International Journal of Applied Engineering Research ISSN 0973-4562 Volume 13, Number 5 (2018) pp. 2786-2790

A Cloud Based Risk Prediction of Coronary Heart Disease

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Abstract

Many people are losing their life due to heart attack. Due to the late detection of the attack we are unable to save the life of human. In this project, an android based prototype software has been developed by integrating clinical data obtained by patients. This portable system gets the electrocardiogram signals of the patients continuously and compares it with the values present in the database for abnormalities Risks are classified into low, medium and high and these values are updated in the cloud for ease of observation for medical practitioners so that, they can help the patients by predicting heart disease before occurring. Also an email is sent to patients care taker for predicting the risk parameters of the patients. This approach aware the patients to get themselves by a cardiologist to avoid sudden death.

Keywords: Risk prediction, Coronary Heart Disease.

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.

In 2015Coronary Artery Disease (CAD) affected 110 million people and resulted in 8.9 million deaths. It makes up 15.9% of all deaths making it the most common cause of death globally. The risk of death from CAD for a given age has decreased between 1980 and 2010, especially in developed countries. The number of cases of CAD for a given age has also decreased between 1990 and 2010. In the United States in 2010 about 20% of those over 65 had CAD, while it was present in 7% of those 45 to 64, and 1.3% of those 18 to 45.Ischemic heart disease(IHD) is one of the major cause of deaths worldwide. As per WHO's report the death toll is 6.96 % in Bangladesh due to ischemic heart diseases (IHD), which ranks it first as the cause of death. There should be extensive efforts at various levels to reduce the mortality and morbidity out of IHDs. In literature there is enough evidence to show that the risk of IHD increases with the risk factors a person has. Preventive medicine is gaining importance and popularity globally. For some diseases, prevention is better than cure. IHD episodes can be primordially, primarily and secondarily prevented. A strategy to prevent development of risk factors or control of risk factors will modify the risk of IHD. Having episode of IHD has long lasting effects on the individual from having repeated episodes of chest pain to having limited quality of life due to heart failure and even death. It is the need of the hour to make maximum number of people aware for health and make them to walk up to a doctor for preventive health checks. Smartphone mobile devices are one of the most widely utilized technologies worldwide. Through it, various applications are being developed and being used by general population for various means. In fact, there is good mental impact of information when mobile application tells about something to an individual. Development of a smartphone based tool would benefit masses of people. Currently there are certain tools available to predict risk of IHD which bears excellent academic excellence but are underutilized by general people due to few limitations like mandatory inputs of Lipid profiles and Blood Pressure (BP) values moreover, these risk scores do not individualizes the risk. Development of a tool to predict the heart attack risk based on risk factors may push much of population to check their own risk. 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 IHD 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. The application generates a score based on the input and categorizes the person into low, medium or high risk.

Hypertension is a condition where the blood pressure in the arteries of the body is higher than 120/80 mm Hg (more than 120 systolic and more than 80 diastolic). 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 [16]. 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 acts 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

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 WiFi 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.

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 has some limitations which makes them underutilized by population. Our research product may reduce this limitation and promote risk evaluation on time.

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.

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.

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) characterised 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

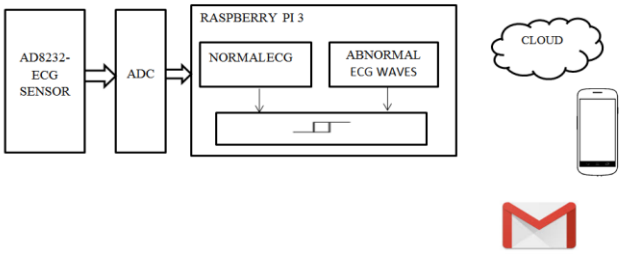
patients, in vehicular networks in particular, and to prevent the possible resulting vehicle collisions. In this paper, we present the proposed RHAMDS's network architecture, workflow, and model variations.

PROPOSED SYSTEM

The surveyed papers have laid a path to implement portable remote device to monitor the coronary heart patient. The proposed system aims to develop a smart embedded system by monitoring the patient throughout by the sensor interfaced with the controlling unit. The sensor continuously senses the heart rate and converts the analog values into digital value by using a analog to digital converter. Then the resultant values are compared with the past history of the patient which is stored in the controlling unit and the heart rate result are updated to the cloud, android application and in case of abnormalities a e-mail is send to the health care. As a result the proposed system proposes the proficient usage of the resource and reliable data communication. In future more reliable sensor modules can be integrated with the portable remote unit.

