

Monitoring and Tracking the Heart Rate Using IoT System

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Abstract: The implementation on newer healthcare services for the elderly citizens has become a severe necessity today. There have been distinct health challenges focused in the society through technical innovations related to health. Most of the elderly citizens today experience loneliness and psychological depressions, either as a result of living alone or due to reduced connection with their family. To enhance the quality of services in the elderly healthcare system we have proposed an IoT (Internet of Things) based healthcare system to integrate various technologies of wearable devices, sensors and wireless sensor networks in order to provide an intensive service. This method would support the real time activity and monitor the health status for the elderly citizens. In purposed system, the information collected by various wearable devices in real time will be stored in the Central database which thereby connects people, doctors, and ambulance at the time of an emergency for getting right information. This way the system could increase accessibility, efficiency, and also will lower the health expenses to improve the comfort, safety and management of daily routines of an elderly life.

Keywords: IoT (Internet of Things), sensors, wearable device.

I. INTRODUCTION

Apart from the developments in hospital equipment's and pharmaceutical products, new catalyst in technological innovations like the internet has become a feasible platform for the elderly citizens. Wellbeing and extreme care can be manifested through applications on smart phones or other smart devices. The connectivity and communication gaps are bridged through these creative applications in a superfluous fashion. The IoT (Internet of Things) is a next generation technology which is connection of uniquely identifiable smart objects and sensors based on the backbone of Internet. These are connected in advanced manner and it can go beyond machine-to machine interactions. Using this automation the elderly healthcare system can be made more advanced. Global healthcare services are facing challenges because of the rapid growth of elderly population, thus a creative way is needed to face this challenge due to recent development in electronics and many number of devices have come up which can monitor patients' health record in real time as well as can be monitored remotely through Internet. The IoT enabled monitoring devices have RFID (Radio Frequency Identification) associated with it.

Using RFID these devices can be accessed over the Internet at any time which in turn will allow constant monitoring of the patients. So H2U healthcare system for elderly is important to meet the health service demands in order to monitor daily activities of the elderly people.

The project is aimed to continuously checking the heart beats and blood pressure of the user who has wear the heart beat sensor and blood pressure sensor. If the heart beat or blood pressure or both exceed or eluded the specific limit then the system sends message to the family member and doctor which is in users database. It also sends location of the patient with the message. And system sends command to buzzer for alarm.

II. LITERATURE SURVEY

In heart beat rate detection framework using multiple sensor signals (Nano fiber), a novel type of Nano fiber (NF) sensor signals, as a potential and alternative choice to ECG signals for heart beat monitoring, are investigated in this paper. To get the heart beat signal, three sensors are deployed at the wrist. However, detecting the heart beat rate (HBR) straight from the raw data is challenging because the signals of interest are masked by different types of noise. To address this concern, a two-step framework based on ensemble empirical mode decomposition (EEMD) and multi set canonical correlation analysis (MCCA) is proposed to extract the signals. The heart rate is one of the most important features that can be extracted from the ECG. This can be done by detecting the characteristic R peaks. Noise and artifacts can however interfere with the ECG, which makes it very hard to get accurate information from the R peak locations. Sometimes the ECG signal can even be completely use-less by for example loose contacts or a defect sensor. In these cases, only using the ECG for heart beat detection is clearly not enough. In multimodal datasets, information from other signals can be used in order to detect these R peak locations under noisy ECG conditions. Blood pressure (BP) and stroke volume (SV) signals can for example be acquired in a sleep monitoring application. Both these signals contain the same heart beat information and can also be used in order to estimate R peak locations. In Heart Beat Detection in Multimodal Data Using Signal Recognition and Beat Location Estimation paper, we suggest a method that is able to detect these signals of interest automatically, assuming that at least one ECG signal is available.

