Home Delivery Logistics Networks using Driverless Delivery Vehicles

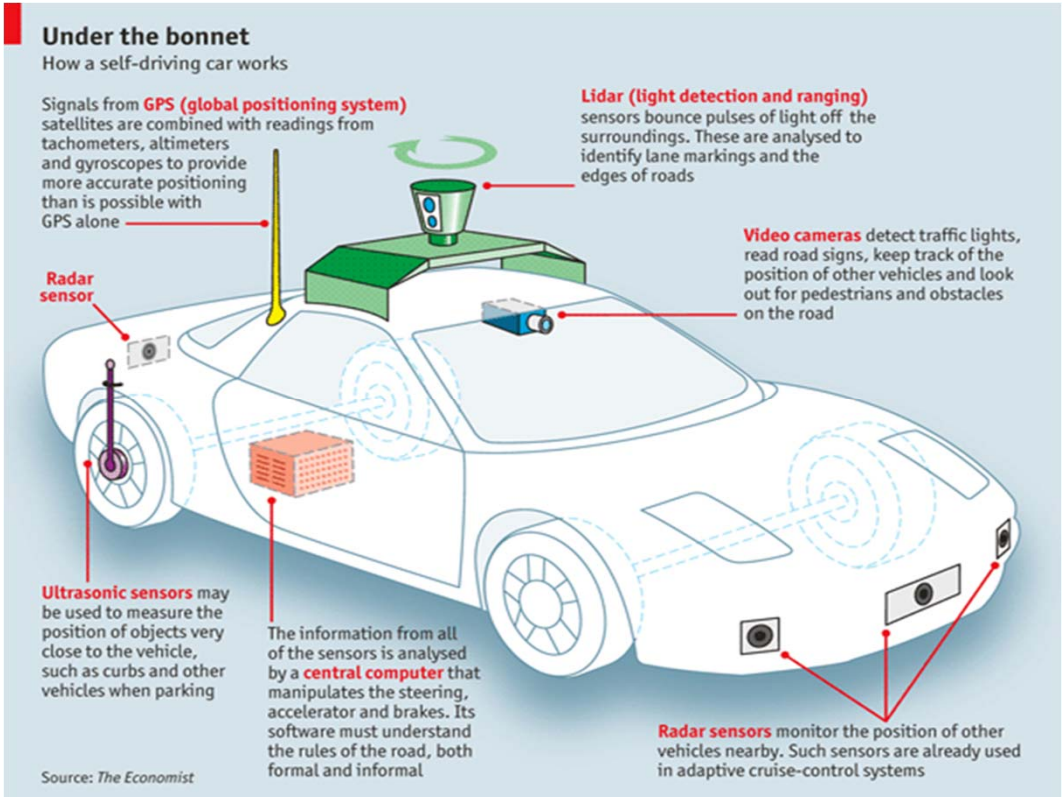
Michael G. Kay

Goal of Research

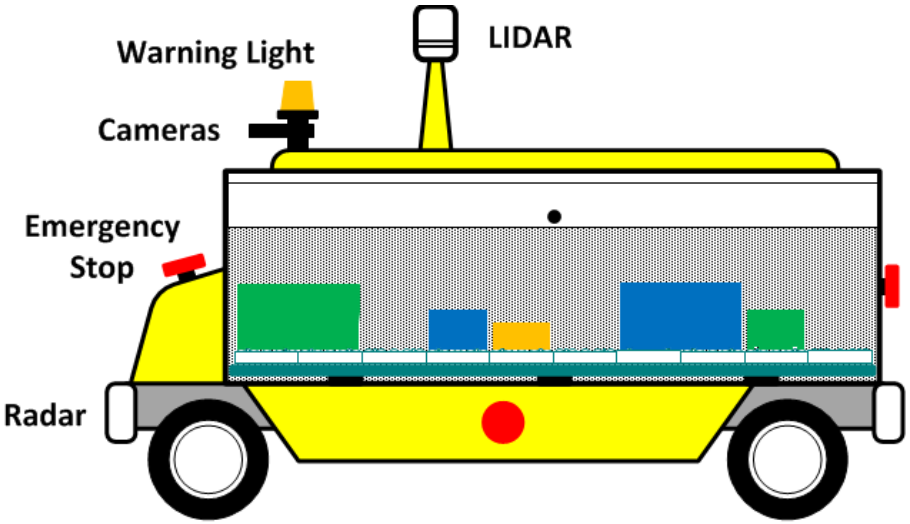
To eliminate the need for all non-recreational shopping by making it possible to have a hot pizza and a vehicle-load of other stuff delivered to your home, exactly when you want, for price of what you would have tipped the pizza delivery guy.

