Birds of Feather Session on Medical CPS

2011 NSF CPS PI Meeting

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Goal of the session

- Bring together a group of people interested in medical CPS
- Create the ground for building a medical CPS research community.

Session participants

- Adam Anderson, Tennessee Tech. U.
- David Arney, CIMIT
- Sanjian Chen, U. Pennsylvania
- Eugene Goldfield, Harvard U.
- Blake Hannaford, U. Washington
- John Hatcliff, Kansas State U.
- Mats Heimdahl, U. Minnesota
- Teruo Higashino, Osaka U.
- Wen-Hao Hsu, Boston U.
- Helen Huang, U. Rhode Island
- Jim Keller, U. Missouri
- Mohammad Khan, UIUC
- Andrew King, U. Pennsylvania
- Rajesh Kumar, Johns Hopkins U.
- Insup Lee, U. Pennsylvania
- Patrick Lincoln, SRI
- Chenyang Lu, Washington U.
- Kamesh Namduri, U. Northern Texas
- Yong-Lae Park, Harvard U.
- Steve Patek, U. Virginia
- Nicholas Sachs, Northwestern U.
- Sriram Sankaranarayanan, U. Colorado
- Mina Santipi, U. Tennessee
- Marge Skubic, U. Missouri
- Oleg Sokolsky, U. Pennsylvania
- Jack Stankovic, U. Virginia
- Dengfeng Sun, Purdue U.
- Yu Sun, U. Southern Florida
- Matt Tresh, Northwestern U.
- Nikolas Tsekos, U. Houston
- Krishna Venkatasubramanian, U. Penn
- Peter Volgyesi, Vanderbilt U.
- David Wentzloff, U. Michigan

What is Medical CPS?

- Major sub-areas of medical CPS:
  - High-confidence development techniques
  - Body Sensor Networks
  - System Biology
  - Surgical Robotics
  - Safety and Security
- Medical CPS group at the CPS-VO has a preliminary taxonomy, should be refined

Distinguishing Features from Other CPS Domains

- Human factors
  - Two distinct individuals: caregiver and patient
  - Patient-specific medicine is the future of healthcare
  - What patient-specific means for MCPS?
    - Patient specific modeling is necessary in this domain
    - Soldiers nowadays get a full body scan before deploying and carry this medical information – first step
  - The number of people involved in MCPS scenarios is much lower than other domains

More Distinguishing Features

- MCPS are often constructed in an ad-hoc manner
  - This is done in day to day usage in response to a specific treatment need of a patient
  - Very much driven by treatment needs
- Commercial aspects of MCPS have to survive a large number of stakeholders (payers, caregivers, patients…), which
  - Requires large number of adopters to be pleased
  - Is much more complex

More Distinguishing Features

- MCPS have to be adaptive to deal with today's medical problems, e.g. chronic diseases
- In building MCPS, engineers need to interact with caregivers, which is tough as they think differently
  - in other domains, like aerospace, we are interacting with other engineers
- Problems with privacy in MCPS may be different
  - Saving patient life may override privacy concern

Building a CPS community

- One way: common challenge problems
  - Should be important enough to get attention
  - Should be broad enough to allow everyone to apply things they are interested in
  - Shared testbed for common experimentation
- Is it important to find such a problem?
  - Good idea, but we need clinical partners here
  - It will raise awareness and help coming up with good ideas

Developing partnership with clinicians

- Without it, we cannot be solving the real problems
- It is easier to start the dialog if we are already working on problems they are interested in
- Problem: Most clinicians are interested in engineering solutions to immediate problems
  - Need to identify the rare visionaries
    - It might be better to deal with clinical researchers rather than doctors
    - M.D.-Ph.D.'s often are better able to think abstractly
- But visionary ideas need not come from caregivers, they can come from engineers as well as from outside
- Include nurses in the dialog
  - Nurses are often more "hands on" than doctors

Learn from successful efforts

- Building a collaboration takes time
- Proceed slowly
  - Understand their immediate problems first
  - Explain what we can do for them (e.g., smart alarms)
    - Most suggestions will be ignored or dismissed
  - Some suggestion will eventually ring a bell and make them think and come up with important problems that it can solve

Workshop on MCPS

- A workshop of clinicians and engineers
  - Help to establish collaboration
- There is a workshop called HCMDSS which is part of CPS week
  - It has not had much participation from clinicians
    - MCPS community can help raise awareness
  - One problem with HCMDSS: it is an engineering conference to which medical people do not come
- **Many clinicians are tech oriented, we could organize a CPS session in their conferences**
  - **Essential to make a list of such venues and make it available to everyone**

Outreach

- "Two guys in a garage"
  - People who like to tinker to see how things work
  - Find them, challenge them with useful problems
- Involve high school students
  - A road show to get students interested?
    - Robotics have the obvious advantage
  - (Grand)Parents often use some medical devices
    - Humanitarian appeal
  - **Maybe design a "MCPS Kid Kit" to get kids into it**
    - **Would NSF be interested in a competition for kit designs?**

Interaction with industry

- Medical device vendors' view is different
  - Preserve market share
  - Tight development cycles, cannot chase wild ideas
  - Regulatory approval of very novel devices is hard
- Companies run a closed shop and see open environments as competition
  - Car companies used to be equally isolated. Now there is USCar collaboration, everyone benefits
  - Medical device companies need to get this
- If we setup a consortium, will they be interested?

Summary

- Important to keep the ball rolling
- Expand conversation with clinicians, manufacturers, other researchers
- Continue conversation in the MCPS group on CPS-VO