, this board with Arduino we can get ECG graph through Processing IDE window.

ECG records the electrical activity generated by heart muscle depolarizations, which propagation pulsating electrical waves towards the skin. Although the electricity amount is in fact very small, it can be picked up reliably with ECG electrodes attached to the skin. The full ECG set up comprises at least four electrodes which are placed on the chest or at the four extremities according to standard nomenclature (RA = right arm; LA = left arm; RL = right leg; LL = left leg).

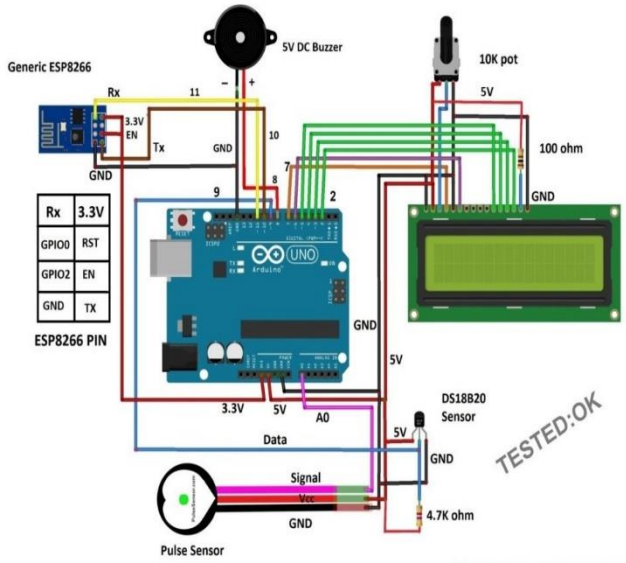
D. Wi-Fi Module



The ESP8266 wi-fi module is a self-contained SOC with incorporated TCP/IP protocol stack that can offer any controller access to wi-fi network. It uses 802.11 b/g/n protocols. Standby power consumption is less than 0.1mW.

4. IMPLEMENTATION

Circuit Diagram and Connections:



4.1 Circuit Diagram

For designing IOT Based Patient Health Monitoring System using ESP8266 & Arduino, assemble the circuit as shown in the figure below.

1. Connect Pulse Sensor output pin to A0 of Arduino and other two pins to VCC & GND.
2. Connect LM35 Temperature Sensor output pin to A1 of Arduino and other two pins to VCC & GND.
3. Connect the LED to Digital Pin 7 of Arduino via 220- ohm resistor.
4. Connect Pin 1,3,5,6 of LCD to GND.
5. Connect Pin 2, 15 of LCD to VCC.
6. Connect Pin 4,6,11,12,13,14 of LCD to Digital Pin 12,11,5,4,3,2 of Arduino.

7. The RX pin of ESP8266 works on 3.3V and it will not communicate with the Arduino when we will connect it directly to the Arduino. So, we will have to make a voltage divider for it which will convert the 5V into 3.3V. This can be done by connecting 2.2K & 1K resistor. Thus, the RX pin of the ESP8266 is connected to the pin 10 of Arduino through the resistors.

8. Connect the TX pin of the ESP8266 to the pin 9 of the Arduino.

9. Connect AD8232 corresponding electrode pads in skin and then provide 3.3V and GND power supply from the Arduino board, the SDN (shutdown) pin is not connected to any part. Output from the breakout board is taken to Arduino's A0 (Analog input 0) pin. To detect the Leads off situation LO – and LO + are connected to Arduino digital pin D11 and D10 respectively.

4.2 Disease Prediction Website

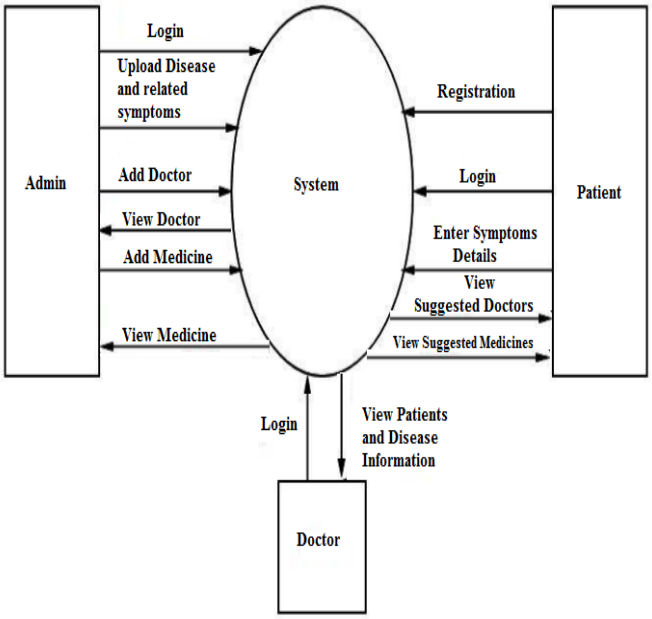


Fig 2 - DFD (Data Flow Diagram) of Website for Disease Prediction

4.2.1 DATA FLOW DIAGRAM

A Data Flow Diagram (DFD) is a graphical representation of the "flow" of data through an Information System. A data flow diagram can also be used for the visualization of Data Processing. It is common practice for a designer to draw a context-level DFD first which shows the interaction between the system and outside entities. This context-level DFD is

then "exploded" to show more detail of the system being modelled.

