Panel on Vehicular Challenges

Topic: New Vehicular Technologies and Urban Requirements

Moderator

Yoshitoshi Murata, Iwate Prefectural University, Japan

Panelists

Felipe Jimenez, Universidad Politecnica de Madrid, España

Akimasa Suzuki, Iwate Prefectural University, Japan

Jeevan Visvesha, ANI Technologies Private Limited, India

Urban Requirements

- Problems especially for developing countries
  - Hard traffic congestions
  - Air pollutions
  - Traffic accidents (by old persons)

  How to solve these problems?
- Existing transportation system
  - Road
  - Road + Metro/Tram
  - Road + Metro + Tram

  Can these system solve above problems?

Technical Challenges for Vehicles

- MaaS: Mobility as a Service
- CASE
  - C: Connected car
  - A: Autonomous car
  - S: Sharing cars
  - E: Electric car

Vehicles in animation

Mobile Suit **Gundam**

???

Flying Nimbus
Dragon Ball/ Son Goku

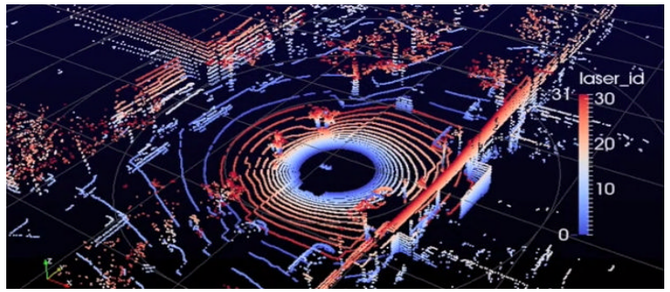
Motor skate board
Detective Conan

Topics of panelist

- Felipe Jimenez
  - Needs for autonomous vehicles deployment. Engineering and non-engineering topics. Main barriers.
- Akimasa Suzuki
  - Solution of the notification for drivers on future connected vehicles.
- Jeevan Visvesha
  - Novel transportation systems suited for urban area and challenging technologies to realize them.

Needs for autonomous vehicles

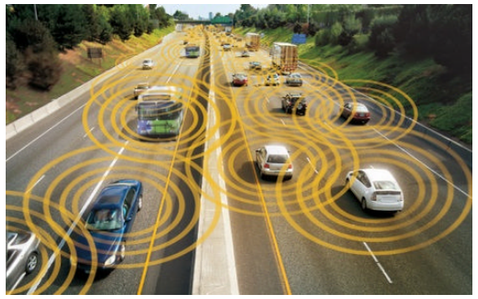
Perception and scenario comprehension



Decision making

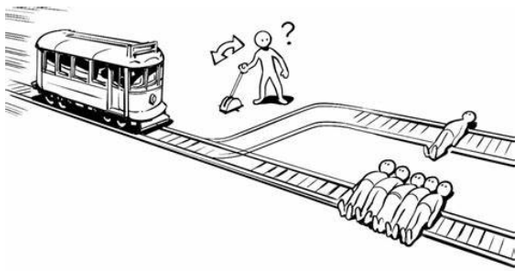
Reliability

Cooperation V2X



Infrastructure

Ethical / legal issues (responsability)



Cyber.security

Which transportation system suits for urban area, the autonomous and connected car, manned drone, or others?

What kinds of technologies are needed for the urban area transportation system?

Notification Methods for Near-future Vehicles

Akimasa Suzuki

Connected car and automatic driving levels

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE) AUTOMATION LEVELS

Full Automation

0	1	2	3	4	5
No Automation	**Driver Assistance**	**Partial Automation**	**Conditional Automation**	**High Automation**	**Full Automation**
Zero autonomy; the driver performs all driving tasks.	Vehicle is controlled by the driver, but some driving assist features may be included in the vehicle design.	Vehicle has combined automated functions, like acceleration and steering, but the driver must remain engaged with the driving task and monitor the environment at all times.	Driver is a necessity, but is not required to monitor the environment. The driver must be ready to take control of the vehicle at all times with notice.	The vehicle is capable of performing all driving functions under certain conditions. The driver may have the option to control the vehicle.	The vehicle is capable of performing all driving functions under all conditions. The driver may have the option to control the vehicle.

