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Heartbeat Monitoring System Using Polymer Sensor Based Bodysuit

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ABSTRACT: In this project, we have presented a state-of-the-art survey on physiological parameters and activity monitoring systems developed in a wearable platform. A wearable health monitoring system's main goal is to enable people to live independent, active lives in their familiar homes while ensuring ongoing, non-intrusive, seamless monitoring of their physical and mental health. Continuous monitoring of health status can provide comprehensive information about individuals' health status over a period of time. The wearable sensors and actuators, coupled with the advanced information and communications technologies have opened the window to a new era of cost-effective remote healthcare services. The systems can include monitoring and data analysis as well as predictive algorithms, which can potentially make the prognosis of certain diseases with a higher degree of confidence, thereby leading to early diagnosis and treatment. In the case of any potential health issue is detected, the system can raise an alarm and notify the persons concerned or the healthcare services via secure wireless media such as the internet and the cellular network so that immediate medical intervention can be initiated. The use of smart textile technologies, such as textile-based interconnectivity for sensors, could result in platforms for health monitoring that are more comfortable and unobtrusive.

KEYWORDS: GSM, Accelerometer sensor, polysomnography(PSG), Wearable Platform.

I.INTRODUCTION

Due to substantial advancements in healthcare and medicine, as well as greater public awareness of the need of personal and environmental hygiene, life expectancy has been rising around the world. Yet, the massive needs for social assistance and healthcare that would result from this ageing population would have a significant impact on the socioeconomic structure of society. In addition, the cost of hospital care, prescription drugs, and medical equipment continues to rise, which drives up the cost of health care services[1]. In order to provide better healthcare services at an affordable cost to the ageing population or to those living in areas with limited access to healthcare while ensuring the maximum level of comfort, independence, and participation among the people, it is therefore of the utmost importance to develop and implement new strategies and technologies.[2][8].

Rest scattered breathing (SDB) is an expanding normal, with in any event half of individuals beyond 65 a years old upset rest with a further 25% of kids encountering SDB by youth Obstructive Rest Apnea, Focal Rest Apnea, Upper Aviation route Opposition and stoutness hyperventilation are the most widely recognized SDB watched and are portrayed by intruded on breathing with various causes. For instance, the most widely recognized rest issue, Obstructive Rest Apnea, is brought about by end of breathing because of blocked aviation routes Focal Rest Apnea, which is increasingly basic among cardiovascular breakdown patients, is brought about by disabled cardiovascular and breathing control frameworks. Because of a maturing populace just as to an expansion in the corpulence among everybody, the quantities of patients with SDB is relied upon to rise altogether later on. Subsequently, rest disarranged research and necessities for increasingly helpful rest checking gadgets are anticipated to grow quickly. The polysomnogram is viewed as the clinical best quality level methods for surveying the nature of rest[11].

It requires the patient to go through different evenings at a particular rest facility. While the nature of determination is the best accessible, it includes some significant downfalls of constrained rest center access, significant expense (~\$800 – \$2,000), and the time required to produce the conclusion[5]. Moreover, the polysomnogram is acted in a new domain and for the most part awkward because of the quantity of sensors applied. Above all, polysomnography assesses just a solitary night/scarcely any evenings depiction of conditions and isn't reasonable for long haul rest checking. These

confinements have prompted the advancement of option analytic tests that can be led inside a home with negligible oversight. These frameworks by and large incorporated a wearable gadget with less sensors[3].

Notwithstanding, IOT stages for far reaching rest observing are not regularly utilized today[7]. While these advances are growing quickly, social insurance industry adjustment is moderate. Information quality, dependability and utility joined effortlessly of-utilization of the gadget are restricting components for more noteworthy take-up of these advancements. While trying to address these issues, we present "VitalCore", a novel IOT prepared, rest checking gadget using another procedure of heart and respiratory estimation with polymerbased electro resistive band (ERB) sensors. Further, the gadget encourages single lead ECG and Accelerometer estimations. The microcontroller underpins the most recent Bluetooth 5 remote speed locally for information move and constant spilling to Bluetooth 4.2/5 savvy gadget or a devoted Bluetooth 5 dongle[9].

II.BACKGROUND WORKS

A.George, H. Dhanasekaran, J.P. Chittiappa, L.A. Challagundla, S.S. Nikkam, O. Abuzagheh: Internet of Things has seeded in many areas of humanoid lifestyle, of which the health care is the most crucial area on which the focus is to be induced. Goal of the scientists and the researchers is to further provide a hint of technology to the human life in order to make it simpler. With this being the focus, this paper will describe the use of smart phones as a sensor to keep the track of the health of the patients. Considering the various disadvantages of using cloud computing, this paper will be talking about the use of fog computing for faster analysis of data. With this aim in hand, we tend to come up and introduce the concept of Fog Computing which is the better system comparative to Cloud Computing.

