Challenges of Connected and Autonomic Vehicles

Moderator

Markus Ullmann, BSI & H-BRS, Germany

Panelists

- Dirceu Cavendish, Kyushu Institute of Technology, Japan
- Manabu Tsukada, University of Tokyo, Japan
- Yasuhiko Watanabe, Yukoku University, Japan
- Rajat Kochhar, Ericsson, India
- Hamid Menouar, Qatar Mobility Innovations Center, Qatar
- Antonio Martin, Universidad de Sevilla, Spain

Topics of the discussion

- Will there be a shift in the buying behavior of vehicles in future ?
  - Western cities: Young people don‘t like buying vehicles. Reasons are manifold: Costs, lack of parking space, reliable public transportation services, horrible motor traffic in cities etc.
    If a vehicle is really needed by young people, they will use vehicle shairing platforms. Connected and autonomous vehicles will not change buying behavior of young people.
  - India: Vehicles are still status symbols. The ownership of a vehicle is an important issue. But cheap prices are important as well.
- Who pushes connected and autonomous driving ?
  - Autonomous Driving is pushed by semiconductor industry to enhance the complexity of vehicles.
- Who needs autonomous driving ?
  - Autonomous Driving is only interesting for old people, people with physical deficiency and people without driving license.

Thanks For The Discussion

Contact

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Departamento de Tecnología Electrónica

CHALLENGES OF CONNECTED AND AUTONOMIC VEHICLES

Nice, July 2017

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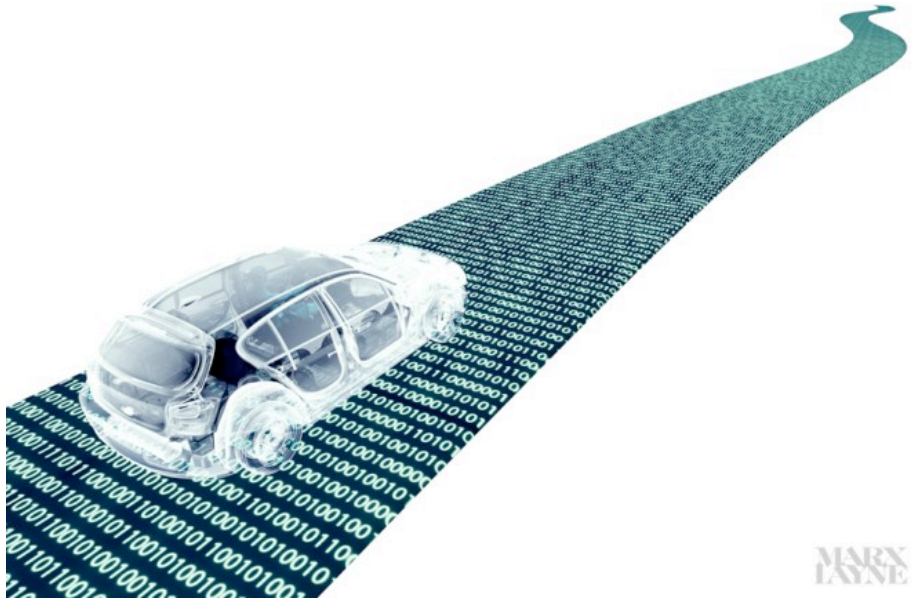
Synopsys

- Introduction to Connected and Autonomous Vehicles (CAVs) .
- Outstanding challenges related .
- Main open issues.



CAVs Future Opportunities

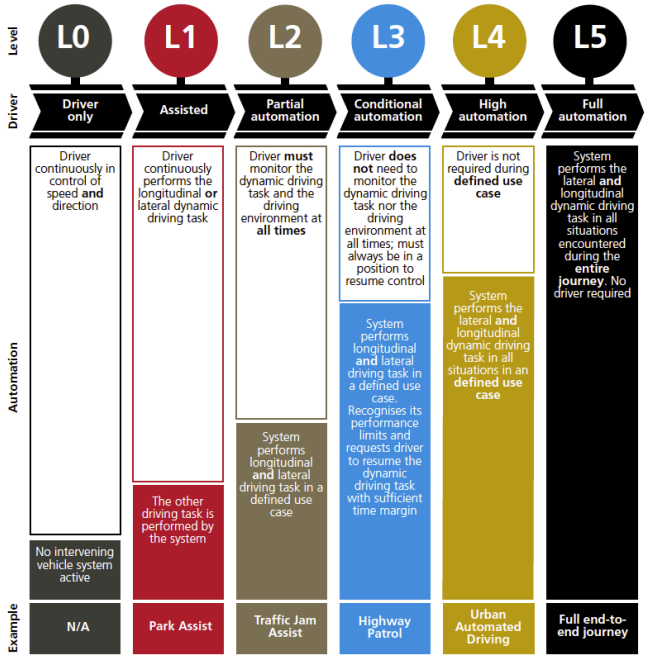
- **Greater efficiency**
  - Reduced congestion with fewer traffic incidents comes fewer reasons to slow traffic.
  - With the ability to operate at higher speeds and reduced space between vehicles,
  - Real-time route optimization to follow the best routes according to real-time information.
- **Increased safety,** 94% of accidents are related to human error.
  - Automated vehicles can remove human error and prevent a huge majority of accidents.
  - With AVs, humans' slower reaction time, distracted driving, etc. can be eliminated.

- Less energy consumption and greater efficiencies lead to more energy savings for your fleet.
- More productivity due to the power of multi-tasking.

The more advanced levels only require the driver to monitor the drive to make sure it goes smoothly.

Defined levels of Automation

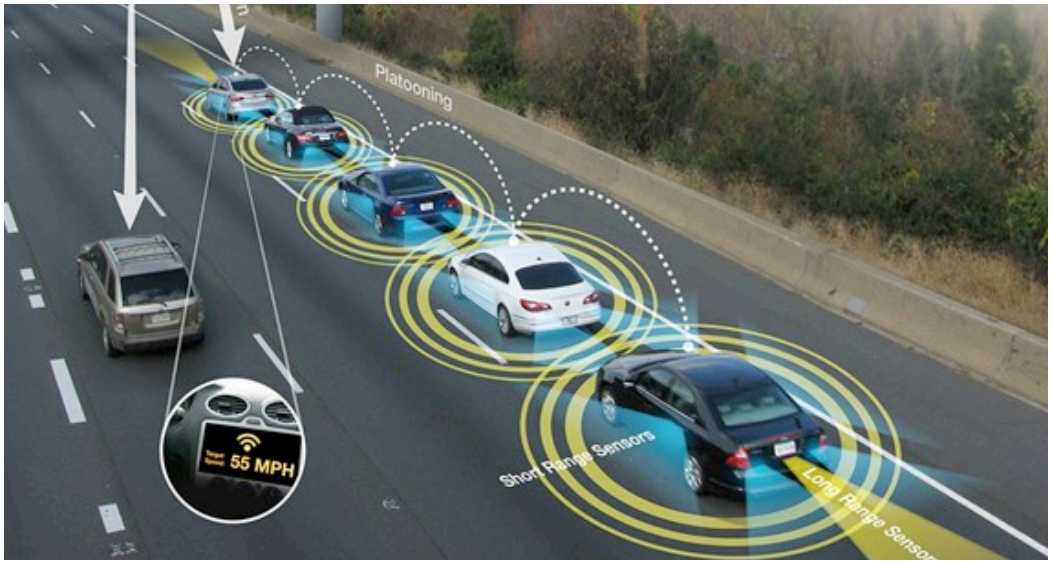
- **0. No automation.**
- **1. Limited automation**, but with driver controlling all driving situations.
- **2.Partial automation,** where software can control acceleration and braking.
- **3. Conditional autonomy,** where the software and sensors accelerate and brake and monitor the vehicles' environment, but the driver to take control when needed.
- **4. High automation,** where the sensors, cameras and software can guide the car to a safe position if the driver fails to re-engage.
- **5: Full automation** where the technology can navigate and manage any situation and the driver need not be engaged.



- The government is setting aside its four-level gradation of autonomy and in its place will adopt the five-level definition of the Society of Automotive Engineers

Challenges of Autonomous Vehicles

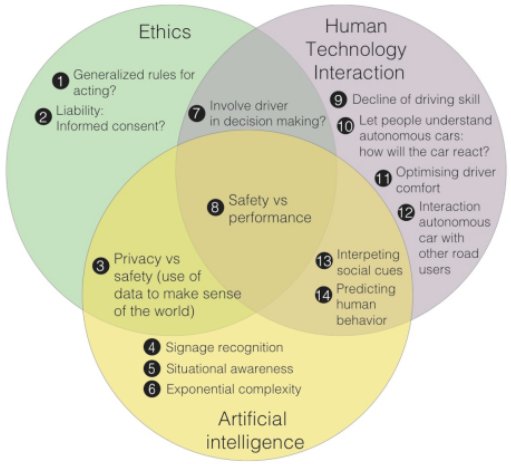
- **States will have different rules.** Safety, need to work with the government and automotive industry to develop standards.
- **Supporting infrastructure must support CAVs.** Need to work with industry to develop framework for CAVs on public roads. Who will own it? Who will fund it?
- **Privacy and Data,** connected cars create vast quantities of data. Who owns it? Who has the right to use it?
- The human factor, Ethical Considerations, social Impact, telecoms regulations, etc.



