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A REMOTE HEALTH MONITORING AND ALERTING SYSTEM FOR GERIATRICS

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ABSTRACT: The Internet of Things (IoT) has made serious impact in each and every industry including health industry. IoT makes smart objects the ultimate building blocks in the development of smart pervasive frameworks. This revolution is redesigning modern health care with promising technological, economic, and social prospects. This rise contributed the detection of chronic life-threatening diseases. Now a days cardiac failure, heart related health problems are arising. Thus, IOT based smart health care system effectively uses internet to monitor patient health and save lives on time. Remote health monitoring is one of the important application of Internet of Things. An infinite array of devices is connected and healthcare industry is able to provide scalable solutions to its patients. With these advancement it prompts timely medical attention to the patients.
INDEXES: IoT, health industry, Smart health care system

I.INTRODUCTION

In early days, the only means of monitoring and managing the health related fleet is carried out by the physical visit of patient to the hospitals. This involves maintaining huge amount of medical reports as a hand copy. In 1950s, the concept of ICU was created initially as post-operative recovery rooms, then more variations came about, including from the 1960s coronary care units monitoring cardiac rhythmicity. In 1980s, most common system were supporting nursing care planning and documentation. Today in modern era almost everything has been automated. In each field humans are replaced by machines as they are more accurate. This project focuses on integrating computer software with health industry. The health problem is rising along with increasing population in today's world. In addition, medical research surveys found that about 80% of aged people are likely to live independently. In hospitals, continuous monitoring is needed for heart attack, after major or minor operations, temperature related illness. But the 24x7 monitoring of patients is strenuous and leads to prohibitive cost. In addition, medical research surveys found that about 80% of aged people are likely to live independently. In the health and wellness monitoring environments, the IoT has emerged as one of the most powerful information gathering and sharing paradigms for personalized healthcare systems [5]. The usage of IoT technologies brings convenience of physicians and patients where the patient can be monitored using a collection of powered sensor nodes. The meaning of IoT is Internet of Things, simply called as Internet of everything. Different wireless communication technologies can be used for (i) connecting the IoT device as local networks, and (ii) connecting these local networks (or individual IoT devices) to the Internet. The connectivity technologies are NFC, Bluetooth, zigbee, cellular network etc. In health monitoring system, wireless network is used to forward measurement through a gateway towards cloud. The main network used here is IoT. A Wireless Body Area Network (WBAN) is an essential part of health monitoring. It is a type of sensor network typically aimed at the acquisition of health related data [20]. WBANs are opening up new opportunities for continuous health monitoring and proactive healthcare [4]. A typical WBAN for health monitoring consists of (i) implantable and wearable sensors, which are attached to the body or even implanted under the skin to measure vital signs and body signals, e.g., body temperature, heartbeat, blood pressure, etc. and (ii) external devices (which could be smartphones) that act as base stations to collect, store, display, and analyze the data. Many recent and ongoing research efforts have addressed the design and

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deployment of WBANs [12]. The storage of these data can done using cloud or web-server that can be accessed using web application or using mobile phones. Cloud computing emerges as a computing infrastructure with the ability to coordinate many networked computers to perform data storage and computation simultaneously. Geo-distributed cloud service is a trend in cloud computing which, by spanning multiple data centres at different geographical locations, can provide a much more economical solution to offer efficient services to groups of users in their proximity in terms of reduced bandwidth costs and increased availability[18].

II.PATIENT MONITORING USING MOBILE PHONE:

Advancement in technology have led to the development of miniature devices like Mobile phones. It is a small hand held device that provides mobile health services to the users. They are capable of detecting a medical emergency and prevents it by reporting it to the medical services or by providing its user with feedback as an early warning. With these portable devices the patients can regularly monitor their health and medical staff can analyze the collected information remotely. This portable monitoring devices is helpful to diagnose and prevent heart diseases. The Mobile Base Unit (MBU) acts as a communication gateway and responsible for processing and a set of BAN devices like sensors. The processing of data can be done remotely by a medical team [8].

II.a Smart Phone Application: Daniel Aranki [5] and fellow used smart phones to monitor the health of the patient. Smartphone-based application is used for remote real-time tele-monitoring of physical activities of patients with Chronic Heart Failure (CHF). Their vital signs data are also collected via a smartphone and reported to the central server. This smartphone application has two functions, collection of data in sensor and collection of self-reported information through daily surveys. The application collects the sensor data and readings from the phone GPS. The GPS values are collected to keep track of the patients' location [5].

