



Silesian
University
of Technology

DEPARTMENT OF FUNDAMENTALS
OF MACHINERY DESIGN

Doctoral Thesis

Identification and minimization of threats
in embedded systems during the car vehicles
maintenance,
in accordance with Industry 4.0 concept

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Supervisor: Ph.D. D.Sc. Eng. Anna Timofiejczuk, Associate Professor

Industry supervisor: Ph.D. Eng. Wojciech Sebzda

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Doctoral thesis – Summary

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The main objective of this dissertation was to elaborate approaches allowing to minimize potential hazards of attacks in embedded systems in a car. A car is considered as an intelligent mechatronic vehicle integrated with the management system following several aspects of the “Industry 4.0” concept.

The PhD project was divided into research stages, presented in 4 experiments. The author focused his attention on various aspects regarding the possibility of eavesdropping, disruption or changing the content of frames during data transmission via the CAN bus. Taking into account the current state-of-the-art in the CAN bus transmission in modern cars, a few concepts of attacks were prepared and tested. Each experiment consisted of 3 parts. In the first part the author focuses on checking whether it is possible to carry out an effective attack on the selected electronic control module. The second part is devoted to elaborating a solution increasing the level of security against the attack. In the third part of the experiments, the validation tests were carried out to confirm the effectiveness of the implemented security measures. It should be emphasized that it is not possible to obtain the security that gives a 100% guarantee, because even the most effective algorithms implemented in security cannot fully take into account new types of threats that are developing very quickly. The role of the author's original concepts presented in the thesis is to minimize the probability of a successful attack.

The dissertation resulted in the development of an innovative security concepts, taking into account contemporary expectations of the automotive industry. As the result of the PhD project a few concepts of relatively simple low-cost solutions were presented. There was also presented more advanced AI-based approach.

The overall results confirmed the high practical potential of developed concepts, which can be implemented in DRÄXLMAIER company. It should be stressed that the innovative burglary protection module supported by AI algorithms is especially interesting to be implemented. It can be successfully used for the development of new products of the company.