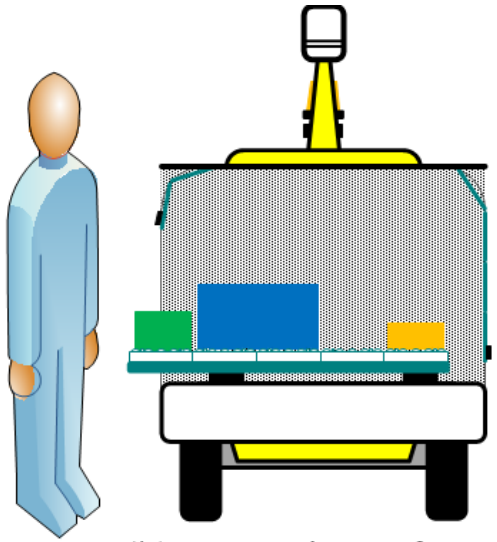
Economics of Driverless Vehicles

- 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

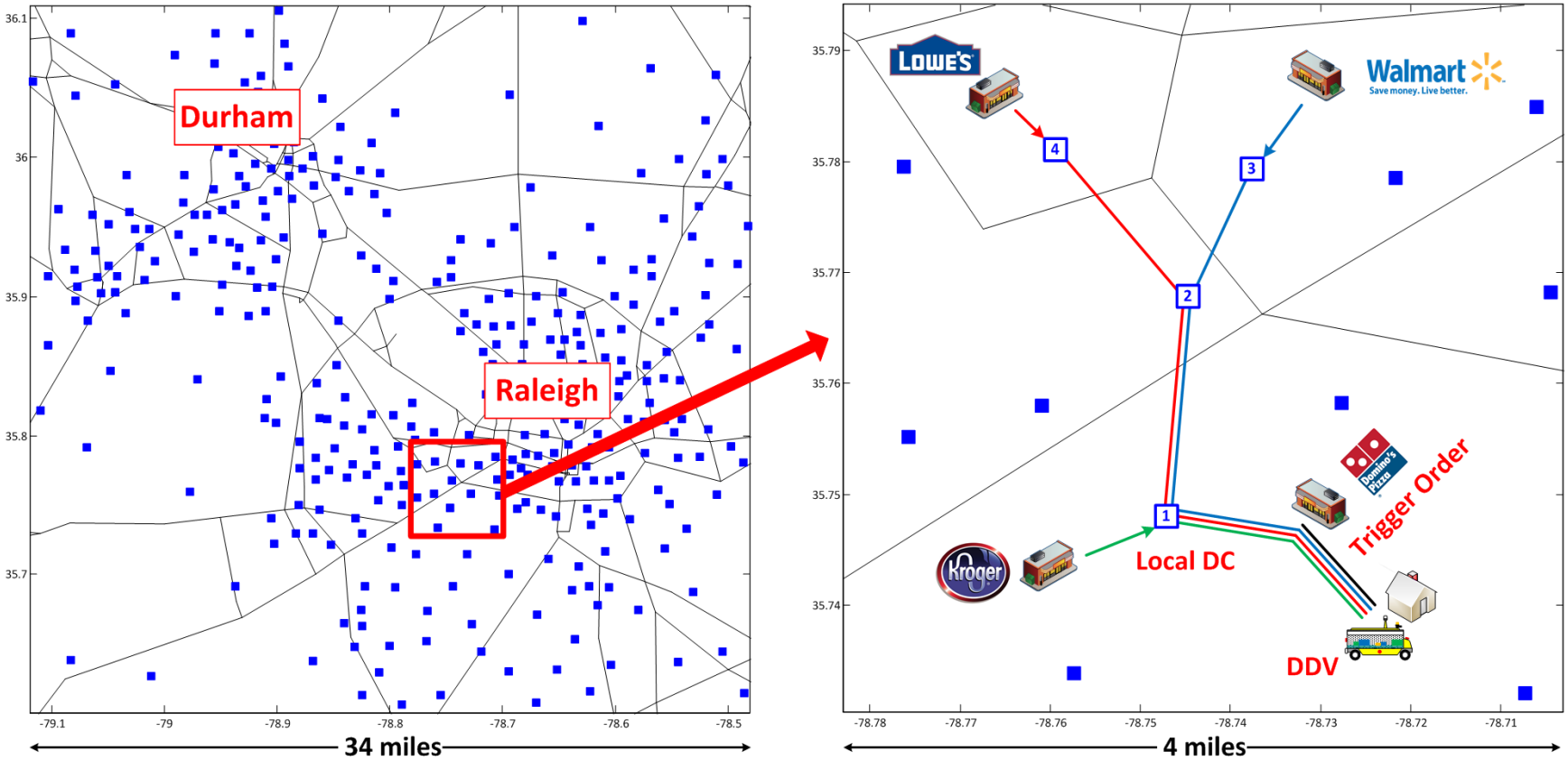




(b) Rear view of DDV.

