Section A -Research paper

Modbus connected Multichannel channel Parameter Data Acquisition, Monitoring, and User Management System

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ABSTRACT-

The main topics of the research article are the design and implementation of a Multichannel Parameter Data Acquisition, Monitoring, and User Management System that use the Modbus protocol for communication. The system seeks to offer a versatile and dependable solution for real-time parameter monitoring and management via several channels.

The system's flexibility and scalability make it suitable for various applications, including industrial automation, process control, and environmental monitoring. The use of the Modbus protocol ensures interoperability with other devices and systems that support this protocol, allowing for easy integration into existing systems. Overall, the research paper demonstrates the design and implementation of a reliable and user-friendly Multichannel Parameter Data Acquisition, Monitoring, and User Management System that utilizes the Modbus protocol for communication. The system's features and capabilities make it a suitable solution for various applications that require real-time monitoring and management of multiple parameters.

Keywords:

1. INTRODUCTION

Data collection and monitoring systems are used in many fields nowadays to gather data from numerous sources and to continuously monitor it. The Modbus-based Multichannel Parameter Data Acquisition, Monitoring, and User Management System may simultaneously gather and monitor data from various sources. An outline of the system's main components is given in this essay.

In the field of industrial automation, the Modbus protocol is frequently employed. It is a protocol for serial communication that enables network-connected devices to talk to one another. Due to its simplicity, versatility, and ease of implementation, the Modbus protocol has emerged as the de facto standard for device-to-device communication in the field of industrial automation.The Multichannel Parameter Data Acquisition System is a device that

may simultaneously gather data from numerous sources. Numerous factors, including temperature, pressure, humidity, flow rate, etc., can be tracked using the system. The system can communicate with devices that support the Modbus protocol because it is built on that protocol.

An essential part of the Multichannel Parameter Data Acquisition System is the User Management System. It enables the creation, administration, and control of user accounts and their corresponding access levels. The system administrator can set up user accounts and control each user's level of system access. This guarantees that the system is secure and that only people with permission can access it.

Several essential characteristics of the Multichannel Parameter Data Acquisition, Monitoring, and User Management System include:

- monitoring and real-time data gathering
- collection of multichannel data from several sources
- Modbus protocol-based device communication

System for managing users and controlling

2. LITRETURESERVEY

"Design and implementation of a multichannel temperature monitoring system based on Modbus protocol" by Li et al. (2017)

This study focused on designing and implementing a multichannel temperature monitoring system based on the Modbus protocol. The system was designed to collect temperature data from multiple sources and display it in real time. The study found that the system was able to accurately collect and monitor temperature data from multiple sources…[1]

"Implementation of Modbus communication protocol for data acquisition and control system" by Sharma and Bharti (2017)

This study focused on the implementation of the Modbus protocol for data acquisition and control systems. The study found that the Modbus protocol was suitable for communication between devices in a data acquisition and control system. The study also found that the protocol was easy to implement and had low overhead.[2]

"Implementation of a Multichannel Data Acquisition and Monitoring System for Industrial Processes" by Idoko et al. (2018)

This study focused on the implementation of a multichannel data acquisition and monitoring system for industrial processes. The system was designed to collect data from multiple sources and display it in real time. The study found that the system was able to accurately collect and monitor data from multiple sources and was suitable for use in industrial processes.[3]

"Design of a data acquisition and control system based on Modbus protocol" by Zhang et al. (2019)

This study focused on the design of a data acquisition and control system based on the Modbus protocol. The system was designed to collect data from multiple sources and control devices based on the collected data. The study found that the system was able to accurately collect data from multiple sources and control devices based on the collected data…[22-31]

3. METHODOLOGY

Depending on the exact implementation and the communication hardware or software used, connecting Modbus with several channels may be possible. However, there

are a few common factors and actions that can assist direct the process:

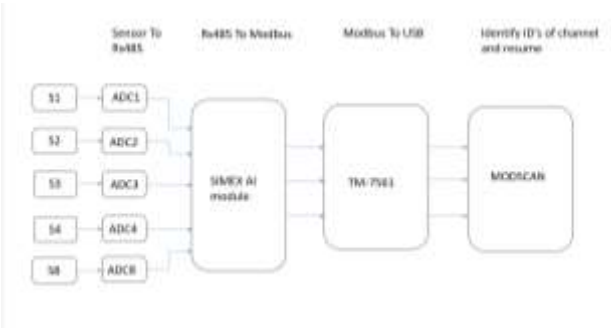
Determine how many channels there are: Establish the number of communication channels to be used as well as the type of communication interface needed (e.g., RS-232, RS-485, Ethernet, etc.).

