Project1: Shared Vision

The purpose of this first project is to implement a JAVA-based multi-thread simulator for traffic information sharing between autonomous vehicles. The idea is to enable each of the vehicles (represented by one or more threads) to communicate with other vehicles in the vicinity, propagate relevant information and avoid delays and situations of conflict.

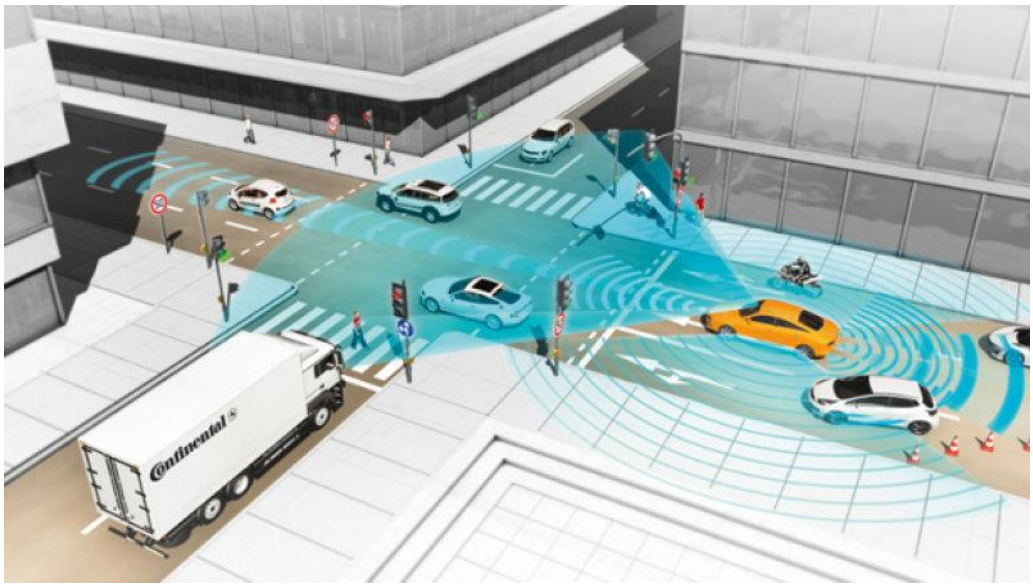

Figura 1: Continental (http://www.continental-corporation.com/)

As a first approach students should consider the following simple topics:

- ***Area:*** *An area of 1000 square meters with individual lanes.*
- ***Number of vehicles:*** *Three vehicles (A, B and C), at least two of them moving in the same lane and direction (for example, A and B).*
- ***Communication:*** *The vehicles should be able to send data such as their position (for the sake of simplicity just a pair of coordinates) to the vehicles in their vicinity (a given radius).*
- ***Scenarios:*** *With this approach it should be possible to simulate the following scenarios:*
    1. ***Detection of road condition*** *as one of the following and maintain the minimum distance presented:*
        - *Dry Asphalt: 10 meters*
        - *Wet Asphalt: 15 meters*
        - *Dry Concrete: 20 meters*
        - *Wet Concrete: 25 meters*
        - *Snow: 45 meters*
        - *Ice : 70 meters*
    2. ***Detection of hazard situation:*** *A vehicle can tell others that an obstacle was detected in a location where they are heading to. The affected vehicles should slow down when approaching the obstacle.*
    3. ***Collision warning in intersection:*** *Vehicles are approaching intersections at the same time and there is the risk of collision.*

In a second phase of development the following scenarios should be added to the simulation:

1. ***Several lanes in the same direction**: Vehicles can choose from one of several lanes.*
2. ***Control Loss Warning**: Vehicle loses control and warns others which should avoid it or slow down.*
3. ***Head on collision warning:** the risk of a head on collision is reduced by sending early warnings to vehicles that are traveling in opposite directions.*
4. ***Non-communicating vehicles:** vehicles that are not autonomous and unable to communicate with others should be added. Note that they can be seen by vehicles that are intelligent and can detect situations of conflict. For example, vehicle A can communicate with vehicle C but not with B. Vehicle A sees that vehicle B is in a situation of conflict with vehicle C which is unable to detect B by himself. A can still warn C and avoid an accident (for example in intersections).*
5. ***Alternative path**: Cars have always a predefined path and an alternative path. In the case of a lane interruption or slow down due to the road conditions the car should follow the alternative path (given it hasn't the same or worst problems).*

Grading

Next we describe a list of topics and the related grade (0 to 20).

Goal	***Grading***
Basic solution as described above (multithreaded with three vehicles, lanes, communication, synchronization and implementation of the topics: Detection of road condition, Detection of hazard situation and Collision warning in intersection.	*10*
Graphical user interface	*2*
Several lanes in the same direction	*1*
Control Loss Warning	*1*
Head on collision warning	*1*
Non-communicating vehicles	*3*
Alternative path	*2*

Note: Questions during presentation will be considered for evaluation of the goals.

Bibliography

- *Georgios Karagiannis, Onur Altintas, Eylem Ekici, Geert J. Heijenk, Boangoat Jarupan, Kenneth Lin, Timothy Weil: Vehicular Networking: A Survey and Tutorial on Requirements, Architectures, Challenges, Standards and Solutions. IEEE Communications Surveys and Tutorials 13(4): 584-616 (2011)*
- *Sichitiu, Mihail L. and Kihl, Maria. "Inter-vehicle communication systems: A survey" IEEE Communications Surveys and Tutorials 10 , no. 1-4 (2008): 88-105.*

Important Dates

***Submission Deadline**: 2 of May 2015.*

***Presentation:** From 4 to 15 of May 2015.(Tentative)*