A Review Paper on Health Alert Wristband using VoIP Calls

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Abstract

The majority of the senior residents are regularly disregarded and are powerless in the midst of health-related crises. The current frameworks can help in keeping track of the condition yet don't have an automated alerting framework that can alert the concerned clinical specialists over long distances. Likewise, they are wired, which can meddle with the patient's movements. Wearable and wireless gadgets are present in the market, yet again their major drawbacks are being significantly expensive and an absence of automated alerting framework. The gadgets that have both wellbeings checking and alerting frameworks are simply exorbitant for ordinary people. To deal with this issue, we have thought of a prospective health alert system. The framework comprises a heartbeat sensor that will continuously monitor the pulse of the user. If the pulse rate deviates from the normal range, it will be detected by the Node MCU. In order to avoid a false alarm for healthcare services, the Node MCU will send an alert to the user using a buzzer in order to get confirmation from the user. The user will respond using the user input buttons, and the system will act accordingly. The location will be fetched from the GPS sensor, and healthcare services and relatives would be alerted about the user's condition and his location using VoIP Calls.

1. INTRODUCTION

The health monitoring and alert system focuses on developing a device that enhances the ability of an individual to protect the health of their friends and family. Monitoring refers to the action of observing signs and symptoms of a disease, a condition, or one or more medical parameters over a period of time. It is carried out by continuous measurement of parameters like pulse, blood pressure, respiratory rate, etc. by using a medical monitor or by performing laboratory tests.

Different sorts of frameworks for health monitoring are available in the market. However, the majority of the frameworks do not have an automated framework for sending alerts to the healthcare services in case of emergency. Likewise, they are very expensive and are not affordable for common people. Even the best devices for health monitoring like ECG machines can only be used on bed-ridden patients. Also, as they are wired devices, they obstruct the patient's movements.

The major drawbacks of existing devices that are wearable and wireless are that they are too expensive for a common man, and they also lack an automated alerting system.

Cardiac arrest can be identified with the help of various signs and symptoms. Some of the detectable signs of cardiac arrest are:

- Breathlessness
- Excessive perspiration
- Abrupt change in body temperature
- Cardiac arrhythmia

However, these symptoms may not always occur during a heart attack like during silent heart attacks. In this case, the victim is not aware of having a heart attack due to a lack of any of the detectable signs and symptoms of cardiac arrests. Even if this is the case, monitoring still plays an important role in saving lives.

2. LITERATURE SURVEY

In [1], it is stated that most of the senior citizens are frequently disregarded and are powerless in the midst of health-related crises. Furthermore, so as to handle this issue, they have thought of a system that uses sensors for monitoring parameters like changes in body temperature, hypertension, excessive perspiration, cardiac arrhythmia, etc. and integrates them with a microcontroller device to alert the clinical specialists during medical emergencies. The device developed is wireless so that it would not create a hindrance for the user's mobility.

In [2], the framework utilizes sensor innovation technology and the internet to convey to friends and family if there should arise an occurrence of a crisis. Temperature and heartbeat sensors are associated with the Arduino-Uno and are utilized to monitor the ring patient's wellbeing. The

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micro-controller device is interfaced with the LCD and wi-fi connection for sending the information to the web-server. If there are any changes in the pulse or temperature of the user, an alarm is sent about the patient utilizing the Internet of Things (IoT). This framework additionally shows the temperature and heartbeat of a patient with timestamps over the Internetwork.

In [3], it is disclosed how to build up a smart wristband to perform photoplethysmography (PPG). It is also called pulse oximetry. The developed wristband procures PPG signals and measures pulse continuously. The evaluated pulse can be transmitted by means of Bluetooth Low Energy (BLE) to a smartphone or PC that is put in the proximity of the device.

In [4], an effective and straightforward method of developing a wristband sensor is described. This sensor will categorize the events as "stressed" and "not stressed" for individuals with dementia. The framework figures the stress level as an integer from zero to five. An investigation was directed in which thirty staff individuals from two nursing homes participated together with six occupants experiencing dementia. During the test, the inhabitants were utilizing the wristband sensor, and the staff was composing observation notes. The result of this trial indicated the correlation between staff observations and sensor examination, while the limits of stress levels adjusted to every individual can form various situations.

