

Material Flows Prediction for Dynamic Facility Layout Problems via Machine Learning Algorithms

Adem Erik, Yusuf Kuvvetli

Çukurova University, Graduate School of Natural and Applied Sciences, Department of
Industrial Engineering, Balcalı Campus, 01330 Sarıçam, Adana, Turkey, admerk01@gmail.com
Çukurova University, Engineering Faculty, Department of Industrial Engineering, Balcalı
Campus, 01330 Sarıçam, Adana, Turkey, ykuvvetli@cu.edu.tr

Abstract

Today, intense competition environment, more frequent changes of product mix, seasonal demand variables, etc. situations push companies to make various efforts to reduce production costs. One of these studies is the facility layout study, which is very effective on costs due to the material flows. Facility layout is the problem of arranging the facilities in a way that will minimize material movements within the facility and ensure continuous flow. With the facility layout, minimum cost facility locations can be determined by considering material movements. In the dynamic facility arrangement problem, the aim is to determine the material flow, demand variability, product mix changes, etc. in periods. It is the redefinition of the facility layout according to the changes caused by the circumstances. The dynamic facility layout problem considers material handling costs and department relocation costs simultaneously across the planning horizon. The most significant parameter in this problem is to determine the demand or material flow requests during planning horizon. Therefore, this study aims to predict the in-bound material flow accurately that will occur in the future periods. In this context, in-plant material flows were predicted by Linear Regression, Polynomial Regression, Random Forest Algorithm, and Prophet Algorithm. Then the performance of these algorithms was evaluated with Mean Absolute Error, Mean Squared Error, Root Mean Squared Error, and Mean Absolute Percentage Error. Thus, the predicted inter-departmental material flows in the future periods can be used in the solution of facility layout problem.

Keywords

Dynamic facility layout problem, In-bound material flow, Machine Learning, Demand Prediction