Remote Blood Pressure Monitoring System for Enhanced Care of Elderly and Bedridden Individuals Using Wireless Sensors and Raspberry Pi

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Abstract: - The paper discusses the use of wireless sensors to monitor the blood pressure of elderly or bedridden individuals, to improve their care. The sensors transmit the blood pressure readings to a PC for storage and display and notify the appropriate individuals via an app. The current method for obtaining blood pressure values is through a contact-detecting technique, which is inconvenient and uncomfortable for patients. Therefore, the researchers propose a Blood Pressure Monitoring System (BPMS) that can remotely monitor patients' blood pressure. The Raspberry Pi processes the data and displays the blood pressure readings on a graphical user interface. The system is designed to be portable and easy to use, allowing patients to monitor their blood pressure from the comfort of their own homes. The results show that the proposed system is accurate and reliable, making it a promising tool for monitoring blood pressure remotely.

Keywords: wireless sensors, blood pressure monitoring, elderly care, remote monitoring, Raspberry Pi, portable system.

INTRODUCTION

Blood pressure is a critical physiological parameter that helps assess an individual's health status. It measures the force of blood pushing against the walls of arteries as the heart pumps blood through the body. Blood pressure readings can indicate potential health risks, such as high blood pressure or hypertension, which can lead to heart disease, stroke, and other serious medical conditions. Traditionally, blood pressure readings are obtained using contact-detecting techniques, such as manual sphygmomanometers or automated blood pressure monitors. However, these methods can be inconvenient, and uncomfortable, and may require a trained healthcare professional to administer them. In recent years, wireless sensors have emerged as a promising alternative for monitoring blood pressure remotely. Wireless sensors are small, portable devices that can be attached to the body to monitor vital signs and other physiological parameters continuously. They can transmit data wirelessly to a central monitoring system, allowing healthcare professionals to monitor patients' health status remotely. This technology has the potential to revolutionize the way we monitor and manage blood pressure, particularly for elderly or bedridden patients who may have difficulty traveling to medical facilities for regular check-ups.

The proposed Blood Pressure Monitoring System (BPMS) aims to leverage wireless sensor technology to monitor patients' blood pressure remotely, in a non-invasive and convenient manner. This system has the potential to improve patient care and outcomes, reduce healthcare costs, and enhance the quality of life for elderly and bedridden individuals.

EXISTING SYSTEM

It involves remote monitoring of patient’s vital signs. The system comprises a network of sensors that are connected to each patient to track their vital signs. The data collected from the sensors is wirelessly transmitted

through a fixed infrastructure of routing nodes to a base station, which is then connected to a host computer running a Java-based GUI to interpret and display the data. The system has three main areas of the interface, including the sensor to BPM, the sensor base station to the host computer, and the human interface to the host computer through the GUI. Additionally, the passage mentions a brief description of the sensor network.

The use of the Internet of Things (IoT) is one method that can be employed to monitor a patient's health remotely. There are many applications available today that are designed and implemented to increase the efficiency of hospital management. An IoT blood pressure monitor has been developed to aid hospital staff in remotely monitoring a patient's blood pressure readings. This technology reduces patients' dependence on hospital staff while also improving doctors' ability to make real-time decisions based on patient conditions. IoT blood pressure monitoring is especially beneficial for elderly or disabled patients who may have difficulty visiting hospitals for regular check-ups. The system expands the medical services setting from the patient's home to the doctor's facility.

Two methods are commonly used to measure blood pressure. The first method involves using a stethoscope, while the second method is an automated process that utilizes high-end technology. Previous research has explored the implementation of monitoring systems based on Internet of Things (IoT) using ZigBee technology.

Wireless sensor networks have various technologies available for transmitting physiological signals communications. These technologies include Infrared, Bluetooth, and ZigBee, among others. However, the infrared transmission has limitations due to its angle limit problem and cannot be used for physiological signal transmission. While Bluetooth provides better transmission rates than ZigBee, ZigBee is preferred for 24-hour communication transmission systems because of its lower power consumption

PROPOSED SYSTEM

The development of a Sphygmomanometer-based Blood Pressure Monitoring System specifically designed for elderly individuals using Raspberry Pi. The system aims to provide a convenient and user-friendly solution for regular blood pressure monitoring, catering to the specific needs of older adults. The Raspberry Pi board, in conjunction with a sphygmomanometer, serves as the core components of the system. Additionally, the system utilizes various peripherals, including a digital display, push buttons, and an optional LCD screen, to enhance user interaction and provide real-time feedback. The proposed system also incorporates wireless connectivity options, such as Wi-Fi or Bluetooth, allowing the collected blood pressure data to be transmitted and stored for further analysis and monitoring. The user interface is designed to be intuitive, displaying the blood pressure readings prominently and facilitating easy navigation through the system. The system's accuracy and reliability are validated through comparative studies with conventional blood pressure monitoring devices. Overall, this system presents a practical solution for elderly individuals to monitor their blood pressure regularly in a non-invasive and efficient manner, promoting better healthcare management and early detection of potential health issues.

