“Improvement of the social environment for practical implementation and horizontal deployment of automated driving services”

“Investigation and research for design and construction of architecture related to autonomous driving and driving support“

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Cabinet Office

Project overview

Improvement of the social environment for practical implementation and horizontal deployment of automated driving services

Investigation and research for design and construction of architecture related to autonomous driving and driving support

Objective

To establish a sustainable service model and to promote the spread
~Realizing an autonomous driving society in rural regions~

Results

・**"Verification of societal implementation"**
: Supported and evaluated the societal implementation at one location
: Conducted practical use simulation at two long-term FOT locations
➡ Solved technical problems and conducted a validation of the business model
(1) For **technical issues** that cannot be conquered by the vehicle itself, **a close inspection of the operational challenges in assisting from the infrastructure was conducted**
(2) Examined the **horizontal deployment of the business model** for continuous service operation
(3) Created a "Deployment manual for societal implementation (draft)"

・ "**Implementation of driving assist service**"
: Developed the functions that support the independent management of autonomous driving in rural regions
➡ The first step (**implementation of necessary functions**)
(1) Operation management support
(2) Vehicle management support
(3) Users service

Societal implementation (In operation)

○ Michino-eki (roadside station) "Kamikoani" (Akita Pref.)
Operating for more than 300 days since November 2019

Long-term FOTs (Experiment finished)

○ Michino-eki (roadside station) "Okueigenji keiryunosato" (Shiga Pref.)
36 days (2019)

○ Michino-eki (roadside station) "Akagikogen" (Shimane Pref.)
40 days (2020)

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Implementation system

Consortium

HIDO
Highway Industry Development Organization

NCE ひと・社会・未来 エヌシーイー株式会社

株式会社オリエンタルコンサルタンツ ORICONSUL

NIPPON KOEI

復建調査設計株式会社 FUKKEN CO.,LTD.

Improvement of the social environment for practical implementation and horizontal deployment of automated driving services

Cooperation

Parties of the social implementation / long-term FOT area

Yamaha Motor Co., Ltd.

Provide experimental vehicle

Consortium

NIPPON KOEI

Pacific Consultants

HIDO
Highway Industry Development Organization

Investigation and research for design and construction of architecture related to autonomous driving and driving support

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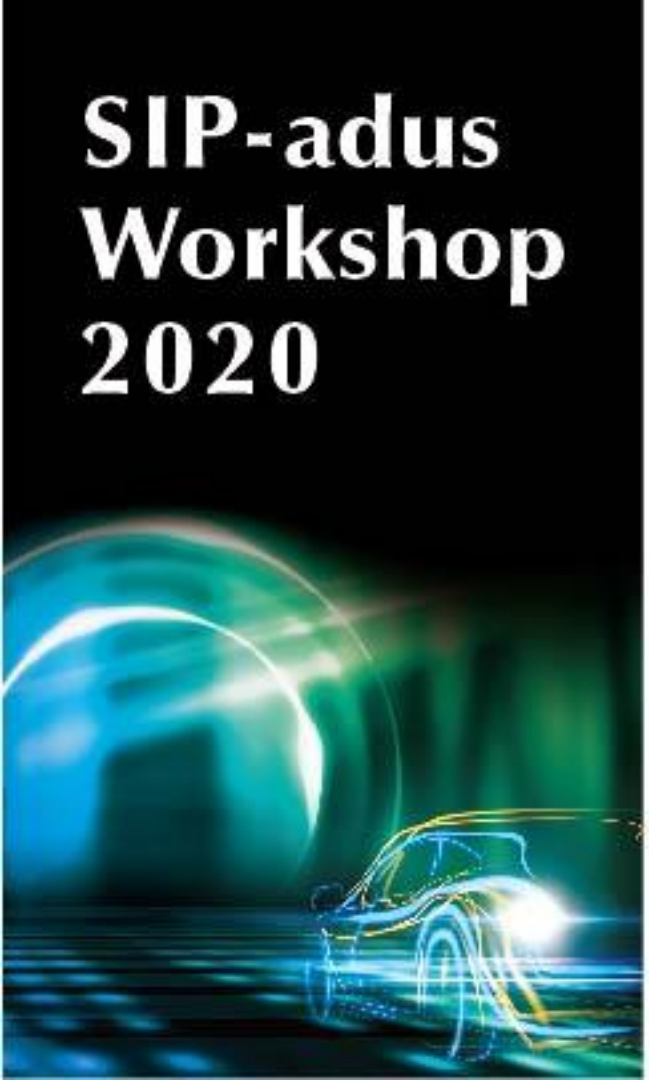


