

Townhouse Dollhouse — Lighting Wiring Reference

4 switched zones · plain warm-white LEDs · ULN2803A low-side driver · cordless 5V.

CONTROLLER

Arduino Nano

DRIVER

ULN2803A
· 8-ch

POWER

USB bank · 5V

OUTPUTS

D3 D5 D6
D9 · PWM

SKETCH

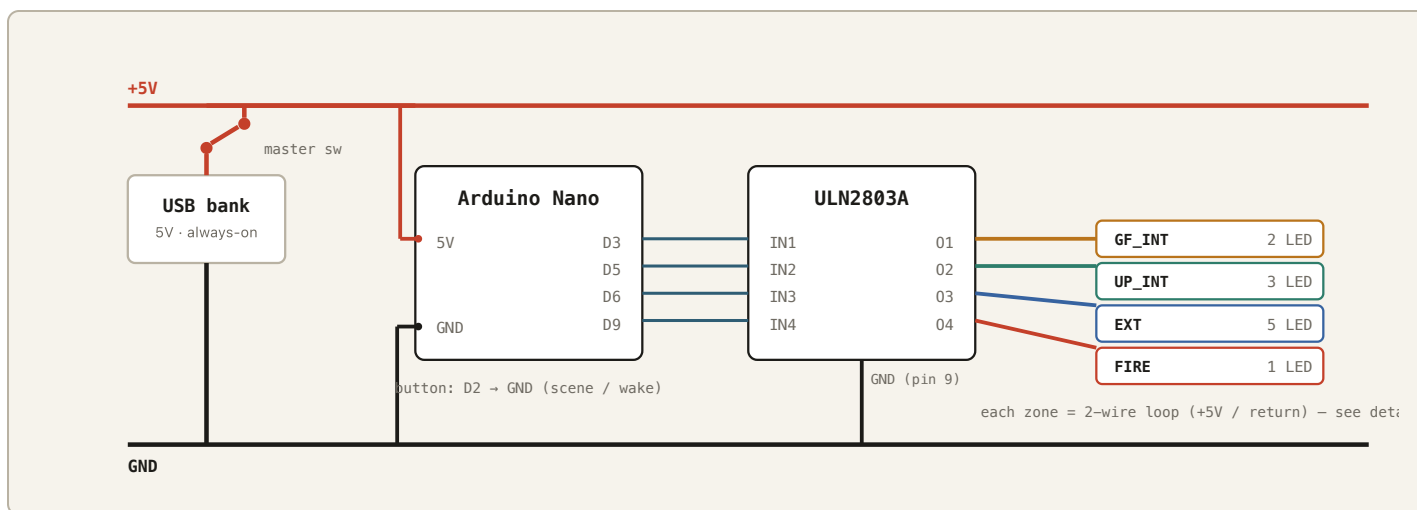
townhouse_lights.ino

SERIES R

220Ω /
LED

1 System schematic

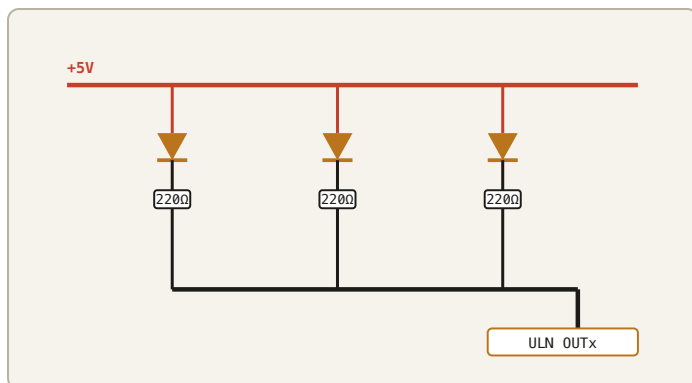
Nano drives ULN inputs; ULN sinks each zone to ground



Signal (slate) = Nano PWM → ULN input. +5V red, GND black. The ULN pulls each zone's return to ground on command; the LED current never touches an Arduino pin.

