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BLOOD PRESSURE AND HEART RATE MONITORING SYSTEM USING WIRELESS TECHNOLOGY

T. SIVALINGAM[1], R. PRABHAKARAN[2], V. GOKUL RAJA[3], R. SATHISHKUMAR[4], M. ABDUL BASITH AKRAM[5]
1 ASSISTANCE PROFESSOR, 2,3,4,5 UG STUDENT
BIOMEDICAL ENGINEERING
VSB ENGINEERING COLLEGE, KARUR, TAMILNADU, INDIA

ABSTRACT
To design as blood pressure and heart rate monitoring system. There are a number of scopes for IoT in order to make a difference in lives of patients. The devices can capture as well as monitor related data regarding patient and allows the providers to obtain the insights without bringing the patients visiting. The procedure can assist the patient results as well as preventing the possible communications for the process that involves risk. However, lack of electronic health record (EHR) system integration is one of the major issues faced while using IoT in healthcare. Some of the EHR systems allow the patients importing data into the record. However, it remains limited to a few dominant where the EHR players as well as leaves providers unspecific of the processing data that can be helpful for the organization to use the process. The challenges for interoperability in order to keep data in distinctive medical devices depend on the purpose and ordering physician. Nowadays, wireless technology has increased in various sectors such as control, automation, etc. To provide better healthcare service, the biomedical field uses the Internet of Things. The Internet of Things is used in hospitals as well as personal health care systems. To ensure innovative work this kind of technology is used by doctors. IoT is treated as smart technology, various parameters are present in this technology to measure consumer power, enhance efficiency, and evaluate cost-related issues. Doctors can detect various chronic diseases by using this technology. Various factors are maintained by this technology in healthcare such as heart rate, body temperature, respiration rate, blood pressure, and this technology is involved in the diagnosis of disease. This paper has been described about the system of Internet of Things and its use in the health care department.

1. INTRODUCTION

The heart is a muscular organ in most animals. This organ pumps blood through the blood vessels of the circulatory system. The pumped blood carries oxygen and nutrients to the body, while carrying metabolic waste such as carbon dioxide to the lungs. In humans, the heart is approximately the size of a closed fist and is located between the lungs, in the middle compartment of the chest. In humans, other mammals, and birds, the heart is divided into four chambers: upper left and right atria and lower left and right ventricles. Commonly the right atrium and ventricle are referred together as the right heart and their left counterparts as the left heart. Fish, in contrast, have two chambers, an atrium and a ventricle, while most reptiles have three chambers. In a healthy heart blood flows one way through the heart due to heart valves, which prevent backflow. The heart is enclosed in a protective sac, the pericardium, which also contains a small amount of fluid. The wall of the heart is made up of three layers: epicardium, myocardium, and endocardium.

The heart pumps blood with a rhythm determined by a group of pacemaker cells in the sinoatrial node. These generate a current that causes the heart to contract, traveling through the atrioventricular node and along the conduction system of the heart. In humans, deoxygenated blood enters the heart through the right atrium from the superior and inferior venae cavae and passes it to the right ventricle. From here it is pumped into pulmonary circulation to the lungs, where it receives oxygen and gives off carbon dioxide. Oxygenated blood then returns to the left atrium, passes through the left ventricle and is pumped out through the aorta into systemic circulation, traveling through arteries, arterioles, and capillaries where nutrients and other substances are exchanged between blood vessels and cells, losing oxygen and gaining carbon dioxide before being returned to the heart through venules and veins. The heart beats at a resting rate close to 72 beats per minute. Exercise temporarily increases the rate, but lowers it in the long term, and is good for heart health.

Cardiovascular diseases are the most common cause of death globally as of 2008, accounting for 30% of deaths. Of these more than three-quarters are a result of coronary artery disease and stroke. Risk factors include: smoking, being overweight, little exercise, high cholesterol, high blood pressure, and poorly controlled diabetes, among others. Cardiovascular diseases do not frequently have symptoms but may cause chest pain or shortness of breath. Diagnosis of heart disease is often done by the taking of a medical history, listening to the heart-sounds with a stethoscope, ECG, echocardiogram, and ultrasound. Specialists who focus on diseases of the heart are called cardiologists, although many specialties of medicine may be involved in treatment.

