A CLOUD BASED RISK PREDICTIONFOR HYPERTENSIVE PATIENTS

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Abstract— Heart Rate Variability (HRV) is a measure of variation in the time interval between consecutive heart beats. Sensitivity of HRV towards various medical condition accounts for its increased usage by doctors as a diagnostic, prognostic tool and to evaluate the effectiveness of the treatment offered. Often borderline hypertensive patients with and without history of a cardiac event are subjected to stroke as well as cardiac mortality at high risk. Monitoring of HRV parameters for such cases of high risk will prove useful in providing adequate medical care at needed times. In this paper, the authors propose a low-cost and easy to use Remote HRV Monitoring System based on the Internet of Things (IOT) technology for borderline Hypertensive patients. In the proposed system, HRV parameters are derived using Wireless ZigBee based pulse sensor and data analysis by using Raspberry board.

Transfer the information by using Wi-Fi, ZigBee Technologies. The Web server collects HRV data and store in the data base. In case of an emergency situation, the care taker and doctor are intimated through for providing adequate medical help. While there are currently no HRV analysis systems that alerts at times of high risk for hypertensive patients along with the aid of a remote doctor, the proposed system aims at achieving the same. The proposed system combines the dual benefits of Zigbee and Wi-Fi technology. By doing so, it successfully fulfils all the ideal traits of a remote health monitoring system in terms of low-cost, long range, security, promptness and easy-to-use that serves in saving lives.

Key words*: Raspberry Pi, Wi-Fi, Pulse, IOT.*

Introduction

With the rapid growing need for timely medical services, the traditional method of treatment at the Health care falls short in success with respect to emergency cases. A method predicts the risks prior need of the hour. IOT for healthcare offers to be a vital solution for such a serious issue. Of many chronic illnesses, Hypertension has become common yet a serious disease that remains as the root cause for major Cardiac mortality and Stroke mortality. There should be extensive efforts at various levels to reduce the mortality and morbidity out of HRV. In hospitals everyday huge number of data is collected of the patients but it is not mined. As there is enough clinical data available, mining the data can lead to developing an android application which will calculate the risk for HRV by giving certain inputs and categorizing the individual into risk as low, medium or high.

We developed a simple approach to predict risk of developing Ischemic Heart Disease (IHD) (Heart Attack) using smart controller based application by continuous monitoring. Though it is often a condition occurring in the elderly, children are also susceptible to fall prey to it. Hypertensive heart disease has topped the table for its death toll in India according to Global Burden of Disease Study 2013. Critical health events like Stroke or Myocardial Infarction (Heart attack) related to Hypertension does not happen all of a sudden; rather it is a continued risk factor that results in such life threatening events. HRV is as an important parameter that uncovers even dilate intricacies regarding health condition. The study of HRV enhances our understanding of physiological phenomenon, the actions of medications and disease mechanisms. HRV parameters act to be a predictor for cardiovascular disease risk. Thus, the proposed system aims to remote monitor as well as alert in critical situation based on the Heart Rate parameters of the patient.

LITERATURE SURVEY

[1] R.N.Kirtana et al (2017) In this paper, the authors propose a low-cost and easy to use Remote HRV

Monitoring System based on the Internet of Things (IOT) technology for borderline Hypertensive patients. In the proposed system, HRV parameters are derived using Wireless ZigBee based pulse sensor. Arduino transmits patient data to server using MQTT protocol. The application server collects HRV data and plots graphs. In case of an emergency situation, the care taker and doctor are intimated through Short Message Service (SMS) for providing adequate medical help. While there are currently no HRV analysis systems that alerts at times of high risk for hypertensive patients along with the aid of a remote doctor, the proposed system aims at achieving the same. The proposed system combines the dual benefits of Zigbee and Wi-Fi technology. By doing so, it successfully fulfils all the ideal traits of a remote health monitoring system in terms of low-cost, long range, security, promptness and easy-to-use that serves in saving lives.