In [5], Voice over Internet protocol (VoIP) is described as a new method for interaction and technology, which allows users to make telephone calls over an IP network. The security issues and concerns involved in VoIP are also discussed. Topics like business concerns of implementing VoIP, components of a VoIP system, and relevant security issues and concerns are explored. The business concerns are those that affect the Quality of Service (QoS). There are various types of VoIP components like end-user equipment, network components, gateways, and call processors. It also includes two common architectures: Session Initiation Protocol (SIP) and Denial of Service (DoS). The encryption and network address translation (NAT) are discussed, emphasizing their impact on the implementation of VoIP.

In [6], it is stated that pulse diagnosis is a common non-invasive method for measurement of the health of a person in Ayurveda. Examination of the pulse requires a lot of experience in pulse reading. There is a need to develop a pulse diagnosis system so as to obtain an accurate diagnosis of disease.

In [7], a framework for estimating the pulse using fingertip and Arduino is portrayed. It depends on the guideline of PPG. It is a system of estimating the changes in blood volume in the tissue utilizing a light source and detector. While beating, the heart actually pumps the blood throughout the body. This affects the blood volume inside the finger artery. An optical sensing mechanism that is placed around the fingertip is used to detect this fluctuation of blood volume. The signal is sent to Arduino with the help of serial port communication. Heart rate monitoring and counting is performed with the help of processing software.

In [8], the design of a wrist wearable device is proposed by integrating a few sensors to sense the heart rate fluctuations from the normal range. The smartphone is informed about the cardiac arrest, and the application on it will send alerts to a couple of emergency contacts.

In [9], it is expressed that roughly 2,000 individuals died every month because of their carelessness towards their wellbeing. This is because they don't possess energy for themselves and disregard their wellbeing due to an overwhelming amount of tasks at hand. Since IoT can make our life simpler, an IoT based healthcare project is proposed for individuals, which will give them all the individual data about their wellbeing on their phone, and they can likewise check their medical history.

In [10], the system consists of medical sensors that collect the data of bodily parameters of users and send it to an intelligent personal digital assistant. It signifies the importance of body sensor networks in the medical field. It helps the chronically ill and elderly people to live an independent life by minimizing the need for caretakers and also provides people with a system for healthcare. Although it has some advantages over the existing system, the field of body sensor networks still faces significant difficulties and research issues which are explored and secured alongside some proposed solutions.

3. EXISTING SYSTEM

Most of the systems we investigated are making use of a microcontroller device for monitoring the patient's condition and use a GSM module for sending alerts. In most of the cases, Arduino is used as the microcontroller device. The microcontroller device is connected to sensors to measure various parameters like temperature, pulse, etc. and alerts are sent if the parameters reach emergency levels. Drawbacks of the existing system:

- There is a need for trans and receiver
- Smart technologies like VoIP are not used
- For incorporating GSM module, there is a need of two microcontroller devices at the transmitter end and receiver end respectively

4. PROPOSED SYSTEM

The proposed system suggests a health alert system that will continuously monitor the pulse of the user and will inform the relatives of the user and healthcare services in case of emergencies. It uses a microcontroller device along with sensors for monitoring the body parameters and uses

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VoIP calls for alerting the healthcare services and relatives in case of emergencies.

4.1. System Layout

As shown in Figure 2, The proposed system comprises a microcontroller device called Node MCU. The framework consists of two sensors: the pulse sensor and the GPS sensor. The pulse sensor uses the principle of PPG and measures the pulse rate in BPM. The GPS sensor monitors the location of the user. The entire circuit of the Node MCU is provided with a 6 V power supply from a button-cell battery. All components, including the battery, are mounted on a wearable frame.

4.2. Working

As Shown in Figure 1, The Node MCU receives data from the pulse sensor and continuously monitors it. If the pulse rate deviates from the normal range, it will be detected by the Node MCU. The system will inform the user about the deviation of a pulse rate from the normal range through an alarm buzzer. The system will wait for the response of the user and act accordingly.

The system provides a set of three user input buttons. They are false alarm button, DND button, and SOS button.

