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Title of Poster: Reconfigurable Computing Telepresence Robot

Abstract:

The purpose of this project was to create a high performance sensor platform with hardware-level data processing capabilities by replacing the proprietary electronics and control system of a military IED examination robot, the MARCbot. The significance of this type of system is that it decreases the amount of data that must be transmitted to a remote computer. This is useful in situations where a Disruption Tolerant Network (DTN) is required due to a significant communication delay between a remote host and the controlled device. This situation could arise when controlling a robotic rover on Mars, where there is a thirty-minute delay between initial transmission and data acquisition from the rover.

The primary task of the robot is to process tele-operation commands from a remote computer and return a live video feed from an onboard camera. A JAVA program on the host computer transmits drive commands using a UDP protocol to the onboard controller, a Xilinx Virtex-6. This Field Programmable Gate Array (FPGA) based controller implements a MicroBlaze soft processor, which runs PetaLinux, a board specific Linux distribution. A program, written in C, running on this system interprets the UDP packets and sends drive commands to the Parallax servo controller over a serial protocol. An onboard camera transmits live video to the JAVA program over an 802.11 standard wireless network so the robot can be operated out of line of sight. The UDP packet structure is designed to be extensible, easily incorporating data from more sensors as they are added.

The hardware and software modifications that have been implemented enable a user to drive the MARCbot and view the video feed in a standalone program from the remote computer. Although the current platform does not incorporate hardware level processing, work is being done to utilize the partial reconfiguration capabilities of the Virtex-6 to optimize multi-sensor processing.