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Comparing the Delivery Methods of Parcel Lockers and Homes: A Mathematically-Based Strategy

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Introduction

The delivery system in urban areas, particularly in the Business to Consumer (B2C) sector, is significantly impacted by the ever-expanding field of e-commerce. When a package is delivered to a customer's address, not only are couriers subject to higher costs due to the additional distance traveled, but also traffic congestion and environmental pollution rise as a result. Literature has looked at the possibility of using locker-equipped collection points to store the goods that users have ordered in order to rationalize deliveries in urban areas. This study contrasts two different delivery methods: deliveries to the customer's residence rather than Lockers. We used a cluster first, route second, and math-heuristic approach to make this comparison. We tried out a new clustering function in the clustering phase, and in the routing phase, we solved a Traveling Salesman Problem for each generated cluster. Finally, we compared the two delivery options using the math-heuristic in a real-world situation the Italian municipality of Dolo near Venice. We take into account two distinct fleets of vehicles, each with a small and medium capacity, when evaluating performance. A sensitivity analysis was also conducted to evaluate the viability of the proposed city logistics plan because customers might make additional trips to Lockers to pick up packages.

Description

Openings in ceilings, floors, stairwells, a broken window at the top of the atrium roof, and a smoke vent there are the horizontal vents. When compared to vertical vents, the flow behaviour in horizontal vents is unstable and oscillatory. Research on how fire moves through horizontal vents. Kerri son compared the experiment data and the field model in a compartment with a ceiling vent. They have observed an oscillating puff of hot gases at the vent caused by the compartment fire. Atkinson observed rapidly rotating smoke rolls close to the ceiling as he experimented with the smoke movement caused by fire conducted an experimental study on the mass flow rate through a horizontal enclosure vent and discovered that buoyancy effects cause a bidirectional flow across the vent dissected the walled in area fire with single and numerous flat vents. They investigated in the laminar flow regime and discovered that the critical grash of number is above which the enclosure's flow becomes chaotic. There were only a few numerical investigations into enclosure fires with ceiling vents [1].

Because of their numerous applications in the thermal design of buildings, solar energy receivers, and compartment fire propagation, predictions of buoyancy-induced thermal plume flow patterns inside vented enclosures have sparked an interest in research. The results of this study will have a significant impact on the tasks of risk assessment and fire safety management for assessing the negative effects of building fires. In terms of building fire safety, the first thing to do is to get away from the fire's heat and smoke. In addition, the present investigation would be beneficial to fire safety measures such as the positioning of smoke extraction fan systems, fire and smoke detectors, smoke vents, smoke curtains, or other physical barriers, fire escape routes, and evacuation modelling. The rate at which oxygen enters buildings and adjacent areas through openings has a significant impact on fire growth and spread. Fire-induced transport phenomena in buildings can be modeled as turbulent flow in partial enclosures induced by buoyancy

Markatos presented one of the earliest studies using field models to predict fire behavior in compartments and aircraft cabins. The volumetric heat source serves as the fire's source, and the K-epsilon turbulence model is used to model the fire's transport phenomena in a two-dimensional enclosure as buoyancy-induced turbulent flow. Markatos and Pericleous carried out subsequent simulations to forecast the temperature and airflow distribution in a three-dimensional heat source compartment. Their mathematical forecasts were contrasted and exploratory perceptions and the capacity of CFD to foresee fire transport conduct was uncovered. By combining the gaseous combustion model and the thermal radiation model, Keramida created an integrated fire spread model that can predict the effects of soot and pyrolysis. Mathematical models were used to study the flow through doors and windows and predict the growth of enclosure fires [2-5].

Conclusion

The numerical investigation of the fire-induced flow through an enclosure's vertical opening was carried out. The thermal plume behaviour as buoyancy-induced flow and found that the characteristics of the flow depend on the size of the fire and the surrounding conditions. The fire-induced flow of hot gases and smoke has been experimentally depicted in a vertical open enclosure by Mercier and Jaluria. The lower opening injects smoke and hot gases into the enclosure, resulting in a downstream wall plume that runs along the enclosure's wall and flow fields. Using Large Eddy simulations, investigated doorway air flow rates in fire scenarios. They have looked at the observational connections on entryway stream rates with the trial information. However, the preceding research focuses primarily on vent-equipped enclosures

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