[2] M.Raihan et al (2016)An Android based prototype software has been developed by integrating clinical data obtained from patients admitted with IHD. The clinical data from 787 patients has been analyzed and correlated with the risk factors like Hypertension, Diabetes, Dyslipidemia (Abnormal cholesterol), Smoking, Family History, Obesity, Stress and existing clinical symptom which may suggest underlying non detected IHD. The data was mined with data mining technology and a score is generated. Risks are classified into low, medium and high for IHD. On comparing and categorizing the patients whose data is obtained for generating the score; we found there is a significant correlation of having a cardiac event when low & high and medium & high category are compared ; p=0.0001 and 0.0001 respectively. Our research is to make simple approach to detect the IHD risk and aware the population to get themselves evaluated by a cardiologist to avoid sudden deaths. Currently available tools have some limitations which makes them underutilized by population. Our research product may reduce this limitation and promote risk evaluation on time.

[3] Salma Banu.N.K et al (2016) In this paper, the various technologies of data mining (DM) models for forecast of heart disease are discussed. Data mining plays an important role in building an intelligent model for medical systems to detect heart disease (HD) using data sets of the patients, which involves risk factor associated with heart disease. Medical practitioners can help the patients by predicting the heart disease before occurring. The large data available from medical diagnosis is analyzed by using data mining tools and useful information known as knowledge is extracted. Mining is a method of exploring massive sets of data to take out patterns which are hidden and previously unknown relationships and knowledge detection to help the better understanding of medical data to prevent heart disease. There are many DM techniques available namely Classification techniques involving Naïve bayes (NB), Decision tree (DT), Neural network (NN), Genetic algorithm (GA), Artificial intelligence (AI) and Clustering algorithms like KNN, and Support vector machine (SVM). Several studies have been carried out for developing prediction model using individual technique and also by combining two or more techniques. This paper provides a quick and easy review and understanding of available prediction models using data mining from 2004 to 2016. The comparison shows the accuracy level of each model given by different researchers.

[4] Megha Koshti (2016) Our main objective is to implement a monitoring system which monitors the heart pulse of a patient. This work presents a novel easy-to-use system intended for the fast and noninvasive monitoring of the Lead I electrocardiogram (ECG) signal by using a wireless steering wheel. The steering wheel used here is a prototype model. As the World-Wide Web (WWW) continues to evolve, it is clear that its underlying technologies are useful for much more than just browsing the web. Web browsers have become the de facto standard user interface for a variety of applications including embedded real time applications. The embedded web server technology is the combination of embedded device and Internet technology. Through this embedded web server user can access their equipment's remotely. The equipment mentioned here could be home appliances and factory devices. A novel heart rate detection algorithm based on the continuous wavelet transform has been implemented, which is specially designed to be robust against the most common sources of noise and interference present when acquiring the ECG in the hands. Skin Electrodes were used to record the nerve voltages for monitoring the heart pulse. The voltages recorded will be sent to an instrumentation

amplifier which amplifies the signal, and then to a filter which filters the noise. Thus, analog signal is given to Analog-to-Digital Convertor (ADC) of Arduino. There, analog voltages are been converted to digital and that digital values will be stored in the EEPROM of Arduino. The values stored in EEPROM will be sent to PC via serial (RS232) wired interface and a serial port will be opened in the MATLAB by using a serial object. GUI is programmed to make the user interface interactive and simple. Using the real time plot, I've plotted the values received by XBEE module and making a running waveform which displays when the MATLAB sent a query to Arduino.

