A Review on Wireless Sensor Node for Simultaneous Monitoring of Health Parameters in Dengue Patients

Shikha kamboo, Vipra Bohara, Laxmi Narayam Balai

***Abstract*— The wide speed enhancements & accepitance of wireless communication & networking techniques & miniatiazation of electronic circuits has created an ever increasing demand for automatic monitaning & logging of various processes & parameters human physiological & vital parameters also need tabe monifored & logged especially in the case of elderly chonically ill or ander intensive case WBAN (wireless body area network) technologies are emerging day by day to provide for automated monitaning of various vital& non vitsl parameter of the human body the sfandarsds for medical WBAN are defined as IEEE 802.15.6 &IEEE802.15.6 WBAN allowe for weareable non invasive miniaturized sensor nodes to monitor various parameter & human baby functions this technology has the potiential to revobionize medice and allied industries especially telemedicine. Dengue ,is a vector generated disecase ,a type of painful fever ,with canse quential and life threating effects as sudden drop in blood pallet .this work is aimed at autenatic monitoring and logging of various vital parrameters of a dengue patient ,who needs continous monitaring ,The propased system ,implements measurement and software defined filtering of ECG Signals along with acquisition of temprature ,Spoz ,& Blood pressure (Systalic and Diastolic) .All these parrameters are accquired by the sensor mode & Sent to the central service over TCP/IP protocol .The server also in corporades on artifical never all net work ,which analyzes all the parrameters and predicts patient over all health status and generates alomms in case of emmergencies.**

***Index Terms*— Wire less body area Net work, Artificial Neural network, Dengue, IEEE802.15.4 ,IEEE802.15.6, Leven berg marquard nevral network , critical case.**

I. INTRODUCTION

The improvements in the wireless networking technologies and the integrated electronic circuits have allowed the advancement in the Wireless Body Area Network. WBAN offers many applications in remote health monitoring and medicine. IEEE 802.15.4j and IEEE 802.15.6 are standards for the medical WBAN. It allows the integration of intelligent and miniaturized sensor nodes in or on a human body to monitor the human body functions It has great potential to make a huge transformation in the future of medical industry. The WBAN concept provides plentiful new innovative ideas to enhance the health care systems.

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The paper presents a wireless monitoring system for patients who need continuous monitoring, using WBAN concept. This wireless monitoring system contains sensor network and remote monitoring application. It contributes to collection of the vital information of the patients such as temperature, pulse rate, ECG (electrocardiogram), oxygen saturation and blood pressure. Moreover, the system also provides management of information collected from the sensors, alert the administration in severe condition of the patients. The design and implementation of system are discussed in this paper.

II. DENGUE

Dengue is a neglected tropical disease that has become the fastest growing mosquito-borne disease, with almost half of the world's population now is at risk. The disease is one of the leading causes of serious illness among children and adults. Early detection of suspected case, access to proper medical care and disease management can help in dramatically lowering the rate of fatal cases. Careful follow up of suspected cases and early detection of plasma leakage is very important to prevent shock or severe organ involvement. The use of the original world health organization (WHO) classification of dengue fever, dengue haemorrhagic fever and dengue shock syndrome that addresses on plasma leakage has proved to be very successful in reducing the case fatality rate of dengue (CFR). Therefore, patients need to be monitored continuously in the critical period of plasma leakage to reduce the CFR.

III. MI-MON SOFTWARE

Wi-Mon is specially integrated software to use the platform of the Wi-Mon device. It is the software that uses data from database to view it more conveniently and comfortably in a user-friendly manner. Wi-Mon software consists of features like admission of new patients, creating doctor profiles, doctor's ward lists, ward rooms, in-built alarming systems, password authentication privileges which are limited to various kind of users, analyzing details of patients and as well as the patient's history.

The privileges for doctors and the administrative officers will vary according to their job titles. Doctors have more privileges than the administrative officers but for an emergency situation the alarm will work for all the users of Wi-Mon software. The patients' vital readings from the sensors will be visible in the interface of the Wi-Mon software under labels. The analyzing part of these readings also can be accessed through the software and it can be saved

as a portable document for future use and the in-built alarming system in the software will alert the hospital through alarming with a sound.