II.b Mobile Phone Accessories: Md. Shaad Mahmud and fellow [17] monitored the Electrocardiogram (ECG) and the Heart rate using a smartphone case. The Smart Case is then tested in a lab environment. The feasibly of the system is validated with the help of designed 3D printed smartphone case. Then the obtained result is compared with the medical grade devices. They also built an android application to obtain and to display data obtained from the physical electrical circuitries. This android application has special functionality to transform the obtained signals to a graph. Thus we can get an ECG signal and can display of real time Electro Cardio Gram signals on the available smartphone. Along with this functionality the android application has also other functionalities where it can also look for an unusual signals in ECG and can predict critical circumstances from the anomalies in the signal. It is also capable of maintaining a record of the ECG and help doctors with the resultant data.

III.HEALTH MONITORING USING BLUETOOTH:

Johan Wannenburg [8] and fellow proposed their system using Bluetooth technology. Bluetooth is having a better data transmission rate with low power consumption. Here the system sends the feedback to the user based on the measured vital physiological parameters and the signals. The feedback is provided to the user by means of a smartphone application which receives data from the device via a Bluetooth. Hence the Bluetooth has been selected as the communication medium between the smartphone and device. The mobile application is developed for Bluetooth pairing with the devices on start-up and is only functional once this Bluetooth paring is successful. This mobile application is also responsible for the reception of vital parameters over Bluetooth and capable of transmitting and receiving messages to and from the wearable device [8]. Andreas K. Triantafyllidis [2] et al uses Bio harness which is a wearable sensing device contains multiple sensors on a strap, which is placed on the patient's body for monitoring heart rate, temperature, etc. The bio harness device provides Bluetooth communication. They also use Bluetooth protocol native security mechanisms in order to protect the sensor data from data hijacking. Therefore a key-based pairing is performed between the Mobile Base Unit (MBU) and Bio Harness for their mutual authentication [2]. Md.Shaad Mahmud [17] and fellow used a hardware system consists of a single chip microcontroller embedded with Bluetooth Low Energy (BLE) hence miniaturizing the size and prolonging the battery life. The recent development of Bluetooth Low Energy (BLE) creates an additional opportunity for making the system low power, low cost with the high data rate applications. BLE is also known as Bluetooth Smart. It is a wireless personal area network (WPAN) technology designed and marketed by Bluetooth Special Interest Group. BLE devices give the same performance on a much lower energy consumption than usual Bluetooth technology, which is also cost efficient.

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Bluetooth Smart is not backward compatible with the previous Bluetooth protocol. Bluetooth Smart uses 2.4 GHz radio frequency. Communication with BLE devices are more complex than classic Bluetooth. BLE is also more secured as it can connect to only one device at a time. In this Bluetooth is equipped with ARM Cortex M0 Development Board that delivers an Arduino compatible Development Kit with integrated Bluetooth 4.0 Bluetooth Low Energy all in a fingertip sized board. The advantage with BLE 4.0 over Bluetooth 2.0 is a low power and compatible with both IOS platform and android platform. [3] discussed about an eye blinking sensor. Nowadays heart attack patients are increasing day by day."Though it is tough to save the heart attack patients, we can increase the statistics of saving the life of patients & the life of others whom they are responsible for. The main design of this project is to track the heart attack of patients who are suffering from any attacks during driving and send them a medical need & thereby to stop the vehicle to ensure that the persons along them are safe from accident. Here, an eye blinking sensor is used to sense the blinking of the eye. spO2 sensor checks the pulse rate of the patient. Both are connected to micro controller.If eye blinking gets stopped then the signal is sent to the controller to make an alarm through the buffer. If spO2 sensor senses a variation in pulse or low oxygen content in blood, it may results in heart failure and therefore the controller stops the motor of the vehicle. Then Tarang F4 transmitter is used to send the vehicle number & the mobile number of the patient to a nearest medical station within 25 km for medical aid. The pulse rate monitored via LCD .The Tarang F4 receiver receives the signal and passes through controller and the number gets displayed in the LCD screen and an alarm is produced through a buzzer as soon the signal is received.

IV.PATIENTMONITORING USING TIMESTAMP:

Robust and reliable time stamps are essential for remote patient monitoring for patient data to have context and to be correlated with other data. Patient history details need to be stored for a significant period of time. It will be difficult to synchronize with reliable time source. Malcolm Clarke [10] and fellow defines a frame work that convey information on the conditions under which observations were made and is transmitted by the gateway including both the local and reference timeline. The timestamps are referred as qualified time that express unique timestamp and unqualified timestamp that includes local time. IEEE 11073-20601 protocol is used to notify the change in time. This information may be used by the gateway to perform the correct translation of timestamps and to construct the appropriate coincident timestamp [10]. If the device doesn't change the time, then it is the responsible of the gateway to apply appropriate transactions.

