Statement of Purpose for the iLabs@MAK Developers' Trip to MIT

The iLabs@MAK Academic trip scheduled for 12th to 20th March, 2010 will focus on eliciting help from the MIT iLab Team in the context of the current research being undertaken at Makerere University. The researchers' principal goal will be the completion of the four ongoing research projects in Remote Laboratories of Fiber Optics Communications, Embedded Systems, Control Systems and DSPs, all of which can be supported by the iLabs Interactive Architecture. The labs are part of an initiative by the iLabs@MAK project to advance research in the online engineering in the Faculty of Technology, Makerere University. These labs will be an online system that will enable students to have access to laboratory equipment for specified experiments through the Faculty intranet.

Embedded Systems

The Embedded Systems research group is developing three Digital Electronics experiments using Field Programmable Gate Arrays (FPGA) board. The experiments are; 3-bit carry look ahead full adder, 8-bit Universal shift register and BCD-to-7 Segment display. Each experiment requires two VIs: the FPGA VI that runs on the FPGA itself and the Host VI that controls (Writes to and reads from) the FPGA VI. Much as the Interactive Architecture is only compatible with LabVIEW 8.6, the researchers have built fully functional VIs using LabVIEW 2009, as well as LabVIEW FPGA 2009 Module. With the help of the iLab expertise at MIT, the team hopes to integrate support for LabVIEW 2009 in the Interactive architecture. In addition to this is guidance into the general considerations made and steps followed when adding a data socket to a given generic VI since all the Host VIs require data sockets.

Digital Signal Processing

The DSP group has built VIs using the LabVIEW DSP module. One of them, the digital filter VI was targeted onto the NI SPEEDY 33 board as the experimentation hardware. The set up of the experiment consists of three stages: the input from an audio device, the processing on the board and the output of the audio signals. During the testing of the filter on the hard ware, audio signals were used as the input through the on board microphone of the NI SPEEDY 33. The output was a graphical display of the input and the filtered signals on separate scales, although it is thought that an audio signal to supplement the graphical display would also be beneficial. The challenges

that need to be addressed are construction of a comprehensive VI that incorporates all the three stages and relevant configuration of the VI to allow remote access in the Interactive Architecture. Also interfacing third party applications like media players with LabVIEW DSP module so that the client can have some control over the input signals is another challenge.

Control Systems

The team doing research in control Systems uses the QNET DC Motor Control Trainer Board. A VI for control of motor speed and position has been constructed and tested on the Board. The modeling and position control VIs have also been tested. The work remaining is the addition of data sockets to the VI so as to read and write into the VIs for remote access, making the relevant changes in the lab server code and rebuilding the client to meet the specifications of the experiments, bootstrapping and debugging of the entire system as well as system tests to ensure the incorporation into the ISA is error-free.

Fiber Optic Communications

In this field, emphasis is being put on optical signal transmission, link budget and losses as well as multiplexing. In this regard, five experiments are being developed and it has been established that all these experiments are possible on the EMONA FOTEx add-on board for the NI ELVIS II. The requirement specifications for the lab have been determined and the system configured to support the running of the FOTEx. A generic VI has been built and works with the FOTEx but is further being modified to have it lighter. Further insight is also being sought as far as the proper positioning of the Data socket publisher and reader in the VI is concerned. It is also hoped that during the training, guidance into modification of the interactive client will be given to enable exposition of more features during each of the experiments.

Other general queries that will need to be addressed include:

1. Is it possible to directly retrieve Lab manuals just before the launch of the experiment?
2. After running the experiment, can a student be able to download Lab data for outside-lab analysis as was possible in the Batched Architecture?

3. Are there any special attributes that a VI must meet so as to be successfully integrated into the architecture without any physical and functional distortion? This involves the size of the front panel.
4. Scheduling functionalities on the Lab Side Scheduling Service is problematic in Firefox but successful in Internet Explorer. Can this be fixed to have everything supported by Mozilla Firefox?

During this trip, the developers also stand a chance of benefiting from questions and interests of the MIT team which might have otherwise never been considered.