A DFD represents flow of data through a system. Data flow diagrams are commonly used during problem analysis. It views a system as a function that transforms the input into desired output. A DFD shows movement of data through the different transformations or processes in the system.

4.2.2 ER diagram :

An entity-relationship (ER) diagram is a specialized graphic that illustrates the interrelationships between entities in a database. ER diagrams often use symbols to represent three different types of information. Boxes are commonly used to represent entities. Diamonds are normally used to represent relationships and ovals are used to represent attribute.

An **entity-relationship model** (ERM) in software engineering is an abstract and conceptual representation of data. Entity-relationship modelling is a relational schema database modelling method, used to produce a type of conceptual schema or semantic data model of a system, often a relational database, and its requirements in a top-down fashion.

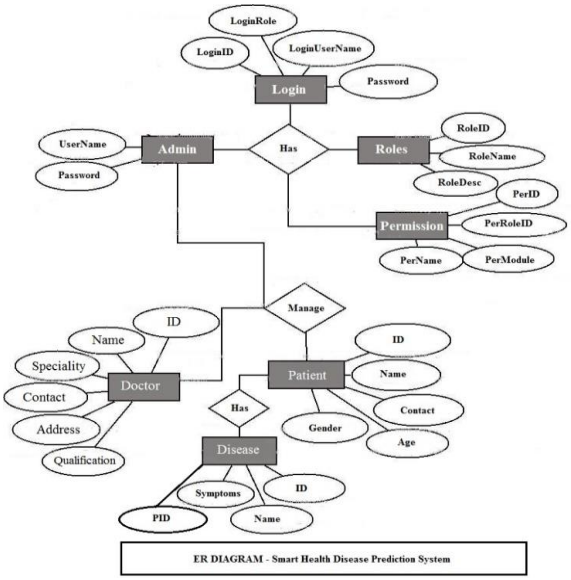


Fig - 3 : ER diagram - disease Prediction System

Hardware Require

- Arduino Uno
- LM 35 temperature sensor
- Heart Beat and Blood Pressure sensor
- ECG sensor
- LCD Display
- Alarm
- GSM Module
- ESP 8266

Software Require

- Python IDLE
- Server (ThingSpeak)
- Technology: Python Django
- IDE : Pycharm/Atom
- Client Side Technologies: HTML, CSS, JavaScript , Bootstrap
- Server Side Technologies: Python
- Data Base Server: SqLite
- Operating System: Microsoft Windows/Linux