“Improvement of the social environment for practical implementation and horizontal deployment of automated driving services”

The societal implementation of autonomous driving service at Michino-eki (roadway station) “Kamikoani” (since November 30, 2019)

■Automatic drive vehicle

Vehicle in use
・Made by Yamaha Motor Co., Ltd. ・Seating capacity: 7
・Running speed around 12 km/h , 1 vehicle

■Operating structure

Traveling route: Route that connects three communities (Kosawada, Fukudate, and Dogawa) with Michino-eki (roadside station) “Kamikoani” as a hub (4 kilometers long)

Service schedule: Regular service: 1 service in the forenoon
Demanded service: Based on reservation

Fare: 200 yen/ride

Operating body: Kamikoani village transfer service association (NPO)

Societal implementation at Kamikoani: Efforts to address operational challenges

■ Measures for business model issues

<Development of new routes based on the needs of the local community>

Consideration in extending the route to the only convenience store in the community

< Strategies to reduce cost >

Integral operation with the Michino-eki (roadside station) by relocating the office inside the roadside station is being considered.

■ Measures for technical issues

<Investigation of maintenance/control method of the infrastructure (electromagnetic induction wire) on the public road>

- Technical knowledge in extending to other areas in the nation is under investigation.
- The degree of impact by snow removal operation is under investigation.

Automated driving service at Michino-eki (roadside station) “Okueigenji keiryunosato” (long-term FOT) (From November 15 to December 20, 2019), 36 days

■ Automatic drive vehicle

Vehicle in use
- Made by Yamaha Motor Co., Ltd. Seating capacity: 6
- Running speed around 12 km/h, 1 vehicle

■ Experiment outline

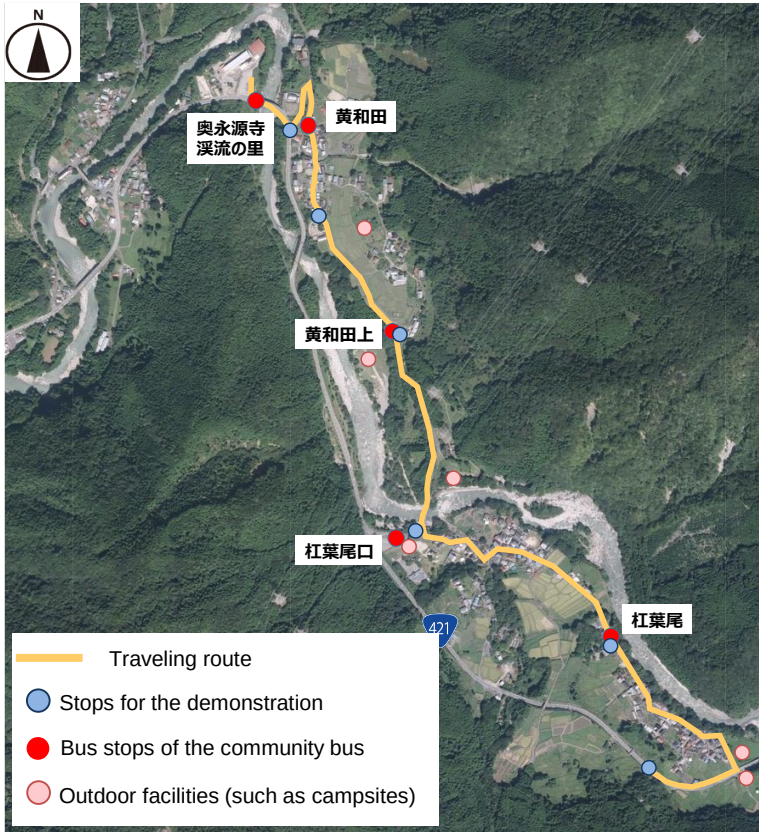
Traveling route: Round trip between Michino-eki (roadside station) “Okueigenji keiryunosato” and Chyoshigaguchi-iriguchi via communities of Kiwadacho and Yuzuriocho (round trip 4.4 km)

