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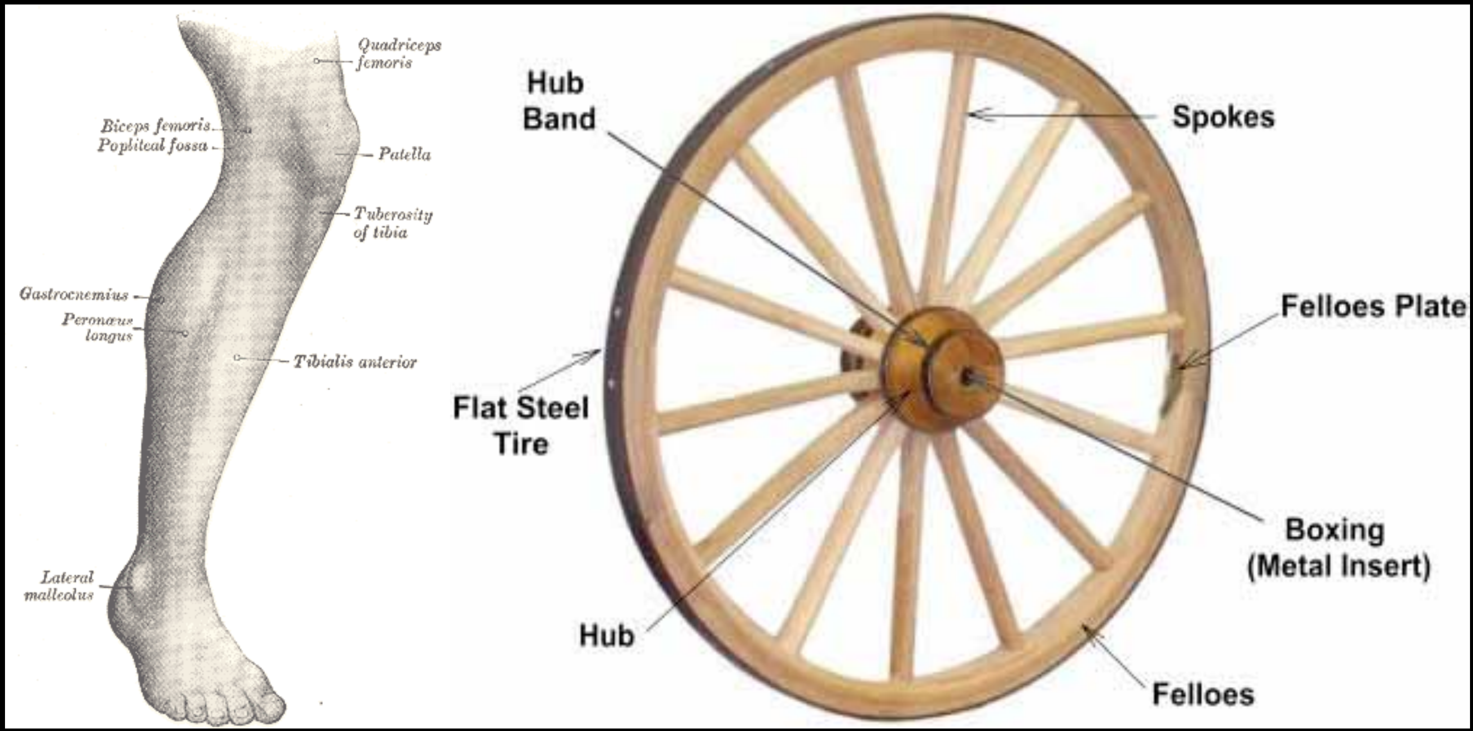
Personal Mobility

William J. Mitchell
Smart Cities



HUGE, GLOBAL PROBLEM: BUILDINGS AND TRANSPORTATION

In the 21st century about 90% of population growth will be in urban areas; these will account for 60% of the population and 80% of the wealth. Hence, the pattern of future energy demand will increasingly be determined by urban networks.

Transportation and building operations typically account for at least 60% of urban energy use.

In congested urban areas, about 40% of total gasoline use is in cars looking for parking.

-Imperial College Urban Energy Systems Project

NEED FOR MAJOR STRUCTURAL CHANGES IN SYSTEMS

Incremental efficiency gains in these domains through new technologies and gadgets are useful, but will not suffice to make a big dent in this usage.

