Japanese-German Research Cooperation on Human Factors in Connected and Automated Driving

Progress report at Steering Committee
May 29, 2020

Satoshi Kitazaki, Ph.D., Japanese project coordinator
Klaus Bengler, Ph.D., German project coordinator
Work packages and tasks

WP1 / Task A: External communication
This WP/Task investigates effective ways to functionalize automated vehicles to be communicative with surrounding road users (e.g. pedestrians, cyclists) for safe and efficient traffic coordination. Understanding cultural differences in external communication in both countries is one of the focuses.

WP2 / Task C: Education and training
This WP/Task investigates education and training of potential users required for safe use of the systems. Existing education opportunities in both countries are considered for implementation.

WP3 / Task B: Drivers’ interaction with automated systems
This WP/Task investigates driver-system interactions in transitions between various levels ranging from Level 0 to Level 4 on restricted motorways as well as in local urban traffic. This work package understands human limitations and explores solutions for the safety problems.
## Collaboration partners

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<thead>
<tr>
<th></th>
<th>Japanese members</th>
<th>German members</th>
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<td><strong>External communication</strong></td>
<td><strong>Task A</strong></td>
<td><strong>WP1</strong></td>
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<tr>
<td></td>
<td>• Keio U</td>
<td>• TU Chemnitz</td>
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<td></td>
<td>• Tokyo BS Co.</td>
<td>• TU Dresden</td>
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<td><strong>Education and training</strong></td>
<td><strong>Task C</strong></td>
<td><strong>WP2</strong></td>
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<td>• U of Tsukuba</td>
<td>• TU Dresden</td>
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<td>• Kumamoto U</td>
<td>• TU Munich</td>
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<td></td>
<td>• Tokyo BS Co.</td>
<td>• DLR</td>
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<tr>
<td>**Drivers’ interaction with</td>
<td><strong>Task B</strong></td>
<td><strong>WP3</strong></td>
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<tr>
<td>automated systems</td>
<td>• AIST</td>
<td>• TU Munich</td>
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<td></td>
<td>• U of Tokyo</td>
<td>• Ulm U</td>
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</tbody>
</table>

**Collaboration partners**

![Collaboration Partners Logos]

**Task A**
- Keio University
- Tokyo BS Co.

**Task C**
- U of Tsukuba
- Kumamoto University
- Tokyo BS Co.

**Task B**
- AIST
- U of Tokyo

**Task WP1**
- TU Chemnitz
- TU Dresden
- Ulm University
- TU Munich
- DLR

**Task WP2**
- TU Dresden
- TU Munich

**Task WP3**
- TU Munich
- Ulm University
Biannual workshops

■ CAD JapanGermany – HF Workshop#1
  • November 11, 2019     Tokyo
  • Kick-off and exchanging research plans of both sides
  • Lab visits and meetings (full day)
    November 15     Keio University
    November 18     AM: University of Tsukuba, PM: AIST

■ CAD JapanGermany – HF Workshop#2
  • May 11-13, 2020     3-4 hours of web meeting each day
    (originally planned to be held in Ulm)
  • Exchanging research progresses of both sides
  • Discussion for next actions
WP1/Task A: External communication

**Germany: TUC, TUM, TUD, UU and DLR**

a. What do drivers use to predict cyclist behaviour?
b. What requirements for external communication result from a multi pedestrian environment?
c. Does context influence comprehension of eHMI icons?
d. When and why do drivers decide to behave cooperatively?
e. Extraction of interaction and cooperation patterns in mixed urban traffic.

**Japan: Keio U**

f. Understanding communication between road users and low speed AVs in last-mile services.
g. Investigation of negative effects of communication between AV and surrounding road users.
WP2/Task C: Education and training

- **Germany: TUM and TUD**
  a. Literature review
  b. Investigation of impact on driving schools (practical considerations)
  ※ Automated driving not yet implemented in driving schools.

- **Japan: U of Tsukuba and Kumamoto U**
  c. Establishing an education strategy
  d. Investigation of education contents
WP3/Task B: Drivers’ interaction with automated systems

- **Germany: TUM and UU**
  a. How should Minimal Risk Maneuvers be designed and how should MRM be communicated to the driver?
  b. Investigation of the transition and task switching process.
      Use and investigation of task sharing.

