

The KURT e-vehicle for enabling urban mobility: versatile, scalable and cost-efficient.

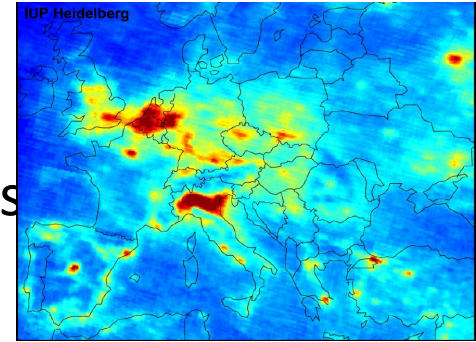


Altreonic profile

- 30 years aero-space-defense (**Eonic Systems NV**)
 - Specialised in parallel Real-Time Operating System
 - Used by ESA (Virtuoso RTOS on Rosetta mission)
 - Virtuoso acquired by Wind River Systems Inc. in 2001
- **Altreonic** today provides solutions for safety critical embedded systems:
 - VirtuosoNext Designer, a very safe and secure distributed RTOS with programming tools
 - GoedelWorks, a portal based environment to support Software Engineering, with embedded certification
- Enabling advantage for the novel e-vehicle **KURT**

Market need

- Smart Cities ban cars and vans from the city-center
 - To avoid congestion (density problems)
 - To minimise noise and heat pollution
 - Pollution → need for minimal emission vehicles
 - Yet, people and goods need to circulate in cities
- Mobility is the next frontier in automation
- Smart Mobility = sustainable Mobility as a Service
- E-vehicles: technology is ready for city, not yet ready for mainstream traffic



Mobility issues

- » Small parcels, pallets, containers, ... for goods
- » Single person, families, masses ... for people
- » Real MaaSService need: point-to-point
- » Space and time (+ energy) are resources
 - Density in space and time is the issue
 - Measured in mass&volume payload / m² road @ speed
- » Today:
 - Multi-modal, space and time inefficient
 - Connection points are bottlenecks
 - Multiple carriers needed

Is this the solution?

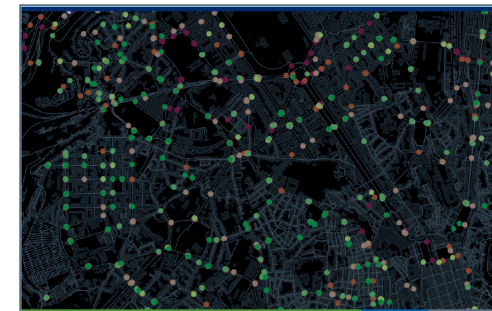


Connectivity is the issue

Or is this the solution?

- » No more cars/vans in city and replaced by TaxiBots ?
 - <http://www.internationaltransportforum.org/cpb/projects/urban-mobility.html> (OECD)
 - 90 % less vehicles, 80% less parking space needed
 - Mobility increases with up to 89% (in km)
 - Less air, heat, noise pollution
 - Enormous economic consequences: MaaS