Because land use, transportation, and energy distribution are tightly coupled, the big potential efficiency gains result from rethinking the whole system.

Our answer: reinvent urban personal transportation.

CITY CAR VIDEO

Animation: By Franco Vairani

PRINCIPLES OF THE CITY CAR

Shared-use, two-passenger electric car that folds and stacks like shopping carts.

Omnidirectional robot wheels and drive-by-wire replace traditional engine, drive train, and steering mechanism.

Swipe your credit card, pick up a car from a stack, and deposit at another stack when you are finished – like having valet parking everywhere.

Recharging occurs whenever the vehicle is stacked, so no need for very long range or heavy, bulky batteries. Inductive charging probably makes sense.

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VEHICLE ARCHITECTURE

Image Credit: Franco Vairani

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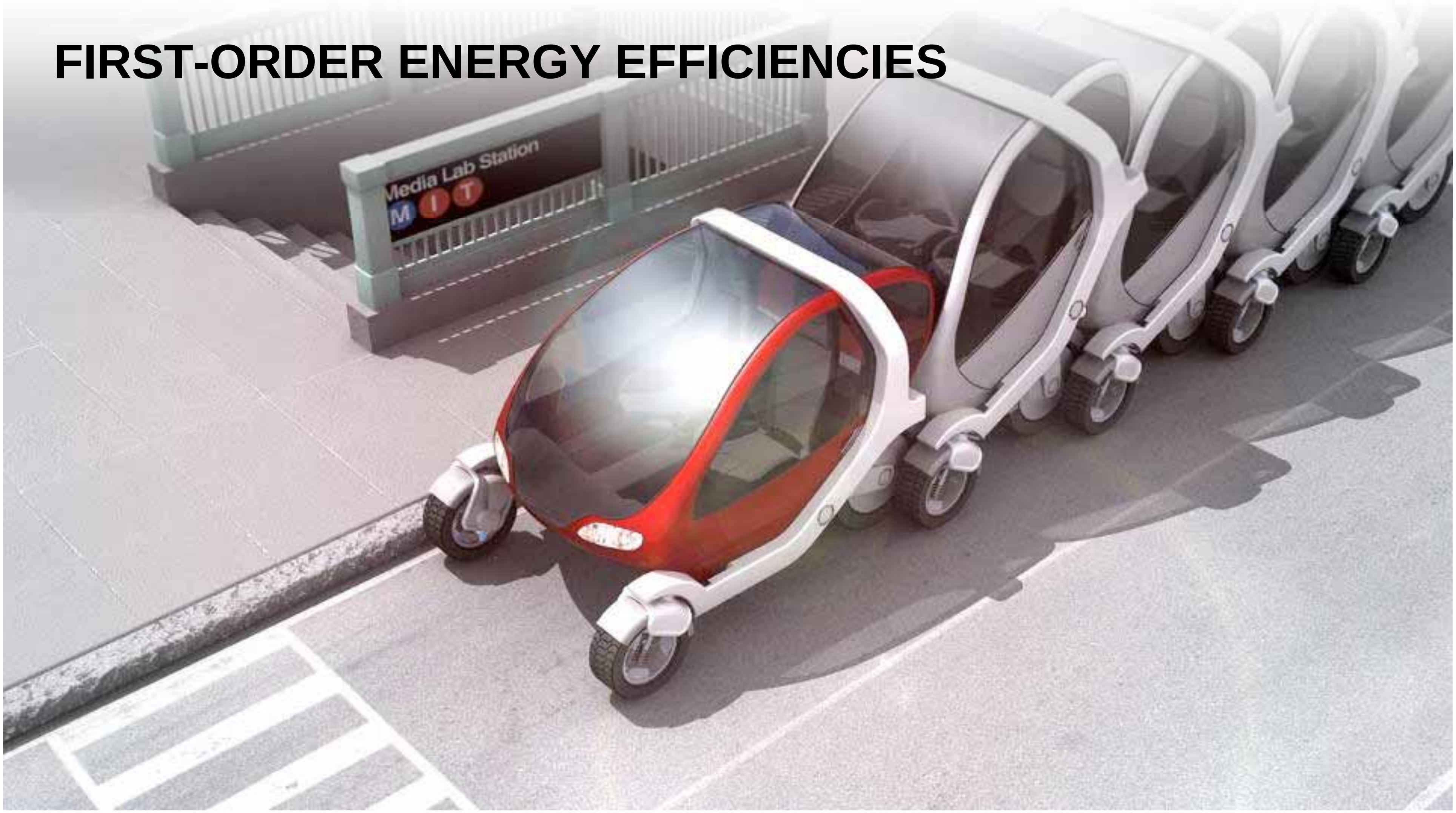
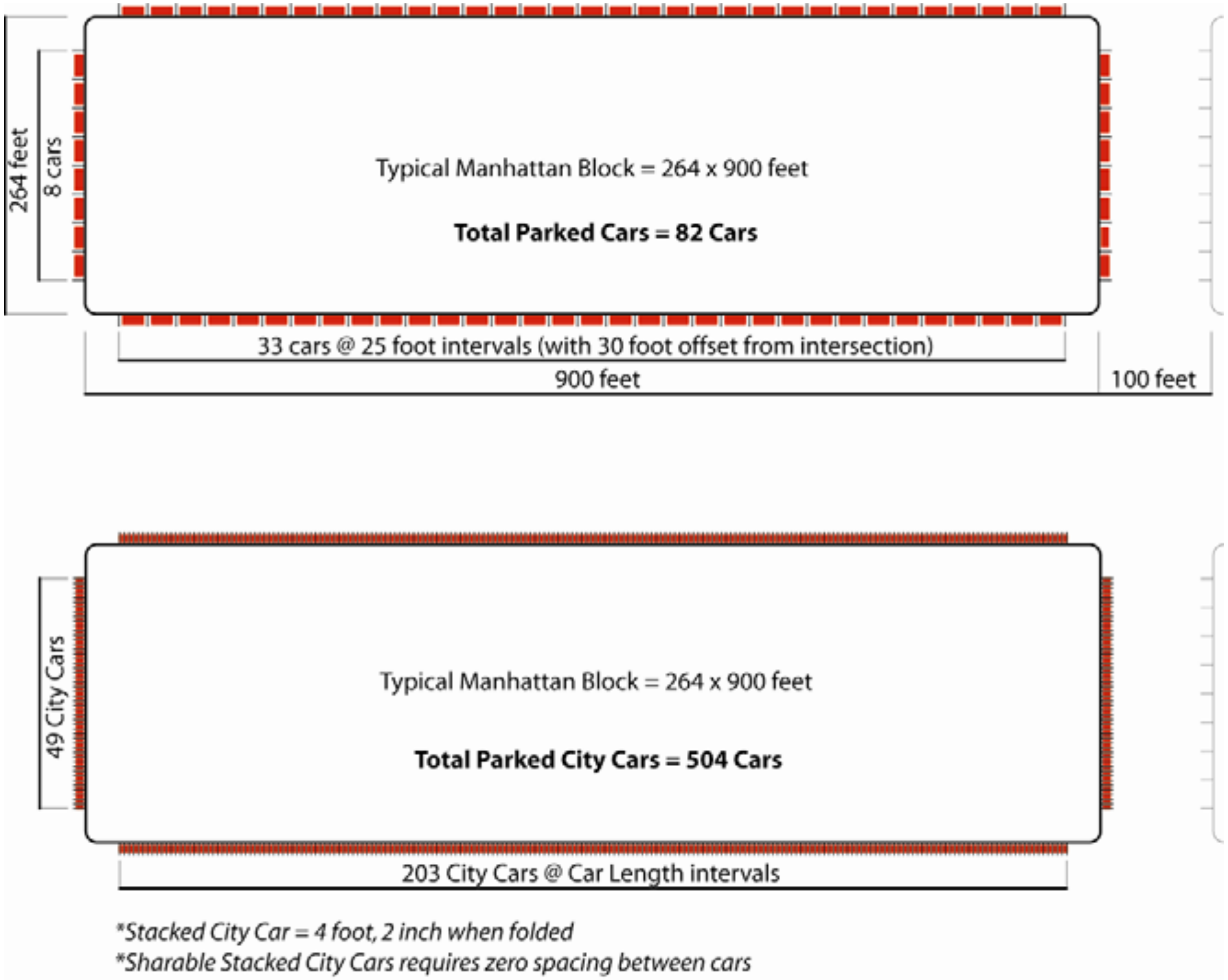
FIRST-ORDER ENERGY EFFICIENCIES



Tiny footprint (size of a Smart when extended, half the size when folded) and much more agile than a traditional car, so makes much more efficient use of urban infrastructure.

