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(B) Implementation and Integration of Microcontroller based Control & Monitoring application for Test Simulator of Centralized Interlock & Protection Module

Fast Interlock and protection system plays very crucial role in ensuring the safe and reliable operation of High power RF sources such as a Gyrotron system. In this context, an Industrial grade prototype Centralized Interlock and Protection Module (CIM) based on ITER-India design has been developed successfully with the help of local industry [1]. The CIM system consist of two types of modules; one is analog and the second is digital. 14 numbers of the analog channels are integrated in 7 modules (called as ACIM) which has 2 analog channels per module. To simulate and verify the performance of the complete CIM system simultaneously, many dummy input signals with different types (analog, digital and optical signals) are required. In this context, it is planned to design and develop a Test simulator/Jig module indigenously, to cater simultaneous testing of seven ACIM modules. Also, this test simulator can serve as a multifunction signal generator with multi-channels for generic applications for any device/system testing/simulation. The test simulator consists of digital potentiometers to generate required DC output voltage ($\pm 10V$ with 20mV resolution), Direct Digital Synthesizer (DDS) based programmable waveform generator ICs for sine wave/triangle wave/square wave generation, cascaded Programmable Instrumentation Amplifiers (PGA) to provide required gain for each DDS output signal and finally high speed buffers to drive the require loads. A combination of 32 Bit Microcontroller (TMS320 series) and Complex Programmable Logic Device (CPLD) is chosen for controlling these specified functions (viz digital potentiometers, DDS waveform generators, PGAs etc.) using a direct data latching method (Input/output expansion). This design has both operational modes: local/ remote mode. A LabVIEW™ based Graphical User Interface (GUI) will be used for remote operation and 7" TFT LCD panel will be used for the local mode operation. Embedded programming will be developed using KEIL C51 and Xilinx ISE tools. A detailed engineering design and development of hardware have been completed. Some basic application programs and commonly used libraries (both microcontroller side and TFT LCD side) have been developed. The integration of these codes, debugging and testing of the final application is to be done. The work involves verification of codes, VHDL coding & CPLD programming, Testing of microcontroller and its peripherals in the custom designed hardware. Also, implementation of the final single application program/code and integrated testing with hardware debugging using LabVIEW and HMI program to be done.

The Project activity will include the following major work scope:

- To understand the Test Simulator requirements and its detailed design concept
- To study TMS320f28335 controller & its peripherals, Code composer studio, LabVIEW™ & VHDL.
- Understand the previously developed C and HMI libraries.
- To develop integrated application program along with VHDL coding and CPLD programming. Integration of codes, debugging and testing of the final application with actual hardware of test simulator.
- Verification and implementation of developed program with actual application (CIM System)

Expected outcome:

- Project progress/updates presentation shall be held on a monthly basis.
- Demonstration of developed GUI Applications (both local and remote modes). Prepare a report and Final presentation.

Project duration and No. of Students: 4 months ; 03 students (max.)

Eligibility:

- Only students with B. Tech in Electronics& Communication/ Instrumentation & Control (ongoing) branches can submit their application at following email addresses.
- Basic Knowledge of programming language such as Microcontroller, VHDL and LabVIEW (preferred) and also have good communication & presentation skills require.

Relevant references: [1] V. Rathod et al., Fusion Eng. Des., 112, 897-905 (2016).

Project Guide/Co-Guide Details:

Project Guide Name: Vipal Rathod / E-mail address : vipal@ipr.res.in / Phone number: 9925812736

Project coordinator's email address: project_ee@ipr.res.in