Project Title: Temperature Control and Alarm System

Project Overview:

The Temperature Control and Alarm System is an automated solution designed to manage heating and cooling processes within a defined temperature range. The system utilizes a Programmable Logic Controller (PLC) to ensure optimal temperature control and safety measures by incorporating both automatic and manual operation modes. The project is aimed at demonstrating the functionality of PLC programming, HMI interaction, and alarm management in an industrial setting.

Key Objectives:

- **Temperature Regulation**: Automatically adjust heating and cooling systems based on real-time temperature readings.
- **Manual Override**: Allow operators to manually control the heating and cooling systems while implementing safety limits.
- **Alarm Notification**: Provide an alarm system that alerts the operator when temperatures fall below or rise above predefined thresholds.
- **User Interface**: Develop an HMI interface using Visual Studio AdvancedHMI to enable operators to interact with the system effectively.

System Components:

- **PLC**: Control unit that executes the logic for temperature monitoring, heating, cooling, and alarm management.
- **Temperature Sensors**: Analog sensors to monitor the ambient temperature, providing data to the PLC.
- **Heating Element**: Device responsible for increasing the temperature when required.
- **Cooling Element**: Device responsible for decreasing the temperature when necessary.
- **HMI (Human-Machine Interface)**: Visual representation of the system, allowing operators to set parameters, view real-time temperature data, and manage alarms.

Functional Description:

1. **Temperature Monitoring**:

- The system continuously monitors the temperature through input from temperature sensors. The readings are sent to the PLC for processing.

2. **Automatic Control**:
    - When the temperature falls below a set point (e.g., 20°C), the PLC activates the heating system.
    - Conversely, if the temperature exceeds another set point (e.g., 30°C), the cooling system is activated.
    - The system checks and adjusts the heating and cooling elements as needed to maintain the desired temperature range.
3. **Manual Control**:
    - The operator can manually activate the heating or cooling systems via the HMI. However, even in manual mode, the PLC enforces temperature limits to prevent overheating or overcooling.
4. **Alarm System**:
    - An alarm is triggered if the temperature drops below the lower limit (e.g., 10°C) or exceeds the upper limit (e.g., 35°C).
    - An **Alarm Reset Button** is available to acknowledge and clear the alarm condition once it is addressed.
5. **User Interaction**:
    - The HMI displays real-time temperature data, system status, and allows operators to manually control the heating and cooling systems.
    - Alarm notifications are visually represented, ensuring quick responses from operators.

Technical Specifications:

- **PLC Model**: (Specify the model used, e.g., Allen-Bradley MicroLogix)
- **HMI Development Environment**: Visual Studio with AdvancedHMI library
- **Input Types**: Analog temperature sensors (e.g., 4-20 mA)
- **Output Types**: Relay outputs for heating and cooling elements
- **Programming Language**: Ladder Logic

- **Data Handling**: Raw data input for temperature readings, with corresponding scaling to Celsius.

Safety Considerations:

- The system design includes safety interlocks to prevent equipment damage due to extreme temperatures.
- The alarm system ensures timely notifications to operators to take corrective actions before critical situations arise.