(c) GEM® eL XD electric utility vehicle.

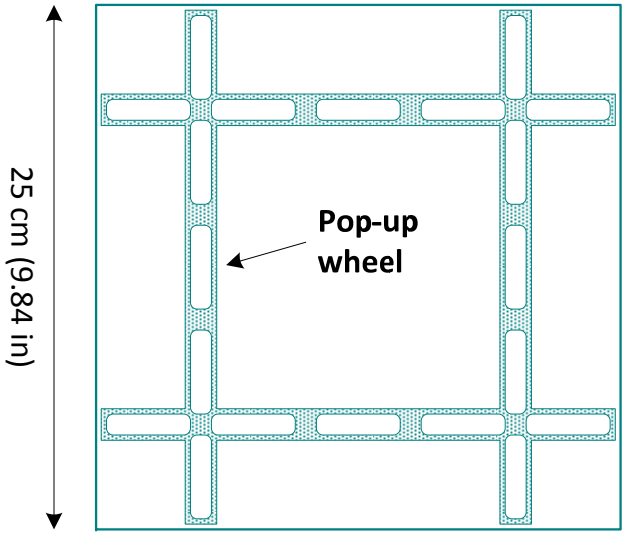
Home Delivery Logistics Network



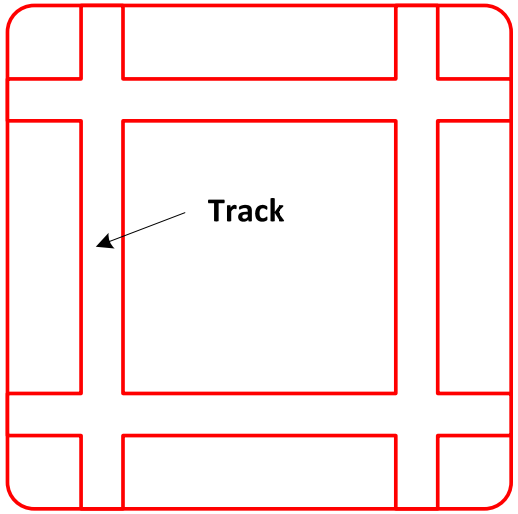
(a) DCs covering Raleigh-Durham metro area.