- How do we transition from analogy to digital? Are autonomous software systems vulnerable to cyber hacking?
- Connected car raises new world of data management, privacy, ownership and emerging cyber-physical risks.

Privacy and Data,

- **New obligations on confidentiality**. Regulation to apply the communications between connected cars and other vehicles or road infrastructure.
- **Data protection**. In most jurisdictions, data protection regulations have not been developed to deal with the specific implications of connected and autonomous cars.
- In this context a **whole range data could be gathered.** Who is the data ownership?
- The **data is stored in the car or in a cloud DD.BB.** effective security measures will need to be in place to protect the data.



- Traditionally most vehicle manufacturers have had very limited information about their customers and managing customer data has not been a key priority.
- The connected car raises a new world of data management, privacy and ownership. This brings significant new challenges and obligations relating to the collection, use and protection of such data.

Supporting infrastructure must support CAVs

- **New technical standards** are needed for the large quantity of new telecommunications technology specific to the developments in autonomous cars.
- Car manufacturers recognize that they need to **collaborate to access all he technologies** needed to develop connected cars and it is driving changed the technology infrastructure.

- Connected and autonomous vehicles raise many IP issues. The volume of new technology required, and the fact that much of this technology needs to be shared widely.
- Maximum benefit of Cavs will require significant investment in new road and communications infrastructure.

Emerging Cyber-Physical Risk in CAVs

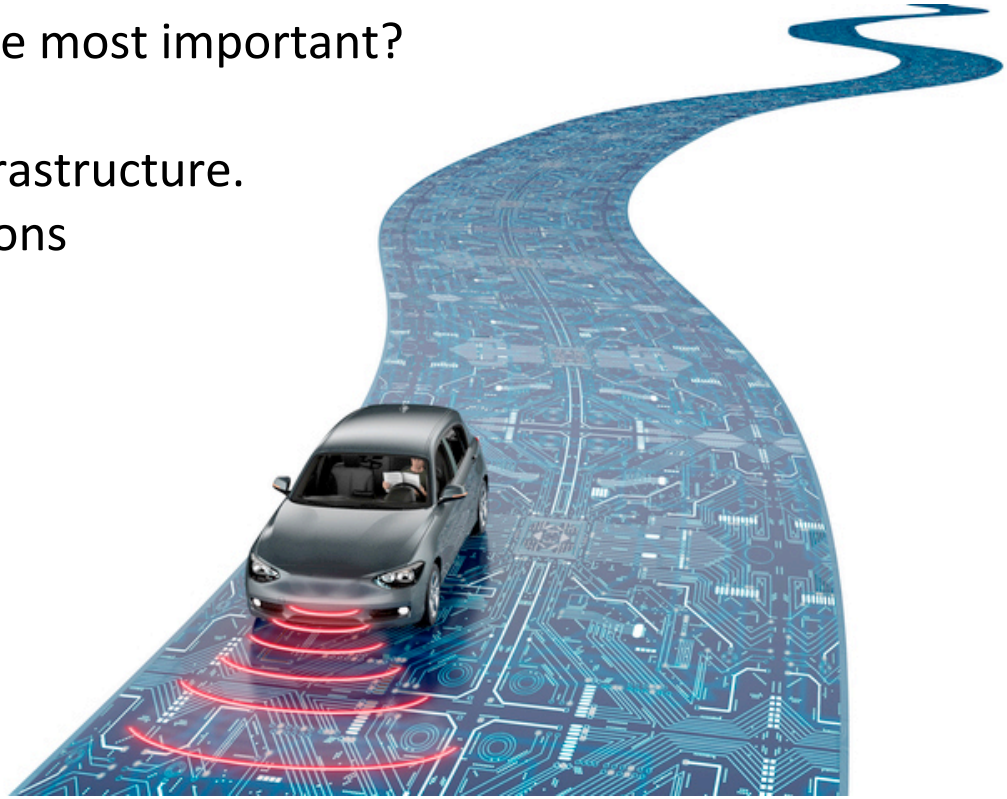
- **Emerging CAVs technologies raise questions** about the readiness of current regulatory approaches to vehicle safety, data protection and cybersecurity.
- **R**igorous cybersecurity **technologies and policy frameworks are needed to protect** connected vehicles and infrastructure.
  - Regulatory Implications, Legal frameworks and guidance for managing cyber risk, etc
  - How do we transition from analogy to digital? Are autonomous software systems vulnerable to cyber hacking?

- Car companies do not have a long tradition of cybersecurity expertise, writing requirements for suppliers and ensuring that they meet minimum security and protection can be a challenging task.
- Connected car raises a new data management world, privacy, ownership and emerging cyber-physical risks.

Main issues addressed.

Which of these issues to we feel is the most important?

1.- Trust in the technology and infrastructure.
2.- Data privacy and ethical questions
3.- Governments and regulations
4. Insurance and liability
5.- Cyber security



- Smooth adaption of the driverless technology is by no means certain. There are many practical, legal and ethical issues, which need to be addressed.
- Driverless cars are part of a broader mobility revolution, which transform the cities of the future
- The driverless future will bring many benefits but also possibility of social and political upheaval due to loss driving as a source of employment

“Anything one man can imagine, other men can make real.”

Jules Verne

Thank for your attention

Merci beaucoup

CHALLENGES OF CONNECTED AND AUTONOMIC VEHICLES

Internet 2017 Panel

Challenges in Connected and Autonomic Vehicles

The Road to Secure/Safe Transportation

Dirceu Cavendish, Kyushu Institute of Technology, Japan

Vehicular Communication Today

Our vehicles are undergoing significant changes

Intra-communication
- CAN bus
- Infotainment system

Inter-communication
- Key fob system
- Mobile to vehicle apps

Connected and Autonomous Vehicles
- Vehicle to server systems - ADAS
- Vehicle to vehicle communication

Network Design Research Center

Autonomous Driving & Threats

Threat types	Mitigations
■ Vehicular sensoring ■ GPS: spoofing ■ Radar: Small dangerous objects ■ Camera: object occlusion; object distraction; non-standard road demarcation ■ Proximity: position/range attacks	■ Multiple sensor sources with consistency checks ■ Multiple position camera sources and checks ■ Secure communication protocols
■ Autonomous Driving Aided System ■ Image processing pattern recognition failures (e.g. stop sign miss) ■ Auto driving logic failure: unexpected scenario; software error	■ Emergency procedures: collision avoidance procedures ■ Self-learning: crowdsourcing driving performance, near misses, and collision events;

Network Design Research Center

Vehicle to Vehicle Comm & Threats

Threat types

- Vehicular sensoring
  - Proximity: position/range attacks
- Autonomous Driving Aided System
  - Auto driving logic failure: unexpected scenario; software error

Mitigations

- Secure communication protocols
- Emergency procedures:
  - Collision avoidance procedures
  - Human handoff

Network Design Research Center

Security and Crowdsourcing

Vehicle Crowdsourcing

- Safety: unpredictable situations; failures
  - ADAS algorithm design and tuning
- Performance: Accuracy verification and performance improvements
- Insurance
  - Risk assessment
  - Crash forensics

How Tesla Fixed a Deadly Flaw in Its Autopilot

CEO Elon Musk on Sunday announced **a software update for its vehicles** that significantly changes how autopilot works, without changing any of the hardware involved. Until now, the autopilot feature—which can self-pilot the car for stretches of highway driving—has relied primarily on a video camera and image-processing software to see the road ahead. A radar system and ultrasonic sensors provided additional data, but the system was programmed not to act on radar data alone due to some fundamental limitations of the technology.

http://www.slate.com/articles/technology/future_tense/2016/09/how_tesla_s_software_update_fixed_a_deadly_flaw_in_autopilot.html - Sept 2016

Tesla shares fall after driver claims car crashed while using autopilot

NEW YORK: Tesla Inc shares dropped on Monday after a Minnesota man claimed his vehicle suddenly accelerated after he engaged the car's driver-assistance system and crashed into a marsh.

http://economictimes.indiatimes.com/news/international/business/tesla-shares-fall-after-driver-claims-car-crashed-while-using-autopilot/articleshow/59640301.cms

Network Design Research Center

Will Road Safety get worst before better?

