FireSentinel – Wiring Diagram and Block Description

1. High-Level Block Diagram

Logical connections between modules:

- Laptop / USB → Arduino Uno (power + programming)
- Arduino Uno connects to:
    - Flame sensor (A0, 5V, GND)
    - Servo 1 (D10, 5V from power bank, GND)
    - Servo 2 (D9, 5V from power bank, GND)
    - Relay IN (D7, relay VCC from buck 5V, relay GND)
    - GSM module (D2 = Arduino RX from GSM TX, D3 = Arduino TX to GSM RX)
- 12V adapter:
    - +12V → Relay COM and buck VIN+
    - −12V → Pump negative and buck VIN−
- Relay switch side:
    - COM → 12V adapter +
    - NO → Pump red (+)
    - Pump black (−) → 12V adapter −
- Buck converter:
    - VIN+ → 12V adapter +
    - VIN− → 12V adapter −
    - VOUT+ (5V or 4V) → relay VCC and GSM VCC (depending on module voltage)
    - VOUT− → common ground
- Power bank (5V):
    - 5V → both servo VCC
    - GND → common ground (tied to Arduino GND and buck GND)

2. Power Domains

- 12V adapter:
    - Powers the 12V water pump via the relay contacts.
    - Feeds the buck converter (VIN+ / VIN−).
- Buck converter:
    - Input: 12V from adapter.

        - Output: 5V or ~4V.
        - 5V: used for relay VCC and for GSM if the GSM accepts 5V.
        - ~4–4.2V: used for SIM800L-type GSM modules.
        - Buck ground is tied to Arduino GND and power bank GND.
- Power bank (5V):
    - Supplies both SG90 servos.
    - Its ground is tied to Arduino GND and buck GND (common ground).
- Arduino Uno:
    - Powered via USB from laptop or separate USB adapter.
    - Must share ground with buck and power bank.

3. Signal Wiring Summary

Arduino → Servos:

- D10 → Servo 1 signal (flame scanner)
- D9 → Servo 2 signal (water nozzle)
- Servo VCC (red) → Power bank 5V
- Servo GND (brown/black) → Power bank GND → Arduino GND (common ground)

Flame sensor:

- VCC → Arduino 5V
- GND → Arduino GND
- AO → Arduino A0 (analog input)

Relay (control side):

- IN → Arduino D7
- VCC → Buck 5V output
- GND → Common ground

Relay (switch side for pump):

- COM → 12V adapter positive
- NO → Pump red (+)
- Pump black (–) → 12V adapter negative
- NC left unconnected (pump off by default)

GSM module:

- VCC → Buck output set to GSM voltage (4.0–4.2V for SIM800L, or 5V if allowed)
- GND → Common ground
- TX → Arduino D2 (SoftwareSerial RX)
- RX → Arduino D3 (SoftwareSerial TX)

- Optional POWER_KEY as per GSM datasheet

4. Common Ground Requirement

All of these must be tied together to a common ground point:

- Arduino GND
- Buck converter ground (VIN– and VOUT–)
- Power bank GND
- Servo grounds
- Relay GND
- GSM GND
- 12V adapter negative (pump negative)

Without a common ground, servos will behave erratically, sensor readings will be wrong, and GSM communication may fail.

5. Safety Notes

- Never power the pump or GSM from the Arduino 5V pin.
- Keep water and pump tubing physically away from Arduino, GSM, buck, and relay.
- Use a fuse (1–2 A) on the pump's 12V positive line if possible.
- Double-check that the 12V and 5V rails are not accidentally shorted together on the breadboard.