

# FireSentinel – Hardware Bill of Materials (BOM)

## 1. Core Control and Logic

1. Arduino Uno R3
  - Type: 8-bit microcontroller board (ATmega328P)
  - Supply voltage: 5 V via USB (or 7–12 V via barrel jack)
  - I/O: 14 digital pins, 6 analog inputs
  - Purpose: Main controller for sensors, servos, relay, and GSM

## 2. Sensing and Detection

2. IR Flame Sensor Module (analog output)
  - Supply voltage: 3.3–5 V
  - Outputs:
    - AO: analog voltage proportional to flame intensity
    - DO (optional): digital output with adjustable threshold
  - Effective detection range used: up to ~24 cm
  - Purpose: Detect flame presence and relative intensity

## 3. Actuators – Servos and Pump

3. SG90 Micro Servo Motor (x2)
  - Quantity: 2
  - Supply voltage: 4.8–6.0 V
  - Torque: about 1.8 kg·cm at 4.8 V (typical)
  - Rotation: about 0–180° (nozzle practically limited to ~0–90° due to weight)
  - Purpose:
    - Servo 1: flame scanning (rotates IR sensor)
    - Servo 2: water nozzle aiming
4. 12 V DC Submersible Water Pump
  - Supply voltage: 12 V DC
  - Approximate rated flow: ~800 L per hour

- Type: Small submersible pump with hose outlet
- Purpose: Provide water flow for extinguishing the detected flame

## 4. Switching and Power Conversion

- 1-Channel Relay Module (5 V coil)
  - Inputs: VCC (5 V), GND, IN (control signal from Arduino)
  - Contacts: COM, NO, NC (sized for 12 V DC pump load)
  - Purpose: Switch the 12 V pump on/off under Arduino control
- Buck Converter (Step-down DC–DC)
  - Input: 12 V DC from adapter
  - Adjustable output: typically 3–12 V
  - Use in project:
    - 5.0 V for relay VCC
    - 4.0–4.2 V or 5 V for GSM module (depending on GSM requirements)
  - Purpose: Provide stable low-voltage rails from the 12 V supply
- 12 V DC Adapter (Wall Plug)
  - Output voltage: 12 V DC
  - Recommended current rating: at least 1–2 A
  - Purpose: Main power source for pump and buck converter
- Power Bank or Separate 5 V USB Adapter
  - Output: 5 V DC
  - Recommended current rating: at least 1 A
  - Purpose: Dedicated power source for both SG90 servo motors

## 5. Communication

- GSM Module (e.g., SIM800L, SIM800, or SIM900)
  - Supply voltage (example SIM800L): about 3.7–4.4 V, with up to 2 A peak current
  - Interfaces: UART TX/RX, optional power key pin
  - Purpose: Send SMS alerts to a registered phone number when fire is detected

## 6. Wiring and Prototyping Accessories

- Jumper Wires

- Types: male–male and male–female
  - Purpose: Connect Arduino, sensors, servos, relay, GSM, and buck on breadboard or headers
11. Thicker Wires for Pump Power
- Gauge: suitable for 12 V, up to around 2 A
  - Purpose: Carry current from 12 V adapter to relay and pump
12. Breadboard and/or Screw Terminals (optional)
- Purpose: Organize and distribute power and signal lines during prototyping
13. Common Ground Wiring
- Several short black jumpers or a ground bus
  - Purpose: Tie all grounds together (Arduino, buck converter, power bank, relay, GSM, pump negative)
14. Inline Fuse (optional but recommended)
- Rating: about 1–2 A, installed on the 12 V positive line to the pump
  - Purpose: Protect against short circuits or overcurrent on the pump circuit
15. Miscellaneous Tools and Consumables
- Small screwdriver (for terminal blocks and buck adjustment)
  - Wire stripper and cutter
  - Multimeter (for checking voltage and continuity)
  - Heat shrink tubing or electrical tape (for insulation)
  - Zip ties, hose clamps, or hot glue (for securing cables and mounting parts)

## 7. Power Domain Summary

---

- 12 V domain:
  - 12 V adapter powers the pump (through the relay) and feeds the buck converter.
- 5 V servo domain:
  - Power bank 5 V powers both SG90 servos.
- Regulated low-voltage domain from buck converter:
  - 5 V for relay VCC.
  - 4.0–4.2 V or 5 V for GSM VCC, depending on the GSM module specification.
- Logic domain:
  - Arduino Uno powered by 5 V via USB.
  - All grounds (Arduino, buck, power bank, relay, GSM, pump negative) are connected together as a common reference.

