2016 IEEE Vehicular Networking Conference (VNC 2016)

Columbus, Ohio, USA
8-10 December 2016
Thursday, December 8, 09:15 - 09:45

O: Opening

Thursday, December 8, 09:45 - 10:30

K1: Keynote on Smart Columbus

Thursday, December 8, 10:30 - 11:00

C1: Coffee Break

Thursday, December 8, 11:00 - 12:00

S1: Physical Layer

Performance Comparison of IEEE 802.11p and ARIB STD-T109
Julian Heinovski (Paderborn University, Germany); Florian Klingler and Falko Dressler (University of Paderborn, Germany); Christoph Sommer (Paderborn University, Germany)

Vehicle-to-Barrier Communication During Real-World Vehicle Crash Tests
Samil Temel (Turkish Air Force Academy, Turkey); Mehmet Can Vuran and Mohammad Lunar (University of Nebraska-Lincoln, USA); Ronald K Faller (University of Nebraska-Lincoln & Midwest Roadside Safety Facility, USA); Cody Stolle (University of Nebraska-Lincoln, USA)

On the Impact of Antenna Patterns on VANET Simulation
David Eckhoff (University of Erlangen, Germany); Alexander Brummer (University of Erlangen-Nuremberg, Germany); Christoph Sommer (Paderborn University, Germany)

Thursday, December 8, 12:00 - 13:00

L1: Lunch

Thursday, December 8, 13:00 - 14:10

S2: Visible Light Communications

Time Variation in Vehicle-to-Vehicle Visible Light Communication Channels
Ai-Ling Chen, Hao-Ping Wu, Yu-Lin Wei and Hsin-Mu Tsai (National Taiwan University, Taiwan)

Broadcasting Brake Lights with MIMO-OFDM Based Vehicular VLC
Bugra Turan (Koc University, Turkey); Omer Narmanlioglu (P. I. Works & Ozyegin University, Turkey); Sinem Coleri Ergen (Koc University, Turkey); Murat Uysal (Ozyegin University, Turkey)

Development of Low-Complexity MLE Method for Image-Sensor-Based Visible Light Communication
Yuki Ohira and Tomohiro Yendo (Nagaoka University of Technology, Japan); Shintaro Arai (Okayama University of Science, Japan)
Thursday, December 8, 14:10 - 15:40
App: App Contest

Thursday, December 8, 15:40 - 16:10
C2: Coffee Break

Thursday, December 8, 16:10 - 18:10
S3: Vehicle Sensing

Realizing Collective Perception in a Vehicle  44
Hendrik-Jörn Günther (Volkswagen Group Research & Technische Universität Braunschweig, Germany); Björn Mennenga (Volkswagen Group Research, Germany); Oliver Trauer (C4C Engineering GmbH, Germany); Raphael Riebl (Technische Hochschule Ingolstadt, Germany); Lars C Wolf (Technische Universität Braunschweig, Germany)

Collective Perception and Decentralized Congestion Control in Vehicular Ad-hoc Networks  52
Hendrik-Jörn Günther (Volkswagen Group Research & Technische Universität Braunschweig, Germany); Raphael Riebl (Technische Hochschule Ingolstadt, Germany); Lars C Wolf (Technische Universität Braunschweig, Germany); Christian Facchi (Ingolstadt University of Applied Sciences, Germany)

Establishing Vehicular Ground Truth  60
Pallavi Meharia (University of Cincinnati, USA); Biswajit Panja (Eastern Michigan University, USA); Dharma P Agrawal (University of Cincinnati, USA)

Coordinated Merge Control Based on V2V Communication  68
Fang-Chieh Chou (University of California, Berkeley, USA); Steven Shladover (UC Berkeley, USA); Gaurav Bansal (Toyota InfoTechnology Center, USA)

MOVESET: MODular VEHICLE SEnsor Technology  76
Qi Chen, Brendan Bellows and Mike P Wittie (Montana State University, USA); Stacy Patterson (Rensselaer Polytechnic Institute, USA); Qing Yang (Montana State University, USA)

Towards Characterizing Bluetooth Discovery in a Vehicular Context  80
Walter Bronzi, Thierry Derrienn and German Castignani (University of Luxembourg / SnT, Luxembourg); Thomas Engel (University of Luxembourg, Luxembourg)