III. IMPLEMENTATION

Implementation Details:

In this project we are using arduino micro controller to develop IoT based application. For elderly persons, Help to You (H2U) is developed that measures heart beats and blood pressure of the person is measured continuously. Pressure sensor measures the pressure and Systolic and diastolic pressure is calculated. The heart beats are measured by Heart beat sensor. If heart beats or Blood pressure become abnormal, SMS is sent to doctors or family members along with current location of that person. Location is tracked by using GPS modem. Buzzer also sounds at that time. The parameters of the person are displayed on the webpage that can be accessed from anywhere.

Diagram:

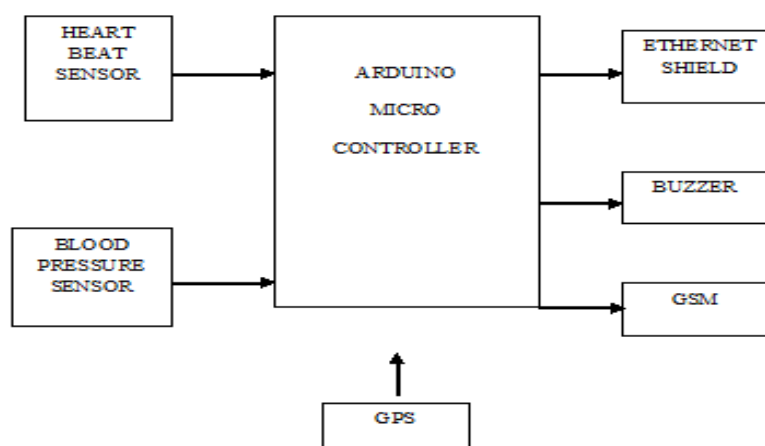


Fig 1. Data Flow

GPS Modem:

The main function of Global Positioning System (GPS) modem is to provide longitude and latitude of the ambulance. The data is received by GPS modem from satellite. And then it gives this bunch of data to Microcontroller through serial communication. As ambulance moves from patient's home to hospital, the co-ordinates of ambulance location will change and these variations are given to Microcontroller. GSM Modem: Main function of GSM Global System for Mobile Communications modem is to send all parameters to user or Doctor through a text SMS. For sending SMS, Microcontroller needs to give different AT commands to GSM modem using a serial communication port.

Heartbeat sensor:

Heart beats are very important for the health of human or we can say patient. Heartbeat sensor works on a principle that blood in the human body pumps with every heartbeat. We have used a LDR and Red LED. Patient needs to place her/his finger between these two components. Red light will reflect from patient's finger to LDR. And blood will pump with every heartbeat. This causes fluctuations in the light intensity. Heart beat sensor used in this system works on the above principle. It gives high pulses with every heartbeat. It works on pure 5 volt DC.

Ethernet Shield:

The Ethernet Shield allows an Arduino board to connect to the internet. It is based on the Wiz net W5100 Ethernet chip (datasheet). The Wiz net W5100 provides network (IP) stack capable of both TCP and UDP. It supports up to four simultaneous socket connections. Use Ethernet library to write sketches which connect to the internet using the shield. The Ethernet shield connects to the Arduino board using long wire-wrap headers which extend through the shield. This keeps the pin layout intact and allows another shield to be stacked on top.

Microcontroller: The microcontroller is main heart of our system. It is communicates with all input and output devices and it controls whole operation of the system of complete flow of the system. We have used 89s51 Microcontroller which is 8051 series Microcontroller. Following are the various functions of Microcontroller:

1. Reading sensor values through Analog to Digital Converter (ADC).
2. Reading longitude and latitude from GPS modem.
3. Reading heartbeat values.
4. Displaying these values on LCD display.
5. Sending these values to GSM modem so that SMS can be sent to the Doctor or any authorized person in hospital.
6. To turn on buzzer when any of the sensor values cross threshold limit.

