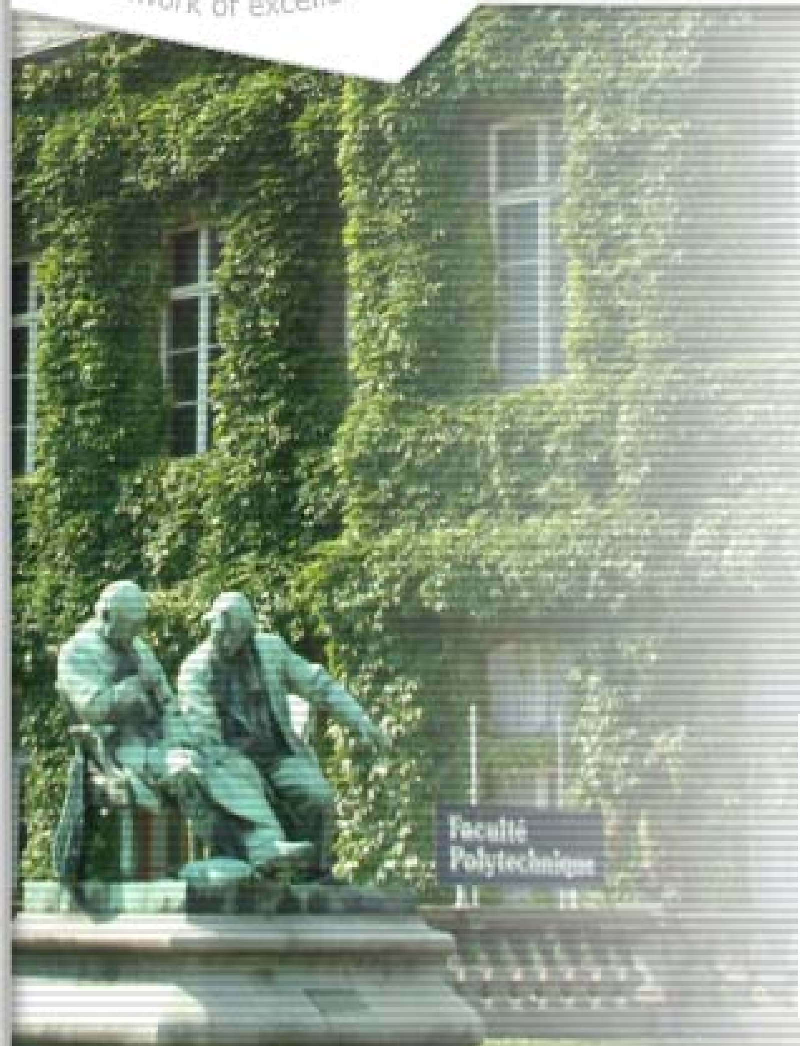
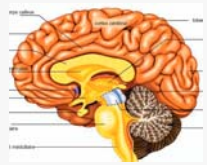