Non-interactive legacy features

Electronic Stability Control

ESC Lives Saved Estimates, by Year and Vehicle Type, 2011–2015

Year	Passenger Cars	Light Trucks/Vans	Total = (1) + (2)
2015	857	1,091	**1,949**
2014	657	918	**1,575**
2013	551	829	**1,380**
2012	466	759	**1,225**
2011	329	567	**896**
TOTAL	**2,860**	**4,164**	**7,024**

Data Source: NHTSA, NCSA, 2011–2014 FARS Final Files, FARS 2015 Annual Report File and IIHS list of ESC-equipped vehicles.

Vehicle Interactive features

Automatic Collision Avoidance

- Parking lot driveway crashes
- Stop sign/traffic light roll over crashes
- Automatic speed reduction for pedestrians
- Highway crash avoidance

	Legacy	Autonomous
Heterogeneous Driving	Driver skills; aggressiveness; mood swings	HW quality; SW versions Manufacturer's features/styles
Map dependency	Static routes/driving conditions; Simple objective function	Real time conditions; Dynamic routing (stability); Multiple objective/diverse functions
Server dependency	None/limited	Navigation (traffic); Crowdsourcing; SW upgrades;
Environmental dependencies	Road and traffic conditions; Weather conditions	Expert system perception of: road and traffic conditions Weather impact on expert system

Network Design Research Center

Connected Automated Vehicles (CAV) in Qatar: Challenges & Implications

February 9th, 2017 Nice, France

Dr. Hamid Menouar
Senior R&D Expert - Product Manager
Qatar Mobility Innovations Center – www.qmic.com

About QMIC

Qatar Mobility Innovations Center

First Independent Innovations Center in Region
Founded in 2009

Innovations Model Optimized for the Region
System Innovations
Idea to Market
User-Centric

Leadership in Key Emerging Market Domains
Intelligent Mobility
Smart Living (IoT)

V2X Field Demo in Qatar by QMIC

Back in **April 2014**, QMIC has deployed and demonstrated the

First MENA Field V2X Demo

QMIC's CV

QMIC's RSU

Gulf Times
Tuesday, April 29, 2014 | 7

QATAR

HE Sheikh Abdulrahman bin Khalifa bin Abdulaziz al-Thani, Minister of Municipality and Urban Planning gets ready for the field demo of Connected Vehicles as Dr Adnan Abu-Dayya opens the door of the car. **PICTURE:** Jayaram

'Connected Vehicles' tech to enhance road safety

Technology & Standardization Expertise

Participated in
Plugtests Events
held in Europe

Participants include:

SIEMENS
RENESAS
HITACHI Inspire the Next
qmic
DENSO
kapsch
NEC
Unex Bridging Next
Fraunhofer FOKUS
NXP

QMIC's V2X Equipment under test during an ETSI TC ITS Plugtests

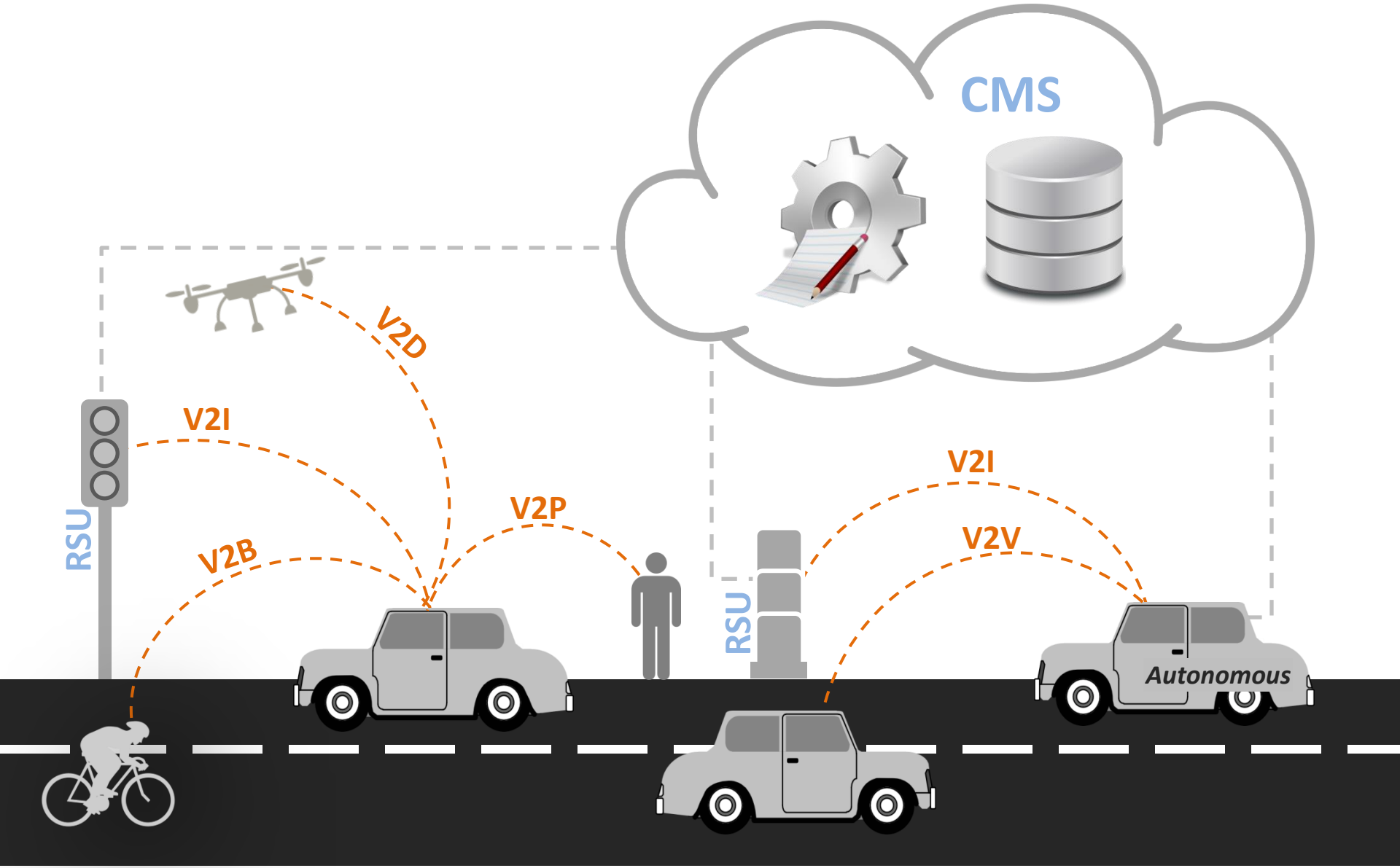
QMIC's team attending an ETSI TC ITS Plugtests event to test the conformance and interoperability of QMIC's V2X technology

QMIC V2X Pilot - 2016-2019

QMIC is preparing to deploy a **large scale V2X Pilot** in Doha.

Deployment **by middle of 2017**

Example use-case of Road Work Warning Executed in Doha by QMIC's Connected Vehicle


CMS
V2D
V2I
V2P
V2B
RSU
V2I
V2V
RSU
Autonomous

DIFFERENT EXPECTATIONS

THERE IS ONE trend of mobility that young people have embraced, though:

Expected Impacts ?

