

Component-based hardware-software system for fuzzy controlling of automated vehicles

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We present an upgraded version of a half-autonomic caterpillar vehicle and its controlling system in this paper. The original version of which was constructed for a competition.

We made a system consisting of two main parts: a fixed base station and a vehicle. The desired route of the vehicle is uploaded to the base station, so that it passes along on this route without any human interaction.

The moving unit basically built from a Ready-to-Run R/C tank model but the electronics were replaced: we use a “mitmót” for low level controlling of the vehicle, and for radio communication with the base station, where a PC is responsible for high level controlling, and displaying. Another “mitmót” is connected to the computer also for communication purposes. A web camera is used for determining the actual position of the vehicle by recognizing the LED pattern located on the top of the vehicle.

An application written for TinyOS runs on the control unit of the vehicle. Several sensors (e.g. collision detectors, metal detector) are connected to this unit, and it also has general purpose outputs.

A fuzzy controller is used for high level controlling, since our system is strongly nonlinear. We achieved our goal by implementing an own fuzzy class library written in C#.NET using .NET class libraries, and C native functions.

We developed our program keeping to the fore the clarity, the extensibility of the code, and the exchangeability of the components. We created a system that consists of both hardware and software that can be easily developed further and adapted for other vehicles, even for new positioning systems. Moreover, we can easily develop the graphical user interface for several purposes.

References:

- [1] Kóczy T. László, Tikk Domonkos: Fuzzy rendszerek (Typotex, 2000)
- [2] <http://www.magyarokamarson.hu>
- [3] Open Source Computer Vision Library
<http://www.intel.com/technology/computing/opencv/index.htm>
- [4] Image Processing Lab in C# (AForge Image Processing Library)
http://www.codeproject.com/cs/media/Image_Processing_Lab.asp
- [5] Camera Calibration Toolbox for Matlab
http://www.vision.caltech.edu/bouguetj/calib_doc/