IV.a Reduced service delay: Qinghua Shen [15] and et other proposed a model that utilized Geo-distributed cloud that reduce the service delay and cost for the service provider. Dusit Niyato [6] and fellow resolved it by providing service on a demand basis. They determine the number of users by using stochastic programming method.

V. PATIENT MONITORING USING WBAN:

Wireless sensor networks (WSN), also called as wireless sensor and actuator networks (WSAN), are sensors used to monitor physical or environmental conditions, such as sound, Temperature, pressure, etc. and to cooperatively pass their data through the network to a main location. The more modern networks are bi-directional, also enabling control of sensor activity. The microcontroller uses input from these sensors and send s the record to the controlling unit. The unique characteristics of Wireless sensor networks include the mobility of sensor nodes, the ability to withstand harsh environmental conditions, node failures, low power and scalability. Wireless Body Area Network (WBAN) is a type of sensor network typically aimed at the acquisition of health related data [12]. Arsalan Mohsen Nia and fellow [4] the key consideration in the design of a Wireless Body Area Network is a communication technology that helps in connecting medical sensors with the base station. The WBAN contains eight sensors in which each sensor collects data at specific sampling frequency related to that application. Each sensor have varying sampling frequency rate. For example, the sampling frequency of heart rate for a normal person is 2-8 Hz. The blood pressure must be sampled at higher frequency of about 100 Hz. The sampling rate of body temperature fluctuates in the range of 0.001 Hz to 1 HZ [18]. Anees Ara and fellow [4] uses WBAN to monitor a patient's health residing at the remote location. The data collected from the sensing nodes are sent to the aggregator. Then the aggregator job is to collect the individual health data from the sensing nodes and compute aggregation on them. The aggregated data is then transmitted securely to the medical server. The data from the medical server is accessed by the trusted authorities and the concerned doctor and the emergency medical team [4]. Udit Satija and et a [19]

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deals with light-weight real-time signal quality assessment technique for improving the battery lifetime of IoT-enabled wearable devices and to reduce the cloud server traffic load. Due to the disconnection of electrodes with skin and the electronic component saturation, sensing device exhibits the absence of ECG signal information in the acquired signal. In practice, we observe that the recording shows the presence of zero amplitude flat line (ZFL), only baseline wander (OBW), and the long pause with physiological and external noises. Existing approaches were developed for detection of ZFL event. In this work, we present a novel approach for detecting aforementioned noise events. Our approach is based on turning points (TP) which can be computed as mentioned in Turning point computation algorithm. S. Pinto [14] proposed a model where they use a wrist band that contains the sensor. The wrist band and the board are connected through Bluetooth, through which communication takes place. They use IEEE 802.15.4 for providing confidentiality of the data [14].

VI. PATIENT MONITORING SYSTEM USING PERVASIVE COMPUTING: Pervasive health systems concern the provision of healthcare Services to anyone, anytime, and anywhere by removing Location, time and other restraints, while increasing both their coverage and quality [2]. The pervasive health monitoring system to provide a sustainable service with guaranteed low delay and low Packet Loss Rate (PLR) to subscribers [15]. The recent advances in pervasive computing technologies have provided the basis for the design and development of several personal health systems and services, the majority of which rely on the adoption of biomedical sensors and networking communication technologies. Andreas K. Triantafyllidis [2] and fellow proposed a remote monitoring system using pervasive computing toward chronic patients' selfmanagement health system encapsulating services to support patients in health information management and sharing. In particular, they elaborated on both objective and subjective elements of information concerning the patient, acquired via a wearable monitoring system and self-reporting by the patient himself/herself, respectively. Yifeng He [21] and fellow proposed a model that optimizes the resource allocations to provide a sustainable and high-quality service in health monitoring systems. The resource allocation is done in two ways: In the first optimization problem, steady rate optimization problem, we optimize the source rate at each sensor to minimize the rate fluctuation with respect to the average sustainable rate, subject to the requirement of uninterrupted service. The second optimization problem is formulated based on the optimal source rates of the sensors obtained in the steady rate optimization problem. In the second optimization problem, the optimization of transmission power and the transmission rate at each aggregator to provide QoS guarantee to data delivery. The second optimization problem is converted into a convex optimization problem, which is then solved efficiently.