2. LITERATURE REVIEW

2.1 PALPATORY METHOD

The relaxed subject sits on a chair. The cuff of the sphygmomanometer is wrapped firmly around the right arm above the elbow. The lower arm should be resting on a table-top or bench. The radial pulse (the pulse at the radial artery in the wrist) is palpated with the fingers of the left hand. The number of beats in 30 seconds is counted, and the heart rate in beats per minute is recorded. The valve on the inflating bulb of the sphygmomanometer is turned fully clockwise so that it is closed. The cuff is inflated slowly (10 mm Hg/sec) by pumping the inflating bulb until the radial pulse is no longer felt. The cuff is inflated further until the pressure is about 30 mm Hg higher. The valve on the inflating bulb is opened slightly by turning it in the counterclockwise direction, allowing the pressure to drop slowly by about 5 mm Hg/sec. At some point, one will be able to feel the radial pulse once again. The pressure indicated on the gauge when the pulse reappears is noted. This is the systolic pressure. Now the pressure in the cuff is quickly released, so as not to cause undue discomfort to the subject. The determination of blood pressure is repeated two more times for the right arm, and then repeated again using the left arm instead of the right arm.

2.2 AUSCULTATORY METHOD

The blood pressure cuff is placed on the subject's right arm, allowing 1 inch between the bottom of the cuff and the crease of the elbow. The brachial pulse is palpated just above the angle of the elbow (the "antecubital fossa"). One group member puts on a stethoscope, with the earpieces on the headpiece angled forward. The recording end of the stethoscope is twisted, so that the diaphragm and not the bell is activated. This can be tested by tapping lightly on the diaphragm. The diaphragm is placed over the brachial artery in the space between the bottom of the cuff and the crease of the elbow. At this point no sounds should be heard. The cuff pressure is inflated quickly to a pressure about 30 mm Hg higher than the systolic pressure determined by the method of palpation. Then the air is let out of the cuff at a rate such that cuff pressure falls at a rate of about 5 mm Hg/sec. At some point the person listening with the stethoscope will begin to hear sounds with each heartbeat. This point marks the systolic pressure. The sounds are called Korotkoff sounds. As the pressure is lowered further, the character of the Korotkoff sounds should change. At some point, the sounds will disappear. The pressure reading at this point gives the diastolic pressure.

2.3 OSCILLOMETRY METHOD

Knowing how cuff-only oscillometric readings are estimated helps in understanding the limitations of this method. With every arterial pulse wave there is a small rise and fall in the volume of the limb, which in turn causes an increase and then a decrease in the pressure within the encircling cuff, which can be detected using a solid-state transducer. When the cuff encircling a limb is inflated with an electronic pump (or sometimes manually), the rising pressure in the cuff eventually stops arterial blood flowing into the

underlying limb and pulsation ceases. This is detected by the machine which continues to inflate the cuff for a second or two more to ensure that the limb flow has stopped completely. At this point, inflation stops, and a valve opens allowing the pressure in the cuff to reduce slowly. The pressure within the cuff is monitored carefully by the machine. At first it only detects the pulseless reduction in pressure. As the pressure in the cuff falls to below the pressure of the peak of the arterial pulse, the machine begins to detect a small pressure wave which reflects the difference between the pressure in the cuff and that in the artery. With further cuff deflation these pressure differences become greater until the cuff begins to fall away from the limb and less of the volume pulsation is detected. The machine therefore records within it a series of pulse waves, which are initially flat, then very slight, then increase to a peak and then diminish until they are hardly detected. Some machines read pressure and volume changes during cuff inflation until the arm stops pulsating after which the cuff rapidly deflates.

