**Smart Home Automation and Control Board**

**Project Description:** Design a central controller board for automating various home systems — like lighting, Environmental control, security, and appliances. The board will gather data from sensors, control high-power devices, and communicate with mobile or cloud systems for remote access.

**Components and Interfaces:**

* **Microcontroller:** STM32F407 with Debugger on STM32F103
* **Communication Interfaces:** Ethernet (2 MB/s), USB 2.0, CAN Bus (1 MB/s), UARTs.

**Sensor Inputs:**

* **Temperature & Humidity Sensor:** DHT22 (digital) for temperature and humidity monitoring
* **Motion Sensor:** HC-SR501 PIR sensor for detecting movement.
* **Other Analog Sensor:** 24-bit ADC: ADS122C04IPW

**Power and Control Outputs:**

* **Relay Control:** 4-channel relay module to switch appliances (lights, fans, etc.)
* **Motor Control:** DRV8701 motor driver to control window blinds or curtains (12V 3A motors)
* **DC-DC Converters:** For 12V, 5V, and 3.3V rails for different modules and sensors

**User Interface & Feedback:**

* **Display (I2C):** Show system status, sensor readings, etc.
* **IR Remote:** For manual control of lights, fan speed, etc.
* **Buzzer/Alarm:** For security or fault alerts
* **Microphone & Speaker:** Voice command capability (via codec + I2C DAC)

**Safety & Power Management:**

* **Voltage & Current Monitoring:** ACS712 sensor for real-time power consumption data
* **Overvoltage/Overcurrent Protection:** TVS diodes, polyfuses, optoisolated relays for AC loads
* **Battery Backup:** UPS circuit for essential systems during power outages