IV. TRADITIONAL METHODS

In this paper, a remote health care system based on wireless sensor network is introduced. This new technology has potential to offer a wide range of benefits to patients, medical personnel, and society through continuous monitoring in the ambulatory setting, early detection of abnormal conditions, supervised rehabilitation, and potential knowledge discovery through data mining of all gathered information. This system can be placed in a hospital or a patient's house, through this wireless sensor network the sensor nodes collect Some physiological indexes of the patients or monitor the running state of the medical devices and transmit the data to the sink node or the local computer. The wireless sensor network can connect to the remote central server by several means. This remote health care system has good scalability and high flexibility and may have a widely application in the community medical service system, care unit and so on. An even bigger, more widely used remote medical service system can be built by connecting the wireless sensor networks to the Internet. This thinks it is very important to serve the patients better. Certainly, some kind of special wireless sensor networks can be developed for special medical use to perfect the remote care system based on wireless sensor networks. The presented gateway-central health care system is a prototype. Tasks like sensor data database, DDS and real-time report are conducted in a low power embedded system. Hardware and software design of the gateway are presented and transmit protocols are designed for this gateway-central system. A series of experiment results show this prototype system is feasible and reliable. In the future, optimizing the interconnection by employing GPRS communication between gateway and remote server to extend the available coverage of the health care system and upgrade the DDS. Then, it may consider for integrating internet-base webpage and voice call function in the gateway. Security issues will also be considered in the future work. [1]

This paper surveyed the existing WSN technology that can be used in health care monitoring. The current state of the art technologies were analysed based upon how well they can meet the information requirements laid by the dictatorial authorities. In existing, researchers raised the major social implications like security problem, privacy issues, energy consumption of sensor nodes and then analysed about the causes and effects of these major issues.[2]

In this research, we have provided an impact on usage of wireless senor networks specifically in healthcare sector. Along this we have provided the different challenges facedby WSN, its advantages and disadvantages. We believe that the wireless sensor networks will have a large impact in future in the healthcare sector. The rapid increase in usages of wireless sensor networks has predicted that these smart sensors will be an integrated part of our daily life, as it already has a tremendous effect on our human life. There is credible future of self organizing WSN in healthcare sector. Wireless sensor networks can improve the systems like in-home assistance and smart nursing. Patient can ensure their privacy while remaining at home and healthcare services will be provided to them at their door step. [3]

The proposed system will be developed to detect early Dengue symptoms and to monitor the patient with this chronic disorder using cloud data logging. It can be used to allow the doctors to attend multiple patients in rural areas without constant focusing on a single patient [8- 10]. The proposed system will be implemented by integrating features of all the hardware components mentioned. All modules will be organized and placed properly to the best working of the system. [4]

By mistreatment Wireless device networks we tend to build patients' life lighter and supply viable solutions. The safety is very vital in observation of health care which can offer by wireless device network. Therefore it's Associate in nursing rising research topic and it's price learning. This paper provides a clearly comprehensive study of security analysis in healthcare application mistreatment WSNs. This paper presents the look, deployment, and analysis of a wireless pulse oximetry monitoring system in an exceedingly hospital unit. The study bestowed during this paper involves real patients monitored in an exceedingly clinical setting. The patients were monitored in place to realistically assess the practicability of WSN technology for patient monitoring. Our analysis is quite spec named Health observation network that integrates WSNs into net. Each WSN is organized as a mobile ad-hoc network with one allotted mesh router connecting with net. The health care knowledge collected by device node area unit all transmitted to mesh router, then forwarded to back-end internet server through net. The entire network administration together with operating mode setting for device node, sensing knowledge managing and analyzing area unit processed on back-end server. A work is built to check the performance of Health Care observation web, wherever device node measures force per unit area, ECG, heart rate, temperature. [5]

After reviewing several articles and research, that has been conducted, we may conclude that: there is still a long way to go in the area of wireless sensor network. Existing medical applications based on sensor networks are in the first-line potential research for use in the future of WSNs and their medical device looks extremely promising. Security issues are a significant area, and there are still a number of large challenges to overcome. The future should include specialized medical technology with WSN, where with the existing infrastructure enhances the collection of data in real time, in which the medical care at home and smart homes will be improve. Also the constant collection of clinical data of patients will reduce the costs of tests and regular visits to the physicians. Another important point in the future will is the relationship between bioscience, biotechnology and nanoscience (nanotechnology) in the development of sensors. [6].