Oscillometric machines usually use the maximum volume change as an indication of the average of the systolic and diastolic BP within the artery. By combining this average with the rate of change of the pressure wave, the machines then use a variety of algorithms to estimate the systolic and diastolic BP. These algorithms vary from machine to machine resulting in slightly different interpretations of the pressures. Pulse detection by oscillometric machines depends on the amount of change in the volume of the arm with each pulse (small pulses are more difficult to detect) and on the regularity and rate of those pulses. With regular pulses and a relatively smoothly changing arm volume it is much easier for the microprocessor to estimate the systolic and diastolic BP. However, if the pulses are irregular or there are movements in the arm under the cuff, pressure changes in the cuff will not rise and fall smoothly leading to difficulty in making the pressure calculations. This can arise with rhythm problems such as atrial fibrillation and when there are frequent extrasystoles which may have a smaller volume than regular beats. Very slow heart rates (<50 bpm) may lead to too few beats being detected during cuff deflation to permit an accurate estimate of BP. The use of reliable solid-state transducers and microprocessor technology allows these pressure changes in the cuff to be detected and analyzed permitting easy access to a fair and reproducible estimation of arterial BP economically and without the need for skilled interpretation.

2.4 INVASIVE METHOD

Invasive (intra-arterial) blood pressure (IBP) monitoring is a commonly used technique in the Intensive Care Unit (ICU) and is also often used in the operating theater. This technique involves direct measurement of arterial pressure by inserting a cannula needle in a suitable artery. The cannula must be connected to a sterile, fluid-filled system, which is connected to an electronic patient monitor. The advantage of this system is that a patient's blood pressure is constantly monitored beat-by-beat, and a waveform (a graph of pressure against time) can be displayed. There are a variety of monitors with invasive blood pressure monitoring for Trauma, critical care and operating room applications. These include single pressure, dual pressure, and multi-parameter (i.e. Pressure / temperature).

2.5 NONINVASIVE METHOD

Monitoring of arterial blood pressure (BP) is a mainstay of hemodynamic monitoring in acutely or critically ill patients. Close monitoring of BP is of great importance to detect and treat hypotension and hypertension early. Both, hypotension and hypertension can impair the function of vital organs, such as the brain, the heart, and the kidneys. The direct measurement of BP via arterial cannulation is regarded as the clinical reference method (criterion standard). In clinical routine, it is commonly performed during high-risk surgery and in intensive care medicine. The cannulation of an artery, however, can be time-consuming, needs to be done by a trained operator, and is associated although very rarely with potential major complications such as embolism, lesion of nerves or vessels, or ischemia. For these reasons, BP is very commonly measured non-invasively. There are several ways to non-invasively measure BP. Monitoring techniques can be classified according to their ability to measure BP intermittently or continuously. In this article, we describe techniques for non- invasive monitoring of arterial BP and discuss their advantages, limitations, and clinical applicability.

3. BLOCK DIAGRAM

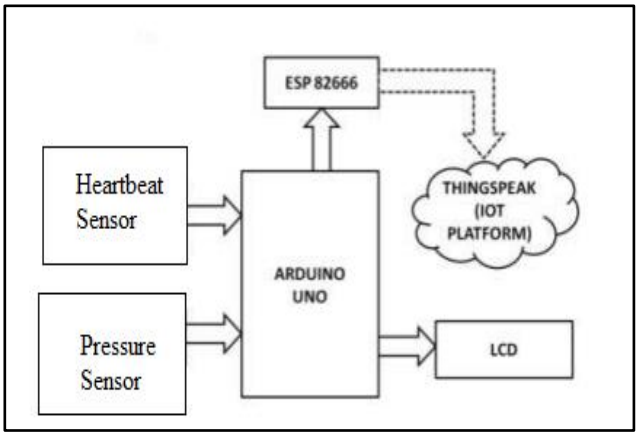

Fig.1.Block diagram of hardware

4. WORKING SETUP

Wireless technology has made blood pressure and heart rate monitoring easier and more convenient than ever before. Here are the general steps for monitoring blood pressure and heart rate using wireless technology:

Choose the right device: There are many different wireless blood pressure and heart rate monitors available on the market. Choose a reliable device that is compatible with your smartphone or tablet.

Install the app: Most wireless blood pressure and heart rate monitors come with an accompanying app that you need to download and install on your smartphone or tablet. Make sure you follow the instructions carefully to ensure that the app is set up correctly.

Connect the device: Once you have installed the app, you need to connect the wireless blood pressure and heart rate monitor to your smartphone or tablet. This typically involves pairing the two devices using Bluetooth.

