LINKS ACTIVITIES ON VULNERABLE ROAD USERS

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**LINKS FOUNDATION**

- **Private research centre** funded by Compagnia di San Paolo and Politecnico di Torino
  - Formerly *Istituto Superiore Mario Boella*
  - Focus on applied research and exploitation of research results

- **Multi Layer Wireless solutions (MLW) Area** has been working on vehicular communications since 2008
  - Both theoretical and practical activities
  - 2 FP7 projects: GAIN and GLOVE
  - 3 H2020 projects: InDrive, **Autopilot** and ICT4Cart
  - 2 regional projects: IoT__ToI and LIMPID
  - 2 private collaborations
  - Participation in 1 ETSI STF (395) and contributions to other WGs; following ETSI MEC for vehicular use cases
  - Several scientific papers, books, etc…

- Continuous development of a **Proof of Concept** composed by several components:
  - On Board Unit (OBU) with hybrid communication (ETSI ITS G5 and cellular), precise positioning and advanced ITS event awareness for autonomous vehicles
  - **Road Side Unit (RSU)** with image processing capabilities
  - **OBU for bicycles**
  - **OBU for drones**
  - Decision Support System tool (with real-time geo information)
LINKS INTERESTS ON THIS MEETING

• LINKS is currently implementing several use cases involving VRUs
  • Pedestrians and cyclists
  • Mainly in the framework of H2020 Autopilot and ICT4CART projects
• We will be glad to present our current activities (see next slides) and to exchange feedbacks
• We are able to rapidly implement and test new messages even in the pre-standardization phase
• We are interested to be updated about the STF activities to implement new proposed approaches in current or new European projects
PEDESTRIAN DETECTION AT CROSSROAD

- Edge detection (on RSU) of VRUs crossing with red
  - Stereo-camera to measure distances
- Notification of jaywalking to autonomous vehicles via DENM
  - over ETSI G5 + SPAT/MAP messages
  - Which position if more than one pedestrian is detected? One DENM per pedestrian?
- Not only a generic danger warning but also information about which lane is busy
  - Using DENM Àlacarte → Lane position field
  - More precise information can be useful but the camera precision is still under investigation
- Data are also sent to the cloud (oneM2M)

FALLEN BICYCLE

- Battery-powered OBU on bicycle
  - Sending CAM and DENM messages
- Integrating a GPS with accelerometers
  - Fill CAM with info about bicycle dynamics
  - Automatic detection of falls
- Notification sent via DENM message
- The DENM is automatically cancelled when the dangerous event is overcome
NEXT STEPS

TORINO SMART ROADS PROJECT

- Torino is becoming an open lab for testing connected and autonomous vehicles
- Same detection but the elaboration will be performed in the edge of the LTE network (ETSI MEC)
  - Delays must be very low
- Planned in the third quarter of 2019

ICT4 CART PROJECT: VIRTUAL MIRROR

- Extension of the pedestrian detection use case
- Not only people but also any vehicle type
  - Focus on safety of VRUs and crossroads
- Comparison between edge computation in ETSI G5 RSUs versus LTE networks
- Messages via DENM or CPM
- Planned in late 2019 or beginning of 2020
CONTACTS

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