TEXAS A&M UNIVERSITY
ENGINEERING TECHNOLOGY AND INDUSTRIAL DISTRIBUTION DEPARTMENT
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PROPOSAL FOR AN ECETDHA MINI-GRANT

DEVELOPMENT OF A REAL-TIME OPERATING SYSTEMS EDUCATION PLATFORM

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Abstract: The grant is requested to design a real-time operating systems (RTOS) education platform based on our built Modular Integrated Stackable Layers - Analog Systems Environment (MISL-ASE) experimenter's board. Students can use this platform to (1) analyze timing requirements for each task; (2) fine-tune real-time scheduling constraints; and (3) design real-time embedded applications, with an emphasis on medical devices.

Justification:

Due to the lack of time and lab facilities, most U.S. Electrical Engineering Technology programs do not offer courses related to real-time operating systems or they just emphasize concepts of RTOS and introduce basic theoretic topics (e.g., various software architectures, real-time multi-task scheduling strategies, and RTOS validation techniques, etc.). As a result, many students who have a good understanding of theory and concepts of RTOS do not have the confidence to map their knowledge onto implementations. To bridge the gap between conceptual understanding and concrete implementations, I will establish an RTOS educational platform for students to: (1) analyze timing requirements for each task; (2) fine-tune real-time scheduling constraints; and (3) design real-time embedded applications.

More specifically, a complex medical device, multi-physiological parameter (heart-rate, body temperature, blood pressure, etc.) monitor, will be developed based on our built MISL-ASE board (Figure 1). This MISL-ASE board adopts the TI-MSP430 intelligence layer of the MISL architecture as the main core and control system that can be directly interfaced to the ASE board. Also, the board encompasses various analog and digital peripherals, and communication interfaces/protocols such as UART (USB, RS-232/485, Bluetooth, and Zigbee), SPI (Ethernet, Wi-Fi, Micro SD card, and flash memory), I^2C (DAC and EEPROM), and 1-wire communication devices, etc. The robust

design of the ASE board facilitates it being interfaced to a number of other embedded intelligence boards such as the Launchpad development system. In addition, the uc/os-III kernel will be used as the real-time kernel/scheduler to execute multiple tasks with different priorities, such as physiological parameter sampling (high priority), data output on UART (medium priority), touchscreen display (medium priority), and keyboard (low priority), etc.

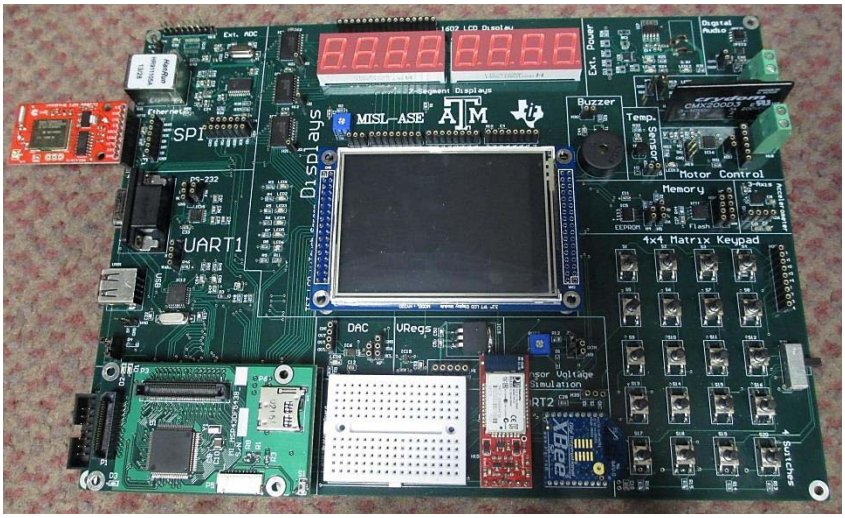

Figure 1. The MISL-ASE development board.

Intended Report:

A report will be generated which will introduce the RTOS education platform, to present the functional block diagram of this platform, and to explain the hardware and software development.

It is intended that the report will be in a form suitable for publication in the *Journal of Engineering Technology*.

Time Line:

Development of an RTOS Education Platform	February 2015 ~ August 2015
Writing of Report	Fall 2015
Submission of Article	Spring 2016

Budget:

As seen on the budget attached, the mini-grant will help the faculty member hire students to work on this project. The additional funds to complete the project will come from the Texas A&M University operating funds.

Student Labor:	80 hours ($8/hour)	$640
Materials:		$360
Total direct cost:		$1000