

Wissenschaftliche Reihe  
Fahrzeugtechnik Universität Stuttgart

RESEARCH

Lorenz Georg Görne

# Method for High-Efficiency Data Compression and Transmission of Vehicle Measurement Data Through Mobile Internet



Universität Stuttgart



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Method for High-Efficiency  
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Transmission of Vehicle  
Measurement Data Through  
Mobile Internet

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Zugl.: Dissertation Universität Stuttgart, 2023  
D93

ISSN 2567-0042 ISSN 2567-0352 (electronic)  
Wissenschaftliche Reihe Fahrzeugtechnik Universität Stuttgart  
ISBN 978-3-658-43798-5 ISBN 978-3-658-43799-2 (eBook)  
<https://doi.org/10.1007/978-3-658-43799-2>

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# Foreword

This thesis was created during my work as research fellow at the Research Institute of Automotive Engineering and Vehicle Engines Stuttgart (FKFS). During that time, I was given the opportunity to familiarize myself with vehicle remote diagnostics and develop measurement software, which is where the idea for this thesis originates from.

First, I would like to thank my supervisor Prof. Dr.-Ing. H.-C. Reuss for supporting me during research and preparation of my dissertation, as well as his advice and supervision that ultimately led to the successful completion of this work.

Further thanks go to Prof. Dr.-Ing. Karl-Ludwig Krieger from the Bremen University for co-reviewing my dissertation, and for giving helpful advice in how to further improve my thesis.

Also, I want to express my gratitude towards my division manager Dr.-Ing. Michael Grimm as well as my project manager Kordian Komarek for making this dissertation possible. Furthermore, my thanks go to my colleagues Andreas Krätschmer and Ralf Lutchen from FKFS for their support and feedback on this thesis. I am grateful for their cooperation and help that strengthened my motivation to complete my dissertation. Thank you Patrick Pfeffer for final review and taking the time to improve this work through corrections and suggestions.

I would like to thank my family for their unwavering support during my life's journey. I am very grateful to my parents for their constant help, which enabled me to get to this point in life, and my brothers Arno and Timon for their generous help.

Lastly, my special thanks go to my partner Hannah. Thank you for your patience and love, which were essential to me for achieving my goal.

Stuttgart

Lorenz Georg Görne

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# Acronyms

ADAS	Advanced Driver Assistance Systems
AI	Artificial Intelligence
API	Application Programmable Interface
ASAM	Association for Standardization of Automation and Measuring Systems
ASCII	American Standard Code for Information Interchange
AUTOSAR	Automotive Open System Architecture
BLF	Binary Logging Format
BST	Bus Signal Transformation
CAN	Controller Area Network
CANFD	Controller Area Network - Flexible Data Rate
CFF	Compression Friendly Format
CPU	Central Processing Unit
DBC	Data Base Can
DST	Differential Signal Transformation
ECU	Electronic Control Unit
HTTP	Hypertext Transfer Protocol
HTTPS	Hypertext Transfer Protocol Secure
IoT	Internet of Things
LIN	Local Interconnect Network
LZMA	Lempel-Ziv-Markow-Algorithm
MDF	Measurement Data Format
MOST	Media Oriented Systems Transport

MQTT	Message Queuing Telemetry Transport
OBD	On-board Diagnostics
OEM	Original Equipment Manufacturer
PrOComp	PRocessing, Optimization and Compression
QUIC	Quick UDP Internet Connections
RAM	Random Access Memory
RAR	Roshal Archive
RLE	Run-Length Encoding
RPM	Revolutions per Minute
SAE	Society of Automotive Engineer
SAT	Signal Alignment Transformation
SSCT	Shannon Source Coding Theorem
SSD	Solid-State Drive
TCP/IP	Transmission Control Protocol/Internet Protocol
UDP	User Datagram Protocol
UDS	Unified Diagnostic Services
URL	Uniform Resource Locator
VPN	Virtual Private Network
XCP	Universal Measurement and Protocol
XML	Extensible Markup Language

# Symbols

<b>Symbols</b>		
<i>CR</i>	Compression ratio	
<i>C</i>	Algorithmic complexity factor	s/Item
<i>D</i>	The vector of all differences of values	
<i>d</i>	A single difference of the value of a signal to its predecessor	
<i>L</i>	Latency of a process	s
<i>l</i>	Fixed bit length of a signal	
<i>R</i>	Throughput rate	MB/s
<i>S</i>	Size of data blocks or buffers	MB
<i>s</i>	Split ratio between two complementary factors	
<i>t</i>	Time spent on a process	s
<i>V</i>	The vector of all values	
<i>v</i>	A single value of a signal	
<i>w</i>	Ratio of two similar factors	

<b>Indices</b>	
block	Related to data blocks
bus	Related to the vehicle communication bus
compr	Related to the compression
crit	Indicating a critical value
fixed	Value does not change during run-time
gross	Gross quantity
in	Incoming
max	Maximum
n	Related to the number of elements
net	Net quantity
opt	Indicating an optimal value
out	Outgoing
overh.	Overhead
pp	Related to the data pre-processing