Attention detection in driver simulator
project #4

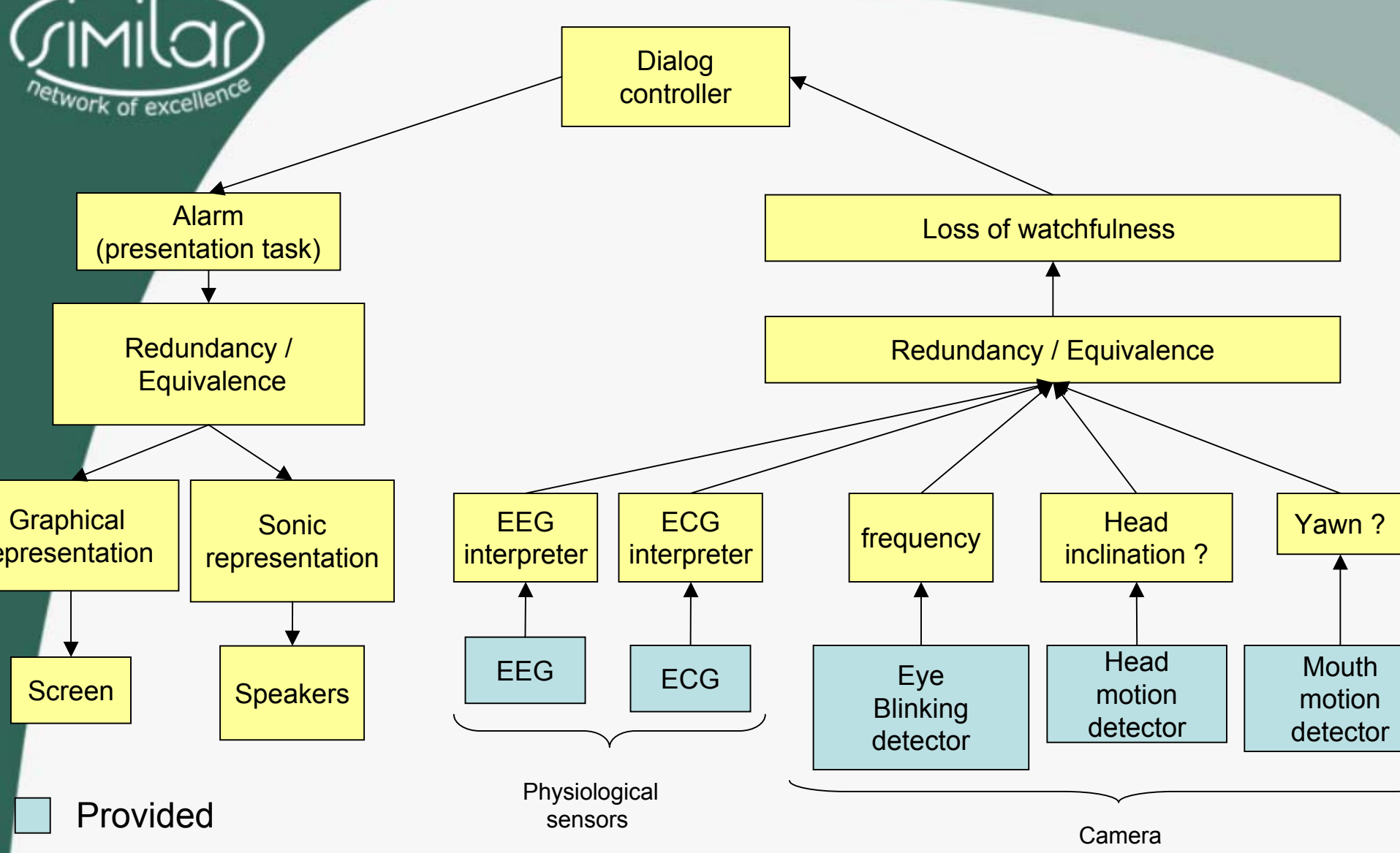
- INPG : L. Bonnaud, A. Caplier
- UCL : D. Trevisan, B. Macq
- Participants : A. Benoit, G. Chanel, P. Ngo, V. Levacic, C. Thillou
- Guest star : L. Lawson, Burak