Assisted by “connection”

Difficulties on automatic vehicle with Level 5

- Accident: Kanazawa seaside line
  - Monorail: easier operation than car.
  - Reverse run at end-loading platform and crash.
  - ATO (Automatic Train Operation)
  - Operated without driver

- Monitoring operator may be still required.
  - Who has responsibility (System developer won't)
  - We have to solve many problem for realizing level 5

Notification method for vehicle

- We should watch outside, navigation system, speed meter, and mirrors.
- Many sound alert would be occurred.
- Connected car:
  Mach information is required to tell for drivers.
- Conventional method: confusion to other information
- Car Sharing: we don‘t know individual systems

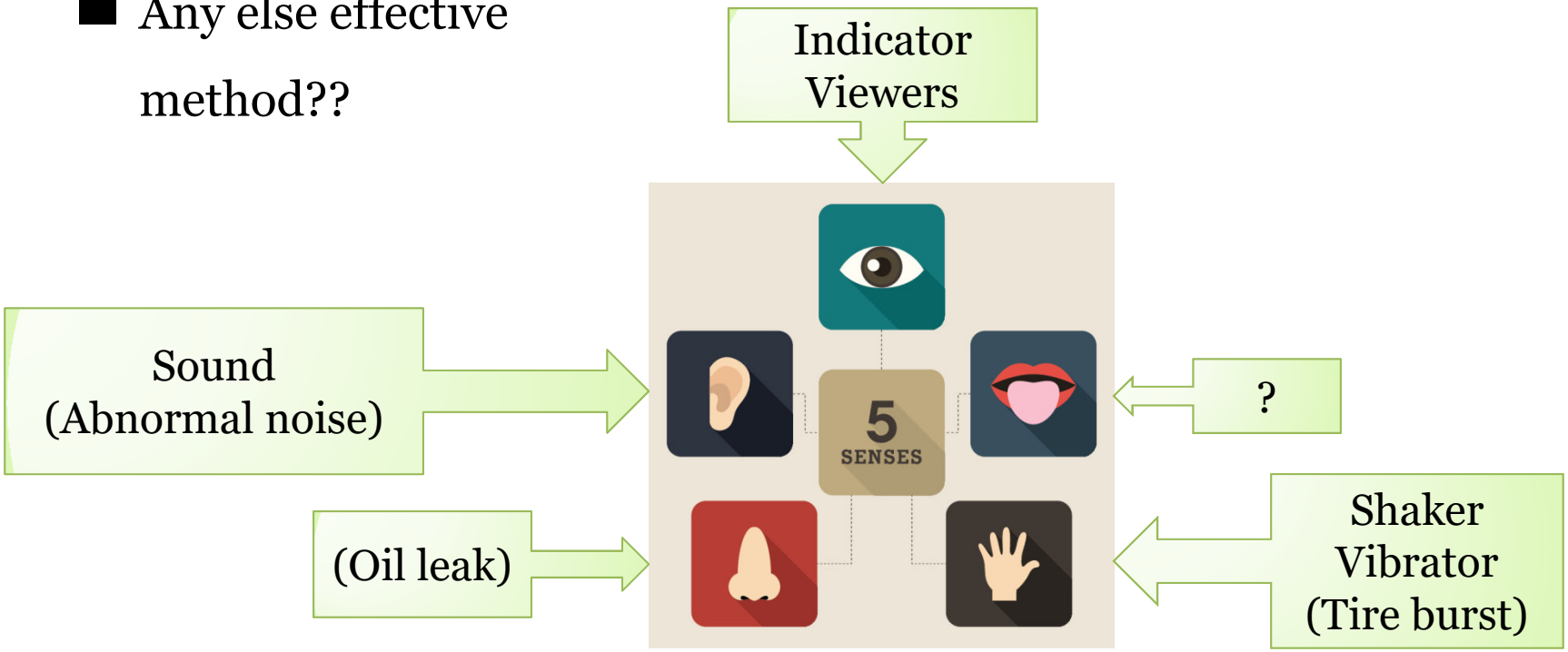
Case: Air plane

- Sound: words
- Indicator on display
- Stick shaker (Stall)

- Professional pilot
- Less traffic than cars
- Less real-time response than car driving

Notifying for human sensors

- Any else effective method??