(b) Delivery of four orders to a home.

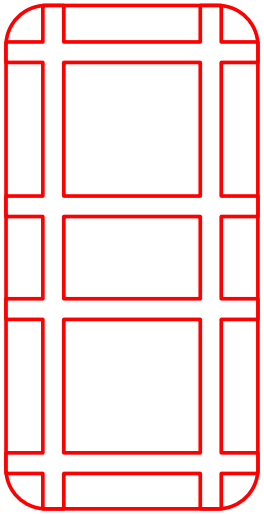
Module and Container Design



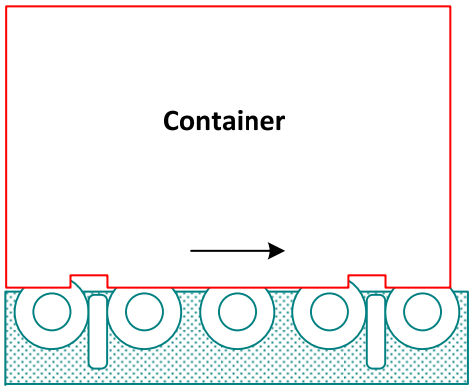
(a) Top view of single module.



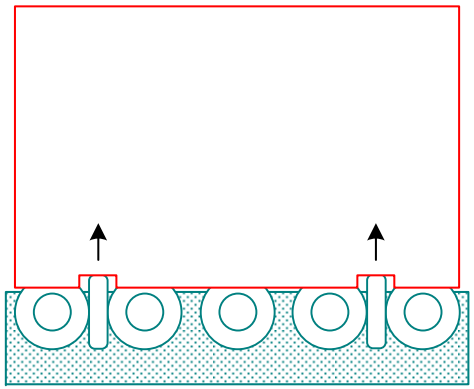
(b) Bottom view of 1 x 1 container.



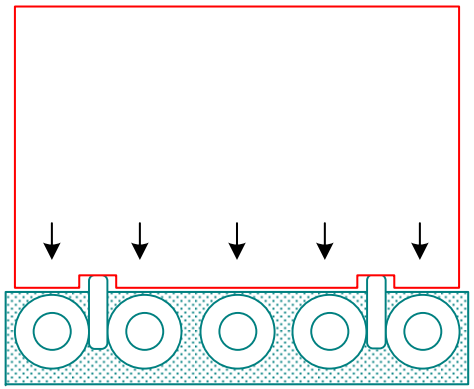
(c) 2 x 1 container (shown half scale).



(a) First pair of wheels moves container moves onto module.