Position the cuff: If you are monitoring your blood pressure, you will need to position the cuff around your upper arm. Make sure that the cuff is snug but not too tight. If you are monitoring your heart rate, you may need to wear a finger clip.

Take the measurement: Once you have positioned the cuff or finger clip correctly, you can take the measurement. Press the button on the device to start the measurement. You should remain still and quiet during the measurement.

View the results: Once the measurement is complete, the results will be displayed on your smartphone or tablet. You may be able to view your blood pressure or heart rate in real-time or you may need to wait for the device to sync with the app.

Store the results: Most wireless blood pressure and heart rate monitors come with a feature that allows you to store your results in the app. This can be helpful for tracking changes in your blood pressure or heart rate over time.

Share the results: You may also be able to share your blood pressure or heart rate results with your healthcare provider. Check with your healthcare provider to see if they have any specific instructions for sharing your results with them.

Maintain the device: Finally, make sure that you maintain your wireless blood pressure and heart rate monitor according to the manufacturer's instructions. This may involve cleaning the device regularly or replacing batteries as needed.

5.CONCLUSION

In conclusion, the combination of hardware and software advancements in blood pressure and heart rate monitoring using wireless technology has led to significant improvements in patient care. Wireless monitoring devices offer convenience and portability, allowing patients to be monitored remotely and reducing the burden on healthcare providers. Software tools like machine learning algorithms and data analytics provide insights into patient health status and can help identify patients who require early intervention. The continued development of wireless monitoring technology holds great promise for the future of healthcare. As more data is collected and analyzed, machine learning algorithms and other data analytics tools will become more sophisticated and enable more accurate predictions about patient health outcomes. The integration of electronic health records and telemedicine platforms will also become more seamless, allowing for better data management and improved patient outcomes. However, it is important to address concerns about patient data security and privacy as wireless monitoring technology becomes more widespread. Regulations and technological solutions must be put in place to ensure patient data is protected and secure. Overall, the advancements in hardware and software components of blood pressure and heart rate monitoring using wireless technology have revolutionized patient care. With continued research and development, this technology has the potential to improve patient outcomes, reduce healthcare costs, and provide a more personalized approach to healthcare.

Blood pressure and heart rate monitoring using wireless technology is becoming increasingly prevalent in the healthcare industry. Wireless monitoring devices offer several benefits over traditional monitoring methods, including early detection of health problems, improved disease management, personalized care, remote monitoring, increased patient engagement, convenience, and cost-effectiveness. These devices can be used in various applications, including home health monitoring, clinical research, telemedicine, workplace wellness programs, emergency medicine, and military medicine. Looking to the future, there are several trends that are likely to shape the development of blood pressure and heart rate monitoring using wireless technology. These include the continued development of wearable technology, the integration of artificial intelligence and machine learning algorithms, the integration with electronic health records, the growth of remote patient monitoring, the focus on personalized medicine, and the expansion of mobile health technology. These trends are likely to result in more accurate and sophisticated monitoring devices, better disease management and patient outcomes, improved communication between patients and healthcare providers, and increased patient engagement in their own health.

It is important to note that while wireless monitoring devices offer numerous benefits, they also present some challenges. These devices may not be suitable for all patients, particularly those with mobility or cognitive impairments. Additionally, there are concerns about the security and privacy of patient data collected by these devices. It is essential that healthcare providers and device manufacturers address these challenges to ensure that wireless monitoring devices can be used safely and effectively by all patients. In conclusion, blood pressure and heart rate monitoring using wireless technology has the potential to revolutionize the way healthcare is delivered. Wireless monitoring devices offer numerous benefits over traditional monitoring methods, including early detection of health problems, improved disease management, personalized care, remote monitoring, increased patient engagement, convenience, and cost-effectiveness. These devices can be used in various applications, including home health monitoring, clinical research, telemedicine, workplace wellness programs, emergency medicine, and military medicine. Looking to the future, the continued development of wearable technology, the integration of artificial intelligence and machine learning algorithms, the integration with electronic health records, the growth of remote patient monitoring, the focus on personalized medicine, and the expansion of mobile health technology are likely to further enhance the capabilities of wireless monitoring devices. It is important that healthcare providers and device manufacturers address the challenges associated with wireless monitoring devices to ensure that they can be used safely and effectively by all patients.