Lilium JET

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Needs for autonomous vehicles

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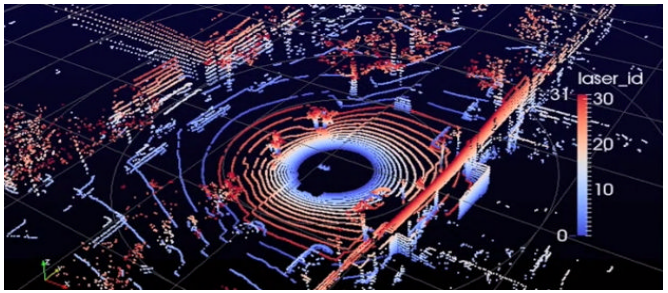
OPEN ISSUES

Surroundings perception with onboard sensors

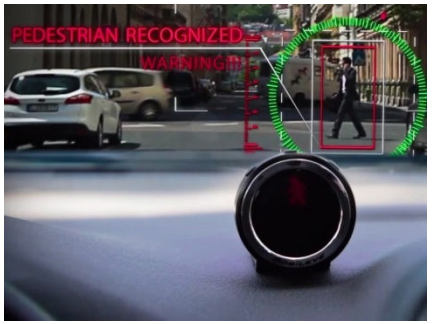
Complete and reliable representation of the vehicle surroindings that garantee that no false positive or negative alarms occur.

