A Survey Protocol

Instructions are bold.

[**CONSENT FORM**]

A.1 Phase 1

[**QUALIFICATION**]

Next, we will introduce the concepts of CAVs and V2X, respectively. Please read the descriptions carefully. When you are confident that you understand each concept, click the "Next" button to answer a few questions about it.

Connected autonomous vehicles (CAVs) are **connected vehicles that have self-driving capabilities**. CAVs use reliable low latency wireless network (such as 5G) and a wide range of sensors (such as internal and external cameras, Lidar, Radar, Ultrasound sensors and GPS) to **exchange information with other vehicles, pedestrians and the infrastructure**. At the same time, the CAVs' driving control occurs **without direct input from the drivers** and thus relieve their workload in driving. For example, when a CAV breaks suddenly, it can transmit a notice to vehicles behind that enables those vehicles to warn their drivers to stop, or automatically apply brakes if a crash is imminent.

Q1. CAVs use wireless communication to share information about themselves with **the infrastructure and other road users**, such as pedestrians and bicyclists.

- ◦ True
- ◦ False
- ◦ Prefer not to answer

Q2. In case there is an emergency, drivers still need to monitor the CAVs **all the times** and react by themselves.

- ◦ True
- ◦ False
- ◦ Prefer not to answer

Q3. CAV is a term used to describe vehicles that are both **connected and automated**.

- ◦ True
- ◦ False
- ◦ Prefer not to answer

CAVs offer opportunities to improve safety for surface transportation and to improve system efficiency by allowing real-time communication with any entity that may affect, or may be affected by, the vehicle. **Vehicle-to-everything (V2X)** is a vehicular communication system that incorporates other more specific types of communication such as **vehicle-to-infrastructure (V2I), vehicle-to-vehicle (V2V), and vehicle-to-pedestrian (V2P)**.

For example:

- **vehicle-to-infrastructure (V2I)** technologies capture vehicle-generated traffic data, wirelessly providing information such as dynamic notifications from the infrastructure to the vehicle that inform the driver of safety, mobility, or environment-related conditions;
- **vehicle-to-vehicle (V2V)** communication enables vehicles to wirelessly exchange information about their speed, location, and heading, and shows great promise in helping to avoid crashes, ease traffic congestion, and improve the environment;
- **vehicle-to-pedestrian (V2P)** communication allows reciprocal broadcast among CAVs and road users (such as pedestrians and bicyclists) so that they can anticipate each others' maneuvers and prevent possible collisions upfront.

Vehicle-to-everything (V2X) can be applied to various situations for different purposes, such as **infotainment, comfort and convenience**; **traffic management**; **road safety**; and **autonomous driving applications**.

Q1. Vehicle-to-infrastructure (V2I) communication will not only help the CAV **obtain the road information forward**, but also require CAVs to **send their information** such as location, speed, planned route, to help a systematic-level traffic management.

- ○ True
- ○ False
- ○ Prefer not to answer

Q2. Vehicle-to-vehicle (V2V) communication will **only** help a CAV receive other vehicles' information for path planning and trajectory prediction but won't send its own information.

- ○ True
- ○ False
- ○ Prefer not to answer

Q3. Vehicle-to-pedestrian (V2P) will **only** inform CAV drivers of the coming pedestrians, but will not warn pedestrians of the coming vehicles.

- ○ True
- ○ False
- ○ Prefer not to answer

Q4. Please select all V2X applications mentioned in the previous description:

- ☐ Infotainment, comfort and convenience
- ☐ Traffic management
- ☐ Road safety
- ☐ Energy consumption reduction
- ☐ Autonomous driving applications
- ☐ Prefer not to answer

[**PRIMING**]

Potential privacy risks of V2X applications:
(For both priming conditions)

The implementation of V2X is inseparable from collecting a wide variety of data. Vehicle-related information such as whereabouts, driver-related information such as in-vehicle activities, and data about nearby pedestrians and vehicles will be collected. Much like existing computers, smartphones, and tablets, the data collection inside and outside CAVs can cause **potential privacy risks** and is **subject to further inferences and analysis** with the help of algorithms and models. For example, a CAV user's home and workplace addresses can be estimated by inferring the CAV's whereabouts. Personal identifiable information will be involved in most authentication processes, thus subject to **privacy leakage**.

