Connected Motorcycle Consortium

VISION

Assure motorcycles maintain their role in future mobility.

Motorcycle safety enhancement by means of connected systems and vehicular onboard sensor systems.

GOAL

Promote and disseminate C-ITS by applying standardization.

Enhance motorcycle safety through motorcycle protection by automotive systems.

Strengthening coordination of motorcycle industry and external stakeholders.

CMC is a non-profit-organization

Connected Motorcycle Consortium

TOGETHER FOR RIDER SAFETY

CMC Next – Use Cases

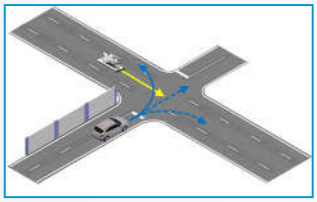
Performed live at Lausitzring

See and be seen by others

Use cases with highest safety relevance

Crossing Traffic

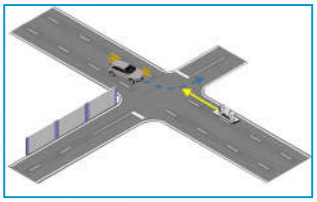
ADAS



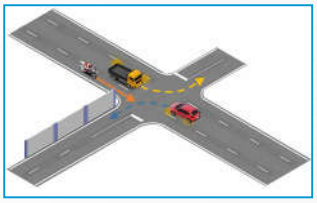
C-ITS

Left Turn Across Path Opposite direction

ADAS

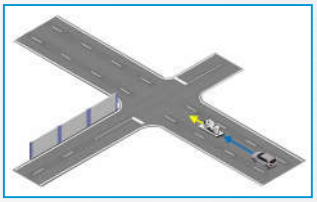


C-ITS

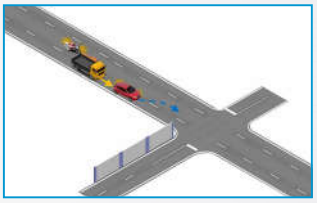


Longitudinal traffic & Lane Change

ADAS



C-ITS



Experience ADAS and C-ITS technology in action

Be aware of the unexpected

CMC specifications grant compatibility with C-ITS applications

Traffic situations

C-ITS: EEBL, SVW and AEVW*

EEBL:
Emergency Electronic Brake

SVW:
Stationary Vehicle Warning

AEVW:
Approaching Emergency Vehicle Warning

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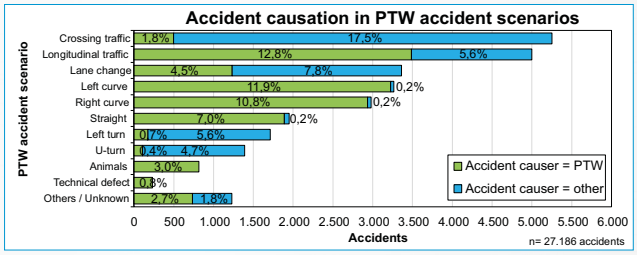
What has been done and lessons learned

CMC Feature Team Accidentology

Accident Analysis with representative accident data from Germany 2019

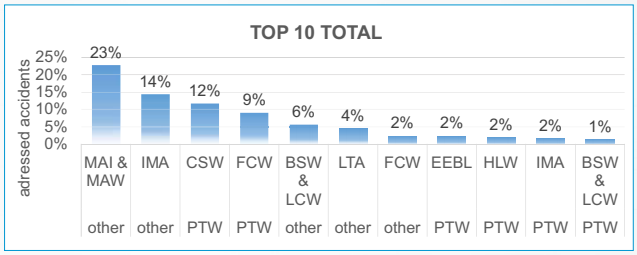
- ✔ Which scenario groups address how many accidents?
- ✔ What is the proportion of the main accident causer?



