IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 1, November 2025
Impact Factor: 7.67

Sensing Driven Automation to Reduce Carbon Footprints in Large Spaces

Mr. Galhe Prathmesh Dattatray, Ms. Bhor Pranali Kundlik, Prof. Kolse C. A., Prof. Said S. K
Department of AI&DS
Jai hind College of Engineering, Kuran, Pune, Maharashtra, India
prathmeshgalhe9@gmail.com and pranalibhor0803@gmail.com

Abstract: *Modern commercial and institutional buildings are major energy consumers, with space heating, ventilation, and lighting alone accounting for roughly half of all energy use [1]. This paper explores how richly sensed indoor environmental data and occupant information can be used to dynamically control HVAC, lighting, fans, and plug-loads to significantly reduce energy consumption. We review methods including occupancy sensing, machine-learning occupancy prediction, demand-controlled ventilation, adaptive thermostat setbacks, and smart appliance control. For instance, occupancy-triggered lighting controls can cut lighting use by 10–90% [2], while integrated ceiling fans and raised thermostat setpoints can reduce cooling energy by ~39% [3]. Demand-based plug-load scheduling has achieved up to 86% savings on selected devices [4]. In a hypothetical open-plan office case study, applying these strategies simultaneously can yield total energy savings on the order of tens of percent (e.g. ~12% overall energy reduction observed in a field trial [5]) while maintaining occupant comfort. We conclude that multi-domain smart controls informed by sensor data offer a promising path to deep, evidence-based energy savings in real buildings.*

Keywords: Energy efficiency, occupancy detection, environmental sensing, HVAC optimization, behavioral analytics, smart building automation, renewable energy integration

DOI: 10.48175/568