International Transport Forum | CPB
Corporate Partnership Board



Urban Mobility System Upgrade

How shared self-driving cars could change city traffic

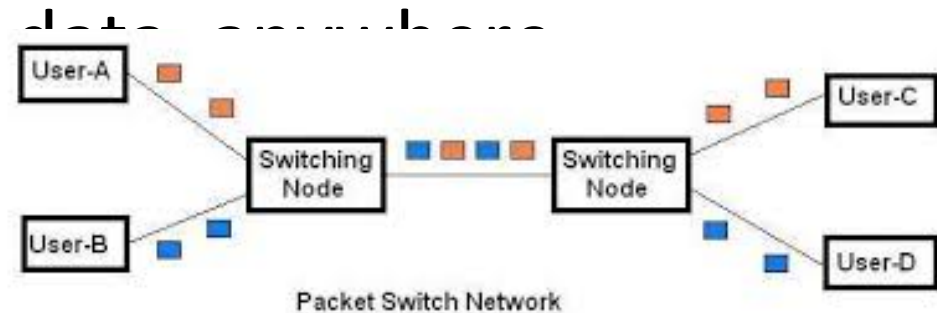
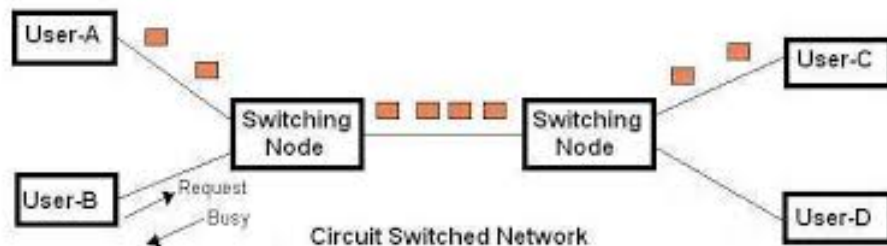


Corporate Partnership Board Report

OECD

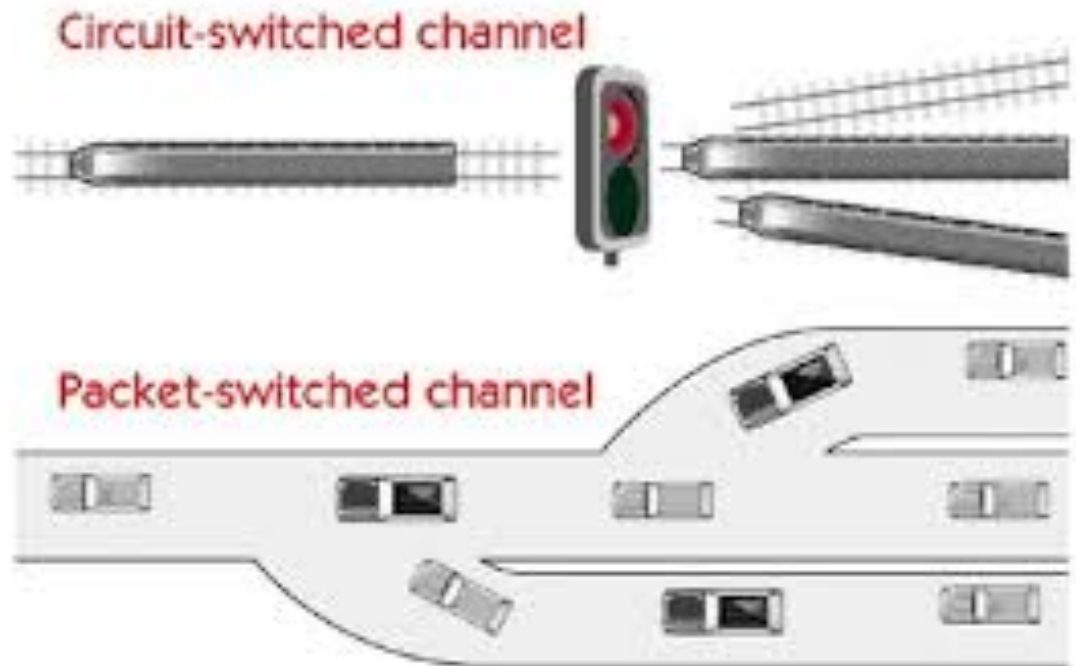
What did telecom do?

- » Before: circuit switching = fixed physical paths
- » Now: packet switching = virtual paths
 - Time and space partitioning
- » Result:
 - Marginal cost of communication close to zero



Packet switching in mobility

- » Moving mass, not bits
- » Trains: circuit switching
- » Roads and cars: packet switching ?
 - Half-way: car underutilised



Objectives of MaaS

- » Increase density in space and time
- Sustainable = Decrease use of resources
 - Free up space
 - Decrease pollution (air, heat, noise)
- » Increase Quality of Service:
 - Move more in less time
 - More comfort
 - Flexibility
- » Shall we go electric?

