



# Modbus connected Multichannel channel Parameter Data Acquisition, Monitoring and User Management System Using Mobile Application

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**ABSTRACT-** This abstract describes a multichannel parameter data acquisition system that is connected to Modbus, a communication protocol commonly used in industrial automation systems. The system is designed to acquire and monitor data from multiple channels simultaneously, allowing for efficient and accurate measurement of various parameters. The Modbus communication protocol enables the system to communicate with other devices in the network, making it ideal for integration into larger automation systems. Overall, this system offers a reliable and effective solution for monitoring and acquiring parameter data in industrial settings. For good reasons, MODBUS is currently the most widely used industrial protocol.

The Modbus protocol is used to facilitate communication between the data acquisition system and other devices on the network, providing a reliable and efficient means of data transmission. The system is ideal for applications where multiple parameters need to be monitored simultaneously, such as in industrial settings or scientific experiments. Its flexibility and ease of use make it a valuable tool for anyone in need of high-quality data acquisition. This unit is capable of measuring eight channels for various parameters like temperature, humidity, and pressure in larger industries. In the development of this system, they are ensuring proper functions for various features of the system. We use the Modbus-connected multichannel channel parameter to cope with different sensors used in the industry.

**Keywords:** Modbus communication, Mobile Application, User Interface, MODBUS is connected to multichannel DAC,DAC

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## 1. INTRODUCTION

The Modbus protocol allows different devices, such as programmable logic controllers (PLCs), sensors, and other industrial devices, to communicate with each other and with a central supervisory control system. This communication is done through a serial or Ethernet

connection, and the protocol defines the structure and format of the messages exchanged between devices.

The Modbus protocol supports a wide range of functions, including reading and writing data to and from devices, reading and writing diagnostic information, and

controlling the behavior of devices. Its simplicity and ease of use make it a popular choice for many industrial applications.

Overall, the Modbus industrial working process enables devices to communicate effectively and reliably, allowing for better control and monitoring of industrial processes.

In industrial settings, data acquisition is critical for ensuring optimal performance and productivity. One way to collect data is through the use of sensors, which can monitor various parameters such as temperature, pressure, flow rate, and more.

With the Modbus communication protocol, up to eight sensors can be connected and their data can be transmitted to a central control system or database. The Modbus protocol allows for efficient and reliable communication between devices, ensuring that data is transmitted accurately and in real-time.

Once the data is collected from the sensors, it can be stored in a database for further analysis and processing. This allows for trends to be identified and patterns to be discovered, which can help optimize industrial processes and improve overall efficiency.

Android applications can offer a wide range of functionalities, from simple applications that perform a single task, such as a calculator or a weather app, to complex applications that offer advanced features, such as social networking, online shopping, or gaming.

Overall, Android applications have become an essential part of our digital lives, providing us with access to a vast range of functionalities and services. In this, we gather sensor data, store it in a database in table format, then transmit that data from the database to an Android app for user-friendliness.

## **2. LITRETURESERVEY**

The Modbus connected multichannel parameter data acquisition, monitoring and user management system is an innovative technology designed to collect, monitor and manage data from multiple sources using the Modbus protocol. This system enables users to acquire and monitor data from various sensors, meters, and devices in real-time, ensuring high accuracy and efficiency. The following literature survey discusses some of the key works on this topic.

X. Zhang et al. described the design and implementation of a Modbus-based remote data acquisition system. The system uses Modbus protocol to communicate with remote devices and collect data from various sensors. The authors demonstrated the system's ability to acquire data from multiple channels and monitor the data in real-time. [1]

S. K. Singh et al. describe Modbus-Based Data Acquisition System for Monitoring of Solar Panel Parameters This paper presents a Modbus-based data acquisition system for monitoring solar panel parameters. The system collects data from various sensors on the solar panel and transmits the data to a remote server using the Modbus protocol. The authors demonstrated the system's ability to monitor the performance of the solar panel in real-time.[2]

