

## Optimization Models and Methods for Tour Planning in Smart Urban Logistics

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### 1. BACKGROUND

- Parcel delivery demands are steadily increasing with the rapid development of e-commerce.
- Traffic congestion and air pollution caused by Large trucks have become one of the urgent problems that city managers need to solve.
- With the increase of labor costs and the restrictions on the working hours of the delivery staff, it is very difficult for delivery companies to provide customers with cheap, efficient and round-the-clock courier services.
- From these perspectives, unmanned electric transportation become a good choice for city logistics.

### 2. RESEARCH TARGET

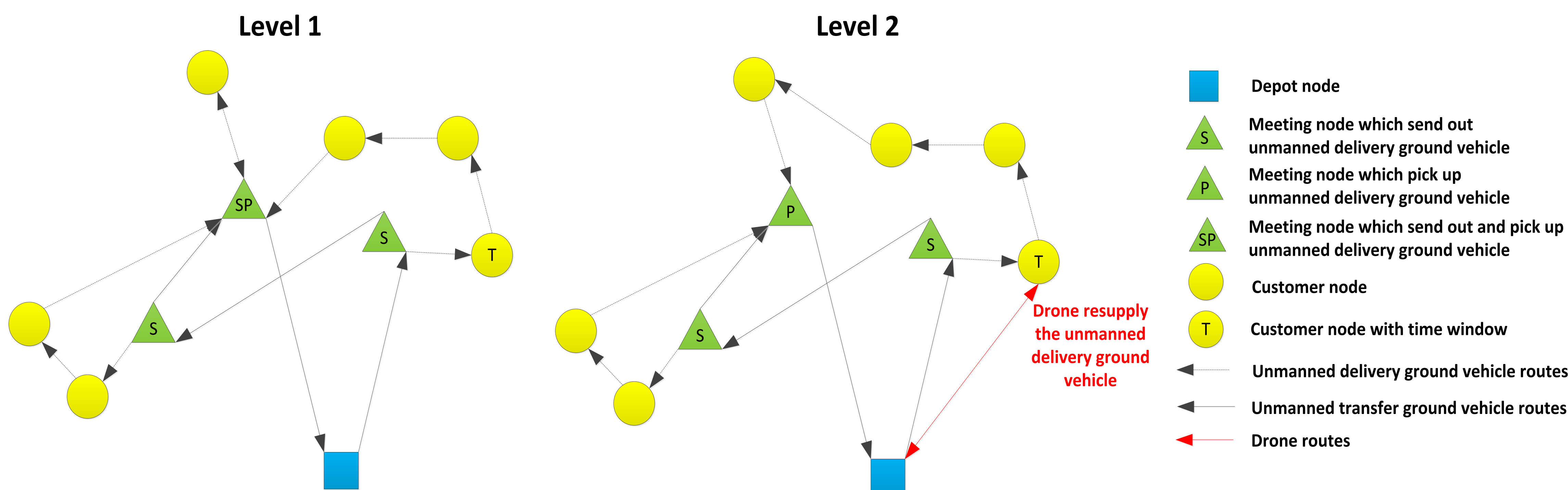
1. Synchronizing unmanned transfer/delivery ground vehicles (and drone) in a city distribution network.
2. Providing an reliable solutions for unmanned delivery system. Verifying the effectiveness of unmanned delivery systems.



### 3. RESEARCH METHOD

- |            |                                  |
|------------|----------------------------------|
| Exact      | • Branch and bound algorithm.    |
|            | • Dynamic programming algorithm. |
|            | • Local Search.                  |
| Heuristics | • Variable Neighborhood Search.  |
|            | • Evolutionary Algorithms.       |

### 4. RESEARCH LEVEL AND DESCRIPTION



Unmanned transfer and delivery ground vehicle system    Unmanned transfer and delivery ground vehicle system with drone resupply

- The unmanned transfer ground vehicle carries unmanned delivery ground vehicles, send out and pick up them at meeting nodes.
- The unmanned delivery vehicle services the customers.
- The drone is used for resupply the unmanned delivery ground vehicle for increasing the maximum delivery capacity of the vehicle.

#### INSTITUTIONS

**AnthroPOLIS**  
HUMAN CENTERED URBAN DESIGN

ALSTOM    GROUPE RENAULT    SNCF    ENGIE    RATP

université  
PARIS-SACLAY

西北工业大学  
NORTHWESTERN POLYTECHNICAL UNIVERSITY

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- Belenguer, J. M., Benavent, E., Martínez, A., Prins, C., Prodhon, C., & Villegas, J. G. (2015). A branch-and-cut algorithm for the single truck and trailer routing problem with satellite depots. Transportation Science.



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