Potential security risks of V2X applications:
(For the privacy&security-priming condition only)

Moreover, V2X is mainly implemented through wireless communication, making it **vulnerable to various security issues and threats**. For example, infrastructure signs such as speed limit **could be changed, added, or removed** through V2X communication. It may cause **false reaction or no reaction** of a CAV and lead to **traffic disturbance, collision, and congestions**.

A.2 Phase 2

Next, we will present 4 different service scenarios of V2X applications in CAVs. Suppose that you are driving one of the CAVs. For each scenario, please 1) read the description carefully at first; and 2) then answer all the questions below it.

[**SCENARIOS 1-4**]

Q1. I believe it is **beneficial to share my data** to use the service described in the scenario.

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Somewhat disagree (3)
- ○ Neutral (4)
- ○ Somewhat agree (5)
- ○ Agree (6)

- Strongly agree (7)
- Prefer not to answer

Q2. I have **privacy concerns to share my data** to use the service described in the scenario.
- Strongly disagree (1)
- Disagree (2)
- Somewhat disagree (3)
- Neutral (4)
- Somewhat agree (5)
- Agree (6)
- Strongly agree (7)
- Prefer not to answer

Q3. I believe it is **beneficial to receives external data** to use the service described in the scenario. [*privacy&security condition only*]
- Strongly disagree (1)
- Disagree (2)
- Somewhat disagree (3)
- Neutral (4)
- Somewhat agree (5)
- Agree (6)
- Strongly agree (7)
- Prefer not to answer

Q4. I have **security concerns to receive external data** to use the service described in the scenario. [*privacy&security condition only*]
- Strongly disagree (1)
- Disagree (2)
- Somewhat disagree (3)
- Neutral (4)
- Somewhat agree (5)
- Agree (6)
- Strongly agree (7)
- Prefer not to answer

Q5. I am **willing to share my data** to use the service described in the scenario.
- Strongly disagree (1)
- Disagree (2)
- Somewhat disagree (3)
- Neutral (4)
- Somewhat agree (5)
- Agree (6)
- Strongly agree (7)
- Prefer not to answer

Q6. I am **confident** in my decision of whether to share my data to use the service described in the scenario.
- Strongly disagree (1)
- Disagree (2)
- Somewhat disagree (3)
- Neutral (4)
- Somewhat agree (5)
- Agree (6)
- Strongly agree (7)
- Prefer not to answer

Q7. **Open-ended question of your willingness to share the data:** you selected [choice] when answering your agreement to share data to use the described service in the scenario. In your own words, please briefly explain why you made the decision.

A.3 Phase 3

In the end, please answer questions about your demographic information and driving related experience.

Q1. How old are you?
- ◦ Under 18 years old
- ◦ 18 - 24 years old
- ◦ 25 - 34 years old
- ◦ 35 - 44 years old
- ◦ 45 - 54 years old
- ◦ 55 - 64 years old
- ◦ 65+ years old
- ◦ Prefer not to answer

Q2. How do you describe yourself?
- ◦ Male
- ◦ Female
- ◦ Non-binary / third gender
- ◦ Prefer to self-describe:

  ☐
- ◦ Prefer not to answer

Q3. What's your ethnicity?
- ◦ American Indian / Alaska Native
- ◦ African / African American
- ◦ Native Hawaii / Pacific Islander
- ◦ Hispanic / Latino
- ◦ Caucasian
- ◦ Asian
- ◦ More than one race
- ◦ Other / Unknown
- ◦ Prefer not to answer

[EXPERIENCE WITH DRIVING ASSISTANT AND CONNECTIVITY FUNCTIONS]

Q4. Have you ever used connectivity functions inside the vehicles, such as Google Android Auto, Apple CarPlay, GM OnStar, or Ford SYNC?
- ◦ No, not at all (1)
- ◦ No, rarely (2)
- ◦ Yes, sometimes (3)
- ◦ Yes, quite often (4)
- ◦ Prefer not to answer

Q5. Have you ever used driving assistance functions, such as automatic parking, cruise control or adaptive cruise control (ACC)?
- ◦ No, not at all (1)
- ◦ No, rarely (2)
- ◦ Yes, sometimes (3)
- ◦ Yes, quite often (4)
- ◦ Prefer not to answer