Y. Cui et al. describes This paper proposes a remote monitoring and control system based on Modbus protocol. The system uses Modbus protocol to communicate with remote devices and collect data from various sensors. The authors demonstrated the system's ability to monitor and control the devices in real-time.[3]

S. K. Pandey et al. describe This paper describes the development of a Modbus-based energy monitoring and management

system for residential buildings. The system collects data from various energy meters and transmits the data to a remote server using the Modbus protocol. The authors demonstrated the system's ability to monitor the energy consumption of residential buildings in real-time.[4]

Y. Zhang et al. describe This paper presents the design and implementation of a Modbus-based monitoring system for water treatment process. The system collects data from various sensors and transmits the data to a remote server using the Modbus protocol. The authors demonstrated the system's ability to monitor the water treatment process in real-time.[5]

### 3. METHODOLOGY

Connecting Modbus with multiple channels will depend on the specific implementation and the hardware or software used for the communication. However, there are some general steps and considerations that can help guide the process:

**Identify the number of channels:** Determine how many channels will be used for communication and the type of communication interface required (e.g., RS-232, RS-485, Ethernet, etc.).

**Choose the communication hardware:** Select the appropriate hardware that supports the required number of channels and communication interface. This may include devices such as Modbus gateways, protocol converters, or Modbus-enabled controllers.

**Configure the hardware:** Configure the hardware for the specific application requirements, such as baud rate, parity, data bits, stop bits, and network settings.

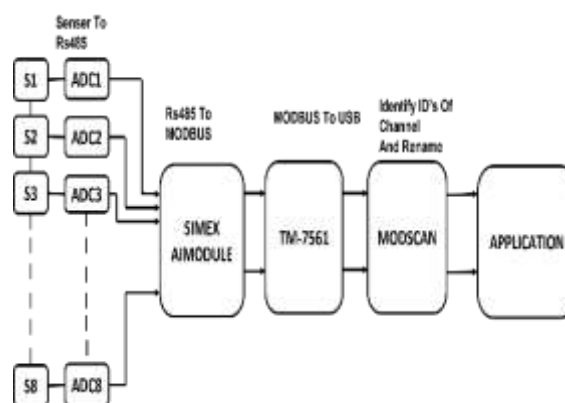
**Develop a communication protocol:** Develop a communication protocol that specifies how data will be exchanged between the Modbus-enabled devices and the multiple channels. This may include defining the data structure, addressing scheme, error handling, and synchronization requirements.

**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:** Monitor the communication setup regularly to ensure it continues to operate correctly and maintain the hardware and software as needed to prevent issues from occurring.

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. It is recommended to consult the documentation and support resources of the specific devices and software used for guidance on the



implementation. [11-16]

#### 3.1Block Diagram

**Sensors:** Detecting and measuring changes in the physical environment, such as those in temperature, pressure, or motion, is the function of a sensor. The sensor generates an analogue signal that corresponds to the quantity being measured.

**Analog-to-digital converter (ADC) :** An analog-to-digital converter (ADC) transforms the analog signal from the sensor into a digital signal. The ADC periodically samples the analog signal and transforms it into a series of digital values that can be used by a microcontroller or other digital circuit for processing.

After that, the digital signal is transformed into a form that the RS485 communication

protocol can understand. Multiple devices can communicate with one another over a single pair of wires thanks to the industrial automation and control system standard known as RS485. The data is subsequently transmitted to other connected devices using the RS485 interface over the communication network. To learn more about the physical environment being measured by the sensor, further processing and analysis of the provided data can be done.

All in all, the use of a sensor, an ADC, and an RS485 interface enables the efficient and dependable transfer of data from the physical world to electronic devices

**SIMEX AIMODULE:**Data is converted from the RS485 communication protocol to the Modbus communication protocol using a device called the SIMEX AIMODULE. To enable communication between various devices that employ various communication protocols, the module is often used in industrial automation and control systems. Data is converted from the RS485 communication protocol to the Modbus communication protocol using a device called the SIMEX AIMODULE. To enable communication between various devices that employ various communication protocols, the module is often used in industrial automation and control systems.