Friday, December 9

Friday, December 9, 09:00 - 09:45
K2: Keynote by Prof. Umit Ozguner
Communication Needs in Collaborative Driving
Prof. Umit Ozguner
Friday, December 9, 09:45 - 10:15

C3: Coffee Break

Friday, December 9, 10:15 - 11:45

S4: LTE & 5G

On the Overhead of Radio Resource Management Schemes for Mobile Underlay D2D Communication  84
Mladen Botsov (BMW Group Research and Technology & Technische Universität Berlin, Germany); Slawomir Stanczak (Fraunhofer Heinrich Hertz Institute & Technische Universität Berlin, Germany); Peter Ferti (BMW Group Research and Technology, Germany)

Enhanced Autonomous Resource Selection for LTE-Based V2V Communication  92
Jiaxin Yang (McGill University, Canada); Benoît Pelletier (InterDigital Canada, Canada); Benoît Champagne (McGill University, Canada)

Pick the Right Guy: CQI-Based LTE Forwarder Selection in VANETs  98
Ion Turcanu (University of Rome "La Sapienza", Italy); Christoph Sommer (Paderborn University, Germany); Andrea Baiocchi (University of Roma Sapienza, Italy); Falko Dressler (University of Paderborn, Germany)

A 5G V2X Testbed for Cooperative Automated Driving  106
Hanwen Cao, Sandip Gangakshedkar, Ali Ali and Mohamed Gharba (Huawei German Research Center, Germany); Joseph Eichinger (Huawei Technologies Düsseldorf GmbH, European Research Center (ERC), Germany)

Friday, December 9, 11:45 - 12:45

L2: Lunch

Friday, December 9, 12:45 - 13:30

S5: Formal Modeling & Simulation

Formal Models for Automotive Systems and Vehicular Networks: Benefits and Challenges  110
Eduardo dos Santos (University of Oxford, United Kingdom & CAPES Foundation, Brazil); Dominik Schoop (Esslingen University of Applied Sciences, Germany); Andrew Simpson (University of Oxford, United Kingdom)

Formally Verifiable Modeling of In-Vehicle Time-Sensitive Networks (TSN) Based on Logic Programming  118
Morteza Hashemi Farzaneh (Technical University of Munich, Germany); Sina Shafaei (Technische Universität München, Germany); Alois Knoll (Technical University Munich Garching, Germany)

Partitioning of Urban Transportation Networks Utilizing Real-World Traffic Parameters for Distributed Simulation in SUMO  122
Md Salman Ahmed and Mohammad Asadul Hoque (East Tennessee State University, USA)
Friday, December 9, 13:30 - 14:00

**P1: 2-min Presentation for Poster/Demo 1**

**Poster: Using Clusters of Parked Cars as Virtual Vehicular Network Infrastructure**  126
Florian Hagenauer and Christoph Sommer (Paderborn University, Germany); Takamasu Higuchi (Toyota InfoTechnology Center, Japan); Onur Altintas (Toyota InfoTechnology Center, USA, Inc., USA); Falko Dressler (University of Paderborn, Germany)

**Poster: Efficient Cluster-Based Resource Allocation for Co-Existing Vehicle and Cellular Users**  128
Idoia de la Iglesia (University of Deusto, Spain & Nokia Bell Labs, Poland); Unai Hernández-Jayo (University of Deusto, Spain); Maciej Januszewski and Jedrzej Stanczak (Nokia Bell Labs, Poland); Eneko Osaba (University of Deusto, Spain); Roberto Carballedo (University of Deusto & Deusto Foundation - Deusto Institute of Technology, Spain)

**Poster: Reliability Enhancement in V2V Networks Through Vehicle-Assisted Relaying**  130
Hussain Elkotby and Mai Vu (Tufts University, USA)

**Poster: A TDM Approach for Latency Reduction of Ultra-Reliable Low-Latency Data in 5G**  132
Karthikeyan Ganesan (Huawei Technologies GmbH & Germany, Germany); Tapisha Soni (Huawei Technologies Duesseldorf GmbH, Germany); Swaroop Nunna (Huawei Technologies Duesseldorf GmbH & European Research Center, Germany); Ali Ali (Huawei German Research Center, Germany)