Assessment of C-ITS application potential

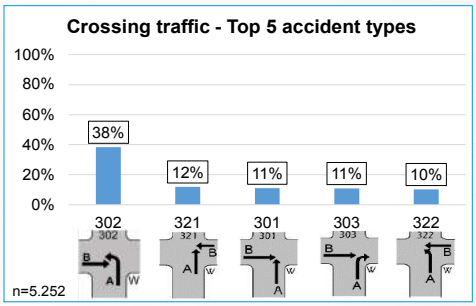
C-ITS Definitions of 2017/2018!

- ✔ Evaluation of the potential of 19 C-ITS



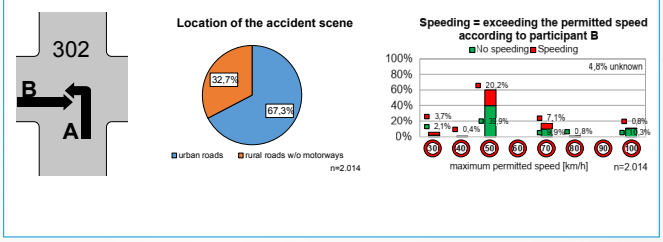
Definition of relevant use cases based on accident type

- ✔ Which use cases frequently occur in the scenario groups?



GIDAS-Analysis and comparison to global data

- ✔ Why did the accident happen?
- ✔ How does the German accident data compare with Italian, French and U.S. accident data?



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Simulation of the IMA&LTA applications in CARLA

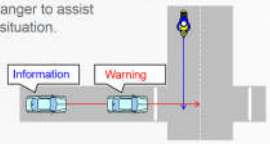
CMC Feature Team Application and Simulation

Application - IMA and LTA

Description

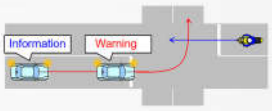
IMA: Intersection Movement Assist

- IMA will notify the driver of the "**Information**" of the approaching motorcycle presence at the intersection when the risk is detected.
- Then, if the risk becomes more critical, IMA will notify the driver of the "**Warning**" of imminent danger to assist the driver in recognizing the situation.

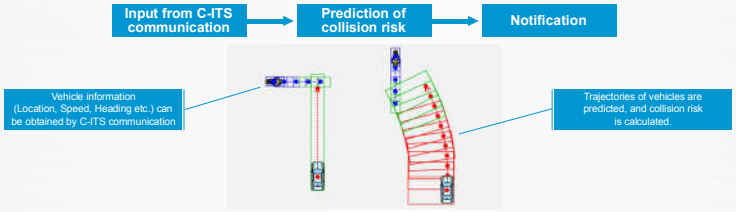


LTA: Left Turn Assist

- LTA will notify the driver of the "**Information**" of the motorcycle presence approaching the intersection when the risk is detected.
- Then, if the risk becomes more critical, LTA will notify the driver of the "**Warning**" of imminent danger to assist the driver in recognizing the situation.



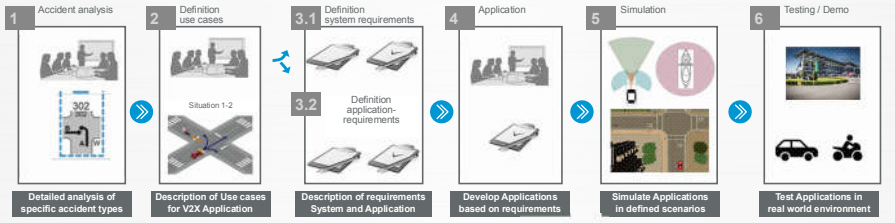
Mechanism



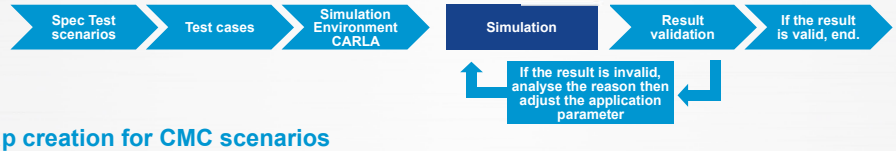
Simulation - Activities

Work approach

Use case driven approach in CMC



The development of the application and the results evaluation after simulation are carried out in recurring loops



