

# Rochester Institute of Technology

## Real Time and Embedded Systems: Project 2a

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### Overview:

Design and implement an embedded, real-time stand-alone system to provide a rough indication of voltage using a servo motor.

### Analysis:

**Signal Generator:** A signal generator is set to produce a waveform with a low frequency and limited amplitude. You are expected to use these three waveforms: sine, square, and triangle.

**Voltage Indicator:** The voltage indicator provides a rough (non-calibrated) indication of the input voltage. The indicator movement reflects the voltage changes of the signal generator. Zero voltage should be represented as a mid-point position on the servo. Counter-clockwise positions from the mid-point represent negative values. Clockwise positions past the mid-point represent positive values.

### Design Constraints:

- The signal generator voltage is measured with the A/D converter on the “purple box” using a QNX Neutrino program.
- The voltage of the signal generator must be constrained to -5 volts to +5 volts to protect the Diamond Systems hardware.
- The measured voltage is indicated by driving one servo using your program on the STM32 development board.
- Set the signal generator frequency low enough to allow the servo to respond in real-time.
- The sampling frequency of the signal generator must be sufficient to provide smooth operation of the servo.
- A push-button on the STM32 development board is used to start the servo motor. (A motion on the joystick button is also acceptable).
- No user interface is required nor permitted except for the communication status display on the QNX/Momentics console window.
- The communication mechanism between the two platforms is at your discretion. Please see the instructor if you'd like any suggestions.
- Each platform must provide a visual or audio indication of a fault condition (communication link is down, out-of-range voltage, etc.)

### WARNING:

The Diamond Systems A/D converter accepts voltages between -10 and +10 volts DC, referenced to ground on the Analog I/O ports. Voltages beyond this specification will damage the hardware! Please limit your signal generator voltage to -5 volts to +5 volts DC. You MUST verify the output voltage of the signal generator with a 'scope or voltmeter prior to connecting to the A/D port. If the signal generator configuration is changed or is unknown, please disconnect the signal and re-measure.

**Report:**

In addition to the demonstration of your project, a brief report with the required sections is required. List the trade-offs and assumptions of your implementation. Inclusion of proof of operation is not required for this project. Your source code must be included in your electronic submission.

**Grading Criteria:**

- Program Operation and Demo – 50%
  - Hardware setup is orderly and well organized – 10%
  - Demo sheet functions all completed – 30%
  - Demo operates without faults or restarts – 10%
- Program Design --- 15%
  - Proper initialization
  - Correct use of functions (no copy/paste/edit slightly)
  - Separation of hardware related code from pure software (e.g. the results reporting code)
- Source Code Structure and Readability – 10%
  - Appropriate use of white space – 2%
  - Consistent and good indentation – 2%
  - Appropriate comments at the function and paragraph levels (such as a for loop) – 2%
  - Following C style guide (good names, etc.)
- Report Content – 25%
  - Report is at least 2 pages (not counting pictures, cover page, diagrams) – 5%
  - Demonstrates team understands the problem, solution, and technology (hardware and software) – 10%
  - Report contains all required sections per the report guidelines – 10%