Introduction

EEG



Heart rate



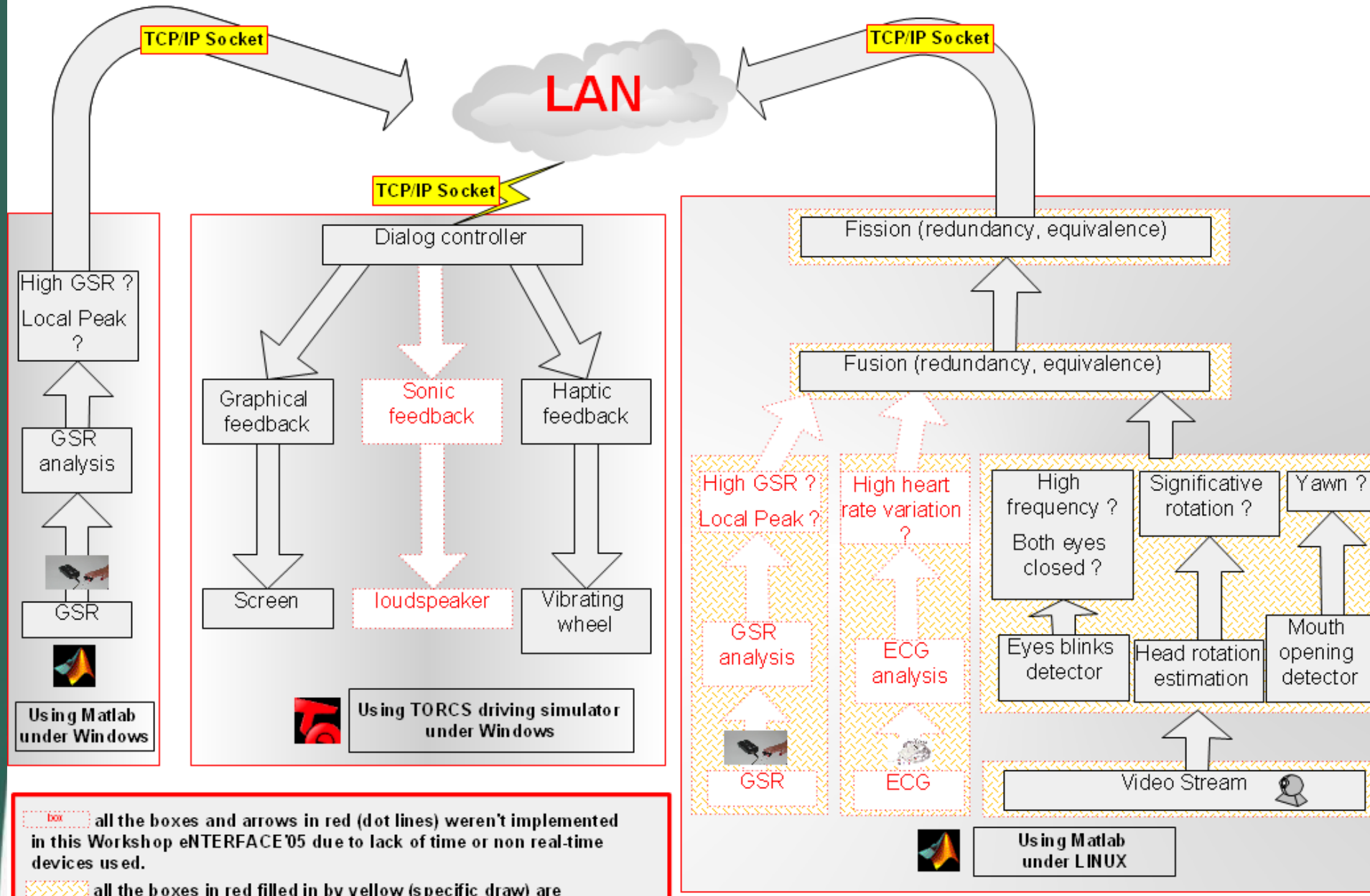
Provided

To be developped

EEG: electroencephalogram
ECG: electrocardiogram

Global architecture Project #4

Workshop eNTERFACE '05



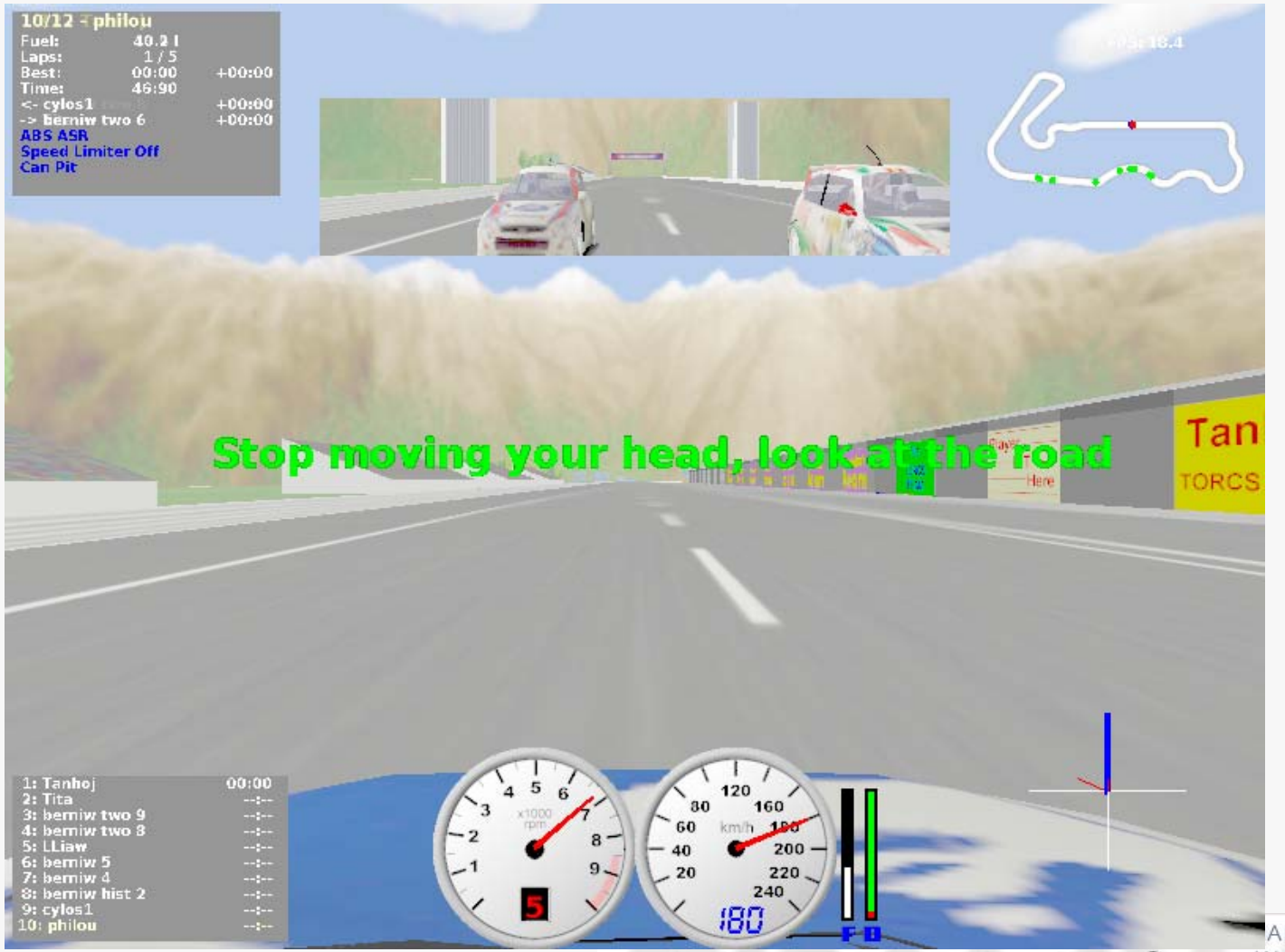
box all the boxes and arrows in red (dot lines) weren't implemented in this Workshop eNTERFACE'05 due to lack of time or non real-time devices used.

all the boxes in red filled in by yellow (specific draw) are OpenInterface components.