City mobility vs. open road

» City:

- Less space available, dense infrastructure
- Shorter distances traveled, lower average speed
- More idle time (parking)
- Density is more of a pollution issue

» Conclusion1:

- An e-car for the road is not a e-car for the city

» Other issues:

- How to bring the e-energy to the vehicles?

Solution approaches

1. **Cost/vehicle/ride sharing** schemes:
 - Reuse idle/empty capacity in time and space
 - Mix people and goods (parcels in the trunk)
 - Works with existing vehicles
2. Create **versatile** vehicle for urban mobility:
 - One example: KURT e-vehicle
 - Safety and cost benefit: (semi)-autonomous
 - No need for another Tesla
3. **Distribute the charging** infrastructure

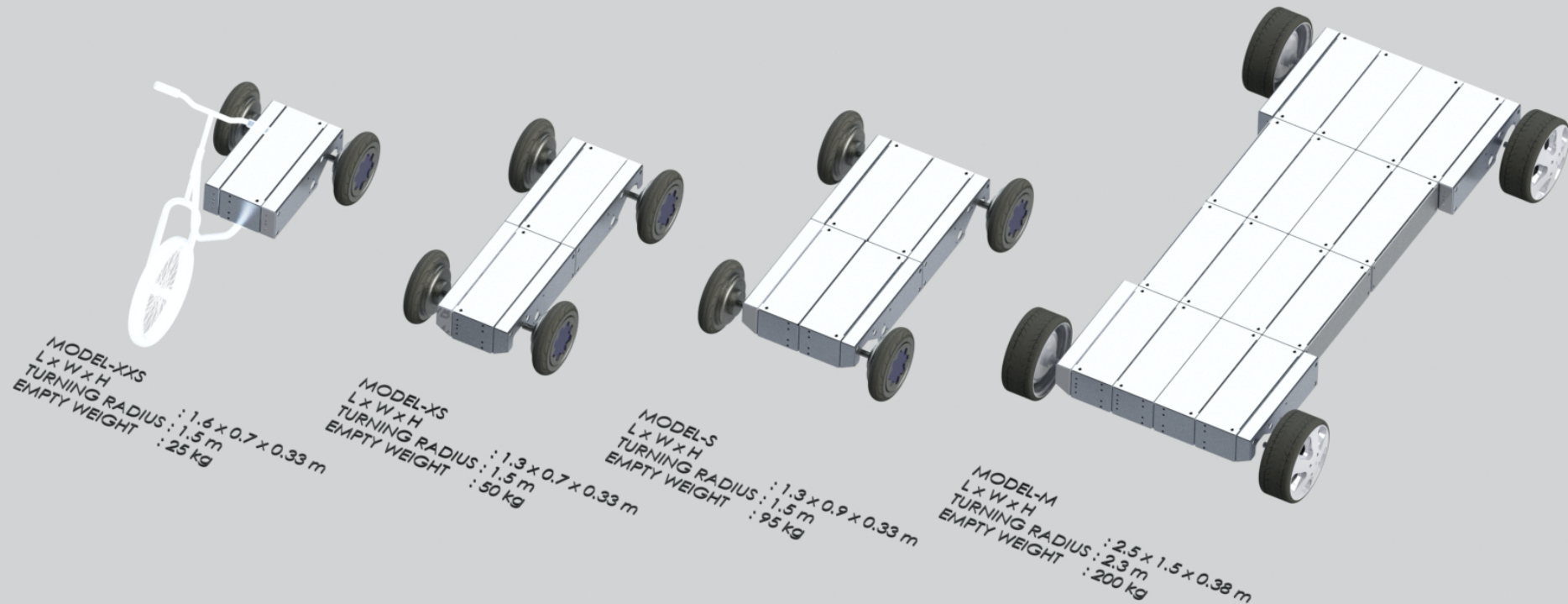
1. Cost/ride/vehicle sharing

- » Cost sharing = incentive
- » Ride sharing = better use of capacity
- » Vehicle sharing = better use of resources
- » Results:
 - Saves money!
 - Low investment: App + marcom
 - Reduces traffic, congestion, pollution, ...
 - Improves Quality of Life

