CER Technology Fellowship Program –2008

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Project Title: Painless Digital Design with Intuitive Graphical Interfaces

Audience: Students taking either of two electrical and computer engineering courses: *Field Programmable Gate Array (FPGA) Synthesis Lab (520.424)* and *Product Design Lab (520.424)*.

Pedagogical Issue: Training in design is essential to engineering education. Most engineering courses are analytic in nature. The student is taught how to analyze a system or how to determine the output when a specified input is applied. By contrast, the art of design is not prescriptive, and learning does not occur by linearly following a syllabus or reading one or more assigned texts. Although design must be disciplined and scientifically and logically sound, it is not formulaic, rather it is iterative and experimental.

Solution: The team will develop a graphical design tool to enhance the learning of engineering "design." Intuitive and flexible tools that ease the cost of prototype development of new products are of great value. The team demonstrated this concept two years ago by developing a graphical user interface for a complex software system in which one can build working software radios using flow graphs. They will now expand this concept to the prototyping systems used in Electrical and Computer Engineering (ECE) teaching laboratories for designing complex digital systems such as video games, digital appliance controllers, special computers for auto emissions systems, and navigation devices. Digital design lab courses in ECE use commercial development hardware and software for which an intended design can be described by a flow graph. Thus, a visual tool similar to that developed for software radios will make a significant impact in learning the art of digital design.

Technologies Used: C/C++, Graphic Design, MatLab, Python

Project Abstract: We propose a graphical design tool to enhance the learning of engineering "design."

Training in design is essential in engineering education. Most engineering courses are analytic in nature: the student is taught how to analyze a system or how to determine the output when a specified input is applied. By contrast, the art of design is not prescriptive, and learning does not occur by linearly following a syllabus or reading one or more assigned texts. Although design must be disciplined and scientifically and logically sound, it is not formulaic, rather it is iterative and experimental.

Hence, intuitive and flexible tools that ease the cost of prototype development of new products are of great value. We demonstrated this concept two years ago by developing a graphical user interface (called GRC) for a complex software system in which one can build working radios. This interface

replaces writing lines of computer code to describe a radio design with a "flow graph" (block diagram) representation of the interconnections of blocks or modules that make up the prototype.

The unexpected popularity of that work motivates us to consider sweeping generalizations of GRC to any design problem in which a flow graph can be used to show the movement of data (signals in to any design problem in which a flow graph can be used to show the movement of data (signals in our case) through a complex system. We propose an extension to the prototyping systems used in ECE teaching laboratories for designing complex digital systems such as video games, digital appliance controllers, special computers for auto emissions systems, and navigation devices. Digital design lab courses in ECE use commercial development hardware and software for which an intended design can be described by a flow graph. Thus, a visual tool similar to GRC will make a significant impact in learning the art of digital design.