5 Challenges

- Driver Simulator
- Attention detection
  - Biological signals – Stress detection
  - Video-based information – Fatigue detection
- Fusion
- Fission
- Integration
  - Distributed architecture
  - OpenInterface

Driver Simulator

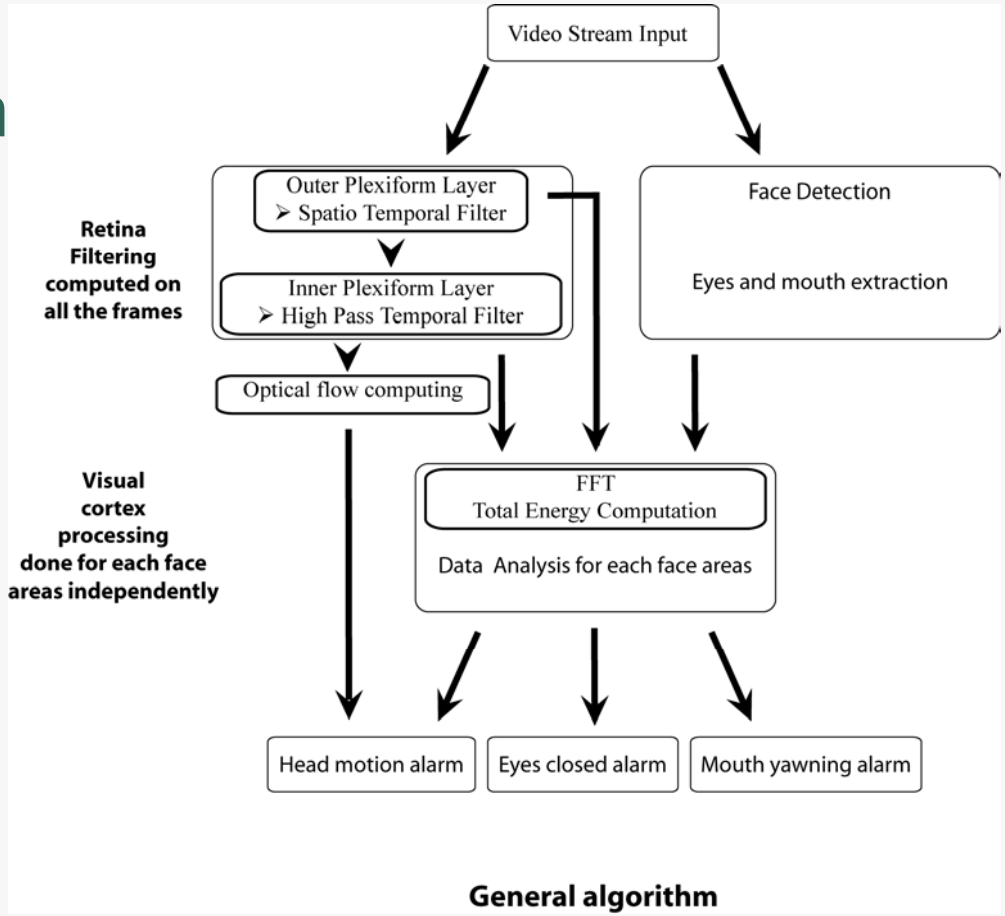


Driver Simulator

- TORCS - GPL program well built with source code well structured (C++ and OpneGl)
- Force Feedback with controlled level of wheel vibration
- Message (color)
- Button click (user's interaction)
- Multi-thread server
- The network protocol used is TCP/IP. We used a "GPL" library called Openthreads to allow threads access global variables with a Mutual Exception implementation

