

Autonomous Urban Driving: Tracking of Road Markings

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Goals and Objectives

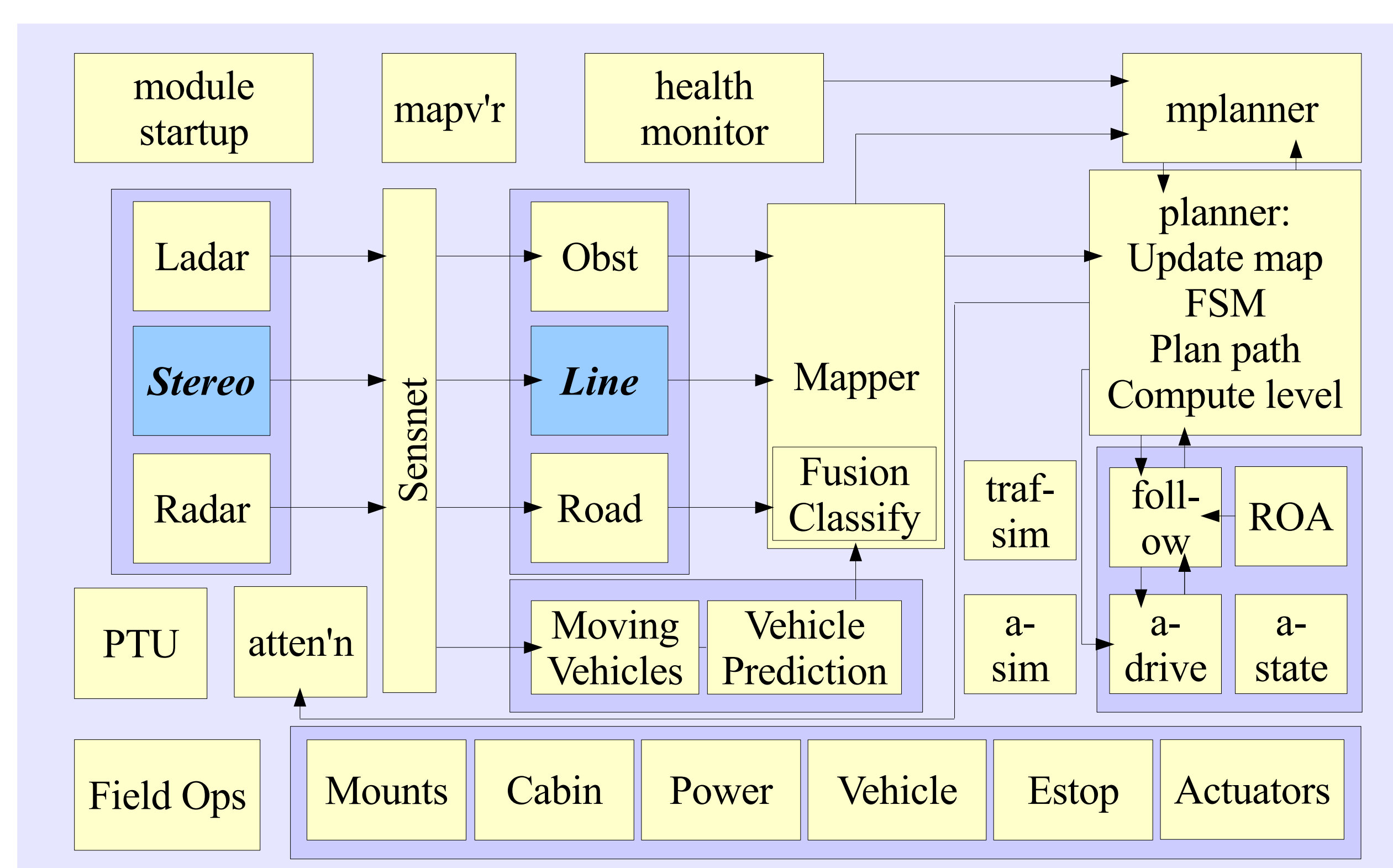
- **Enable an autonomous vehicle to drive on urban streets with no prior information about the road.**
- **Sensors and perceptors, which are the eyes and brain of the vehicle, must provide reliable data about the surroundings to ensure safe driving.**
- **Necessary data concerns type and location of road markings. Therefore, it is important to have a detector for these, which can perform in the diverse environment of urban traffic.**



Example of traffic situation. CalTech's autonomous vehicle is the van to the right.