As a Modbus slave device, the AIMODULE reacts to commands from a Modbus master device. In order for the Modbus master device to access the data received from RS485 devices, the module translates the data into registers for Modbus.

Overall, the SIMEX AIMODULE and the Modbus protocol enable effective and dependable communication between components in industrial automation and control systems that use several communication protocols. In order to facilitate seamless integration and data transmission between various devices, the module acts as a bridge between RS485 and Modbus devices.

**MODBUS TO USB converter :**Data is converted from the Modbus communication protocol to the USB communication protocol using a device called the TM-7561. To enable communication between various devices that employ various communication protocols, the device is commonly used in industrial automation and control systems. Devices that make use of the Modbus communication protocol send data to the TM-7561. A Modbus master device can access the data, which is normally stored in Modbus registers. The data is subsequently processed by the device and converted into a USB communication protocol-compatible format. A widely accepted standard for communication between computers and other electrical devices is the USB protocol. A USB cable is used to connect the TM-7561 to a computer or other electrical device so that it can function as a USB device. The device then transmits the transformed data to the computer so that software programmes can process and analyse it. [17-20]

**MODSCAN:** In industrial automation and control systems, a software programme called MODSCAN is used to connect with Modbus devices. Users of the programme can rename channels and change their channel IDs to make them easier to find and organise. Users can use MODSCAN to scan the Modbus network and get each channel's ID. Along with details on the device type and the data being transmitted, the application also displays each channel's ID. The ID of each channel can then be renamed by users for simpler identification and organisation.

**Application:**Large industrial automation and control systems, where there may be several Modbus devices and channels that need to be monitored and handled, might benefit greatly from this functionality. We are gathering various forms of data from the sensors attached to industrial projects for this application. Through MODBUS, we gather the sensor data, transmit it to the database, and then send that information to the mobile application's user interface

## 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 attached to the ADC, which transforms the physical parameter into the proper electrical signal. The appropriate electrical signal is then attached to the ADC to transform the sensor data to RS485.

**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.

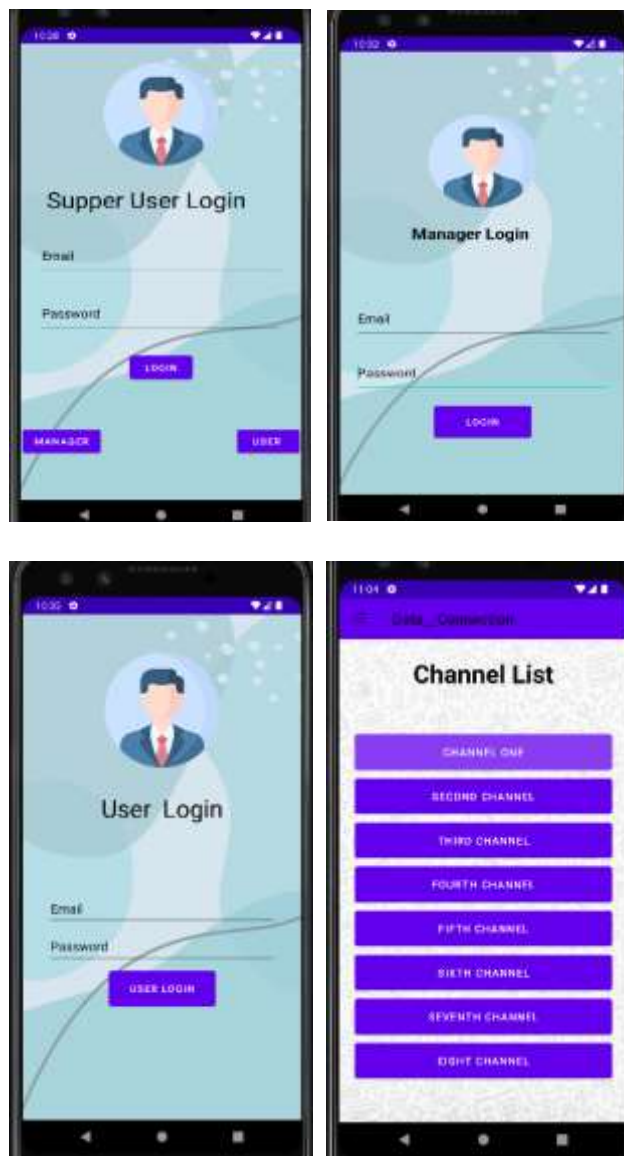
**10.Remote access:** Allow remote access to the system via the internet.

