Slide 1

The research proposal focus on the cyber security and ethical considerations of data-driven technology on the wheel, through the society's lense. As the data- driven technology on the wheel, here we consider connected and autonomous vehicles on the road and railway in Denmark.

Slide 2

Background

Recent breakthroughs in advanced digitalisation techniques in machine learning (ML) and artificial intelligence (AI) to emulate human cognitive capabilities, have had an ever-increasing impact on new generations of vehicles. By providing connected semi-autonomous and autonomous mobility capabilities, the technological breakthrough is looking to significantly challenge, and alter existing behaviours and practices in our society.

Beyond the undeniable benefits, such as transit towards more efficient, greener and smarter mobility of connected autonomous technology, the question of this technology's privacy, ethicality, safety and cyber security, which is also intended to function with limited human surveillance, has emerged.

(European Union Agency for Network and Information Security, 2015) Rios-Torres & Malikopoulos, 2016; Clements & Kockelman, 2017; Fu et al., 2020; Liu et al., 2020; European Union Agency for Cybersecurity, 2021; Sun et al., 2021).

Slide 3

Problem Definition and Motivation

For a country perspective, in 2018 the Minister of Transport's Expert Group in Denmark, identified three development paths:

1. Gradual automation of passenger cars.

2. Completely self-driving taxis.
3. Self-driving public transport as future perspectives for the transport system in light of automation and new business models.

Point number 01 - Today, Denmark is far ahead with digitalisation. Curretnly, there are autonomous metro in Copenhagen, and Aalborg is experimenting with self-driving buses, while Copenhagen is looking forward to experiencing a self-driving electric shuttles service combining intelligent autonomous technology and sustainable urban planning.

Thus, in the long run, development, where buses, self-driving taxis, and minibuses are all part of Mobility-as-a-Service (MaaS), is expected. MaaS - Mobility-as-a-Service integrates diverse transport services into a single service provider with on-demand accessibility complementing a high-class public transport service model around the rider's choices. MaaS allow riders to plan, book, and pay for their trips simultaneously.

(Ho et al., 2018; Ministry for Transport, Building, and Housing, 2018; Railway Technology, 2018; Connectedautomateddriving.eu, 2020; EU Commission, 2020; Hensher & Mulley, 2021; Zhao et al., 2021)

Point number 02 - Implementing new mobility technologies has implications for society, while social factors also can influence mobility decisions.

Point number 03 - Realising the full potential of technology transition demands understanding the society's resposen, while analysing holistic benefits to society and the economy. Thus, a focus on society and its behaviour is paramount to the future of mobility and technology adaptation.

(Baccarella et al., 2021; Chehri & Mouftah, 2019; Government Office for Science, 2019)

Point number 04 - Vehicle-to-vehicle and vehicle-to-infrastructure communication based on semi-autonomous and autonomous mobility technology imply the processing and storage of sensitive personal data. This raises several unanswered questions in relation to

data processing, privacy, and regulations. Further, letting a computer in charge of mobility also gives rise to cybersecurity concerns.

As societies are approaching the prospect of technological development and use of data with caution without guaranteeing safety and secure functioning of transportation, those investments in new technologies could be questionable.

(Nash et al., 2017; Council of Europe, 2020; Pangbourne et al., 2020),

Point number 05 - Given the high confidence the Danish society placed on the government and public sector, it is important to integrate these technologies in a way that aligns with the public and political views. Thus, assessing public view and understanding on semi-autonomous and autonomous mobility technology seems relevant.

(Ministry of Finance and Ministry of Industry, Business and Financial Affairs, 2019)

Slide 4

Recent Related Works

Considering the most recent related works on social perception in autonomous mobility, the following studies can be highlighted.

Chinen et al, in 2020 highlight the changes to perception of the participant after a riding experience in emergency mobility services.

A study of public perception on the responsibility for autonomous vehicle (AV) led incidents by Le Rette et al. in 2021 - concluded that many people expect AVs should be programmed to handle challenging road infrastructure. However, only a few respondents consider AVs to be safe currently.

In 2020 Yuen et al. used theory of planning behavior to understand public acceptance of AVs involving 526 residents in Seoul, Korea. Here, the cumulative effect of attitude, influence, behavioral control, relative advantage, subjective norms, compatibility affect AVs public acceptance.

To conclude, the study by Goldbach et al. in 2022, highlight the paying sufficient attention to qualitative actors.

Slide 5

Research Gaps in the existing literature

A review of the current research on the topics revealed the following research gaps

- ✓ Existing reports in Denmark have focused on threat assessment and implementation of effective cybersecurity policies and practices in public transportation management (Center for Cyber Security, 2021a; Center for Cyber Security, 2021b). Yet understanding the society's perception of the technology has not been conducted.