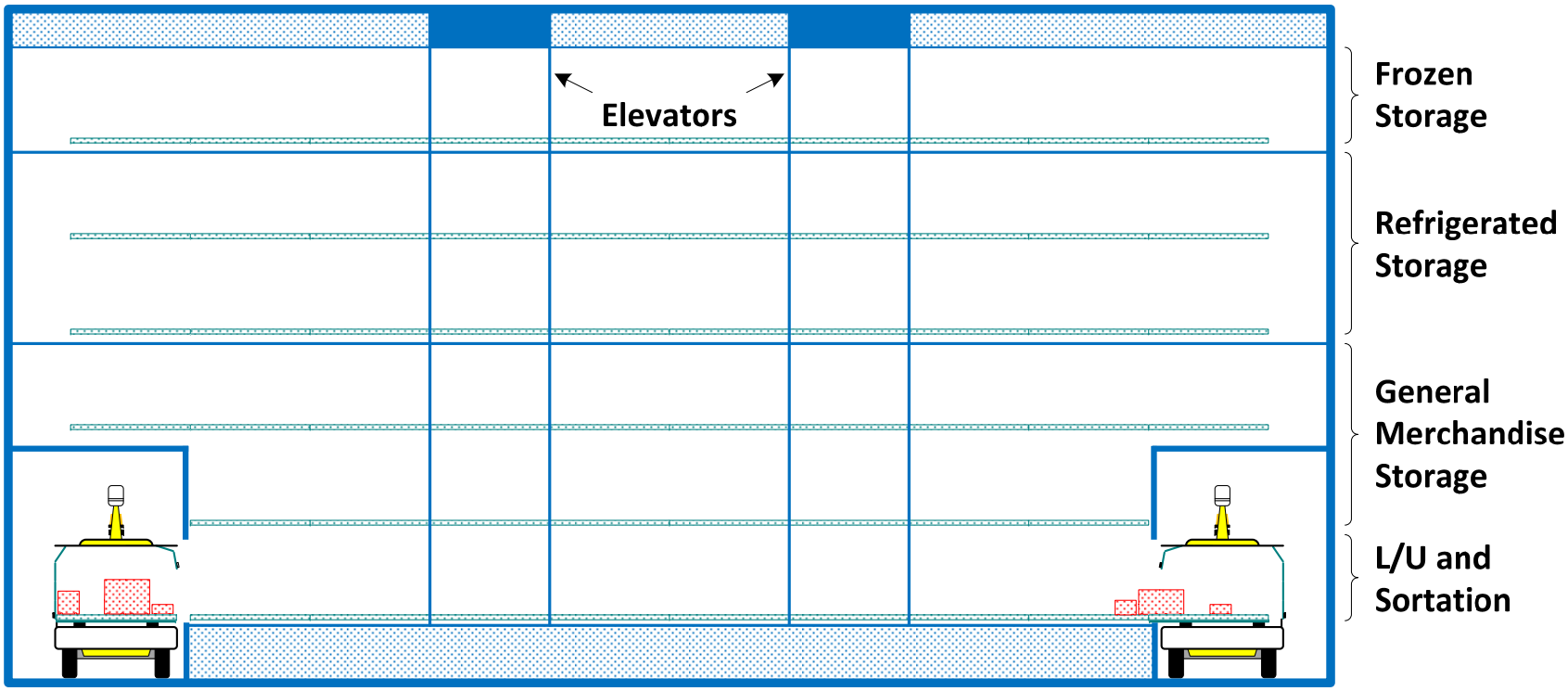
(b) Container stops and second pair of wheels is raised.