In order to avoid sending false alerts to relatives and healthcare services, a false alarm button is incorporated into the system. Whenever the user receives an alert from

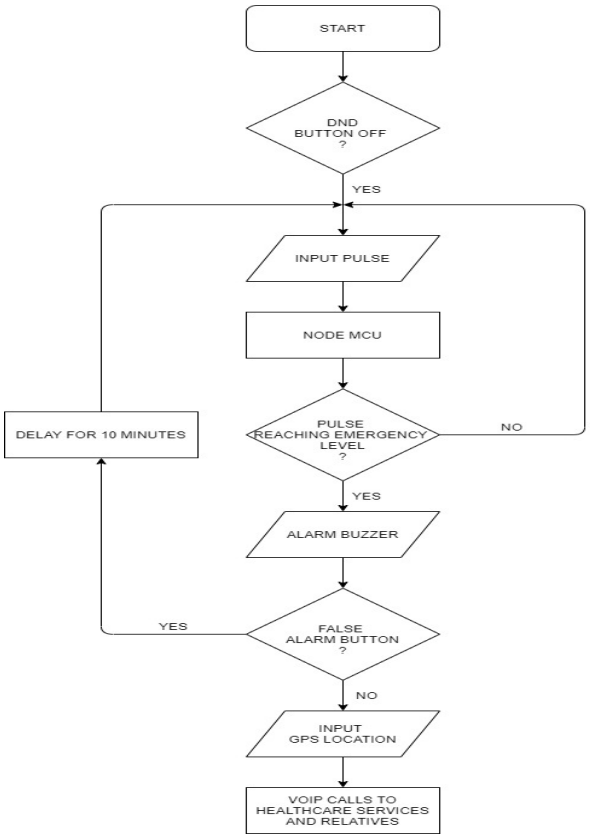

Figure 1: Operational flowchart

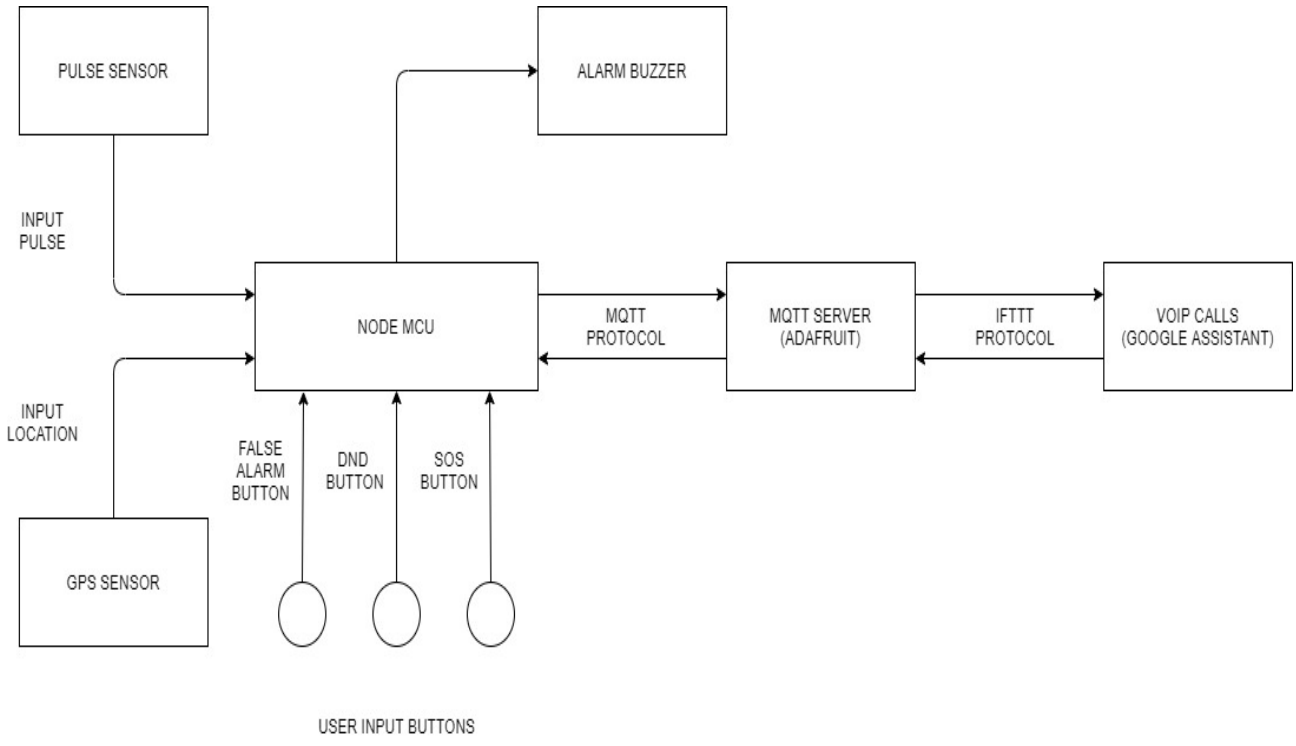

Figure 2: System Architecture

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the system through an alarm buzzer, the false alarm button can be used if the user is fine and doesn't find any apparent signs of a heart attack. This will cancel the alerts. If the user does not press a false alarm button within one minute after receiving an alert from the alarm buzzer, the alert will be sent to the user's relatives and healthcare services, respectively.

