Connectivity Will Make Motorcycling Safer

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Benefit: Valuable Contribution to Future Mobility

- MCs have a great potential
  - Ideal urban mobility
  - Minimal space requirements
  - Smart combination of leisure and commuting
  - Favourable ecological footprint
Mission: Integration of Motorcycles in Connected Environment
CMC Industry Initiative

**Mission**

Enhance Riding safety by jointly promoting, researching and developing C-ITS for Motorcycles

**Objectives**

- **Integrating** motorcycles as an accepted and recognized partner into global future ITS strategies
- **Joining** our forces to create a common approach on ITS for motorcycles
- **Achieving** a successful implementation and deployment of motorcycle ITS functions
Challenge: Motorcycle Safety

Development of car and motorcycle fatalities

Source: IfZ
Reasons: Perception Failures

Majority of accidents: Caused by other vehicle driver
- 50 - 70 % OV driver causes accident

Majority of collision partner: Car
- 60 - 90 % Collision partner is a car

Majority of collision type: Crossing and turning
- 15 - 30 % Collisions at intersections

Source Data based on country specific studies (USA, Europe, Japan)
Causation and Solution

Human Error

"I never saw him."

70 - 90% perception failure by car driver

Digital conspicuity

MAI (Motorcycle Approach Indication)
MAW (Motorcycle Approach Warning)
Taylor made ITS technology needed

**Design**
- Limited space
- High vibrations
- Limitation on sensing parameters

**No cabin**
- Antenna positioning
- Exposed to elements (*rain, humidity, etc.*)

**Dynamics**
- Leaning in corners
- Steering by inertia
- High influence of rider

**Localisation**
- Width of PTW is under 1 meter
- Vehicle movement
- Higher positioning accuracy needed
Motorcycle Day 1 applications

- EEBL (Electric Emergency Brake Light) – Deceleration Behaviour of Motorcycles
- Slow or Stationary Vehicle(s) Warning – Triggering Conditions for Motorcycles
- Weather Conditions / Adverse Weather Warning – Motorcycle can’t trigger
- Traffic Jam Ahead Warning – Triggering Conditions for Motorcycles
- Road Works Warning – No big Difference to Car
- Approaching Emergency Vehicle Warning – No big Difference to Car - Routing for EV towards bikes?
- Hazardous Location Warning – No big Difference to Car
### Use case: Stationary Vehicle Warning

<table>
<thead>
<tr>
<th>Condition</th>
<th>✓</th>
<th>X</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hazard light on</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Parking brake</td>
<td>✓</td>
<td>X</td>
</tr>
<tr>
<td>Door open</td>
<td>✓</td>
<td>X</td>
</tr>
<tr>
<td>Trunk open</td>
<td>✓</td>
<td>X</td>
</tr>
<tr>
<td>Drivers seat not occupied</td>
<td>✓</td>
<td>X</td>
</tr>
<tr>
<td>Proposal: side stand</td>
<td>X</td>
<td>✓</td>
</tr>
</tbody>
</table>
Motorcycles behave different than cars

Use case: Traffic Jam

Requirement:
...indicate a velocity less than or equal to 30 km/h of at least five other vehicles in at most 100 m distance and the same driving direction...
Triggering Conditions based on cars BUT....

Use case: Traffic Jam

PTW can ride through traffic jam
Sends „wrong“ trigger conditions – cancel traffic jam
CAM assumes car: example steering angle

- CAM: Request steeringWheelAngle, -511 to +510, Unit: 1.5deg
- Motorcycle: Steering Angle is practically ‘minute’

DENM assumes car: example Impact Reduction Container

- DENM : Request impactReduction
- Limitation : Different structure, no pillar, occupant position, hard to calculate turn radius,
- Consideration : suitable DENM definition for the PTW structure.

\[
\text{ImpactReductionContainer} ::= \text{SEQUENCE} \{ \\
\text{heightLonCarrLeft, heightLonCarr, heightLonCarrRight, posLonCarrLeft, posLonCarr, posLonCarrRight, positionOfPillars, positionOfPillars, posCentMass, posCentMass, wheelBaseVehicle, wheelBaseVehicle, turningRadius, turningRadius, posFrontAx, posFrontAx, positionOfOccupants, positionOfOccupants, vehicleMass, vehicleMass, requestResponseIndication, requestResponseIndication} \\
\} 
\]
Day 1.5 – Information with Basic Function & Simple requirements for left turn and intersection

Car & motorcycle calculate the relative distance.
If distance below a respective threshold
Car driver and the PTW rider will be informed.

If the car driver reacts
(e.g., by releasing the gas pedal or by braking),
information will be canceled.

The scenario is considered until the motorcycle
and the car passed the intersection safely.
Day 2 – Fully developed Safety Applications to go beyond Information Stage for intersection & left turn

Warning to car driver & motorcyclist only in case of potential collision.

Car and the motorcycle calculate the “time to collision” (TTC)

If TTC falls below critical threshold (i.e., a collision may occur), both the car driver and the motorcyclist will be warned via their HMI.

If the car driver will react appropriately, both warnings will be canceled.

The scenario is considered until motorcycle and car passed the intersection safely.
Real safety impact as Day 2 function

- MAW is a real safety function with only warning in critical situation
- MAW huge impact on motorcycle safety as a DAY 2 function
MoU Statement

“...A cooperative approach to enhance motorcycle safety possibly by joint promotion, research and development of C-ITS on Powered Two Wheelers ("PTW") in Japan, USA and Europe....”

Signed by BMW Motorrad, Honda and Yamaha

*Powered Two Wheeler

Signed June 2015
Thank you for your attention

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