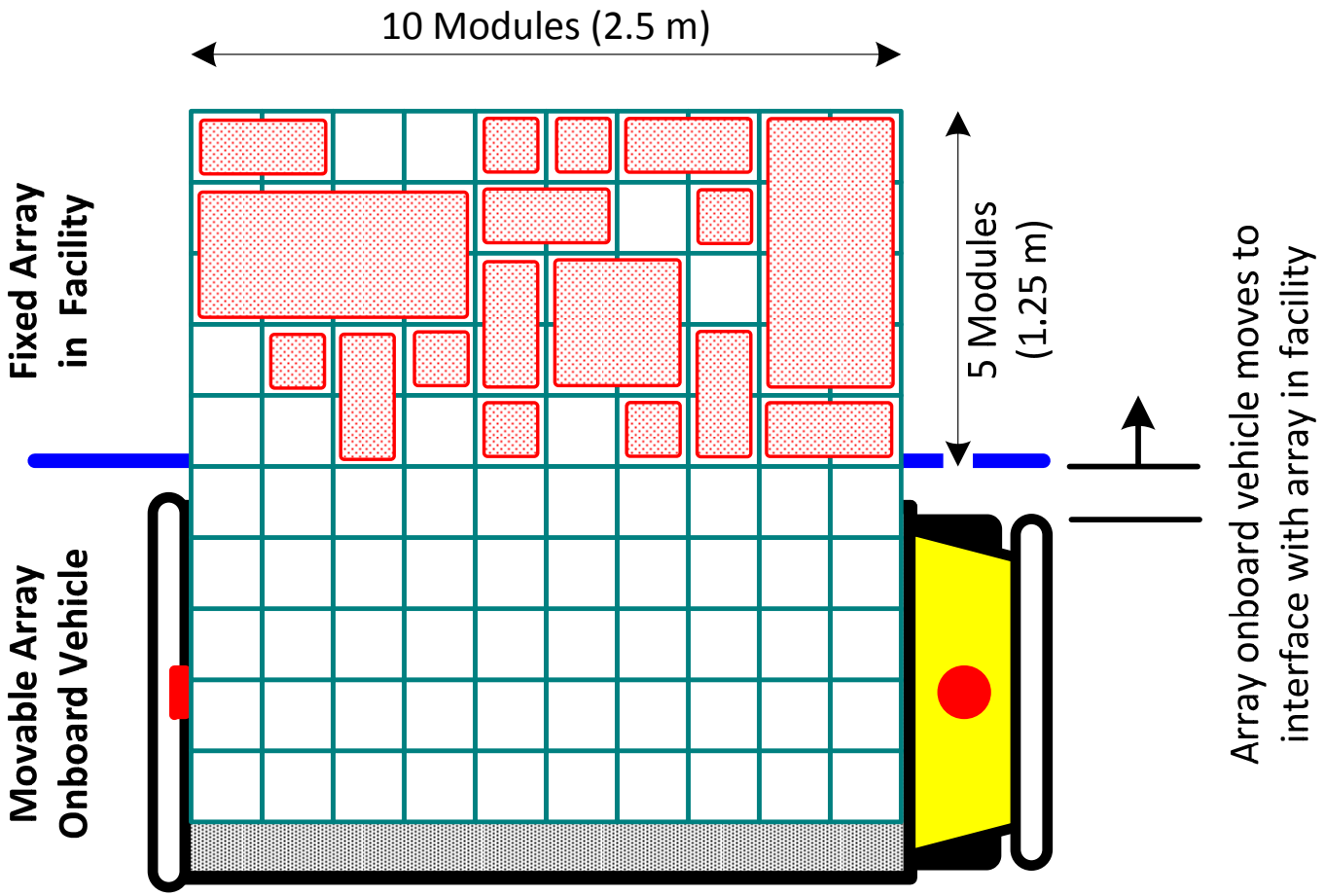
(c) First pair of wheels is lowered and second pair moves container in orthogonal direction.

DC (top view of one level)

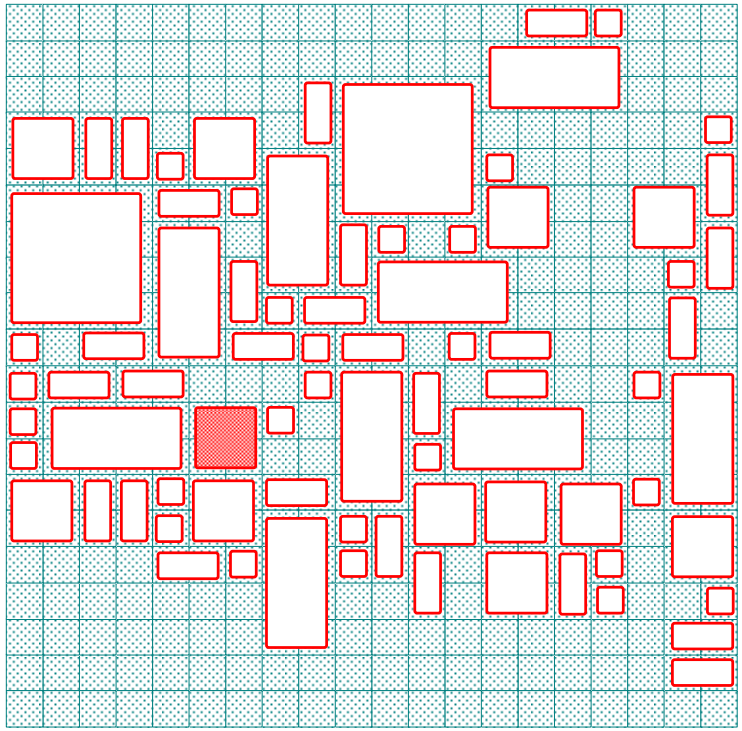
DC (side view)


