Project Presentation
PRO. 048

Electrical Power Supply Quality Monitor

Presenter: Odhiambo Kelvin Omondi
F17/2141/2004

Supervisor: Prof. Elijah Mwangi

Examiner: Dr. Mbuthia
Part I: Introduction to Power Quality
What is Power Quality?

• Power Quality (PQ) definition:
  absence of disturbances on single-phase low voltage ac supply mains.

• Power Quality (PQ) problem:
  “Any power problem manifested in V, I or freq deviations that results in failure or misoperation of equipment”

Power Quality = Voltage Quality
Power quality problems

- Voltage dips
- Voltage surges/spikes
- Overvoltage
- Harmonics
- Frequency variations
- Under voltage
- Voltage fluctuations
What is a PQ monitor?

• Monitors deviations in voltage supplied from power system
• ‘Good’ → perfect sinusoidal at 50 Hz
• ‘Bad’ → any deviation caused by events in PQ monitoring
• Deviation can be in:
  – Magnitude
  – Frequency
  – Purity of waveform
Project Objectives

• Design a low cost Electrical Power Quality Monitor
Features & Benefits

It has the ability to:

✓ Record **nature** of disturbances
✓ Give alerts of disturbances
✓ Respond to **voltage** and **frequency changes**

Benefits it offers:

• **Diagnose** PQ problems
• **Understand** PQ reliability
• Evaluate **measures** for improvements
• **Predict** future load equipment performance
• Improve **efficiency** of operating systems
Part II: Design
AC Signal → Noise and Spikes section → Frequency Disturbances Detector → Rectification and Smoothening → Overvoltage and Under-voltage Circuit
Noise and spikes detector

Features:
- 50 Hz filter
- Bicolor LED
- Speaker
- Buzzer

5k pot. Adjust for least light
SCR – spike trigger
Frequency detector

Features:
• Filter
• Rectifier diodes
Perfect at 50 Hz
Above and below, Freq. deviation
Rectification

Features:
- Step-down transformer
- Bridge rectifier

To the overvoltage circuit
Overvoltage circuit

Features:
- MOSFET triggering
- Inverting amplifier
- LEDs

\( V_{IN} > 0V \)
\[ R_2 / R_1 = V_{LED} / V_{WIN+} \] green LED ON
(UNDERVOLTAGE)

\( V_{IN} < 0V \)
\[ R_2 | R_3 / R_1 = V_{LED} / V_{WIN-} \] red LED ON
(UNDERVOLTAGE)
Part III: Simulation Results:

Done by Multism pro. Edition software
Output waveform at 50 Hz

Perfect ac supply
Frequency Detector output waveforms

(a) Output waveform at 30 Hz

(b) At frequency of 55Hz
The LED lights to indicate overvoltage
Voltages monitor showing normal operation at 230V
Conclusion and Recommendation

- detect transient disturbances on low-voltage ac supply mains.
- Voltage and frequency monitored
- Spikes and noise detection
- can be used to trigger a digital waveform recorder
- Power back ups
Thank you