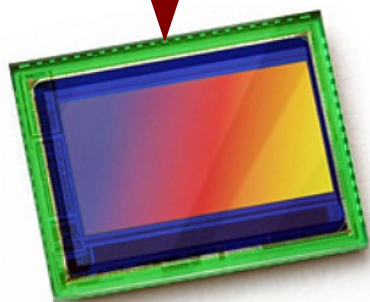


OpticalFlow-Z

**ZMP**



Insect eye

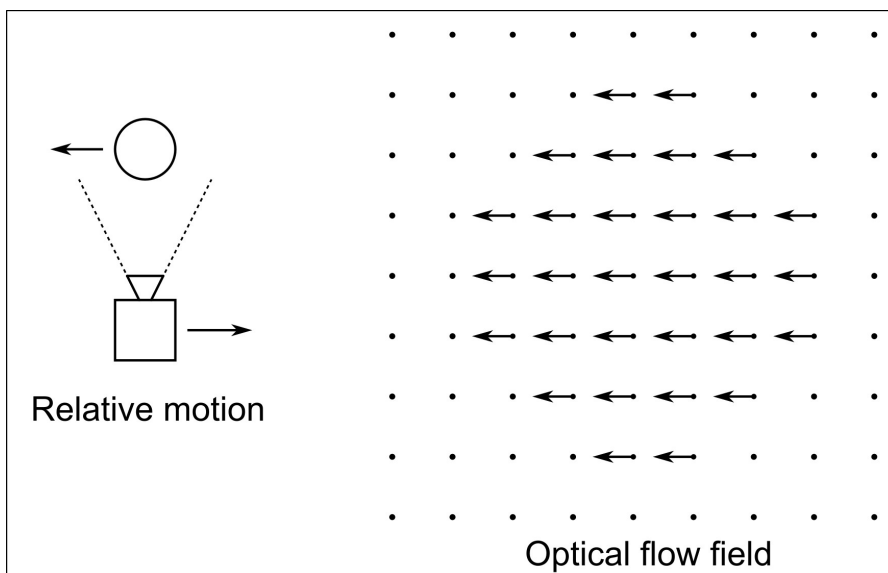


CMOS image sensor

Insects can navigate effectively using vision...

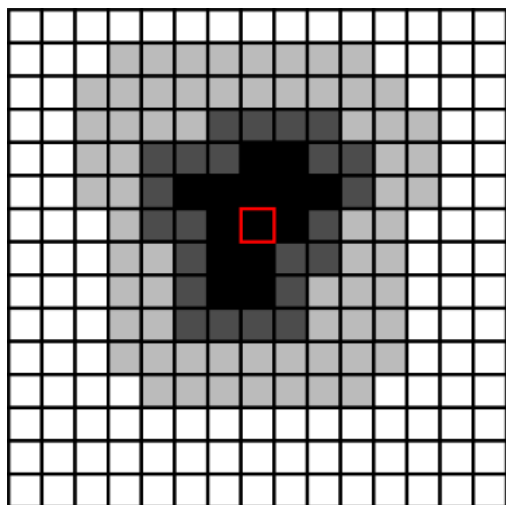
...**without** needing a powerful CPU/GPU like many modern image processing algorithms

Applying the techniques used by insects to modern digital electronics, we can create new types of miniature sensors such as the OpticalFlow-Z

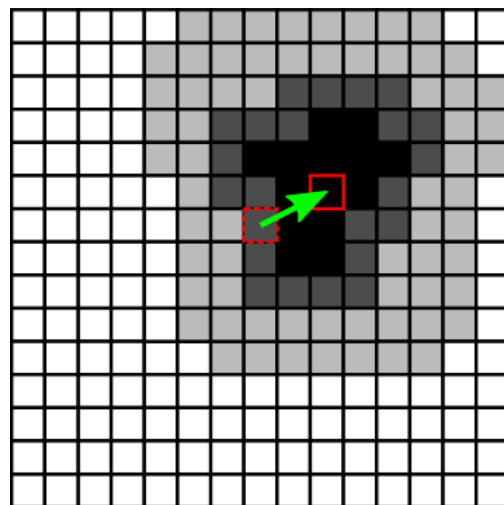


## Measurement of relative motion:

- Motion of objects seen by the sensor
- Motion of the sensor relative to a stationary background
- A combination of the two