[5] Samr Ali et al (2017) Continuous growing interest in IoT applications particularly for a smart city setting has attracted many researchers. E-health applications in IoT networks are the newest area of interest in this research field. On the other hand, networking and communications fields are witnessing a revolution through the new concepts of Mobile Edge Computing (MEC) characterized by latency sensitivity and geographical awareness. Moreover, the Software Defined Network (SDN) is an innovative network paradigm that allows programming of the network through the separation of the data plane and the control plane and provides global intelligence for the network. We marry this technologies to propose a novel IOT e-health service; Real time Heart Attack Mobile Detection Service (RHAMDS) through voice control and gesture control using smart watches. RHAMDS aims to improve response time of emergency aid for heart attack patients, in vehicular networks in particular, and to prevent the possible resulting vehicle collisions. In this paper, we present the proposed RHAMDS's network architecture, workflow, and model variations.

Design of Proposed Hardware

Development of Smart HRV monitoring system for hyper tension patients with Raspberry PI has been discussed in this section. The platform has three main parts: the sensor, Controller board, IoT module

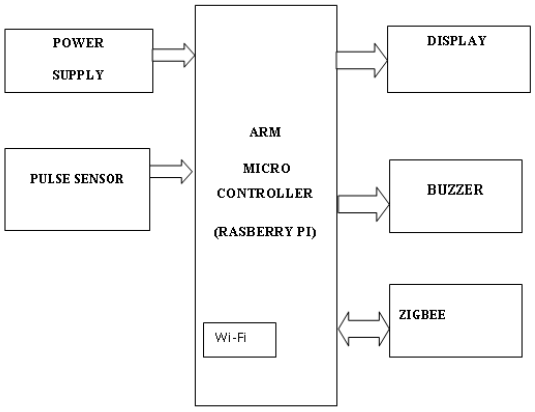

Fig. 1.Patients Section

The block diagram of the proposed system consists of Raspberry Pi microcontroller is interfaced with A Pulse sensor which measures the HRV of the patient. These values are sending to the microcontroller for comparing the range of normal and critical values of the patient. The pulse values are sending to the Web server by using Wi-Fi present in Raspberry pi and also sending these values to nearest monitoring person by using ZigBee Technology.

Modules used in this project

Technologies used in our project to get effective data of a patient health details are:

PULSE SENSOR

Pulse sensor is also called as Heart Beat Sensor. This heart beat sensor is designed to give digital output of heat beat when a finger is placed inside it. When the heart detector is working, the top-most LED flashes in unison with each heart beat. This digital output can be connected to microcontroller directly to measure the Beats Per Minute (BPM) rate. It works on the principle of light modulation by blood flow through finger at each pulse.

Fig.2.Pulse Sensor

ZIGBEE:

ZigBee technology is a low data rate, low power consumption, low cost; wireless networking protocol ZigBee can be implemented in mesh networks larger than is possible with Bluetooth. ZigBee compliant wireless devices are expected to transmit 10-75 meters, depending on the RF environment and the power output consumption required for a given application, and will operate in the unlicensed RF worldwide (2.4GHz global, 915MHz Americas or 868 MHz Europe). All ZigBee hardware designer has to do in this case is ensure that the host's serial port logic levels are compatible with the XBee's 2.8- to 3.4-V logic levels. The logic level conversion can be performed using either a standard RS-232 IC or logic level translators such as the 74LVTH125 when the host is directly connected to the XBee UART. The X-Bee RF Modules interface to a host device through a logic-level asynchronous Serial port. Through its serial port, the module can communicate with any logic and voltage Compatible UART; or through a level translator to any serial device.

Data is presented to the X-Bee module through its DIN pin, and it must be in the asynchronous serial format, which consists of a start bit, 8 data bits, and a stop bit. Because the input data goes directly into the input of a UART within the X-Bee module, no bit inversions are necessary within the asynchronous serial data stream. All of the required timing and parity checking is automatically taken care of by the X-Bee's UART.