System Description

The California Institute of Technology has an autonomous van named Alice. It has a detector for road markings implemented and the goal was to improve this by enabling *tracking* of detected lines.



Software architecture of Alice.

Tracking Algorithm

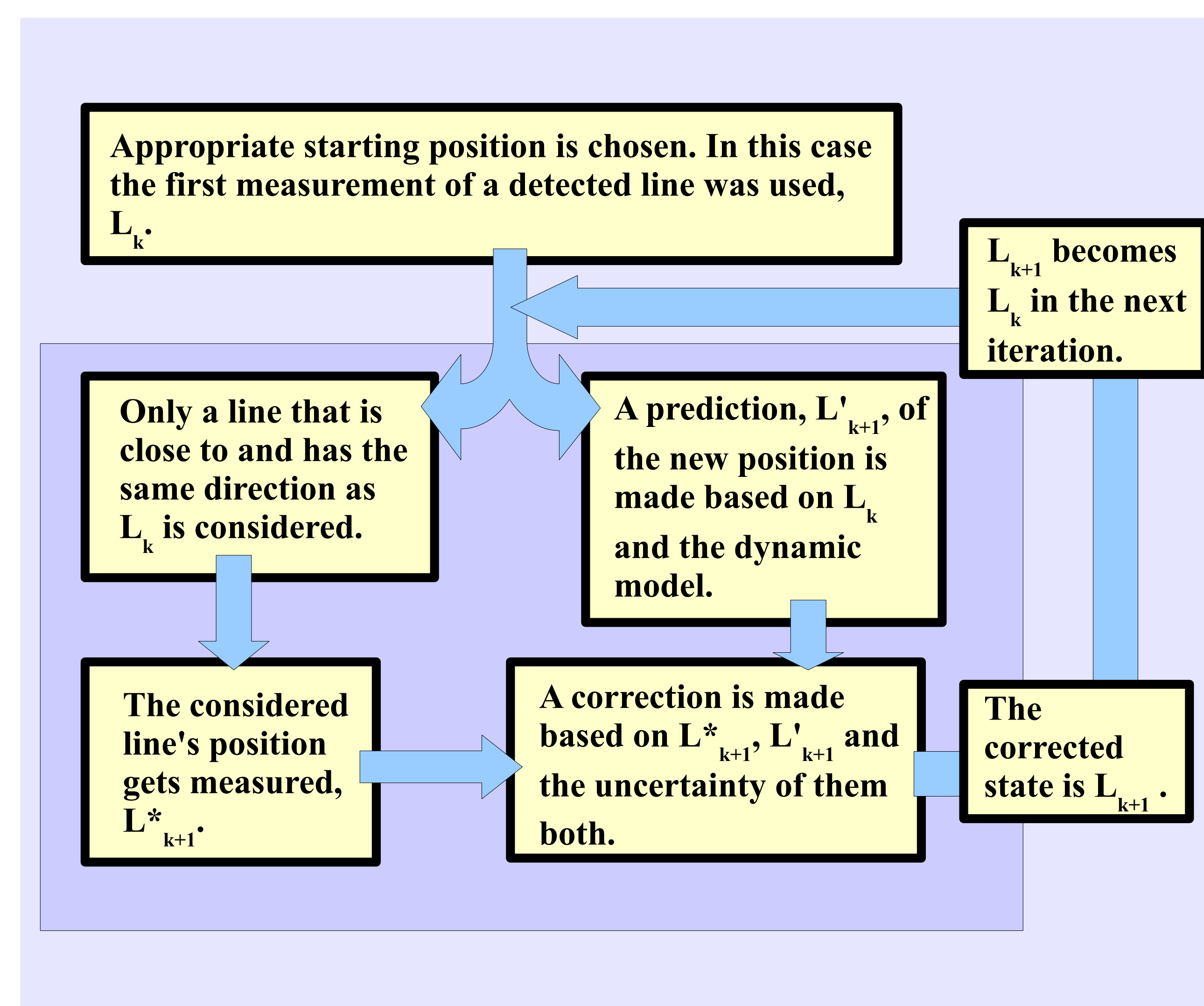
One could say that *tracking* uses three main parts to determine where the next position of a road line is:

- The previous position of the line.
- The measured position of the current line.
- The predicted position of the current line, based on a dynamic model describing how the line continues in space.

A well known algorithm for tracking is the *Kalman filter*. It merges the three main parts mentioned above to obtain the optimal next position with respect to the uncertainty of measurement and prediction.

