

FFI

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Automatisk undanmanöver vid osymmetrisk  
krock, del 2



Project within Vehicle and Traffic Safety, 2009-00078

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### FFI in short

FFI is a partnership between the Swedish government and automotive industry for joint funding of research, innovation and development concentrating on Climate & Environment and Safety. FFI has R&D activities worth approx. €100 million per year, of which half is governmental funding. The background to the investment is that development within road transportation and Swedish automotive industry has big impact for growth. FFI will contribute to the following main goals: Reducing the environmental impact of transport, reducing the number killed and injured in traffic and Strengthening international competitiveness. Currently there are five collaboration programs: **Vehicle Development, Transport Efficiency, Vehicle and Traffic Safety, Energy & Environment and Sustainable Production Technology.**

For more information: [www.vinnova.se/ffi](http://www.vinnova.se/ffi)

## 1. Executive summary

Modern vehicles present an excellent protection to many sorts of frontal collisions. This is achieved by taking care of the crash energy by actually enhance absorption within the frontal structure.

In others words, by getting a controlled deformation during the crushing process, the forces acting onto the vehicle passenger are limited. In addition, the protection systems as belts and airbags enhance the smoothing of the crash pulse.

Nevertheless, this can only functions if the impact forces can be taken by the vehicle front structure. If the external forces do not apply on the frontal structure, a small overlap occurs (see: figure 1). In such a case, the adequate protection of the occupant is not ensured.

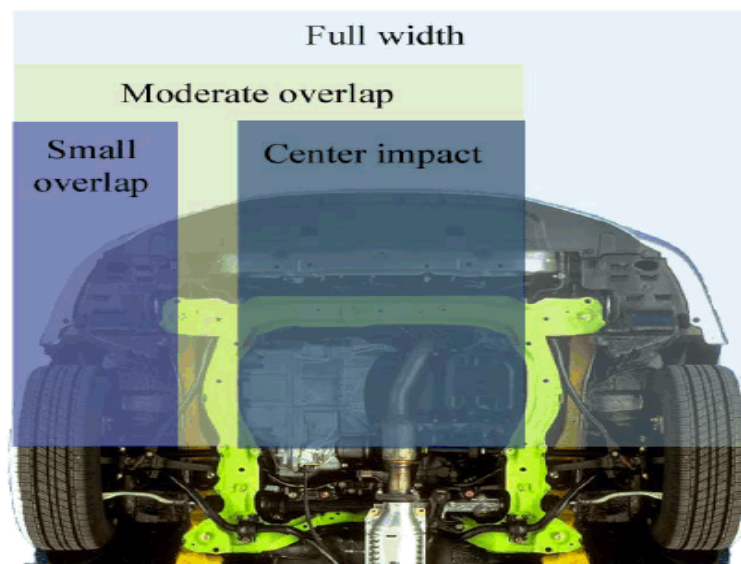


Figure 1: Front-vehicle structure

The purpose of the project is to study the feasibility of a system in which a sensor, detecting a coming vehicle and thus a potential small-overlap situation, would activate the automatic steering of the host vehicle aiming then at avoiding the small overlap situation.

Due to Saab Automobiles bankruptcy and internal prioritizing, Autoliv has decided to stopped this project, which **does not** prejudge of the feasibility of such kind of automatic steering systems.

## 2. Background

### Accidentology

A study relating to the crashes in Sweden in 2011 of belted people showed that 69% of the fatalities happens in frontal collisions, and that 48% of the fatalities caused in frontal collisions, occurred in small overlap collisions.

In consequence, there exists a strong correlation between the level of severity of the injuries and small overlap as impact mode.

### Technology

Stereo-vision technology is about using a pair of images taken at exactly the same time which describes the same scene from 2 different angles of view. This slight difference in the angle of view enables the system to compute a direct distance measurement.

This is done by computing a disparity image, i.e. the difference, expressed in pixel coordinates, of the corresponding point in the left and the right image. The depth, i.e. the distance between the camera and a given point in the world, is then deduced by a trigonometric relation.