Buzzer:

Buzzer is used to give indication about the parameter crossing a threshold limit. For example if temperature increases and it goes beyond certain value then the buzzer will be turned on. This is helpful so that the person near the patient in ambulance can be informed about the unwanted situation or about variation in the health parameter

Mathematical Model:-

In this paper, we propose an approach Heart Beat Detection System which helps to user if his/her heart beat or blood pressure is exceed over specific limit. If exceed over limit then this system sends the message to family member or doctor which is in database

System $S = \{U, H, B, A, G, E, Z, S\}$

Input = $\{H, B, G\}$

Output = $\{E, Z, S\}$

Where

U – Set of users

H- Heart beats

B – Blood Pressure

A– Arduino Micro Controller

G- GPS

E- Ethernet Shield

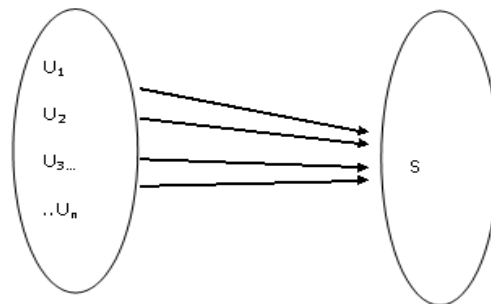
Z- Buzzer

S- GSM

Consider a set U consisting of various users,

$$U = \{U_1, U_2, U_3, \dots, U_n\}$$

The relation between User Set and System can be represented as follows, which is one to one relationships.



IV. CONCLUSION

IoT H2U health predictive analytics care system can provide early treatment and detect danger signs quite early to prevent the need for hospitalization. The length of hospital stay is minimized and the physician and nurses can be connected and monitor the patients based on the report generated by the real time sensors and daily clinical updates by the patient on the database server. It will also help the patient to intervene from any worries hopefully preventing any difficulties when they stay alone in home. The interaction through the IoT system is quite cost-effective and ensures higher security level in terms of communication.

REFERENCES

- [1] S.M.R. Islam, D. Kwak, MD.H Kabir, M. Hossain and K.-S Kwaki, "The Internet of things for health care: a comprehensive survey," IEEE Acces, vol. 3, pp.678-708, Jun. 2015.
- [2] M. Kumar, "Security issues and privacy concerns in the implementation of wireless body area network," in Proc. of Int. Conf. on Information Technology, Bhubaneswar, Odisha, India, pp.58-62, Dec. 2014.
- [3] S.K. Dhar, S.S. Bhunia and N. Mukherjee, "Interference aware scheduling of sensors in IoT enabled health-care monitoring system," in Proc. of Fourth Int. Conf. of Emerging Applications of Information Technology, Kolkata, West Bengal, India, pp.152-157, Dec. 2014.
- [4] A. Wood, G. Virone, T. Doan, Q. Cao, L. Selavo, Y. Wu, L. Fang, Z. He, S. Lin and J. Stankovic, "ALARM-NET: wireless sensor networks for assisted-living and residential monitoring," Technical Report CS-2006- 13, University of Virginia, 2006.
- [5] A. Boutayeb and S. Boutayeb, "The burden of non-communicable diseases in developing countries," International Journal Equity Health, vol. 4, 10.1186/1475-9276-4-2, pp.2-8, Jan. 2005.
- [6] H. Huo, Y. Xu, H. Yan, S. Mubeen and H. Zhang, "An elderly health care system using wireless sensors networks at home," in Proc. of Third Int. Conf. on Sensor Technologies and Applications, Athens, Greece, pp.158-163, Jun. 2009.
- [7] C.-C Lin, M.-J Chiu, C.-C Hsiao, R.-G Lee and Y.-S Tsai, "Wireless health care service system for elderly with wementia," IEEE Trans. on Information Technology in Biomedicine, vol. 10, issue 4, pp.696-704, Oct. 2006.
- [8] E. Jovanov, "Wireless technology and system integration in body area networks for m-Health applications," in Proc. of 27th Annual Int. Conf. of the IEEE Engineering in Medicine and Biology, Shanghai, China, pp.7158-7160, Jan. 2006.