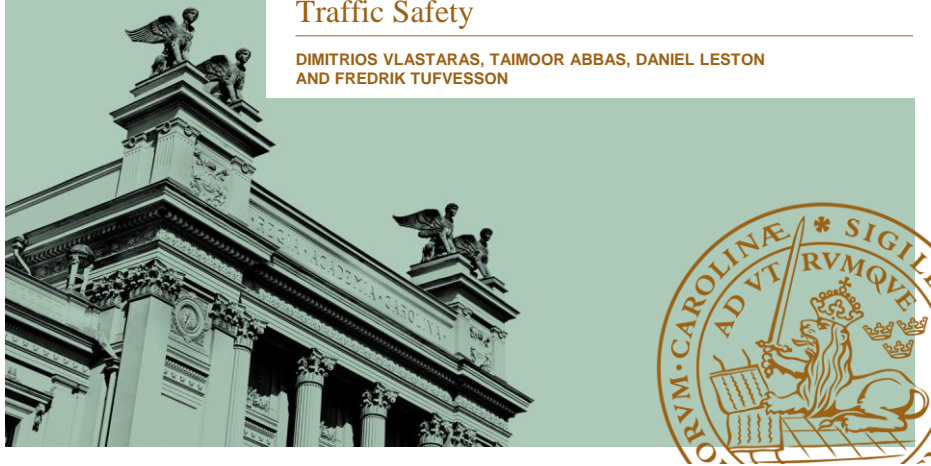


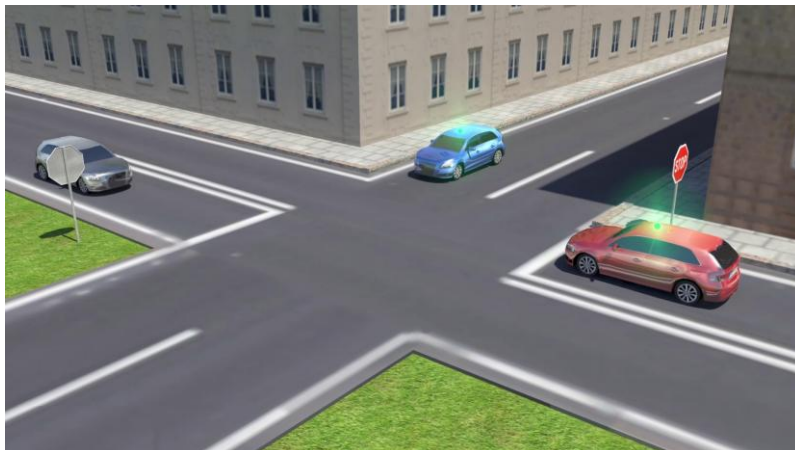


Universal Medium Range Radar and IEEE 802.11p Modem Solution for Integrated Traffic Safety

DIMITRIOS VLASTARAS, TAIMOOR ABBAS, DANIEL LESTON AND FREDRIK TUFVESSON



Background



Background



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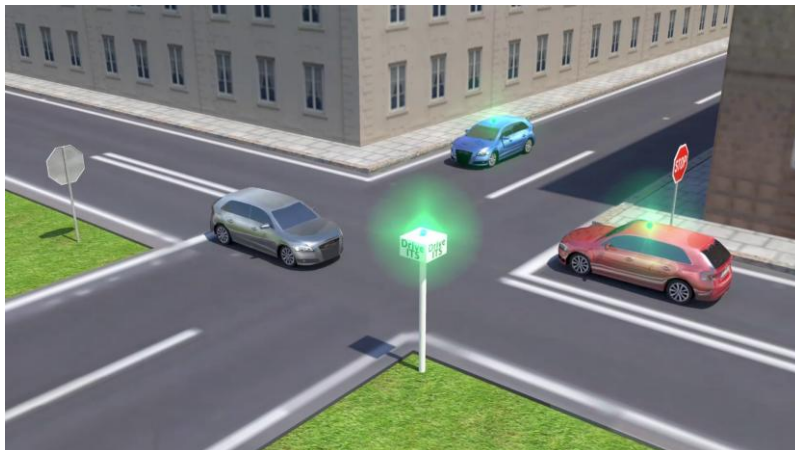
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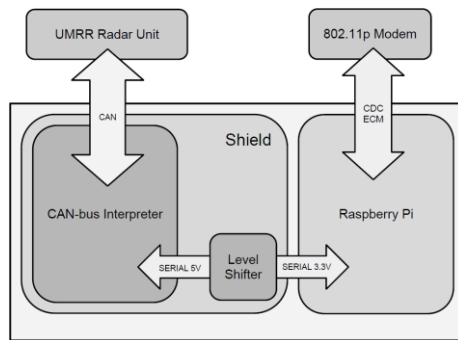
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System Description



- UMRR Radar Unit
- 802.11p Modem
 - **Cooperative Awareness Messages (CAM)**
 - **Basic Safety Message (BSM)**
- Embedded Solution
 - Raspberry Pi
 - CAN-bus Shield



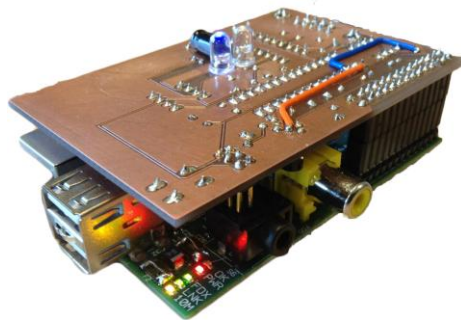
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Communication and Verification Test