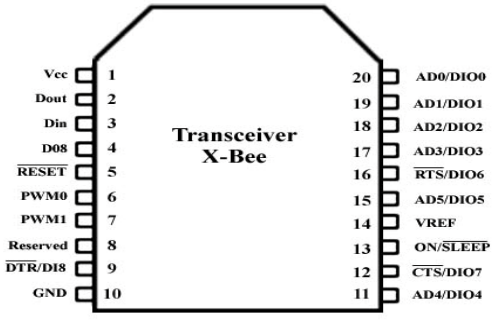

Fig.3. ZIGBEE pin diagram

FLOW CHART

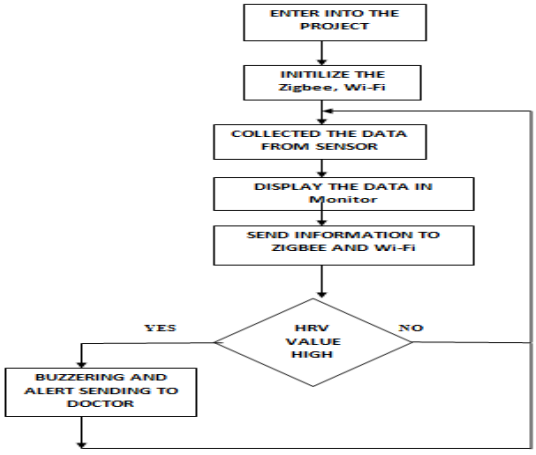

Fig.3. FLOW CHART

WORKING

- Whenever on the HRV monitoring system First of all patient wear the pulse sensor here pulse sensor used for measuring the pulse rate of the patient.
- The sensor collect the pulse value and sent the information to the micro controller for data processing and display shows the pulse value.
- And the data will be updated to local storage by using ZigBee wireless communication technology.
- Here ZigBee will be interfaced to the Raspberry Pi board by using UART protocol.
- And this same information will be updated into Hospital server by using Wi-Fi.
- In the Raspberry Pi board the pulse value will be analyzed by threshold values if any values greater or less than threshold value it will provide alert to the Doctor and nearest peoples by using Communication technologies and Buzzer.

RESULTS

In this HRV monitoring application Implementation need hardware modules in the below fig indicates the Hardware modules and sensors interfacing.

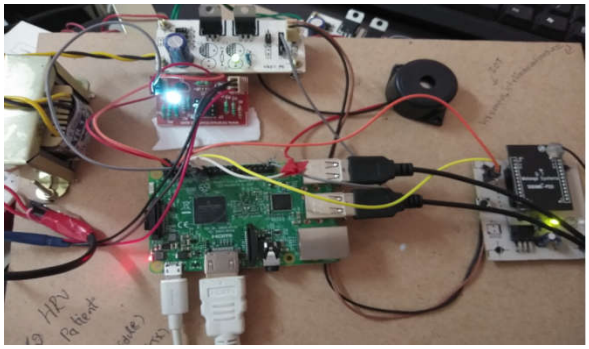

Fig.4 Hardware model of the HRV Monitoring

After connecting all required hardware Raspberry pi board connected to 5v/2A adopter for on the board and HDMI to VGA cable for display the data in Monitor.

After Powering the Pi board and click on the LX Terminal it shows the operation of RPi board as shown in below figure.

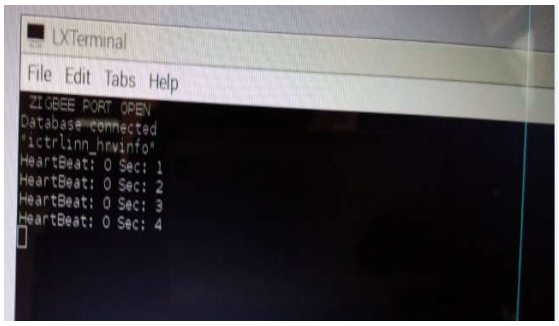

Fig.5 LX Terminal Display

In this shows the initialization of ZigBee and Data base connection establishment. Completing the initialization pulse sensor attached to the finger as shown below figure

