Multi Axis Motor Control System for BARC-TIFR LINAC Scattering Chamber

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Introduction

A general purpose scattering chamber of 150 cm diameter and 50 cm height is recently installed at BARC – TIFR LINAC facility . Scattering chamber is used in several experiments using particle accelerators. A remote controlled system is developed to to perform various operation in scattering chamber. Four servo motors with PLC interface have been used to meet the precise positioning of target and detectors in scattering chamber. User interface software has been developed in Java which interacts with the system over Ethernet.

System Architecture

The System Consists of two Servomotors for Arm rotation which is of higher torque for the precise angular rotation of the arms. System architecture can be easily explained by fig1. One servo motor is used for Target ladder rotation. One more is used for changing the target height and removal of the target from the scattering chamber. All these motors provide very precise rotation and speed control with GE –Fanuc 90-30 Series PLC controller. Motors are driven by individual Servo amplifier. All these motors are controlled by a four channel PLC based motion controller. The motors are daisy chained via their servo amplifier and are interconnected over an optical fiber link. A communication module provides the user interaction from the system over RS 232 link. This link is converted to Ethernet by using an RS 232 to Ethernet switch . PLC Communication module has a very important role towards the flexibility of the system. Normally PLC systems comes with their own propriety SCADA system, which is required to be configured/developed by the factory or significant time have to be invested in learning , also interaction with the other systems becomes difficult. Communication module provides the open protocol for the interaction to PLC , without any extra software interface on PLC CPU.

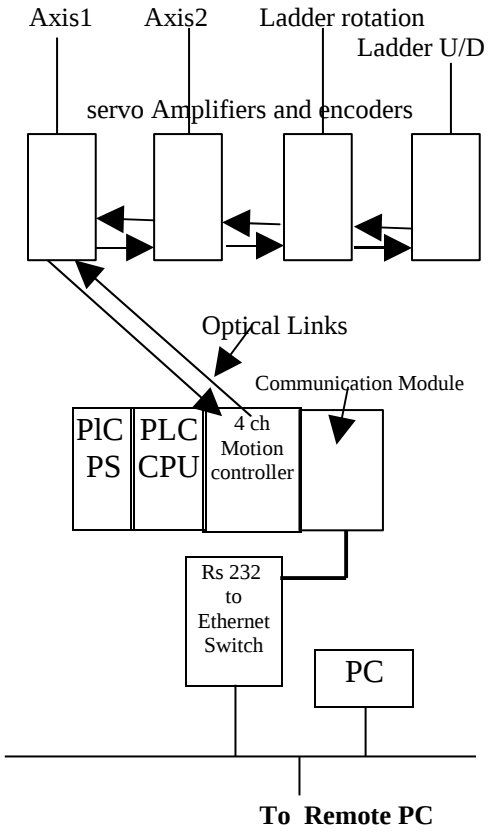

Fig. 1 System Architecture

Ethernet in place of RS232 or RS485 makes the system very flexible as it provide multiple interaction points with the system with remote as well as local terminal. Well

established TCP /IP protocol suit provides a very reliable communication system .

Both local and remote controls are implemented on PCs .

Software Architecture

The system consists of three intelligent units with PLC microprocessor , RS 232 to Ethernet converter and PC. PLC and PC are the programmable nodes. Software architecture can be easily explained as in fig 2.

RS232 to Ethernet switch is preprogrammed and can be configured in different modes of operation (Real Com , TCP/IP server, TCP/IP client) by using web interface or telnet interface or dedicated software provided by the vendor. TCP/IP server mode has been selected for this system with maximum no of allowable connection one. Limiting the connection at RS232 to Ethernet Switch ensures interaction with the system from only one node at a time which avoids any possibility of multiple controls.

Software at PLC system has been written in ladder logic and GE-Fanuc Motion program. Logic has been implemented by using virtual coils and switched. Interface between PLC CPU and Motion controller (DSM324) has been implemented in GE–Fanuc communication software interface which is a special program block of GE-Fanuc PLC ladder logic. PLC ladder logic program provides the interface between PLC CPU , motion controller's program module parameter and User interaction.

PLCs communication module provides the interface between user program and PLC system. Communication module can be configured in either MOD Bus client , GE Fanuc Propriety protocol and open CCM protocol. CCM protocol have been selected because of simplicity.

PC software is developed in Java for the testing and installation phase by using previously developed objects for LINAC software. Final software interface under GTK is under development. The GTK GUI will reflect the actual position of arms based on read back values. The software would further take care of deciding on the direction(ie Clockwise or anti-clockwise) for the both arms to minimize the no of cable twist arising due to rotation. The software will also provide a view of target ladder showing its orientation and height with the interface for controlling these parameters.

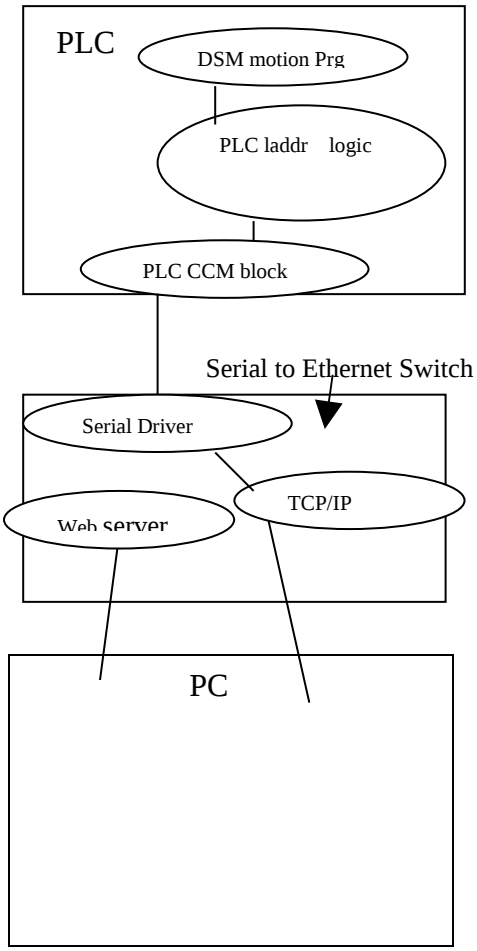

Fig. 2 Software Architecture

Acknowledgment

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