5.1 PURPOSE

The purpose of blood pressure and heart rate monitoring using wireless technology is to provide an efficient and convenient way to track these vital signs remotely, in real-time, and over extended periods. Wireless monitoring can help individuals and healthcare professionals detect changes or abnormalities in blood pressure and heart rate patterns early, allowing for early intervention or treatment before they become serious health issues. Using wireless technology, blood pressure and heart rate data can be transmitted in real-time to a remote server or mobile device, where it can be analyzed and used to generate personalized insights and recommendations for individuals. This data can also be shared with healthcare professionals, allowing them to monitor a patient's progress and make informed decisions about treatment plans. Wireless blood pressure and heart rate monitoring is especially helpful for people who have chronic conditions such as hypertension, heart disease, or diabetes, as well as those who are recovering from surgery or managing their health at home. By providing a way to monitor these vital signs continuously, wireless technology can help people take control of their health and improve their quality of life.

Early detection of health problems: Monitoring blood pressure and heart rate regularly can help detect any abnormal fluctuations or trends, which may indicate underlying health issues such as hypertension, arrhythmia, or heart disease. Early detection of these problems can lead to prompt medical intervention and better outcomes.

Better management of chronic conditions: Patients with chronic conditions such as hypertension or diabetes may need to monitor their blood pressure and heart rate regularly to track the effectiveness of their treatment plans. Wireless monitoring can make it easier for patients to track and share this data with their healthcare providers, leading to better disease management and improved health outcomes.

Remote monitoring: Wireless blood pressure and heart rate monitoring can allow healthcare providers to remotely monitor patients' vital signs in real-time. This can be especially useful for patients with chronic conditions or those who are recovering from surgery, as it can provide early warning signs of complications and allow for prompt medical intervention.

Personalized care: Wireless monitoring can enable healthcare providers to tailor treatment plans to individual patients' needs and adjust them based on real-time data. This can lead to more personalized and effective care, as well as better patient outcomes.

Overall, blood pressure and heart rate monitoring using wireless technology can provide valuable insights into patients' health status, allowing for early detection and better management of health problems, as well as personalized and remote care.

5.2 CUSTOMERS

Individuals with chronic conditions: Patients with chronic conditions such as hypertension or diabetes may need to monitor their blood pressure and heart rate regularly to track the effectiveness of their treatment plans.

Elderly individuals: As people age, their blood pressure and heart rate can change, and they may be at higher risk for heart disease and other health problems. Wireless monitoring can help elderly individuals and their caregivers keep track of their vital signs and detect any potential health issues.

Athletes and fitness enthusiasts: Athletes and fitness enthusiasts may use wireless monitoring to track their heart rate during exercise and adjust their workout intensity accordingly. This can help optimize their training and prevent overexertion or injury.

Hospitals and healthcare providers: Healthcare providers may use wireless monitoring to remotely monitor patients' vital signs in real-time, allowing for prompt medical intervention and improved patient outcomes. Hospitals may also use wireless monitoring for patients in intensive care units or recovering from surgery.

Overall, the customers of blood pressure and heart rate monitoring using wireless technology can include individuals with chronic conditions, elderly individuals, athletes and fitness enthusiasts, as well as

hospitals and healthcare providers.

5.3 FEATURES

Real-time monitoring: Wireless blood pressure and heart rate monitoring devices can provide real-time data on patients' vital signs, which can allow for prompt medical intervention if necessary.

Non-invasive measurement: Many wireless blood pressure and heart rate monitoring devices are non-invasive and can be used at home, without the need for a healthcare professional.

Bluetooth connectivity: Many wireless monitoring devices use Bluetooth connectivity to transmit data to a smartphone or other mobile device, allowing patients to track and share their data with their healthcare providers.

Data analysis and insights: Some wireless monitoring devices can analyze the data they collect and provide insights into patients' health status, such as trends or patterns in their blood pressure or heart rate.

Alerts and notifications: Wireless monitoring devices may be equipped with alerts or notifications to warn patients or healthcare providers of any abnormal fluctuations or trends in blood pressure or heart rate.

