Electrical Systems National, Domestic, and IoT Device

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1. Sri Lankan Electricity System

1.1 How Power Is Generated and Transmitted to Houses

Sri Lanka uses mainly 3 methods:

- Hydropower (Mahaweli reservoirs and other major dams)
- Thermal power (coal at Norochcholai, diesel and furnace oil plants)
- Renewables (solar farms, rooftop solar, wind)

Step-by-step flow:

1. **Generation**
   Power is produced at power plants (11 kV–15 kV for most hydros, much higher for thermal stations).
2. **Step-up transformation**
   Voltage is increased using step-up transformers to 132 kV, 220 kV, or 400 kV for efficient long-distance transmission.
3. **Transmission**
   High-voltage AC lines carry energy across the country via the CEB national transmission grid.
4. **Step-down at Grid Substations**
   Voltage is reduced to 33 kV or 11 kV at primary substations.
5. **Distribution**
   Local substations further reduce voltage to 400/230 V for homes.
6. **Supply to Houses**
   Final delivery uses service drops, meters, MCBs, and consumer wiring.

1.2 Voltages Used

- 400 V (three-phase) → Line-to-line

- 230 V (single-phase) → Line-to-neutral
- 50 Hz frequency (standard)
- High-voltage lines: 132 kV, 220 kV, and sometimes 400 kV

2. Electrical System in a House

2.1 Wiring

A typical house uses:

- **Single-phase 230 V supply**
- **Main components:**
    - Service cable
    - Energy meter
    - Main breaker (MCB)
    - Residual Current Device (RCD) / RCCB
    - Distribution board with separate circuits

Circuit types:

- Lighting circuits (1–1.5 mm^2 wires)
- Socket/outlet circuits (2.5 mm^2 wires)
- High-load appliances (air conditioners, heaters, ovens) may use dedicated breakers and 4–6 mm^2 cables

Color coding :

- Live – **Brown**
- Neutral – **Blue**
- Earth – **Green/Yellow**

2.2 Protection

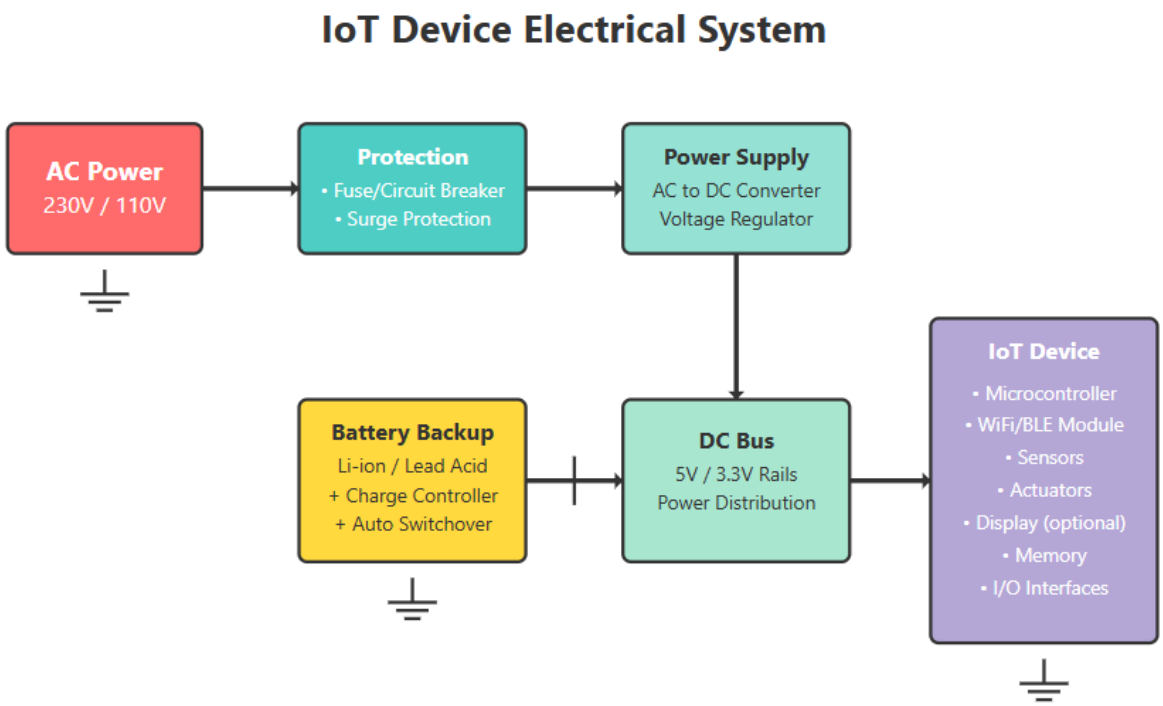
Protection ensures safety against fire and electrocution:

- Main MCB – protects against short circuits/overload

- RCD / RCCB – protects against electric shock by monitoring leakage currents
- Earthing – diverts fault current safely into the ground
- Surge protectors – protect against lightning and grid surges

3. Electrical System for an IoT Device

3.1 Wiring



- Clear power flow from AC input through all components
- Ground connections for safety
- DC distribution bus to power all IoT components

3.2 Protection

IoT devices are sensitive, so basic protection is essential:

- **Fuse**– prevents overcurrent
- **TVS diode** – protects against voltage spikes
- **Reverse-polarity protection** – using a diode or MOSFET
- **Voltage regulator** – ensures stable voltage

- **ESD protection** – for sensors and communication pins

3.3. Backup Power:

- Battery system with charge controller
- Automatic switchover when main power fails
- Keeps the IoT device running during power outages