**11.Data backup:** Backup 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.

## MOBILE APPLICATION



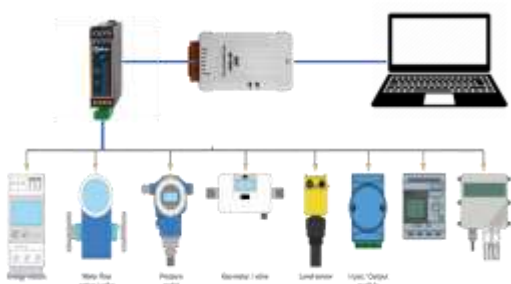
In this mobile application, three sections are created.

**1.Supper User Login:** A super user typically has elevated privileges and access to all features and functionalities of the application. The super user login page would be used by the administrator or owner of the application. On the Supper user login page, we provide the features of adding managers and users and also provide all access through the Supper user.

**2.Manager Login:** A manager may have access to certain sections or features of the application that a regular user does not, but not all of them. On the manager, we provide the function that adds the user and sees all the data in the application.

**3.User:** A user is a regular user of the application who has access to only the basic features and functionalities. The user login page would be used by anyone who has registered through supper user and manager in the application and has not been assigned a managerial role. The user has access only to view the data.

## 5. EXPERIMENT



A boiler is a device that is used to heat water or other fluids and generate steam or hot water for various industrial and commercial applications. In this example, the boiler is connected to several other devices via a Modbus communication protocol

A pressure meter is a device that measures the pressure of the fluid in the boiler. By monitoring the pressure, the boiler can be controlled to maintain optimal pressure levels and prevent damage or safety hazards.

A water level valve is a device that regulates the water level in the boiler. It ensures that the water level is maintained within a safe range, preventing the boiler from running dry or overflowing.

A level sensor is a device that detects the level of the water in the boiler. This information is used to control the water level valve and ensure that the water level is maintained at the desired level.

An energy meter is a device that measures the energy consumption of the boiler. By monitoring the energy usage, the boiler's efficiency can be improved, and potential energy waste can be identified and minimized.

All these devices are connected to the boiler via the Modbus communication protocol. Modbus is a widely used communication protocol in industrial automation systems. It enables the devices to exchange data and control signals with the boiler, allowing for more efficient and effective operation of the boiler.

## 6. CONCLUSION

In conclusion, the Modbus connected multichannel parameter data acquisition, monitoring, and user management system using a mobile application is a highly efficient and effective solution for managing and monitoring complex industrial processes. The system provides a streamlined approach to data acquisition and analysis, enabling real-time monitoring of multiple channels of data from a variety of industrial sensors and devices.

One of the key benefits of this system is its ability to provide remote access to real-time data, allowing users to monitor critical processes and make informed decisions from anywhere in the world. This is made possible by the mobile application, which enables users to view data on their smartphones or tablets, providing a highly flexible and convenient way to access and analyze data.

Moreover, the user management system provides a high level of security, ensuring that only authorized personnel can access the data. This is essential in industrial settings where data security is of utmost importance.

Overall, the Modbus connected multichannel parameter data acquisition, monitoring, and user management system is a highly effective solution for managing and monitoring complex industrial processes. Its ability to provide real-time data and remote access, coupled with its user management system and security features, makes it an essential tool for industries looking to streamline their processes, reduce downtime, and increase productivity.

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