**Poster: A Scheduling Method for V2V Networks Using Successive Interference Cancellation**  134
Yuta Watanabe, Koya Sato and Takeo Fuji (The University of Electro-Communications, Japan)

**Poster: Power over Data Lines for CAN Using AMI Code**  136
Tatsuki Matsushita, Daisuke Umehara and Wakasugi Koichiro (Kyoto Institute of Technology, Japan)

**Poster: Symbol Detection with OR Rule for CAN FD**  138
Natsumi Sato, Daisuke Umehara and Wakasugi Koichiro (Kyoto Institute of Technology, Japan)

**Poster: On-Board Camera Video Transmission over Vehicular VLC**  140
Omer Narmanlioglu (P. I. Works & Ozyegin University, Turkey); Bugra Turan (Koc University, Turkey); Burak Kebapci (Ozyegin University, Turkey); Sinem Coleri Ergen (Koc University, Turkey); Murat Uysal (Ozyegin University, Turkey)

**Poster: Monitoring Transit Systems Using Low Cost WiFi Technology**  142
Samy S. El-Tawab, Raymond Oram, Michael Garcia and Chris Johns (James Madison University, USA); B. Brian Park (University of Virginia, USA)

**Poster: LuST-LTE: A Simulation Package for Pervasive Vehicular Connectivity**  144
Thierry Derrmann (University of Luxembourg / SnT, Luxembourg); Sébastien Faye (University of Luxembourg, SnT, Luxembourg); Raphael Frank (University of Luxembourg, Luxembourg); Thomas Engel (University of Luxembourg, Luxembourg)

**Poster: A Lightweight Localization Algorithm Using V2V and V2I Short Range Communication in Highly Dense Reference Networks**  146
Heath J. LeBlanc, Firas Hassan and Edgar Gomez (Ohio Northern University, USA); Nesreen Alsbo (University of Central Oklahoma, USA)

**Poster: A Hybrid MAC Scheme for Emergency Systems in Urban VANETs Environment**  148
Saifullah Khan (Carl von Ossietzky University, Oldenburg, Germany); Muhammad Alam (Instituto de Telecomunicacoes, Portugal); Nils Henning Müllner (Mälardalen University, Sweden); Martin Fränzlé (OFFIS Institute for Computer Science and University of Oldenburg, Germany)

**Demo: OpenC2X - An Open Source Experimental and Prototyping Platform Supporting ETSI ITS-G5**  150
Sven Laux, Gurjashan Singh Pannu, Stefan Schneider, Jan Tiemann and Florian Klingler (University of Paderborn, Germany); Christoph Sommer (Paderborn University, Germany); Falko Dressler (University of Paderborn, Germany)
Demo: Real-time Vehicle Movement Tracking on Android Devices Through Bluetooth Communication with DSRC Devices  152
Md Saliman Ahmed and Mohammad Asadul Hoque (East Tennessee State University, USA); Asad Khattak (University of Tennessee, USA)

Poster: SafeRoute A Framework for Assessment of Road Safety  154
R. Vince Rabsatt (University of California Los Angeles, USA); Haik Kalantarian (University of California, Los Angeles, USA); Mario Gerla (University of California at Los Angeles, USA)

Friday, December 9, 14:00 - 15:30

C4: Poster/Demo 1 (with coffee)

Friday, December 9, 15:30 - 16:40

S6: Multi-hop Communications I

LASP: Look-Ahead Spatial Protocol for Vehicular Multi-hop Communication  156
Rui Meireles and Peter Steenkiste (Carnegie Mellon University, USA); Joao Barros (Instituto de Telecomunicações & Universidade do Porto, Portugal); Daniel C. Moura (University of Porto, Portugal)

Towards Reliable Multi-Hop Broadcast in VANETs: An Analytical Approach  164
Mozhdeh Gholibeigi, Mitra Baratchi, Hans van den Berg and Geert Heijenk (University of Twente, The Netherlands)

Selective Message Relaying for Multi-Hopping Vehicular Networks  172
Bengi Aygun (Nokia Bell Labs, Germany); Chung-Wei Lin and Shinichi Shiraiishi (Toyota InfoTechnology Center, USA); Alexander M. Wyglinski (Worcester Polytechnic Institute, USA)