FLOW CHART

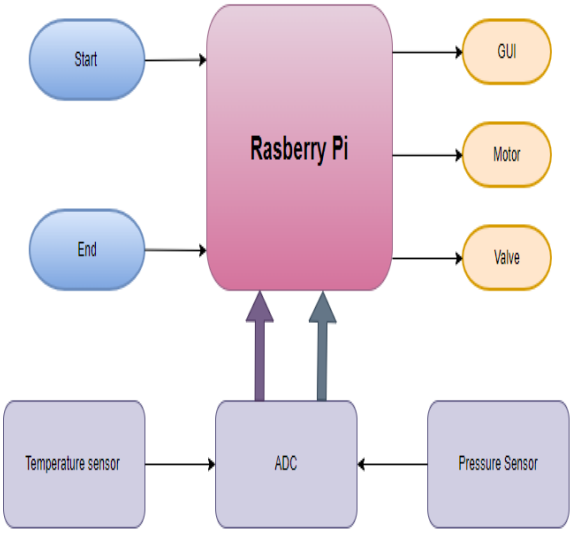


Fig 1.1 Flow chart

Description: The above picture shows the flow a process.

BLOOD PRESSURE MODULE

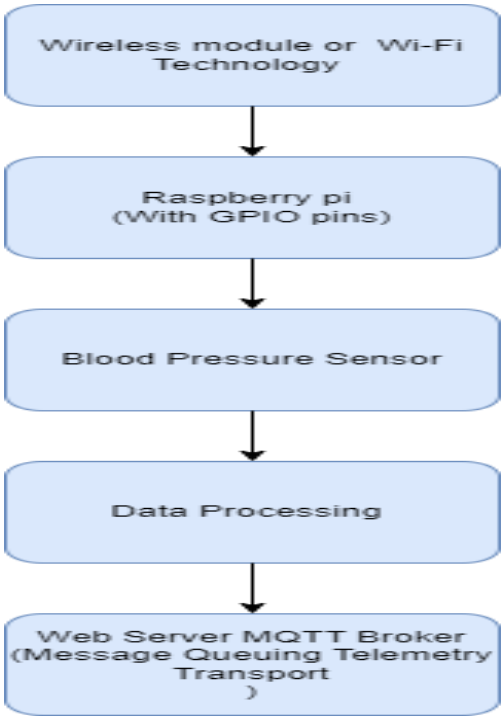


Fig 1.2 Structure of the project

Description: The above image shows the flow of the project

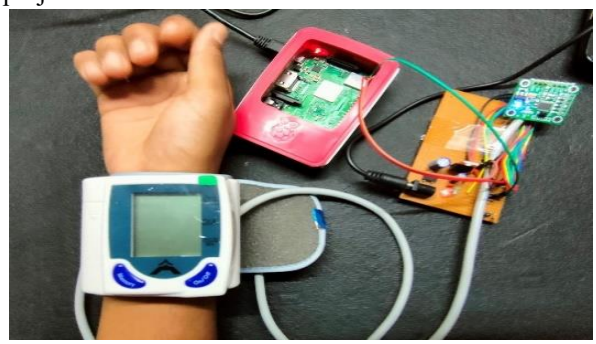


Fig 1.3 Device Before Activation

Description: It shows the device activation of the blood pressure sensor.

Fig 1.4 Device After Activation

Description: It shows the device after the activation.

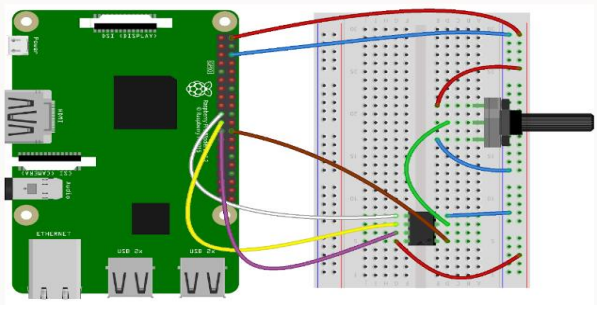
COMPONENTS DETAILS

Sphygmomanometer:

A sphygmomanometer is a logical gadget used to recognition pulse. It consists of an inflatable cuff that is wrapped around the upper arm, a pressure gauge, and a valve or release button to control the pressure in the cuff. The sphygmomanometer works by briefly restricting blood flow through the artery in the arm and then slowly releasing the pressure to allow blood to flow through again. The gauge measures the pressure in the cuff as the pressure is released, providing a reading of the patient's blood pressure in millimetres of mercury (mmHg). The measurement includes two numbers, systolic pressure and diastolic pressure. A typical blood pressure reading might be something like "120 over 80" (written as 120/80 mmHg), with the systolic pressure being 120 and the diastolic pressure being 80. Sphygmomanometers can be either manual (requiring a stethoscope and human interpretation) or electronic (automatically displaying the reading).