Points
- Ensures means of transportation for the last one mile between one’s home and the hub of the community in countryside areas
- Meets tourism needs such as mountain climbing or autumn-leaf viewing in the area

Service schedule Regular service: 7 services (Sundays), 6 services (other)

Fare Various charging systems such as commuter ticket, one-day pass, coupon tickets, and demanded tickets were set

■ Traveling route

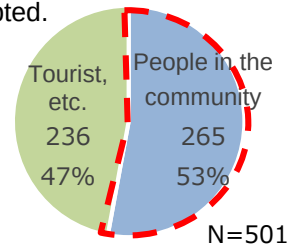


Okueigenji (long-term FOT): Summary of the results

■Passenger volume

○ 216 services were operated and a total of 501 people used the automated driving service (among them, 265 were people from the community)

* Observation group, those concerned with the experiment, and people from media are excepted.



■Utilization by tourists

○ Use as a means of transportation for sightseeing during foliage season and to travel to the trail head

■Utilization by people in the community

○ To ship products to the morning market held in the Michinoeki (roadside station), or to visit facilities in the Michinoeki such as community salon

Automated driving service at Michino-eki (roadside station) “Akagikogen” (long-term FOT) (from September 1 to October 10, 2020), 40 days

■Automatic drive vehicle

Vehicle in use
・Made by Yamaha Motor Co., Ltd. Seating capacity: 6
・Running speed around 12 km/h, 1 vehicle

■Experiment outline

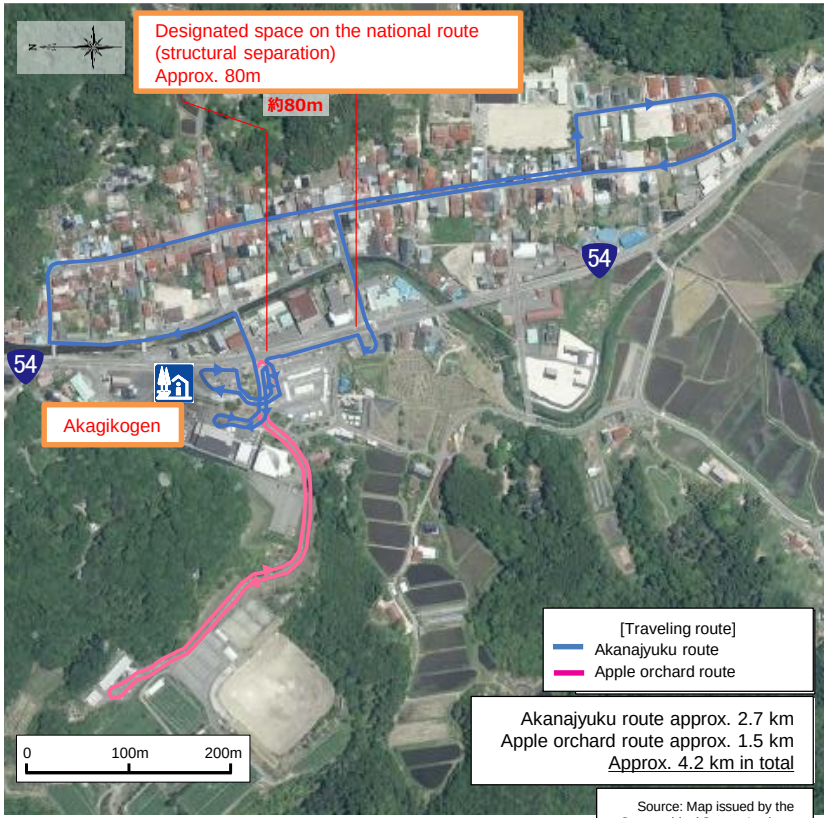
Traveling routes
- “Akanajyuku” route (approx. 2.7 km)
- “Apple orchard” route (approx. 1.5 km)

