

Optimization of a Flexible Schedule for Public Transportation with autonomous vessels

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Abstract

We consider autonomous vessels for transporting people on the coastal area of a city. Typically, vessels are schedule with predefined arrival and departure times established by the management following some criteria or a model.

We propose an approach aiming to enhance the system operation, moving from a full fixed schedule to a system that follows the demand. We propose an optimization model aiming to minimize the penalty assigned to the deviation from the targeted users' arrival times. One challenge is that including full flexibility on the schedule may lead to problems that are impractical due the time required to find a solution, hence, defeating the purpose of an approach that aims to follow demand.

To overcome that challenge, we developed an optimization model that mixes typical patterns of passenger movements for some established boat routes, while reserving some of the system capacity to respond to the dynamics of the demand. While the system could be in principle implemented with manned boats, the uncertainty introduced by the demand response schedule may lead to confusion and errors by the crew, and also not be incompatible with labor agreements.

For that reason, the use of autonomous vessels is key to respond more precisely to last minute changes to the stops schedule. We present illustrative examples to show that the schedules found with this approach are both practical and may lead to a more efficient and flexible use of the boats in peak hours.