Zhao Liu as well as Abdullah Tolaymat: Sleep disturbances are frequently treated in paediatric neurology offices and frequently coexist with a variety of neurological conditions and genetic syndromes as either the primary complaint or a secondary issue. By the time they reach adolescence, about 25% of kids may have at least one sleep issue, and that number rises to up to 75% in people who have epilepsy, ADHD, Autism Spectrum Disorder, or migraines. Sleep disorders change the way the body naturally sleeps, which results in disturbed sleep and poorer sleep quality, which can worsen headache frequency, make managing epilepsy more difficult, make people more prone to emotional instability, hyperactive behaviour, or cognitive impairment. Narcolepsy and insomnia are examples of primary sleep disorders, although central sleep apneas and peripheral obstructive disorders caused by neuromuscular disorders can also be secondary to neurologic diseases.

Julie Carrier, Georges Kaddoum, and Jean-Marc Lina: At least 50% of the rapidly expanding older population around the world has disrupted sleep. The use of sleep studies as a diagnostic tool by medical professionals has expanded significantly. Today, polysomnography (PSG) data collected in a sleep lab is the gold standard. However, it is obtrusive, requires qualified technicians, and is time and cost expensive. With the introduction of commercial off-the-shelf technologies in the medical field, alternatives to the conventional methods have been conceived to ensure sleep stages and sleep quality detection which may be now used at home on several nights. Cardio-respiratory and physical activities abide the most promising physiological measurements to detect sleep stages without complete PSG.

Jayeeta Saha, Arnab Kumar Saha, Aiswarya Chatterjee, Suyash Agrawal, Ankita Saha, Avirup Kar, Himadri, Nath Saha.: Nowadays, automation and Internet of Things are changing the world. The day-by-day development of the Internet of Things causes a revolution in modern technology, which makes our life easier and automated. Due to a busy schedule and irregular lifestyle, health hazard is not an age-dependent factor in the recent era. Under these circumstances, Internet of Things has provided a much easier solution for remote real-time health monitoring of patients from the hospital as well as home. Sensors acquire the data of various parameters regarding patients' health, and the Internet of Things stores that data and displays through the website, which provides access for remote monitoring. Use of Sensor reduces the human error, and the size of the system reduces the occupied space of the room.

Soren Leth, John Hansen, Olav W. Nielsen and Birthe Dinesen: Physical inactivity and unhealthy lifestyle are major contributors to the rise in cardiovascular and chronic diseases. The use of self-monitoring has proven motivational for some groups of patients with chronic disease. Commercial self-monitoring gadgets are becoming more and more common, not just in the consumer sector but also in the fields of research and medicine. Most customers use self-monitoring to increase the effectiveness of their workouts, to track their lifestyle, and for motivating purposes. Healthcare professionals use the trackers to help patients monitor their daily activity and to motivate patients for improved physical activity. The need for physical activity in vulnerable groups such as the elderly, those with chronic diseases and obese patients has been well established.

III, METHODS

EXISTING METHOD:

The existing system is based on radio communication. They are using accelerometer and it will monitor by RF transmitter to RF receiver and the emergency alarm is activated. Microcontroller 8051 based system used in the existing method, the alarm is activated when the patient in the abnormal condition.

PROPOSED METHOD:

The main feature of this project is GSM based technology that continuously monitoring the sleep disorder and other heartbeat disorders in the realtime. In this way , it monitors the patients health level continuously and protect them. Textile based temperature sensor Rectal thermometer is usually the most accurate method of measuring body temperature. This method, however, is not suitable for ongoing monitoring because it is intrusive, time-consuming, and demands private arrangements. A tympanic thermometer measures temperature from the tympanic membrane of the ear by placing a probe in the auditory canal which is not convenient for long-term use. Besides this, the ear canal needs to be properly cleaned as earwax can decrease the measurement accuracy. Oral thermometers are also known to provide reliable readings when measurement is taken from the sublingual pocket. In comparison to the methods outlined above, measuring the temperature in the armpit or axilla is more practical. Because there is no primary blood flow at this location, this approach is occasionally thought to be unreliable for estimating core body temperature. The measurement can also be affected by the environmental temperature and perspiration. However, both oral and axillary measurement techniques restrict movement of certain body parts and thus, are not suitable for continuous monitoring.