2. A vehicle as a Packet Carrier

- » What is the equivalent of a telecom Packet?
 - Carrier: allows the packet to move
 - Payload: just bits, content is less important
 - Separation between carrier and payload
- » For vehicles:
 - Carrier: scalable propulsion platform
 - Payload: superstructure matching application
 - Enabled by compactness of e-propulsion

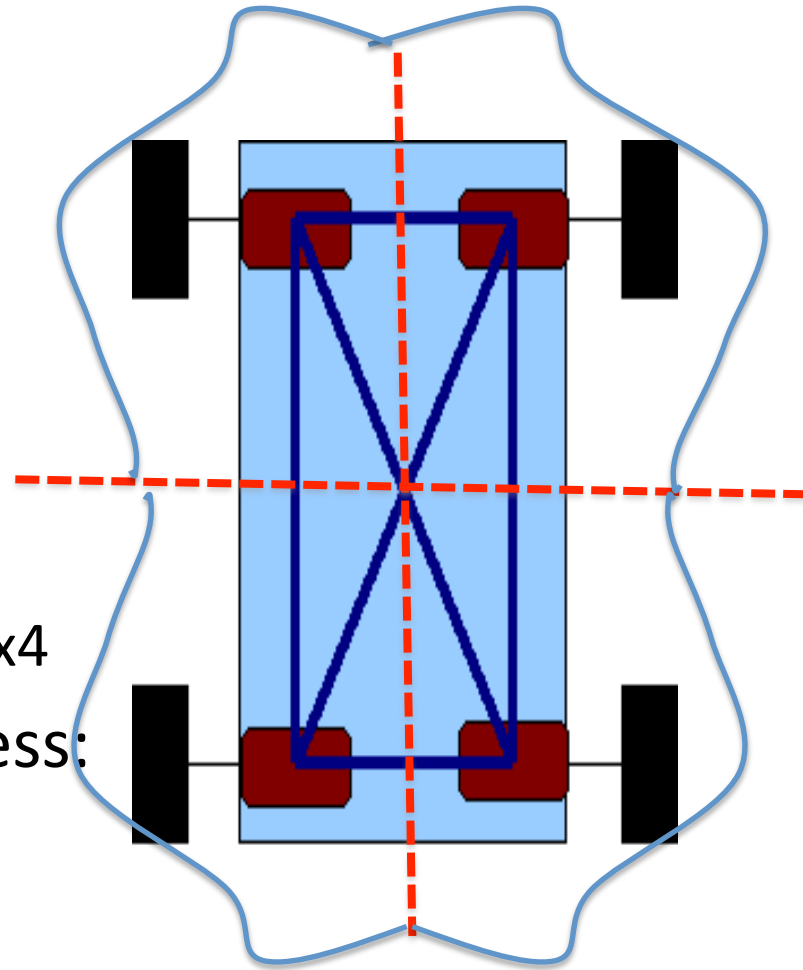
The modularity of KURT electric microcar