Sensors with different capabilities

Appropiate for some purposes and scenarios but useless in others

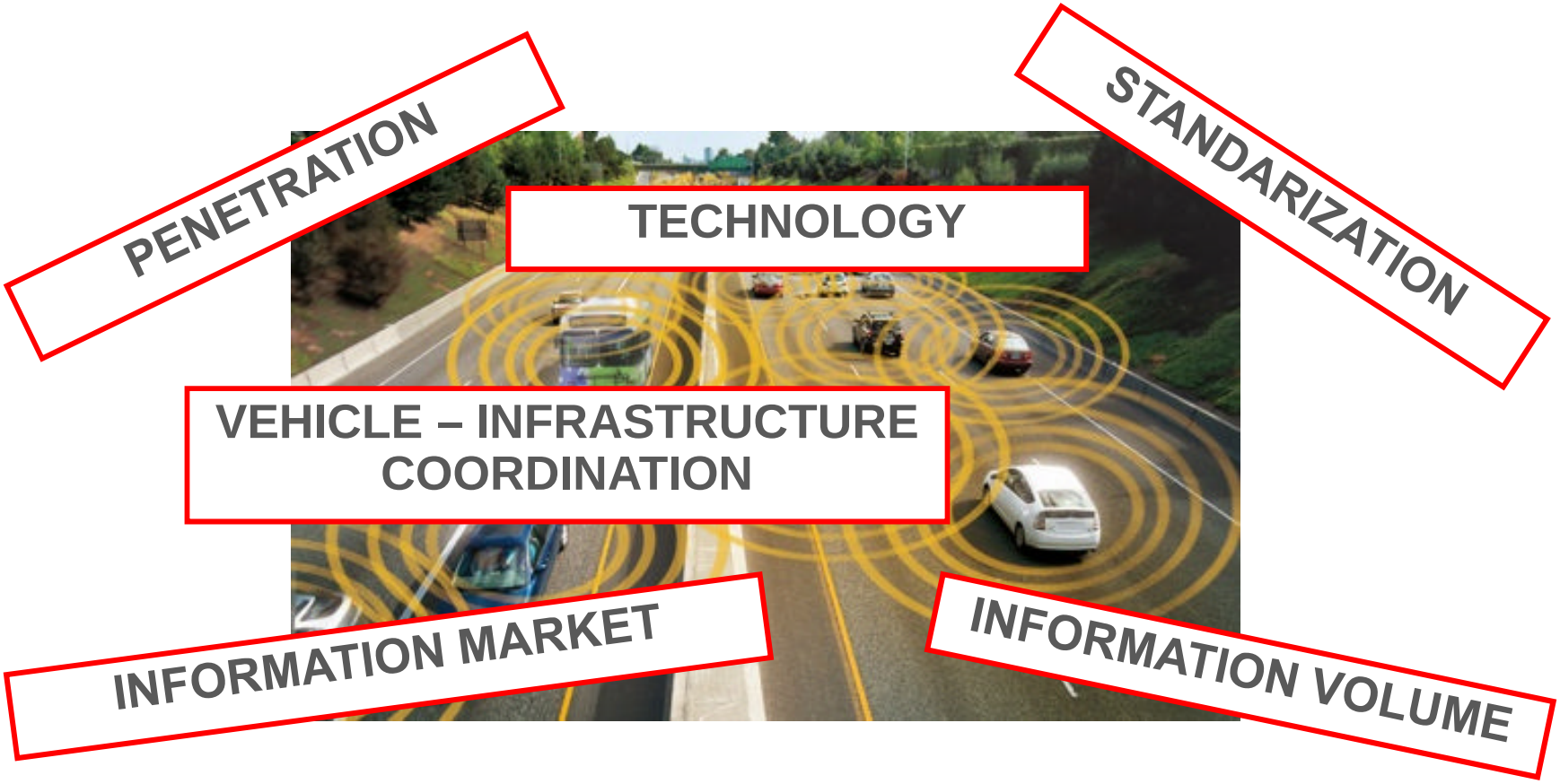


Sensor fusion



OPEN ISSUES

Surroundings perception using vehicular communications



OPEN ISSUES

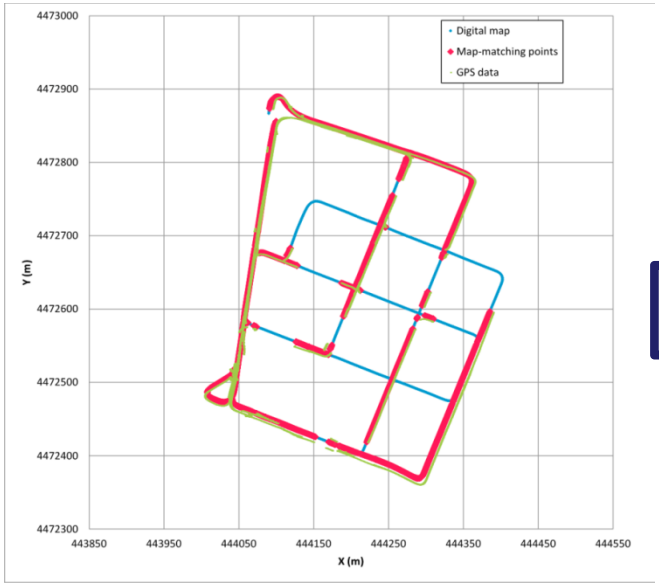
Positioning as a secondary sensor

POSITIONING

- ACCURACY (in-the-lane accuracy)

DIGITAL MAPS

- ACCURACY
- DETAIL
- UPDATENESS



FUSION

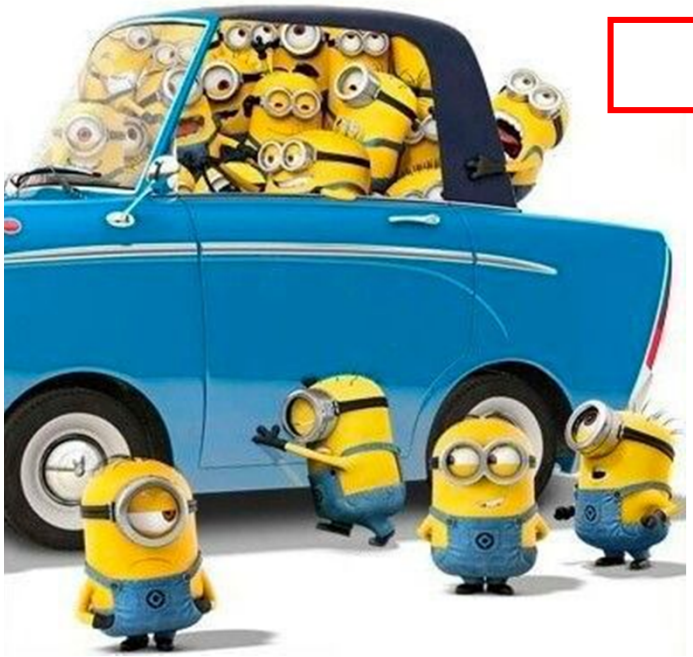
- Positioning
- Information sources
- Map-matching

OPEN ISSUES

Toma de decisiones

WHAT SHOULD ONBOARD INTELLIGENCE PROVIDE?