5. OUTPUT SCREENS AND RESULTS

Thingspeak Screen

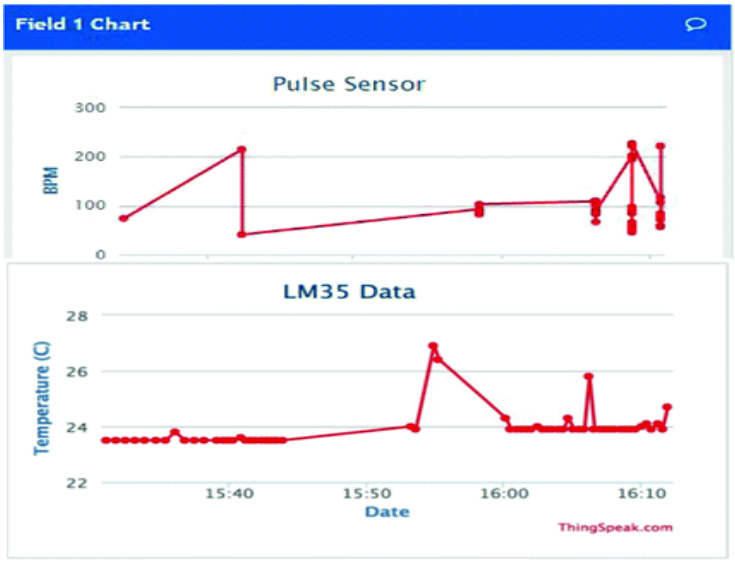


Chart -1: Pulse and LM35 graph

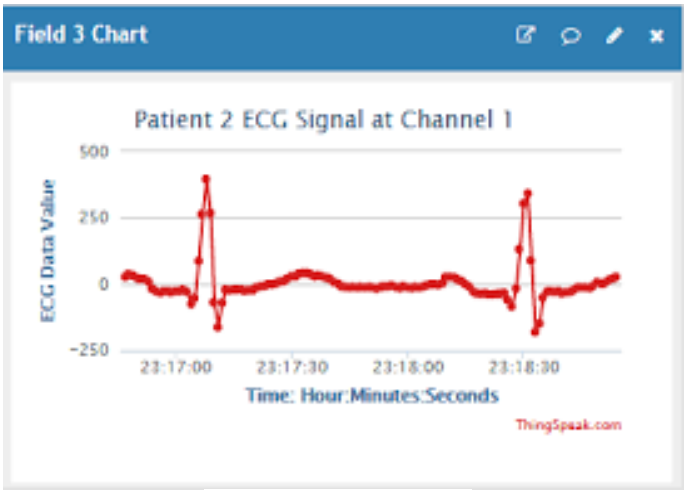
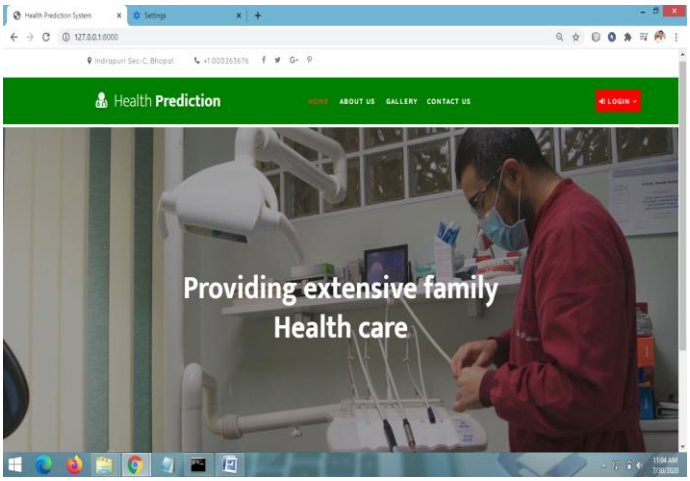
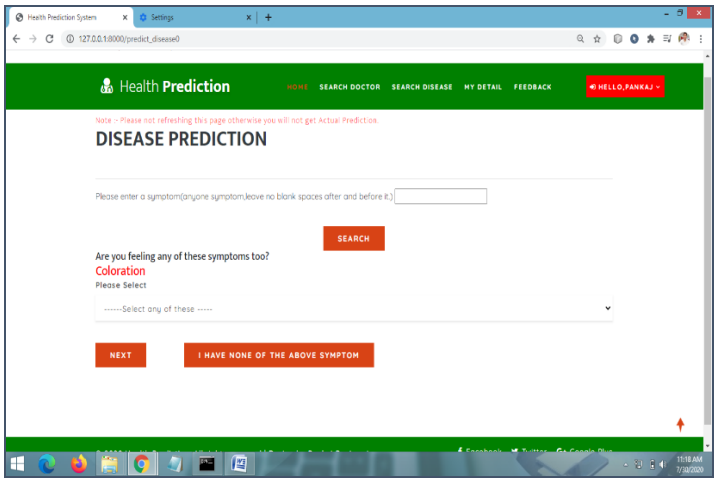