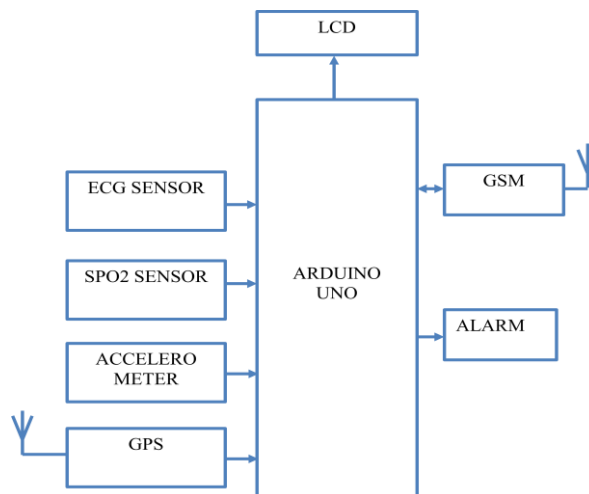


Fig 1: PROPOSED SYSTEM BLOCK DIAGRAM

The normal core body temp of a person remains within a narrow range of 36 °C–37.5 °C, although it can vary by few degrees due to environmental influence, diseases or physical activities. The skin temperature differs from the core body temperature by as much as 2.5 °C [150]. As a result, the temperature sensors used to detect body temperature must be capable of measuring temperatures between 35 and 40 °C. The precision of measurements must be ensured because a mistake could affect the diagnosis and course of treatment. Generally, 0.1 °C of accuracy is preferred [151]. Flexible temperature sensors made of textiles may be helpful for measuring body temperature in a wearable platform. They can be fabricated from fiber or single yarn using conventional textile manufacturing technologies such as weaving, knitting, embroidery, and printing. Temperature sensors fabricated on flexible substrates can also be incorporated into textiles. Whatever be the case, higher accuracy, linearity, sensitivity, and fast response time within the range of 35 °C–40 °C are critical for the temperature sensors. Apart from that, selection of proper encapsulation material is also important in order to protect it from external mechanical and environmental impacts.

Wearable technology has the ability to track and record information about a person's physiological state and physical activities in real time. Systems for monitoring a person's health using flexible sensors that can be integrated into clothing, elastic bands, and textile fibres may be used in wearable sensor-based systems. Monitoring physiological signals continuously could aid in early detection and diagnosis of a number of cardiovascular, neurological, and pulmonary illnesses. Real-time tracking of a person's mobility activities can also help with sleep evaluation, gait pattern

analysis, and fall detection. A range of electrical and MEMS sensors, actuators, wireless communication modules, and signal processing units are typically included in wearable health monitoring systems. The measurements made possible by the sensors linked together in a wireless Body Sensor Network (BSN) are transmitted to the medical staff over the internet, serving as a gateway to distant medical institutions. Figure 1 gives a generic overview of the remote health monitoring system, while the particular system that is built may vary based on the application needs. As an illustration, some systems can be created using a small number of sensors, each of which is capable of sending data directly to the nearest gateway. In other systems, the sensors could be linked together by a body sensor network (BSN), and the central BSN node would collect data from the sensors and carry out some basic processing before sending the information to the advanced processing platform.

Wearable Health Monitoring Systems

Sensors that are non-intrusive and non-invasive are essential components of long-term and ambulatory health monitoring systems. Wearable sensors are suitable for monitoring a person's health or fitness without interfering with their regular activities because they are becoming increasingly comfortable and unobtrusive. The sensors can track a variety of physiological signs and data as well as a person's activity and mobility by attaching them to various body parts. A low-cost, inconspicuous, and long-term health monitoring system is now possible thanks to developments in low-power, small wearables (sensors, actuators, antennae, and smart textiles), inexpensive computer and storage devices, and contemporary communication technologies.

Cardiovascular Monitoring System

Electrocardiograms (ECGs) represent a non-invasive approach for measuring and recording the fluctuations of cardiac potential. This is the most widely used and effective diagnostic tool that physicians have used for decades to identify heart-related problems such as different forms of arrhythmias. Although many arrhythmias are not life-threatening, some results from weak or damaged heart such as myocardial infarction (MI) that may lead to cardiac arrest, if not managed immediately. After a heart attack, patients are required to receive immediate medical attention, which, otherwise, may turn fatal. These complications can be avoided if any inconsistency in cardiac activity is detected and treated in an early stage that calls for outpatient ambulatory monitoring of ECG. Brugada Syndrome, Arrhythmogenic Right Ventricular Cardiomyopathy, and other uncommon, dangerous arrhythmias In the centre of the electrodes' pads is conductive gel that acts as a conduit between the skin and the electrode. While being the only technology currently available, this conducting gel has the potential to be poisonous and irritating to the skin, making it unsuitable for long-term ambulatory monitoring.

