Use of formal models in model-driven design of embedded systems.

CPA 2009, Fringe Session

Oguzcan Oguz, Jan Broenink
Control Engineering, University of Twente, The Netherlands
The project: **Model-driven design of dependable SW intensive embedded systems (ES)**

- ES gaining more use and importance.
- ES: specific purpose computers.
- Need for a adequate model-driven design process.
- Need for concurrency in ES: Interplay with the concurrent world and real-time constraints.
Need to have model-driven design approach
  - Manage complexity, validation, early execution, abstraction.

Specific purposes and needs of different ES
  - Cannot abstract from the hardware.

Different views while designing ES
  - Control Theory, Software Engineering, Formal Methods

Research questions
  - What are the essential models & methods to integrate?
    - Concurrency included in some of the methods.
  - Can there be a unifying approach, theory?
  - If not or if it is too complex, what other techniques are there for integration?
    - Co-simulation?
TS-ARM 7400

Controls the behavior, CSP coded here.
200 MHz ARM9 + MMU, 32 MB Ram, 32 MB Flash, Ethernet, USB, SD card

MiniMegaBoard

Controls sensors & servos. I/O interface.
Atmel Atmega32 (16 MHz) 8bit \( \mu \)Controller, timers, 4PWM

Wireless
Wi-Fi - USB stick

Battery
4x AA

Distance
IR sensor

Contact
Switch

Line follower
IR sensor

Motors
DC / encoders

Motors
DC / encoders

Distance
IR sensor

Contact
Switch

Line follower
IR sensor

Wireless
Wi-Fi - USB stick

Battery
4x AA
Research Plan & Approach

- Modeling the testbed robot behavior using different views
  - Control Eng., Software Eng., Formal Methods & Tools
  - CSP to handle concurrency.

- Integration of the models
  - Gathering more specific research questions.

- Inspecting the existent solutions/efforts that try to integrate the essential views.