For the convenience of users, an additional feature called DND mode is introduced into the system. This feature allows the users to temporarily shut down the system for any important occasions where they do not want the system to send alerts. The user can press the DND button and activate the DND mode and can press the DND button again to deactivate the DND mode.

In cases like sensor damage or silent heart attack, it is difficult to detect cardiac arrests or heart attacks as there may not be any significant change in the parameters being monitored. An SOS feature is provided in the system, which bypasses the conventional pathway and sends alerts to relatives and healthcare services.

The alert consists of the patient's name and location, wherein the location is fetched from the GPS sensor. The alerts will be sent via calls and text messages using VoIP.

5. CONCLUSION

Nowadays, there are many cases of cardiovascular emergencies in both the elderly and young people. Therefore, there is an increasing demand for wearable health monitoring devices that do not meddle with the patient's movements.

The system monitors the heart rate of the patient, and health alerts will be sent to relatives and healthcare services when it reaches emergency levels using VoIP calls. The goal of the framework is to produce a wearable device that can monitor the condition of the user while not affecting the mobility of the user at affordable prices. The data of previously recorded heart attacks are considered as a base for defining normal and emergency conditions for the user. This data can be obtained from the hospital databases. There are various types of cardiovascular diseases which include minor cardiac arrests, sudden heart attacks, silent heart attacks, etc. wherein in most of the cases, the patients are not aware of the fact that they are having a heart attack. The measurement of medical parameters may not be that helpful for alerting relatives and healthcare services in such emergency cases. Even the maximum accuracy of ECG machines for monitoring heart rate is approximately 92%. Since the human body parameters keep changing constantly, it is hard to make an ideal framework that can accomplish 100% efficiency.

The goal of our system is to help the patients in case of all cardiovascular diseases, which can be detected by constant monitoring of certain human body parameters. Although the system may not have achieved 100% accuracy, it is still a versatile device that can detect any forms of cardiovascular emergencies and alert healthcare services. With further improvements and development, the system can also be responsible for detecting all other types of cardiovascular diseases and make a truly versatile and adaptable framework.

6. SCOPE FOR FUTURE WORK

With evolution and enhancement in sensors and transducers, more efficient sensors are available in the market, which can be incorporated in the framework. The frame design can be improved to become more attractive and user-friendly. Printed circuit boards (PCBs) and customized thin wires can be used to further enhance the framework by reducing external wiring. Big data can be incorporated into the framework for better analysis of the user's condition.

7. REFERENCES

[1] Valliappan.Sp, Prithvi Raj Mohan B, Rakesh Kumar, "Design of Low-Cost Wearable Remote Health Monitoring and Alert System for Elderly Heart Patients, "IEEE, School of Electrical and Electronics Engineering, SASTRA University, Thanjavur

[2] D.Shiva Rama Krishnan, Subhash Chand Gupta, Tanupriya Choudhury, "An IoT based Patient Health Monitoring System," 2018 International Conference on Advances in Computing and Communication Engineering (ICACCE-2018) Paris, France.

[3] Nicholas constant, Tanya Wang, "Pulseband: How to design smart wristband to monitor heart- rate" Researchgate Publications

[4] Basel Kikhia, Thanos G. Stavropoulos, Stelious Andreadis, "Sensor: To measure stress'' Mdpi journal.

[5] Rahul Singh Ritu Chauhan, "Review Paper: VOIP.," International Journal Of Advanced Research – (er publications)

[6] Krittika Goyal Ravindra Agarwal, " pulse-based sensor designer," Biomedical Research.

[7] Bandana Mallick, Ajit Kumar Patro, "Heart Rate Monitoring System Using Arduino And Processing Software," International Journal of Science, Engineering and Technology Research (IJSETR), Volume 5, Issue 1, January 2016.

[8] Vivek P N, Sushma S, Suhas R C, Reshma B S, Raksha Ramakrishna" Design and Implementation of smart wrist band in an emergency.", Advances in Electronics Volume 2015, Article ID 140762

[9] Sachin Kumar Verma," Iot based healthcare system"," Researchgate Publications.

[10] Narendra Kumar, Alok Aggarwal, and Nidhi Gupta, "WEARABLE SENSORS FOR REMOTE HEALTHCARE MONITORING SYSTEM," International Journal of Engineering

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