Attention Detection

- Video-based system
- Fatigue detection
  - Eyes
  - Yawn
  - Head movement

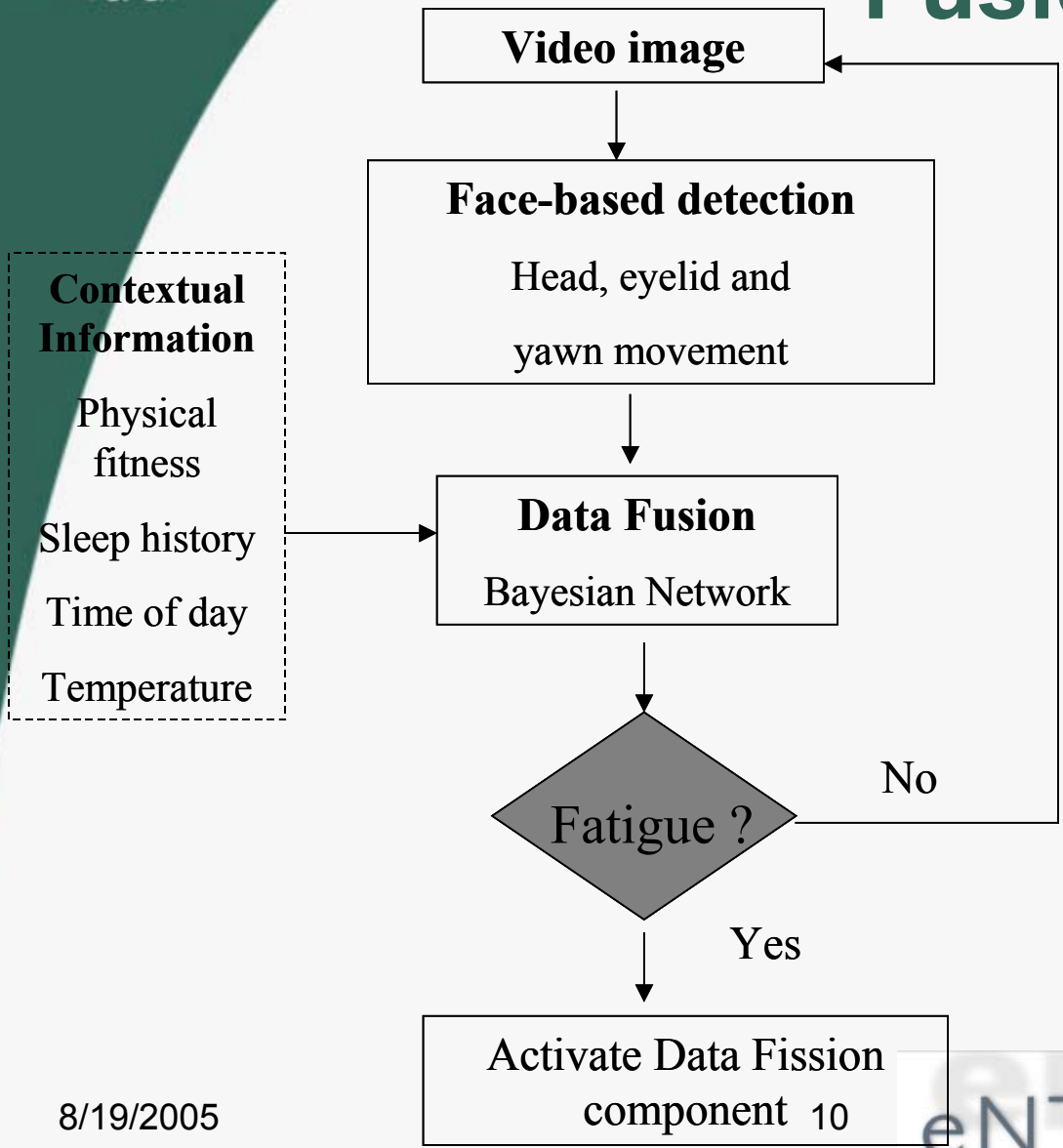


General algorithm

Attention Detection

- Biological-based system (stress detection)
- ECG and GSR
- 3 situations :
  - rest / relaxation
  - Stress stimuli while reading
    - Hand clapping
    - Light in eyes
    - Answering simple question
    - Telephone call, “your dead” (killer game)
  - Playing with the driving simulator (difficult tracks)
- GSR acquisition and analysis can be integrated in real time
- New experiments for detecting relax situation