2. Amplifier - A signal amplifier can be used to amplify the signal from the blood pressure sensor, which may be weak and noisy.

3. ADC - An Analog-to-Digital Converter (ADC) can be used with a Raspberry Pi to convert analog signals, such as those from sensors, into digital signals that can be read and processed by the Raspberry Pi.



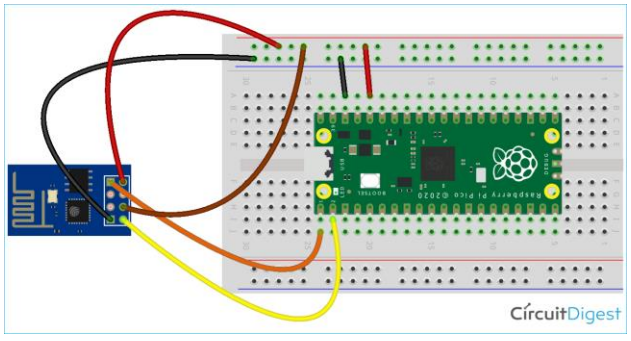
4. Raspberry pi board:

A wireless blood pressure sensor can be connected to a Raspberry Pi board via a wireless communication protocol, such as Bluetooth or Wi-Fi.

- Choose a blood pressure sensor that supports wireless communication, such as a Bluetooth-enabled blood pressure monitor.
- Connect the wireless module to the Raspberry Pi. This may involve plugging in a USB Bluetooth dongle or connecting a Wi-Fi module to the Raspberry Pi's GPIO pins.
- Install the appropriate drivers and software for the wireless module on the Raspberry Pi. For example, if using a Bluetooth module, install the BlueZ software stack.
- Pair the blood pressure sensor with the Raspberry Pi using the wireless protocol. This may involve entering a PIN or passcode.
- Write software to communicate with the blood pressure sensor and receive readings. This software can be written in a programming language such as Python, and may involve using a library or API provided by the blood pressure sensor manufacturer.
- Display the blood pressure readings on a screen attached to the Raspberry Pi, or on a remote device such as a smartphone or computer.

Wireless module

This is the component that enables wireless communication between the blood pressure sensor and other devices, such as smartphones or computers. The wireless module can be Wi-Fi, Bluetooth, or other wireless technology.



DISPLAY

The sensor readings can be displayed on a screen attached to the Raspberry Pi, or on a remote device, such as a smartphone or computer.

IMPLEMENTATION

The blood pressure sensor is connected to the Raspberry Pi, typically through an analog-to-digital converter (ADC) or a voltage divider circuit. The Raspberry Pi reads the analog signal from the sensor and converts it into a digital signal. The digital signal is processed by software on the Raspberry Pi, which may include calibration to ensure accurate readings, data filtering to remove noise, and scaling to convert the signal into meaningful blood pressure readings. The blood pressure readings are transmitted wirelessly using a communication module, such as Wi-Fi, Bluetooth, or ZigBee. The transmitted data is received by a receiver or gateway device, which may be connected to a screen or web interface for display or analysis. The displayed data can be used by healthcare professionals to monitor the blood pressure of patients in real-time, or by individuals to track their blood pressure over time.

CONCLUSION

In conclusion, the wireless blood pressure sensor using Raspberry Pi is a powerful tool for monitoring and tracking blood pressure readings in real-time. With the help of appropriate hardware components and software tools, the Raspberry Pi can convert the analog signals

from a blood pressure sensor into digital readings, process and filter the data, and transmit it wirelessly using a communication module. This data can then be displayed on a screen or web interface for real-time monitoring or analysis. Overall, the wireless blood pressure sensor using Raspberry Pi is a promising technology for healthcare professionals and individuals looking to monitor and track blood pressure in real-time. Integration with cloud-based analytics platforms to provide more advanced data analysis and reporting capabilities. This could involve using machine learning algorithms to identify trends and patterns in blood pressure data, and providing actionable insights and recommendations to patients and healthcare professionals. Improved security features, such as the use of blockchain technology or multi-factor authentication, to ensure the privacy and security of patient data during wireless transmission and storage.

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