Chart -2 : ECG graph

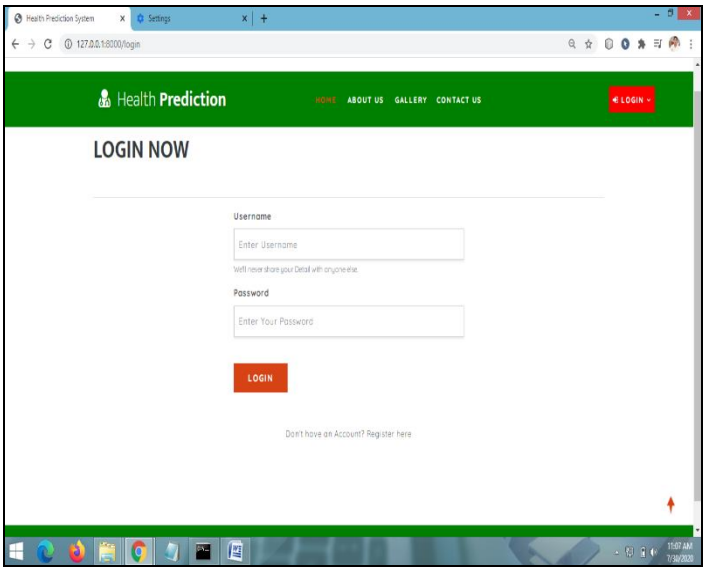
HOME PAGE



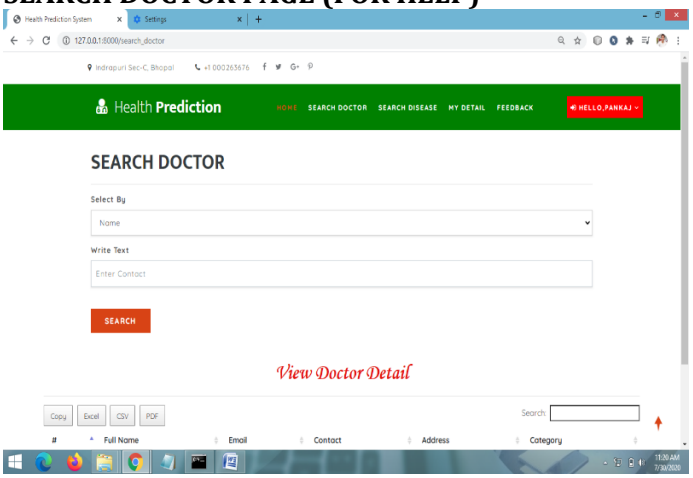
VIEW DISEASE PREDICTION RESULT PAGE



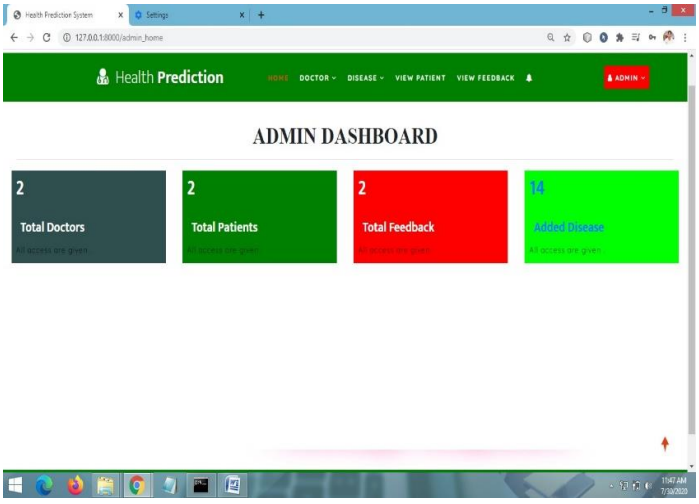
LOGIN PAGE



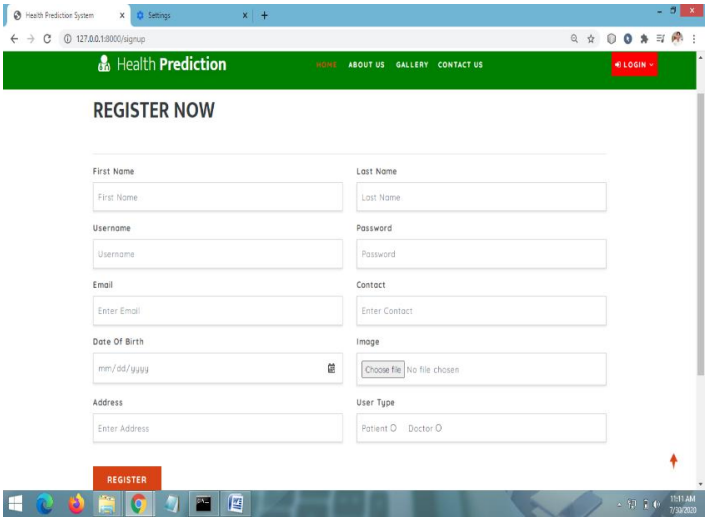
SEARCH DOCTOR PAGE (FOR HELP)



ADMIN PAGE



SIGN UP PAGE



6. CONCLUSION

Hence this project provides the ease for the doctors to monitor the health of the patients even outside the hospital

or apart from their duty hours. The health of the patients is monitored remotely. This project is cost effective and provides timely response to improve the patients' health and avoids the patients to have long stays in hospital it also helps them to move freely and walk happily with the help of wireless sensors, These are the measurable benefits which avoids the patients from daily regular visits to hospitals which is extremely painful for chronically ill, elderly and bedridden patients in home. So by using the project we can solve many problems of the healthcare which the society is facing and improve the quality for a better human life. The objective of developing monitoring systems is to reduce health care costs by reducing physician office visits, hospitalizations, and diagnostic testing procedure.

Data mining can be helpful in the field of restorative space. Anyway protection, security and unfit to sign into the record are the huge issues on the off chance that they are not tended to and settled appropriately.

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