

SACARI: an Immersive Remote Driving Interface for Autonomous Vehicles



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Goals

- Design and develop a Mixed Reality system for the driving assistance of an autonomous car.
- Study the different possible interactions and find the best one
- Represent the vehicle's environment in the best way
- Design the distant communication architecture between the vehicle and the control center

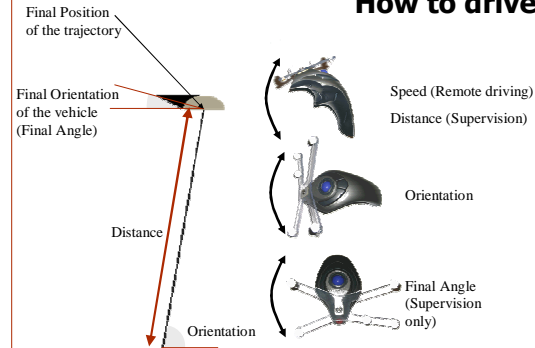
Context

- Project implying several labs, among them the IEF (www.u-psud.fr/ief/): develops the autonomous vehicle PiCar
- Possible applications
 - Teleoperation
 - Management of a vehicles' fleet
 - Perceptive study of human beings

Problems

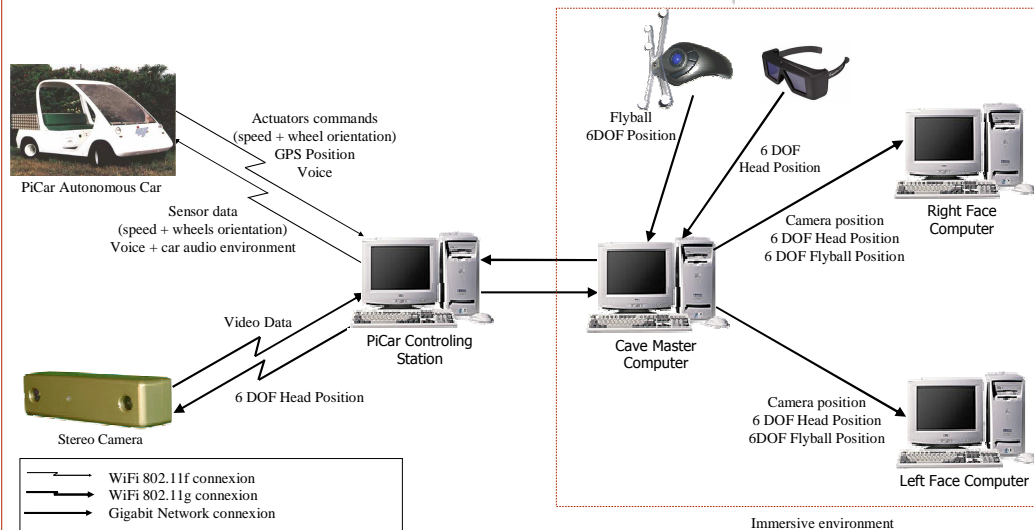
- Find a device and interface to supervise and drive the vehicle effectively
- Merge all the informations coming from the vehicle (video, position, speed,...)
- Capture and interpret user feedback to deliver vehicle commands
- Choose and represent information in such a way that the user feels physically present on the site

How to drive the vehicle

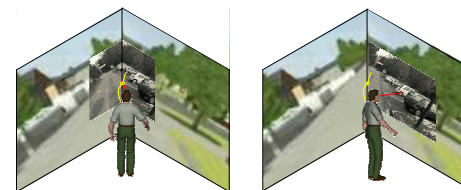


- 2 ways of driving: supervision or remote driving
- In remote driving mode, speed and orientation are directly sent to the vehicle
- In supervision mode, final position and orientation of the trajectory are translated to instantaneous speeds and orientation that are sent to the vehicle
- New trajectory is given every 10 seconds
- Advantages of the system:
 - Flyball is well adapted to both supervision and remote driving, compared to a steering wheel for example
 - Very intuitive: user can drive the simulator correctly within ten minutes
 - Precise orientation and speed commands, compared to a mouse or a joystick
- Main drawback: tiresome when used for a long time

Global architecture of the system



The SACARI Interface



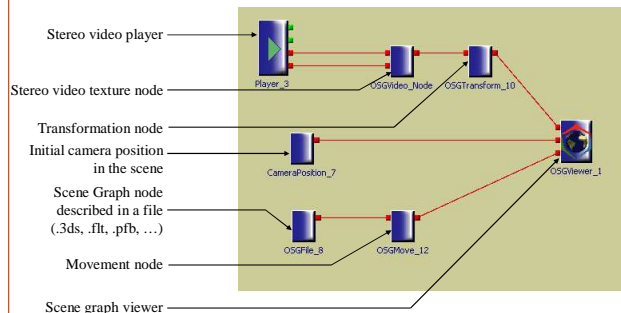
- The head position controls the video texture position in the scene
- Possibility to switch between autonomous driving and remote driving
- Possibility to control the vehicle from the immersive device or from a desktop
- The virtual scene is made from digital map of the area, the position of the vehicle being given by a GPS

Driving the autonomous vehicle: the simulator



- Simulator of the vehicle's intrinsic properties for remote driving and supervision
- Necessary to test the different ways of driving and supervizing the vehicle
- Allows to test the different ways to represent the incoming information

Software Platform



Software platform features

- Scene graph designer on top of R^T Maps[®] and OpenSceneGraph
- possibility to use it in a graphical cluster, to display the scene in a CAVE
- Different stereo features: Quad buffer, anaglyph, polarized, ...
- Parameterization of the scene graph camera (field of view, near/far clip, ...)
- Different ways to handle camera: drive-like, flight-like, or trackball-like
- VR or desktop dedicated devices can be used VR dedicated device driver: EvServer

Perspectives

