Abstract

The DIY and desktop manufacturing community has been growing due to the availability of affordable rapid prototyping machinery. Desktop CNC Mills and Lathes which are 2.5D+ capable are costly when coupled with the requisite software and workstation computer. This thesis provides a fully implemented control solution which is low-cost and working largely with opensource hardware and software. An effective low-cost system was devised using a combination of pre-existing hardware. A BeagleBone Black (BBB) is used as the primary controller with a Xylotex DB-25 Parallel Port adapter, this feeds the signals to a ZenToolWorks Mach-3 5-Axis Breakout Board which distributes the signals to multiple TB6560 Stepper Motor Drivers. Since the BeagleBone is especially sensitive to power input noise, a MOKO 9000mAh battery was used in conjunction with a 3.7V 3000mAh LiPo battery to provide regulated power and prevent damage in the event of power failure. The Linux Machinekit OS which uses the Xenomai Real Time Operating System (RTOS) is used on the BBB CNC controllers. LinuxCNC is the G-Code interpreter and control software which provides the Axis Graphical User Interface (GUI); this allows for tool virtualization and layman control of the CNC. The BBB CNC controllers are accessed and controlled via a Secure SHell (SSH) connection with X-Forwarding enabled. A TP-Link MR3040 router in conjunction with a TP-Link 5-port ethernet switch is used to create a designated and isolated network. A BBB with a ChipSee 7" capacitive touchscreen LCD is used to provide an additional low-cost control hub which is hardwired to the designated network. The isolated network setup allows for command and control of the BBB CNC controllers by any authenticated WiFi enabled device which is in range. This thesis is a baseline which successfully implements a standalone, low-cost, network enabled,expandable desktop manufacturing center.