Fusion



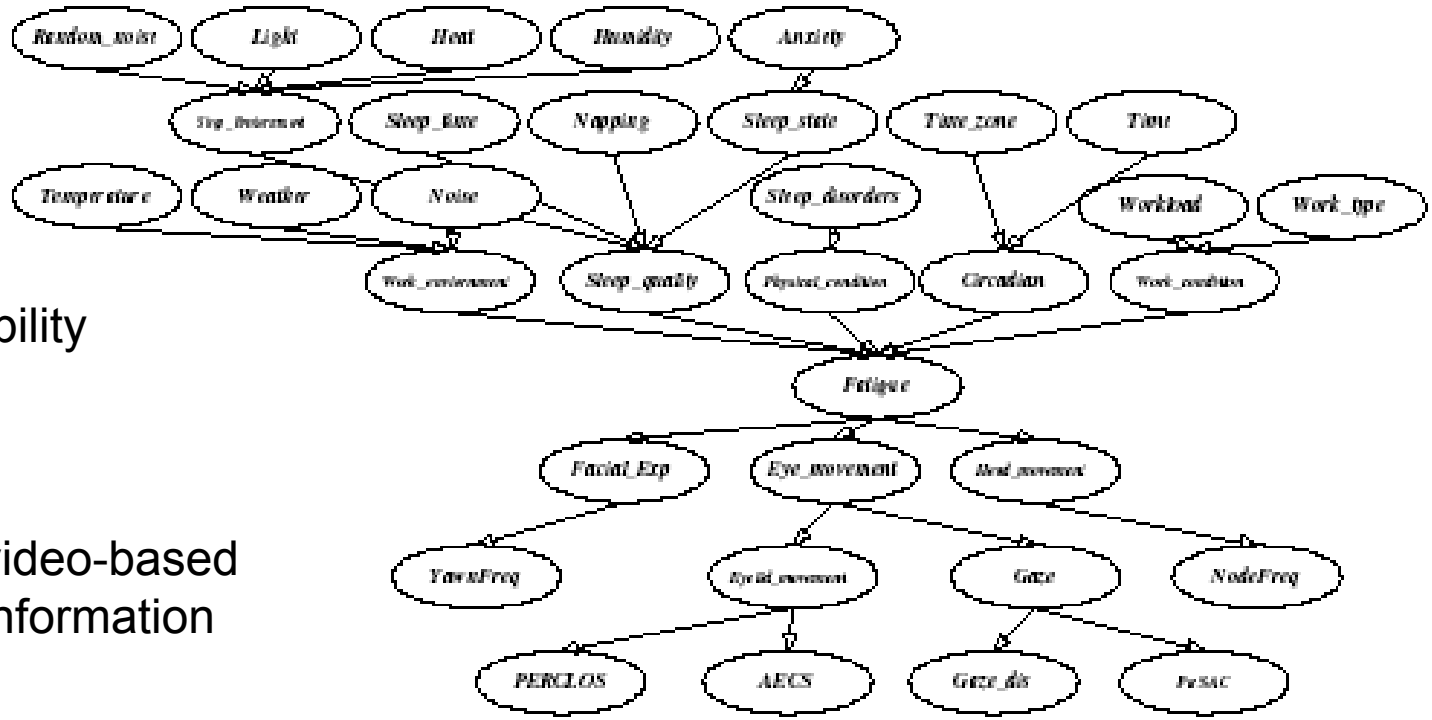
Bayesian Network for detecting Fatigue State

Fusion

Contextual information

Prior probability

video-based information



Qiang Ji, Zhiwei Zhu and Peilin Lan, Real-Time Nonintrusive Monitoring and Prediction of Driver Fatigue, IEEE Transactions on Vehicular Technology, Vol. 53, No. 4, July, 2004, p1052-1068].