RELIABILITY



FLEXIBILITY

HUMAN BEHAVIOUR

- **Rules observation**
- **Responsability**

OPEN ISSUES

Integration in non-structured scenarios

The autonomous vehicle is not capable of managing chaos; humans do.

Efficient shared space management

OPEN ISSUES

Infrastructure integration

- Correct conditions of horizontal and vertical signaling



- Adquisition, processing and dissemination of information

OPEN ISSUES

Driver interaction

- Driver role in autonomous vehicles
- Autonomous – manual driving transition

OPEN ISSUES

Other technical aspects

- Shared environment with other users
- Hackers threat
- High reability of the systems

OPEN ISSUES

FROM ASSISTED DRIVING TO COMPLETELY AUTOMATED DRIVING

- Driver interaction
- Other users interaction
- Reliable surroundings detection
- Cheaper technologies
- Legal issues
- Ethical issues
- “Predictable” behavior
- Information and communication management
- …

OPEN ISSUES

Is necessary a transport model change?

- Other ways of mobility (mobility as a service)
- Is going to change the vehicle propriety model?

- If manufacturers assume responsibility, what should insurance companies do?
- Who is responsible in case of an accident?

- What should driving schools do?

- How connected and automated vehicles can interact with conventional ones?

OPEN ISSUES

Which would be the impact on the transport mode choice?

Autonomous vehicles combine some advantages of public transport and traditional private vehicles.

Why would be the impact on commercial vehicles operation?

-More efficient operations
-Operation during low traffic schedules

OPEN ISSUES

¿AUTONOMOUS DRIVING OR AUTOMATION ON CERTAIN CIRCUNSTANCIES TO IMPROVE SAFETY AND EFFICIENCY?

IS AUTONOMOUS DRIVING POSSIBLE WITHOUT COOPERATIVE DRIVING?

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Needs for autonomous vehicles

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Novel transportation systems suited for urban area and challenging technologies to realize them.

JEEVAN VISVESHA

Hardware and Automotive Security Engineer

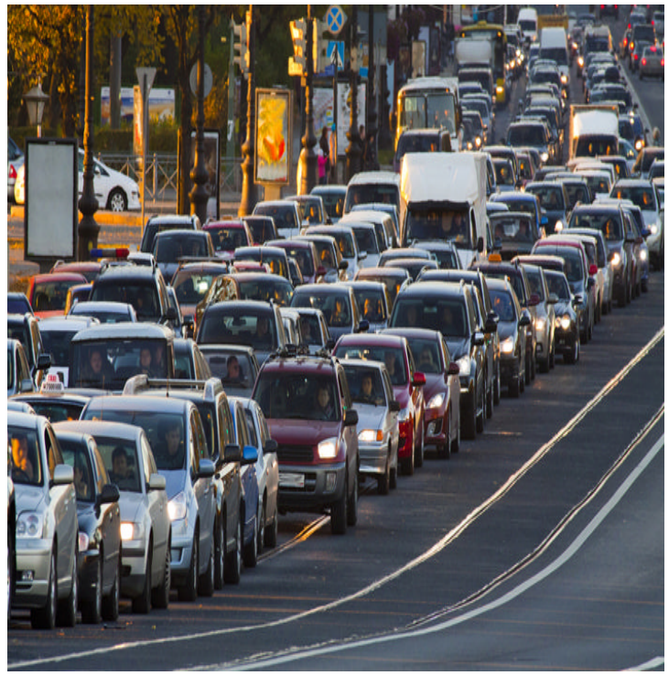
ANI Technologies Private Limited

Agenda

- Novel transportation system
- Existing transport mode
- Future technologies for short distance and long distance transportation
- Challenges to realize
- Conclusion

Novel Transportation system

Over the past few decades, due to increase in human capacity, congestion and emission. Few countries are moving towards enhancing the public transportation with advanced technologies.