- Less spaces for roads and parking
- Dynamic & Intelligent fleet

Connected

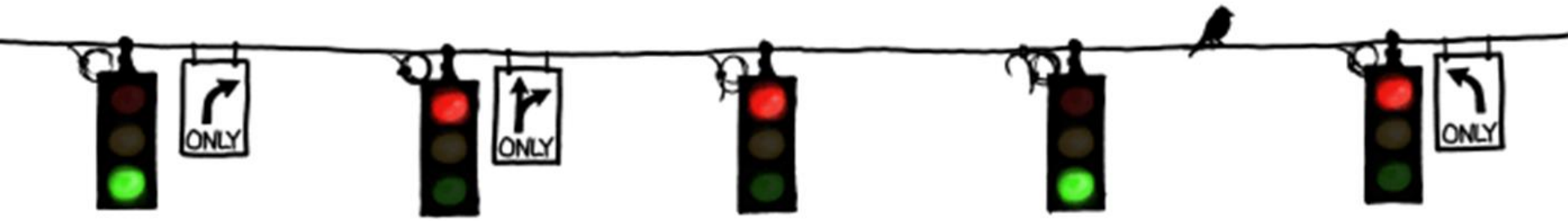
Intelligent

Fleet of Taxi

ROBOTS

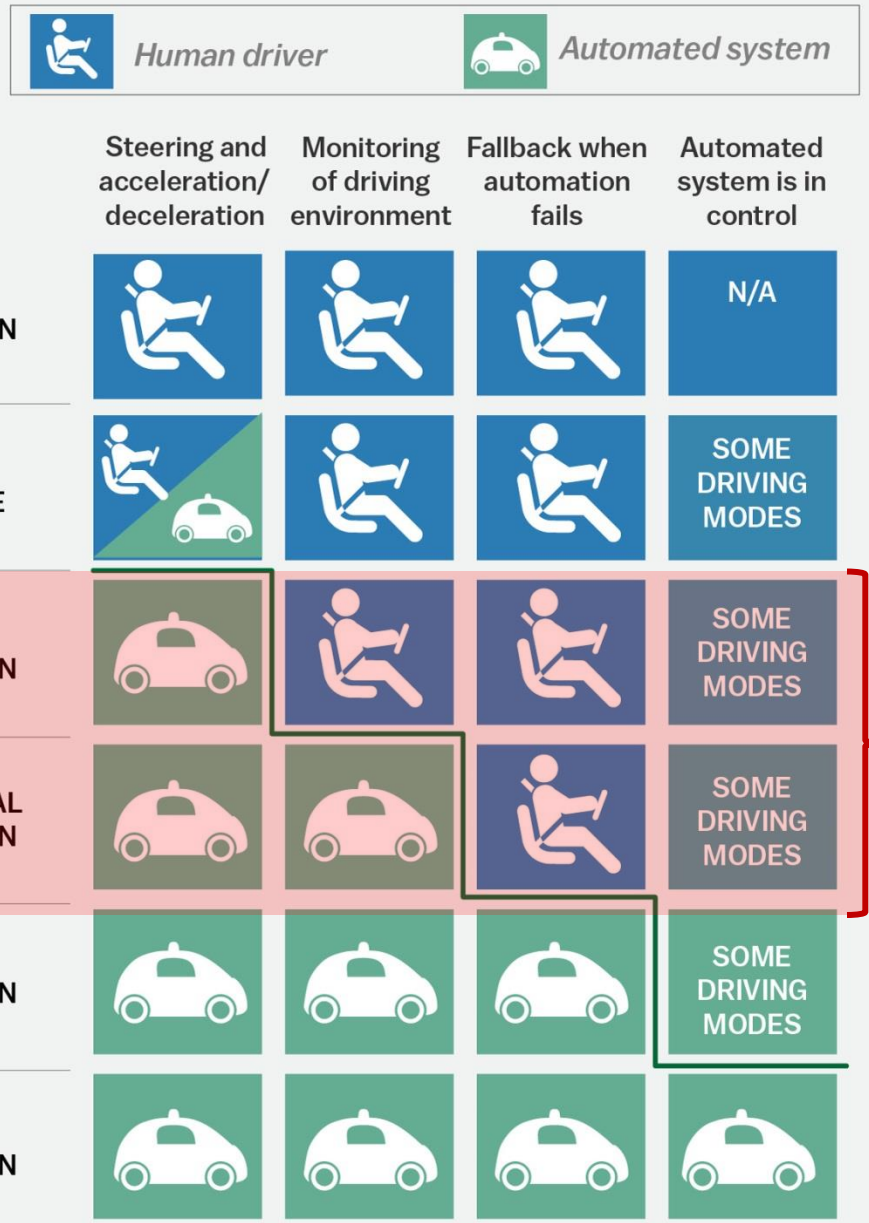
TRAFFIC
Simulation
&
NETWORK
Simulation
Combined

VIRTUAL SIGNAGE
DEPLOYMENT & MAINTENANCE COST



The 5 levels of driving automation

For on-road vehicles



CHALLENGING

LONG **TRANSITION** PERIOD

Source: SAE International

TRANSITION PERIOD

Deal well with the transition period

e.g. **Allocate Parts of your Infrastructure for CAVs**

Plan your **infrastructure** in a way it **Can be Easily Transformed**

And reused to fit future needs.

Support your planning with the right **Regulations and Law Enforcements**

We plan our cities for tomorrow; let's plan them **for Tomorrow's Users.**

Connected & Autonomous Vehicles will change our cities

Dr. Hamid Menouar (menouar.com)
Senior R&D Expert - Product Manager @QMIC

Thank You

Challenge of Connected Autonomous Vehicle

Manabu Tsukada
The University of Tokyo

2017.07.25

Self Introduction

- 2007—2013 Ph.D & Post-doc
  - Expert Engineer, Inria, France
  - 2011 Ph.D at Mines ParisTech

With GeoNet team 2010

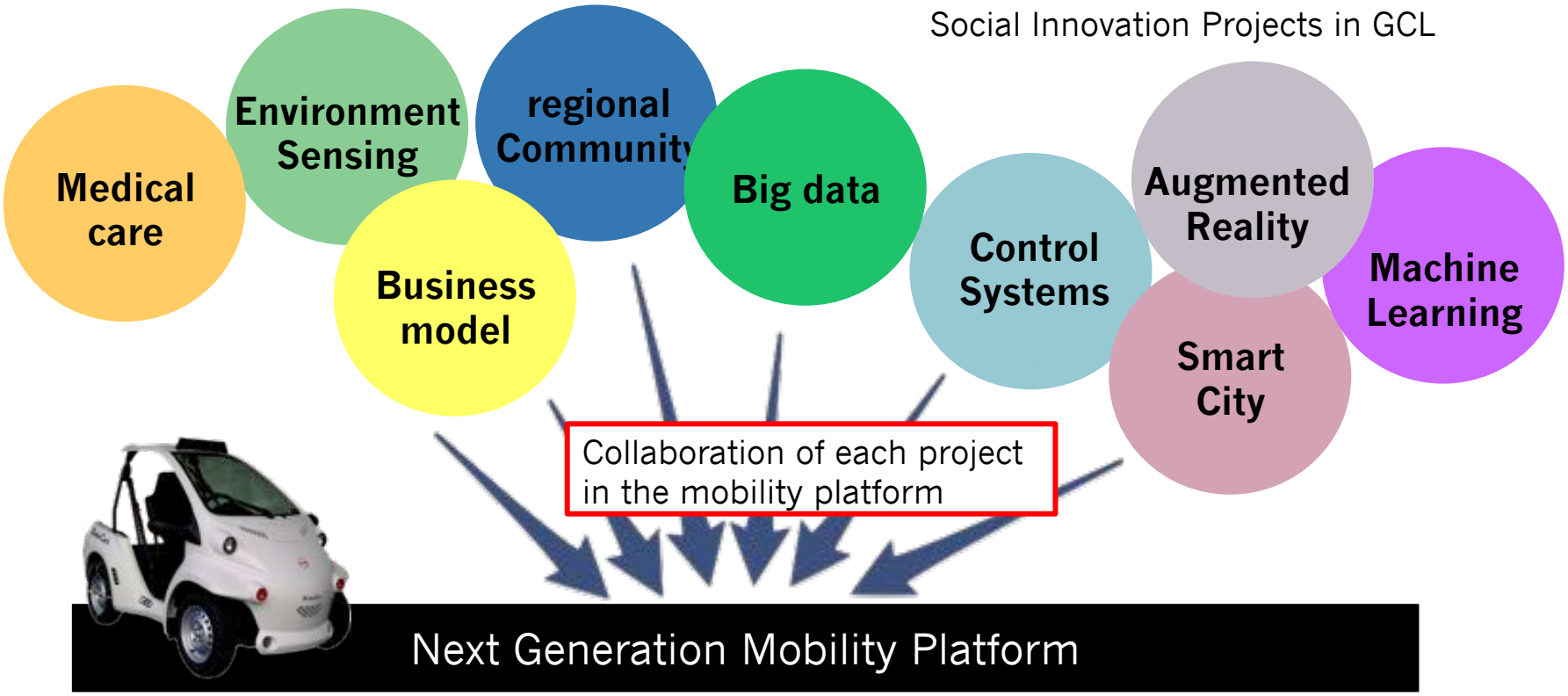
With IMARA team 2010

- 2013 – current, Assistant professor
  - Graduate School of Information Science and Technology, The University of Tokyo