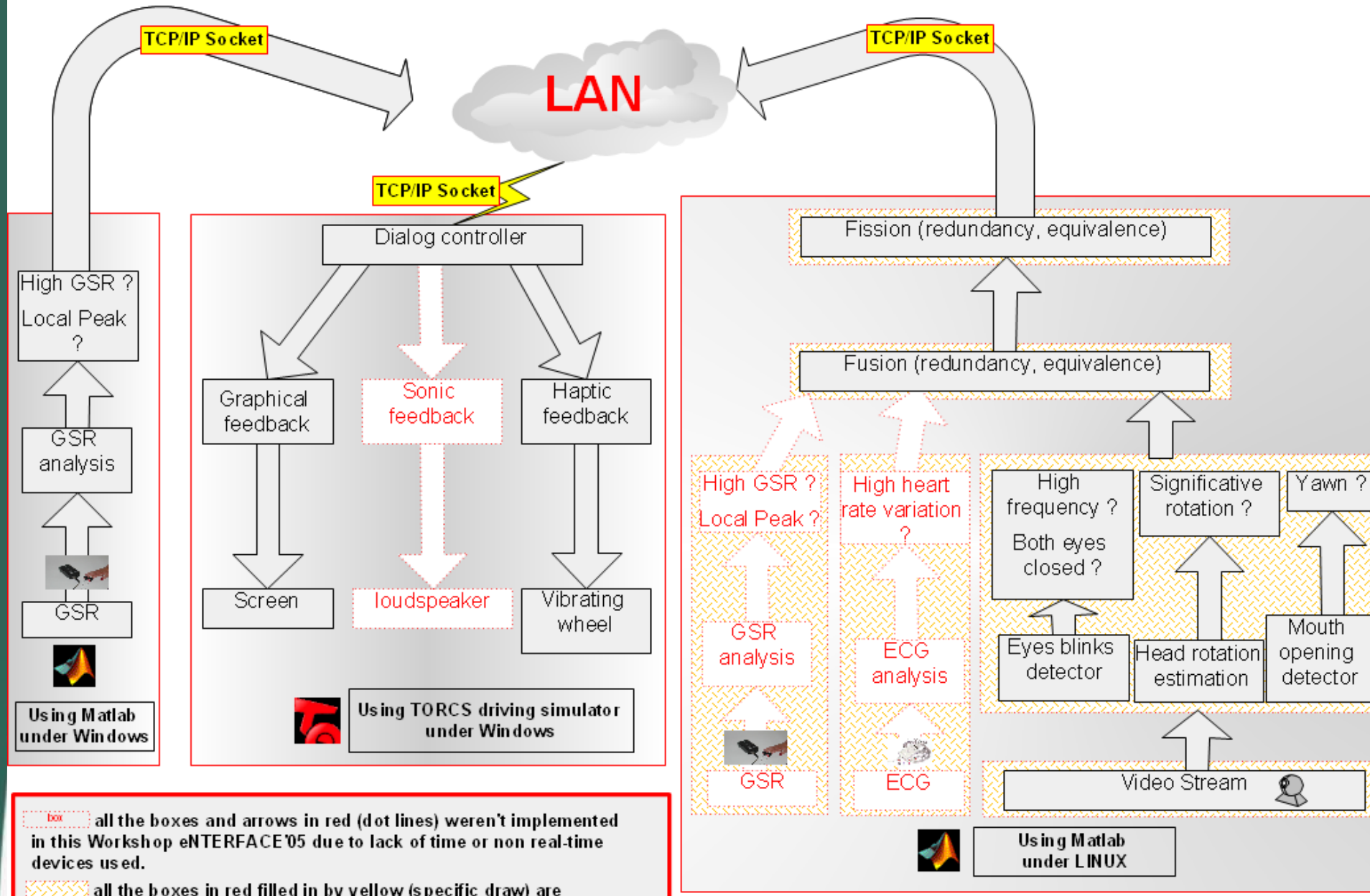
Fission

Data fission responsibility is to collect the data from data fusion and to generate a XML message that is sent to the driver simulator

Fatigue range	[0,33]	[33,66]	[66,100]
Message	« »	« Tired »	« A sleep »
Message color	« »	« Green »	« Red »
Shaking power	« 0 »	« 0 »	« 100 »

Global architecture Project #4

Workshop eNTERFACE '05



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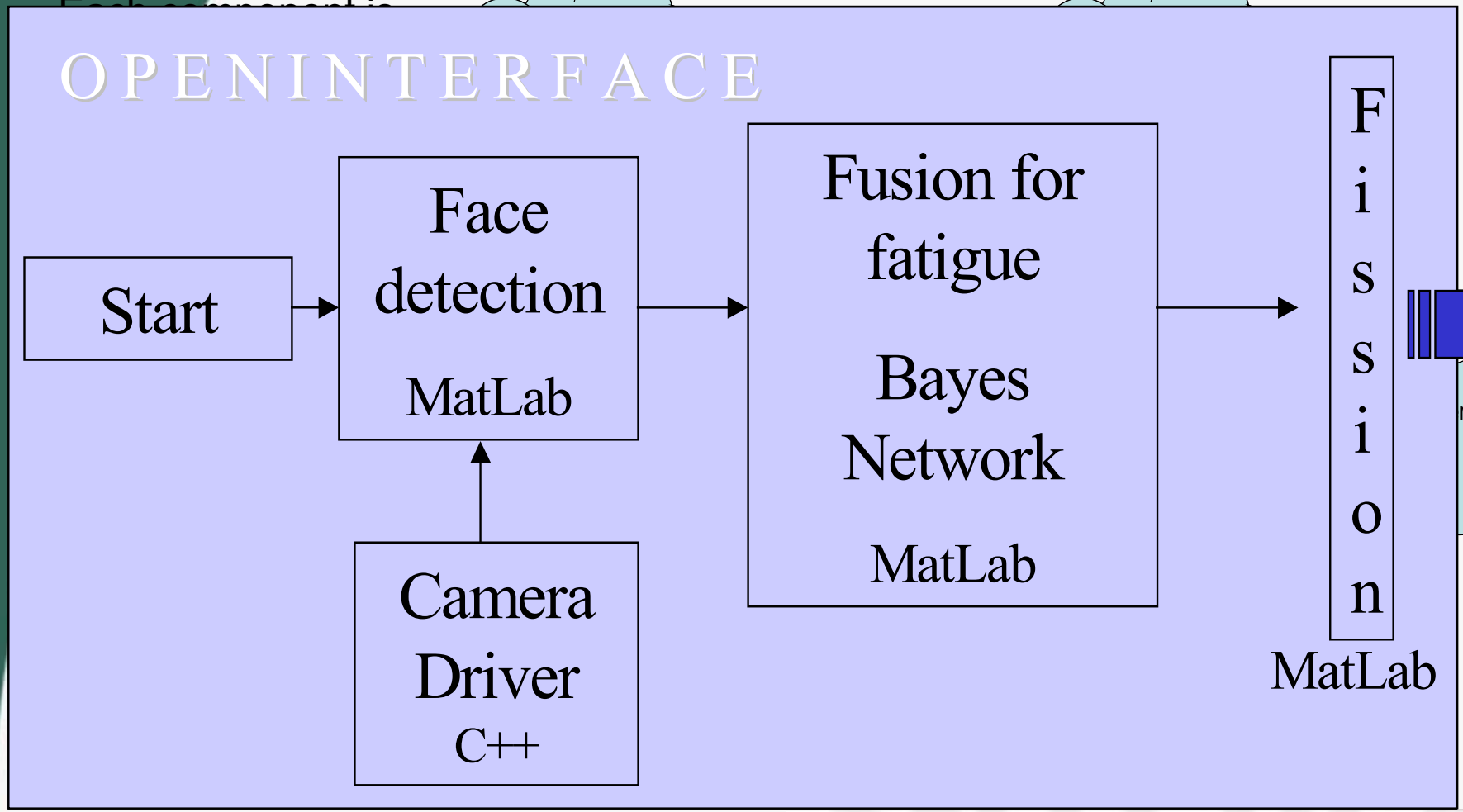
OpenInterface Integration



