ABSTRACT

Computer Numerical Control Machines have been around for a while, however their popularity is rapidly growing in all machining arenas. This is due to the impressive capabilities of these machines to create complex shapes that would take a skilled craftsman much longer time.

In the traditional CNC systems, application software, system software and the hardware are bound together by the designer to achieve required compatibility and for the proprietorship. Such systems are inflexible, expensive and too complex for modifications if necessary. To stay competitive in the market, it has become necessary for the manufactures to develop hardware independent software, adopt modularised approach and use open communication protocols. To cop-up with the market requirements, frequent updates are also needed. To meet these goals, open architecture seems to be the best solution since the architecture is regularly modified by the contribution from the open community.

This research studies the existing proprietary CNC controllers and open controllers and makes an attempt to develop a CNC controller with open standards at hardware and software. The hardware of the control system is designed based on the DSP Processor and FPGA architecture. The software is developed in Qt-Creator using Linux Operating System. The communication between the different modules are established by standard serial communication protocols such as USB and SPI. The integrated development environment for the DSP processor and FPGA has also been selected using open platform.

This research integrates the application software, system software and hardware and an elaborate analysis is done to evaluate the performance of the designed motion controller. Execution speed of different G-Codes matches with the operation of the existing machines. Since each software and hardware module has been developed in an open platform, sufficient flexibility is available for the modifications.

Indian machine tool manufactures depend only on the imported CNC controllers, since fully indigenous open Computer Numerical Controllers are not readily available in the market. The developed controller has been calibrated and tested for the standards required by the Indian Machine Tool Manufactures.