**Conceptual Schematic Overview**

**1. Rogowski Coil Interface:**

* **Input:** Rogowski coil terminals.
* **Integrator Circuit:** Converts the coil's output (proportional to di/dt) to a voltage proportional to current.
  + **Components:** Operational amplifier (e.g., TLV2372), resistor (R), and capacitor (C) forming an RC integrator.

**2. Microcontroller Unit (MCU):**

* **Type:** ESP32
* **Functions:**
  + Processes the integrated signal.
  + Handles communication protocols (LoRa/GSM).
  + Manages data logging and system control.

**3. Display Module:**

* **Type:** 0.96" OLED (SSD1306).
* **Interface:** I2C.
* **Purpose:** Displays real-time data such as current readings, system status, and alerts.

**4. Power Management:**

* **Solar Panel:**
  + **Specification:** 5V, 100–500 mA.
  + **Function:** Charges the battery and powers the system.
* **Battery:**
  + **Type:** 3.7V LiPo, 1000–1500 mAh.
  + **Purpose:** Provides power during low-light conditions.
* **Charging Circuit:**
  + **Controller:** TP4056 or CN3791.
  + **Function:** Manages charging from the solar panel to the battery.
* **Voltage Regulation:**
  + **Component:** Boost converter (e.g., MT3608).
  + **Function:** Steps up battery voltage to 5V for system components.

**5. Communication Modules:**

* **LoRa Module:**
  + **Type:** RFM95.
  + **Interface:** SPI.
  + **Purpose:** Long-range wireless communication.
* **GSM Module (Optional):**
  + **Type:** SIM800L.
  + **Interface:** UART.
  + **Purpose:** Cellular communication for data transmission.

**6. Additional Components:**

* **GPS Module:**
  + **Type:** NEO-6M.
  + **Interface:** UART.
  + **Purpose:** Provides location data for fault logging.
* **Sensors:**
  + **Purpose:** Monitor environmental conditions or system parameters.
* **Protection Circuits:**
  + **Components:** Diodes, fuses, or TVS diodes.
  + **Purpose:** Protect against voltage spikes and reverse polarity.