

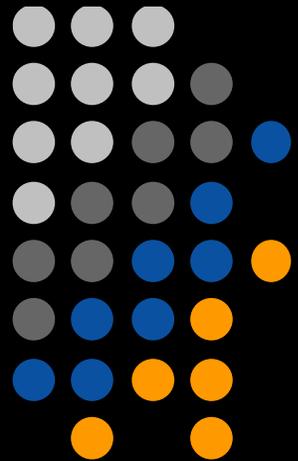
Long term pilot deployment for automated driving bus operation at Kashiwa-no-ha area



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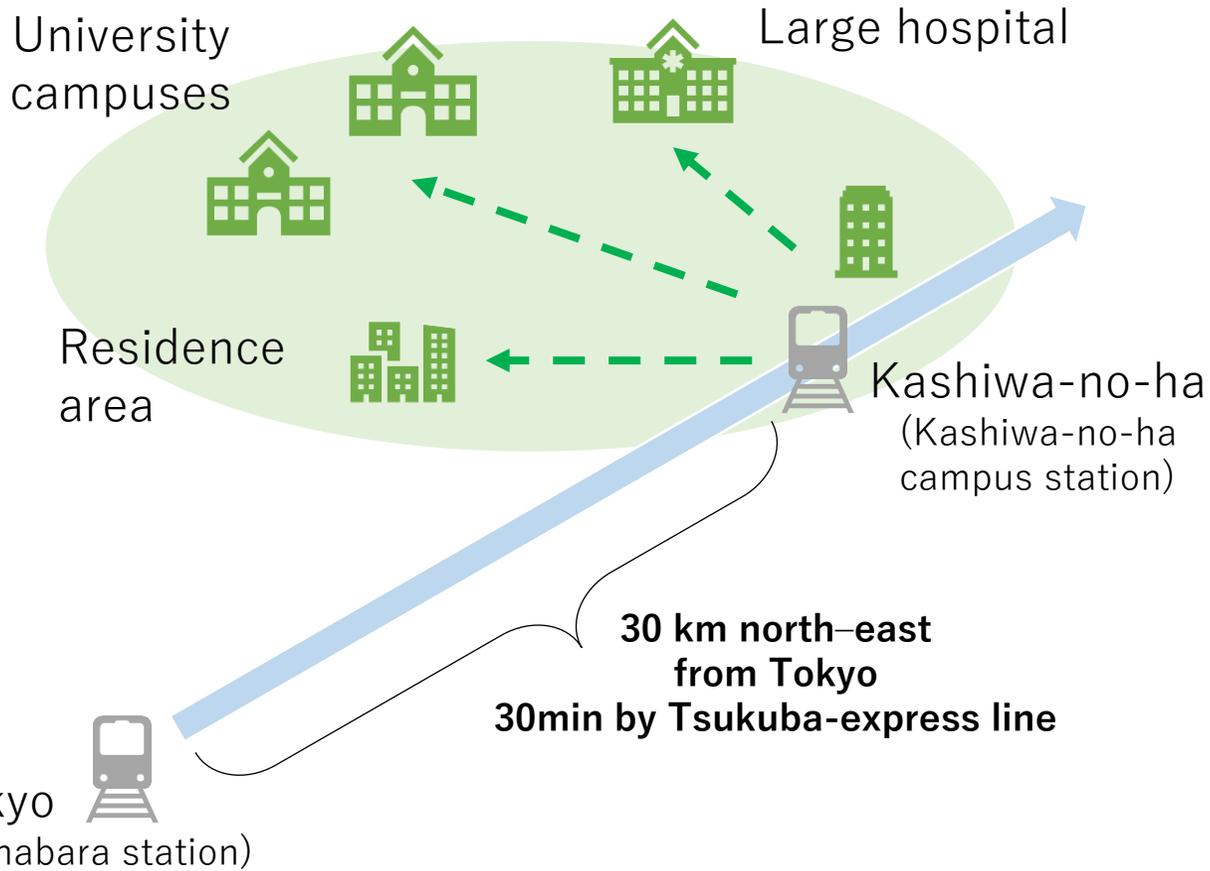
Member of Advanced Mobility Research Center (ITS Center)
Institute of Industrial Science, the University of Tokyo



東京大学
生産技術研究所
Institute of Industrial Science,
The University of Tokyo



Introduction : Kashiwa-no-ha smart city



- 10 goals by smart city consortium
- “Goal4: A sustainable transit and transportation system” [1]
 - This area dotted with University campus, hospital, residence area.

