car detection, character recognition, traffic scenes, vision sensor

Włodzimierz Kasprzak *, Marcin Jankowski

The implementation of a vision sensor for traffic surveillance

1 Road traffic control within OMNI

The EC project OMNI ("Open Model For Network-wide Heterogeneous Intersection-based Transport Management") [1] provides an open-architecture model for road traffic management, by defining: standard interfacing for new applications or devices, and the integration of technology (surveillance applications, advanced sensors, other urban traffic strategies, etc) from different vendors.

One of the devices, specified in the OMNI model, is the video sensor [2], [3]. In this paper we describe our design and implementation of a modular video sensor software. We have implemented following vision modules within OMNI [4]: (1) camera auto-calibration, (2) traffic flow and (3) queue length detection, (4) car plate recognition. An additional communication module provides an interface to the OMNI-MOUN interface. A programming class implements each vision module and it can be transformed into an independent process or object, if a distributed system is required for it, by using the libraries of DCOM or CORBA.

2 Communication with OMNI

The OMNI interface module constitutes an object of a class called LLFieldVideoSensor. The information exchange between OMNI and our video sensor is implemented by a set of DCOM interfaces, which are defined by OMNI: ILLFieldVideoSensor - to control the image analysis process, ILLLaneSensor - to inform about the lane's queue length and occupancy ratio, ILLZoneSensor - to inform about the traffic flow.

3 The auto-calibration module

The authors have implemented a semi-automatic *camera calibration* procedure, a simplification of [5]. The user should first measure manually in the environment and secondly he should set the following parameters, required by the semi-automatic calibration procedure (Fig. 1): to select image lines, defining the Vanishing Point (VP), to point the line segment, according to which the calibration of the camera's focal length shall be performed, to measure the height over the road of camera's origin center. After the transformation parameters from the camera to road coordinates are known the complete camera transformation matrix is computed.

4 Traffic flow and queue length detection

In a selective way, for each lane, the following 'measurement' is performed: *queue length* (occupancy ratio) detection - if vehicles are queuing and not moving; *traffic flow*, i.e. the number of vehicles in a lane per minute, which are passing the zone (Fig. 2).

*Institute of Control and Computation Eng.,Warsaw University of Technology, ul. Nowowiejska 15/19, 00-665 Warszawa, E-mail: W.Kasprzak@ia.pw.edu.pl , M.Jankowski@elka.pw.edu.pl

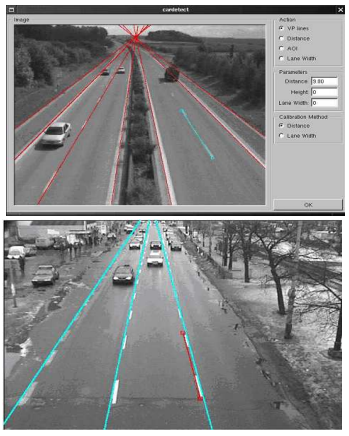

Figure 1. Camera calibration: (left) the dialogue window, used for camera calibration; (b) example of camera calibration (blue lines were automatically detected - red line is marked by the user to specify the scale factor).

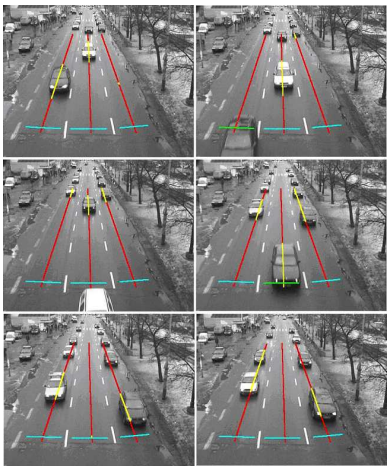

Figure 2. Some results of car counting (change form blue to green horizontal line) and queue length estimation (red line is changing to a yellow one).

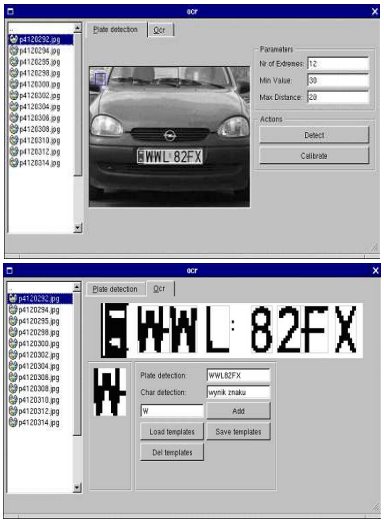

Figure 3. Dialogue windows for licence plate detection and recognition.

5 Licence plate recognition

The licence plate detection performs two main tasks [4], [6]: (1) the detection of a rectangular image area, where the licence plate is expected to be located, and (2) the detection of each individual character in the licence plate area. With its results it fits either a conventional OCR (optical character recognition) package or our character recognition procedure, which can learn character patterns from current user-defined image data (Fig. 3).

Acknowledgment

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