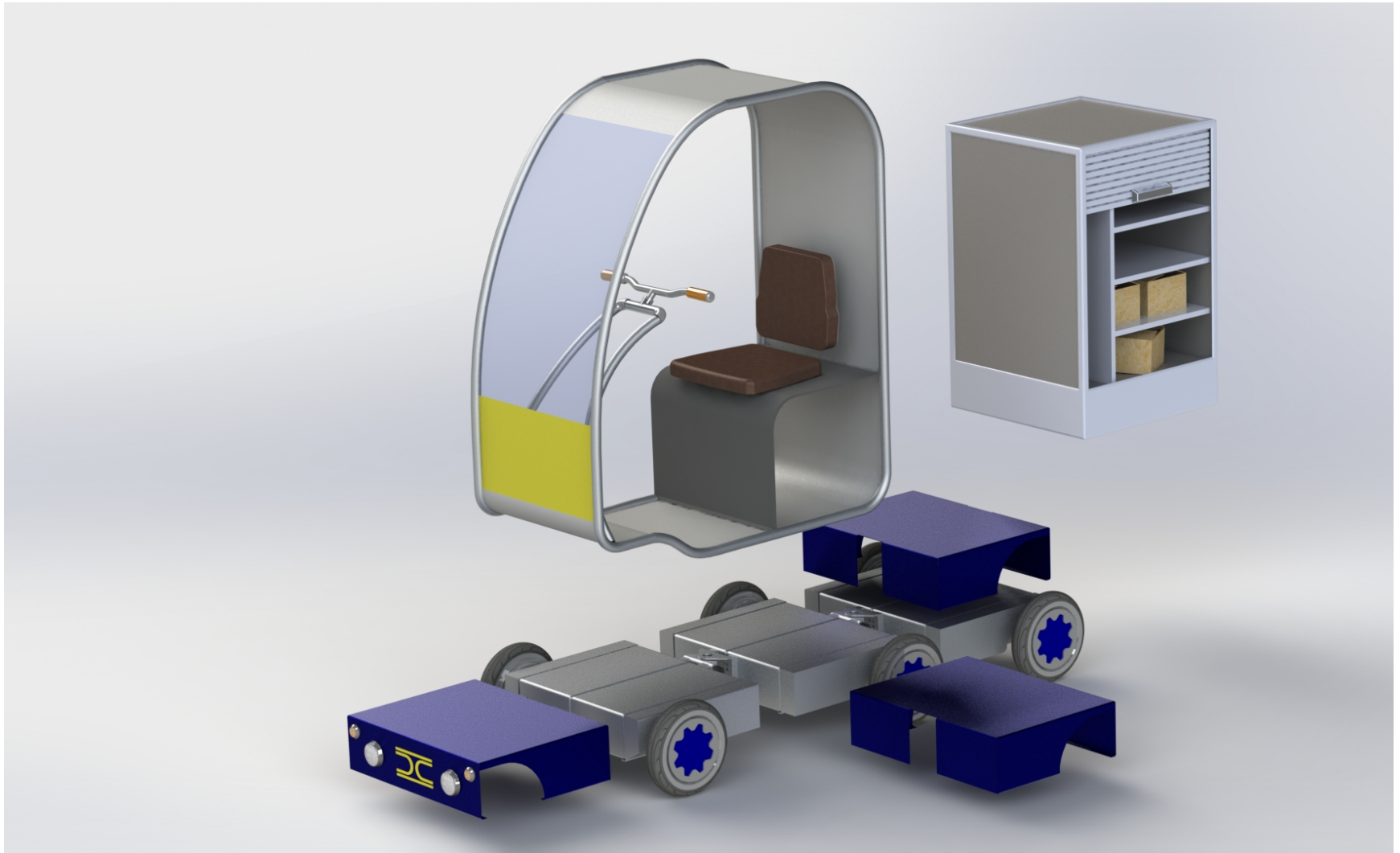
Standardisation = economic enabler

Novel Modular and Redundant architecture

- Patent pending
- Combine reusable units
 - Economy of scale (COG!)
 - Redundancy (fault tolerant)
- Propulsion Unit =
 - Battery (LiOn, MNH, ...) + motor
 - Suspension + wheels
 - Vectoring steer/drive by wire/4x4
- Smart environmental awareness:
 - Obstacle detection/avoidance
 - Assisted auto-navigation
- International patent