Elevators
Frozen Storage
Refrigerated Storage
General Merchandise Storage
L/U and Sortation

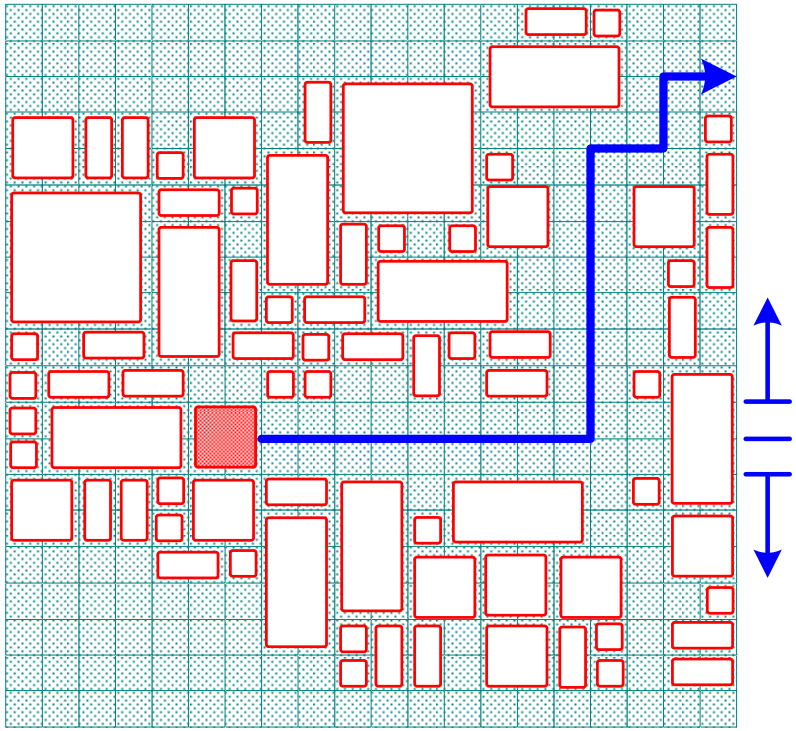
Automated Loading/Unloading



Container Accessibility

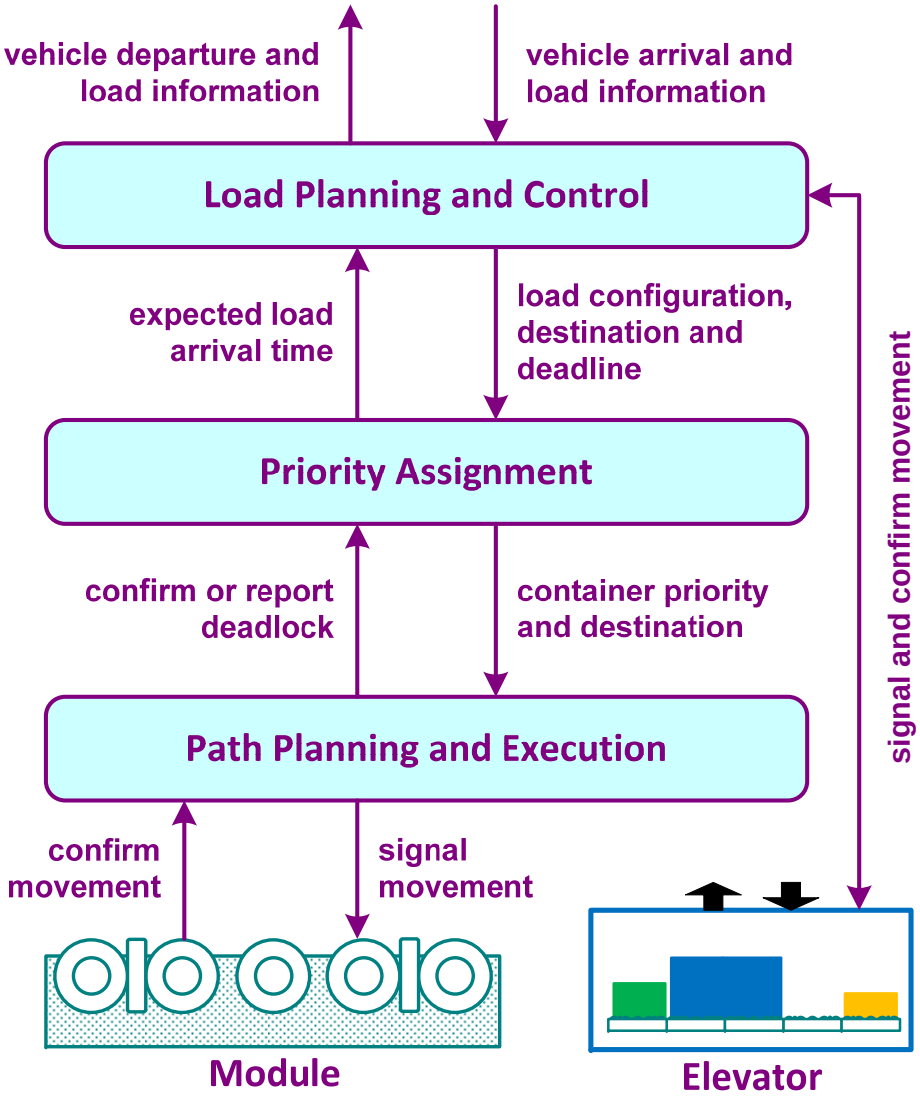


(a) Storage area prior to retrieval of shaded container.



(b) Storage area after path cleared for shaded container.

Three-layer Storage System Control



Home Delivery Cost Estimate

Module Cost	L/U Time (min)	DC Space Util.	Household Demand (trips/week)															
			2								4							
			Modules per Trip								Modules per Trip							
			10				20				10				20			
				DC	Trip	Mod		DC	Trip	Mod		DC	Trip	Mod		DC	Trip	Mod
50	5	0.6	*1*	1.46	2.27	0.23	*9*	2.27	3.19	0.16	*17*	0.73	1.54	0.15	*25*	1.14	2.05	0.10