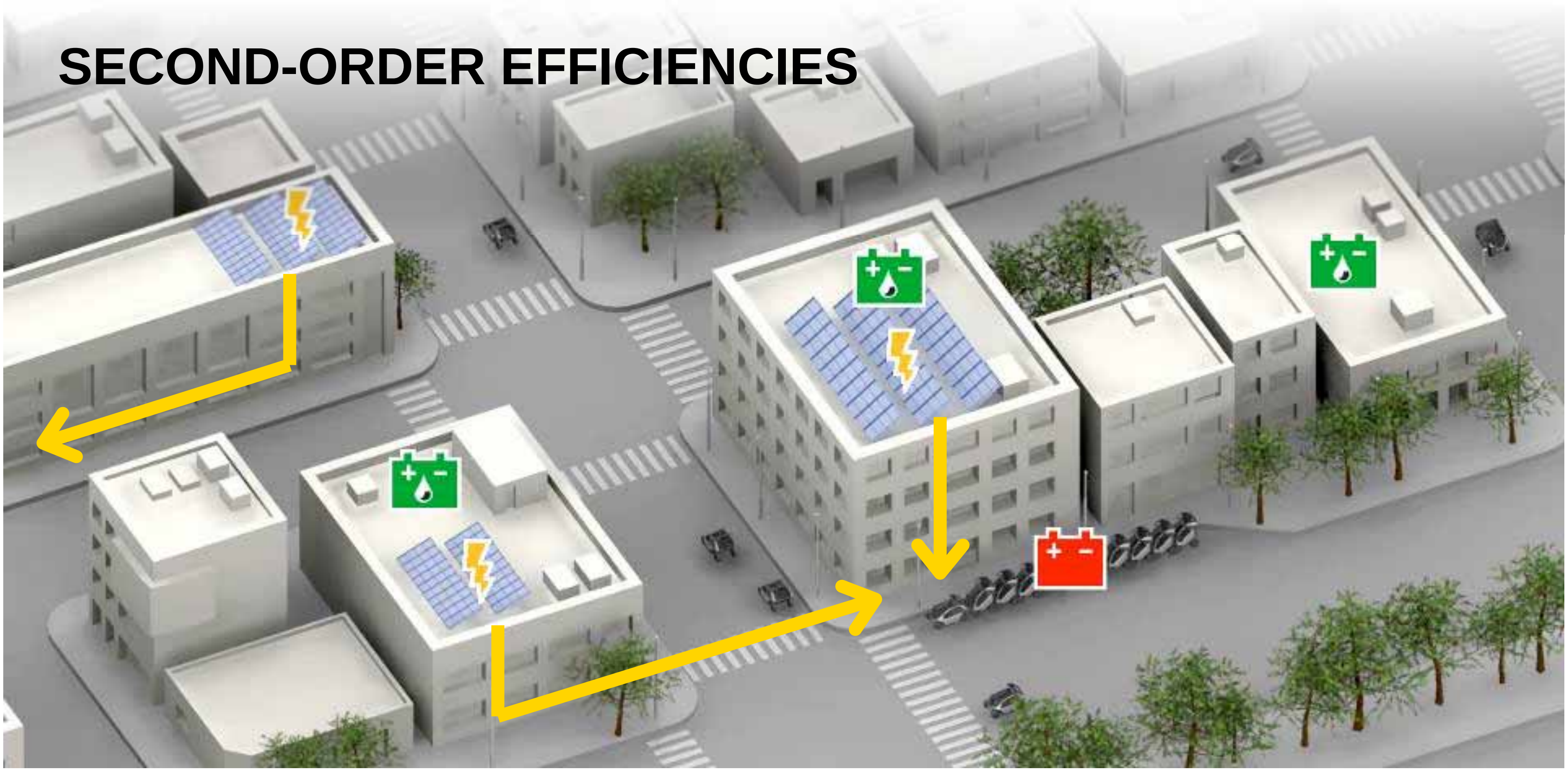
Very lightweight, all electric, digitally controlled, almost silent, no tailpipe emissions.

Shared use principle allows very high utilization rate and transformation of the automobile industry from a low-margin, commodity product business to an innovative service business.



City Car to Typical Car Parking Ratio = 6.1 : 1

SECOND-ORDER EFFICIENCIES



With large-scale use, car stacks throw enormous battery capacity into the electrical grid.