Modular build-up = easy to assemble



Benefits

- » Low empty weight: 100 kg can move 300 kg
- » Low production cost at low volume
- » Lower energy consumption ($E = mv^2/2$)
- » Recycable by using aluminium
- » Compact and robust: saving space
- » Distributed architecture:
 - Steer by wire: flexibility
 - Redundancy for autonomous driving
- » Remote monitoring and steering:
 - Lower operational costs

XXS for fun (1)



W	L	H
0,7 m	1,3 m	1 m
Cargo	20-30 kg	

Moving 1 person + parcels (2)



B	L	H
0,7 m	1,3 m	1 m
Cargo	20-30 kg	

Moving cargo and parcels



W	0,9 m
L	2,3 m
H	1,6 m
Cargo	70 - 100 kg
Range	60 km

0,9 m
2,0 m
1,8 m
70 - 80 kg
100 km

Bulk transport



W	L	H
0,9 m	4,4 m	1,8 m
Cargo	2x300+ 50 kg	



Moving cargo in warehouse

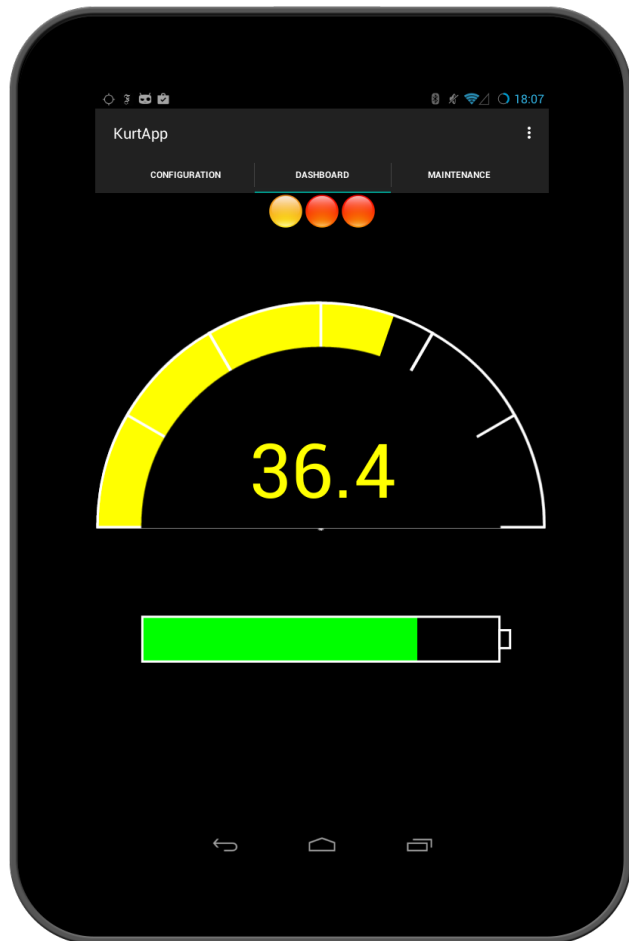


Moving people indoors & outdoors

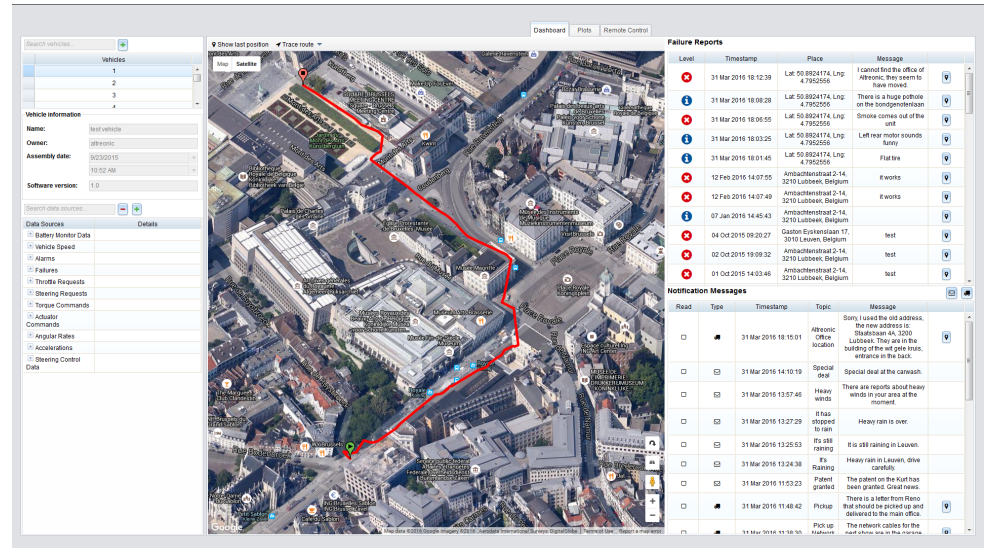


KURT Fleet Monitoring App

Server side (web client)

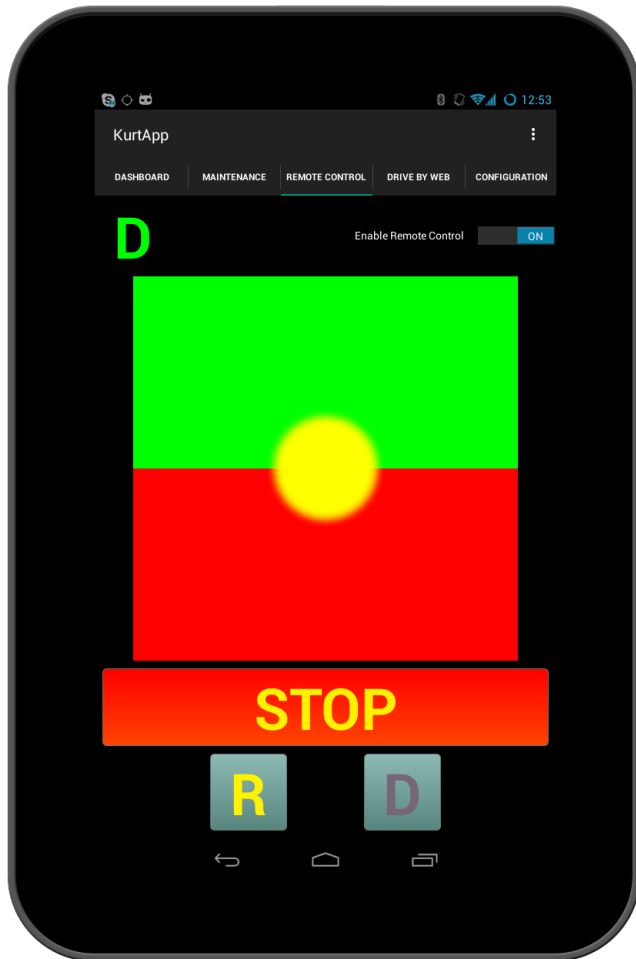


Android tablet as dashboard



- Monitors:
 - Battery, temperature, motor, ...
 - Manoeuvres
 - Alarm conditions
 - Position (requires GPS or transponders)
- Send message to dispatching center
- Receive message from dispatching center

KURT Remote Steering App



- Optional:

- Authentication
- Manoeuvring using smartphone
- Steer by web:
 - Camera input from KURT
 - Operator steers using web client
- Obstacle detection/avoidance

In all cases:

- Authentication
- Speed and acceleration limited

3. Distributed charging

- » Each KURT vehicle has:
 - Batteries to last a full day in city
 - A few KWh is enough (*“Ceci n’est pas une Tesla”*)
- » Charging infrastructure already exists:
 - Each building has spare e-capacity
 - Often parking space in front or in garage
 - Slow charging during the night is OK
 - Fee for using the charging connector
- » Complement with carports and solar panels?

Movie of first production prototype



Thanks for your attention. QUESTIONS?
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