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Automated Cardiac Monitoring System for Pervasive Healthcare services in THINGSPEAK Cloud with KNN Algorithm

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***Abstract*: The Internet of Things (IoT) techniques have irresistible superiority in solving the problems of cardiac diseases attack they can change the service mode into a pervasive way, and trigger the healthcare service based on patients' physical status rather than their feelings. In order to realize the pervasive healthcare service, a remote monitoring system is essential. The proposed system is a pervasive monitoring system that can send patients' physical signs to remote cloud application in real time IoT. The system is mainly composed of two parts: the data acquisition part and the data transmission part. The monitoring scheme (monitoring parameters and frequency for each parameter) is the key point of the data acquisition part. Multiple physical signs (blood pressure, Temperature, heart rate and Mem's sensor(Paralysis) as well as an environmental indicator with GPS (patients' location) are designed to be sampled at different rates continuously and send notification SMS to specific people using GSM. Four data transmission modes are presented taking risk, medical analysis needs, demands for communication and computing resources into consideration. Finally, a sample prototype is implemented to present an overview of the system To achieve the accurate percentage of prediction of the Health Care on the dataset with machine learning algorithm. Loading the dataset with proper cleaning and stemming with preprocessing and set them for clustering and classification. Based on the classification we need to predict the percentage patients with the concrete reason based on the type of the attributes which is crossing the threshold. This threshold should be generated by mean weighted average vector. So proper boundary of accuracy comes for classification. For prediction feasible algorithms KNN is used.**

***Keywords:* Heart rate sensors Pervasive, KNN, Thing Speak, Cardiac, GSM.**

1. Introduction

Nowadays, heart diseases cause more than 1,500,000 deaths in China and various countries each year and are now the leading cause of death in the country. Usually, patients with heart diseases live at home and ask for healthcare service when they feel sick. However, usually they won't feel sick until the very late stage of the disease, and it is so late that the damages have already turned irreversible. And most of the patients die before they get any treatment. Therefore, the key to improve heart diseases healthcare performance and reduce the death rate is turning the passive healthcare mode into a pervasive way.

That means the physical status of patients should be monitored by physicians, who will decide when to delivery healthcare service based on patients' real-time status. The essential part of this pervasive healthcare mode is the real-time monitoring system.

As the amount of elderly people and chronic diseases patients grow rapidly, drawbacks of traditional healthcare service are increasingly prominent. The most significant one is that healthcare service is only available in hospitals, so it is inconvenient for elderly or disabled people, and cannot fulfill healthcare demands under emergency conditions. The main objective of this project is to transmitting the patient's health monitoring parameters through wireless communication. These input data are uploaded in cloud server and transmitted to the computer and mobile for family and doctor's reference. Advances in information and communication technologies have led to the emergence of Internet of Things. In the modern health care environment, the usage of Internet of Things technologies brings convenience of physicians and patients, since they are applied to various medical areas (such as real-time monitoring, patient information management, and healthcare management).

With the proposed Internet of Things (IoT) technique, it is feasible to monitor vital functions of human no matter where they are and what they are doing. Additionally, the data acquired can be sent to the remote physicians with low cost SMS, which ensures these experts be aware of patients' physical status continuously and in real-time IoT Server. we proposed an IoT-based monitoring system for pervasive heart diseases healthcare with GPS and GSM technologies. This system monitors the patients' physical signs such as blood pressure, ECG, Heart rate and Temperature as well as relevant environmental indicators location continuously, and provides four different data transmission modes that balance the healthcare need and demands for communication and computing resources also first aid operations performed with two gear motor if no response from remote users. This monitoring system fulfills the basic needs of pervasive healthcare for heart diseases, also takes the cost into consideration to ensure the pervasive mode as economical as possible.

Discovery of the Health Care on various patients manually is too complex and tedious and that too with multiple attributes and parameters. So this work proposes the machine learning model for training and testing process. First we take the dataset and divide into 2 parts for training and testing. First part will be made with the classification using generated thresholds on each and every attributes. And the classification will be shown in the graph. Next for all the testing tuples inputs will be given to KNN algorithm so that classification will be done according to the flow of the regular process of relevant algorithms. And will be compared for predictive analysis for accuracy. The International Health Care Federation has claimed that presently 246 million people are suffering from Health Care worldwide and this number is expected to increase up to 380 million by 2025.

2. System design

The system is classified into two parts, viz. Hardware & Software.it consists of:

A. Heart beat sensor

A person's heartbeat is the sound of the valves in his/her's heart contracting or expanding as they force blood from one region to another. The number of times the heart beats per minute (BPM), is the heart beat rate and the beat of the heart that can be felt in any artery that lies close to the skin is the pulse

- *Manual Way:* Heart beat can be checked manually by checking one's pulses at two locations- wrist (the radial pulse) and the neck (carotid pulse). The procedure is to place the two fingers (index and middle finger) on the wrist (or neck below the windpipe) and count the number of pulses for 30 seconds and then multiplying that number by 2 to get the heart beat rate. However, pressure should be applied minimum and also fingers should be moved up and down till the pulse is felt
- *Using a sensor:* Heart Beat can be measured based on optical power variation as light is scattered or absorbed during its path through the blood as the heart beat changes.