Frame 1



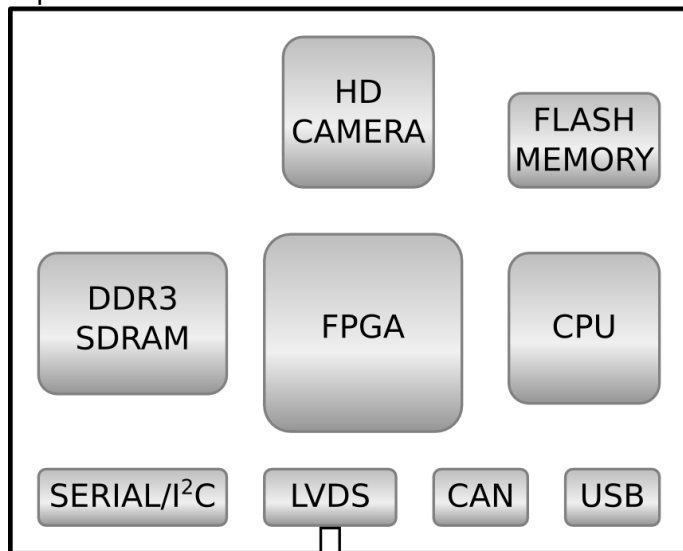
Frame 2

## Calculated from successive images

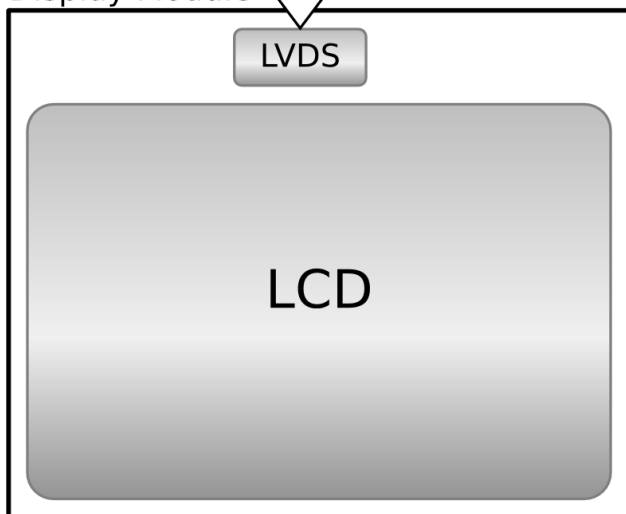
- Features such as edges are detected in the images
- The area around each sample point is compared between both images
- The motion vector at each sample point is determined by the distance objects have moved

# ZMP OpticalFlow-Z Sensor

OpticalFlow-Z Module



Display Module

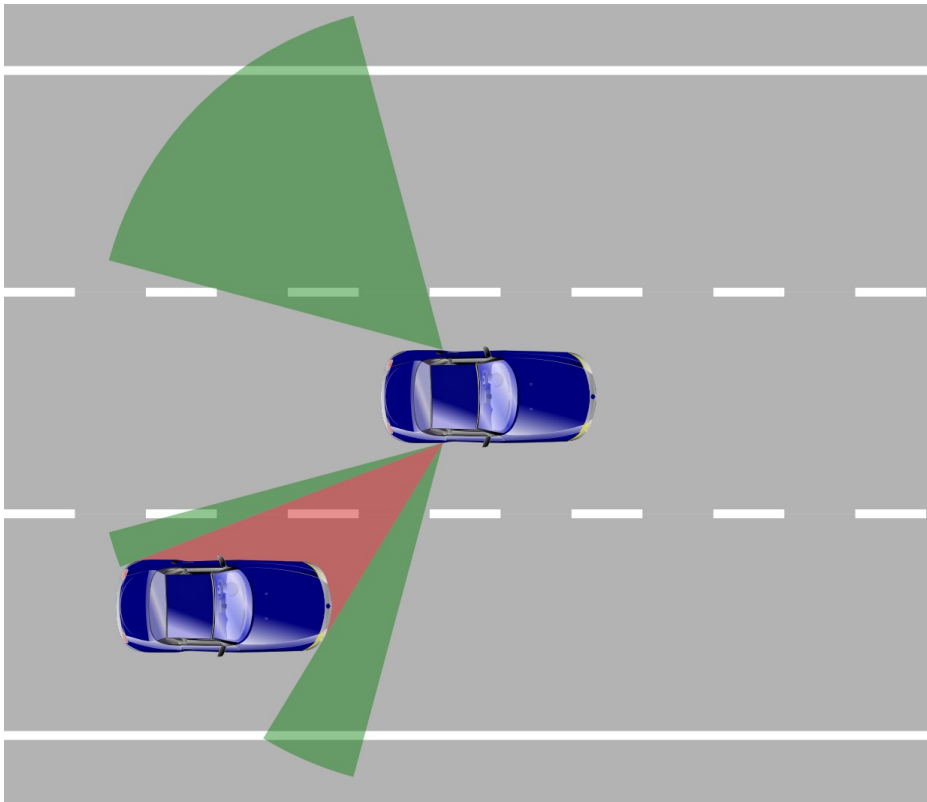


## OpticalFlow-Z module

- HD image sensor
  - Up to 1920x1080 (30 frames/sec)
  - Up to 240 frames/sec (320x240 pixels)
- FPGA
  - Parallel processing of image data
- CPU
  - ARM Cortex-M3 (120 MHz)
- Memory
  - 1 Gbit DDR3 SDRAM (5.3 Gb/s)
  - 64 Mbit flash memory
- Multiple interfaces
  - CAN/USB/serial/I2C/LVDS
- Small size
  - 50x50 mm

## Display Module

- 4.3 inch colour display
  - 480x272 pixels
  - 60 frames/sec

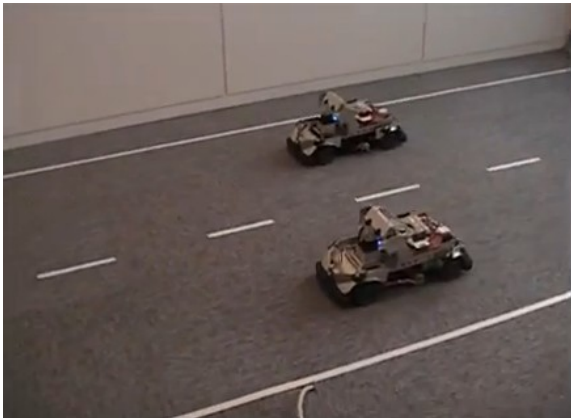


Example usage:

## Detection of overtaking cars

- It can be difficult for drivers to notice cars approaching quickly from behind
- OpticalFlow-Z can detect this situation and alert the driver

“Safe” objects such as the road and background have a relative motion towards the rear of the car, while “dangerous” objects such as overtaking cars have the opposite motion.



It is therefore quite simple to detect a dangerous situation (see video)