Map creation for CMC scenarios

over-/underpass

curved road

intersection

Simulation examples in CARLA

IMA information

IMA warning

www.cmc-info.net

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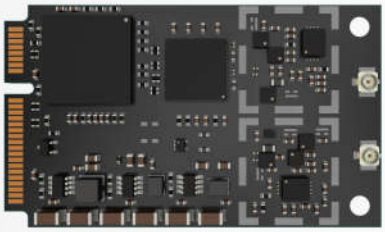
CMC Prototype Technology

Developed and run by nfiniity GmbH



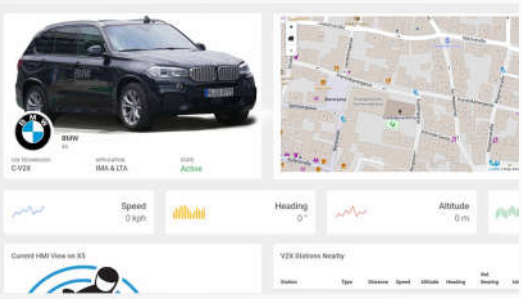
Advanced V2X Module

- LTE-V2X/C-V2X and DSRC/ITS-G5
- Dual RF-Frontend with Diversity
- AEC-QX Components
- Compact Size
- Hardware Security Module
- Wide temperature range

CUBE EVK

Designed to showcase the power and versatility of our technology.

- Included Applications:
  EEBL, FCW, IMA, LTA, DNPW, SVW, AEVW, RWW
- Develop Custom C++ or Python Apps on top of the V2X stack
- Security 1.3.1



CUBE DASHBOARD

- Web-based Dashboard
- Real-time Views
- Status Validation
- V2X Messages Visualization
- Debug Monitoring
- DENM Generator

AI and Simulation

- Create Traffic Scenarios
- Simulation-based Development for Applications
- Data Generation for AI Models

www.cmc-info.net

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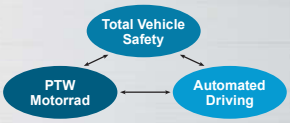
TOGETHER FOR RIDER SAFETY

Motorcycle rider protection through ADAS

Experienced & proven by Feature Team Testing

Motorcycle rider protection is being driven forward in close cooperation between car and motorcycle development divisions



Goals:

- To increase safety for Powered Two Wheelers

- To promote Powered Two Wheelers as a sustainable form of mobility for the future

Connected Motorcycle Consortium

- To prove current technology's effectiveness and focus improvements to maximize benefit

EURO NCAP www.euroncap.com

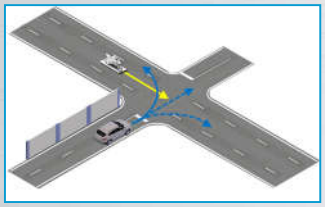
NHTSA

Results:

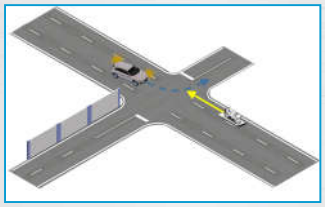
- **Analysis of severe motorcycle accidents:**

  ~35% riding accidents and ~65% collision type accidents.

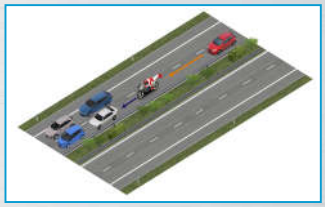
  Today's AEB-functions in cars address about 70% of these collision type accidents.



