CPS: Synergy: Integrated modeling, Analysis and Synthesis of Miniature Medical Devices

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http://github.com/pillforge

BACKGROUND

Miniature medical devices are classical CPS that can operate autonomously within the human body to augment surgeons’ ability to diagnose, prevent, monitor, and cure diseases.

AN EXAMPLE OF A CUSTOM APPROACH: WIRELESS TISSUE PALPATION

The objective of this project is to create a focused cyber-physical design environment to accelerate the development of miniature medical devices.

DESIGN ENVIRONMENT

A versatile component model will provide the structural and semantic foundation for the entire model-based design flow.

A pre-built component library will provide the building blocks for design construction.

The goal is to synthesize application software, printed circuit board (PCB), computer aided design (CAD) models, and bill of materials with cost estimates with minimal manual guidance.

DESIGN CONSIDERATIONS

The CPS design framework must address crosscutting constraints such as (1) size – ideally, a capsule device should be small enough to swallow or to enter natural orifices without requiring a dedicated incision; (2) power consumption – given the limited space available onboard, energy is limited; (3) communication bandwidth – wireless signals must be transmitted through the human body with a sufficient data rate; (4) fail safe operation – since the device is deep inside the human body, the user has no access to it; and (5) effective interaction with the target site, according to the specific functions the device is required to fulfill.

GOAL: TinyOS application for a closed loop control of an actuator from sensor readings is compared with a custom implementation of the same task on a 8051 MCU programmed in barebone C.

EXPERIMENTAL VALIDATION

Component based implementation of the closed loop experiment using TinyOS on the MSP430 MCU.

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