25TH ITS WORLD CONGRESS
COPENHAGEN
17 – 21 SEPTEMBER 2018
Quality of life

PRACTICAL BREAKTHROUGH OF AUTOMATED NEXT GENERATION TRANSPORT IMPLEMENTATION IN TRANSITION OF AI GROWING

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R&D Structure for Automated Driving System in SIP

Organization Structure

SIP-adus
Promoting Committee

Chair: PD Kuzumaki (Toyota)
Members: ITS related ministries/ agencies, automakers, experienced academics, automotive organizations

System Implementation WG
[1] Development and verification of automated driving system
[2] Basic technologies to reduce traffic fatalities and congestion

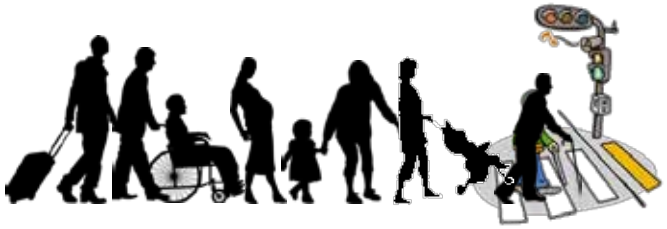
Map Structuring TF
Investigate and examine more sophisticated map information

International Cooperation WG
[3] Establish international coordination

FOT Planning TF
Examine details, location and scale of FOT

Next-Generation Urban Transport WG※
[4] Deployment in next-generation urban transport

Pedestrian Accessibility & Safety Support System

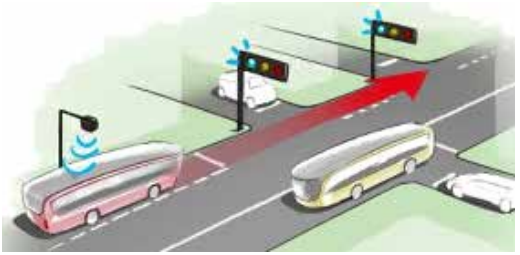


Advanced Pedestrian Information Communication System

Improve accessibility to ART (Remove barrier/ Time saving for getting on/off)

Precise Docking, Smooth Acceleration/Deceleration

Stress free Public Transport
(Secure Rapidness and On-time)



Advanced Public Transport Priority System

ART Information Center
Open Information Platform for ART related applications

Automated Bus Field Operational Test in Okinawa

General perception was good but the driver needed to override at intersections, lane change situations and something out of very normal situations

Experiment course	From AEON MALL OKINAWA RYCOM to GINOWAN PORT MARINA
Course distance	Approximately 20 km
Max speed	40km/h
Test ride event	22 times
Total running distance	Approximately 440 km
Test ride passengers	140
Override for steering control	2.3 times on average
Override for brake control	4.0 times on average

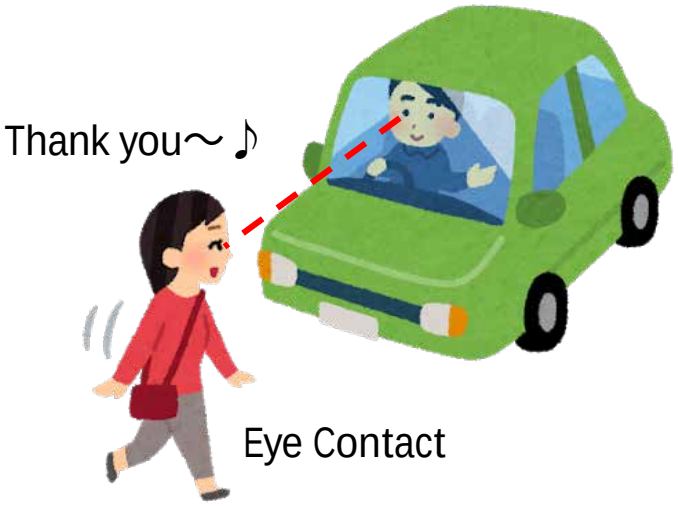
Technology Barrier of current Automated Bus

Why so slow? Why so much human driver override was required?