- ITS-G5 Implementation and Communication Test
 - RSU broadcasting ITS-G5 frames (CAM Messages)
 - Drive C2X receiver saving received frames
 - Wireshark successfully dissected the data
- Verification Test
 - Drive C2X Volvo car driving and broadcasting
 - RSU detecting and broadcasting
 - Drive C2X roadside receiver saving received frames

Latitude: 57°44'2647.69"N (577354698)
 Longitude: 11°51'3102.12"E (118616989)
 Speed: 10.44 m/s | 37.58 km/h (1044)
 Heading: 5.4° (54)

Latitude: 57°44'2647.97"N (577355470)
 Longitude: 11°51'3102.42"E (118617823)
 Speed: 10.00 m/s | 36.00 km/h (1000)
 Heading: 240.0° (2400)

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Accuracy Tests

- Objectives
 - Measure the accuracy of the RSU in time and spatial domains
- Methodology
 - Log car coordinates and time with GPS
 - Log car coordinates and time with RSU
 - Compare in time and spatial domain



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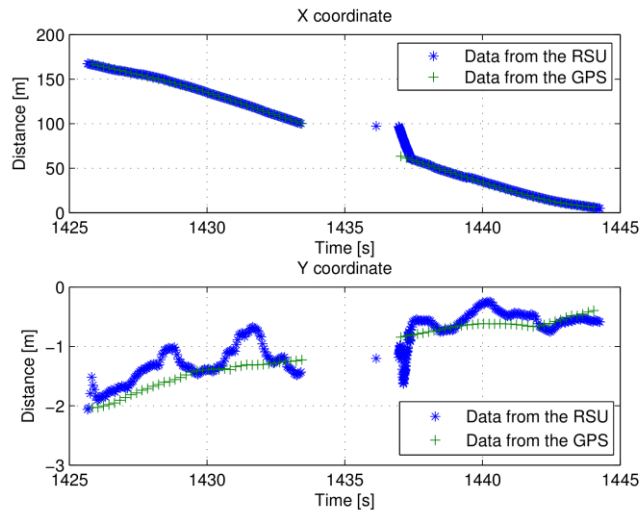
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Accuracy Tests – Single Measurement

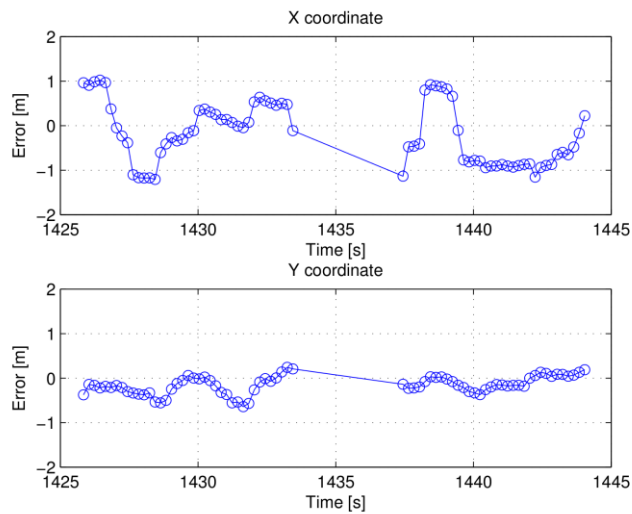


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Accuracy Tests – Measurement Error

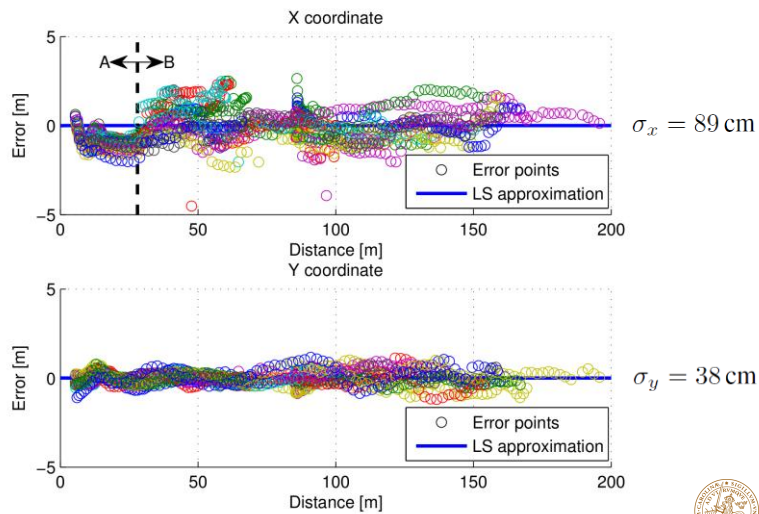


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Accuracy Tests – Total Error



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Conclusions

- Road Side Unit (RSU) Implemented
 - UMRR radar
 - 802.11p modem
- Functional Tests
 - ITS-G5 protocol implemented
 - Detects and reports vehicles
- Accuracy Tests
 - Promising results
 - $\sigma_x = 89$ cm and $\sigma_y = 38$ cm
- Increase early penetration rate of Intelligent Transportation Systems

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