Select the communication equipment: Choose hardware that can accommodate the necessary number of channels and communication interfaces. Devices like Modbus gateways, protocol converters, or Modbus-capable controllers may be included in this.

Set the hardware up: Set up the hardware according to the particular needs of the application, including the baud rate, parity, data bits, stop bits, and network configuration.

Create a protocol for communication: Create a communication protocol that outlines the data transfer procedures between the Modbus-capable hardware and the various channels. Determining the data structure, addressing method, error handling, and synchronization needs may fall under this category.

Test and verify: Test the communication setup and verify that data is being exchanged correctly between the Modbus-enabled devices and the multiple channels. This may involve using diagnostic tools such as a Modbus scanner or analyzer.



Monitor and maintain: Regularly check that the communication configuration is still functioning properly, and maintain the hardware and software as necessary to avoid problems.

Overall, connecting Modbus with multiple channels will require careful planning and consideration of the hardware and software components, as well as the communication protocol and testing requirements. For advice on the implementation, it is advised to refer to the documentation and support materials of the particular devices and software being utilized.

4. ALGORITHM

Here's an algorithm for a Modbus-connected multichannel parameter data acquisition, monitoring, and user management system using a mobile application:

1. Sensor: The sensor is connected to the ADC, which transforms the physical parameter into the appropriate electrical signal. The required electrical signal is then connected to the ADC to convert the sensor data to RS485 format.
2. Establish connection: Connect the Modbus devices to the system via RS485 communication protocol and establish the connection.
3. Multichannel data acquisition: Read data from multiple channels and store them in a database.
Real-time monitoring: Display the acquired data on the mobile application in real time.
4. User management: Allow the user to log in and manage the system.
5. Authentication: Authenticate users before granting access to the system.
6. User roles and permissions: Assign different user roles and permissions to ensure that only authorized users can access the system.
7. User activity logging: Log user activity to keep track of system usage.
8. Alerts and notifications: Send alerts and notifications to the user in case of any critical events.
9. Data analysis: Analyze the data acquired from multiple channels and provide insights

to the user.

10. Remote access: Allow remote access to the system via the Internet.

11. Data backup: Back up the acquired data regularly to prevent data loss.

13. Data export: Allow users to export data in different formats for further analysis.

14. Configuration: Provide the user with the ability to configure the system, including channel settings, alert settings, and notification settings.

5. HARDWARE REQUIRED

1. Sensor: The sensor is connected to the ADC, which transforms the physical parameter into the appropriate electrical signal. The required electrical signal is then connected to the ADC to convert the sensor data to RS485 format.

2. Power Supply: The reliable power supply is a crucial aspect of a Modbus-connected multichannel channel parameter data acquisition, monitoring, and user management system. This system, designed to gather and analyze data from multiple channels, requires a stable power source to ensure accurate readings and uninterrupted operation. The power supply unit (PSU) chosen should meet the specific power requirements of the Modbus devices, data acquisition modules, monitoring equipment, and associated peripherals. A regulated power supply is recommended to provide a constant voltage output and minimize voltage fluctuations or noise that could impact data accuracy. Considerations such as redundancy and proper grounding are essential to maintain system integrity and protect against power disruptions and electrical noise. Additionally, the power supply setup should account for the power needs of user management and monitoring components, such as displays and network devices. Adhering to manufacturer guidelines and seeking professional expertise when needed will ensure an optimal power supply solution for the Modbus-connected multichannel system, promoting reliable data acquisition, monitoring, and user management capabilities.

3. Modbus: Modbus is a communication standard used in systems for industrial automation. It was created by Modicon in 1979 and is now a widely accepted communication protocol used in a variety of sectors, including manufacturing, water treatment, and the oil and gas industry.

