PROJECT ABSTRACT

Maximum Demand Controller with Load Tripping for Industrial Feeders

An Arduino-based maximum demand controller that measures feeder load, warns at 90% of the keypad-set demand limit and trips low-priority loads in order — built-to-order with panel, load bank, firmware, report, PPT and viva kit.

01. Title

Maximum Demand Controller with Load Tripping for Industrial Feeders

02. Introduction / Background

Industrial electricity bills have two parts: energy (kWh) and maximum demand (kW) — the highest average load over a demand interval. Breaching the contracted demand once can trigger penalties for months, so plants install maximum demand controllers that watch the load trend and shed non-critical loads before the limit is crossed. Students learn the tariff structure in power systems courses but rarely see the controller logic: demand computation, the warning stage, priority-ordered tripping and the restoration sequence. This project builds a bench-scale version — current sensors on a simulated feeder, three switchable load stages, a keypad-set demand limit and a relay bank that trips lowest-priority-first with a pre-trip warning — so the full penalty-avoidance logic runs visibly.

03. Problem Statement

The demand-tariff concept stays theoretical because students never operate the controller that enforces it. The project fills this gap with a working panel where the demand setpoint, warning stage, trip order and restoration hysteresis are all observable and adjustable, and every event is logged for the demonstration.

04. Objectives

- Measure total feeder demand continuously with per-branch current sensors.
- Provide a keypad-set demand limit stored in EEPROM.
- Warn at 90% of the limit with buzzer and lamp before any tripping.
- Trip loads lowest-priority-first through a relay bank on breaching the limit.
- Restore tripped loads automatically with hysteresis and time delay.
- Log every warning, trip and restoration with timestamps on the LCD.
- Deliver the complete student kit: panel, firmware, wiring docs, report, PPT and viva Q&A.;

05. Proposed Methodology

The system is developed in three stages. (1) Sensing: Hall-effect/CT sensors on three load branches feed an Arduino that sums instantaneous demand in watts. (2) Control logic: firmware compares demand against the EEPROM setpoint every second; a 90% warning stage fires first, then priority-ordered tripping with a settling delay between trips, protecting the critical load always. (3) Restoration: when demand falls below setpoint-minus-hysteresis for the restoration delay, loads return one at a time in reverse order. A lamp/heater load bank simulates the industrial load mix at bench scale.

06. System Architecture / Working

Three modules: sensing (current sensors per branch), decision (Arduino demand computation, setpoint comparison, warning/trip/restore state machine) and actuation (relay bank switching the three load stages). The LCD shows live demand, setpoint and a scrolling event log. The working flow is: set the demand limit on the keypad → apply stepped loads → observe the 90% warning → watch priority tripping hold demand under the limit → reduce load and observe ordered restoration.

07. Hardware / Software Requirements

- Arduino Uno (ATmega328P)
- Hall-effect / CT current sensors, one per load branch
- 4-channel relay bank for load switching
- 4×4 matrix keypad + 16×2 LCD with I2C backpack
- Buzzer + panel warning lamps
- Lamp/heater load bank, 3 priority stages, approx. 100–1500 W (design)
- 230 V AC to 5 V/12 V supplies, panel enclosure
- Arduino firmware: demand loop, hysteresis trip/restore, EEPROM, event log

08. Expected Outcomes

A working panel that holds a simulated feeder under a keypad-set demand limit: warning at 90%, ordered tripping of low- and medium-priority loads on breach, never touching the critical load, and timed restoration with hysteresis. The stepped-load demonstration script produces the expected event sequence, verified on the buyer's build; timings are design targets.

09. Applications

- Teaching demand-tariff and penalty-avoidance concepts
- Demonstrating priority load shedding logic
- Training in relay-based industrial control panels
- Understanding hysteresis in on/off control

10. Future Scope

- True 15/30-minute sliding demand-interval computation
- Three-phase power measurement for real feeders
- GSM alert on demand-breach events
- Data logging to SD card for load-profile analysis