- ✓ Understanding of who should have final governance on AI ethics? Will it be government, corporations or consumers are yet to be decided.

- ✓ Will AI lead to questioning the human decision-making process in the long run, and whether will it impact society as a whole is yet to be examined.

- ✓ Further there is limited understanding of the public perception on technology from different demographic segments of the society, including disabilities groups, age groups, occupational groups, socioeconomic status groups, or geographic groups (urban, rural, suburban).

- ✓ Lastly but not least, a holistic perspective on semi-autonomous and autonomous mobility technology is lacking in Denmark, integrating society's view. Yet such a holistic perspective is beneficial to move forward with transparency and understanding as a country and as a society.

Slide 6

The Purpose of the research is to gain a holistic view of the impact of connected and autonomous technology in transportation on Danish society from a society's point of view.

In doing so, the First Objective is

- ✓ To understand if and under what conditions people intend to use connected and autonomous transportation.

The Second Objective is

- ✓ To identify society's perception on rules and ethics governing connected and autonomous technology and its implication for shaping the norms of future society and technology.

Lastly to

- ✓ To understand society's perception on privacy and cyber security around connected and autonomous technology. How the society perceive its implication in shaping the norms of future society and technology?

Slide 7

The research questions will be focus on 03 main areas.

The first question

- ✓ What are the most concerning facts around connected and autonomous technology in roads and railways?

The second question

- ✓ Based on the finding from the first question, in the context of Danish society, how do demographic factors such as gender, age, prior experience with technology, social-economic status, and education level affect attitudes and intentions towards connected and autonomous technology in transportation?

The third question

- ✓ How does society perceive the implication of connected and autonomous technology on shaping the norms of future society and technology?

Slide 8

The methodology will base on two main focus areas.

Literature Study and Questionnaire base survey

- ✓ As inductive research, the literature review will first present essential theories and basic concepts on connected and autonomous technology and explain their relevance to the research work.
- ✓ Secondly, the literature review will examine existing literature to identify the most concerning facts on connected and autonomous technology in road and railway transportation.
- ✓ Thirdly the literature review will focus on understanding existing literature on social perception about connected and autonomous technology.
- ✓ The outcome of the literature research serves as the basis for qualitative survey.

With regard to questionnaire base survey

- ✓ A combination of close questioners and open questioners will be used to obtain standardised information together with in-depth explanations where deemed necessary.
- ✓ The intended use of open questionnaires is to facilitate a larger audience which might help to elaborate intentions and intuitions and their relationships based on demographics.
- ✓ The main focus of the questioners' design is to understand the perception of trust and security around connected and autonomous technology and its implication for shaping the norms of future society.

Slide 9

Ethical Consideration

Regards to ethical consideration:

- Given the nature of the qualitative survey analysisng results and demographics factors, requires, the use of written consent forms signed by the participants. This helps to assure compliance with the Data Protection Act and ethical requirements.
- An information sheet will also be provided to all survey participants detailing the nature and scope of the study, the researcher's identity (s) and information regarding processing of data collected, including any data sharing.

(Bailey, 2013: University of Essex, 2021)

Slide 10

When considering the scope and limitations on the following can be identities as limitations on questionaries and analysing data.

- ✓ The study mainly focuses on connected and autonomous technology in roads and railways.
- ✓ Being fairly new technology, only limited information regards to user experience is available. Thus, the study outcomes are mainly determined by attitudes, expectations and intentions (Goldbach, 2022)
- ✓ Given the literature base, the questioners will focus mainly on attitudes and intentions of the local society.
- ✓ Respondents' bias toward giving the more socially acceptable answer could be a study limitation.
- ✓ Qualitative questioners take longer to analyse responses and thus limit data analysis compared to quantitative questioners.
- ✓ Open-ended questions could lead to different misinterpretations.
- ✓ When analysing the data, language limitations could derive from translating from Danish to English and could lead to misunderstandings.
- ✓ Using a standard set of questioners limits the flexibility of using vocabulary appropriate to the respondents and thus impacts the quality of answers.
- ✓ The use of social media such as LinkedIn and Facebook to send questionnaires limits the access to remote populations living off-grid of social media.

(Barrett, 2018; McLeod, 2018; SAGE, 2018)

Slide 11

Regards to research timelines

From Mary to Jun, a literature search and review will be conducted, forming the base for the qualitative survey question formation.

Within the given limited time frame, the survey question formulation is hoped to be finalized by the end of June, which will allow sufficient time to send, collect and analyze survey results until mid-Aug.

Based on the analysis, it may be necessary to revisit the literature review to form the base for some of the new findings from the survey results. The study is planned to be finalized by the end of August, after discussion and several reviews with the research supervisor.

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