Effective utilization of inexpensive, off-peak power and clean but intermittent power sources – solar, wind, wave, etc.

A smart, distributed power generation system composed of these sources (the entire city as a virtual power plant) minimizes transmission losses.

This fits nicely, as well, with fuel cells in buildings – where they make much more sense than in vehicles.

CITY CAR: DUAL-USE PRODUCT

City Car in Motion

Mobility
(Shared Use)

City Car at Rest

Energy Storage Device
(Renewable Friendly)

* Whenever at rest, plugged into power grid

THIRD-ORDER EFFICIENCIES

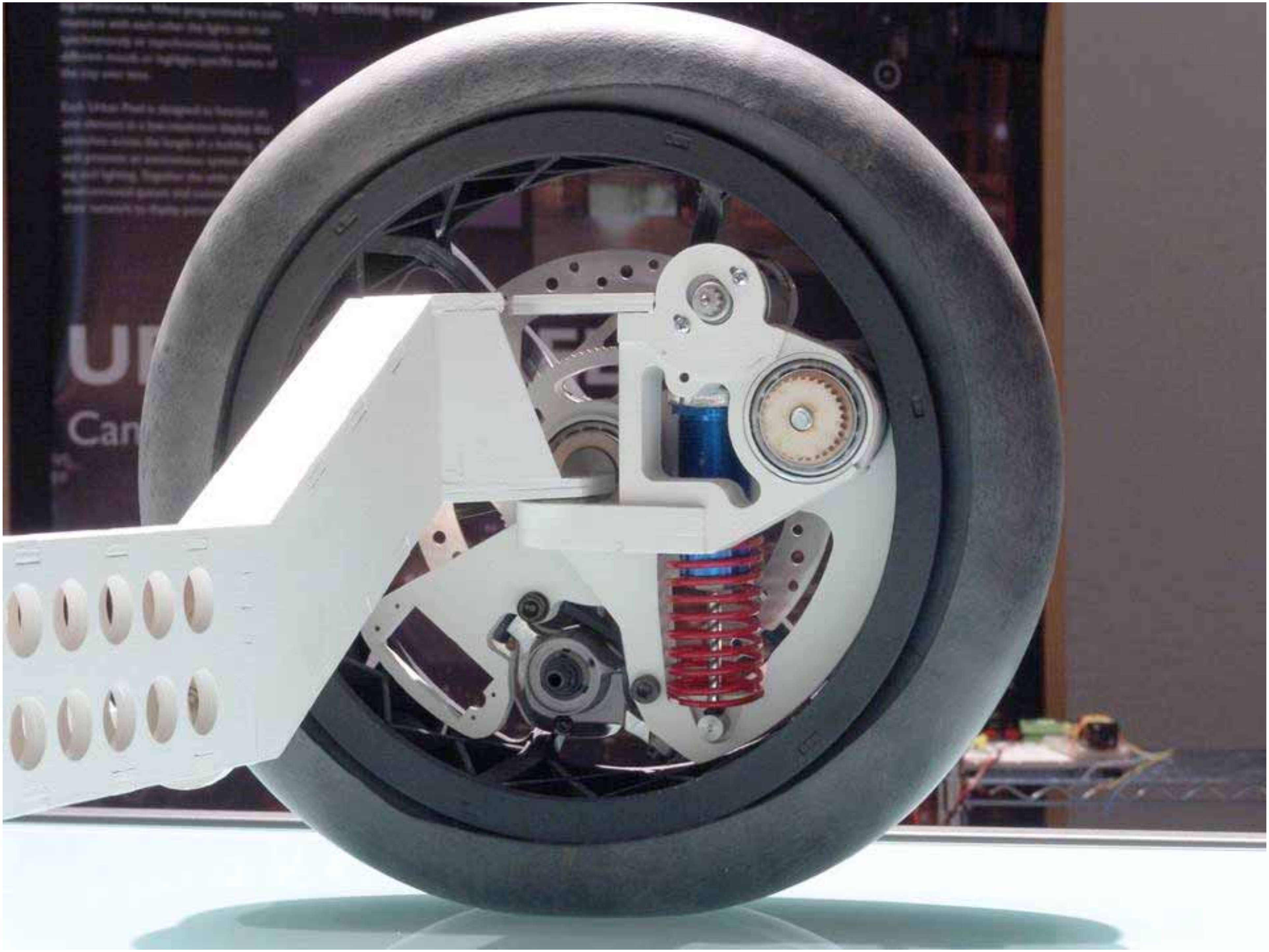
Intelligent utilization of a city's resources, based on ubiquitously embedded intelligence and ubiquitous mobile networking