Friday, December 9, 16:40 - 16:55

C5: Short Break

Friday, December 9, 16:55 - 18:05

S7: Multi-hop Communications II

Low-Delay Forwarding with Multiple Candidates for VANETs Using Multi-Criteria Decision Making  180
Karsten Roscher and Josef Jiru (Fraunhofer ESK, Germany); Rudi Knorr (Fraunhofer Institute for Embedded Systems and Communication Technologies (ESK), Germany)

PeRCEIVE: Proactive Caching in ICN-based VANETs  188
Dennis Grew and Marco Wagner (Robert Bosch GmbH, Germany); Hannes Frey (Universität Koblenz-Landau, Germany)

Connected Vehicles Under Information-Centric Architectures  196
Mehrnaz Tavan (Rutgers, the State University of New Jersey, USA); Roy Yates and Dipankar Raychaudhuri (Rutgers University, USA)
Saturday, December 10

Saturday, December 10, 09:00 - 10:10

S8: Application I

**eCall++: An Enhanced Emergency Call System for Improved Road Safety**  204
Jon Blancou and João Almeida (Instituto de Telecomunicações, DETI - University of Aveiro, Portugal); Bruno Fernandes and Luis Silva (Instituto de Telecomunicações, Portugal); Muhammad Alam (Instituto de Telecomunicações, Portugal); José Fonseca (Universidade de Aveiro, Portugal); Joaquim Ferreira (University of Aveiro, Portugal)

**RideSense: Towards Ticketless Transportation**  212
Rufeng Meng (University of South Carolina, USA); David W Grömling (Technische Universität Darmstadt, Germany); Romit Roy Choudhury (University of Illinois at Urbana-Champaign, USA); Srijani Nelakuditi (University of South Carolina, USA)

**Adaptive Cloud Offloading for Vehicular Applications**  220
Ashwin Ashok (Georgia State University, USA); Peter Steenkiste (Carnegie Mellon University, USA); Fan Bai (General Motors, USA)

Saturday, December 10, 10:10 - 10:30

C6: Coffee Break

Saturday, December 10, 10:30 - 11:50

S9: Application II

**Technical Evaluation of GLOSA Systems and Results From the Field**  228
Rainer Stahlmann and Malte Möller (AUDI AG, Germany); Alexej Brauer (Technische Universität München, Germany); Reinhard German and David Eckhoff (University of Erlangen, Germany)

**Detecting Relative Position of User Devices and Mobile Access Points**  236
Leonid Kholkine (University of Porto, Portugal); Pedro Miguel Santos (University of Porto & Instituto de Telecomunicações, Portugal); André Cardote (Instituto de Telecomunicações, Universidade de Aveiro, Portugal); Ana C Aguiar (Instituto de Telecomunicações & University of Porto, Portugal)

**Cooperative ITS for Two-Wheel Vehicles to Improve Safety on Roads**  244
Jose Santa (University Centre of Defence at the Spanish Air Force Academy, Spain); Pedro Javier Fernández Ruiz (University of Murcia, Spain); Miguel Angel Zamora (University Of Murcia, Spain)

Saturday, December 10, 11:50 - 12:50

L3: Lunch

Saturday, December 10, 12:50 - 14:30

K3: Panel: The Future of V2X Communication

Organizer: Dr. Jim Lansford, Qualcomm
Saturday, December 10, 14:30 - 15:50

S10: Security and Privacy

**Vehicular PKI Scalability-Consistency Trade-Offs in Large Scale Distributed Scenarios** 248
Pierpaolo Cincilla (SystemX, France); Omar Hicham (University of Pierre and Marie Curie, France); Benoit Charles (IDnomic, France)

**Marrying Safety with Privacy: A Holistic Solution for Location Privacy in VANETs** 256
David Eckhoff (University of Erlangen, Germany); Christoph Sommer (Paderborn University, Germany)

**Security Vulnerabilities of IEEE 802.11p and Visible Light Communication Based Platoons** 264
Seyhan Ucar, Sinem Coleri Ergen and Ozgur Ozkasap (Koc University, Turkey)