Points
Secured travel space for automatic drive vehicle on Japan National Route 54
Ensured means of transportation for daily life and utilized for tourism promotion
Investigated various charging systems

Service schedule
Akanajyuku route: 9 on weekdays, 4 on holidays by subscription
Apple orchard route: 2 on holidays by subscription

Fare
Various charging systems such as coupon tickets and value for money one-month commuter ticket were set

■Traveling route



Akagikogen (long-term FOT): Efforts in ensuring travel space

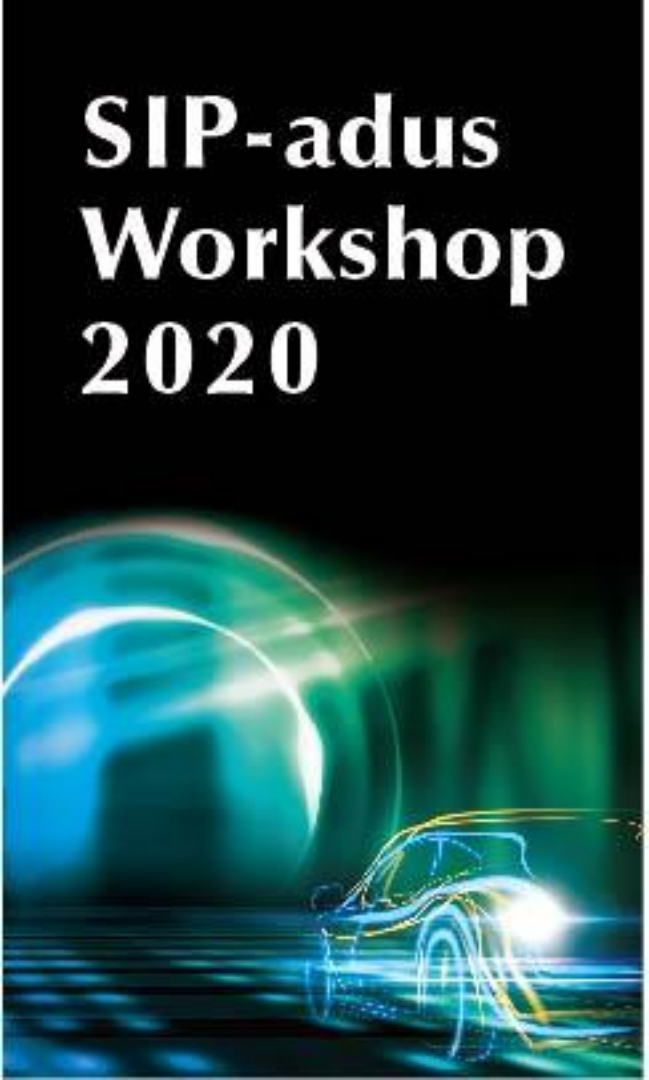
■ Securing designated space

○ Secured a designated space for an automatic drive vehicle on the road shoulder section of Japan National Route 54 on the Akanajyuku route (approximately 80m between Akana station bus stop and the Michino-eki). A fence and hand operated gate were installed to physically separate the designated space from the road.

○ Installed a traveling route for the automatic drive vehicle in the parking lot of the Michino-eki (roadside station). Clarified a line on the road surface to visually separate the traveling route.

General vehicle running parallel to the automatic drive vehicle running in the designated space.

