UNC CHARLOTTE
The WILLIAM STATES LEE COLLEGE *of* ENGINEERING

Company Name	Internal ECE department	**Date Submitted**	June 7, 2017
Project Title	Real-time Embedded Object Detection and Tracking (UNCC_EMBED)	**Planned Semester**	Fall 2017 and Spri 2018

Fund to support the project:

Single Team ($3,000) from Dr. Tabkhi grant from NSF fund #

Faculty Mentor

Faculty Mentor: **Dr. Hamed Tabkhi** **email htabkhiv@uncc.edu**

Technical Contact(s)*
*This can be one or more at the option of the Supporter

Senior Design Project Description

Company Name	Internal ECE Dept.	**Date Submitted**	June 7, 2017
Project Title	Real-time Embedded Object Detection and Tracking	**Planned Semester**	Fall 2017

Personnel

Typical teams will have 4-6 students, with engineering disciplines assigned based on the anticipated Scope of the Project. 250 hours are expected per person.
Complete the following table if this information is known, otherwise the Senior Design Committee will develop based on the project scope:

Discipline	**Number**	**Discipline**	**Number**
Mechanical		Electrical	1
Computer	3	Systems	
Other ( )			

Project Overview:

Embedded vision is considered one top-tier, fast-growing area. Embedded vision refers to the deployment of visual capabilities to embedded systems for a better understanding of 2D/3D visual scenes. It covers a variety of rapidly growing markets and applications. Examples are Advanced Driver Assistance System (ADAS),

industrial vision, video surveillance, and robotics. With the industry movement toward ubiquitous vision computing, vision capabilities and visual analysis will become an inherent part of many embedded platforms. Embedded vision technology would be a pioneer market in digital signal processing.

The aim of this project is to create an embedded system with capabilities to run real-time object detection and tracking. In this regard, the students need to perform hardware/software co-design for embedded platforms including developing custom hardware accelerators for compute-intensive vision kernels as well as embedded software for the control and decision making. For implementation, the student will work with Xilinx Zynq platform as the state-of-the-art embedded platform combining ARM cores with FPGAs fabric in a single chip. To develop both hardware and software the students will work with Xilinx VIvado Design Suites. In addition, the students will develop an architecture simulation model of their design for high-level performance estimation and design space exploration. The simulation model will be developed on top of Gem5 architecture simulation environment.

Learning opportunities in this project are many! Overall, accepted student candidates will have a chance to work with Zynq platform and learn hardware/software co-design in a very practical way. Learning DMAs, AXI buses, embedded real-time software development, hardware accelerator design are only a few examples. The results of this project can be used for a diverse set of applications including robotics, autonomous vehicles, and smart glasses.

Initial Project Requirements:

The students will work with Xilinx Zynq ZedBoards and Xilinx Zynq UltraScale+ boards. Both boards are available in my research lab. The students also can use the space available in my research lab to conduct their research. Also, students will able to use the lab servers and computers for development and simulation.

Expected Deliverables/Results:

The students will deliver a simulation model of the entire system based on Gem-5 architecture simulator. The simulation model should capture the custom hardware accelerators, the communication fabric, and software running on the ARM processors. This includes the development of device drivers to make the system functional.

Disposition of Deliverables at the End of the Project:

A prototyped model of real-time object detection and tracking will run on Xilinx Zynq board.

List here any specific skills, requirements, knowledge needed or suggested (If none please state none):

Basic knowledge of computer architecture is a MUST. The students encourage to take the computer architecture course (ECGR 4181). Also, the basic understanding of C/C++ programming, embedded systems, Linux operating systems and VNDL/FPGA programming will be required.