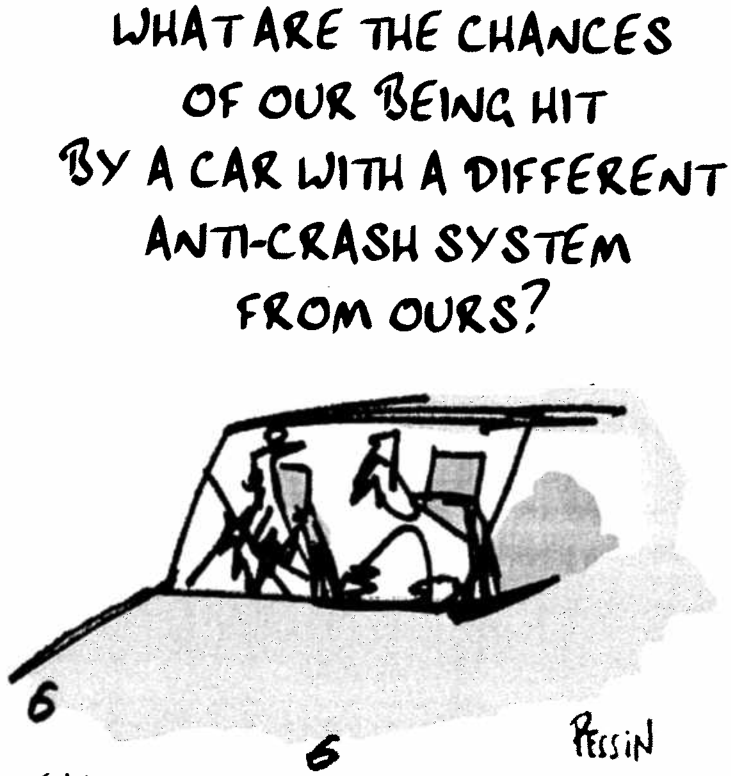
INEDIT #55
July 2006

INDUSTRY/SOFTWARE/PATENTS

Toward a "Zero Accident" Car

Interview with Hiromichi Yanagihara, Chief Technologist, Executive Advisory Group of TME NV/SA

The E-Motion project and the automaker Toyota have come together to collaborate in the domain of driver assistance systems. A venture that stands out as an example of smooth and effective organisation.



INédit : *What led you to work with INRIA?*
Hiromichi Yanagihara: Our goal in entering the European market has been to meet its demands as effectively as possible. In particular, we're trying to align ourselves with the imperatives on respecting the environment – our hybrid car is one example – and building highly safe vehicles with the objective of zero accidents. Our expansion into Europe is also fueled by a desire to contribute to European society. Participating in European research, as well as building factories in European countries, is part of this strategy. We first learned of INRIA's research during a gathering organized by Agence d'Etude et de Promotion de l'Isère, or AEPI [regional economic development agency] in January 2005. We found the INRIA researchers very friendly and their work very interesting. A few months later, we decided to contact them to initiate a collaborative project.

INédit : *What is the focus of this project?*
Hiromichi Yanagihara: Christian Laugier's team, E-Motion, is specialized in advanced and secure robotized systems. They develop innovative technologies for those interested in driver assistance systems. For example, they've come up with a novel approach allowing real time interpretation of sensor data (see article on this subject). There's a lot of research to be done in this domain, which ranges from sensors to analysis of the data collected and design of suitable interfaces. We've started with relatively modest projects that allow us to get to know each other better and appreciate of our respective contributions. Once this work was completed, we started, at the start of 2006, a much broader collaboration, due to last for three years, which involves the INRIA start-up Probayes, and which takes us to Grenoble on a regular basis.■

→ CONTACT
Hiromichi Yanagihara, *Chief Technologist, Executive Advisory Group of Toyota Motor Europe NV/SA, Brussels.*
Tel.: + 32 2 712 34 96, Hiromichi.Yanagihara@toyota-europe.com

PATENTS

■ USING RANDOMNESS TO INTERPRET SENSORS

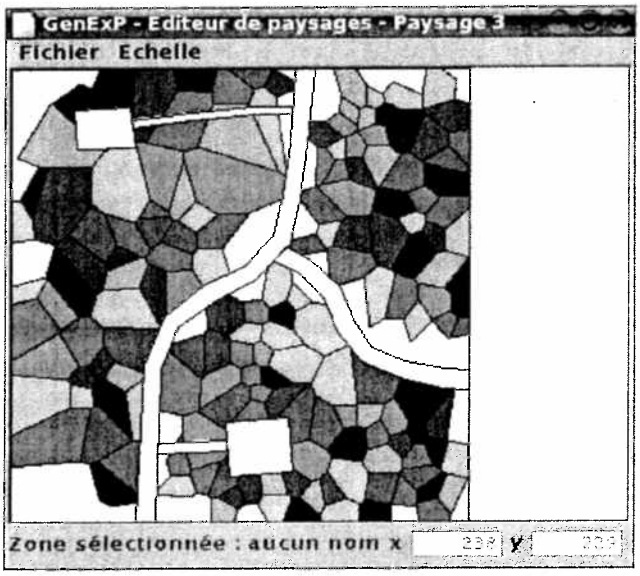
Whether we are dealing with an autonomous robot or a car equipped with sensors to assist the driver, the problem is the same: how the enormous data flow collected using sensors can be processed and interpreted in spite of the uncertainty surrounding its exact quantity. Bayesian techniques offer a solution to this problem and were the inspiration behind the Bayesian Occupation Filter (BOF) patented by the E-motion team and its partners. The process is based on a Bayesian filtering mechanism designed to predict and estimate the current states of the world from a sequence of observations. It achieves this by using a sensor model, a dynamic model and prior knowledge of the perception task to be carried out, with all the variables and data expressed in probabilistic terms. Within the road safety context, for example, this principle could be used to anticipate the possible presence of a pedestrian ahead of a vehicle, on the basis of knowledge already acquired concerning previous states of the environment.