Crossing Traffic

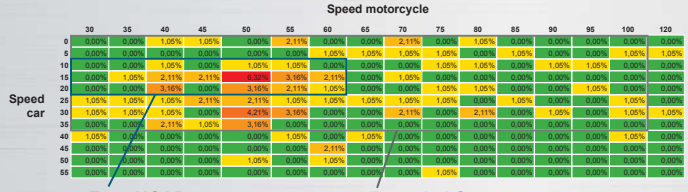


Left Turn Across Path Opposite direction



Rear end-collision

- **Front collision warning and braking function for turning with oncoming traffic:**
  Extended to accident-relevant speed range



Euro NCAP 2023 29,5%

Extended System > 80% already in the market

Functional range plotted over the cases from accident statistics

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TOGETHER FOR RIDER SAFETY

Study on Rider Reaction Times

CMC Feature Team Accidentology

Motivation

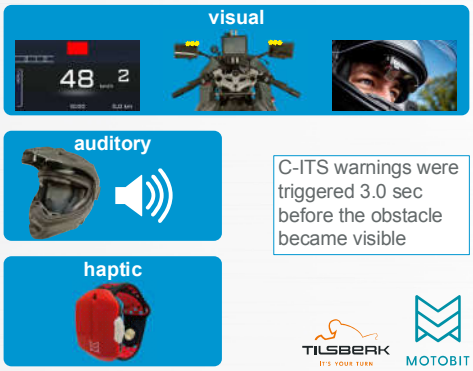
Safety applications that run in the PTW (ARAS or C-ITS based) need an interface to communicate information to the rider (e.g., warning), because the rider needs to initiate the necessary avoidance maneuver, e.g., braking.

Research question

What are motorcyclists' reactions towards different types of advisory notifications/ warnings?

METHODS

Rider notification concepts



C-ITS warnings were triggered 3.0 sec before the obstacle became visible

TILSBERK IT'S YOUR TURN

MOTOBIT

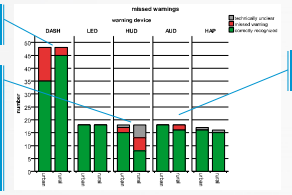
User study on the WIVW DESMORI dynamic motorcycle riding simulator

RESULTS

Gaze reaction

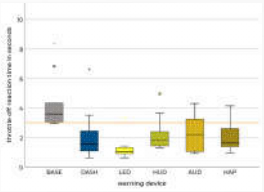
Not salient enough to capture the riders' attention.

Visually controlling the environment (behaviour of other traffic participants at crossings, trajectory planning on rural roads), led to a decreased focus on the HUD screen content.



Would have preferred a louder auditory warning.

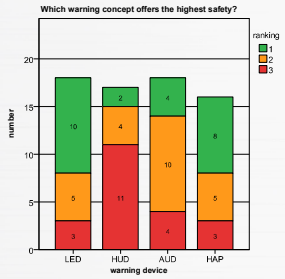
Throttle off reaction

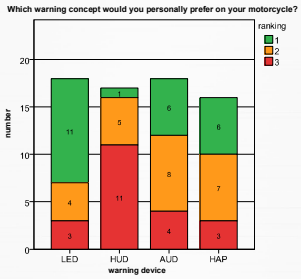


- On average, all warnings provoke earlier throttle off reactions than those observed in the baseline (before potential threat is seen).
- Tendentially, the LED reactions are faster on average and more homogenous.

– the orange line indicates the point in time when the obstacle becomes visible and the warning disappears

User feedback





- Individual preferences: all warning devices receive rankings from best to worst.
- The PTW-fixed LED is seen as most safe and most accepted at a time.

CONCLUSIONS

General

- Participant studies on the motorcycle riding simulator created empirical evidence for the comparison of future notification concepts in a safe and controlled environment.

Rider notification concepts

- The dashboard notification as stand-alone warning creates too much missed warnings.
- All other warning devices are generally useful to reduce the situation criticality by means of an increased situation awareness (attention towards the road and potentially critical upcoming situations). Throttle off and braking are less often necessary or can be initiated later and smoother, which in turn increases the reaction time in numbers.
- Yet, the mirror-mounted LEDs received the highest acceptance for reasons of comfort (e.g., "can not be forgotten", "fear of battery running low") and perceived safety (e.g., "no stable connection to external device necessary"), while the reaction times of those riders that decided to decelerate (throttle off & braking) were fast.