SCOPE
Senior Capstone Program in Engineering

The MathWorks

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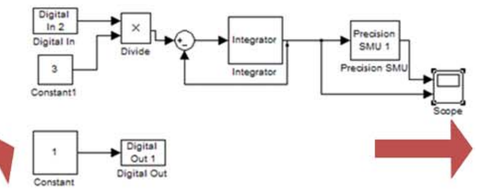
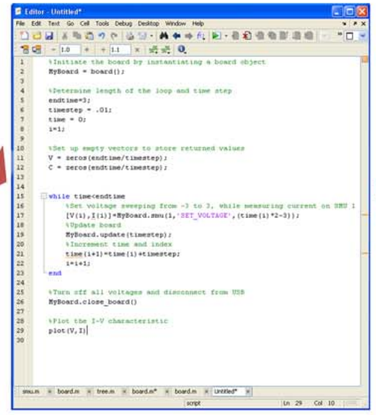
Mission Statement

As The MathWorks SCOPE team, we seek to improve the educational utility of MATLAB and Simulink by providing a simple and inexpensive method to have these software tools interact with physical systems. Our product provides a smooth transition from the virtual world (modeling) to the physical world (hardware) by allowing students to apply their current understanding of MATLAB or Simulink, no matter their expertise.

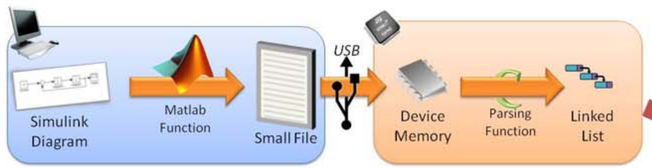
The MathWorks Connectivity System

User Personas. We target introductory undergraduate engineering students and professors, who value experimenting with and learning about fundamental engineering concepts that segway into detailed engineering or complicated, expensive systems.



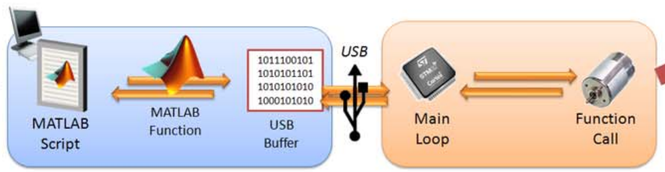


Untethered Software

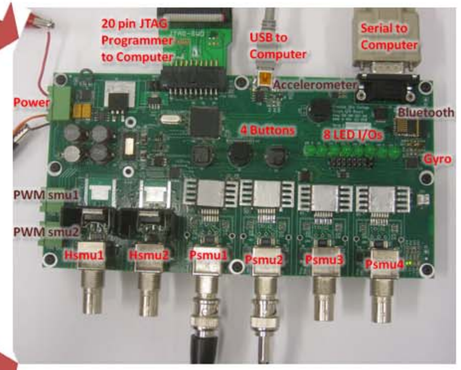


Untethered Mode. Users can upload Simulink diagrams to the board and run them completely untethered to a computer. This is advantageous for mobile or robotic applications. Diagrams loaded to the board and subsequent logged data is persistent, until a new model is downloaded.

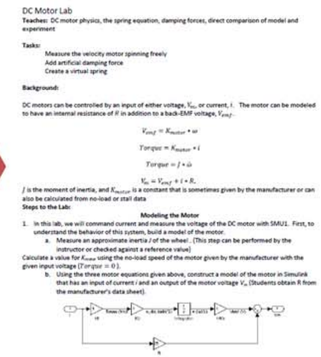
USB Tethered Software



Tethered Mode. Board is controlled by setting and reading values through MATLAB scripting. All MATLAB functions are available, and can be integrated with the hardware specific functions. This is advantageous when comparing simulation models with practical results.



Solution Hardware. The processor is a 32 bit Arm Cortex M3 microcontroller, clocking at 72MHz and offers 256kB dynamic memory, full speed USB device and host communication, and ethernet support. The Psmu and Hsmu refer to precision and high source-measure units respectively. Bright red indicates working functionality, where faded indicates features to be included in the next revision.



Sample Labs. In addition to the system, we have developed several labs demonstrating how to use our system in experiments teaching students fundamental engineering concepts, such as how to control a DC motor.

Project Summary:

The 2009-2010 Olin-MathWorks SCOPE team worked to identify and develop an affordable solution which allows students and professors to interface hardware with MATLAB and Simulink in real time. Many classes currently use these tools for purely computational projects and could benefit from an inexpensive and easily implementable device that connects to hardware; however, currently no such system, exist.

The team conducted an examination of potential users, existing products, and possible technologies to find the user group with the greatest potential and their unmet needs. Our target users include introductory and mechanical engineering courses that could benefit from hardware interfacing, but have access to few products that are simple and inexpensive. We have developed a concept for a hardware interface device, and have created a hardware, firmware, and software prototype to test the feasibility of the most important features of this product.

The software provides two major modes of use. Tethered mode allows the user to run MATLAB scripts while the board is connected to the computer via a USB connection. These scripts can integrate our custom commands for controlling the board with any other MATLAB command. Untethered Mode allows the student to download (limited) Simulink diagrams to the device using a USB connection, run the Simulink diagram with the board connected or disconnected from the computer, and then download the results of the experiment.

At this point, the team has produced a first prototype of the system and has developed a set of labs which use our device. In addition, the team has identified issues and short comings of this prototype device that may be mitigated in future works.