IV.RESULT ANALYSIS

Bluetooth is a popular low power RF communication technology that has been widely used in devices such as laptops, smartphones and fitness trackers for short range data communication [186,187]. It uses the 2.4 GHz frequency band in the industrial, scientific and medical (ISM) radio spectrum and transmits signal over 79 designated channels using the Frequency Hopping Spread Spectrum (FHSS) method. The FHSS technology provides highly secured data transfer and is less vulnerable to noise and interference. Based on Bluetooth connectivity, one master device can communicate with seven slave devices to create a star-shaped network structure (Piconet). The master defines the clock and hopping sequence for the whole Piconet. The Bluetooth technology can support a data rate of ~3 Mbps depending on the modulation schemes, although the maximum throughput may only reach ~2.1 Mbps. For general applications, the transmission distance typically ranges from 1 m to 10 m

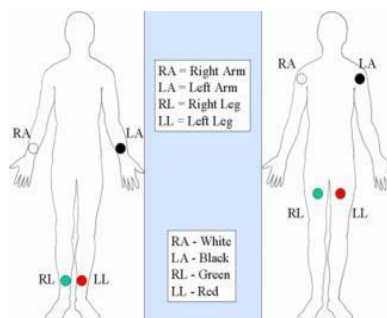


Fig 2: Limb Leads



ANT is a proprietary protocol stack designed for ultra-low-power, short-range wireless communications in sensor networks, especially for health and fitness monitoring systems [19,188]. It ensures low power consumption by using low data rate, shorter delay cycles, and deep-sleep mode and can operate for longer periods of time, for example, it can run a year on a 250 mAh coin cell battery. Similar to other wireless protocols presented above, it also operates in the 2.4 GHz ISM band. It uses TDMA (time division multiple access) to communicate with multiple nodes over a single 1 MHz channel. It can switch channels if any interference occurs. ANT can be distinguished from other wireless protocols by its unique feature in which it acts as a master for one channel while simultaneously serving as a slave for another channel. Like ZigBee, ANT supports multiple network topologies and also ensures coexistence with neighboring ANT nodes using adaptive isochronous network technology. The maximum data rate achieved by ANT systems ranges from 20–60 kbps and there is a trade-off between data rate and low power consumption.

In addition to the significant advances in the past decade, there are challenges that require further research and development in order to improve the performance of the heart monitoring system. First, the bio-potential (ECG, EDA) monitoring devices frequently have low signal-to-noise ratios (SNR), which mostly result from noise that is brought on by user movement. By using front end amplifiers with high input impedance or flexible electrodes, motion artefact (MA) can be reduced to a minimum. Using signal processing methods like adaptive filtering, empirical mode decomposition (EMD), independent component analysis (ICA), or time-frequency analysis can help increase the SNR.

Second, the hardware and computation resource for the on-body central node of a multi-sensor BSN system can be a limiting factor for seamless connectivity and data handling. The central processing node of the BSN network exchanges data with the on-body sensors as well as the home gateway, and sometimes performs limited processing. Therefore, a robust and efficient algorithm is required for the central BSN node to optimize its performance. In addition to that, an efficient data compression algorithm needs to be implemented in the central node in order to deal with a large volume of data and transmit them to the nearest gateway. Third, a key concern for the wearable healthcare system is associated with the privacy and security of the sensitive medical information of the user. More efforts are needed in order to develop algorithms to ensure highly secured communication channels in existing low power, short range wireless platforms.

IV.RESULTS



LOCATION: N*53
\$GPVT..... N*
ACCELEROMETER:79
H. B:0
Spo2:0
ECG:0
NORMAL





In this effective way we are designing a polymer sensor based bodysuit for measuring heartbeat and other breathing disorders. The main feature of this project is IoT based technology continuously monitoring the heart disorders in real time. Patient status is continuously monitored and updated in GSM. We are capturing a patient movement and monitoring the health level of the patient. It is low cost and highly protected. It sends the patient activities (heartbeat, fall movement) to the relatives and nearby healthcare centres to provide the safety measures to the affected patients.

V.CONCLUSION

Life expectancy in most countries has been increasing continually over the several few decades thanks to significant improvements in medicine, public health, as well as personal and environmental hygiene. Nonetheless, a big ageing population is anticipated to emerge in the near future, which would place a heavy load on the socio-economic structure of these countries due to rising life expectancy and declining birth rates. Thus, it is crucial to create systems that are affordable and simple to use for the benefit of older healthcare and wellbeing. Remote health monitoring, based on non-invasive and wearable sensors, actuators and modern communication and information technologies offers an efficient and cost-effective solution that allows the elderly to continue to live in their comfortable home environment instead of expensive healthcare facilities. These tools will also allow medical professionals to assess patients' health issues, continuously track crucial physiological indicators, and solicit input from remote locations. We present and assess several recently reported low-cost, non-invasive health and activity monitoring devices in this study. A study of textile-based sensors that could be used in wearable technology is also included. The compatibility of various communication technologies, as well as potential developments and research difficulties in remote monitoring systems, will be covered in the last section.

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