CMC Roadmap

Motorcycles on track to connectivity &
Evaluation of the potential of C-ITS for motorcycles on the basis of real accidents

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Agenda

• Brief introduction of CMC
  • Motivation: Enhancement of motorcycle safety
  • Working Group: Unification and Interoperability

• Motorcycle accidents statistics
  • Analyses and evaluation

• Potential and benefit of C-ITS
  • Exemplified by the application “Left Turn Assist”

• CMC Roadmap
Motivation: Enhancement of motorcycle safety

Trend of car and motorcycle fatalities

Source: International Traffic Safety Data and Analysis Group (IRTAD)
CMC’s mission: motorcycle safety

- Make motorcycle riding safer by vehicle-to-vehicle communication
- Avoid accidents, e.g. where motorcycles are being overlooked
- We jointly promote, research and develop connectivity for motorcycles
Introduction of CMC and C-ITS

CMC Working Group Unification & Interoperability

- 6 Task Groups:
  - CMC C-ITS Roadmap
  - Application- / Use Case Description
  - Rider Motivation, Behaviour and Modelling
  - Profiling
  - HMI Guideline for C-ITS on PTW
  - Accidentology
V2V communication example: Animation of LTA

Vehicles communicate with each other.
Fatally injured road users in Germany

Source: Statistisches Bundesamt, Wiesbaden, Fachserie 8 / Reihe 7
Year 2000 = 100%
Investigation area

- Hannover, Germany
- Dresden, Germany

Source: Google Maps & GIDAS

Information

- Technical
- Medical
- Reconstruction

Database

- ≈ 2,000 traffic accidents with personal damage per year - since 1999 -
- Ø 3,500 single information per accident

German accident data – GIDAS
Method: Accident scenarios of motorcycles

1. Creation of a dataset

2. Weighting towards the German traffic accident statistics of 2016

3. Scenario classification

**Driving Accidents:**
- Straight
- Left curve
- Right curve
- Others / Un-known

**Collision Accidents:**
- Crossing traffic
- Longitudinal traffic
- Lane change
- Left turn
- U-turn
- Animals
- Technical defect
- Others / Un-known
Accident scenarios by type of accident

n = 28,002 accidents

- Collision accidents
- Driving accidents

- Crossing traffic: 5,612 accidents
- Longitudinal traffic: 5,151 accidents
- Lane change: 3,538 accidents
- Left curve: 3,168 accidents
- Right curve: 2,816 accidents
- Straight: 2,018 accidents
- Left turn: 1,950 accidents
- U-turn: 1,311 accidents
- Animals: 896 accidents
- Technical defect: 269 accidents
- Others / Unknown: 1,274 accidents
Top 10 – motorcycle accident causation

Collision accidents

<table>
<thead>
<tr>
<th>Type</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crossing traffic</td>
<td>5,000</td>
<td>17.9%</td>
</tr>
<tr>
<td>Longitudinal traffic</td>
<td>4,000</td>
<td>13.2%</td>
</tr>
<tr>
<td>Lane Change</td>
<td>3,000</td>
<td>8.0%</td>
</tr>
<tr>
<td>Left turn</td>
<td>2,000</td>
<td>6.2%</td>
</tr>
<tr>
<td>Longitudinal traffic</td>
<td>1,500</td>
<td>5.2%</td>
</tr>
<tr>
<td>Lane change</td>
<td>1,000</td>
<td>4.6%</td>
</tr>
<tr>
<td>U-turn</td>
<td>500</td>
<td>4.4%</td>
</tr>
</tbody>
</table>

n = 28,002 accidents

Driving accidents

<table>
<thead>
<tr>
<th>Type</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left curve</td>
<td>11.1%</td>
</tr>
<tr>
<td>Right curve</td>
<td>10.0%</td>
</tr>
<tr>
<td>Straight</td>
<td>7.2%</td>
</tr>
</tbody>
</table>

Accident Causer = Motorcycle
Accident Causer = Other
Top 10 – motorcycle accident causation

Collision accidents

<table>
<thead>
<tr>
<th>Incident</th>
<th>Percentage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crossing traffic</td>
<td>17.9%</td>
<td>Accident Causer = Motorcycle</td>
</tr>
<tr>
<td>Longitudinal traffic</td>
<td>13.2%</td>
<td>Accident Causer = Other</td>
</tr>
<tr>
<td>Lane Change</td>
<td>8.0%</td>
<td></td>
</tr>
<tr>
<td>Left turn</td>
<td>6.2%</td>
<td></td>
</tr>
<tr>
<td>Longitudinal traffic</td>
<td>5.2%</td>
<td></td>
</tr>
<tr>
<td>Lane change</td>
<td>4.6%</td>
<td></td>
</tr>
<tr>
<td>U-turn</td>
<td>4.4%</td>
<td></td>
</tr>
</tbody>
</table>

n = 28,002 accidents

Driving accidents are mainly addressed by independently operating advanced rider assistant systems (not C-ITS).

