The Application of Condensate Water for Carbon Reduction

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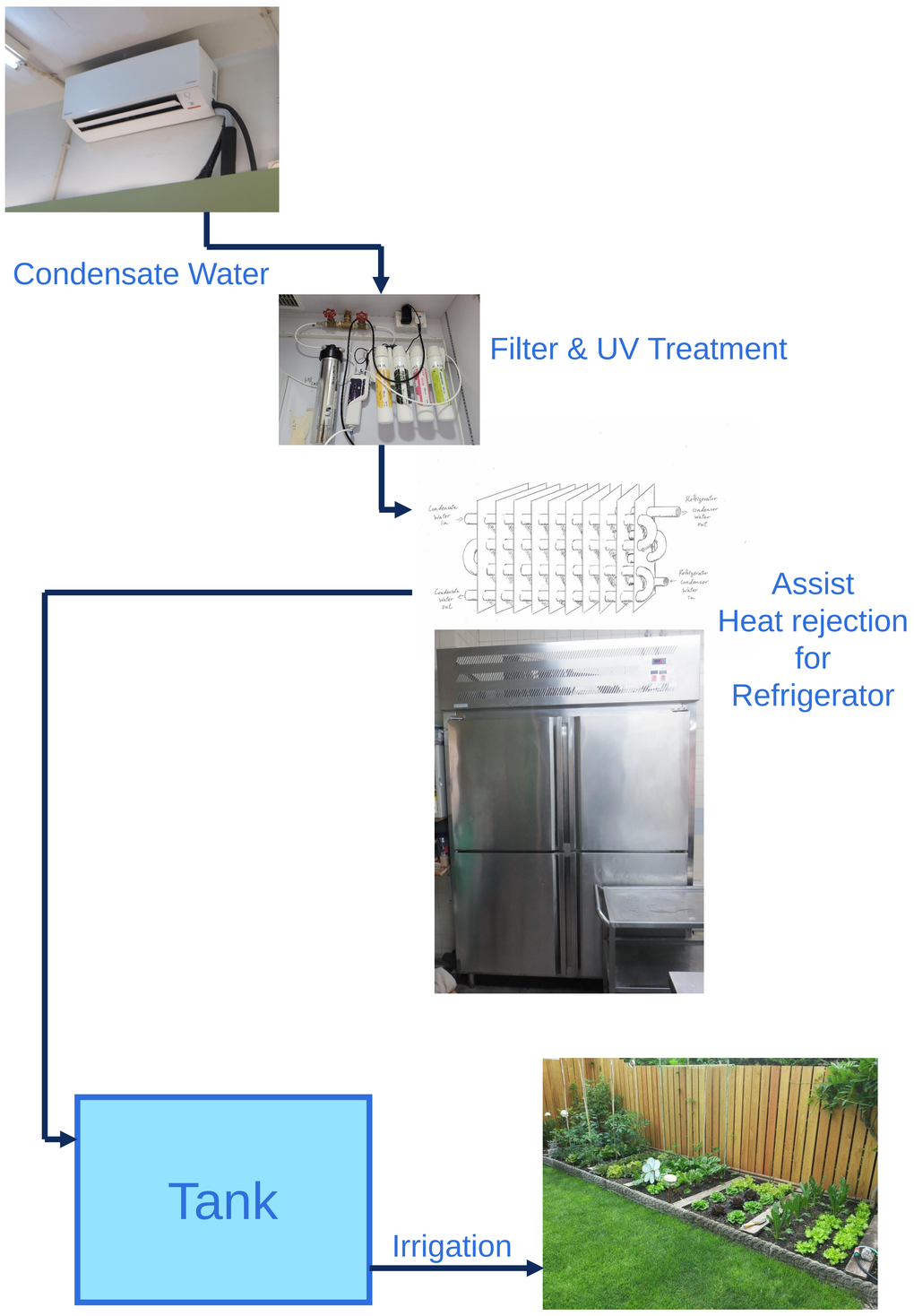
Background

The HVAC system is known to consume the most energy in a building, making it a significant contributor to carbon emissions. Besides the cooling effect of treated air, the condensate water produced by air-conditioners also embodied a carbon footprint. Typically, the condensate water is drained to the wastewater pipe, rendering the emitted carbon footprint meaningless. To address this issue and achieve a reduction in carbon emissions, this research aims to analyze the characteristics of condensate water produced by the HVAC system to discover its potential purpose. Understanding the properties of the condensate water could lead to new opportunities for its reuse or recycling, potentially reducing the HVAC system's carbon footprint and improving the building's sustainability.

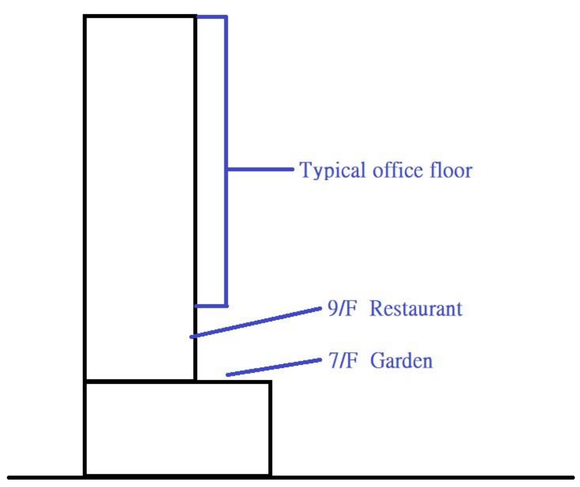
Objectives

Condensate water is suitable for irrigation. This research study aims to create a condensate water recovery system. Compared with the existing condensate irrigation systems, the innovation of the proposed system is a process of heat exchange before the condensate water is stored. The low temperature (around 16℃) of condensate water can be utilized to assist the heat rejection for refrigerators / freezers.



Methodology

The study uses theoretical calculation and analysis. Assuming the condensate water recovery system will be applied in a proposed commercial building in Hong Kong, the study created a condensate water recovery system.



The mean value of 10-years' weather data was used for calculating the content of condensation.

The investment costs and carbon reduction were also estimated.

Findings

Based on the calculation, the proposed building collects 114.46m^3 condensate water in a year. The carbon emission from transporting this volume of potable water has been reduced. Furthermore, the condensate water assists in the heat rejection of the refrigerator. The power consumption of refrigerators is also reduced.

Conclusion

The proposed system cannot achieve payback, although carbon emissions can be reduced by the proposed system. The limitation of the proposed system was identified. For popularizing the proposed system, modification of the proposed system for fitting various HVAC systems has also been analyzed. Future research should apply simulation and experiment to prove the feasibility of this proposed system.