GCL Camp in May

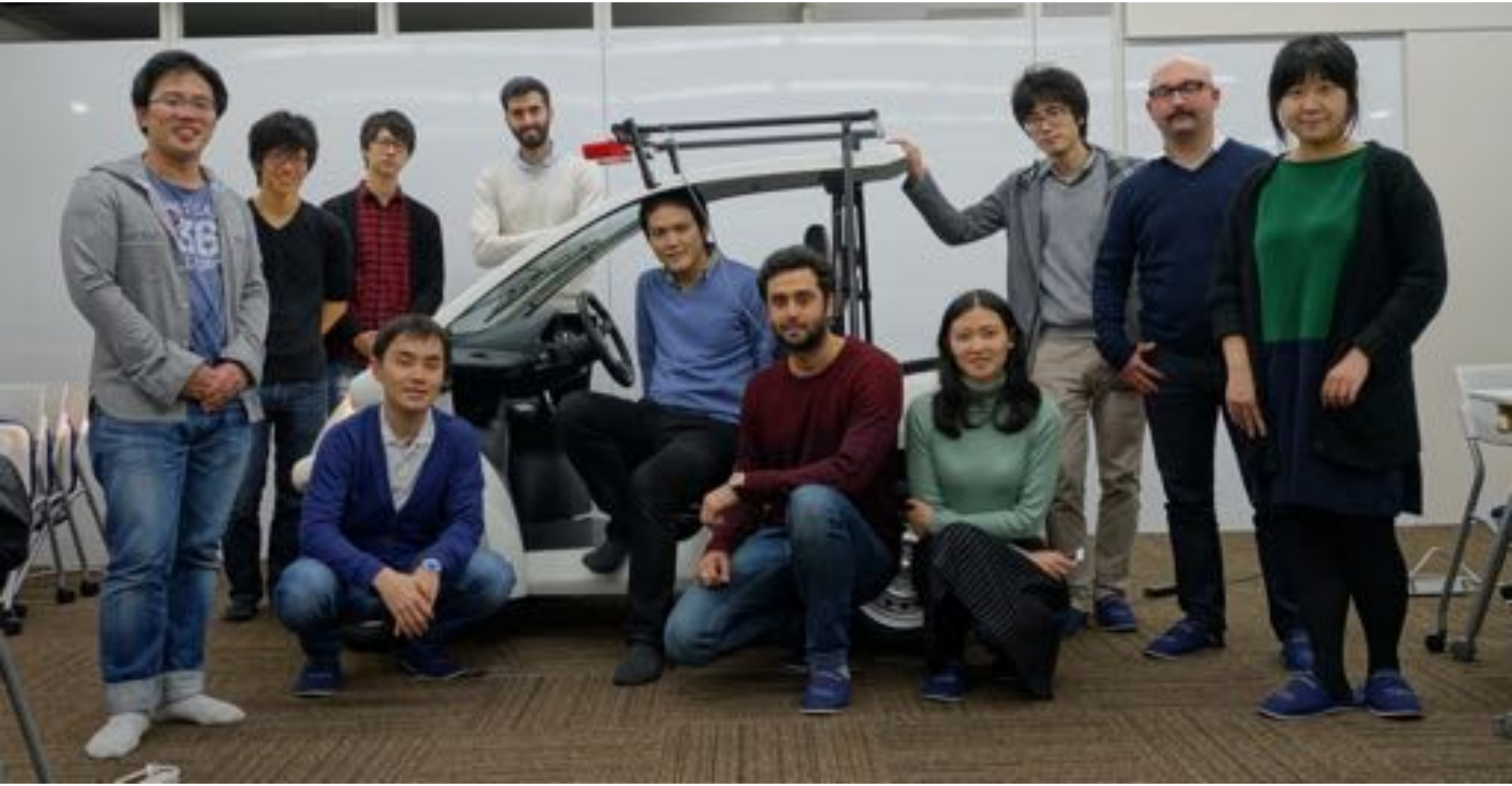
- 3 days near lake Yamanaka (Friday + Weekend)
- There are about 100 members in GCL
- 70% are participated in the camp
- To know the new members and each other

Next Generation Mobility Platform



- Validations, experiments, and demonstrations
- Of each GCL course students,
- On common mobility platform,

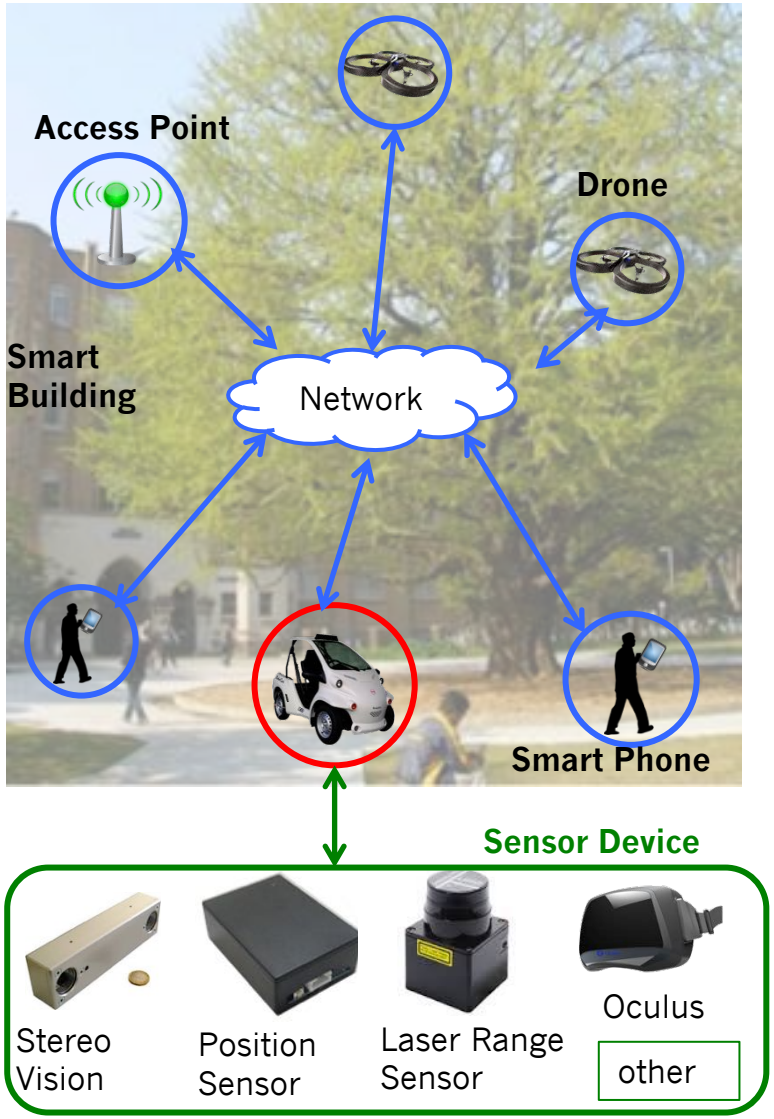
Autonomous Vehicle



http://www.zmp.co.jp/products/robocar-mv

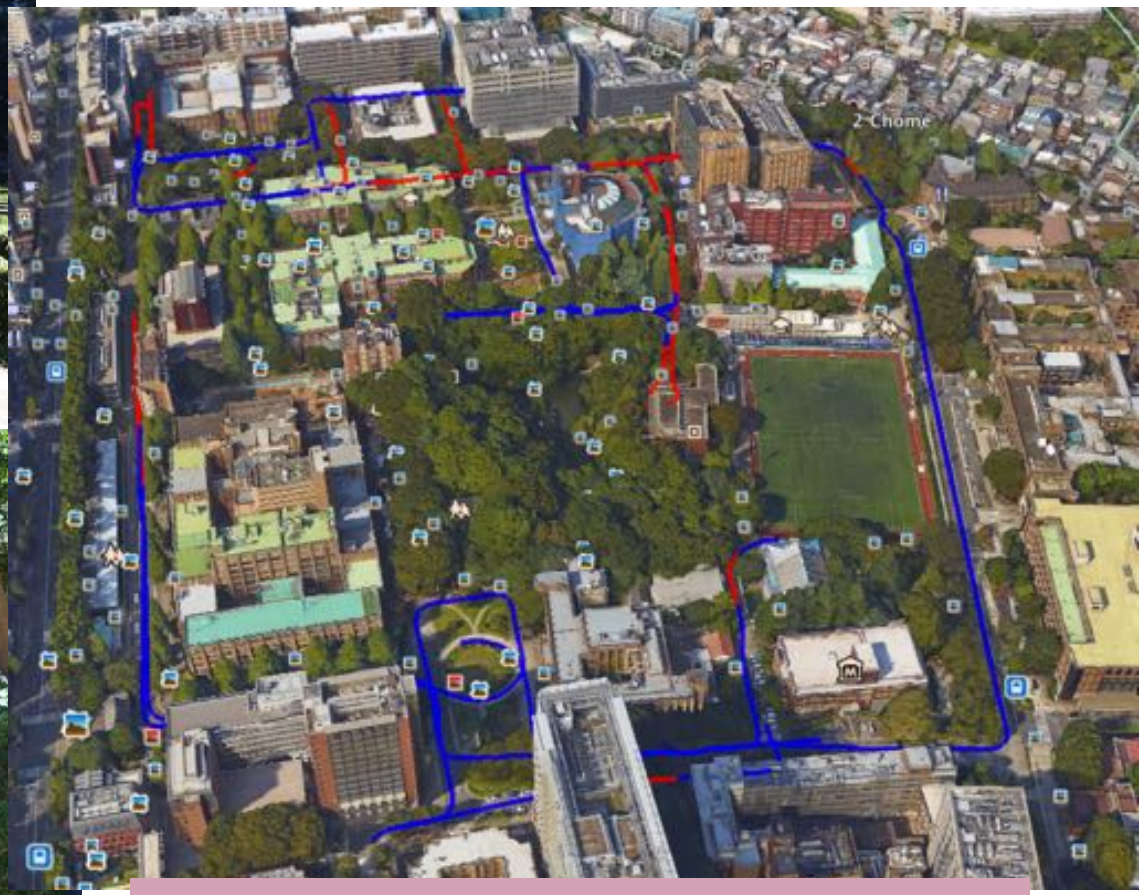
Smart Campus & Mobility

- Beyond road mobility
- Harmonization of human and mobility device in the life
- Focus on mobility service constricted upon autonomous driving but not autonomous driving it self