Line installed in the parking lot of the Michinoeki (roadside station) that indicates the traveling route of the automatic drive vehicle



“Investigation and research for design and construction of architecture related to autonomous driving and driving support”

Created a staged program（Stage1）

[Explanatory notes]
Blue: dynamic data
Black: static data
Highlighted in yellow: in progress/completed
Highlighted in light blue: supporting function with higher needs

Stage 1 (implemented during this term)

Function layer

Operation management:
- Location management (location of the bus)
- Safety monitor of the vehicle (camera images/sound inside and outside of the vehicle)
- Vehicle dispatch management

Reservation management:
- Reservations for regular services and demanded services
  Flexible and wider reservation (Date, services, users)
- Travel planning function

Passenger management (vehicle):
- Management/browsing of Passenger information

Functions for users:
- Authentication function (identity verification)
- Vehicle reservation function
- Browsing of bus location, timetable, etc.
- Members/non-members management (based on fixed amount)

Stage 2

Function layer

Operation management:
- Environmental information (climate, regulation)
- Usage performance aggregation (aggregation of passenger data, aggregation of sales result, aggregation of new users, and aggregation of operation information (suspension of operation, delay) accidents))
- Display of outline map of the traveling route

Distribution management:
- Transporting item/distribution schedule management
- Vehicle dispatch management

Facility/equipment management:
- Signal, road marking, road sign, etc.
- Operation/monitoring of electromagnetic induction wire

Functions for users:
- Reservation function that is related to facilities such as hospitals (for local residents)

Charge related functions:
- Fare confirmation/charge

Stage 3

Function layer

Expanded function:
- Watching service (wandering seniors citizens, etc.)
  Notification function to families
- Dynamic timetable creation (using AI for example)

Reservation management:
- Suggestion feature of travel planning service (using AI for example)
- Function to share travel planning with friends (SNS)

Facility/equipment management:
- Contributions from the citizens (users' voice)
- Business operator/administrator management

Functions for users:
- Reservation function that is linked with sightseeing facilities, etc. (for tourists)

(for tourists)

Charge related functions (linked with market):
- Prepaid public transit IC cards, cashless settlement, and point service

Data layer

D: stands for data

- Traveling route D, timetable D, bus stop location D, and vehicle D
- User D (date of birth, gender, etc.)
- Operational D (Camera D, get-on and get-off history D, and earning and expense D)
- Map D, facility D, equipment D
- Climate D, regulation information D
- Location D (vehicle, bus stops, activity of people)

Asset layer

- Road infrastructure
- Automatic drive vehicle
- Incidental devices of the vehicle (camera, etc.)
- Additional facility
- Users

