Source: https://www.raillynews.com/2020/06/Karsan-won-the-electric-minibus-tender-in-Romania/

Minibuses on demand

Upcomming urban disruption

Bogusz Jelinski
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Bus is cheaper than a cab but …

- long waiting times and it takes longer to travel
- sometimes unpredictable
- need of transfers
- dirty, crowdy, no privacy at all
- not always a sit for everyone
- higher chance for infections with diseases
- hard to drive in narrow European streets

Source: https://www.freeimages.com/photo/bus-ride-1469975

Idea – a taxi trip that costs like a bus ticket

But how to reduce costs without affecting significantly the duration of any passenger's trip:

- By taking **more passengers** than a cab today, even **ten**, that share the same or similar route
- By reducing the operational costs with **electric drive train**
- By matching supply with demand much better that buses today – no empty buses during off-peak hours
- Maybe not by getting rid of its driver

Source: https://mms.businesswire.com/media/20200428005241/en/787801/5/4193311cEasyMile_1.jpg?download=1

We might still need the driver

We probably won't be able to get rid of the driver in near future because:

- most legislatures will not allow for self-driving for buses
- or will limit their speed to a ridiculous value
- we might need someone in place to reduce fraud*, misuse, vandalism or sabotage
- driver's presence will improve passengers' comfort and security
- driver might be needed to support unexperienced or digitally weak customers

* e.g. going in without an order or with an unregistered co-passenger, ordering a shorter trip but staying in for a longer one.

This idea is gaining momentum

Moia: https://www.moia.io/en

Navya: https://navya.tech/en/

EasyMile: https://easymile.com/

2GetThere: https://www.2getthere.eu/

Baidu: https://apollo.auto/

Yutong: https://en.yutong.com/

Coast Autonomous: https://coastautonomous.com/

MillaPod: https://millagroup.fr/fr/tag/millapod/

May Mobility: https://maymobility.com/

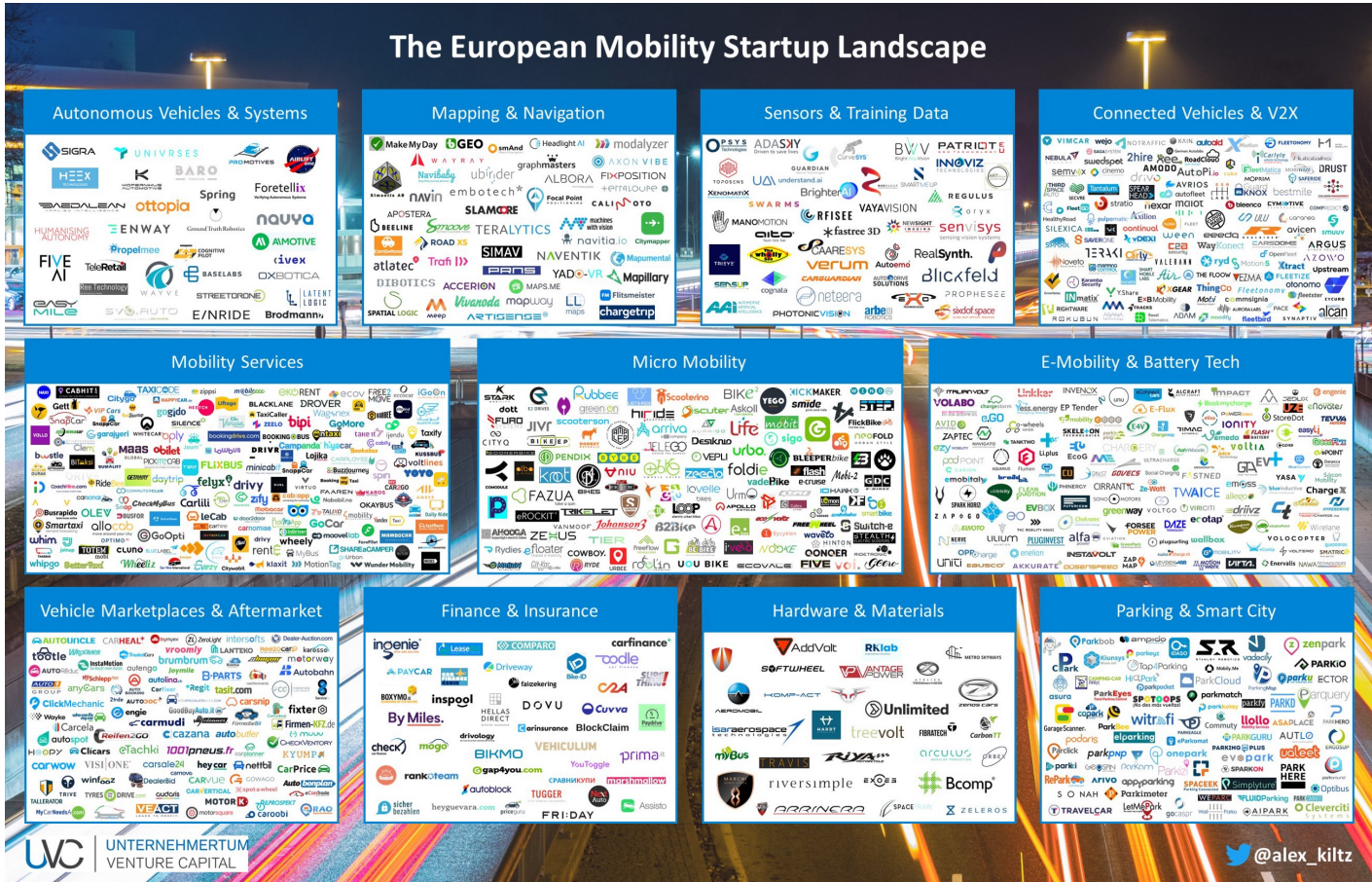
Optimus Ride: https://www.optimusride.com/