Infusion therapy is one of the common medications being administered in hospitals. Therefore, real-time monitoring and controlling are highly recommended most especially for those patients who require continuous medication; this procedure is called intermittent infusion or piggyback

infusion. This study can measure the infusion rate in drop per minute using IR sensor and display it on the Android mobile phone and Personal Computer using Ethernet shield as a wireless communication device. Once the actual reading and calculated reading is not equal, there is a pop-up window display on Android mobile phone and PC that alerts the attending nurse. The PC can only control the motor to stop the infusion when both readings are not equal. It also shows that the primary and secondary setup of IVPB system is successfully detected and monitored the drop rate per minute with minimal percentage error found. After a series of testing in detecting and controlling the system, it is showed that the drop rate of 10dpm, 15dpm, 20dpm and 60dpm for both 1000mL and 500mL fluid volume got a 0.07% and 0.5% percentage error respectively, and it is validated using a mathematical formula. This study could not be evaluated in actual situation. Before evaluating the IVPB system in actual situations such as in hospitals, there are some changes that need to work on such as the GUI to add more functions since it will be evaluated in the hospitals, the aesthetic design of the system to attach easily to the drip chamber and realtime monitoring of the fluid level. [7].

The proposed wearable device enables a person to measure his/her blood pressure, heart rate and body temperature in real time. The current trend is to continuously monitor vital signs or any other health parameters in real time. However, it is very impractical to use oscillometric method for measuring blood pressure in a continuous manner. Also, there can be allergies caused by the blood pressure cuff itself if worn for a prolonged time.

One solution is to approximate the blood pressure by calculating the pulse transfer time (PTT) using ECG sensors. As our device has a modularize architecture, new sensors can be connected and reprogrammed accordingly. Moreover, the system can used to monitor vital signs (blood pressure, heart rate and body temperature) periodically especially in elderly people and patients with white coat hypertension. [8]

The security is very important in monitoring of healthcare which may provide by wireless sensor network. Wireless sensor networks make patients‟ life more comfortable and provide viable solutions. So it is an emerging research topic and it is worth studying. This paper provides study of health WSNs. This paper presents the design& implementation of healthcare monitoring system using WSN with GSM modem. A test bed is constructed to test the performance of Health Care Monitoring where sensor node measures blood pressure, Electrocardiogram, heart rate, temperature & Respiration.[9]

The biggest benefit to having a wireless network is that it allows providers to deploy technology at the bedside, as part of normal health care workflow. Also used for detection of chronic diseases beforehand [7]. It can be used in military for security purposes assists seamless communication between individual and machine. This paper has thus, helped review the basic research on Wireless Body Area Networks in Smart Health Care. This work provides an overview on research propagation within human body. As explained above, a WBAN is expected to have great beneficial results on patients' bodies, helping them track any unusual effect on the body and allow early detection of problems. With the technological evolution it is expected very soon, the medical aspect of the world will take new turn with physical large monitoring devices being replaced by wireless networking system and WBAN will play an important role in the long run. [10]

By using Wireless sensor networks we make patients' life more comfortable and provide viable solutions. The security is very important in monitoring of healthcare which may provide by wireless sensor network. So it is an emerging research topic and it is worth studying. This paper provides a clearly comprehensive study of security research in healthcare application using WSNs. This paper presents the design, deployment, and evaluation of a wireless pulseoximetry monitoring system in a hospital unit. The study presented in this paper involves real patients monitored in a clinical setting. The patients were monitored in situ to realistically assess the feasibility of WSN technology for patient monitoring. Our research is kind of network architecture named Health monitoring network which integrates WSNs into internet. Each WSN is organized as a mobile ad-hoc network with one allocated mesh router connecting with internet. The health care data collected by sensor node are all transmitted to mesh router, then forwarded to back-end web server through internet.

