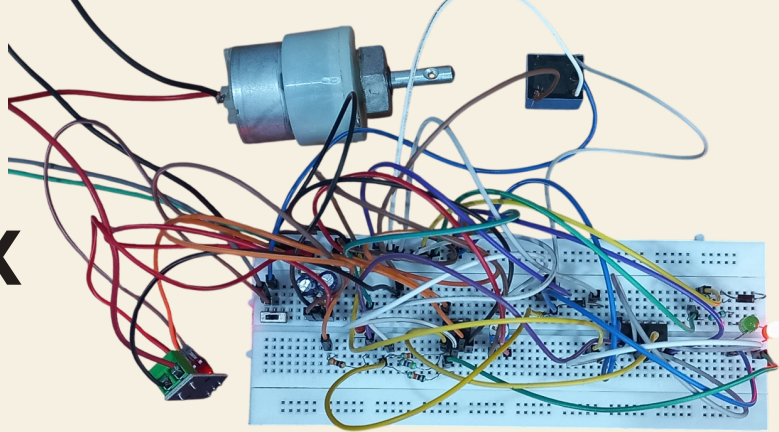# LogicX 2025

SMART POWER EXTENSION BOX

AUTOMATIC OVERLOAD CUTOFF SYSTEM USING ACS712 AND LOGIC GATES

ABSTRACT

This project presents a smart logic-based power extension system that can automatically detect and isolate overload conditions to prevent electrical hazards. The system uses a current sensor (ACS712), a comparator (LM393), and a NAND gate latch (74HC00) to sense excess current, trigger cutoff, and hold the power OFF until manually reset. Unlike microcontroller-based systems, this purely hardware logic design ensures fast, reliable, and low-cost protection for household or laboratory appliances.

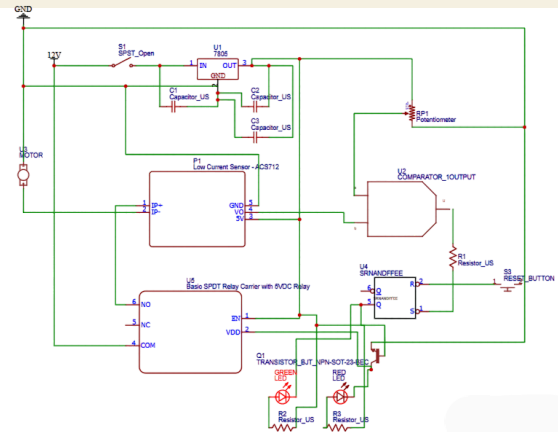## CIRCUIT PRINCIPLE

Logical Relation

Relay = NAND (RESET, SET)
where:
- SET = Output from LM393 (active LOW when overload detected)
- RESET = Manual pushbutton (active LOW)

TRUTH TABLE

Condition	LM393 OUT (SET)	RESET	NAND OUT (Q)	Relay / Motor State
Normal	1	1	1	ON
Overload	0	1	0	OFF
Cleared (latched)	1	1	0	OFF
Manual Reset	1	0	1	ON

COMPONENTS USED

- IC LM393 – Dual Comparator
- IC 74HC00 – Quad 2-input NAND Gate
- ACS712 – 5A Current Sensor Module
- 2N2222 / BC547 – NPN Transistor
- Relay – 5 V DC SPDT, 5 A
- Potentiometer – 10 kΩ
- Resistors – 10 kΩ ×4, 330 Ω ×2
- 1N4007 – Flyback Diode, LEDs – Red & Green
- Capacitors – 100 μF (2 Nos), 0.1 μF (1 No)
- Voltage Regulator – 7805
- SPST Switch, Pushbutton (Reset), Breadboard, Jumper Wires
- DC Power Adapter – 12 V, 1 A
- Load – 12 V DC BO Geared Motor (100 RPM)

WORKING

The ACS712 senses current through the load. When it exceeds the set limit, LM393 output goes LOW, triggering the NAND latch, which turns OFF the relay via the transistor. The system remains OFF until the RESET button is pressed. This ensures manual restart after overloads for user safety.

APPLICATIONS

- Smart overload-protected power strips.
- DC lab and equipment safety systems.
- Automatic power cutoff in home and office setups.