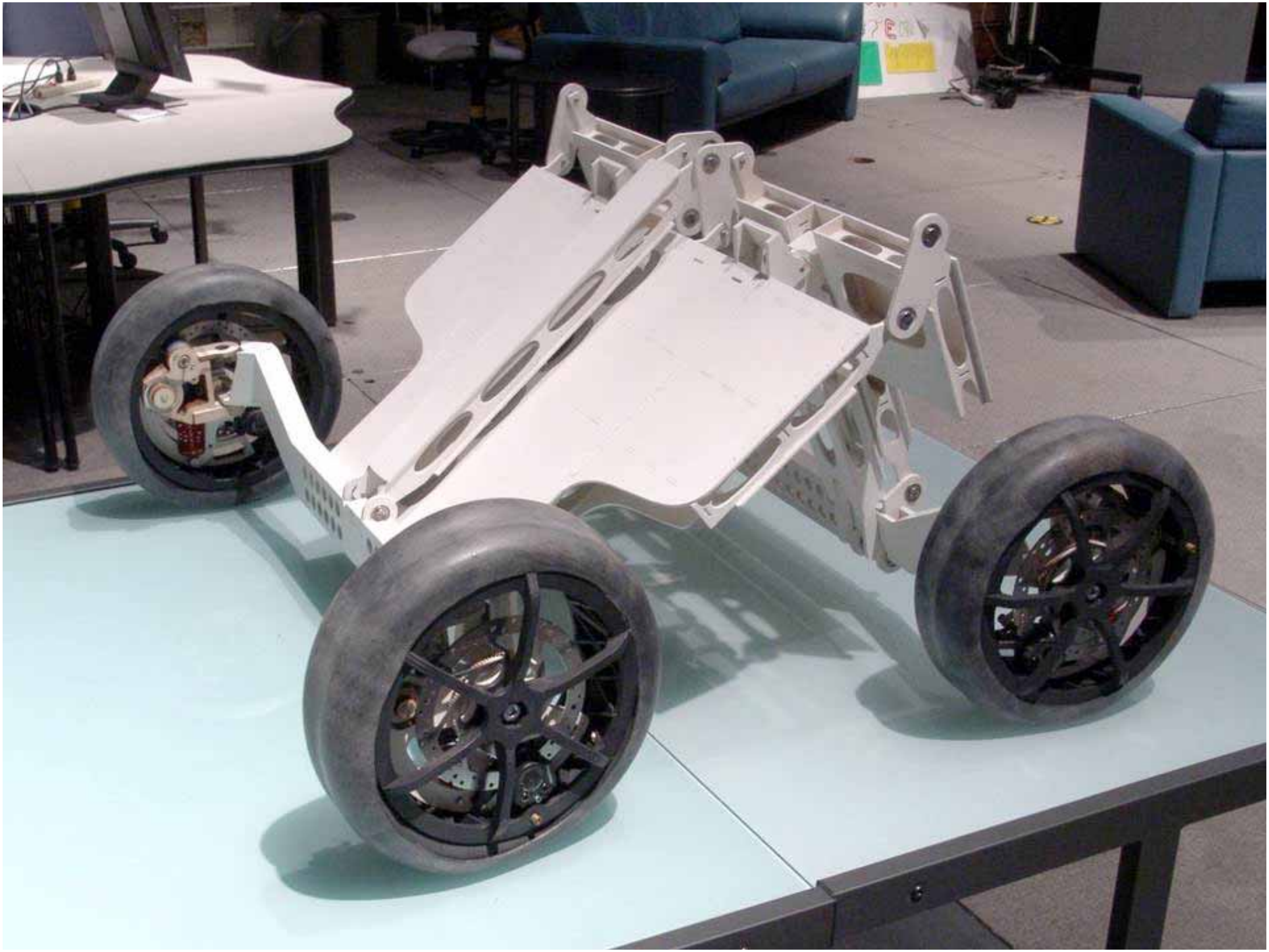
Cars know patterns of energy prices and mobility demand, and intelligently play the energy futures market