Built a system prototype version （implemented and operated in two locations）

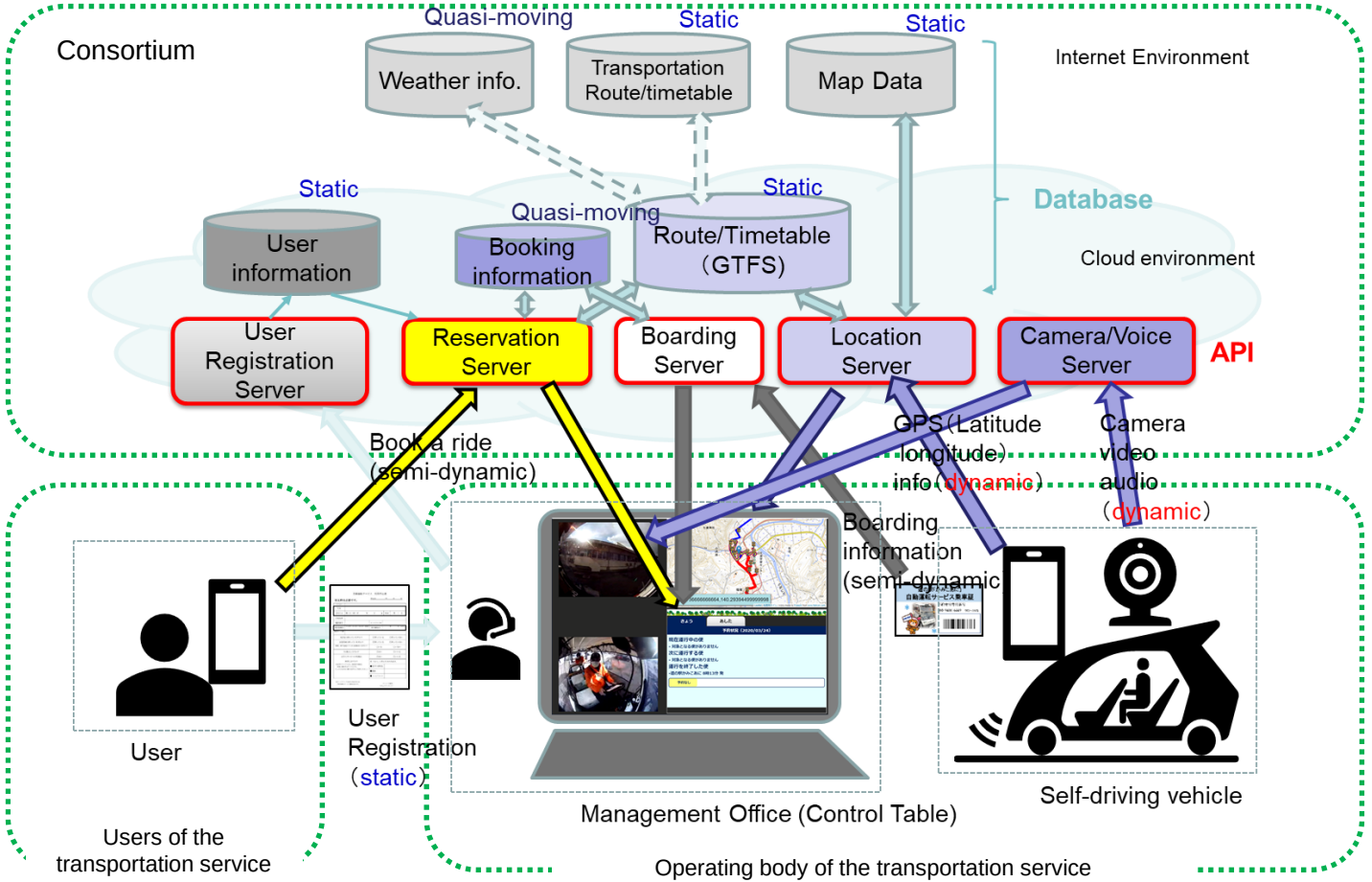
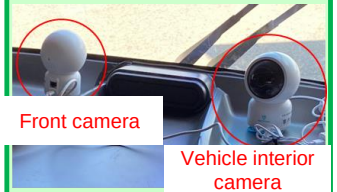


Image of the functions realized in Stage 1（example of operation in Michino-eki (roadside station) “Akagikogen”）

Vehicle monitoring (image)

(Inside the vehicle)

Operation procedure
(1) Automatically sends images to the office only by power activation
(2) Angle of the camera can be operated from the office and voice interaction is available



Operation management system

(Office)

Operation procedure
(1) Boot the computer
(2) Monitor the vehicle, location, or manage reservations via browser

Location

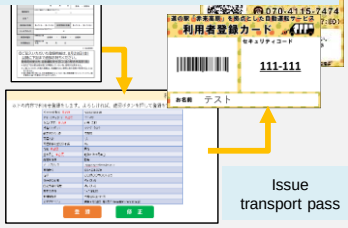
(Inside the vehicle)

Operation procedure
(1) Boot the Wi-Fi and the smart phone
(2) Open the “Position information collecting” application

Get-on and get-off management

(Office)

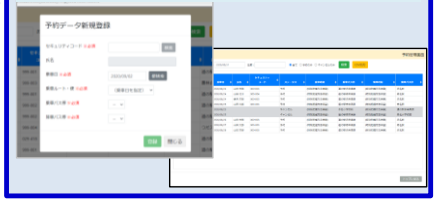
Operation procedure
(1) Fill out the registration form
(2) Register the used information in the database
(3) Issue a transport pass



Register

User management (office)