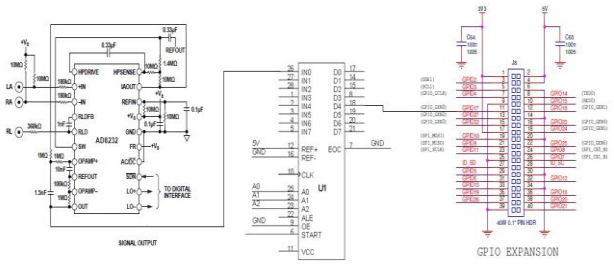
BLOCK DIAGRAM

The block diagram of the proposed system consists of Raspberry Pi microcontroller is interfaced with an IC3208 for analog to digital conversion of ECG waves that is sensed by the Electrocardiogram monitoring module. Digital values are send to the microcontroller for comparing the range of normal and critical ECG values of the patient. The ECG waves are plotted by using matlab plot functions for send the ECG wave of critical conditions to the patient to the health care. Both normal and abnormalities are observed mail is send to the health care. The current observation of the ECG values are updates in Thing speak cloud and android application developed.



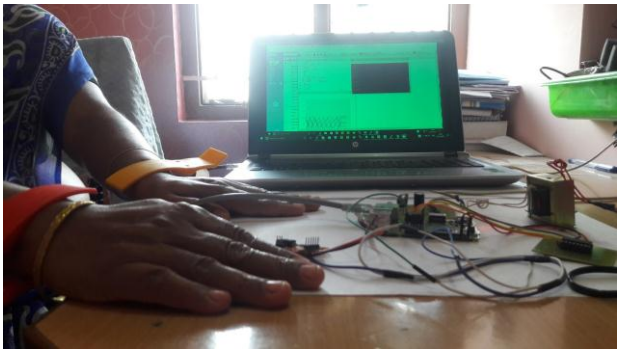
SCHEMATIC DIAGRAM

The portable device is designed using the Raspberry Pi 3 board. The Raspberry Pi board is given a power supply of about 5V. The sensors which are connected are given power through the GPIO pins. A ECG sensor AD3282 is connected to the GPIO pin of the Pi board, to monitor the patient's heart beat. In order to convert the analog values detected by the sensor into digital value a ADC converter module is used with MCP3208. The patient's heart beat is converted into digital values continuously.A ECG sensing module is interfaced with the Pi board of the device to sense the patient's heart beat.



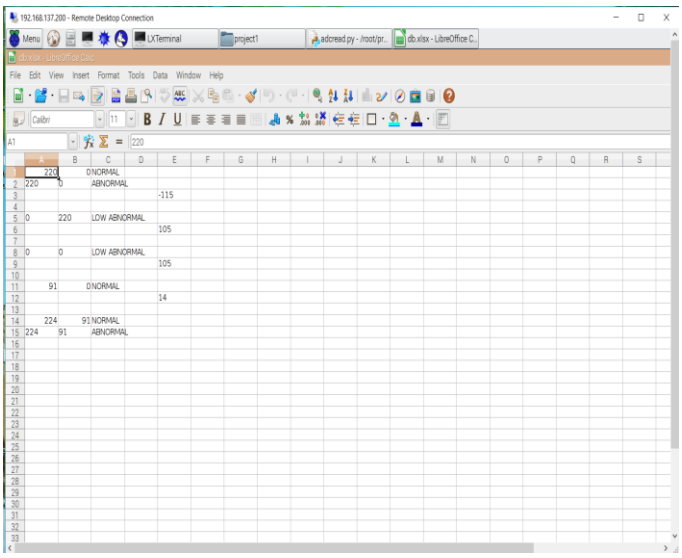
EXPERIMENTAL SETUP

The proposed system for predicting coronary heart disease is developed and the results are obtained as discussed here. The Raspberry Pi 3 module is integrated with the ECG Monitoring sensor module for sensing the heart beat of the patient. In the overall module Raspberry Pi 3 board and sensor is provided with separate power supply. The Raspberry Pi 3 requires 5V, 2A and the sensor module also requires a 5V power supply. Figure below shows the Experimental setup of this project.



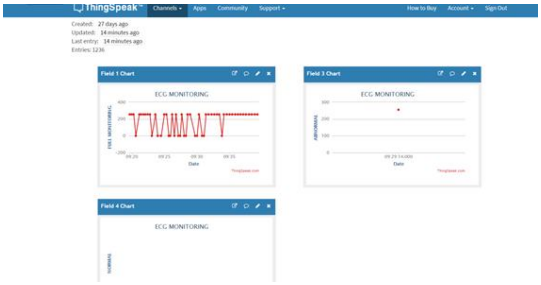
ANALYSIS OF PREDICTIVE ALGORITHM

Analysis of heart rate to predict the coronary heart disease is done by the algorithm developed and the past history of the patient stored in the Raspberry Pi3. Here the algorithm calculates the normal and abnormal range and then predicts the Coronary Heart disease.



