

Introduction

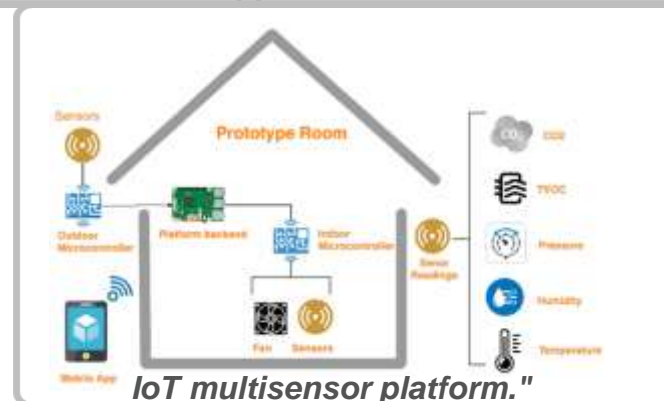
This thesis explores the application of Artificial Intelligence (AI) technologies to enhance energy efficiency in smart buildings. It focuses on various AI techniques, including demand forecasting and energy management optimization, and provides a comparative analysis between these AI-driven methods and traditional energy management systems. The study develops a classification (taxonomy) of AI technologies based on their advantages and limitations, using case studies to evaluate real-world implementations in smart buildings. The findings highlight how AI can significantly improve energy consumption, reduce operational costs, and support sustainable practices. Lastly, recommendations for future research and development emphasize further refinement of AI solutions to drive energy efficiency in smart building networks.

AI Applications and Case Studies



1. Machine Learning		3. Rule-Based Systems and Fuzzy Approaches	
Supervised Learning	ANN (Artificial Neural Networks)	4. Hybrid Approaches and Multi-Objective Systems	IA Hybrid Approaches
	Regression Algorithms		Multi-Objective Approaches
	SVR (Support Vector Regression)		Multi-Agent Systems
	Random Forest (RF)		Autonomic Approaches
	LSTM (Long Short-Term Memory)		Ontology
Unsupervised Learning	CNN (Convolutional Neural Networks)	5. Automated Learning	ELM (Extreme Learning Machine)
	Regression Neural Networks		Autoencoder
	K-means		
Reinforcement Learning	K-nearest neighbor (KNN)	6. Other Approaches and Models	ARIMA, SARIMA
	DBSCAN (Density-Based Spatial Clustering of Applications with Noise)		Radial Basis Functions Network
2. Evolutionary Algorithms and Bio-Inspired Approaches	Transfer Kernel Learning	7. Other Approaches and Models	XGBoost
	Reinforcement Learning		Regression Forest
	DRL (Deep Reinforcement Learning)		
	Regression Forest		
	Evolutionary Algorithms		
	Bio-Inspired Approaches		
	Z-number		

AI Applications and Methods



Conclusions

1. Energy savings of up to 60% in lighting can be achieved through automation, using sensors that detect occupancy and adjust brightness accordingly.
2. Optimizing the HVAC system (cooling and heating systems) can result in savings of 5% to 15%.
3. In this way, AI contributes to reducing energy consumption, enhancing efficiency, and lowering operating costs across all categories of office equipment, heating, and ventilation systems.