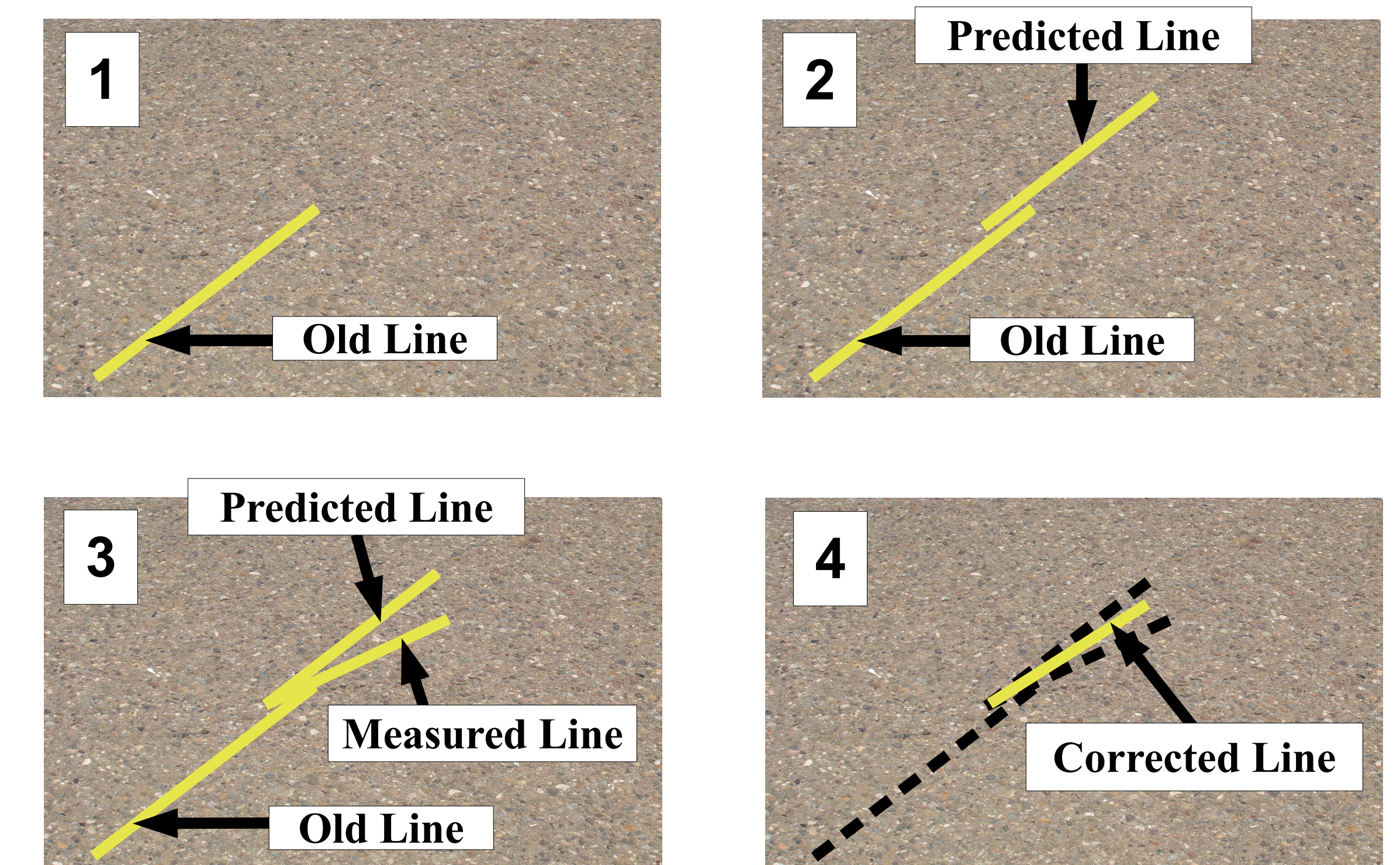
Kalman Filter

In a simplified manner, the steps of the *Kalman filter* loop are the following:



Implementation

The detector for road markings used stereo vision data to obtain the lines. The *Kalman filter* was implemented into the detector and it worked as follows:



Result

- The *Kalman filter* has been successfully implemented in the detector for road markings.
- The consistency of detected straight lines got improved.
- To achieve sufficient results in realistic urban environments further tuning of the uncertainties in the filter and some modification to the dynamic model of the lines are necessary.



This is what Alice sees with the left camera of the stereo pair. For visualisation, the corrected line gets displayed with its edges painted blue.