UNIVERSITY OF TARTU
Faculty of Science and Technology
Institute of Computer Science
Innovation and Technology Management Curriculum

Nataliia Pabat

Security Risk Management in Teleoperated Driving

Master's Thesis (20 ECTS)

Supervisors: Raimundas Matulevičius, PhD
Abasi-amefon Obot Affia, PhD

Tartu 2024

Security Risk Management in Teleoperated Driving

Abstract:

Teleoperated driving technology allows setting apart human operators from the physical automobile and still effectively controlling it remotely, decreasing dependence on the physical presence of the driver inside the vehicle. However, with a constant focus on the safety of this process, security risks may be overlooked. The primary goal of this report is to analyse the Teleoperated Driving System (TDS) and the data used inside this system, conduct a security risk management assessment, and propose risk mitigation and countermeasures for these security risks.

We conducted the literature review, including determining the detailed TDS architecture (assets and their interconnections), defining potential security risks, and proposing possible countermeasures based on the literature review results. Next, a fine-grained analysis of TDS and the teleoperation establishment process is performed. The system assets, business assets, and connections were analysed using a security risk management approach and ISSRM diagram to identify security risks, threats, and vulnerabilities. Further, security requirements and controls were defined to mitigate the identified security risks.

We validated our findings with expert feedback and the threat analysis tool. The validation helps to explain the feasibility and correctness of the proposed security risk management strategy validated by the tool for threat analysis in the automotive domain and approved by experts in the teleoperation and security domain.

Turvariskide Haldamine Kaugjuhtimisega Sõidus

Lühikokkuvõte:

Kaugjuhtimisega sõidutehnoloogia võimaldab inimoperaatorid füüsilisest sõidukist eraldada ja seejuures seda siiski tõhusalt eemalt juhtida, vähendades sõltuvust juhi füüsilisest olemasolust sõidukis. Kuna aga pidevalt keskendutakse selle protsessi ohutusele, võidakse turvariskidest mööda vaadata. Selle aruande peamine eesmärk on analüüsida kaugjuhtimissüsteemi (TDS) ja selles süsteemis kasutatavaid andmeid, viia läbi turvariskide haldamise hindamine ning pakkuda välja meetmeid ja lahendusi, et neid riske leevendada ja maandada.

Töö käigus uuriti ja anti ülevaade teoreetilisest kirjandusest, sealhulgas määratleti kirjanduse põhjal TDS-i detailne arhitektuur (varad ja nende seosed), defineeriti võimalikud turvariskid ja pakuti välja võimalikud vastumeetmed. Seejärel viidi läbi TDS-i ja teleoperatsiooni loomise protsessi üksikasjalik analüüs. Süsteemi varasid, ärivarasid ja ühendusi analüüsiti turvariskide haldamise lähenemisviisi ja ISSRM-diagrammi abil, et tuvastada turvariske, ohte ja haavatavusi. Lisaks määratleti turvanõuded ja -kontrollid, et leevendada tuvastatud turvariske.

Kinnitasime oma leiud ekspertide tagasiside ja ohuanalüüsi tööriista abil. Valideerimine aitab selgitada välja pakutud turvariskide haldamise strateegia teostatavust ja õigsust, mis on kinnitatud autotööstuse ohuanalüüsi tööriistaga ja heaks kiidetud teleoperatsiooni ja turvalisuse valdkonna ekspertide poolt.

Võtmesõnad:

Kaugjuhtimisega Sõidusüsteem, Kaugjuhtimine, Eemalt juhtimine, Kaugjuhtimise seadistamine, Turvariskide Haldamine (SRM), Autonoomne sõiduk, Võrgustik

CERCS:

T120 - Süsteemitehnoloogia, arvutitehnoloogia

VII Licence

I, **Nataliia Pabat**,

   *(*author's name*)*

1. grant the University of Tartu a free permit (non-exclusive licence) to:

   reproduce, for preservation, including for adding to the DSpace digital archives until the expiry of the term of copyright, my thesis

   Security Risk Management in Teleoperated Driving,

   *(*title of thesis*)*

   supervised by Raimundas Matulevičius and Abasi-amefon Obot Affia.

   *(*supervisor's name*)*

2. I grant the University of Tartu the permit to make the thesis specified in point 1 available to the public via the web environment of the University of Tartu, including via the DSpace digital archives, under the Creative Commons licence CC BY NC ND 4.0, which allows, by giving appropriate credit to the author, to reproduce, distribute the work and communicate it to the public, and prohibits the creation of derivative works and any commercial use of the work from 15/05/2024 until the expiry of the term of copyright (06/06/2029),

3. I am aware that the author retains the rights specified in points 1 and 2.

4. I confirm that granting the non-exclusive licence does not infringe other persons' intellectual property rights or rights arising from the personal data protection legislation.

Nataliia Pabat
15/05/2024