Q6. How many years have you been driving?
- ◦ <2 years
- ◦ 2 - 5 years
- ◦ 5 - 10 years
- ◦ >10 years
- ◦ Prefer not to answer

Q7. What is your average mileages per year?
- ◦ <2,000 miles
- ◦ 2,000 - 5,000 miles
- ◦ 5,000 - 10,000 miles

- 10,000 - 20,000 miles
- >20,000 miles
- Prefer not to answer

Q8. Which option best describes your trust in the V2X communication?
- Completely distrust (1)
- Distrust (2)
- Unsure (3)
- Trust (4)
- Completely trust (5)
- Prefer not to answer

Finally, please answer 11 questions about your opinions on privacy issues in general.

Please indicate your agreement on the following descriptions on a 7-point Likert scale, "1" meaning "Strongly Disagree" and "7" meaning "Strongly Agree":

Q1. Companies seeking information should disclose the way the data are collected, processed, and used.
- Strongly disagree (1)
- Disagree (2)
- Somewhat disagree (3)
- Neutral (4)
- Somewhat agree (5)
- Agree (6)
- Strongly agree (7)
- Prefer not to answer

Q2. A good privacy policy should have a clear and conspicuous disclosure.
- Strongly disagree (1)
- Disagree (2)
- Somewhat disagree (3)
- Neutral (4)
- Somewhat agree (5)
- Agree (6)
- Strongly agree (7)
- Prefer not to answer

Q3. It is very important to me that I am aware and knowledgeable about how my personal information will be used.
- Strongly disagree (1)
- Disagree (2)
- Somewhat disagree (3)
- Neutral (4)
- Somewhat agree (5)
- Agree (6)
- Strongly agree (7)
- Prefer not to answer

Q4. It usually bothers me when companies ask me for personal information.
- Strongly disagree (1)
- Disagree (2)
- Somewhat disagree (3)
- Neutral (4)
- Somewhat agree (5)
- Agree (6)
- Strongly agree (7)
- Prefer not to answer

Q5. When companies ask me for personal information, I sometimes think twice before providing it.
- Strongly disagree (1)

- Disagree (2)
- Somewhat disagree (3)
- Neutral (4)
- Somewhat agree (5)
- Agree (6)
- Strongly agree (7)
- Prefer not to answer

Q6. It bothers me to give so many personal information to so many companies.
- Strongly disagree (1)
- Disagree (2)
- Somewhat disagree (3)
- Neutral (4)
- Somewhat agree (5)
- Agree (6)
- Strongly agree (7)
- Prefer not to answer

Q7. I'm concerned that companies are collecting too much personal information about me.
- Strongly disagree (1)
- Disagree (2)
- Somewhat disagree (3)
- Neutral (4)
- Somewhat agree (5)
- Agree (6)
- Strongly agree (7)
- Prefer not to answer

Q8. Online companies should not use personal information for any purpose unless it has been authorized by the individuals who provided information.
- Strongly disagree (1)
- Disagree (2)
- Somewhat disagree (3)
- Neutral (4)
- Somewhat agree (5)
- Agree (6)
- Strongly agree (7)
- Prefer not to answer

Q9. When people give personal information to an online company for some reason, the online company should never use the information for any other reason.
- Strongly disagree (1)
- Disagree (2)
- Somewhat disagree (3)
- Neutral (4)
- Somewhat agree (5)
- Agree (6)
- Strongly agree (7)
- Prefer not to answer

Q10. Online companies should never sell the personal information in their computer databases to other companies.
- Strongly disagree (1)
- Disagree (2)
- Somewhat disagree (3)
- Neutral (4)
- Somewhat agree (5)
- Agree (6)
- Strongly agree (7)
- Prefer not to answer

Q11. Online companies should never share personal information with other companies unless it has been authorized by the individuals who provided the information.

- ◦ Strongly disagree (1)
- ◦ Disagree (2)
- ◦ Somewhat disagree (3)
- ◦ Neutral (4)
- ◦ Somewhat agree (5)
- ◦ Agree (6)
- ◦ Strongly agree (7)
- ◦ Prefer not to answer