VERIFICATION
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PROJECT of the PEGASUS FAMILY

GROUND TRUTH DATA CAPTURING VEHICLE

Designing a Ground Truth Reference Sensor System

Xun Dai, AVL

Urban Junctions as ODD

High dynamics and traffic participants in an urban environment can be a challenge for automated vehicles and also for reference sensor system. With focus on urban intersections, the challenges are multifold.

Fig 1 - Urban junctions can be very complex[1]

Requirement Engineering

Starting with defining the most vulnerable road users like child pedestrian, bicycle rider, motorcycle; followed by defining the complex junction geometries that occur in an urban environment.

Two different maneuvering modes are defined (as edge cases): *Stop&Go* - 'ego vehicle starts at 0km/h with a constant acceleration to cross the intersection' *Passing* - 'ego vehicle starts at a certain speed and drives through the intersection at a given speed', these modes are used as base to re-construct different real-life maneuvers on intersections which can prove to be critical.

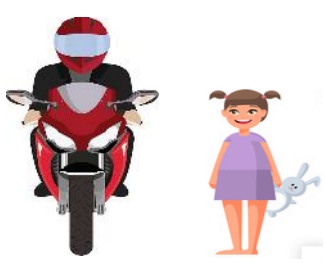

Fig 2.1 - Vulnerable Road Users

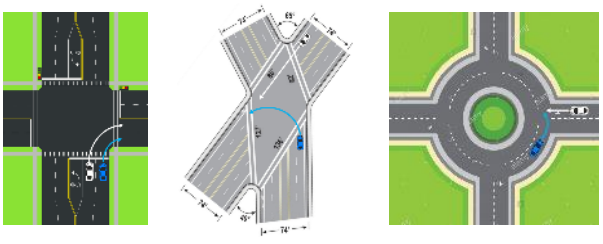

Fig 2.2 - Types of junctions

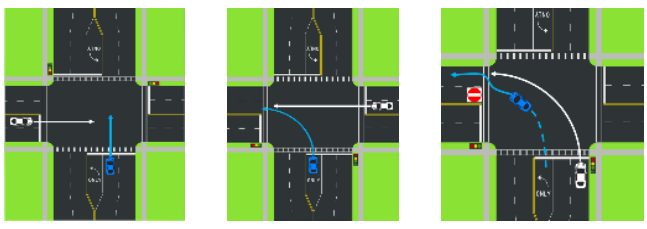

Fig2.3 - Different types of maneuvers

Sensor Simulation Tools

To design and verify the multi sensor system layout Simulation tools like AVL '*AD SensorLab*' are used. Detailed sensor positioning can be evaluated, optimizing field of view and minimizing dead zones. To verify the required perception range and satisfy the requirements generated for various critical situations that can occur in an urban junction the use cases can be visualized in the simulation tool.

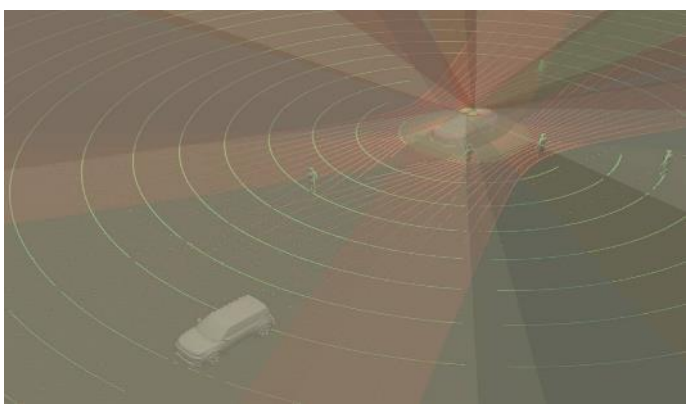

Fig 3.1 - Simulating the sensor FOV, perception range against various traffic participants

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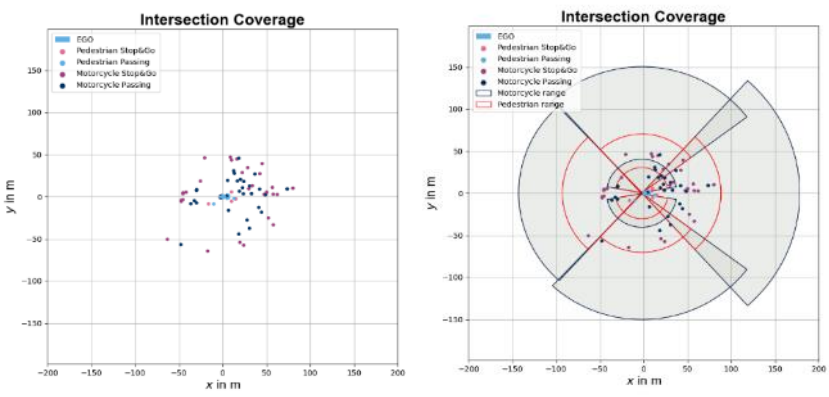

Fig3.2:-Sensor coverage and range(against UAI requirements)

Fig.3.2 shows the simulated sensor coverage for various traffic participants placed at a certain distance & orientation as a result from the defined Use Cases.

Building It Up – the DGT system

Hardware and Software Integration of the sensors into an all-weather(IP67) one-box solution, which can be easily mounted on any vehicle. The sensors are calibrated and synchronized with each other.

Fig4:-Reference sensor system

Fig5:-Sensors under Test

Sensor Under Test (SeUT) Integration

Extending the sensor suit in the vehicle, automotive sensors like Bosch Radar and 2x Valeo Lidar's are integrated into the vehicle, in order to capture the data parallel, which can be compared with the reference sensor data. In short, sensor evaluation against reference system.

Result

Data Recording Vehicle with reference sensor system including 6 HD cameras, 3 high resolution lidars providing a 360° field of view and additional 2xValeo Lidar, 1xBosch Radar as Sensor Under Test layer.

Fig6:-Data Recording Vehicle

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Contacts, references

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[1]https://deltasoftwaresolutions.net/pedestrian-counts/

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