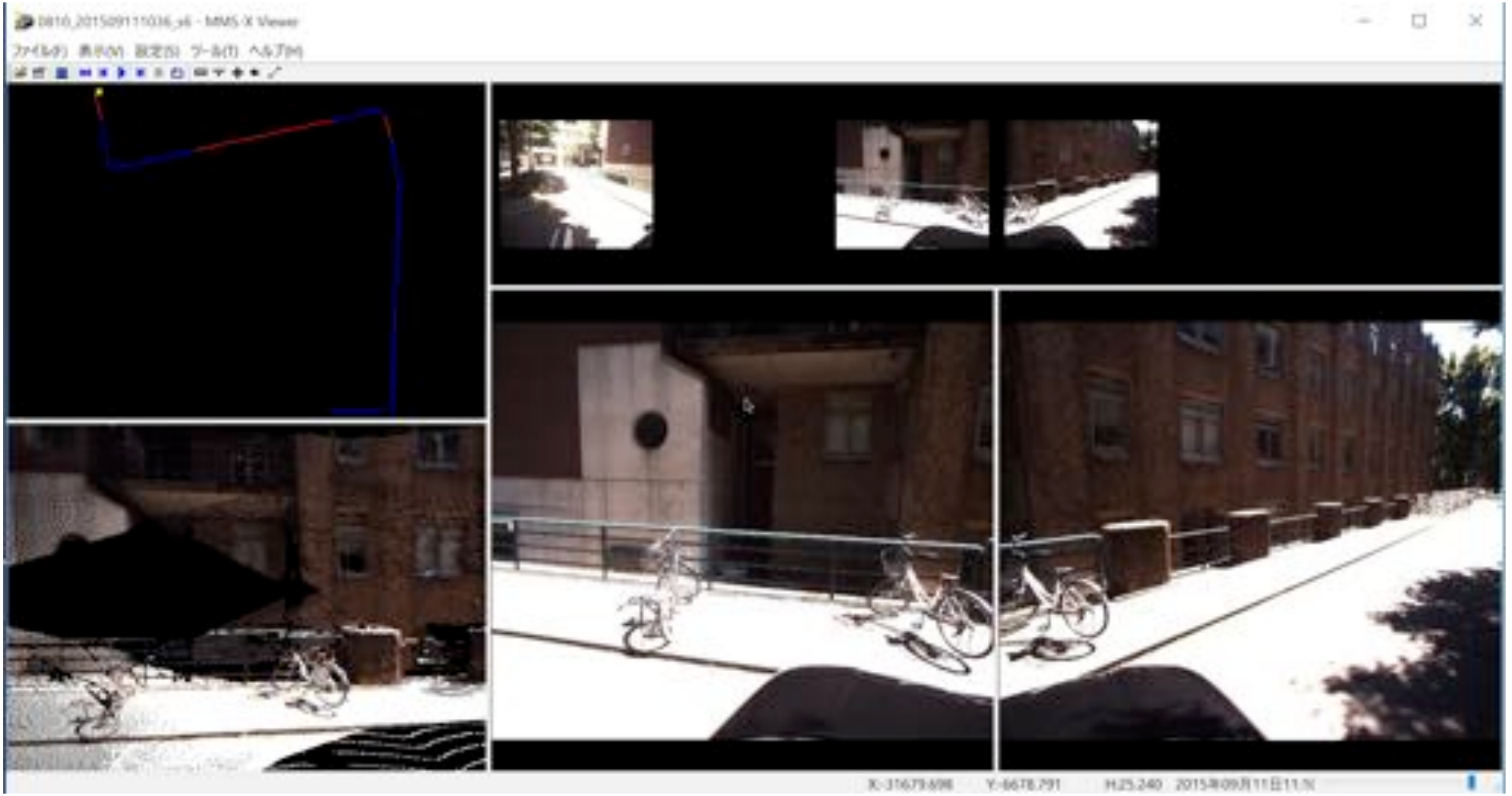
Point Cloud Measurement

mobile mapping system

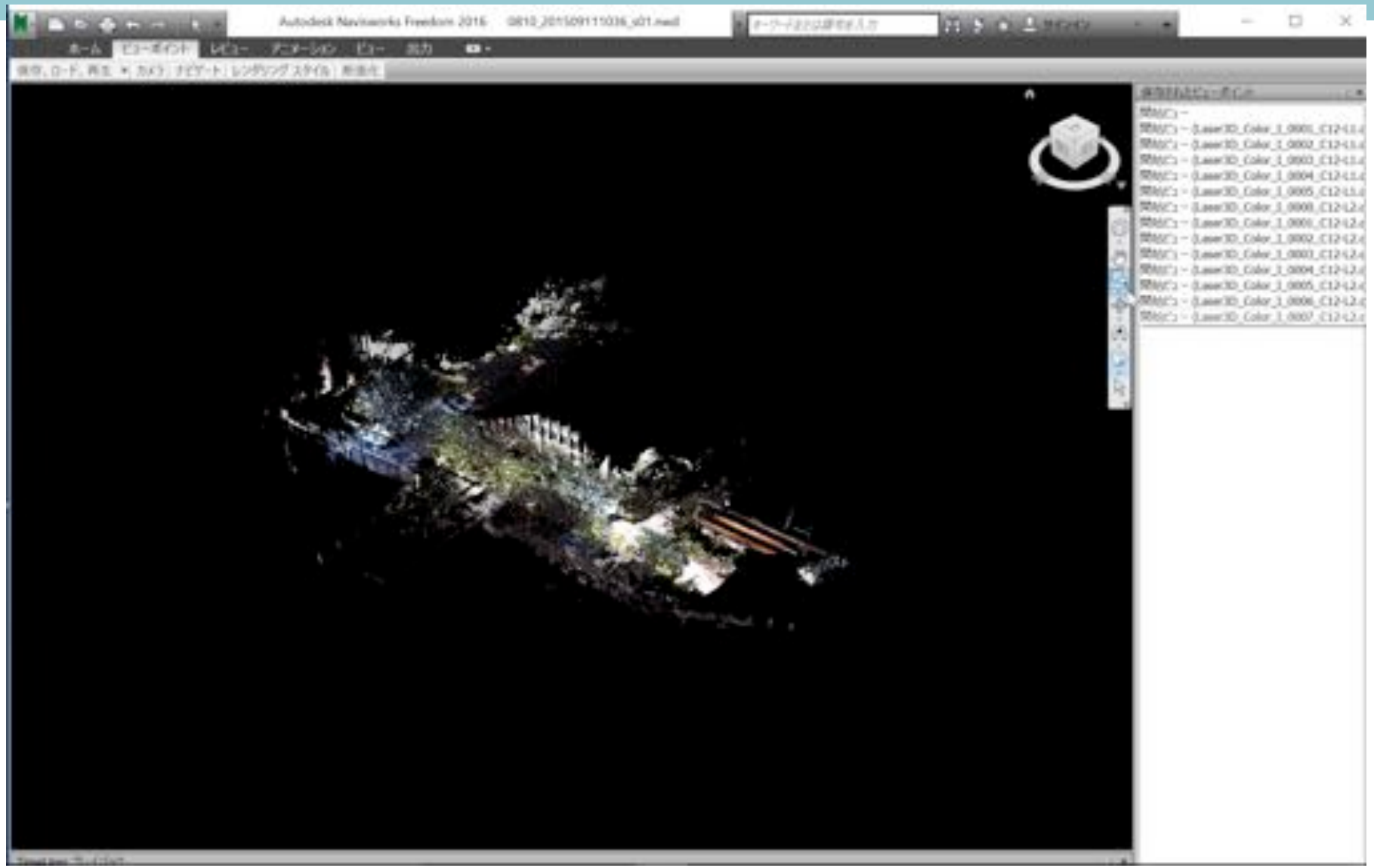


Hongo Campus, University of Tokyo

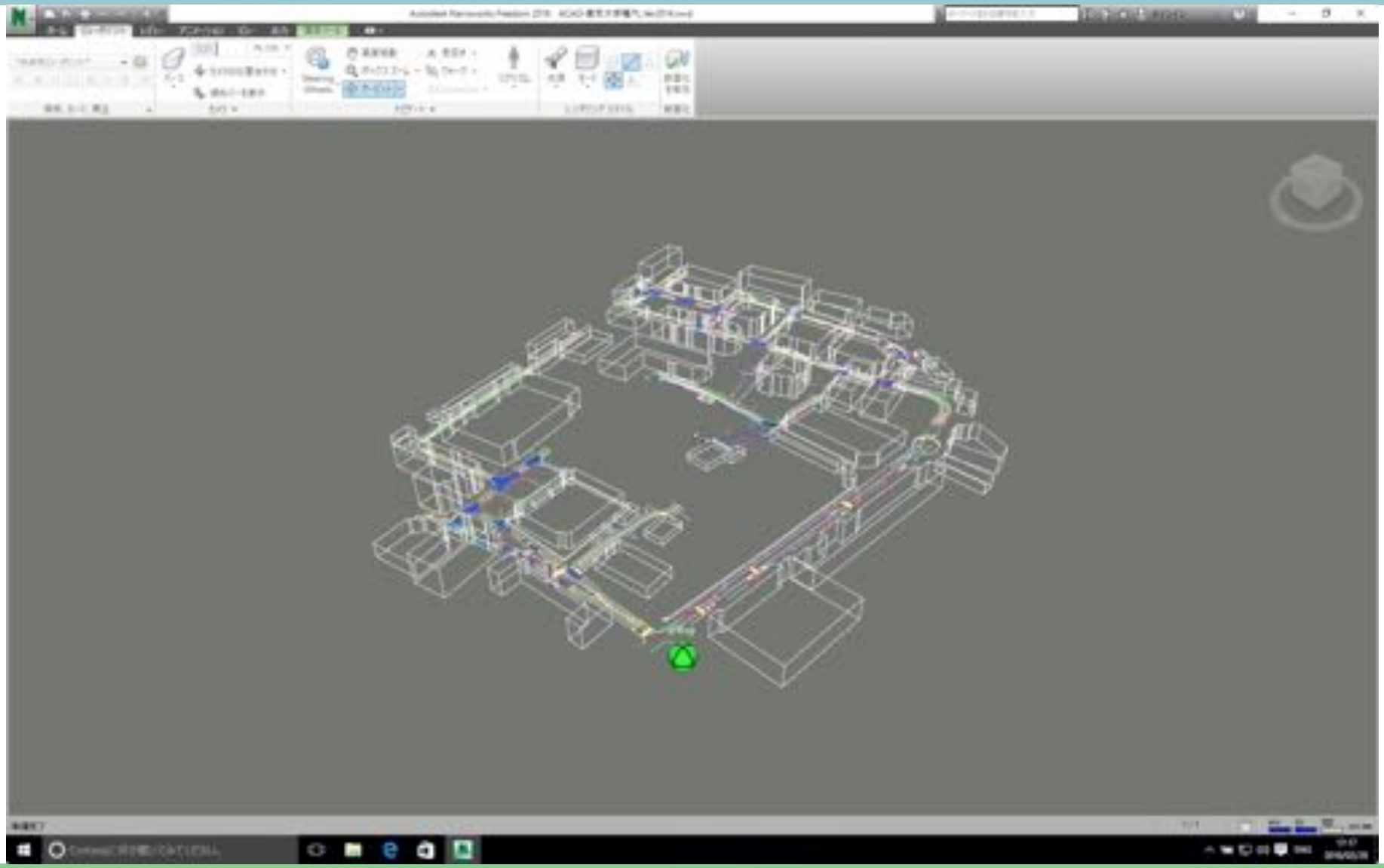
