AUTONOMOUS MULTI–SENSOR MEASUREMENT SYSTEM FOR TURBOMACHINERY AND HARSH ENVIRONMENTS

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ABSTRACT

A multi – sensor modular measurement system for use in harsh environments is presented and demonstrated in this paper. The main aspects of the system include the autonomous operation and remote sensing as well as the small size and agility. The system utilizes a previously developed wireless data acquisition board and sensors of pressure, temperature and various physical and chemical properties to create an autonomous instrument which can be used for monitoring and controlling processes of industrial interest.

INTRODUCTION

Obtaining real – time data of physical and thermal properties in the environments of high pressure, temperature and inhomogeneous materials found in flows of industrial processes like biomass digesters or circulating fluidized bed boilers will enable better control of these processes thus improving their efficiency.

RESULTS AND DISCUSSION

The wireless data acquisition boards consist of a fast and high resolution analogue-to-digital recorder and logger. Each board has 4 analogue input channels synchronized from a single optical signal while the boards can be utilized in a stacked configuration providing 16 simultaneous analogue voltage acquisition channels. Therefore efforts were made to design a modular system that will easily enable board stacking and will be able to sustain them in harsh environments. The data are temporarily stored on an on-board mini solid state disk before being sent out by the embedded Wi-Fi module.

The sensors employed, other than pressure and temperature sensors, can measure properties like density and viscosity (e.g. cantilever beam sensor or capillary viscometer) as well as thermal (e.g. transient hot wire, temperature oscillation technique) , and can be chosen according with the application the system is used for. Such industrial applications can include waste heat recovery systems, biomass digesters and industrial boilers.

Furthermore, water resistance of the developed autonomous measurement device, enhances the applications domain. Related applications can be an important area of this autonomous device deployment, as there are harsh environments encountered often in such processes. The autonomous sensing device is foreseen to be utilized for measurements in steam applications. Thus the corrosion aggressive environment of sea water including desalination units as well as applications of hydropower and wave energy power generation units are processes of prime interest for the application of this type of autonomous multi-sensor device.

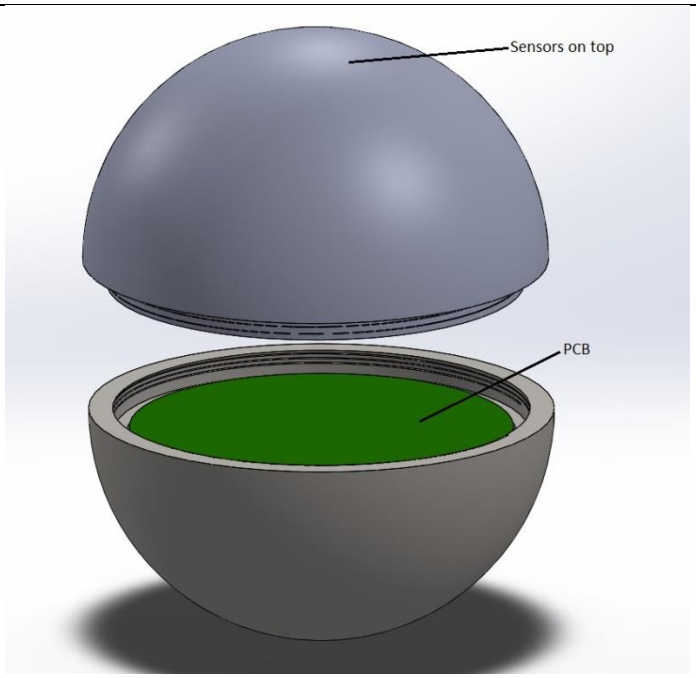

Figure 1. Wireless data acquisition device preliminary CAD drawing

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