**Exploiting Propagation Effects for Authentication and Misbehavior Detection in VANETs** 268
Ala'a Al-Momani, Rens van der Heijden and Frank Kargl (Ulm University, Germany); Christian Waldschmidt (University of Ulm, Germany)

**Proactive Certificate Validation for VANETs** 272
Hongyu Jin and Panagiotis Papadimitratos (KTH, Sweden)

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Saturday, December 10, 15:50 - 16:20

P2: 2-min Presentation for Poster/Demo 2

**Poster: V2V Communication - Keeping You Under Non-Disputable Surveillance** 276
Markus Ullmann (Federal Office for Information Security & University of Applied Sciences Bonn-Rhein-Sieg, Germany); Thomas Strubbe (BSI, Germany); Christian Wieschebrink (Federal Office for Information Security (BSI), Germany)

**Poster: Simple Key Management Scheme for In-Vehicle System** 278
Tori Sakon (University of Hyogo & Sumitomo Electric Industries, ltd., Japan); Yukikazu Nakamoto (University of Hyogo, Japan)

**Poster: Hardware Based Security Enhanced Framework for Automotives** 280
Ali Shuja Siddiqui and Yutian Gui (Florida Institute of Technology, USA); Jim Plusquellic (University of New Mexico, USA); Fareena Saqib (Florida Institute of Technology, USA)

**Poster: Anomaly-Based Misbehaviour Detection in Connected Car Backends** 282
Olga Berlin (Daimler AG, Germany); Matthias Matousek (Ulm University, Germany); Albert Held (Daimler AG, Germany); Frank Kargl (Ulm University, Germany)

**Poster: PREXT: Privacy Extension for Veins VANET Simulator** 284
Karim Emara (SnT, University of Luxembourg, Luxembourg)

**Poster: Message Authentication and Secret Key Agreement in VANETs via Angle of Arrival** 286
Amr Abdelaziz (The Ohio State University & Military Technical College, USA); Can Emre Koksal (The Ohio State University, USA); Ron Burton (Transportation Research Center, Columbus, OH, USA)

**Poster: On the Effect of RF Jamming Attack on Autonomous Platooning Systems with Radio and VLC Hybrid Communication** 288
Susumu Ishihara and Yusuke Ueta (Shizuoka University, Japan); Mario Gerla (University of California at Los Angeles, USA)

**Poster: Qualia Exploitation of Sensing Technology (QuEST) for Vehicular Network Optimization** 290
Teresa Hawkes (University of Oklahoma, USA); Trevor Bihl (Air Force Institute of Technology, USA); Steven Rogers (Air Force Research Laboratory, USA)
**Poster: Synchronised Charging of Electric Vehicles with Distant Renewable Energy Resources**  292  
Tobias Kleinschmidt and Oliver Fuhr (TU Dortmund University, Germany); Christian Wietfeld (TU Dortmund University & Communication Networks Institute, Germany)

**Poster: Electric Vehicle Network Bidirectional Charging for Flexible Vehicle-to-Grid Services**  294  
Seungwook Yoon and Euseok Hwang (Gwangju Institute of Science and Technology, Korea)

**Demo: A Prototype for a Platoon-based Cyclist Cooperative System**  296  
Juan Salamanca (Icesi University, Colombia); Sandra Céspedes (Universidad de Chile, Chile); Daniel Vinasco (Universidad Icesi, Colombia); Alexis Yañez (Universidad de Chile, Chile)

**Demo: Communication Requirements of CACC for High-Density Platooning**  298  
Marcin Ochocki, Vladimir Vukadinovic and Maciej Januszewski (Nokia Bell Labs, Poland); Idoia de la Iglesia (University of Deusto, Spain & Nokia Bell Labs, Poland)

**Poster: Insights on Communication Range and Capacity Requirements of Automated Vehicles**  300  
Miguel Sepulcre (Universidad Miguel Hernandez de Elche, Spain); Onur Altintas (Toyota InfoTechnology Center, USA, Inc., USA); Javier Gozalvez (Universidad Miguel Hernandez de Elche, Spain)

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**Saturday, December 10, 16:20 - 17:50**

**C7: Poster/Demo 2 (with coffee)**

**Saturday, December 10, 17:50 - 18:10**

**C: Closing**