Cars operate in an environment of fine-grained, highly dynamic road congestion pricing, and intelligently play in the road space market

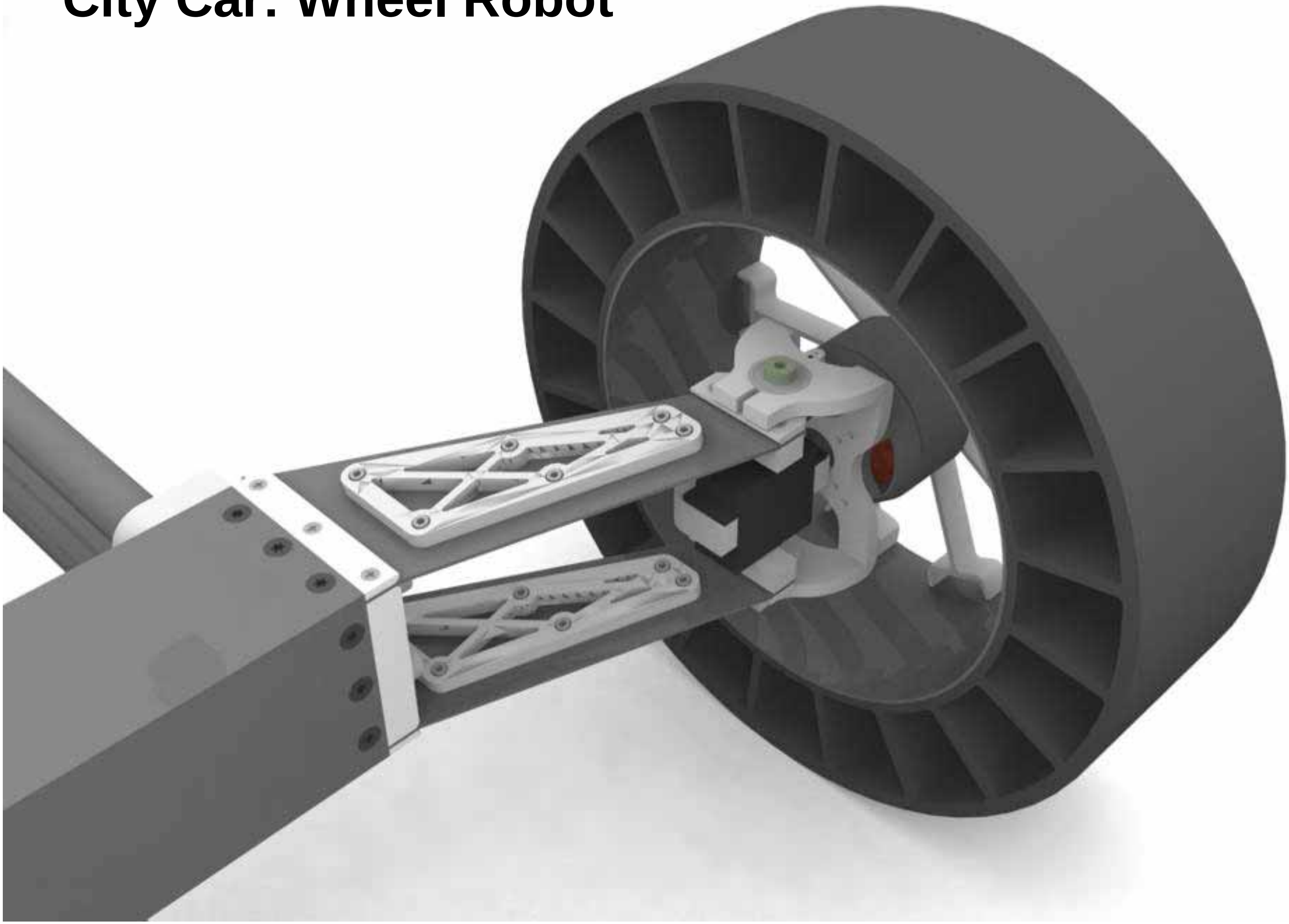
Cars know parking space availability and dynamically adjusted prices, and intelligently play in the parking space market

