

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

5. 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
6. 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
7. 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
8. 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

9. 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

10. 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.