Point Cloud



Point Cloud

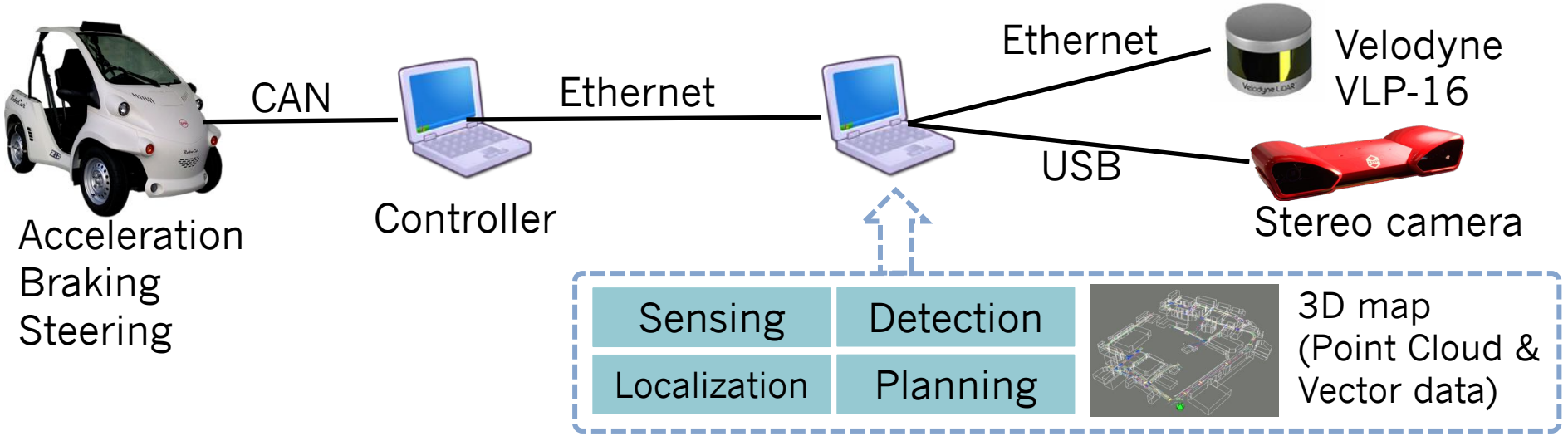

Autodesk Navisworks Freedom 2016
ホーム
ビューポイント
レビュー
アニメーション
ビュー
出力

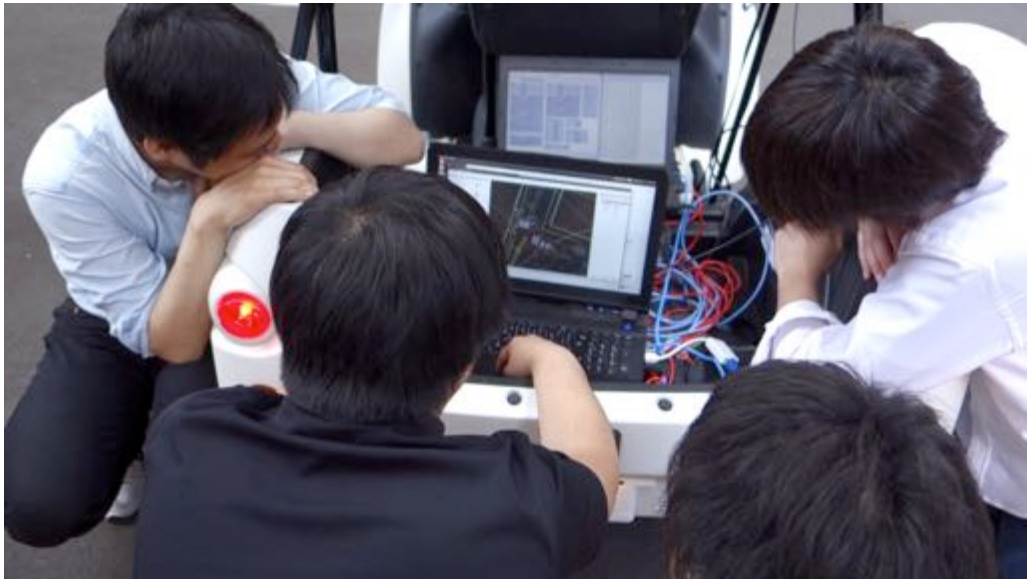
Vector data (ADASMap)