Driving accidents

- Left curve
- Right curve
- Straight
Source: CMC document “Application- and Use-Case description”

Conversion into

Filter criteria

Applying the filter criteria to the dataset

Evaluating the potential of 19 C-ITS applications

Result

Nr. of addressed accidents with distinction regarding causation
Results – Top 10 applications

Share in addressed motorcycle accidents (n=28,002, Germany, 2016)

- MAI: Motorcycle Approach Indication
- MAW: Motorcycle Approach Warning
- IMA: Intersection Movement Assist
- FCW: Forward Collision Warning
- BSW: Blind Spot Warning
- LCW: Lane Change Warning
- LTA: Left Turning Assist
- EEBL: Emergency Electronic Brake Lights
- AWW: Adverse Weather Warning

Accident Causer:
- MAI / MAW: Other
- IMA: Other
- FCW: PTW
- BSW & LCW: Other
- LTA: Other
- IMA: PTW
- FCW: Other
- EEBL: PTW
- BSW & LCW: PTW
- AWW: PTW
### Example: Left Turn Assist - result

<table>
<thead>
<tr>
<th>Nr.</th>
<th>Scenario</th>
<th>Accident Causer</th>
<th>no. of accidents</th>
<th>%</th>
<th>no. of accidents</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Crossing traffic</td>
<td>Other</td>
<td>5.008</td>
<td>17,9%</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>2</td>
<td>Longitudinal traffic</td>
<td>PTW</td>
<td>3.689</td>
<td>13,2%</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>3</td>
<td>Lane Change</td>
<td>Other</td>
<td>2.238</td>
<td>8,0%</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>4</td>
<td>Left turn</td>
<td>Other</td>
<td>1.744</td>
<td>6,2%</td>
<td>1.244</td>
<td>71%</td>
</tr>
<tr>
<td>5</td>
<td>Longitudinal traffic</td>
<td>Other</td>
<td>1.463</td>
<td>5,2%</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>6</td>
<td>Lane change</td>
<td>PTW</td>
<td>1.300</td>
<td>4,6%</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>7</td>
<td>U-turn</td>
<td>Other</td>
<td>1.245</td>
<td>4,4%</td>
<td>0</td>
<td>0%</td>
</tr>
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<td>...</td>
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<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>13</td>
<td>Left turn</td>
<td>PTW</td>
<td>206</td>
<td>0,7%</td>
<td>123</td>
<td>60%</td>
</tr>
</tbody>
</table>

The LTA could address:
- 1.244 accidents, if the accident causer is the Other vehicle.
- 123 accidents, if the accident causer is the PTW.

Efficiency of LTA in the scenario Left turn is over 70%!
Example scenario: Left turn

Source: GIDAS accident case from 2017
Example scenario: Left turn without LTA
Example scenario: Left turn with LTA
## Results – Top 10 applications

### Share in addressed motorcycle accidents

(n=28,002, Germany, 2016)

<table>
<thead>
<tr>
<th>Application</th>
<th>Accident</th>
<th>MAI / MAW</th>
<th>IMA</th>
<th>FCW</th>
<th>BSW &amp; LCW</th>
<th>LTA</th>
<th>IMA</th>
<th>FCW</th>
<th>EEBL</th>
<th>BSW &amp; LCW</th>
<th>AWW</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Share</td>
<td></td>
<td></td>
<td>Share</td>
<td></td>
<td></td>
<td>Share</td>
<td>Share</td>
<td>Share</td>
<td>Share</td>
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<tr>
<td></td>
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<td>(%)</td>
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<td>(%)</td>
<td>(%)</td>
<td>(%)</td>
<td>(%)</td>
</tr>
<tr>
<td>MAI / MAW</td>
<td>Other</td>
<td>22%</td>
<td>9%</td>
<td>6%</td>
<td>4%</td>
<td>2%</td>
<td>2%</td>
<td>2%</td>
<td>1%</td>
<td>1%</td>
<td></td>
</tr>
<tr>
<td>IMA</td>
<td>Other</td>
<td>14%</td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>FCW</td>
<td>PTW</td>
<td>9%</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BSW &amp; LCW</td>
<td>Other</td>
<td>6%</td>
<td></td>
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<tr>
<td>LTA</td>
<td>Other</td>
<td>4%</td>
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<tr>
<td>IMA</td>
<td>PTW</td>
<td>2%</td>
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<td></td>
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<tr>
<td>FCW</td>
<td>Other</td>
<td>2%</td>
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<td></td>
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<tr>
<td>EEBL</td>
<td>PTW</td>
<td>2%</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BSW &amp; LCW</td>
<td>PTW</td>
<td>2%</td>
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<tr>
<td>AWW</td>
<td>PTW</td>
<td>1%</td>
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</tbody>
</table>

**Definitions:**
- **MAI:** Motorcycle Approach Indication
- **MAW:** Motorcycle Approach Warning
- **IMA:** Intersection Movement Assist
- **FCW:** Forward Collision Warning
- **BSW:** Blind Spot Warning
- **LCW:** Lane Change Warning
- **LTA:** Left Turning Assist
- **EEBL:** Emergency Electronic Brake Lights
- **AWW:** Adverse Weather Warning

**Note:** The chart represents the share of accidents addressed by each application. The data is based on 28,002 motorcycle accidents in Germany, 2016.
CMC Roadmap – to make the road safer

See and Get Seen by others
- Motorcycle Approach Indication
- Intersection Movement Assist
- Forward Collision Warning

Motorcycle Approach Warning

Be Warned of the unexpected
- Emergency Electronic Brake Lights
- Adverse Weather Warning
- Road Works Warning
- Broken Down Vehicle Warning
- Left Turn Assist
- Intersection Movement Assist
- Forward Collision Warning
- Do Not Pass Warning
- Traffic Light Violation Warning

Lane Change Warning / Blind Spot Warning

Ride with Less Stress
- Group Riding
- Green Light Optimized Speed Advisory
- Fuelling & Charging Information
- Transit Signal Priority

Cooperated Driving
- Lane Merge Assistant
- Connected Automated Cruise Control

technical evolution – availability & reliability of data

ITS phase I
- Motorcycle Approach Warning

ITS phase II
- Lane Change Warning / Blind Spot Warning

ITS phase III
- Do Not Pass Warning
- Traffic Light Violation Warning
CMC booth

Hall 6 – indoor
Thank you for your attention