Cold Storage multi-Channel Temperature Scanner Using PIC18F452 and WIN-IO-2PT2THM with Modbus RTU Interface

Abstract:

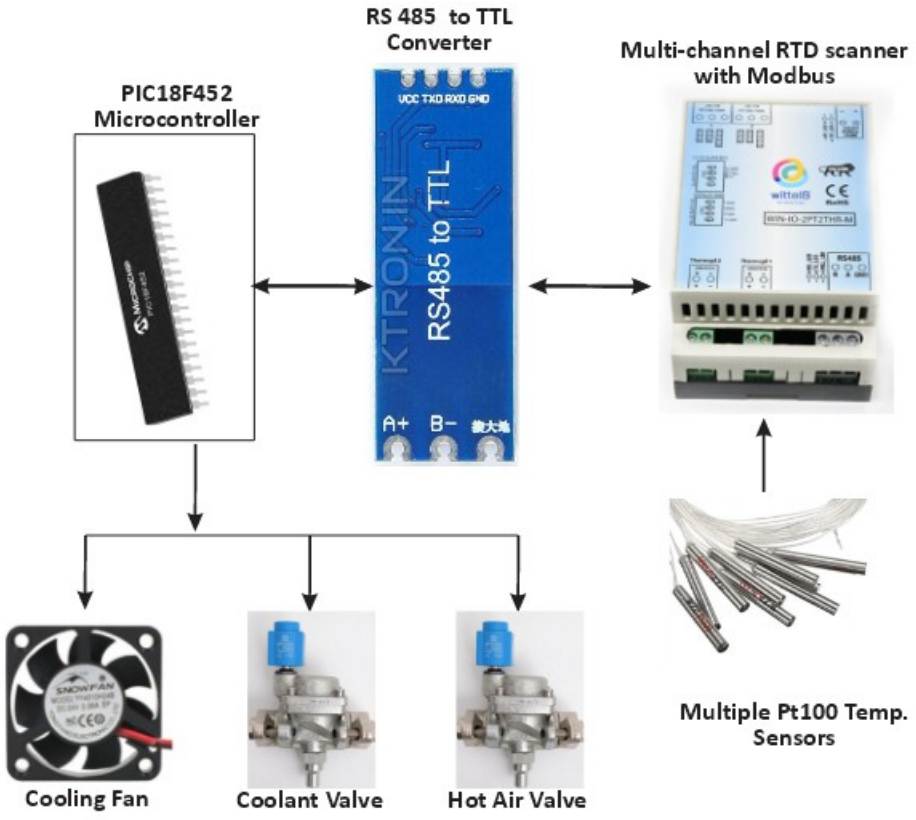
This project involves the development of a **cost-effective and reliable Cold Storage Room Controller** using a **PIC18F452 microcontroller** interfaced with the **WIN-IO-2PT2THM** industrial temperature measurement module via **Modbus RTU over RS-485**. The system is designed to monitor and manage environmental conditions inside cold storage chambers, replacing more expensive PLC-based systems currently in use.

The **WIN-IO-2PT2THM** module is a versatile and high-precision sensor interface that supports two **RTD inputs (PT100/PT1000)** and two **thermocouple inputs** (K, J, N, R, S, T, E, B), enabling accurate temperature monitoring. This module communicates with the PIC18F452 via **RS-485 Modbus**, facilitated by a **TTL to RS-485 converter**.

In addition to temperature sensing, the system incorporates a **digital humidity sensor** (such as DHT22 or SHT21) connected directly to the PIC18F452. The controller collects real-time temperature and humidity data, processes it, and can trigger Coolant & Hot Air Valves, alarms, or notifications based on threshold conditions.

This modular design offers a **low-cost and scalable solution** for cold storage monitoring in warehouses, pharma, and food industries. By replacing PLCs with microcontroller-based logic, the per-chamber hardware cost is significantly reduced without compromising reliability or industrial protocol compatibility.

Block Diagram:



Key Features:

- High-precision temperature monitoring using WIN-IO-2PT2THM
- Supports PT100/PT1000 RTDs and multiple thermocouple types
- Modbus RTU communication via RS-485 (using TTL to RS-485 module)
- Real-time humidity monitoring using a digital humidity sensor
- PIC18F452-based cost-efficient control and monitoring logic
- Suitable for cold storage applications with reliable industrial performance
- Easy integration with alarms, displays, or remote monitoring systems

Applications & Pros of the Project:

1. **Low-Cost Control Solution:**
   Replacing PLCs with PIC18F452 dramatically reduces system cost per cold room, making it ideal for scaling across multiple chambers.
2. **Industrial-Grade Sensor Interface:**
   Leverages the **WIN-IO-2PT2THM module**, ensuring compatibility with a wide range of RTD and thermocouple sensors used in industrial setups.
3. **Standardized Communication Protocol:**
   Uses **Modbus RTU over RS-485**, ensuring robust and long-distance communication between the controller and sensors. **Flexible and Programmable:**
   Easily adaptable to different motion profiles, speeds, and directions using firmware.
4. **Integrated Humidity Monitoring:**
   Adds additional capability by including a digital humidity sensor for comprehensive environment control.
5. **Embedded System Flexibility:**
   Easy to modify firmware for different control logic, thresholds, logging, or display integration.
6. **Compact and Customizable:**
   Smaller and more tailored than standard PLCs, the system is better suited for compact cold room panels.
7. **Educational and Industry-Relevant:**
   Bridges the gap between embedded system education and practical industrial applications