2 Zone loop detail — how LEDs attach

Repeat per zone · add LEDs anywhere on the loop



Every fixture in a zone shares two wires: **+5V** and the zone's **return** to its ULN output. Wire an LED like this and drop it anywhere on the loop — no order, no polarity chain to keep straight beyond each LED's own + (anode) toward 5V.

- **Anode (+, longer leg)** → +5V rail
- **Cathode (-, flat side)** → 220Ω → zone return
- One resistor **per LED** — keeps brightness even if one fails

BRIGHTNESS KNOB — start at 220Ω. Too dim? drop toward 150Ω. Too bright? the sketch's per-zone level also trims it in software. Dollhouse rooms read best low.

3 Output map

ZONE	ARDUINO	ULN IN	ULN OUT (PIN)	FIXTURES	CONTROL
 GF_INT	D3 · PWM	IN1	OUT1 · pin18	living + kitchen ceilings	dim
 UP_INT	D5 · PWM	IN2	OUT2 · pin17	2x bedroom ceiling, attic	dim
 EXT	D6 · PWM	IN3	OUT3 · pin16	porch A/B, entry, deck, balcony	dim
 FIRE	D9 · PWM	IN4	OUT4 · pin15	hearth	flicker

ULN2803A: GND = pin 9. COM (pin 10) unused for LEDs. Inputs IN1–8 = pins 1–8; outputs OUT1–8 = pins 18–11.

4 Fixture schedule

FIXTURE	ZONE	INSTALL AT
Porch light A	 EXT	Pic 8–9
Porch light B	 EXT	Pic 8–9
Front-door entry	 EXT	Pic 8–9
Side deck / wing	 EXT	Pic 8–9
Fireplace / hearth	 FIRE	Pic 10
GF living ceiling	 GF_INT	Pic 11 +
GF kitchen ceiling	 GF_INT	Pic 11 +
Balcony wall light	 EXT	Pic 12–13
2F bedroom ceiling	 UP_INT	Pic 14 +
2F bedroom ceiling	 UP_INT	Pic 14 +
Attic ceiling	 UP_INT	Pic 16–17
Spare — eave / yard	—	any

SCENES — button on D2 cycles; auto-fades dark after 20 min idle.

Evening → All On → Night → Off

5 Build-order checklist

- ☐ Pic 5 — base closing
Mount Nano + ULN driver board + power bank + master switch in the crawlspace. Run a 2-wire loop (+5V + return) for each zone up into the house.
- ☐ Pic 8–9 — GF walls
Wire the 4 **EXT** fixtures (porch A/B, entry, deck) onto the EXT loop through pre-drilled holes.
- ☐ Pic 10 — chimney base
Drop the **FIRE** hearth LED into the chimney.
- ☐ Pic 11 — GF ceiling
+ **WIRE BEFORE GLUE** Glue the 2 **GF_INT** LEDs to the panel *underside*, route to a corner, then set the floor.
- ☐ Pic 12–13 — 2F walls
Wire the **EXT** balcony light.
- ☐ Pic 14 — 2F ceiling
+ **WIRE BEFORE GLUE** Glue the 2 **UP_INT** bedroom LEDs to the panel *underside* before it goes down.
- ☐ Pic 16–17 — roof
Fix the **UP_INT** attic LED to a rafter before closing the roof; dormers double as light wells.
- ☐ Finish
Route the power-bank charge port to a hidden opening (rear wall / chimney base). Leave a base access hatch.

6 Bill of materials

Arduino + LEDs already on hand (struck through)

☐ Arduino Nano	×1	☐ USB-A pigtail / breakout	×1
☐ Warm white LEDs	×12	☐ Hookup wire 26–30 AWG (R/B/sig)	~10m
☐ ULN2803A driver (+ DIP socket)	×1	☐ Perfboard for driver board	×1
☐ 220Ω resistors (150Ω to brighten)	×14	☐ Hot glue + sticks	–
☐ Momentary pushbutton	×1	☐ Heat-shrink / Kapton tape	–
☐ Slide switch (master, in 5V line)	×1	☐ 1000μF cap across 5V (optional)	×1
☐ USB power bank · always-on mode	×1	☐ Drill bits 1–1.5mm	–

Tools: soldering iron + solder, wire strippers, flush cutters, multimeter (verify each zone before gluing it in).