Compatibility with other devices: Many wireless monitoring devices are compatible with other health monitoring devices, such as fitness trackers or smartwatches, which can provide a more comprehensive view of patients' health status.

Remote monitoring: Wireless monitoring devices can allow healthcare providers to remotely monitor patients' vital signs, which can be especially useful for patients with chronic conditions or those who are recovering from surgery.

Overall, blood pressure and heart rate monitoring using wireless technology can offer several features that make monitoring easier, more convenient, and more accessible, while also providing valuable insights into patients' health status.

5.4 BENEFITS

Early detection of health problems: Wireless monitoring can help detect any abnormal fluctuations or trends in blood pressure or heart rate, which may indicate underlying health issues such as hypertension, arrhythmia, or heart disease. Early detection of these problems can lead to prompt medical intervention and better outcomes.

Improved disease management: Regular blood pressure and heart rate monitoring can help patients with chronic conditions such as hypertension or diabetes manage their disease more effectively. Wireless monitoring can make it easier for patients to track and share their data with their healthcare providers, leading to better disease management and improved health outcomes.

Personalized care: Wireless monitoring can enable healthcare providers to tailor treatment plans to individual patients' needs and adjust them based on real-time data. This can lead to more personalized and effective care, as well as better patient outcomes.

Remote monitoring: Wireless blood pressure and heart rate monitoring can allow healthcare providers to remotely monitor patients' vital signs in real-time. This can be especially useful for patients with chronic conditions or those who are recovering from surgery, as it can provide early warning signs of complications and allow for prompt medical intervention.

Increased patient engagement: Wireless monitoring can make it easier for patients to take an active role in managing their health, which can increase patient engagement and lead to better health outcomes.

Convenience: Wireless monitoring can allow patients to monitor their vital signs at home, without the need for frequent visits to a healthcare provider.

Cost-effectiveness: Wireless monitoring can potentially reduce healthcare costs by allowing for earlier detection of health problems, which can prevent costlier treatments or hospitalizations.

Overall, blood pressure and heart rate monitoring using wireless technology can provide several benefits, including earlier detection and better management of health problems, more personalized and remote care, increased patient engagement, and cost-effectiveness.

6. REFERENCES

[1] Bharat singh, shabana urooj, sakshi Mishra, surajeet Haldar, " blood pressure monitoring using wireless technology" in international conference on pervasive computing advances and application, perCAA 2019.
[2] Kejela Adane Dulecha, Amruth Ramesh Thelkar, "Blood Pressure, Heart Beat and Body Temperature Measurement by Using GSM and Low-Cost Microcontroller with Health Care Announcement" in Journal of Control and Instrumentation Engineering, e-ISSN: 2582-3000, Volume-7, Issue-1 (January-April, 2021).
[3] Bharat Singh and Shabana Urooj (2018) "Intravenous Drug Delivery System for Blood Pressure Patient Based on Adaptive Parameter Estimation" International Journal of Natural Computing Research 7(3): 42-53.
[4] MILL MAN J and HAWKIES C.C, "INTEGRATED ELECTRONICS" MCGRAW HILL, 1972.
[5] "DESIGN WITH PIC MICROCONTROLLER" by John Bheat Man.
[6]Md. Nashiruddin Parvez, Mayank Maheshwari, Abhijeet Kumar, Ms. Vinodhini,"ARDUINO BASED HEARTBEAT SENSOR" in © 2018 JETIR October 2018, Volume 5, Issue 10 www.jetir.org (ISSN-2349-5162).
[7] https://en.wikipedia.org/wiki/Blood_pressure
[8] https://en.wikipedia.org/wiki/Heart_rate
[9] ANITHA. A, SUDHARSHAN BANAKAR, TEJASHWINI A," Wireless Heartbeat Monitoring System Using Android" in © NOV 2018 | IRE Journals | Volume 2 Issue 6 | ISSN: 2456-8880.
[10] K. Sriram Datta, L. Mani Kumar, M. Kiran, M. Pavan Satya Arun, R.G V V D S Pavan Kumar," HEARTBEAT SENSOR USING ARDUINO" in Pramana Research Journal Volume 10, Issue 4, 2020 ISSN NO: 2249-2976