The whole network administration including working mode setting for sensor node, sensing data managing and analyzing are processed on back-end server. A test bed is constructed to test the performance of Health Care Monitoring Net, where sensor node measures blood pressure, ECG, heart rate, temperature.[11]

Wireless sensor network (WSN) by the features of low power consuming and low cost gained much more attention from researchers, because the application of WSN in varied area such as pollution monitoring, habitat monitoring, health monitoring, military target tracking etc. WSN is also improving reliability of the link which is creating between sensor and monitor. Each sensor of WSN consists three subsystems: (A)sensor subsystem: sense the environment which we monitoring(B)processing subsystem: perform local computation on the sense data (C) communication subsystem: exchange the message with neighbour sensor. Application of wireless sensor network in body area of health monitoring is called WBAN(WIRELESS BODY AREA NETWORK) or WBSN(WIRELESS BODY SENSOR NETWORK). WBAN is very useful for early detection the parameter of emergency condition of patients and it can be continuously monitor the health condition of patients. health monitoring required sensor according to the health parameter. Wireless body sensors arranged in patient's body and they can be used to monitor any condition of patients. These sensors monitor the patient's body signs. [12]

In this project a model of the wireless-sensorbased bridge health monitoring system is developed. Sensors and wireless communication protocols have been used to create a Node and data transmissions. ARM7 does the Analog-digital conversion between sensors and ZigBee modules, which are in the form of a single unit called a "Node" that combines all these sensors, an ARM processor, and a ZigBee module. The maximum number of sensors was selected to allow wireless

communication stability to be tested. In this study, wireless network was achieved, with low consumption of power.[13]

In this paper, the architecture of wearable sensors for remote healthcare monitoring system which composed of three tiers were described. A differentiated services scheme based on priority scheduling and data compression methods were presented in second tier. The method not only reduces transmission delay of physiological vital signs but also improves its bandwidth utilization. The role of wireless technology in healthcare applications is expected to become more important with an increase in deployment of mobile devices and wireless networks. This new technology has potential to provide many ad-vantages to patients, medical staff, and society at large through continuous monitoring of various physiological vital signs and provide real-time feedback to the user and the medical staff. [14]

The random movement of nodes in WSN is very difficult for identification. Here the proposed solution supports nodes' mobility without any restrictions in communication. Here we presented a reliable solution to support nodes mobility in a controlled scenario such as a hospital infirmary. The solution proposes a new approach for an intra-handover mechanism that minimizes the messages exchange between nodes and their network attached points (APs). It guarantees continuous communication to the mobile nodes even if they move around different WSN APs coverage areas. The future direction will be towards implementing the proposed model and comparing the proposed model with existing models in terms of efficiencies, performance evaluation study through simulation, the analysis of this proposal, and results comparing to other approaches should be performed. [15]

In the paper we have surveyed different recently developed applications of embedded to mobile phone sensors. Some of these applications are already distributed and used for medical purposes, but the other are research projects so far. The main reason to use mobile phones in healthcare domain is to improve quality and availability of the healthcare services Variety of mobile sensors are used in existing application It can improve quality and decrease cost of healthcare services The combination of intelligent data processing for clinical decision making processes and subsequently alert agents and healthcare professionals alike is a step towards optimization of dynamic healthcare monitoring services tailored according to each individual user. [16]

In this paper, we proposed an unsupervised approach for anomaly detection in medical WSNs, where faulty measurements and injected data could threaten the life of the monitored patient. The proposed approach is based on the MD and a KDE to detect abnormal measurements and to distinguish faulty measurement from a clinical emergency, through the use of spatial and temporal correlation between monitored attributes. The system keeps its relevancy over time by updating the statistical parameters and obtaining more precise evaluation of the normal state of the patient. The proposed approach is suitable for online detection and isolation of faulty or injected measurements with low computational complexity and storage requirement. We have evaluated the proposed approach using real and synthetic medical datasets. Our experimental results show the effectiveness of our proposed approach in reducing the number of false alarms triggered by faulty measurements (or maliciously injected data) in medical WSNs. Most of the time, collected measurements are normal. The reduction of exchanged data between wireless sensors and sink node will be studied in future work. Our next task will be oriented toward distributed detection of an anomaly in sensors to reduce the wasted energy by the transmission of faulty measurements.[17].