50	5	0.8	*2*	1.29	2.10	0.21	*10*	1.93	2.84	0.14	*18*	0.64	1.45	0.15	*26*	0.96	1.88	0.09
50	10	0.6	*3*	1.46	2.27	0.23	*11*	2.27	3.19	0.16	*19*	1.32	2.13	0.21	*27*	1.64	2.56	0.13
50	10	0.8	*4*	1.29	2.10	0.21	*12*	1.93	2.84	0.14	*20*	1.32	2.13	0.21	*28*	1.64	2.56	0.13
100	5	0.6	*5*	2.51	3.39	0.34	*13*	4.01	5.02	0.25	*21*	1.25	2.14	0.21	*29*	2.01	3.01	0.15
100	5	0.8	*6*	2.16	3.05	0.30	*14*	3.32	4.32	0.22	*22*	1.08	1.97	0.20	*30*	1.66	2.66	0.13
100	10	0.6	*7*	2.51	3.39	0.34	*15*	4.01	5.02	0.25	*23*	2.12	3.01	0.30	*31*	2.71	3.71	0.19
100	10	0.8	*8*	2.16	3.05	0.30	*16*	3.32	4.32	0.22	*24*	2.12	3.01	0.30	*32*	2.71	3.71	0.19

(DC cost in $, DC + vehicle cost = Trip cost in $, Mod = cost per module delivered in $)