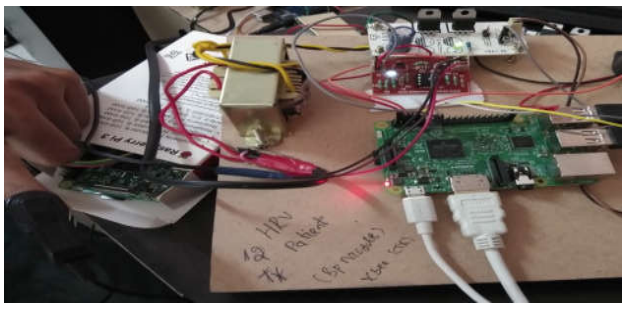

Fig.6 Pulse sensor wearing to finger.

Up to 60 sec it counts the pulse of the patient after completing the time pulse of the patient will be shown in UI window.

The pulse value of the patient will be vary according to the patient condition like as shown below figures

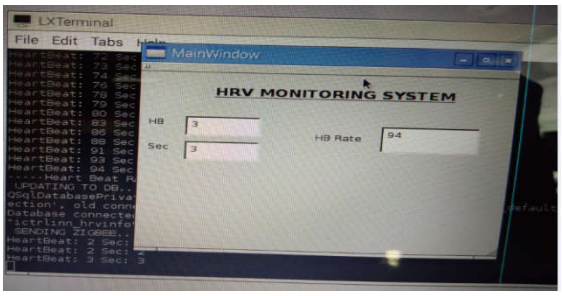

Fig.7 Pulse value for normal patient.

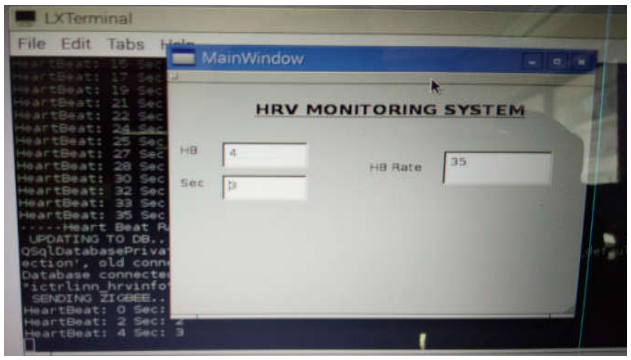

Fig.8 Low Pulse value of patient

Fig.9 Pulse value of HRV patient.

After displaying the data in the Ui Window data will be updated in to Local monitoring section by using ZigBee technology and IOT web server by using Inbuilt Wi-Fi Module of the Pi board.

To monitoring the HRV patient pulse information by doctor anywhere by clicking the web link they get the values of present pulse value in shown fig 6.7 and complete patient pulse value will be shown in fig 6.8

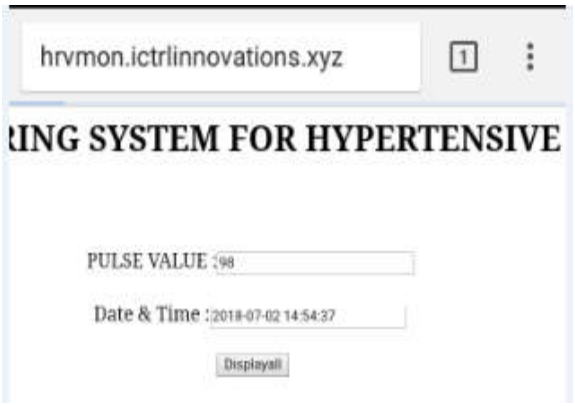

Fig.10 Pulse value of Patient in IOT web server.

Fig.11 HRV patient pulse data.

CONCLUSION

Our proposed system provides the immediate care to the HRV patients in hospitals by continuously detecting the changes in their vital parameters. And also it leads to an improvement in quality of care in hospitals.

FUTURE WORK

Future work will focus on monitoring additional health related parameters using a broader combination of transducers, sensors, and correlation techniques, and on improving system reliability and robustness to patient movement and connectivity losses.

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