Modbus is a flexible protocol since it is open and may be used by any manufacturer to create their own devices. It is built on a master-slave architecture in which a master device (such as a computer or programmable logic controller) interacts with numerous slave devices (like sensors, actuators, and other devices) through communication. To transfer data between the master and the slaves, the protocol employs a straightforward request-response method.

Modbus protocols come in a variety of forms, including Modbus ASCII (which utilizes ASCII characters for communication), Modbus TCP (which uses Ethernet connection), and Modbus RTU (which uses serial communication). The most widely used protocol in industrial automation is Modbus RTU, however, Modbus TCP is becoming more and more popular because of its Ethernet interoperability.

Modbus is a versatile protocol that is quite easy to apply to a wide range of devices. The Modbus Organization has also standardized it, ensuring interoperability between various devices made by various manufacturers.

4.TM7561:

Advantech produces the TM7561, a Modbus RTU to USB converter. Through the USB connection, it is used to link Modbus devices that adhere to the RTU protocol to a computer.

The TM7561 converter can be used with a variety of devices, including sensors, PLCs, and other automation devices, and it supports a standard Modbus RTU connection. It connects to the computer via a built-in USB interface and can support baud rates of up to 115,200 bps.

The converter is appropriate for use in industrial settings because of its tough and

compact construction. Additionally, it has an LED indicator that shows the power supply and communication status. There is no need for an external power source because the converter is powered by a USB port.

The Advantech utility program makes it simple to configure the TM7561 converter, which works with a variety of operating systems including Windows, Linux, and macOS. Connecting Modbus RTU devices to a computer for data collecting, monitoring, and control is a trustworthy and economical solution.

5.RS485:

RS485 is a commonly used communication protocol for connecting devices in a Modbus-connected multichannel channel parameter data acquisition, monitoring, and user management system. It provides a reliable and robust method of transmitting data over long distances, making it ideal for industrial applications. The RS485 protocol allows multiple devices to be connected in a multidrop configuration, enabling data acquisition and monitoring from multiple channels simultaneously. This protocol utilizes differential signaling, which helps to minimize the impact of electrical noise and interference, ensuring accurate and stable data transmission. The RS485 interface typically requires a dedicated transceiver chip to convert the signals between the RS485 protocol and the electrical levels compatible with the system. Additionally, proper termination and biasing techniques are employed to optimize signal integrity and prevent reflections. Overall, RS485 plays a crucial role in enabling efficient and reliable communication between devices in a Modbus-based multichannel system, facilitating seamless data acquisition, monitoring, and user management functionalities.

6. EXPERIMENT

A boiler is a tool utilized in a lot of commercial and industrial applications to provide steam or different drinks for steam or hot water In this example the boiler is hooked up to numerous other gadgets through Modbus verbal exchange protocol to prevent is feasible. A lift valve is a device that controls the water degree in a boiler. This ensures that the water remains at a secure degree, stopping the boiler from walking dry or overflowing. A stage sensor is a device that measures the amount of water within the boiler. This data is used to manipulate the water degree and make certain that the water stage remains at the desired degree. A strength meter is a device that measures the electricity used in a boiler. Monitoring energy consumption can improve boiler efficiency and detection and reduce capacity power waste. All those gadgets are related to the boiler through the Modbus communication protocol. Modbus is a communique protocol broadly utilized in business automation structures. This allows the devices to change statistics and control alerts with the boiler, making the boiler greater efficient and effective.

7. CONCLUSION

A useful tool for both researchers and business experts, the multichannel parameter data acquisition, monitoring, and user management system is connected to Modbus. For increased speed and accuracy in data collection, this system offers a user-friendly interface for simultaneously collecting and monitoring data from numerous channels. The Modbus protocol is a great option for industrial applications since it guarantees a dependable connection between the system and external gadgets.

This system's user management system adds an extra degree of protection by limiting access to only authorized individuals. This guarantees that the information gathered is kept private and that only authorized people can alter the system's settings. The system is a good option for usage in many research

and development projects because of its adaptability and scalability.

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