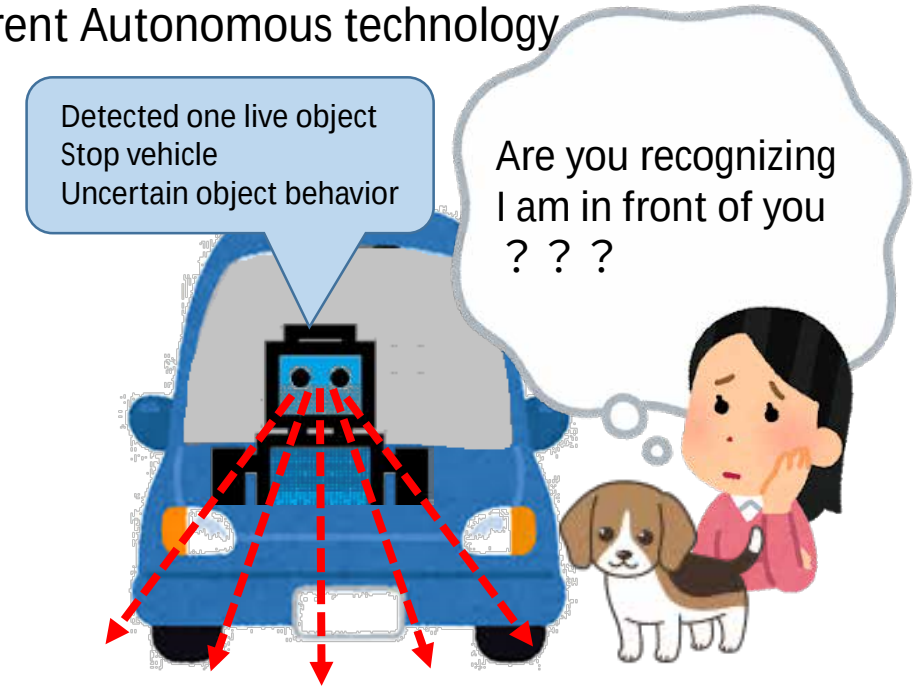
Still several technology barriers are remaining against full autonomous vehicle
But what is the biggest one?

Communication between Human and Autonomous Vehicle

Human driver



Current Autonomous technology



Non-Verbal Communication between Human(driver/pedestrian) and Autonomous Vehicle

"I don't go across now"

Pressure
"Don't rush in this timing"

"You turn right first, please"

Non-verbal Communications

Message from situation
"Go slowly and carefully"

Speed down and yield
"You go first, please"

Priority of road maintenance
at 4-way intersection(No rule)

Research of interaction between pedestrian and Automated Vehicle

Utilizing Large scale Virtual Reality facility

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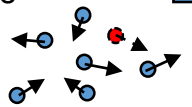
How Autonomous vehicle reacts in shared space between Vehicle and Pedestrian

Human behavior data collection and Modeling

Simulation by using Cyber agent
and detect hidden risks in the cyber space
AI(Deep-learning) learns several risks

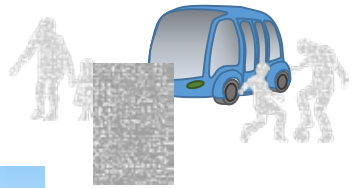


Feedback

Feedback

Feedback

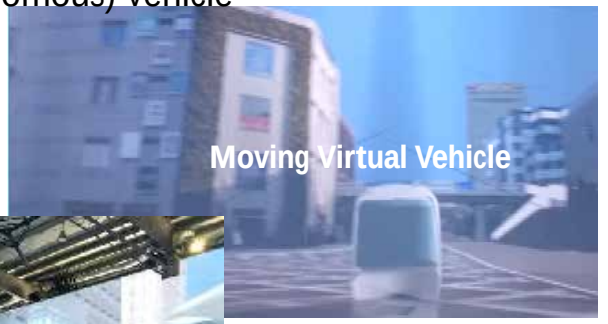
Control Specification Development:
Real (Autonomous) Vehicle with Virtual pedestrian and obstacles