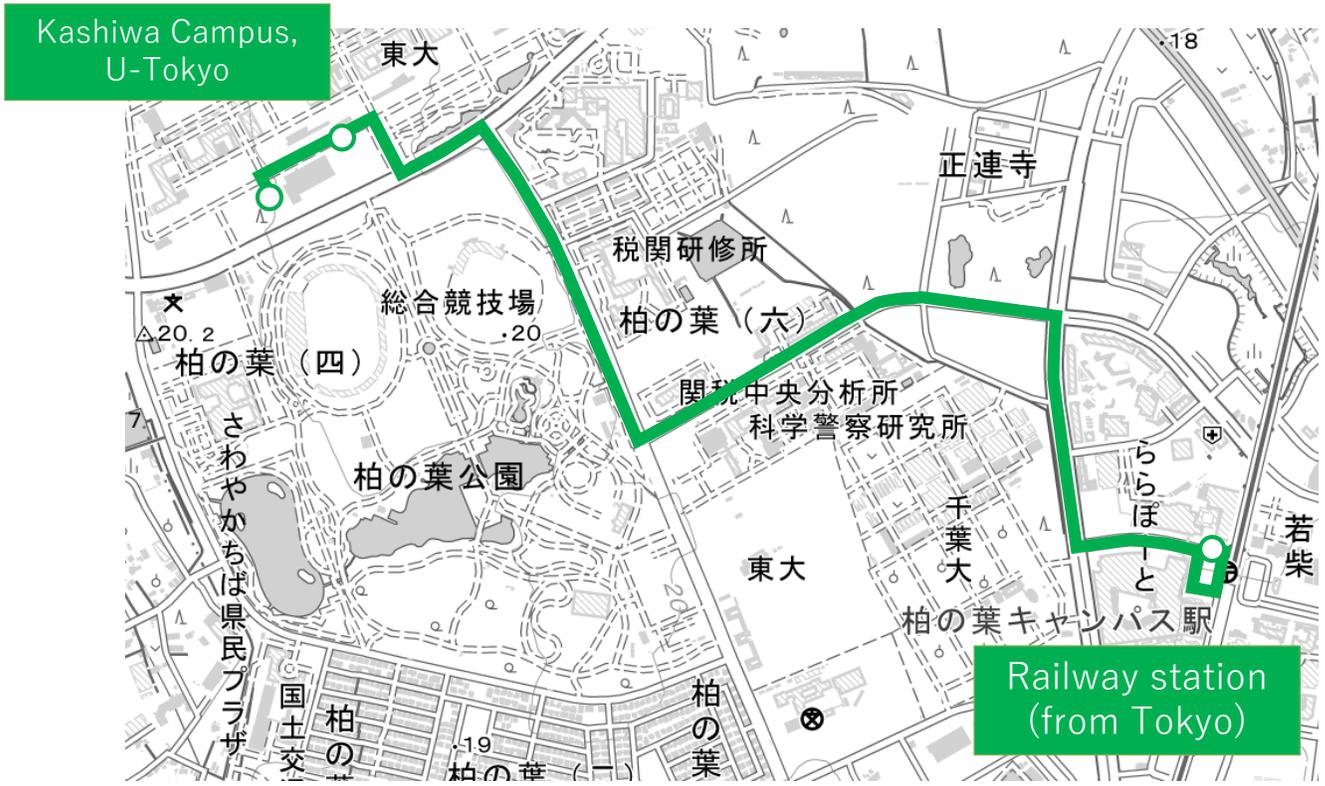
[1]<https://www.kashiwanoha-smartcity.com/en/about/>

Demands for Mobility is existing to connect these cites



Automated bus pilot deployment

1st November, 2019~



※Source: Chiriin map (Denshikokudo web) added bus route



Depart from	Station	Campus
#1	12:35	13:05
#2	13:25	13:55
#3	14:15	14:35

Bus service between the campus and railway station by the automated vehicle

Eco-System for the pilot deployment

Kashiwa ITS^[2]



Administration

Kashiwa City



Urban Design Center Kashiwa-no-ha



Industry

Advanced Smart Mobility Co., Ltd.

Aichi Steel Corporation

BOLDLY Inc.

Tobu bus east Co., Ltd.

Mitsui Fudosan Co., Ltd.

Sompo Japan Insurance Inc.