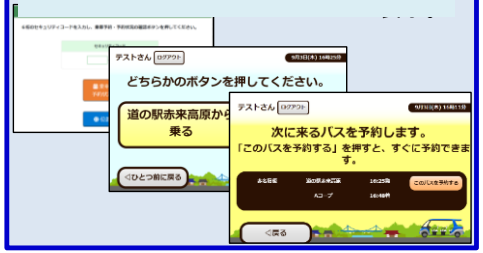
Operation procedure
(1) Enter the reservation information accepted from a telephone call through the administration screen and set the reservation
(2) Information will be reflected in the operation management screen after completion
(3) OD records or users’ information can be managed as well



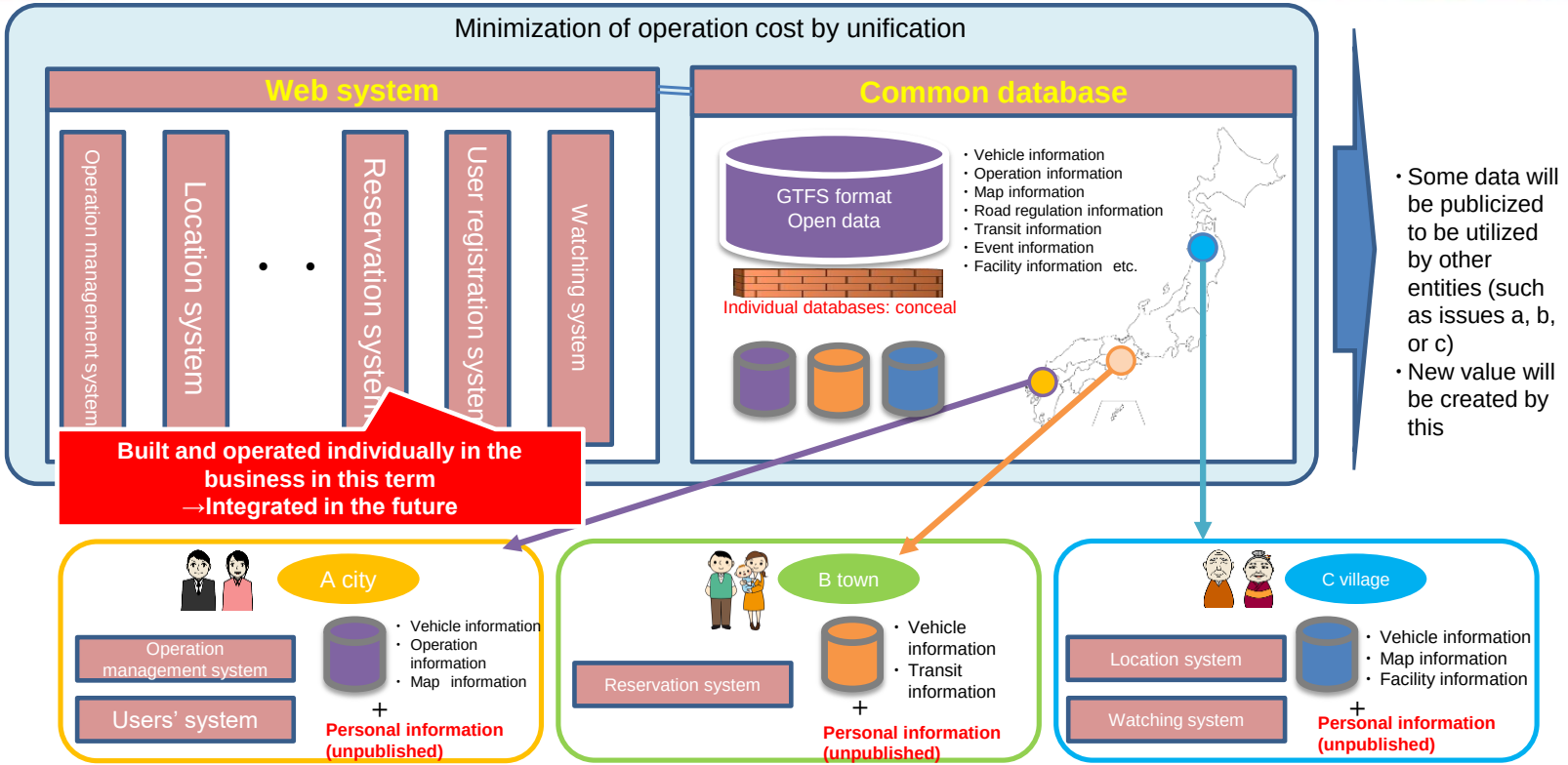
Reservation management (general users)

(General users)

Operation procedure
(1) Login with the number written in the transport pass
(2) Reserve the service on the day or on the following day (OD selection available)
(3) After reservation is made, reservation information will appear on the operation management screen.