Field Test

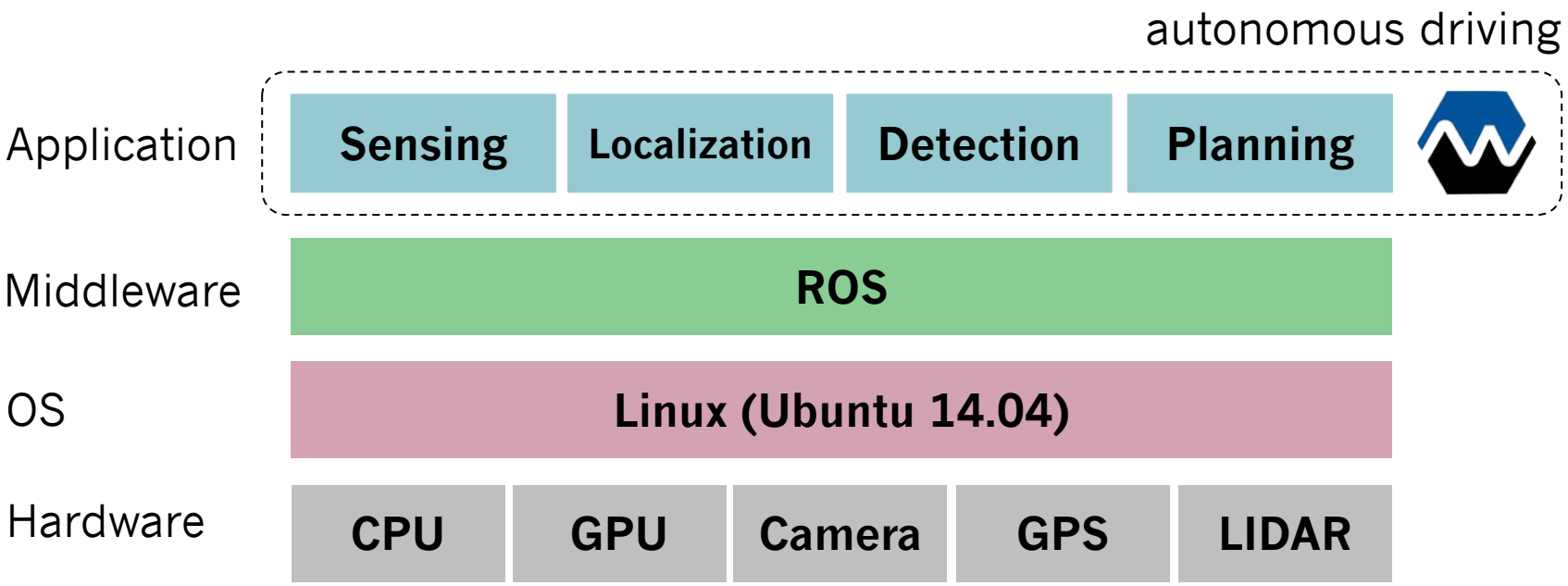
System Configuration





AutoWare

- Open-source software for urban autonomous driving
- Providing basic autonomous driving function based on ROS
- https://github.com/CPFL/Autoware



AutoWare


Interact
Move Camera
Select
Focus Camera
Measure
2D Pose Estimate
2D Nav Goal
Publish Point
Time
ROS Time: 1494474049.01
ROS Elapsed: 71.68
Wall Time: 1495186078.70
Wall Elapsed: 226.03
Experimental
Reset
Left-Click: Rotate. Middle-Click: Move X/Y. Right-Click: Move Z. Shift: More options.
9 fps

Thanks

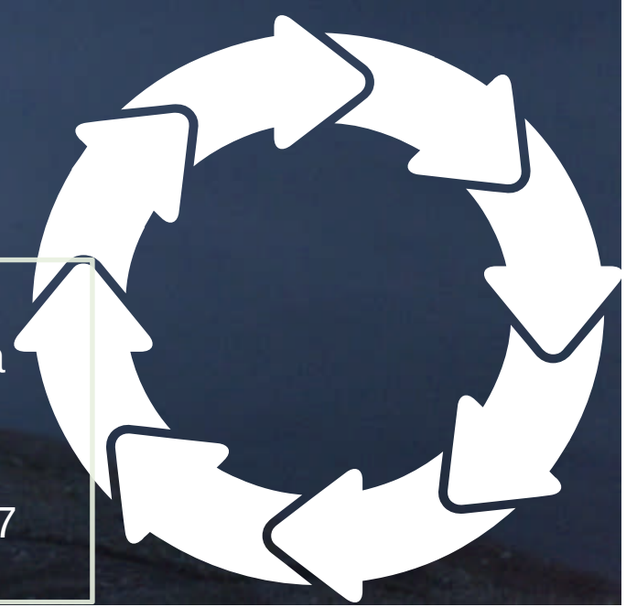
Manabu Tsukada

tsukada@hongo.wide.ad.jp

http://www.hongo.wide.ad.jp/~tsukada/

CONNECTED AND AUTOMATED VEHICLES IN INDIA

Rajat Kochhar
Ericsson , India
ICWMC'17
Nice , France
July 23-27 2017



AGENDA

1. BACKGROUND AND STATISTICS
2. INDIA'S READINESS FOR CONNECTED AND AUTOMATED VEHICLES
3. CHALLENGES AND REGULATORY HURDLES
4. ONGOING PROGRESS BY INDIAN COMPANIES
5. FUTURE..

BACKGROUND AND STATISTICS

- In last 15 years, we have seen entry of numerous global automotive players in India
- In 2000, only 16 car manufacturers were present in India and we will expect by 2020 around 55 car manufacturers to compete for business in India.
- India will be world’s 3rd biggest car market by 2020.
- Also , around 39 manufacturers will be making cars in India by 2020 serving both domestic and exports market taking it 4th spot in the world.

THE FLIP SIDE

- In India , road accidents kill nearly 400 people every day.
- Traffic congestion costs the economy a whopping $11Bn (£7.63Bn)..
- Despite this, only 1.4% of the total cars sold in 2015 (more than 2M) featured basic connectivity, let alone autonomous vehicles.
- Lack of 4G LTE connectivity till last year.
- Mass adoption of connectivity is tough in a cost driven market like India.
- Infrastructural roadblocks and lack of lane discipline .

THE SILVER LINING

- The Prime Minister’s ambitious plan of making 100 smart cities will give an impetus to further connected car developments in India.
- The government has also laid out plans to invest $1.7Tn by 2020 in upgrading its infrastructure to accommodate smart city projects, the majority of which will be dedicated to road networks
- Nationwide 4G LTE connectivity provided by multiple telecom operators.
- Few of the big conglomerates and a number of startups are working on making connected and autonomous cars a reality despite many infrastructural and regulatory hurdles.

THE LAW SAYS..

- The **Motor Vehicles (Amendment) Bill, 2016 :** “In order to promote innovation and research and development in the fields of vehicular engineering, mechanically propelled vehicles, and transportation in general, the central government may exempt certain types of mechanically propelled vehicles from the application of the provisions of this Act.”

- The bill was introduced in the Parliament in August, earlier year. It has since been referred to a parliamentary standing committee

- Once the law is cleared, India would harbor the capabilities to test any innovation across the transport industry, such as semi autonomous and fully autonomous vehicles, both passenger and commercial.

TATA ELXSI

- Tata Elxsi, part of India’s $100B+ Tata’s group is developing software platforms , software based driving aids and assistance systems to some of the world’s largest automakers.

- Tata Elxsi has licensed its software platform to one of the top five carmakers globally that will help hasten the development of their own driverless car.

- Tata Elxsi's middleware platform AUTONOMAI will act as an interface between the hardware such as stereoscopic cameras, radars and lidars and the artificial intelligence (AI) and machine learning algorithms that will be trained to react to complex driving scenarios.

- After training and feeding hundreds of photos, our system cannot identify 15 percent of the vehicles on the Indian road,” said Nitin Pai, senior vice president and head of strategy and marketing at Tata Elxsi. “The driverless car is ready for the road. But is the road ready for the car?

M&M DIGISENSE

- Mahindra & Mahindra Ltd (M&M Ltd), part of the $17.8-billion Mahindra Group, launched a technology platform called DiGiSENSE in August 2016

- This technology platform connects Mahindra vehicles, tractors, trucks and construction equipment to the cloud .

- The new platform has been conceived, developed and manufactured in India in collaboration with Tech Mahindra, Bosch and Vodafone.

- This service is particularly useful for companies such as Amazon and Flipkart to track their courier delivery and optimize the cost and time involved.

- With the possibility of over the air (OTA) upgrades, the technology can also be updated to support future functionalities.

REALTY CHECK & FUTURE ..

- Self-driving cars are a LONG way off . Such vehicles would be far too expensive for most Indian consumers.

- But there’s a bigger problem: autonomous cars need predictable conditions – and Indian conditions (as of now) are not.

- Connected driver assistance systems show strong potential to improve road safety, with little change to existing road infrastructure required.

- Fully autonomous shuttles could potentially operate within specific zones, such as university campuses , IT company campuses etc.

THANKS

IARIA INTERNET 2017

25/July/2017
Nice, France

How drivers use free time ?

Yasuhiko Watanabe
Ryukoku University

free time
created by autonomic vehicles
is used for communication with

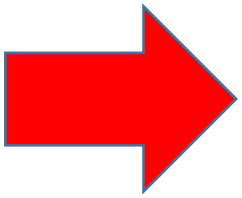
- specific persons
- general public

In order to
promote communication,
many of us disclose

- where we are
- what we like
- what we do

In order to
promote communication,
many of us disclose

- where we are
- what we like
- what we do



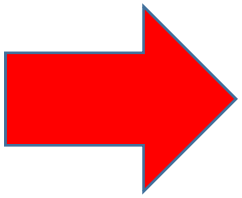
privacy risk

In order to use the INTERNET, many online users believe

[Viseu 2004]

- you do not disclose your personal info.
- but, your friend may disclose [he/she disclose personal info.]
  - where you are
  - what you are doing

Tom and I go together



privacy risk