Mitsubishi Auto Leasing Corporation

Pacific Consultants Co., Ltd.

Automated driving system

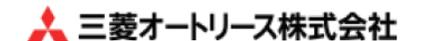
Transport operator

Real estate business

Insurance

Leasing

Consultants



Academia

Mobility Innovation Collaborative Research Organization, the University of Tokyo

Institute of Industrial Science, the University of Tokyo

Graduation School of Frontier Science, the University of Tokyo



[2] <http://www.kashiwa-its.jp/activity3/>



Automated bus for the pilot deployment



Automated Driving System Licensed as Level 2

by Advanced Smart Mobility Co., LTD.

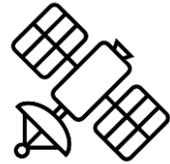
- Desired path tracking
- Velocity control
- Braking according to objects in front of the bus

Driver can override any time.

※Source: Graduate School of Frontier Science, the University of Tokyo

Measures for Level 4 automated driving

Signal from
GPS/QZSS



Signal from
Magnet positioning
on road



- **GPS/QZSS**

- Robustness
- Trees, Bridges and Tall buildings

- **Magnet positioning sensor**

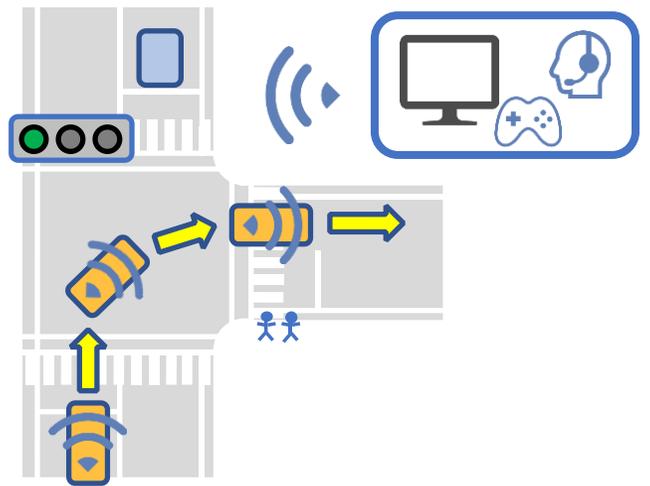
- Positioning marker on road
- Install / Maintenance

Preparing for Level 4 Mobility service

- Resolve the scenes difficult to operate at Level 4
- e.g. Right turn at intersection

Remote monitoring or Control

- Go/No-Go judgement by operator



Connecting to Infrastructure

- Traffic signal (on coming vehicle and vulnerable road users)



Examples of discussions in Automated Driving Research Activity (ITS-Japan)

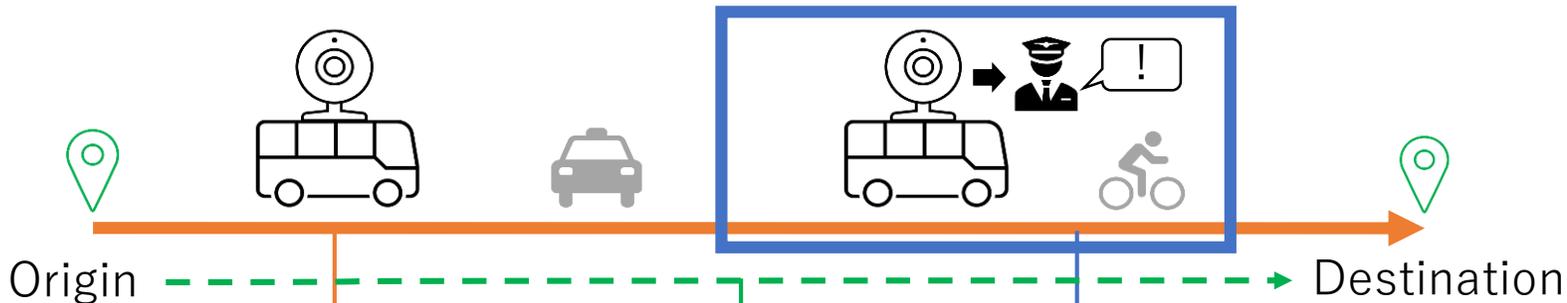
➔ **Collaboration and discussion to realize Level 4 mobility service**



