Module Title: Introduction to Programming Intelligent Physical Systems

Lecturer: Samarjit Chakraborty, Technical University of Munich, Germany

Module Description:

Traditionally, computers have been used to process data. So programming computers consisted of listing the sequence of computations the computer was expected to perform. But increasingly computers are being transformed from purely data processing machines to being the brain of physical devices like cars and robots that are expected to "do" things and behave in an intelligent manner in complex situations. Here, the "doing things" take precedence over computations that might be necessary in the process.

How should computers be programmed for this new role? This is what this course will be about. In order for computers to be able to make physical systems do this, we need to be able to correctly specify what they need to do, and how to do them. Again, this is fundamentally different from specifying computations. Instead, we will discuss how to model the behavior of physical systems, how to control such behavior or how to enforce a desired behavior, and finally how to encode such control strategies as a computer program. This will be an introductory course that will require no background in control theory. It is targeted towards senior undergraduate students and Master's students of Computer Science.

Lectures:

Lecture 1: General introduction and basics of systems modeling
Lecture 2: Introduction to control theory
Lecture 3: Implementing control strategies on distributed embedded systems
Lecture 4: Designing networked control systems, including a demo of a distributed controller running wirelessly communicating embedded processors

Each lecture will be of 3 hours.

Speaker's bio:

Samarjit Chakraborty is a Professor of Electrical Engineering at TU Munich in Germany, where he holds the Chair for Real-Time Computer Systems. From 2011 ‚Äì 2016 he also led a research program on embedded systems for electric vehicles at the TUM CREATE Center for Electromobility in Singapore, where he also served as a Scientific Advisor. Prior to taking up his current position at TU Munich in 2008, he was an Assistant Professor of Computer Science at the National University of Singapore from 2003 - 2008. He obtained his Ph.D. in Electrical Engineering from ETH Zurich in 2003. His research interests include distributed embedded systems, hardware/software co-design, embedded control systems, energy storage systems, electromobility, and sensor network-based information processing for healthcare, smart-buildings and transportation.