	Current Transportation system	Future and Emerging transportation system
Current Societal needs	Existing systems provide high levels of mobility and convenience but at high cost and with notable limitations.	Future systems would need to be cheaper, safer, faster, more comfortable, and more convenient than is the current set of transportation options.
Future and emerging Societal needs	Current modes may not be able to adapt to future needs or societal changes.	Future systems would be developed to respond to new and emerging needs (e.g., for independent mobility for growing elderly population).

Example

- United States collectively spends approximately $800 billion per year on motor vehicles, fuels, and related items.
- According to the National Highway Traffic Safety Administration report, 30,057 fatalities and just under 1.6 million non-fatal injuries resulted from traffic crashes in 2013.

Source: The Exploratory Advanced Research Program on Novel Surface Transportation Modes

Existing Transport models

- Personal mobility vehicles
- Infrastructure based Vehicle charging
- Self driving vehicles
- Shared fleet of On-Demand self driving
- Train
- Bus
- Cab service

Future Technologies

What is the advantage of inventing some enhanced surface mobility ???

- Innovation
- Private Sector
- Passenger Comfort
- Safety
- Security
- Current traffic congestion
- Challenges In travel pattern

Future Technologies for short range

Straddling bus

Also known as an elevated bus. This bus travels on top of all vehicles while allowing the vehicles to travel underneath and bus also can make frequent stop without creating congestion for other vehicles.

Advantages

- Solves huge traffic congestion
- The transport as a system is too fast.
- Comparatively inexpensive model as this is the second story of bus travel

Disadvantages

- Tracks required relatively straight road, thereby making it difficult to maneuver for changing lanes
- Expensive infrastructure change development

Future Technologies for short range

Levitation Car

A magnetic levitating vehicle (MagLev) is a vehicle that uses a strong electromagnetic field to resist gravity and keep the vehicle floating out of the ground

Advantages

- Solve traffic Congestion as it can rotate easily (having more degrees of freedom)
- Fuel efficient as there is no road friction

Disadvantages

- Entire road needs to be magnetic bed
- Huge infrastructure cost

Future Technologies for short range

Autonomous vehicles for cab service

Advantages

- Lesser waiting time
- Rush hour will get a lot more pleasant
- Most of the space needed for parking is set free

Disadvantages

- Safety concern
- Security breach resulting in a Vehicle take over
- Unemployment

Future Technologies for short range

Flying taxi

Advantages

- Traffic Congestion reduces to maximum extent
- Lesser time for travel as it can take relatively straight path for the destination

Disadvantages

- Safety (Massive safety concern)
- Security breach resulting in a Vehicle take over (Massive destruction)
- Unemployment
- Huge infrastructure change required for the vehicles to stop for passenger to get off
- Huge parking space
- 3D Dimensional routing
- Lesser flight time restriction on battery

Future Technologies for long range

Tube-rail

Advantages

- Fastest Surface transport (neatly twice the airspeed)
- Low power consumption.
- Less cost in the long run
- Immune to bad weather

Disadvantages

- Initial cost for infrastructure requires huge investment
- High risk to life when something happens
- The installation requires cutting of large number of trees, which causes environmental loss
- Might cause dizziness due to high speed

Future Technologies for long range

Never ending train

Train stopping at each station and waiting for new people to get in is a time consuming.

This works on a concept where a Small cabin car will get detached from the top of train. A new cabin car will get attached to the train from the train station

The locomotive underneath never stops

Advantages

- Very less waiting time at the train station
- Quick way of passenger entering and leaving the train

Disadvantages

- Safety concern if the cabin car doesn't attach or detach properly
- An infrastructure change required

Conclusion

Although there are lot of advanced and enhanced surface technologies invented, still it faces significant issues with expenditure, infrastructure, Safety and Security.

Is it really wise to invent these things ??

Debating topic