PROJECT TITLE :

Industrial DataLogger (IoTComm Board)

Developed By : FARDEEN ATTAR

Components List and Summary:

1. **ATmega2560 (U1)**
   a. **Use**: This is the central microcontroller used for processing and controlling all functionalities in the project.
2. **MAX485**
   a. **Use**: A transceiver that enables RS-485 communication, allowing data transmission over long distances in noisy environments.
3. **AMS1117 (Voltage Regulator)**
   a. **Use**: A low dropout regulator that ensures a stable 3.3V output to supply power to the low-power components on the board.
4. **CP2102 (USB-to-UART Bridge)**
   a. **Use**: Used to convert USB signals to UART for communication between the microcontroller and the computer.
5. **MCP3424**
   a. **Use**: A 4-channel 18-bit ADC used for precise analog-to-digital conversions for various sensor inputs.
6. **RS232 Transceiver**
   a. **Use**: Converts the RS232 signal levels to TTL for communication with the ATmega2560.
7. **SIM7000G**
   a. **Use**: A GSM/GPRS/3G module for wireless communication and IoT-based functionalities like sending/receiving SMS or connecting to the internet.
8. **74LVC125A**

a. **Use**: A quad buffer used for voltage level shifting and signal buffering between components.

9. **SX1262 (LoRa Module)**

   a. **Use**: A low-power, long-range communication transceiver for LoRa communication.

10. **LM39302R-ADJ (Adjustable Voltage Regulator)**

    a. **Use**: Provides an adjustable regulated voltage output to supply various parts of the circuit.

11. **LED-0603 (Red)**

    a. **Use**: Indicator LEDs for status updates or signaling.

12. **Oscillator (5x3 SMD)**

    a. **Use**: Provides the clock signal for the ATmega2560 and other components.

13. **Capacitors (Various)**

    a. **Use**: For power filtering and stabilization throughout the circuit (e.g., 0.1µF, 10µF, 100nF).

14. **Resistors (Various)**

    a. **Use**: For current limiting, voltage dividing, and other signal conditioning functions (e.g., 10kΩ, 3.3kΩ, 20kΩ).

15. **SIM7000G Module Antenna**

    a. **Use**: Provides RF/GPS antenna connectivity for the SIM7000G module.

16. **MicroSD Card Module**

    a. **Use**: A storage expansion interface, enabling data logging or file system access.

17. **Ethernet Module (LAN8720A)**

    a. **Use**: Ethernet PHY chip for enabling wired internet connectivity for the ESP32.

Project Summary:

This PCB design implements a versatile IoT communication hub, powered by the ATmega2560 microcontroller, that can interact with various communication protocols and external modules. It supports multiple wired and wireless communication interfaces, including **RS-485**, **RS232**, **LoRa**, and **GSM/3G** through the **SIM7000G** module, enabling data transmission over long distances or cellular networks. Additionally, **Ethernet** connectivity is provided through the **LAN8720A module**, allowing for integration with local networks.

The product is designed for applications requiring real-time data acquisition, wireless communication, and remote monitoring, making it suitable for **IoT systems**, **industrial automation**, or **smart city projects**. The inclusion of the **MCP3424 ADC** ensures precise sensor data acquisition (e.g., 4-20 mA sensors), while **MicroSD card storage** supports data logging. The **CP2102 USB-to-UART bridge** simplifies programming and debugging via USB.

The board is powered by regulated 5V and 3.3V supplies, with the **AMS1117** and **LM39302R-ADJ** ensuring stable voltage for the microcontroller and modules. The product can function autonomously in harsh environments, leveraging its wireless communication capabilities to collect, process, and transmit data from various connected sensors and devices.