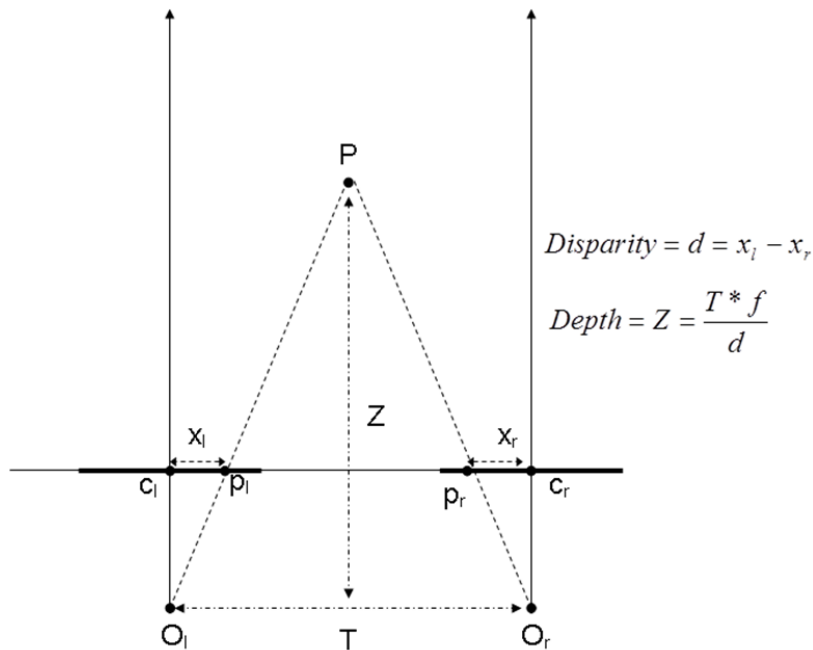


Figure 2: Stereo-Vision Principle

Equivalent computation are made for all the pixel which results into a depth image which associate a distance to each pixel.

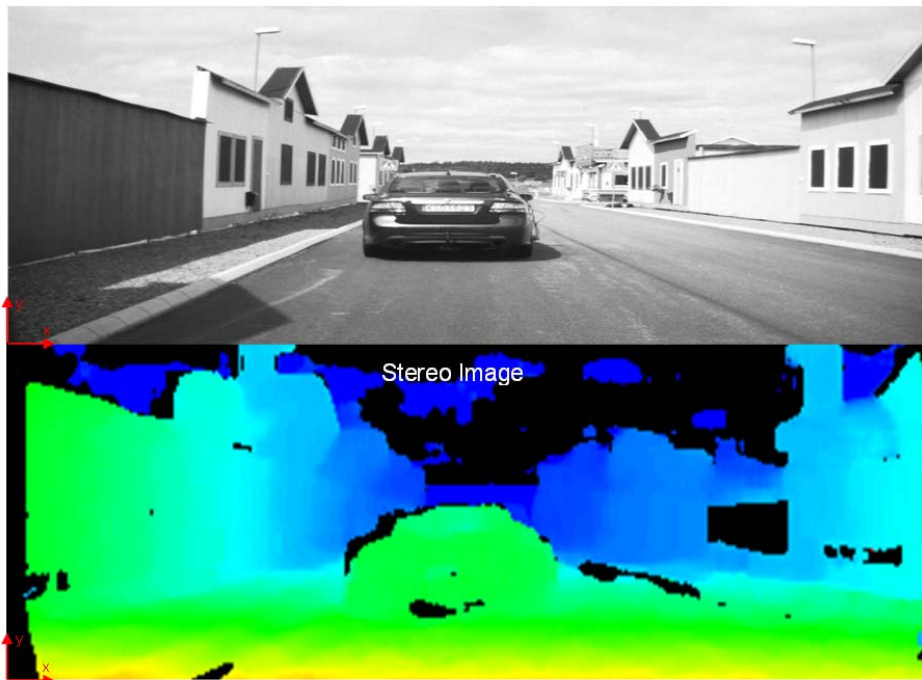


Figure 3: Depth image

## 3. Objective

The project objective is to do a feasibility study which means answering the following questions.

- Is it possible to design a system that handle small-overlap?
- What is the required sensing accuracy?
- How fast the steering system should be? Is it possible to achieve the required swiftness by selective braking?

Thus the overall objective is that the Saab vehicle equipped with the stereo-vision automatically brakes on selected scenarios.



## 4. Project realization

The work is split into 3 main work packages.

### **Work Package 1:**

This work package is about Testing

It is made of three sub-parts:

- Part A: Test preparation
- Part B: Test execution
- Part C: Test analysis

Autoliv Electronics AB is the main responsible of this work package.

### **Work Package 2:**

This work package includes theoretical studies and is made of two sub-parts:

- Part A: improvement of the image processing algorithm
- Part B: safety analysis as functional safety.
- Part C: design of specific test methods

Autoliv Electronics AB is the responsible of the part A while Saab Automobiles is responsible of the part B and C.

### **Work Package 3:**

This work package includes validation of the tests methods as well as the construction of a demonstration vehicle. Autoliv Development and Saab has a shared responsibility of the this phase.

## 5. Results and deliverables

### 5.1 Delivery to FFI-goals

As the project as being stopped, it has not contributed to FFI-goals.

The only work that have been performed is the part A of the Work-package 1, i.e. update of the test vehicle and update and validation of part of the test system.



## **6. Dissemination and publications**

### **6.1 Knowledge and results dissemination**

No results dissemination were made in the project.

### **6.2 Publications**

No publications were made in the project.

## **7. Conclusions and future research**

Steering Assist Systems and Automatic Steering Systems are currently growing research topics within several OEMS having even made demonstrator which indicates how interesting the topic is.

## **8. Participating parties and contact person**

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