Home Delivery Logistics Networks using Driverless Delivery Vehicles

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Goal of Research

To eliminate the need for all non-recreational shopping by making it possible to have a hot pizza and a vehicle-load of other stuff delivered to your home, exactly when you want, for price of what you would have tipped the pizza delivery guy.
Economics of Driverless Vehicles

• Average cost of FedEx driver (UPS = $45/hr) = $27/hr x 2000 hr/yr = $54,000 per year

• Cost of capital = 5% => $54,000/0.05 = $1.08 million max driverless investment
Driverless Delivery Vehicle

(b) Rear view of DDV.

(c) GEM® eL XD electric utility vehicle.
Home Delivery Logistics Network

(a) DCs covering Raleigh-Durham metro area.

(b) Delivery of four orders to a home.
Module and Container Design

(a) Top view of single module.  
(b) Bottom view of 1 x 1 container.  
(c) 2 x 1 container (shown half scale).

(a) First pair of wheels moves container moves onto module.  
(b) Container stops and second pair of wheels is raised.  
(c) First pair of wheels is lowered and second pair moves container in orthogonal direction.

25 cm (9.84 in)
DC (top view of one level)
DC (side view)
Automated Loading/Unloading

10 Modules (2.5 m)

Fixed Array in Facility

Movable Array Onboard Vehicle

Array onboard vehicle moves to interface with array in facility

5 Modules (1.25 m)
Container Accessibility

(a) Storage area prior to retrieval of shaded container.
(b) Storage area after path cleared for shaded container.
Three-layer Storage System Control

Load Planning and Control
- vehicle departure and load information
- expected load arrival time
- load configuration, destination and deadline
- signal and confirm movement

Priority Assignment
- confirm or report deadlock
- container priority and destination

Path Planning and Execution
- confirm movement
- signal movement

Module

Elevator
## Home Delivery Cost Estimate

<table>
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<tr>
<th>Module Cost</th>
<th>L/U Time (min)</th>
<th>DC Space Util.</th>
<th>Household Demand (trips/week)</th>
<th>Modules per Trip</th>
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(DC cost in $, DC + vehicle cost = Trip cost in $, Mod = cost per module delivered in $)