Data from Automated bus

City design

Number of uses
OD information



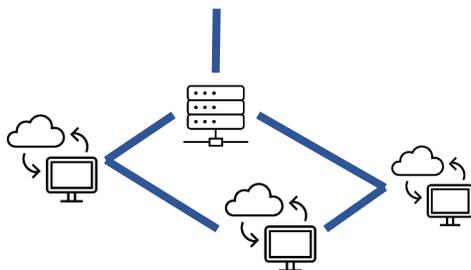
Vehicle development / Maintenance

Vehicle motion
Position/Velocity
Status of Automation

Academic Research

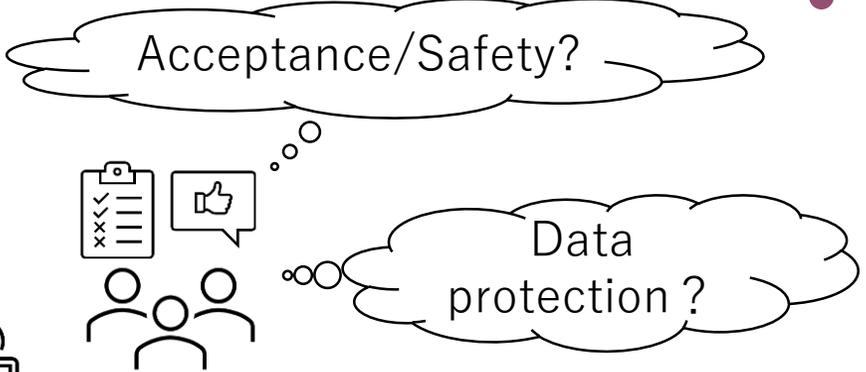
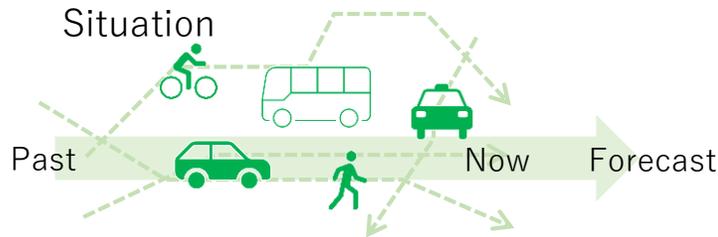
Near-crash situation
Override situation
HMI

How to Unify and Process ?

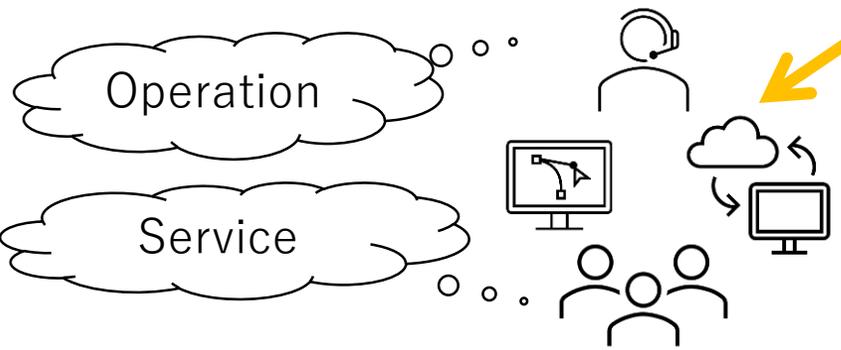


Mobility integration to the Digital world

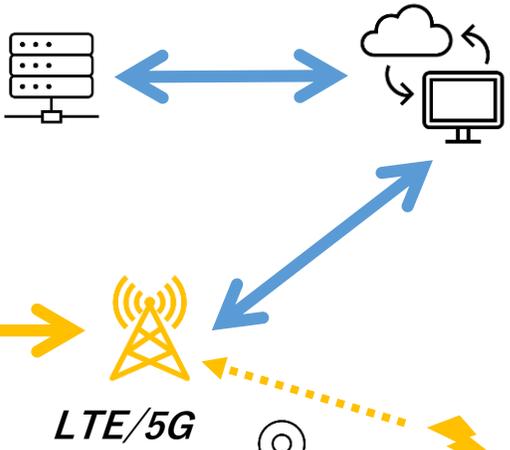
Digital world



Acceptance and Safety discussion with data



For service and operation



Automated Driving



Physical world

Pilot deployment

Conclusion

- Long term pilot deployment by the Automated bus under the smart city Kashiwa-no-ha project
- The pilot deployment based on the eco-system
- Preparing Level 4 mobility service
- Enhancing Mobility to the Digital world