VII. PATIENT MONITORING SYSTEM TO ENSURE SECURITY: Anees Ara [4] The sensors are deployed in hostile environments hence, security and privacy are a major concern. In order to ensure security and privacy during data transmission in remote health monitoring, a bilinear pairing based Secure Privacy-Preserving Data Aggregation (SPPDA) scheme is used. Based on the combination of a Bilinear ElGamal cryptosystem and aggregate signature, a concrete SPPDA scheme is designed. Security analysis is conducted to state and prove the correctness this scheme. Security analysis also demonstrated that this scheme preserves data confidentiality, data authenticity, and data privacy; it also resists passive eavesdropping and replay attacks. The proposed SPPDA scheme is semantically secure under Decisional Bilinear Diffie-Hellman assumptions.

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COMMUNICATION MODULE	HARDWARE DESCRIPTION	MEASURED SIGNALS	MEDICAL APPLICATIONS
Bluetooth	[7] Wrist Band Sensors, Handheld Spirometer, Chest Patch	Ambient Temperature, Relative Humidity	Detection and prediction of chronic respiratory diseases
	[8] Wearable Body Sensors	SpO2, Saturation of Oxygen, Heart Rate, Blood Pressure, Skin Temperature, Pulse Oximetry	Prevention and early diagnosis
	[14] We-Watch Wrist Band, We-Care Board, Wireless Charging Dock Station	Body Temperature, Pressure, Humidity, Light	Collects vital data of elderly people
	[18] Wearable Sensor Node, Accelerometer, Solar Energy Harvester	Temperature, Heartbeat	Medical monitoring
Smartphone	[1] Heartbeat Sensor, Temperature Sensor, Amplifier(IC LM358)	Heartbeat, Temperature	Monitoring of old people and sick people
	[4] ECG and EEG monitors	Blood Pressure, Oxygen Saturation, Temperature, Blood Sugar, EEG	Long term continuous health monitoring
	[5] Wearable Body Sensors	Heart Rate, Blood Pressure	Telephone based monitoring
	[9] Camera, Temperature Sensor, Heartbeat Sensor	Temperature, Heart Rate	General medical monitoring
	[13] Wearable Heartbeat Sensor	Heart Rate	Monitoring patient Heart rate
	[20] Temperature Sensor, Gas Sensor, Heart Beat Sensor, Blood Pressure Sensor, LM35, Arduino UNO, ADXL345	Temperature, Blood Pressure, Heart Rate	Outdoor health monitoring
	[22] ECG Sensor, Blood Pressure Sensor, Glucose Checker	Heart Rate, Blood Pressure	Continuous health monitoring
SOA, SOAP/WSDL	Wearable Multi Sensing Device	Heart Rate, Respiratory Rate, Skin Temperature	General patient monitoring
Zigbee	[16] Intel galileo generation 2, Arduino, X-Bee S2 Module, LM35 Temperature Sensor, X-Bee Adapter	Temperature	Measure hotness or coldness of a body
WLAN	[21] Wearable body sensors with energy harvesting device.	ECG signals, pulse rate, Temperature	General monitory of patients with less packet loss
	[6] Wearable Sensors	Heart Rate, Pulse, Blood Pressure	Remote patient monitoring

The above table infers the various communication modules used in health monitoring system. These modules include Bluetooth , smart phone, SOA, SOAP/WSDL, ZigBee, and WLAN. As a result in the advancement of technology WLAN is considered to be more efficient and accurate.

VIII. CONCLUSION

Thus we have proposed a wearable health monitoring system embedded in an IoT platform that integrates nodes and applications providing a high-quality of recorded signals. The system allows monitoring multiple patients on a relatively large indoor area like home, building, nursing home etc. We infer that In our proposed model the periodic visit of patient to the doctor is also considerably reduced. Hence, the practicability of our IoT-based healthcare system for geriatrics is guaranteed.

