Industry Partner:
Toyon Research Corp. is a small business research and development organization with offices in Goleta, CA and Sterling, VA. The Embedded Systems Group provides a range of consulting and design service to a variety of different industry and government customers. Whenever possible we seek to publish and contribute to open source projects. The group specializes in machine and vision processing with a particular emphasis on high performance embedded computing.

Project Description:
Historically, Camera Link has been the default standard for machine vision camera interfaces. Camera Link is simple and requires minimal software configuration and control. More recently, GigE Vision, USB 3.0 Vision, and CoaXPress have been released. These standards rely on low-cost, commodity gigabit SERDES interfaces, but there are correspondingly much higher levels of software support required. While these standards are published, there are as of yet no open source versions of software to support these standards in embedded hardware. Vendors do sell IP cores but at significant cost and are challenging to customize.

The focus of this work would be to develop an open sourced machine vision implementation to be hosted on github. This would focus on CoaXPress due to its simplified transport protocol and hardware interface. This software engineering work would be complemented by a CoaXPress driver board for Toyon's HD-SWIR camera and FLIR's Tau camera series.

Figure 1 - Illustration of CoaXPress machine vision interface.

The goal of this effort is to create and publish an open source implementation of the firmware and software required to implement a CoaXPress transmitter on the Smart Vision Development Kit.

This will facilitate researchers and developers being better able to work with machine vision and general digital camera interfaces.
Figure 2 - Avnet Smart Vision Development Kit (SVDK) consists of camera module, carrier board, and PicoZed Zynq-based FPGA board.

Student Requirements:

- U.S. Citizens are preferred
- Willingness to publish open source code to [https://github.com/Toyon/](https://github.com/Toyon/)

Ideal Student Qualifications:

It is envisioned that this project will require a development team that consists of both software and hardware development persons. While it is not expected that all qualifications will be fulfilled at the start of the project it is expected that these will be of interest to the students and that they will be learned over the lifetime of the project.

- Xilinx FPGA development tools, namely Vivado and SDK as well as use of video processing blocks and gigabit transceivers
- Language entry with either Verilog or high level synthesis via MathWorks HDL Coder
- Software engineering experience particularly with Eclipse C/C++
- Familiarity with the CoaXPress standard and GeniCam [https://en.wikipedia.org/wiki/GenICam](https://en.wikipedia.org/wiki/GenICam)

Assets Provided by the Company:

- CoaXPress framegrabbers
- CoaXPress FMC boards, cameras, and/or development boards with CoaXPress transceivers
- Engineering support

Company Web Site:

http://www.toyon.com