- **Japan: AIST and U of Tokyo**
  d. Investigation of HMI supporting driver’s OEDR task and driver-initiated transitions

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Task sharing:
“[...] the vehicle can cooperate with the driver to maintain the automated driving functionality”
(Walch et al., 2016, p. 262)

Automated driving Manual driving Automated driving

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- Transition type A
  - Level 3/4 → OEDR
  - OEDR → Level 0
  - Engage in NDRA
  - Monitor the surrounding environment
  - Lane-change
  - VMS (Variable Message Sign)

- RTI

- Engage in NDRA
  - Playing a tablet game

- Advance announcement of a transition (Auditory message)

- OEDR

- Undetected motorcycle
  - Intrusion from non-priority road

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Federal Ministry of Education and Research
Next actions

- More frequent communication for each WP/Task will be planned.
- Series of webinars will start (see below). The webinars will be open to students and maybe to public.
- Exchanging staff and students is postponed due to COVID-19.
- Joint workshops at international conferences are postponed or transferred to online.
- CAD JapanGermany-HF Workshop#3 will be held in the fall 2020. We want to have an in-person workshop in Tokyo and the decision will be made later.

Possible topics of webinars by German partners.

<table>
<thead>
<tr>
<th>Possible lectures (web or visit)</th>
<th>Lecturer</th>
<th>Time (min)</th>
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</thead>
<tbody>
<tr>
<td>TUM</td>
<td>Shared Control paradigms for automated driving</td>
<td>Klaus Bengler</td>
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<td></td>
<td>Wizard of Oz experiments</td>
<td>Klaus Bengler</td>
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<tr>
<td>TUChemitz</td>
<td>Human Factors in Automated Driving/Systems (visit/web)</td>
<td>Ackermann, C. Krems, J.</td>
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<td></td>
<td>Research Methods (Video Simulation, Psycho-physics, Driving Simulator, etc.) (visit)</td>
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<td>Comfort and Driving Style (visit/web)</td>
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<td>Interaction between highly automated cars and VRU (visit/web)</td>
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<td>Ulm U</td>
<td>Cooperative Human-Machine Interaction</td>
<td>Martin Baumann</td>
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<td>Interaction and cooperation between vehicles from a psychological human factors perspective</td>
<td>Linda Miller</td>
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<td></td>
<td>Driver-vehicle interaction and transitions during automated driving</td>
<td>Aminin Leitner</td>
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<td>TU Dresden</td>
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<td>DLR</td>
<td>Webinar eHMI: Results of the EU-Project interACT</td>
<td>Wilbrink, M. / Oehl, M. Schießl, C. / Theisen, M.</td>
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<td></td>
<td>Webinar / joint workshop: implicit communication, interaction and cooperation --&gt; Human performance, models (patterns, indicators), methodologies</td>
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Possible topics of webinars by Japanese partners.

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<tr>
<td>U of Tsukuba</td>
<td>Human-automation interaction (web)</td>
<td>Makoto I.</td>
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<td></td>
<td>Shared Control (visit)</td>
<td>Yuichi S.</td>
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<tr>
<td></td>
<td>Education and Training for Automated Driving (visit)</td>
<td>Heping Z.</td>
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<tr>
<td>Keio U</td>
<td>Design and evaluation of HMI of GV Cooperative Safety System (web)</td>
<td>Tatsuru Daimon</td>
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<td>Deployment of connected and automated vehicle in Rural Japan - Strategic spatial planning, governance and</td>
<td>Tomoyuki Furutani</td>
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<td>Tokyo U</td>
<td>Evaluation of HMI for ADAS/CAV</td>
<td>Kimihiko N.</td>
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<tr>
<td>U of Kumamoto</td>
<td>Effects of Learning Media</td>
<td>Yoshikazu G.</td>
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<td>AIST</td>
<td>ISO21959 Part 1 and Part 2 Human performance and state in the context of automated driving</td>
<td>Satoshi K. &amp; Klaus Bengler</td>
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<td></td>
<td>Innovation and Invention (MOT)</td>
<td>Satoshi K.</td>
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<td>Human-Centered Engineering: Practical applications</td>
<td>Satoshi K.</td>
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<td></td>
<td>Summary of SIP-adus Phase 1 &amp; Phase 2 projects</td>
<td>Satoshi K.</td>
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<td>Visual attention in experimental psychology</td>
<td>Ken Kihara</td>
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<td>Driver behavior model</td>
<td>Toshihiro Sato</td>
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Coordinators’ overall opinions

Satoshi Kitazaki

- The collaboration has been successful and will continue growing to produce several joint research.
- It is a great contrast that the research in the German consortium tends to be science oriented, whereas the research in the Japanese consortium tends to be solution oriented. Integration of findings from these two strategies will strengthen safety and comfort of automated driving.

Klaus Bengler

- Since the 2019 kickoff the collaboration network could be further established on the individual level – regardless COVID19
- Project type and collaboration format receive great interest and positive feedback in the international community
- The national research discussion benefits from this international collaboration