IX. REFERENCES

[1] Anagh Biswas, Arundhati Sen, Arnab Sarkar, T.K.Rana, "Real Time Health Monitoring of Patients from a Remote Place",2017

[2] Andreas K. Triantafyllidis, Vassilis G. Koutkias, Ioanna Chouvarda, and Nicos Maglaveras, "A Pervasive Health System Integrating Patient Monitoring, Status Logging, and Social Sharing" , ieee journal of biomedical and health informatics, vol. 17, no. 1, january 2013

[3] Christo Ananth, S.Shafiqa Shalaysha, M.Vaishnavi, J.Sasi Rabiyathul Sabena, A.P.L.Sangeetha, M.Santhi, "Realtime Monitoring Of Cardiac Patients At Distance Using Tarang Communication", International Journal of Innovative Research in Engineering & Science (IJIRES), Volume 9, Issue 3,September 2014,pp-15-20

[4] Arsalan Mohsen Nia, Mehran Mozaffari-Kermani, Susmita Sur-Kolay, Anand Raghunathan, and Niraj K. Jha,"Energy-Efficient Long-term Continuous Personal Health Monitoring",2015

[5] Daniel Aranki, Gregorij Kurillo, Posu Yan, David M.Liebovitz, MD and Ruzena Bajcsy, "Real-Time Tele-monitoring of patients with ChronicHeart-Failure Using a Samrtphone",2016

[6] Dusit Niyato, Ekram Hossain, and Sergio Camorlinga, "Remote Patient Monitoring Service using Heterogeneous Wireless Access Networks:Architecture and Optimization ,2009

[7] James Dieffenderfer, Henry Goodell, Steven Mills, Michael McKnight,Shanshan Yao, Feiyan Lin, Eric Beppler,Brinnae Bent, Bongmook Lee, Veena Misra, Yong Zhu, Omer Oralkan, Jason Strohmaier, John Muth, David Peden, and Alper Bozkurt, "Low Power Wearable Systems for Continuous Monitoring of Environment and Health for Chronic Respiratory Disease",2015

[8] Johan Wannenburg and Reza Malekian, "Body Sensor Network for Mobile Health Monitoring, a Diagnosis and Anticipating System", 2015

[9] Kalvinder Singh, Vallipuram Muthukkumarasamy ," Authenticated Key Establishment Protocols for a Home Health Care System",2007

[10] Malcolm Clarke, Paul Schluter, Barry Reinhold, and Brian Reinhold, "Designing robust and reliable timestamps for remote patient monitoring", DOI 10.1109,2016

[11] Malti Bansal, Bani Gandhi "IoT Based Smart Health Care System using CNT Electrodes (for Continuous ECG monitoring)",2017

[12] Mohammad Deylami, Emil Jovanov, "A Distributed Scheme to Manage the Dynamic Coexistence of IEEE 802.15.4-Based Health Monitoring WBANs",2014

[13] Nabil Alshurafa, Costas Sideris, Mohammad Pourhomayoun, HaikKalantarian, Majid Sarrafzadeh,, Jo-Ann Eastwood, "Remote Health Monitoring Outcome Success Prediction using Baseline and First Month Intervention Data", DOI 10.1109,2015

[14] S. Pinto, J. Cabral and T. Gomes," We-Care: An IoT-based Health Care System for Elderly People",2017

[15] Qinghua Shen, Xiaohui Liang, Xuemin (Sherman) Shen, Xiaodong Lin, Henry Y. Luo, "Exploiting Geo-Distributed Clouds for a E-Health Monitoring System With Minimum Service Delay and Privacy Preservation",2014

[16] Ravi Kishore Kodali, Govinda Swamy and Boppana Lakshmi," An Implementation of IoT for Healthcare", 015 IEEE Recent Advances inIntelligent Computational Systems (RAICS) , December 2015

[17] Md. Shaad Mahmud, Honggang Wang, A.M. Esfar-E-Alam, Hua Fang, "A Wireless Health Monitoring System Using Mobile Phone Accessories",2016

[18] Taiyang Wu, Fan Wu, Student Member, Jean-Michel Redout´ e, Mehmet Rasit Yuce, Senior Member, IEEE, "An Autonomous Wireless Body Area Network Implementation Towards IoT Connected Healthcare Applications", DOI 10.1109,2017 [19] Udit Satija, Barathram.Ramkumar and M. Sabarimalai Manikandan," Real-Time Signal Quality-Aware ECG Telemetry System for IoT-Based Health Care Monitoring", DOI 10.1109/,2017

[20] R.Veyilazhagan and V.Bhanumathi, " An Outdoor Intelligent Health Care Patient Monitoring System ",2017

[21] Yifeng He, Wenwu Zhu, and Ling Guan, "Optimal Resource Allocation for Pervasive Health Monitoring Systems with Body Sensor Networks", IEEE TRANSACTIONS ON MOBILE COMPUTING, VOL. 10, NO. 11, NOVEMBER 2011.

Zain UI Abideen, Munam Ali Shah, "An IoT Based Robust Healthcare Model for Continuous Health Monitoring", 2017