

UNIVERSITY OF LOUISIANA AT LAFAYETTE

STEP Committee

Technology Fee Application

Upgrading Computer Data Acquisition in the
Physical Chemistry Laboratory

Title

Kathleen Knierim

Name of Submitter
(Faculty or Staff Only)

Chemistry Department

Organization

Title: Upgrading Computer Data Acquisition in the Physical Chemistry Laboratory Date: July 15, 2019
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ABSTRACT (250 words or less):

Computerized data acquisition is ubiquitous in modern chemistry labs and students graduating in chemistry need to be experienced with electronic data acquisition. The physical chemistry laboratory courses at UL are upper level courses required for a degree certified by the American Chemical Society. Computer use is fundamental in physical chemistry, but these physical chemistry laboratory courses currently involve very limited computer interfacing due to outdated computer systems. The multi-purpose data acquisition board currently in use in the physical chemistry lab is installed in a PC that is about 18 years old. The old data acquisition board does not fit in current PCs. This proposal is to purchase a new National Instruments data acquisition system which will update and expand electronic data acquisition in the chem 311 and chem 312 courses. The new system will connect to a PC through the USB port so that it can be moved to a different PC if necessary. The National Instruments compact DAQ system proposed here is a multi-function data input system with sufficient precision to be suitable for a variety of experiments in upper level physical chemistry. This upgrade will allow students to focus on the significance of the data acquired rather than the tedium of manually recording data.

The objective of this proposal is to upgrade computer interfacing capabilities in the physical chemistry laboratory. Two physical chemistry laboratory classes, chem 311 and chem 312 are required for all chemistry majors seeking a degree certified by the American Chemical Society. Approximately 5-9 students take physical chemistry lab each semester. These students go on to work as chemists in industry or to graduate school. In either industry or academic research they need to be able to work with computer interfaces for data acquisition. Providing these students access to appropriate technology in their coursework at UL will benefit all students by maintaining the reputation for quality of a UL degree. The physical chemistry lab courses are upper level courses which emphasize critical thinking skills. Students need to be able to use modern data acquisition techniques and still gain experience with the steps between raw data and end result of an experiment, rather than simply approaching computerized data acquisition as a "black box". The proposed data acquisition components will provide this experience. At present there is one PC in the physical chemistry lab that has a National Instruments data acquisition board, but this PC is outdated (running Windows 2000) and the data acquisition board is not designed to fit current PCs. Several of the experiments in the physical chemistry lab involve tedious recording of data points which are then input into a spreadsheet for analysis. The ability to directly record temperature through thermocouple or thermistor input, as well as voltage from an electrochemical cell or various detectors will allow students to focus more on the significance of the data rather than the tedium of recording numbers by hand.

As a core upgrade for this lab, this proposal includes a National Instruments compact DAQ package consisting of a cDAQ-9174 chassis, NI-9217 temperature input module and thermistor probe, NI-9219 temperature input module and PTFE coated thin wire thermocouple probe, NI-9205 voltage input module, NI-9238 voltage input module, and a standard configuration Dell PC plus wifi adapter and surge protector. The DAQ chassis connects through standard USB so it will be transferrable to other PCs in the future. It is expected that this equipment will be in use for more than 10 years. The system proposed here will allow for high precision data acquisition for a variety of experiments. The two temperature input modules are for accommodating both thermocouple and resistance based temperature probes. These probes each have different advantages. The thermistor probe has greater resolution; the thermocouple probes are available in many configurations, including the PTFE coated thin wire form listed here which will be used to monitor the temperature of an electrochemical cell. The NI-9205 voltage input module covers voltage input up to 10 V with 16 bit precision. Some experiments require higher precision with lower voltages so an NI-9238 voltage input module is included for voltages up to 0.5 V with 24 bit precision. The Dell PC will receive data from the compact DAQ package through USB and be used for data processing. It will be placed on a cart that can be moved to different stations within the lab, therefore wifi connectivity is required. This core system will allow for input from devices used at present and also provide the ability to update the lab by developing new experiments.

Dr. Knierim will have primary responsibility for initial installation and implementation of this upgrade. Both Dr. Knierim and Dr. Karsili will be involved in maintaining the system and developing additional experiments making use of the DAQ system. Students in chem 311 and 312 will operate the data acquisition system with instructor (Dr. Knierim or Dr. Karsili) guidance. Both Dr. Knierim and Dr. Karsili

have extensive experience with computer applications in physical chemistry and are well qualified to implement this laboratory upgrade.

Previous funded STEP projects: Dr. Knierim participated in two funded STEP proposals for installing smart classrooms in Montgomery Hall (rooms 106 and 227).

Budget Proposal

1. **Equipment total \$5,316**

cDAQ-9174 chassis	\$ 904
NI-9217 temperature input module	\$ 621
Cole-Parmer thermister probe	\$ 112
NI-9219 temperature input module	\$ 362
VWR thin wire thermocouple probe	\$ 179
NI-9205 voltage input module	\$ 899
NI-9238 voltage input module	\$1,234
Standard Desktop from PC depot	\$ 965
Wifi adapter	\$ 20
Surge Protector	\$ 20

2. **Software \$0**

3. **Supplies \$0**

4. **Maintenance \$0**

5. **Personnel \$0**

6. **Other \$0**

TOTAL: \$5,316