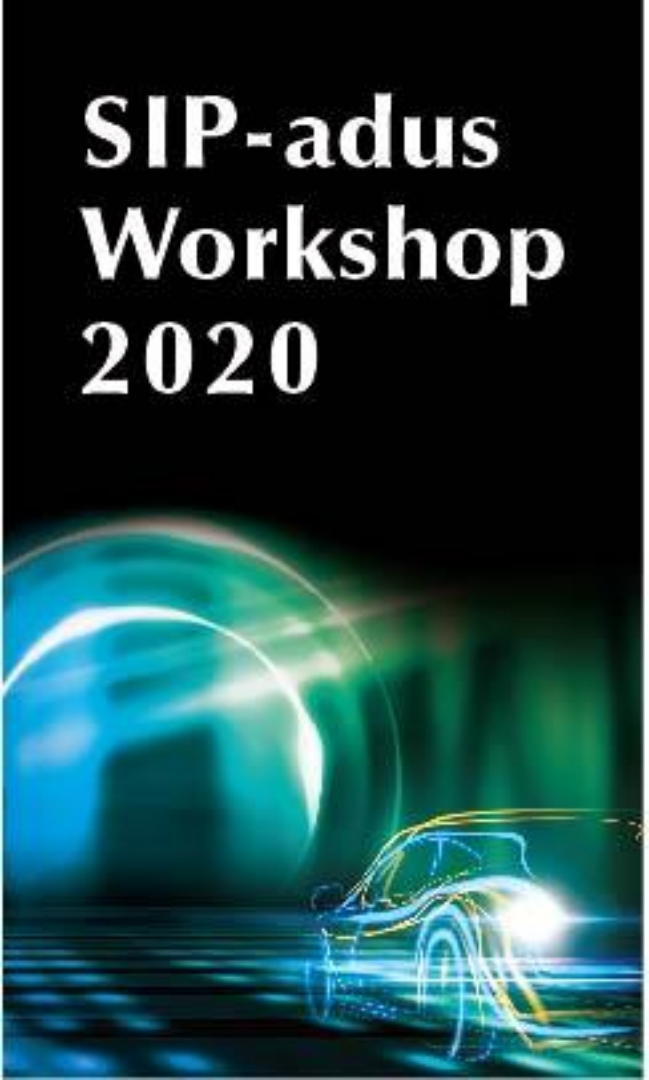


Architecture system that supports expansion of automated driving service nationwide



Select data to be utilized from the system database that is integrated on the cloud

With high versatility, enables **application that meets the need** of the local government



Summary

Summary

Results

- ○ **Automated driving service has been operated in a hilly rural area for approximately a year!**
- ○ **Feasibility in various regions was assessed based on long-term FOTs in several regions!**

Issues to be imposed

- ○ **Issues regarding infrastructure**
  - **・Investigation regarding efficient maintenance/management technique of electromagnetic induction wires, etc.**
- ○ **Issues regarding business/structure**
  - **・Creation of business models based on different needs of regions**
  - **・Organizing the method of business tie-up (example: food distribution, school bus)**
- ○ **Issues regarding system**
  - **・Creation of an easy-to-use system that helps improve IT literacy**
  - **・Commercialization of the service**

Future schedule

- ○ **～ end of December 2020**
  - **・Collect the findings from the societal implementation area and long-term FOT areas, and perform valuation and verification**
- ○ **～ 2022** **・Expand the implementation example of automated driving service**
- ○ **～ 2030** **・Realize in 100 areas (Government objective)**

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Workshop
2020
Thank you