V. METHODOLOGY

Heart rate is the number of heartbeats per unit of time and is usually expressed in beats per minute (bpm). In adults, a normal heart beats about 60 to 100 times a minute during resting condition. The resting heart rate is directly related to the health and fitness of a person and hence is important to know. This system has incorporated a microcontroller based heart rate and body temperature measurement system that uses optical sensors to measure the alteration in blood volume at fingertip with each heartbeat and LM35 sensor for body temperature.The heart beat sensor consists of an infrared light-emitting-diode (IR LED) and a photodiode. The IR diode transmits an infrared light into the fingertip (placed over the sensor unit), and the photodiode senses the portion of the light that is reflected back. The intensity of reflected light depends upon the blood volume inside the fingertip. So, each heart beat slightly alters the amount of reflected infrared light that can be detected by the photodiode. The changing blood volume with heartbeat results in a train of pulses at the output of the photodiode, the magnitude of which is too small to be detected directly by a microcontroller. Therefore, atwo-stage high gain, active low pass filter is designed using two Operational Amplifiers (Op-Amps) to filter and amplify the signal to appropriate voltage level so that the number of pulses within a certain interval (say 15 sec) can be counted by a microcontroller and easily determined the heart rate in bpm.

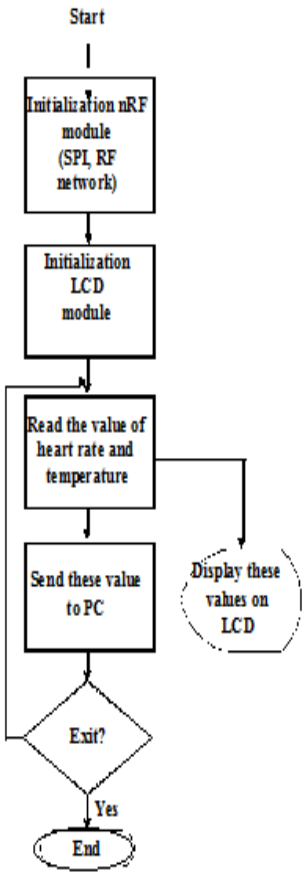

Fig: Program flowchart for transmission section

VI. CONCLUSION

The proposed work has presented a complete to BAN(wire\less body area network). System for continuous monitoring of dengue patients. The proposed system combines various techniques such as active filtering TCP/IP based client- server interaction over wireless networks use of artificial neural network use of artificial neural network for patient healths estimation & raising an alarm in event of critical condition the system also facilliates transfer of patient monitoring data by E-mail concerned doctors as to allow for urgent assistance in case of any emergency. The system has been implemented in MATLAB employing the signal processing TCP/IP sochets & neural network tool bolx of Matlab. The modebus architecture of the system allows for the implementation of the proposed system on single chip solutions such as DSP processors to enable mass prodiction of WBAN facilitator ASIC application specific integrated circuits. Continuous monitoring of vital parameters of the patient including ECG, Temperature, Pulse Rate, oxygen saturation (SPO2) & blood pressure are realized in a single sensor node & transmitted to the main server over TCP/IP connection. The employment of TCP/IP protocol provides encapsulation from the network type or device used thus various network topologies & network divices including GSM/GPRS, zigbee, wifi, etc can be intefrated in a single solution.also incorporated is a levenberg marquard artificial neural network.

at the server side which is trained with historical patient dat which predicts the overall health status of the patient by thresholding the ANN predicted health status can be employed to generate alarms in case of critical condition. The proposed system has been implemented & demonstrated by the results above.

VII. AUTHORS REVIEW

Authors are review many papers and they found Design & Development of a continuous penitent monitoring system for dengue using state of art technology such as Wireless Sensor Networks, IOT (Internet of Things), and advanced Signal Processing Technologies. Improvement in overall accuracy and precision of existing systems , by employing hybrid measurement technologies or redundancy , along with advanced time or frequency domain signal processing , thus enhancing overall receptivity & reliability of the system. Implementation of a smart architecture on low power 8-bit microcontroller along with WiFi connectivity to realize an IOT (Internet of Things) connected smart patient monitoring system. Integration of various parametric alarms with various level of reliability and plethora of mediums such as E-mail client, GSM Modem. Optionally alarm communications can be integrated on popular apps such as Whatsapp or Hike. The proposed system shall be supportive of multiple protocols for wireless communications such as Zigbee, Z-Wave, WiFi(802.11.4), along with long distance protocols such as LORA WAN. Integration of the above
system implemented as embedded system using 8 bit microcontroller as slave and MATLB server acting as master node for coordinated multi sensor data collection, plotting & data logging solution. Integration of the proposed system with commercially available cloud platforms such as Amazon or Google, to provide App Based monitoring and control on mobile devices. Usage of advanced Machine Learning or Artificial Intelligence algorithms along with high performance clustering algorithms to interpret health hazards, predict health risk & correlate with clinical data.

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