B. GSM

The GSM system is the most widely used cellular technology in use in the world today. It has been a particularly successful cellular phone technology for a variety of reasons including the ability to roam worldwide with the certainty of being able to be able to operate on GSM networks in exactly the same way - provided billing agreements are in place. The letters GSM originally stood for the words Groupe Speciale Mobile, but as it became clear this cellular technology was being used worldwide the meaning of GSM was changed to Global System for Mobile Communications. Since this cellular technology was first deployed in 1991, the use of GSM has grown steadily, and it is now the most widely cell phone system in the world. GSM reached the 1 billion subscriber point in February 2004, and is now well over the 3 billion subscriber mark and still steadily increasing

C. Gear motor

A gear motor is a specific type of electrical motor that is designed to produce high torque while maintaining a low horsepower, or low speed, motor output. Gear motors can be found in many different applications, and are probably used in many devices in your home

D. Relay driver IC ULN2003

This project is designed for a three-phase-solid-state relay system. It incorporates three single phase units wherein each phase is controlled individually by power TRIAC with RC snubber network for a zero-voltage switching (ZVS). The relay driver ULN2003 IC is a high voltage and current darlington array IC, it comprises of 7-open collector darlington pairs with common emitters.

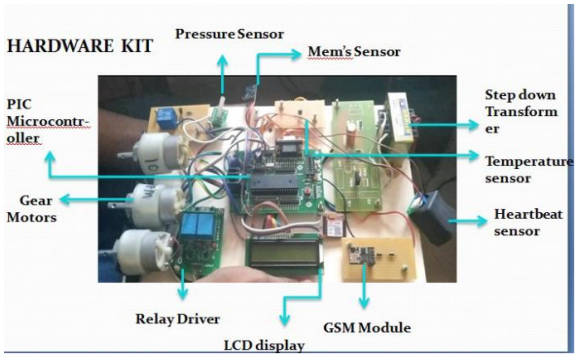

Fig. 1. Hardware part of the architecture

E. Software Implementation using ML algorithm

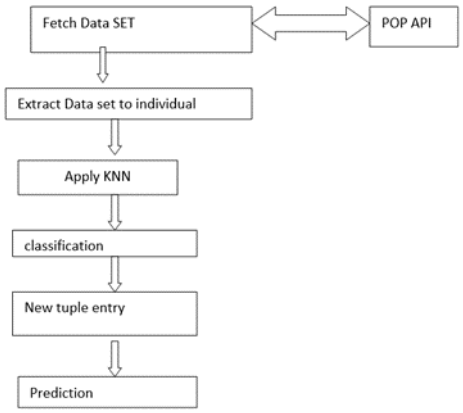

Fig. 2. Flowchart

- The K-nearest neighbour approach is most accessible of all machine learning algorithms, and it is easy to conclude the outcome of KNN. This KNN algorithm can be used to predict labels of any type. An element is classified by a majority vote of its neighbours, and

the element is doled out to the class most regular among its K nearest neighbours where K gives a positive integer range from 1 to n number of trained set of elements.

- Analytically it is strong
- It is easily adaptive to both traditional and local information. KNN algorithm uses the closest data to estimate points so that it can take full advantage of local information and form highly nonlinear to take decision boundaries for each data point.
- Parallel implementation can be done quickly as it is instance based. So for each data point has to be calculated and scored. The algorithm will check against the training table for the K nearest neighbour. As each data point is independent of the others or neighbours parallelly, we can conduct execution of search and score.
- The training sample elements are described by using n-dimensional numeric attributes. These samples are stored in an n-dimensional space. When we want to test sample (unknown class label has to be predicted) the K-nearest neighbour classifier searches the K training samples which are closet to the unknown sample. Nearness is defined in terms of Euclidean distance. The Euclidean distance is a distance between two points P (p1, p2.....Pn and Q (Q1, Q2...Qn) given by the equation.

$$d(P,Q) = \sum_{i=1}^{n} (P_i - Q_i)^2$$

The KNN algorithm steps:

- The new tuple instance will be checked with the already available cases that are based on distance assignment and classified by using K value
- More the instances or tuples are similar then least distance is assigned and vice-versa
- Based on the distance the instance and K value are determined; the instance is assigned to a class.
- KNN classifier is K dependent since it predicts the outcome based on the value of K (number of nearest neighbours). Hence for different values of K, the outcome may not be the same.

