PROJECT ABSTRACT

Clap-Counting Fan Speed Controller

A clap-counting fan speed controller: electret-mic front end with comparator, firmware counting 1–4 claps in a 1.5 s window for low/medium/high/off, zero-cross synchronized triac regulation of a 230V fan, and LED speed indication. Delivered built-to-order with working prototype, firmware, sensitivity-tuning procedure, report, PPT and viva kit.

01. Title

Clap-Counting Fan Speed Controller

02. Introduction / Background

The classic clap switch is a one-trick circuit: one clap toggles a light. Counting claps instead of merely detecting them turns a single binary input into multiple commands — enough for a fan's speed steps, hands-free. The engineering sits in two places: the acoustic front end, which must catch a clap's sharp transient while ignoring speech and TV audio, and the power stage, where a triac with zero-cross timing regulates a real AC fan. Together they form a touchless controller that is genuinely usable and a strong demo of signal conditioning plus power electronics.

03. Problem Statement

Students build clap switches as toys; few extend the idea into a multi-state controller with real power regulation. This project does: clap counting with false-trigger filtering driving a triac-regulated fan at three speeds plus off — a complete sense-to-mains control loop the student can demonstrate and defend.

04. Objectives

- Detect claps with an electret microphone, preamplifier and comparator stage.
- Count 1–4 claps inside a 1.5 s window to select low, medium, high or off.
- Reject speech and ambient noise with threshold and timing filters.
- Regulate a 230V fan at three speeds with zero-cross synchronized triac control.
- Indicate the active speed on LEDs with a manual override switch.
- Deliver the complete student kit: prototype, firmware, tuning procedure, report, PPT and viva Q&A.;

05. Proposed Methodology

The electret mic's output is amplified and compared against a potentiometer-set threshold, converting clap transients into digital pulses. Firmware timestamps each pulse, counts those inside the 1.5 s window (ignoring pulses closer than the debounce gap), and maps 1–4 claps to the four fan states. Each speed maps to a triac firing angle computed against the zero-cross detector, so every half-cycle is cut at the same phase. A documented procedure tunes the threshold for the student's own room.

06. System Architecture / Working

A clap's sharp transient crosses the comparator threshold and reaches the Arduino as a pulse; the firmware counts pulses in the window and selects the fan state. The zero-cross detector synchronizes triac firing: earlier firing delivers more of each half-cycle (faster fan), later firing less (slower). The BT136 triac, driven through the MOC3021 optocoupler, regulates the fan motor; the speed LEDs show the active level and the manual override forces full speed.

07. Hardware / Software Requirements

- Arduino Nano (ATmega328P)
- Electret microphone + preamp/comparator module
- BT136 triac and MOC3021 optocoupler
- Zero-crossing detector circuit
- 3-LED speed indicator, manual override switch
- 230V table-fan demo load
- Breadboard/PCB build
- Arduino IDE (C/C++ firmware)

08. Expected Outcomes

- A fan responding to 1–4 claps with three speeds plus off, demonstrated live.
- A tuned threshold rejecting normal room noise, documented in the report.
- An oscilloscope capture of the phase-cut fan waveform.
- A complete report, PPT and viva Q&A; on acoustic detection and triac control.

09. Applications

- Teaching analog front ends: mic biasing, amplification, thresholding.
- Demonstrating multi-state control from a single sensor input.
- Touchless control concepts for accessibility.

10. Future Scope

- Clap-pattern passwords (e.g. specific rhythms) for access control.
- Voice-command extension with a speech module.
- Multi-appliance control: different clap counts for different devices.
- Softer-start ramping to reduce fan inrush on speed changes.