ABSTRACT

Servers generate a significant amount of heat during operation. To maintain server performance, an effective cooling system is essential. However, operational costs can increase significantly if cooling management is not optimized. This study aims to optimize energy consumption in cooling systems within a data center environment using a machine learning approach. The background of this research highlights the importance of operational efficiency in maintaining optimal system performance while minimizing unnecessary energy consumption. The main problem addressed is how cooling systems can be dynamically managed to efficiently respond to workload fluctuations.

The simulation in this study was conducted using VirtualBox with Ubuntu as the operating system, where a Precision Air Conditioning (PAC) Control Server simulation was implemented. In the PAC Control Server, Reinforcement Learning (RL) was applied to take actions based on environmental conditions. The data generated by RL was integrated and visualized in Flask through a web-based interface, providing accurate and real-time data representation.

The research methods include system model design, simulation scenarios, data collection from simulation results, and data analysis to evaluate system performance. The testing results demonstrate that the RL achieved an average reward of 4.76 with reward range -5 to 5, convergence rate of 13.2, sample efficiency of 10.15, stability of 2.6, temperature prediction accuracy of 94.30%, and humidity prediction accuracy of 92.20%. Using the model, RL able to decrease the temperature and increase the humidity when the data center servers being stress tested. The simulation data was visualized through Flask, offering real-time projections and supporting the operational efficiency of the cooling system.

Keywords: *data center, reinforcement learning, cooling system, ubuntu,flask*.