Non-Contact Current Sensors for Power Distribution

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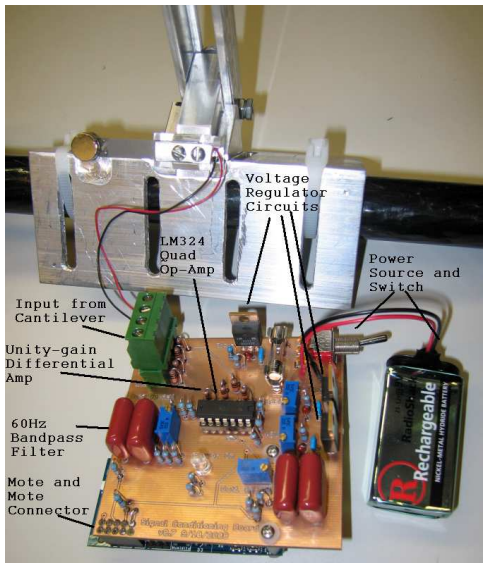
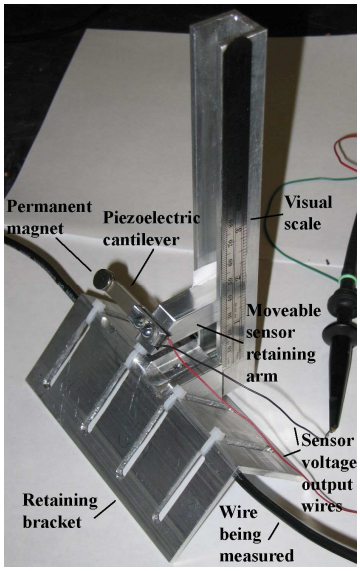
Vision

Presently, power operators have very little data in terms of real-time performance of the electric distribution grid. While overall load levels of the system are easily measured, localized data is typically unavailable due to the high cost of conventional sensor technologies. As a result, increased current draw due to loading changes or system problems may go unnoticed until a failure occurs.

By adapting previously-developed non-contact current sensor technology in combination with readily-available wireless communications, it will be possible to produce inexpensive current sensors for distribution-level (25kV-40kV) power lines. By lowering the cost barrier to implementation, the sensors will allow the creation of a more intelligent power grid, enabling operators to make better informed real-time decisions.



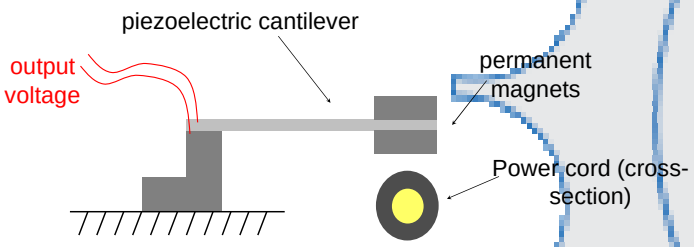


Research Questions

•How well will piezoceramic sensors perform at distribution-level voltages and currents? Will the stronger electric fields affect sensor operation?
•What is the amperage limit for linear sensor operation?
•Is it possible to use to precisely-spaced sensors in a single package to make a self-callibrating unit?
•How may collected data best be condensed so as to not overwhelm operators with data?

Methods

•An aluminum test fixture has been developed, enabling testing of previously-developed non-contact current sensors on single-conductor wires at varying distances from the conductor.
•A signal conditioning board is used to convert differential signals from sensors to single-ended signals readable by a Mote for transmission to a standard PC.
•After being demonstrated in the lab, the apparatus will be transported to PG&E's San Ramon test facility for live tests at distribution voltages.



Findings

•Preliminary tests have been performed on a single sensor. Sensor output is linear, and signal attenuates with distance proportional to $x^{-1.669}$.
•Sensor can detect useable signals from 3cm away from wire..
•Second sensor mount has been built, but retaining mechanisms still need fine-tuning.