Transdev https://www.transdev.com/en/

Ohmio: https://ohmio.com/

Neolix: https://www.linkedin.com/company/neolix-autonomous-driving/

National Electric Vehicles Sweden: https://www.nevs.com/en/



Source: https://cdn-images-1.medium.com/max/2600/1*oMiHKEIY6Pb_dB5xdCEQtA.jpeg

How it could work - ordering a cab

Ordering and use should be convenient:

- From a mobile app
- From ticket machines available at least at hubs – temporary user authenticating with QR code
- By just entering the cab (participation in current route) and authentication with mobile app or RFID card
- By being a paid co-passenger
- Ordering a route in a cab – maybe only in an idle one with no active route (not necessarily it will be that cab to take that customer)

Fast dispatcher – key technology enabler

An effective dispatcher is needed to process thousands of requests per minute*:

- A multi-threaded pool finder with up to 4 shared orders
- Route matcher – to add passengers to currently executed routes
- Effective linear solver which tackles one million variables
- Rest API for easy client integration

All that is available now e.g. here: https://gitlab.com/kabina/kaboot

* A linear transportation model with 1 million variables (1k passengers * 1k cabs) has more feasible solutions than the number of atoms in the universe

Kaboot - implementation details

- It is all open-source with non-restrictive licensing
- Based on industry-leading SpringBoot and Java
- Any database, tested extensively with PostgresQL
- Pool finder implemented in C, Java version available but 3x slower
- Uses GLPK solver to find optimal routing plans
- greedy (low-cost method) heuristic used to support the solver in most challanging scenarious

Idea behind Kabina project

The idea behind Kabina is to provide an enabler (a software skeleton, testing framework and RestAPI standard proposal) for a cab service that can assign even 10 passengers to one minibus, thus reducing cost of the driver per passenger, among other things. Such extended cab service would allow for the shift to sustainable transport, it might be cost-competitive with the public transport while providing better service quality including shorter travel time.

Kabina subrojects

- **Kabina**: mobile application for taxi customers
- **Kab**: mobile application for taxi drivers
- **Kaboot**: dispatcher with RestAPI
- **Kadm**: administration and surveillance
- **Kaut**: authentication module in the cab