On-Load Tap Changer Working Model for Transformers

Final-Year Project Abstract · Electrical Engineering · Hardware

01 · Title

On-Load Tap Changer Working Model for Transformers — a hand-operated tap selector and diverter-switch model demonstrating voltage regulation under load.

02 · Introduction / Background

Distribution voltage must be held within limits as load varies, and the standard method is changing the transformer's tap position. Off-circuit changers require de-energization; on-load tap changers (OLTC) change taps while loaded, using a tap selector that pre-selects the next tap at no load and a diverter switch that transfers the load current across taps through transition resistors — the make-before-break sequence that prevents tap-to-tap shorts. This project models that mechanism: a small five-tap transformer, rotary selector, exposed diverter chamber with transition resistors, voltmeter, lamp load bank and a mechanical interlock enforcing the correct sequence.

03 · Problem Statement

The selector–diverter sequence is the heart of on-load tap changing, yet students meet it only as a schematic. The critical ideas — why the selector moves at no load, why the diverter bridges through resistors, what the interlock prevents — remain abstract. A working model that performs the sequence under real load, slowly and visibly, is needed.

04 · Objectives

- Build a five-tap transformer model with accessible secondary taps.
- Implement a rotary tap selector and a diverter switch with transition resistors.
- Demonstrate every tap change under genuine lamp load with visible voltage steps.
- Enforce selector–diverter sequencing with a mechanical interlock.

05 · Proposed Methodology

The transformer is energized through an isolation transformer with the lamp load bank on. The operator pre-selects the next tap on the rotary selector (no load current), then operates the diverter lever, which bridges the two taps through transition resistors and hands the load current to the new tap — the make-before-break transfer. The secondary voltmeter shows the voltage step and panel lamps show the active tap. The sequence is stepped through all five taps in both directions, and the interlock is demonstrated by attempting an illegal move.

06 · System Architecture / Working

Tapped transformer → rotary selector (pre-selection, no-load) → diverter chamber with transition resistors (load transfer) → loaded secondary with voltmeter. Lamp load bank keeps the change genuinely on-load; the interlock is the sequencing authority; tap lamps are the state display. The operator performs the exact steps a motor-driven OLTC executes automatically.

07 · Hardware / Software Requirements

Component	Specification
Transformer	230 V / 24 V, approx. 200 VA, 5 taps
Step voltage	Approx. 2.5% per tap (design target)
Selector	Manual rotary with position lamps
Diverter	Manual lever, transition resistors
Load	Lamp bank approx. 50 W
Supply	230 V AC via isolation transformer
Software	None

08 · Expected Outcomes

- Visible voltage steps at each tap change under load.
- Demonstrated make-before-break diverter transfer through resistors.
- Understanding of why selector and diverter roles are separated.
- A recorded tap-vs-voltage table for the report.

09 · Applications

- Electrical machines laboratory demonstrations.
- Utility training on voltage-regulation equipment.
- Classroom aid for transformer courses.
- Seminar and viva demonstration of OLTC principles.

10 · Future Scope

- Motorized diverter drive with timing measurement.
- Automatic voltage-regulator relay closing the loop.
- Vacuum-interrupter diverter cutaway for HV context.
- 17-tap extended selector matching real units.