A Proposal for a Control Systems Society Technical Committee on Healthcare and Medical Systems

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November 5, 2012

This document describes a proposal for the creation of a new Technical Committee within the IEEE Control Systems Society focused on the problem of Medical and Healthcare Systems (TC-MHCS). The TC-MHCS is intended to serve as a comprehensive effort within the CSS Technical Activities Board (TAB) reflecting activities in bioengineering, healthcare delivery, medical treatment, and related topics, such as epidemiology and behavioral health. These represent timely topics of great societal importance and high public impact for which the control systems field can make major contributions.

I. History of the initiative to establish a new TC

During the TAB meeting held at the 2010 ACC in Baltimore, then VP for Technical Activities Sam Ge challenged the TC chairs present to consider new topics for technical committees within CSS. The idea for the TC-MHCS was brought by Daniel Rivera to Francesco Bullo (Sam Ge's successor as VP for Technical Activities); Francesco correspondingly provided support for the initiative through seed funding for two "interest group" meetings that were held at the 2011 ACC in San Francisco and the 2011 IEEE-CDC in Orlando, respectively. The latter meeting was extremely well attended, featuring 20 attendees. A series of dialogues with the ExCom during spring 2012 defined the process for approving the TC, with the TC concept presented to the TAB during the 2012 ACC in Montreal. Both the ExCom and attendees at the Montreal TAB meeting voiced enthusiasm for the new TC initiative.

II. Motivation for a new TC

The motivation for the new TC stems from various sources and influences; these include:

1. *Societal importance of healthcare*. Healthcare constitutes a major segment of the world economy, and has clear public impact. Contributions to improvements in medicine, healthcare, and the understanding and treatment of disease by control engineers can lead to an improved quality of life for both individuals and communities.

2. *Medicine and healthcare as grand challenges for control*. The CSS report on the impact of control technology (http://ieeecss.org/general/impact-control-technology) describes only the dynamics and control of the artificial pancreas as a grand challenge involving biomedicine and healthcare. The new TC is expected to create awareness and stimulate efforts towards articulating more of these challenges among the CSS membership.

3. *Absence of existing technical committees meaningfully addressing the topic.* There currently exist no technical committees within CSS with direct focus on this class of problems. The overlap with the TC on Systems Biology (addressed later in this document) is perceived to be minor.

4. *Opportunity to synergize efforts in the area*. To quote from the popular movie *Field of Dreams*, "if they build it they will come." Currently, the CSS conference suite features sessions and papers on the topics of biomedical systems, healthcare, and medicine; however, these efforts are haphazard and not coordinated by any existing technical committee or organized structure within CSS. By pursuing TC best practices, it is expected that the TC will create otherwise non-existent communication and interaction between members of CSS, ultimately resulting in a surge of activities in themes of medicine and healthcare for the Society.

III. Areas of emphasis; benefits

The TC focus is viewed as broad and multifaceted, featuring (but not limited to) problems in biomedicine, disease treatment and management, healthcare delivery, behavioral health, and personalized medicine. The membership is expected to be diverse; hence the topics that will be examined by the TC will be correspondingly so. For example, topics represented during the interest meetings included anesthesia modeling and delivery, HIV treatment, stroke rehabilitation, diabetes and the artificial pancreas, analysis of electronic medical records, cancer treatment, treatment of Parkinson's, electrocardiography, and prevention and treatment of drug abuse. The benefits of the TC structure include:

1. Invited session organization for CDCs, ACCs, and MSCs,
2. Special issues for IEEE publications (CSM, TAC, and TCST),
3. Organization of edited volumes and monographs,
4. Organization of pre-conference workshops and related activities, and
5. Mentorship and member development activities. This includes fostering members into senior and fellow grades for IEEE.

IV. Overlap with Existing TCs

The issue of a possible overlap with the TC on Systems Biology (TC-SB) was discussed prior to the TAB meeting in Montreal. It was felt that the overlap existing between these TCs was the kind that naturally exists at the boundary of two different yet complementary fields - one that has the potential to drive synergistic innovations across both. TC-SB chair Mustafa Khammash is supportive of the TC-MHCS and looks forward to potential collaboration.

V. Leadership structure

The leadership structure of the proposed TC consists of a TC chair, with four recognized members of CSS serving as members of a steering committee:

Daniel E. Rivera, Arizona State University (TC Chair)

Frank Allgower, University of Stuttgart
Antonios Armaou, Penn State University
Yannis Paschalidis, Boston University
Ann Rundell, Purdue University

The steering committee will provide guidance on the activities and additional structure for the TC, particularly during its initial formative stages.

VI. Establishment

Approval of the TC by the TAB is sought at this time with the intention of having it officially established by the 2013 calendar year. A third "interest group" meeting intended to bring attention to the TC has been organized for Wednesday, December 12, 2012 from 10 – 11 a.m. in Room Tsunami A of the 2012 IEEE-CDC conference hotel.