C-ITS for Traffic Warnings

The city of Eindhoven has planned to deploy Cooperative ITS solutions, in order to improve traffic efficiency, reduce pollutant emissions and increase road safety. MACQ, Dynniq, A-Team and TU/e have partnered with other (associated) partners in the EU project "C-Mobile", to bring this solution to the next level. During this project, the first source, MACQ is responsible to install cameras on traffic light controllers to detect pedestrian’s positions. The second source is to connect to National Data Warehouse (NDW) for roadworks warnings. These data from both sources Macq and NDW will be translate to DENM for the cloud platform. These DENM encoded messages will be sent via cellular model to the display application used by pedestrians/cyclists. This is a challenge worthy of Computer Science students, as the DATEX II data of NDW uses a different geographic referencing system than the DENM. The DENM encoding tool can be extended to support IEEE802.11p communication from MACQ/RSU to a car(A-Team). TU/e will be responsible to develop **DENM encoding tool for** cellular and IEEE 802.11p model, integrate and simulate the DENM data for various traffic warnings such as Blind spot detection, Pedestrian warning, Road works warning, Road Hazard warning within Eindhoven.

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**Requirements**

**Roadside equipment**

- Type of TLC Similar to Helmond
- RSU
- Wired
- Display app
- Validation Cloud
- DENM encoding tool – cellular based
- DENM encoding tool – 11p based

**A-Team**

- BSD
- Pedestrian warning

**Cyclists/Pedestrians**

- RWW
- RHW
- Pedestrian warning

**DENM**

- IEEE 802.11p
- DATEX II (RHW, RWW)
- HMI
- Camera + processing
- VRU detection
- MQTT DENM
- Cellular MQTT DENM
- NDW

**DATEX II (RHW, RWW)**
ASSIGNMENT

1. Create a local Validation Cloud that:
   • Encode the data to DENM from Macq Cameras and NDW
   • Previous SEP project can be considered to ensure the security and authorization credentials required for validation cloud

2. Write an application that:
   • Develop a tool to encode DATEX II data from NDW into DENM
   • Subscribes to the local validation cloud via cellular data connection which can be done by extending already completed SEP summer project for displaying warnings to pedestrians/cyclists
   • Develop a tool to encode static data from MACQ into DENM
   • Subscribe to MACQ for sending DENM data to A-Team’s dashboard/OBU

3. Validate Non-Functional Requirements
   1. Check the performance and reliability of cellular and IEEE802.11p communication
   2. Validate about the capacity and efficiency of this DENM encoding tool
   3. The DENM encoding block should therefore also look at how long a message should live inside the cloud to prevent having old roadwork messages stuck in the system for years
   4. Perform integration test to ensure seamless communication between cameras/RSUs, pedestrians and vehicles
   5. Perform deployment validation at Eindhoven test site location

4. All communication should be secure.
5. All data handling should be efficient in terms of bandwidth and size.
6. The application should be documented in such a way that developers after this project can build further on your work.