

Evaluation Of Real-Time Delays For Networked Telerobotics

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Summary

A real-time telerobotic system consisting of client station (operator) and server station (slave arm) interconnected by a computer network has been implemented using a distributed component framework. To minimize overall delays a multithreaded execution is proposed for pipelining of information processing and real-time transmission. Thread engineering allowed pipelining stereo grabbing and live transfer of stereo video data. Different scenarios are statistically analyzed to relate the effect of thread manipulation to overall time delays. Analysis of telerobotic delays through three campus routes with different network loads is presented. A sampling rate of 120 Hz is achieved for force feedback and 50 Hz for operator commands when network load is below 80%. Copying stereo images from cameras to memory is done in 24 ms. Stereo video transfer operates at a rate of 17 fps. Total reference delays for force and stereo are 8 ms and 83 ms, respectively. The environment interaction delay is 183 ms (5.5 Hz) when slave arm is operated at 10 Hz. However, short instantaneous traffic irregularities may cause deviation and scattering from above reference rates.

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