3. Thing speak

ThingSpeak is an IoT application and API to store and retrieve data from different sensors or devices in the system through internet. It allows creating channels which can be used to store data related to a project. It produces graphs with the collected data and hence provides an efficient way to analyze and monitor the data of interest. Read and write API keys are generated for each channel through which data can be read from or written to the channel. ThingSpeak also facilitates the use of Matlab functionalities by integrating Matlab from MathWorks within it. This eliminates the need of purchasing the Matlab license from MathWorks. To use the services of ThingSpeak, it is required to have an account in it.

Steps to create an account are:

- Open the url ie,https://thingspeak.com/
- Sign Up has to be clicked.
- After filling the details click continue.
- If the details are verified by the system, then a confirmation mail will be sent to the mail-id that we have provided while registering.
- Click on the verify link in the mail.
- Once verification is done, account will be created.
- Then create a new channel by clicking on New Channel.
- Provide name to your channel and select as many fields as you require.
- Check Make Private checkbox
- Click on save channel.
- Now, navigate to API keys item in the menu.
- You will find two keys: Write API and Read API.
- Once the data is received by the cloud, graphs will be plotted for the received values.

Any abnormalities in the health conditions can be known directly and are informed to the person registered

4. Results

The heart rate of monitored person can be seen on the hardware display as well as in the graph. It can also be seen on Cloud in the form of Graph. The heart rate and the graph can be plotted in real time on cloud which is with the doctor or guardian for monitoring the patient regularly. And the KNN algorithm is used and trained and tested with the dataset of patient with heart rate, BP etc. to achieve accuracy.

5. Conclusion

In this paper, we have analyzed automated cardiac disease using IoT. Any abnormalities in the health conditions can be known directly. The proposed system is simple, power efficient and easy to understand. It acts as a connection between patient and doctor. The hardware for the project is implemented and the output results are verified successfully. In this paper a real-time low cost heart disease monitoring system is introduced. If the system detects any of these abnormalities it will alert through SMS registered. The proposed system helps in remote heart rate monitoring of a person. It detects abnormalities if any in the monitored heart rate and reports the abnormalities to the concerned person through message. Information is stored in the cloud for future reference and analysis. Using KNN algorithm the accuracy is achieved by training with the dataset which is of BP, Heartrate values.

References

[1] Uniyal D, Raychoudhury V, “Pervasive healthcare-a comprehensive survey of tools and techniques,” Computing Research Repository, 2014.

[2] Lin, Q., Zhang, D., Ni, H., Zhou, X., Yu, Z. An integrated service platform for pervasive elderly care. Proceedings of the IEEE Asia-Pacific In Services Computing Conference (APSCC) 2012: 165–172.
[3] Ganz, A., Schafer, J., Gandhi, S., Puleo, E., Wilson, C., Robertson, M. PERCEPT indoor navigation system for the blind and visually impaired: architecture and experimentation. International Journal of Telemedicine and Applications 2012: 19.
[4] Hu, Y.X., Chen, Y., Li, L.M., Hao, H.W. Wireless wrist-wearable wake/sleep identification device for closed-loop deep brain stimulation. Proceedngs of the Electronics Letters 2013, 49(7): 452–453.
[5] Lee, J., Jung, J., Kim, Y.T. Design and development of mobile cardiac marker monitoring system for prevention of acute cardiovascular disease. Proceedings of IEEE Sensors 2011: 1724–1727.
[6] Poorejbari S, Vahdat-Nejad H, Mansoor W. Diabetes patients monitoring by cloud computing. Cloud Computing Systems and Applications in Healthcare 2016: 99.
[7] Varshney U. Pervasive healthcare and wireless health monitoring. Mobile Networks and Applications 2007; 12(2-3): 113-127.
[8] Rofouei, M., Sinclair, M., Bittner, R., Blank, T., Heffron, J. A non-invasive wearable neck-cuff system for real-time sleep monitoring. Proceedings of International Conference on Body Sensor Networks, Dallas, TXm USA, 23-25 May 2011.
[9] Majdi Bsoul, Hlaing Minn, Lakshman Tamil. Apnea MedAssist: real-time sleep apnea monitor using single-lead ECG. IEEE Transactions on Information Technology in Biomedicine 2011; 15(3): 416-427.
[10] C.T. Lin et al. Wireless and wearable EEG system for evaluating driver vigilance. IEEE Transactions on Biomedical Circuits and Systems 2014; 8(2): 165-176.
[11] Taskeen, Roopa, Anitha, Vishwanath, “IoT Based Remote Heart Rate Monitoring System, IJSTE, 2018.
[12] Alauddin Al-Omary, Wael El-Medany and Riyad Al-Hakim, “Heart Disease Monitoring System Using Web and Smartphone”. International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, vol. 3, no. 4, pp. 8265-8273, April 2014.