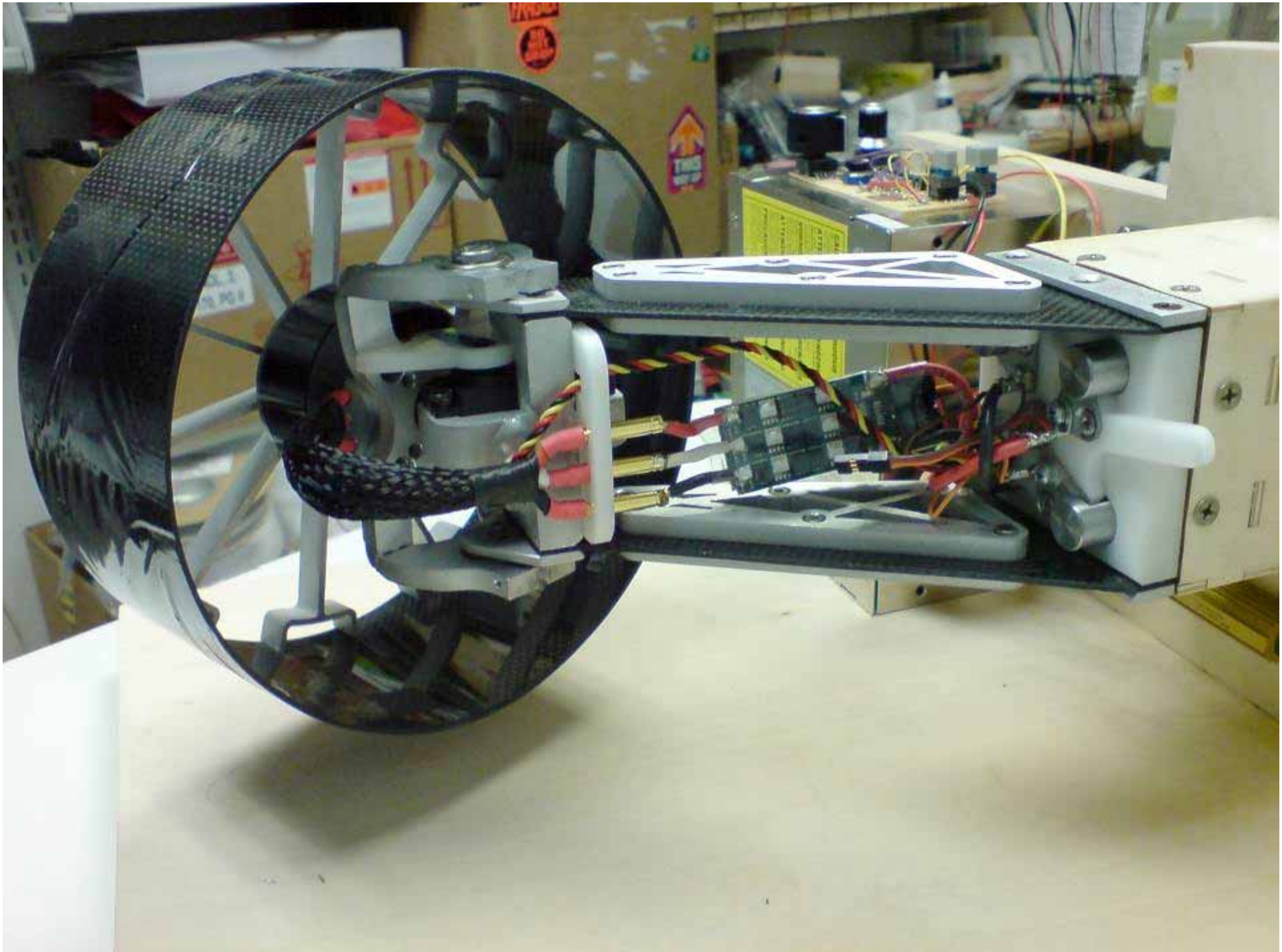
Cars become Google for the city, efficiently getting you to its resources, while taking account of time and cost constraints





City Car: Wheel Robot





Folding Concept Scooter with SYM and ITRI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石牌站

Take advantage of the ubiquity of the electric power grid -- automatically recharge wherever you park

Develop complementary relationship to transit systems -- solving the “last ten kilometer” problem

Maximize mobility while minimizing the number of vehicles on the road

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Credits

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Smart Cities

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Peter Schmitt, MS Candidate
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Eric Weber, Visiting Scholar

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Mitchell Joachim, PhD
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Phil Liang, SNIF