Pedestrian reaction research and acceptance evaluation:
Real Human with the Virtual (Autonomous) Vehicle

Field test in public spaces

Feasibility study in test sites



Development of
*Autonomous vehicle algorism
*Road infrastructure & design
*Risk detection both Vehicle and infrastructure

Outside of the Large scale
Virtual Reality facility

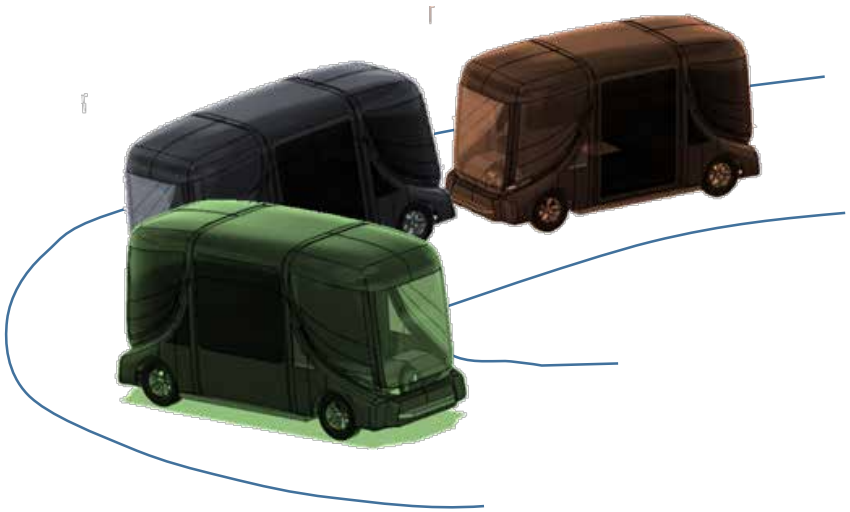
Inside of the Large scale
Virtual Reality facility

More practical application development in transition of autonomous technology (1)

Collaboration between driver and AI in vehicle

Human driver's task: Recognizing complex atmosphere of the traffic which is difficult for AI
AI (Machine) task: Complex vehicle control which only skilled human driver can do it

For example; Advanced Vehicle support system such as sharp turn at the narrow corner by long articulate bus, long semi-trailer or small shuttle platooning system.



More practical application development in transition of autonomous technology (2)

