

Armadillo System Software

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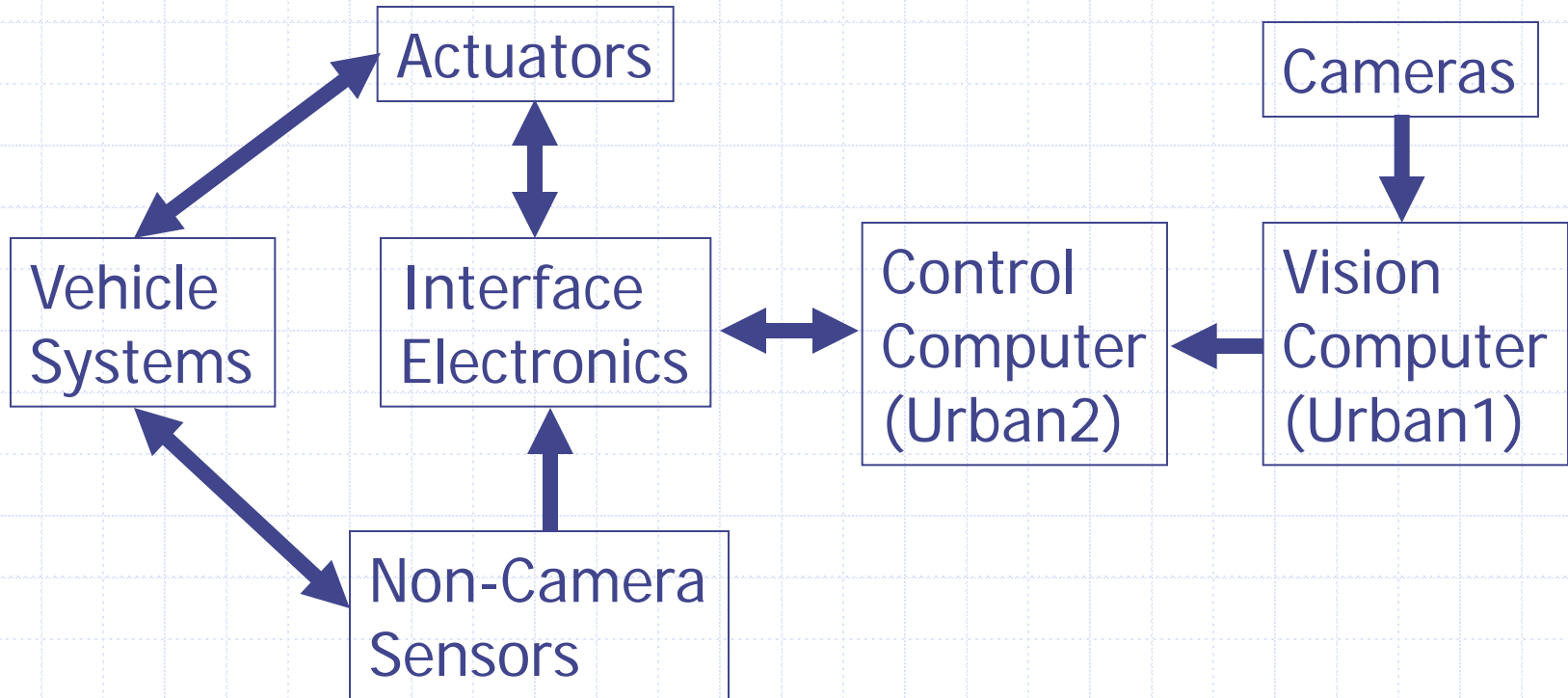
5-December-2006

Software Lead - Team Cybernet

Software Organization

- ◆ The Vehicle is a “Level 2 Compliant JAUS 3.2 Subsystem”
- ◆ The JAUS breakdown is:
 - 2 subsystems (vehicle, OCU)
 - 3 nodes (OCU, Urban1, Urband2)
 - Many components.

System Block Diagram



Vehicle Configurations

E-Stop	Automation Enable	Result
Disengaged	Disengaged	Manual Operation
Disengaged	Engaged	Autonomous Operation
Engaged	Disengaged	Engine Off, Brake Pressed
Engaged	Engaged	Engine Off, Brake Pressed

Control Software

- ◆ The Control Software resides on the Control Computer (Urban2)
- ◆ The Control Software is packaged as a JAUS 3.2 Subsystem.
- ◆ The Control Software is organized like a protocol stack, in layers that go from high-level abstract planning down to direct PID servo loop controls.

Control Software Layers

- ◆ Mission Planner
- ◆ Mission Segment Driver
- ◆ Extended Waypoint Driver
- ◆ Global Vector Driver
- ◆ Reflexive Driver
- ◆ Primitive Driver

Primitive Driver

- ◆ Defined as a JAUS 3.2 Component
- ◆ Processes SetWrenchEffort, and QueryWrenchEffort messages.
- ◆ Sends ReportWrenchEffort messages as needed.
- ◆ Contains numerous PID threads.

Reflexive Driver

- ◆ Defined as a JAUS 3.2 Component
- ◆ Processes SetWrenchEffort, and QueryWrenchEffort messages.
- ◆ Sends ReportWrenchEffort messages as needed.
- ◆ Modifies commanded wrench efforts so that they do not violate vehicle physics.
- ◆ Calls PrimitiveDriver with modified msgs.

Global Vector Driver

- ◆ Defined as a JAUS 3.2 Component
- ◆ Processes SetGlobalVector, and QueryGlobalVector messages.
- ◆ Sends ReportGlobalVector messages as needed.
- ◆ Converts absolute heading and speed into wrench effort and passes the result to the reflexive driver.

Extended Waypoint Driver

- ◆ Not a standard JAUS Component
- ◆ Processes SetExtendedWaypoint, and QueryExtendedWaypoint messages.
- ◆ Sends ReportExtendedWaypoint messages as needed.
- ◆ Converts the difference between vehicle pose and the given extended waypoint into a heading and speed, and passes the result to the global vector driver.

Extended Waypoint

- ◆ The JAUS 3.2 specification defines a waypoint as a numbered position in space.
- ◆ An Extended Waypoint contains additional information:
 - Speed to be at when the waypoint is reached
 - Attitude to be at when the waypoint is reached

Mission Segment Driver

- ◆ Continuously decides “where to now?”
- ◆ Navigates from the entry point of a mission segment to the exit point of the mission segment.
- ◆ Different mission segments will specify different navigation algorithms.

Mission Segment

- ◆ An abstraction of a segment of the course map.
- ◆ The behavior within a mission segment is homogeneous.
- ◆ Contains at least one entry extended waypoint.
- ◆ Contains at least one exit extended waypoint.

Subsystem Commander

- ◆ Controls autonomous vehicle activity.
- ◆ Invokes the mission planner.
- ◆ Can be used for tele-operation and diagnostics.

Communicator

- ◆ Listens at port 192.245.33.99:8200
- ◆ Routes messages to components

Global Pose Sensor

- ◆ Defined JAUS component
- ◆ Handles QueryGlobalPose
- ◆ Sends ReportGlobalPose
- ◆ Encapsulates the fusion of GPS, INS, magnetometer, and odometer data.

Velocity State Sensor

- ◆ Defined JAUS component
- ◆ Handles QueryVelocityState
- ◆ Sends ReportVelocityState
- ◆ Encapsulates the fusion of differential odometry sensors, accelerometers.

References

- ◆ JAUS 3.2 Reference Architecture Specification (www.jauswg.org)