Autarkic Sensor Network for Condition Monitoring of Power Lines

1. Overview

The condition monitoring of power lines aims at the optimization of the capacity utilization of energy transport while guarantee hazard free operation.

Therefore real-time data is collected by on-line monitoring of
  • temperature,
  • inclination angle (sag) of the power line,
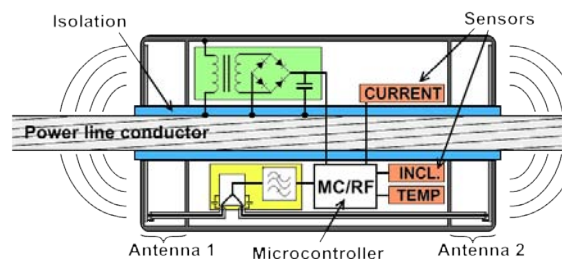 • electric current and
  • oscillation.

Fig. 1: Scheme of a sensor node

2. Features

Sensor node positioned on the power lines collect the data, send it to the neighboring sensor node until reaching the next transformer station. There, the data is provided in an internet-based remote maintenance system. The sensor nodes form a self organizing network structure.

Fig. 2: Sensor node mounted on a power line

The housing is made of PUR (Polyurethan) and contents the electronics, sensors, antennas and antenna filter. It is internally coated with copper and collects the current from the stray field to power the sensor node.

A capacitive MEMS inclination sensor detects the sag of the power line and its oscillation caused by wind motion.
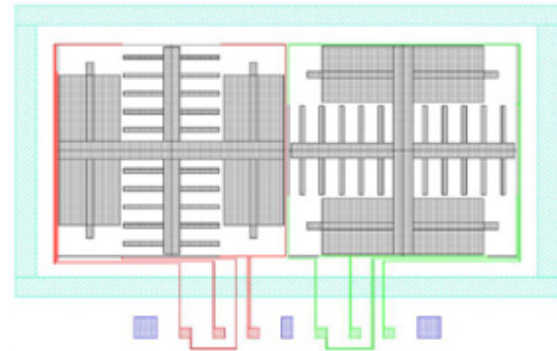

Fig. 3: Schematic layout of the MEMS Inclination sensor with 0.01° resolution

The antennas are located on the small sides of the sensor node. In order to avoid partial discharges slot antennas are used that distribute the 50 Hz electric field. The antennas are high efficient and have a good directionality along the conductor lines. The antenna filter avoids the influence of interfering signals cause by partial discharge.

3. Specifications

Nominal distance between eGrains	500 meters (max. 1,000 m)
Suitable for 110 kV… 380 kV power lines	50 Hz or 60 Hz
Data transmission frequency	2.4 GHz
Full scale range of inclination sensor	±10° with 0.01° accuracy

4. Project Partners

The project is a cooperation between Fraunhofer ENAS, Fraunhofer IZM, Chemnitz University of Technology, enviaM Mitteldeutsche Energie AG, amprion GmbH, ELMOS Semiconductor AG, audacia, Microelectronic Packaging Dresden GmbH, and unilab Systemhaus GmbH. It is supported by Federal Ministry of Education and Research, contract no. 16SV3771.

5. Contact

Dr. Steffen Kurth
Phone: +49 371 45001-255
Fax: +49 371 45001-355
Email: steffen.kurth@enas.fraunhofer.de