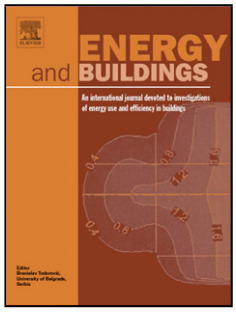
Accepted Manuscript



Title: Optimal Sensor Placement Strategy for Office Buildings Using Clustering Algorithms

Authors: Duwaraka Yoganathan, Sekhar Kondepudi, Balaji Kalluri, Sumanth Manthapuri

PII: S0378-7788(17)30472-3
DOI: https://doi.org/10.1016/j.enbuild.2017.10.074
Reference: ENB 8094

To appear in: *ENB*

Received date: 17-2-2017
Revised date: 5-9-2017
Accepted date: 22-10-2017

Please cite this article as: Duwaraka Yoganathan, Sekhar Kondepudi, Balaji Kalluri, Sumanth Manthapuri, Optimal Sensor Placement Strategy for Office Buildings Using Clustering Algorithms, Energy and Buildings https://doi.org/10.1016/j.enbuild.2017.10.074

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

ACCEPTED MANUSCRIPT

<AT>Optimal Sensor Placement Strategy for Office Buildings Using Clustering Algorithms

<AU>

<AFF>[1]Duwaraka Yoganathan*
<AFF>[2]Sekhar Kondepudi*
<AFF>[3]Balaji Kalluri*
<AFF>[4]Sumanth Manthapuri*

<PA>*Department of Building, National University of Singapore, Singapore-119077.

<ABS-HEAD>ABSTRACT

<ABS-P>*Sensor networks embedded in the built environment provide critical information for intelligent building energy management. Data from sensors enable optimizing energy efficiency and indoor environmental quality without compromising occupant comfort. Thus help achieve efficient operation of building systems at reduced operating costs. Ideally, towards these goals all possible measurement points in buildings should be measured and verified. However, this would inevitably incur tremendous cost and time. Alternatively, an approach to identify the optimal measurement points that can provide a holistic picture of the building's internal environment is desirable. This paper proposes a novel data driven approach based on field measurements in an office building to derive the optimal (number and locations of) measuring points. Clustering algorithms, information loss approach and Pareto principle were used to derive the optimal sensor placement strategy. The findings of this study can have important implications for researchers and practitioners.*

<KWD>Keywords: Cluster Analysis; Optimal Sensor Placement; Office Buildings

<H1>1 INTRODUCTION

Commercial buildings account for 40% of the world's energy use<xps:span class="xps_endnote">1</xps:span> and 30% of the energy consumed by an average commercial building is wasted due to inefficiencies<xps:span class="xps_endnote">2</xps:span>. Therefore having more intelligent buildings with sensor networks that provide critical information for building control systems can greatly impact energy conservation and reduce wastage.

In general, a large number of sensor nodes are preferred for accurate estimation of physical parameters in built environment. However, this is often viewed by building owners as arduous and cost prohibitive. This is because the installation, deployment, commissioning and maintenance of large amount of sensors and processing the huge amount of data generated from these sensors are often challenging, time consuming and cost-intensive. Therefore, an optimized sensor placement technique can drastically minimize the cost and effort required in measuring and processing a large amount of redundant sensor data to a great extent.

Previous works on optimized sensor placement strategies are mainly based on heuristic algorithms. In these studies, an optimal sensor configuration is selected based on the Fisher Information Matrix (FIM) [1], [2], Bayesian loss function [3] and Information Entropy Norm [4]. However, a major drawback of these approaches is that they do not guarantee a practical solution because the sensor configuration is chosen on a heuristic manner.

Thus motivated, this study aims to propose a data driven approach that guarantees optimal sensor placement strategy using exploratory data mining techniques for any target building. In particular, we develop a systematic approach that combines cluster analysis algorithms,

Download English Version:

https://daneshyari.com/en/article/6729497

Download Persian Version:

https://daneshyari.com/article/6729497

Daneshyari.com