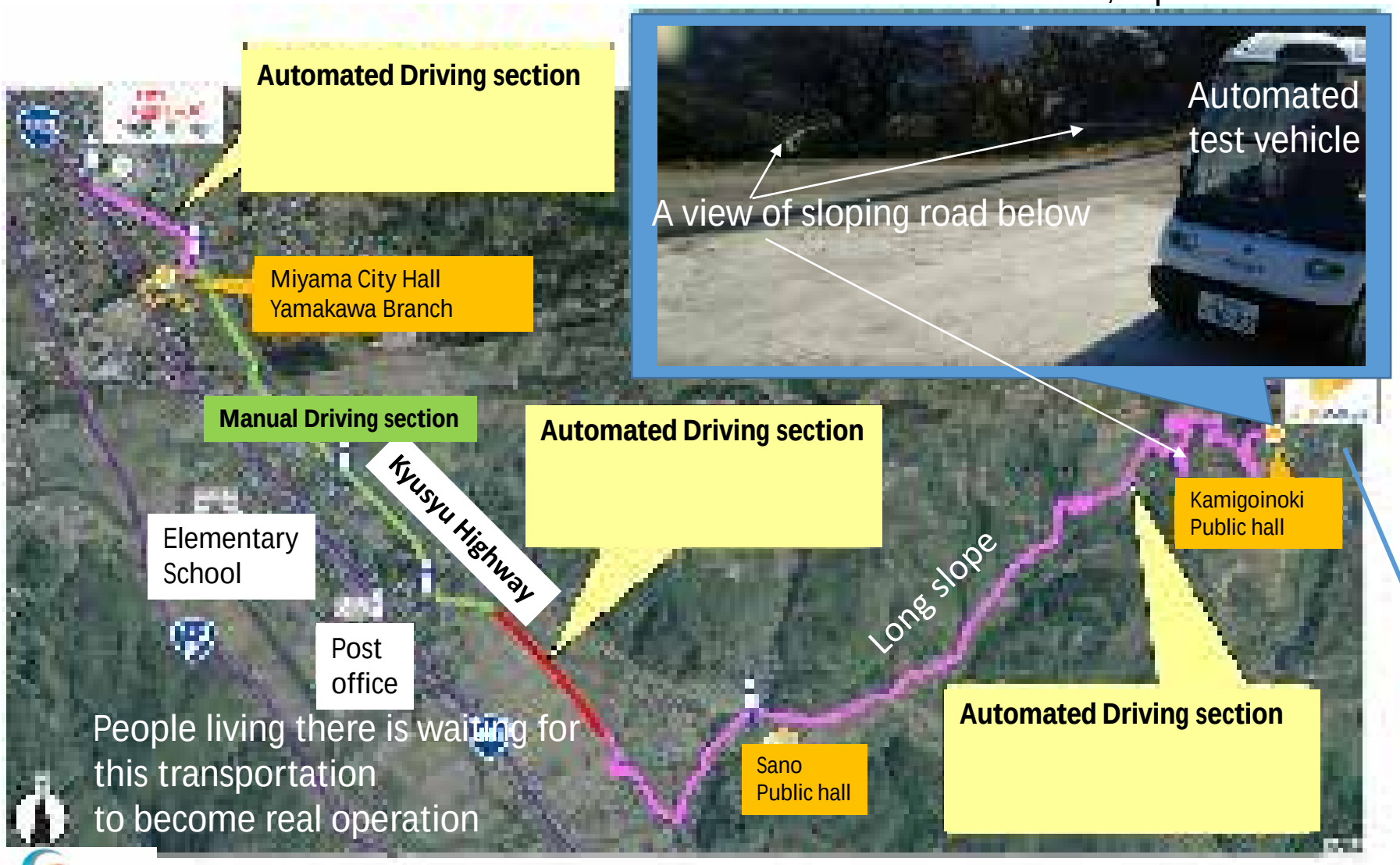
Precise Docking at Bus stop

For People who use Wheelchair and People who is totally blind, Gap is “awful valley”

Precise Docking can fill up the awful valley

Even Slow Automated Vehicle works well at the specific situations(1)

Transportation to high altitude village
Demonstration at mountain area in Fukuoka, Japan



Ministry of Land, Infrastructure, Transport and Tourism (MLIT) has been conducting those FOTs in several places in Japan by utilizing government-designated road stops as a part of SIP activity.

Even Slow Automated Vehicle works well at the specific situations(2)

In addition to activities by MLIT, Ministry of Economy, Trade and Industry(METI) has been conducting FOTs with several Business models including
City area model, Sightseeing area model, Depopulated area model and Community bus model

Snow-covered road (Eiheiji)

Depopulated area model

City area model

Unmanned vehicle demo (Wajima)

Sightseeing area model

Automated driving demo (Chatan)

Community bus model

BRT route utilization (Hitachi)

Summary

1. Automated bus still has several challenges in order to drive with higher speed especially in public roads and complex road situations.
   Need to research for non-verbal communication between AD vehicle and pedestrian.

2. Advanced driver assistance and partial automation will also work well for the issue of high skill driver shortage and driver load mitigation as well as improving accessibility to get in and out of a bus.

3. Even Slow Automated Vehicle works well at the specific situations

Thank you for your attention

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