

Autonomous driving applied to parking procedure: RATP experience

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INTELLIGENT GARAGE

BUS PARKING AUTOMATION

RATP GROUP



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Project presentation

- **Operator: RATP**
 - Project leader, coordination, bus provision, organization of tests, test case specifications, FMS interface, cybersecurity analysis, obstacle detection algorithms.
- **Research Lab: CEA**
 - Development of algorithms (bus localization, bus navigation control, fleet management supervision)
- **Bus manufacturer : IVECO Bus**
 - Bus interfaces to drive by wire and actuator development, demonstration safety analysis



Objectives and benefits

- **Objectives:**
 - To test the technical feasibility of automation of bus parking in a bus depot
 - To evaluate the impact of such innovation on the overall performance of the system.
- **Benefits:**
 - Shortening the time needed for bus parking for the driver
 - Making the parking spaces smaller thus reducing the size of the bus depot.

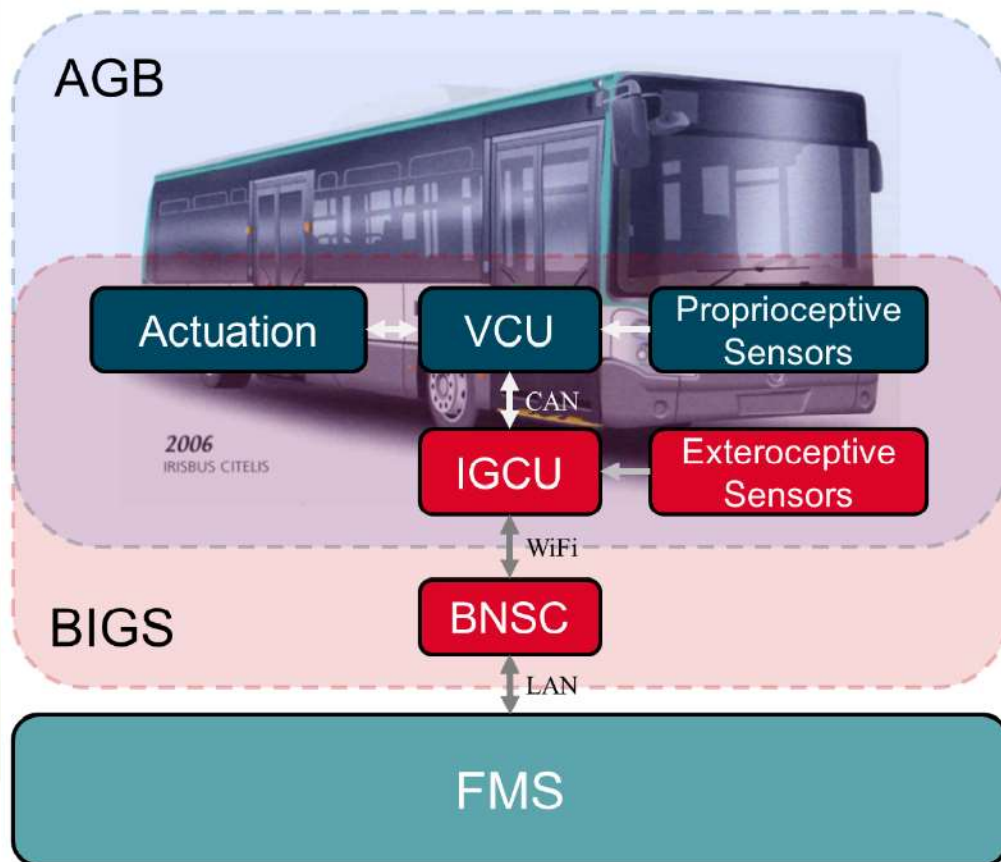


RATP requirements

- Level 4 automation
- Underground bus depot
- Minor modifications on the infrastructure
- Test case scenario: from the entrance of the bus depot until a parking space at -2/3 level
- Interface with existing FMS
- Bus should move in an unprotected environment (vehicles, pedestrians, etc.)



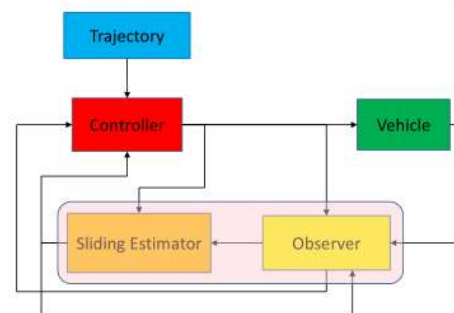
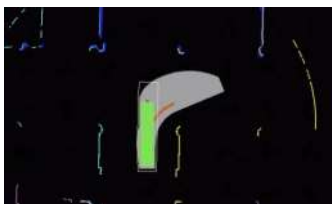
Overall Architecture Design



Name	Definition
AGB	Automatic Guided Bus
BIGS	Bus Intelligent Garage System
IGCU	Intelligent Garage Control Unit
VCU	Vehicle Control Unit
Actuation	Vehicle actuators
Proprio. Sensors	Vehicle standard sensors (speed, steering angle...)
Extero. Sensors	BIGS embedded sensors (Cameras, IMU, LIDARs)
BNSC	Bus Navigation Supervisory Control
FMS	Fleet Management System



Technical aspects



Demo results : video

- We achieve to automate the bus for parking procedure



Lessons learned

- First level of drive-by-wire vehicle
- Successful integration of perception and navigation control algorithms
- Development of plug and play localization module with no need to equip infrastructure
- Testing of the technical feasibility of automation of bus parking in a bus depot



Thank you



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