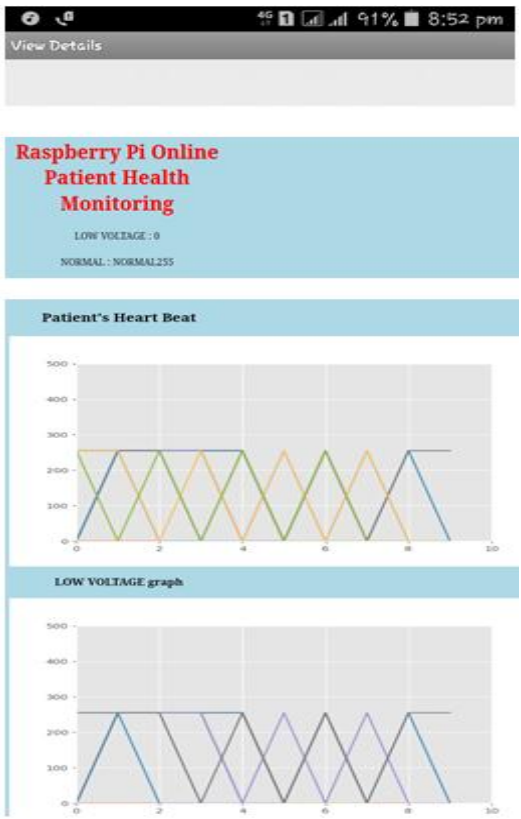
RESULT

After the analysis of predictive algorithm the values are upload to the cloud and mobile application developed, critical conditions are mailed to the patient registered health care.



Data uploaded to Thingspeak Cloud

Mail Send to Health Care of the Patient



Current ECG values updated in the Mobile Application

CONCLUSION

In this project, design and implementation of smart monitoring system is proposed. This system continuously monitors the coronary heart patient and updates the data to the Thingspeak cloud and if any abnormalities are observed an e-mail notification is send to the health care. The patient can view his ECG details using ECG Monitor application developed.

FUTURE WORK

The developed system can be converted into a wearable device by increasing the complexity of algorithm to predict the heart attack.

REFERENCE

[1] R.N.Rirtana, Y.V.Lokeswari,An IoT Based Remote HRV Monitoring SystemForHypertensive Patients,IEEE International Conference on Computer, Communication, and Signal Processing (ICCCSP-2017) 978-1-5090-3716-2/17/$31.00 ©2017 IEEE

[2] M.Raihan, Saikat Mondal, Arun More,Md.Omar Faruqe Sagor, Gopal Sikder, Mahub Arab Majumder,Mohammad Abdullah, Smart Based Ischemic Heart Disease (Heart Attack) Risk Prediction Using Clinical Data and Data Mining Approaches, a Prototype Design,19th International Conference on Computer and Information Technology, December 18-20, 2016, North South University, Dhaka, Bangladesh.

[3] Salma Banu N.K, Suma Swamy, Prediction of Heart Disease at early stage using Data Mining and Big Data Analytics, A Survey, 2016 International Conference on Electrical, Electronics, Communication, Computer and Optimization Techniques (ICEECCOT) .

[4] Mamidi Manisha, Katakam Nerraja, Vemuri Sinhura, Paruchuri Ramya, IoT on Heart Attack Detection and Heart Rate Monitoring ,International Journal of Innovation in Engineering and Technology(IJIET).

[5] Dr.Neeraj Bhargava, Sonia Dayma. Abishek Kumar, Pramod Singh, An Approach for Classification using Simple CART Algorithm in Weka,2017 11 th International Conference on Intelligent Systems and Control (ISCO) .

[6] M. Raihan, Saikat Mondal, Arun More, Md. Omar Faruqe Sagor, Gopal Sikder, Mahbub Arab Majumder, Mohammad Abdullah Al Manjur and Kushal Ghosh Smartphone Based Ischemic Heart Disease (Heart Attack) Risk Prediction using Clinical Data and Data Mining Approaches, a Prototype Design, 19th International Conference on Computer and Information Technology, December 18-20, 2016, North South University, Dhaka, Bangladesh.

[7] Kusprasapta Mutijarsa,Muhammad Ichwan, Dina Budhi Utami,Heart Rate Prediction Based on Cycling Cadence Using Feedforward Neural Network,2016

International Conference on Computer, Control, Informatics and its Applications.

[8] J. Mohammed, C. H. Lung, A. Ocneanu, A. Thakral, C. Jones and A. Adler, Internet of Things: Remote patient monitoring using web services and cloud computing, Internet of Things (iThings), 2014 IEEE Int. Conf., and Green Computing and Communications (GreenCom), IEEE and Cyber, Physical and Social Computing (CPSCom),Taipei,2014, pp. 256-263.

[9] N. Natarajan, A. K. Balakrishnan and K. Ukkirapandian,A study on analysis of Heart Rate Variability in hypertensive individuals, Int. J. of Biomedical and Advance Research, vol. 5, no.2, pp. 109-111, 2014.

[10] L. Burke, J. Ma, K. Azar, G. Bennett, E. Peterson,Y. Zheng, W. Riley, J. Stephens, S. Shah, B. Suffoletto, T. Turan, B. Spring, J. Steinberger and C. Quinn,Current Science on Consumer Use of Mobile Health for Cardiovascular Disease Prevention, Circulation, vol. 132, no. 12, pp. 1157-1213, 2015.