Future Works

- Integrate biological signals for fatigue detection
- Usability tests to assess interface interactions.
- Improve the Bayesian Network to take account more specialized information about head orientation once this information is available in the head detection code.
- Transform the face detection component into 3 OpenInterface components.

Conclusion

- 1st goal: real time distributed system based on video data, integrated under OpenInterface, for driver attention level analysis with feed-back to the user
- 2nd goal: multimodal system taking into account the biological signals - Stress

TEAM





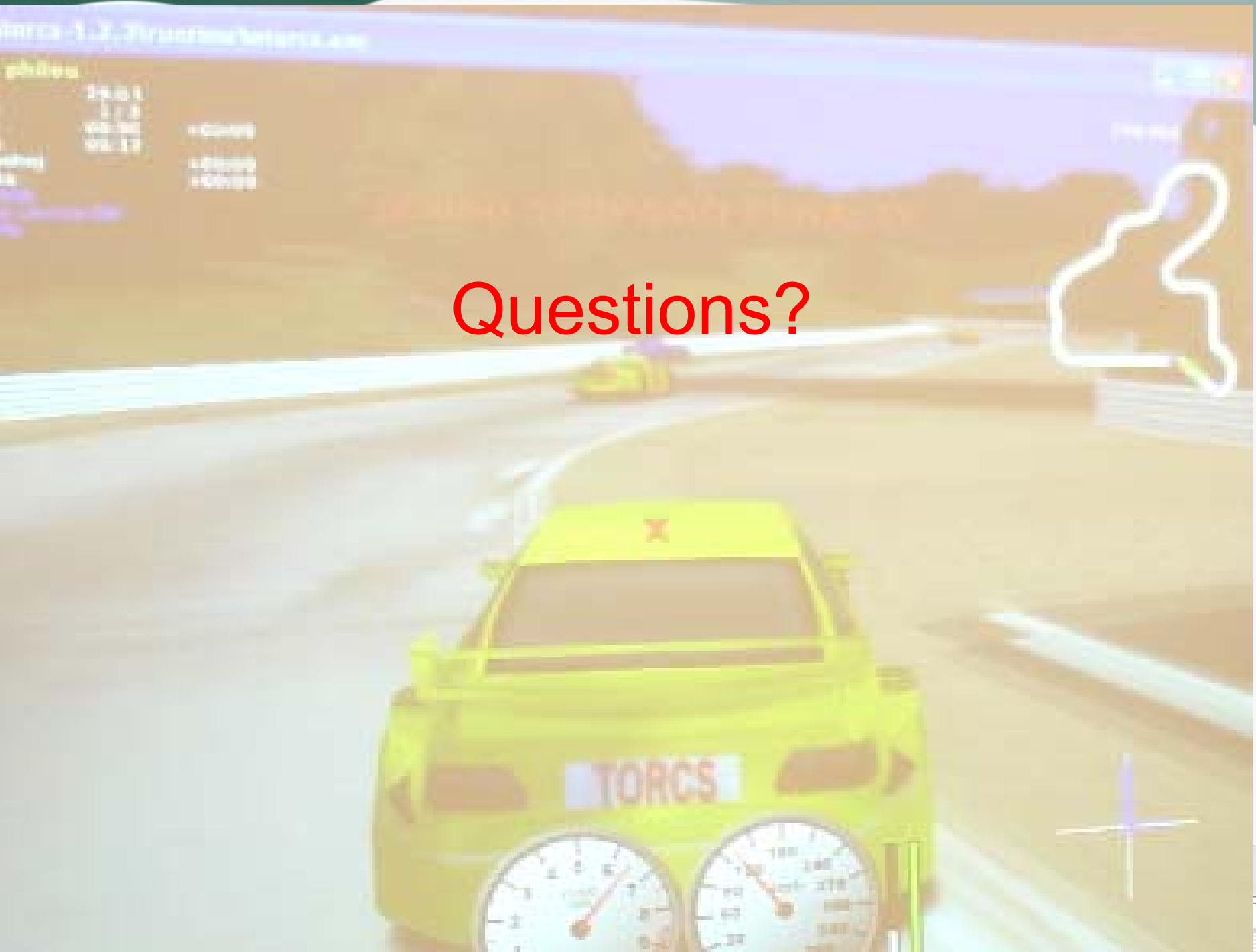




TEAM

DEMO

Have Fun and come to play during our Demo session!


Questions?
TORCS