The Bayesian occupancy filter is original in that it combines a Bayesian filtering principle – suited to uncertainty processing – with a discretized representation of space and speeds, used to characterize the probability of a moving object being present in each element of the resulting grid. This type of processing is perfectly suited to the way sensors operate (laser, radar, camera, etc.). In particular, it can be used to model changes (including temporary occlusions) in the environment by simply updating the occupancy grid one step at a time. This patent, registered by the INRIA and CNRS, has led to industrial collaboration with Toyota and Denso, the automotive OEM company. A second patent has followed, this time registered by the INRIA, CNRS and INPG and a start-up company called Probayes. The new patent takes into account the real operating conditions of the system (a broad speed spectrum, for example), adds a wavelet-based model compression procedure for more effective processing and introduces the principle of massively parallel computing for hardware implementation.■

➔ CONTACT
Christian Laugier, *project E-motion, INRIA Rhône-Alpes*
Tel.: + 33 4 76 61 52 22, Christian@Laugier@inria.fr

SOFTWARE

■ SIMULATING AGRICULTURAL LANDSCAPES



© projet Orpailleur / INRIA

How can agricultural landscapes be designed to limit the dispersion – by wind, regrowth or transport – of transgenes resulting from genetically modified crops? Researchers from the Orpailleur team were involved in elaborating tools to address this problem as part of a project set up by the French Minister of Research that brought together teams from Loria, Inra, université Paris-Sud and Cetiom[1]. They have developed Genexp, a simulator of agricultural landscapes that involves dividing the landscape into plots using the statistical parameters of real landscapes by applying standard computational geometry. Crops (rape, corn, wheat, GMO or otherwise, etc.) are divided up into plots chosen according to neighbouring crops and the type of crop that previously occupied the plot in question. The original feature of this software is that it is combined with data mining software (Carrotage software) also developed by the Orpailleur team to integrate knowledge on crop succession created from agricultural data. In this way, Genexp provides perennial maps of agricultural landscapes for the Mapod-Maîs and Genesys-colza software that is used by agronomists to simulate the dispersion of pollen and seeds from GMOs in time and space. Genexp is available as GNU freeware. http://www.loria.fr/~jfmari/GenExP/.■

[1]*Cetiom: Technical centre for research and development of oilseed production procedures in France*

➔ CONTACT
Jean-François Mari, *université Nancy 2, project Orpailleur, INRIA Lorraine and Loria*
Tél. : + 33 3 83 59 20 79, Jean-François.Mari@inria.fr

■ BUILDING SELF-ADAPTIVE SOFTWARE

By pooling computer equipment that has wide geographic distribution, computing grids provide unrivalled computing power and storage capacity. Nonetheless, developing applications that are part of such an infrastructure remains difficult. In particular, the optimal functioning of the application must be ensured, despite variations in the number of available processors. Researchers from the Paris team developed the Dynaco software to help developers integrate these requirements into their own software.

Dynaco (Dynamic Adaptation for Components) provides a simple and effective approach to designing software components that are able to self-adapt to the context in which they are run. This software provides an extremely flexible framework that makes it possible to specify the structure of the adaptation mechanism and combine its various elements. More specifically, it defines the interfaces between the three entities (a decider, a planner and an executor) competing for the desired dynamic adaptation. The software's strength lies in that fact that it lets the developer specialize in his/her approach to his/her particular application, thus making it possible to ensure that the applications are adaptable, independently of the way in which they are programmed. Dynaco's second original feature is that it is able to handle applications containing programmes that run in parallel on individual processors. This extension of the dynamic adaptation model is used to ensure that the processes are adapted coherently with a re-dimensioning of resources, particularly according to the availability of the processors. Dynaco has been implemented for the Fractal component model developed by the Objectweb consortium. It is distributed under LGLP licence http://dynaco.gforge.inria.fr/.■

➔ CONTACT
Françoise André, *université de Rennes 1, project Paris, INRIA Rennes and Irisa*
Tel.: + 33 2 99 84 71 73, Francoise.Andre@inria.fr