

ClapSwitch

Interrupt-Based Clap-Controlled LED Switch

Model: Arduino UNO/Nano + KY-037 Sound Sensor | Firmware v1.0 | June 2025

1. Product Overview

ClapSwitch uses a hardware interrupt on Arduino Pin 2 to detect sound pulses from a microphone module. Two claps turn the LED (or relay) ON; one clap turns it OFF. Software debouncing and a configurable time window filter noise and echoes, giving reliable, instant response without polling.

Key features:

- Hardware interrupt (ISR) — responds in microseconds, not loop-poll delay.
- Software debounce inside ISR — rejects vibration/echo within 100 ms.
- Configurable clap window — default 400 ms; widen for slower clappers.
- Safe volatile variable handoff — `noInterrupts()` guards shared state.
- Serial monitor output at 115 200 baud for live clap-count diagnostics.

2. Technical Specifications

Microcontroller	Arduino UNO or Nano (ATmega328P)
Sound Sensor	KY-037 / KY-038 or equivalent (digital OUT)
Interrupt Pin	Digital Pin 2 (Interrupt 0)
LED / Output Pin	Digital Pin 13 (built-in or external)
Trigger Mode	RISING edge (change to FALLING if needed)
Debounce Delay	100 ms (configurable via <code>debounceDelay</code>)
Clap Window	400 ms (configurable via <code>clapWindow</code>)
Turn ON pattern	2 claps within the window
Turn OFF pattern	1 clap within the window
Baud Rate	115 200 bps
Supply Voltage	5 V USB or 7–12 V DC barrel jack

3. Hardware & Wiring

3.1 Component List

- 1× Arduino UNO or Nano
- 1× KY-037 / KY-038 Sound Sensor Module (digital output)
- 1× LED + 220 Ω resistor (or relay module for mains loads)
- Jumper wires, USB cable

3.2 Pin Connections

Component	Pin / Wire	Arduino Pin
KY-037	VCC	5 V
KY-037	GND	GND
KY-037	D0 (Digital Out)	Pin 2 (INT0)
LED	Anode (+)	Pin 13 via 220 Ω
LED	Cathode (-)	GND

Note: If your sensor outputs LOW on sound, change RISING to FALLING in attachInterrupt().

4. Software Installation

4.1 Prerequisites

- Arduino IDE 2.x — arduino.cc/en/software
- No external libraries needed — Servo.h not required; built-in interrupts only.

4.2 Upload Steps

1. Connect Arduino to your PC via USB.
2. Open Arduino IDE → paste or open the ClapSwitch firmware sketch.
3. Select Tools → Board → Arduino UNO (or Nano) and the correct COM port.
4. Click Upload (→). Wait for "Done uploading".
5. Open Serial Monitor at 115 200 baud — you should see: Fast Interrupt Switch Initialized.

5. Configuration

Edit these four constants at the top of the sketch and re-upload to apply.

Constant	Default	Purpose
<code>debounceDelay</code>	100 ms	Min. gap between valid claps — filters echo/vibration.
<code>clapWindow</code>	400 ms	Total time allowed to complete the clap sequence.
<code>soundPin</code>	2	Interrupt-capable pin — do not change unless using Mega.
<code>ledPin</code>	13	Output pin for LED or relay signal.

6. Operation

6.1 Normal Use

- Power on — LED is OFF, serial prints initialization message.
- Clap twice within 400 ms → LED turns ON.
- Clap once within 400 ms → LED turns OFF.
- Clap count and state are printed to Serial Monitor after each sequence.

6.2 Interrupt Logic Flow

The ISR fires on every RISING edge from the sound sensor:

```
Sound detected → ISR fires → debounce check passes?  
YES → clapCount++, record firstClapTime on 1st clap  
NO → ignored (echo/vibration)
```

The main loop checks once the clap window expires:

```
clapCount == 2 AND light OFF → turn ON  
clapCount == 1 AND light ON → turn OFF  
Any other count → reset, do nothing
```

7. Troubleshooting

Symptom	Likely Cause	Fix
LED never turns ON	Sensor wired wrong	Check D0 → Pin 2; VCC → 5 V
LED toggles on noise	debounceDelay too low	Increase to 150–200 ms
Clap not recognised	clapWindow too short	Increase to 500–600 ms
Needs 3+ claps	Sensor too sensitive	Turn sensitivity pot down
No Serial output	Wrong baud rate	Set monitor to 115 200 bps
Random triggers	RISING vs FALLING wrong	Swap trigger mode in sketch

8. Safety & Maintenance

- Keep electronics away from moisture — not rated for outdoor use.
- When driving a relay/mains load, use an optoisolated relay module.
- Do not exceed 40 mA per GPIO pin — always use a current-limiting resistor.
- Clean the microphone mesh with dry compressed air; avoid liquids.
- Disconnect power before modifying wiring.

9. Quick-Reference Card

Action	Trigger / Setting
Turn LED ON	2 claps within clapWindow (400 ms)
Turn LED OFF	1 clap within clapWindow (400 ms)
Debug output	Serial Monitor @ 115 200 baud
Adjust sensitivity	Turn pot on KY-037 module

For support visit www.clapswitch.dev/support | Firmware source: github.com/clapswitch/arduino