CO-207

REALISTIC ROAD MODELLING FOR DRIVING SIMULATORS USING GIS DATA

DESPINE G., BAILLARD C.
SIRADEL, RENNES, FRANCE

BACKGROUND AND OBJECTIVES

The Siradel company is partner of the collaborative project PlatSim initiated by ECA Faros, a driving simulator editor. One goal of this project is to model real cities to run driving simulation within real-like environments. In this paper we propose an automatic solution to create compliant 3D road databases from standard GPS car map and existing GIS data.

APPROACH AND METHODS

Road modelling for traffic simulation involves data of very different types. We use a data model based on three levels.

- The road network level describes how road axes are arranged, the main traffic rules and the priority at crossroads.
- The traffic level describes the possible traffic flows. This level allows the simulator to generate a random traffic around the driver.
- The graphical & physical level enables the generation of the 3D scene and constrains the vehicle behavior by defining authorized driving surfaces and obstacle areas.

A set of transversal links insures consistency between these three levels. Any change in the network level leads to a change in the graphical and the traffic levels.

In the second part of the paper we describe how such a data model can be automatically instantiated using two kinds of data as input: a GPS navigation data base, providing 2D road axes associated with driving attributes, and a 3D GIS database representing the ground, 3D road axes, vegetation and buildings.

GPS car map attributes provide various information like driving directions, road classes, estimated speed, authorized or forbidden maneuvers. However they do not include any information about the road width, the number of lanes or the shape of the road profile. A set of rules is therefore defined to interpret attributes and find the most likely road model.

The crossroad organization is the major issue in road modelling as a wide variety of cases can be found in the real world: shifted branches, 5 or more concurring branches, L-shaped main street, compound crossroads… This diversity makes the modelling process more complex, because it affects both the geometry construction and the traffic rule design. This problem is tackled by introducing the concept of road continuity: two roads are associated if they present semantic and geometrical similarities. A crossroad can then be regarded as a set of crossing traffic flows rather than independent branches connected to the same point.

Priority rules and road markings are finally created according to simple rules: pedestrian crossings are created at each intersection and longitudinal lines are inserted between lanes; according to the priority system, transversal road markings are created at intersections and appropriate signs are inserted on the side.

RESULTS

The method has been tested on a district of the city of Lyon, France. The input data consist of a 2D GPS car map provided by TeleAtlas and a GIS 3D data base produced by Siradel. An area of 1.4 km² covering 28 km of roads with 285 intersections was produced with a computational time inferior to 5 minutes. The resulting data base was successfully interfaced with the ECA Faros EFX driving simulator (see Fig. 1).

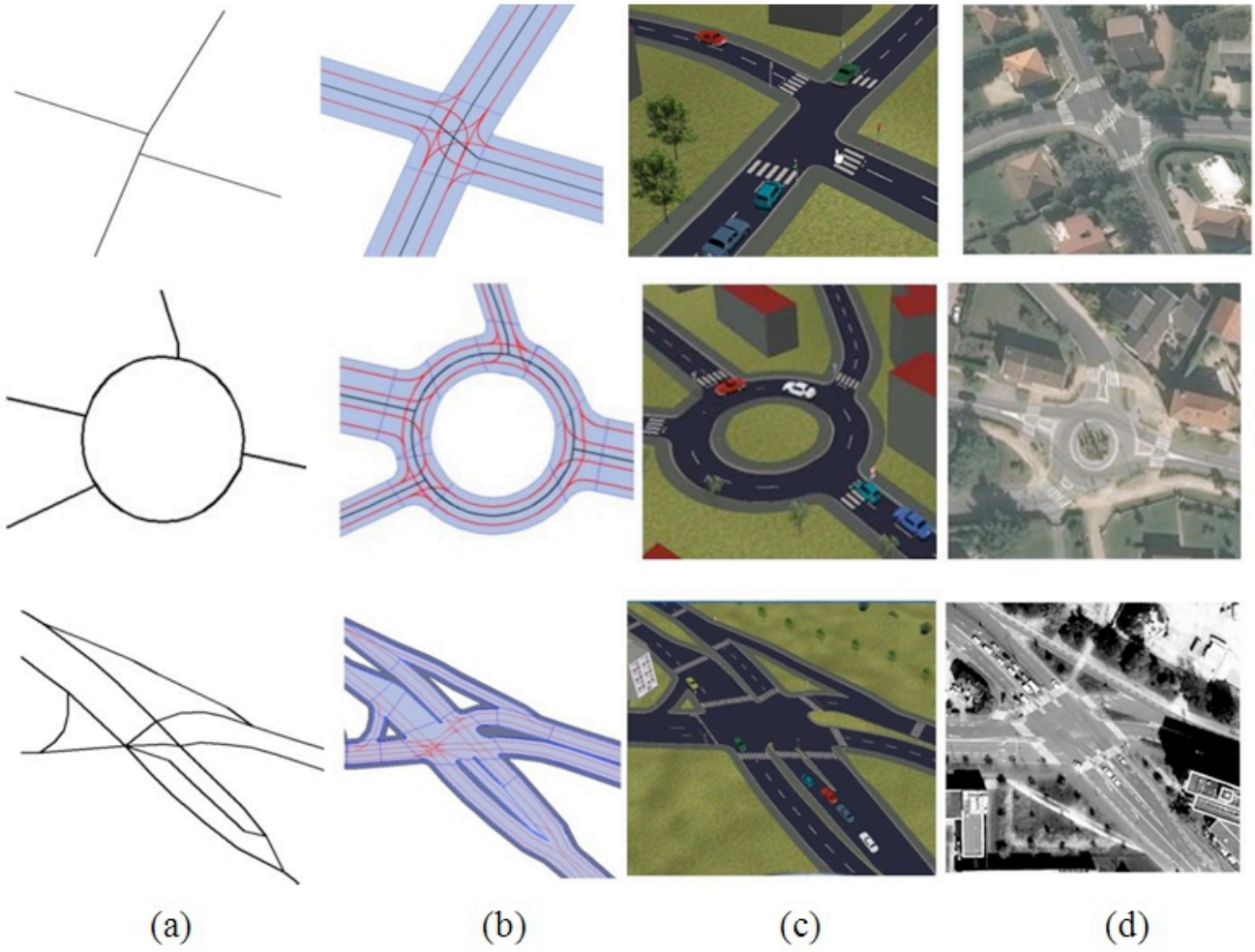

Figure 1. Details of the resulting base. (a.) input polylines from the GPS navigation map; (b.) traffic lanes in red and the carriageway in blue; (c.) resulting 3D scene in the simulator; (d.) corresponding orthoimage

CONCLUSION AND FUTURE PLANS

In this paper we propose an automatic solution for creating 3D road models for driving simulators based on existing road networks. The work described in this paper is a part of a more general study involving various data sources, like aerial photographs, Digital Elevation Models, terrestrial images and terrestrial laser point clouds. The final objective is to automatically and reliably extract most information required by the driving simulators.