Haptic Teleoperated Steering System for Unmanned Ground Vehicles

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The teleoperation of Unmanned Ground Vehicle places high demands to its steering system. The main objective of this research was to design and introduce a haptic teleoperated steering system. While turning the steering wheel into desired angle, master controller detects the signal and transmit it to slave controller through wireless communication module. Then, it drives the slave motor. If there any disturbance torque on the slave motor, armature current changes proportionally to that torque. The change in armature current was sensed by a current sensor connected to the slave controller. Then, that data transmits to the master controller. After that, master controller regenerates a haptic feedback current signal and sends it to the feedback motor driver. Then, the relationship of master and the slave motor responses was obtained. Whenever the slave side feels any force, the current drawn by the slave motor was increased from its normal value. This current regenerates the proportional torque on the master side. Control scenario was evaluated with control systems applications. By the use of a PID controller allowed more precise control of position and thus, faster achievement of a stable position. The design was simulated in Simulink software and control algorithm was tested for prototype model. The system is settled within 8.4 s for the given angle inputs and disturbances. The system responded to each force acting on the slave end according to a specific program, which was coded and installed on a microcontroller. The results proved the model can generate haptic feedback on the teleoperator. Further development of enhanced performance of the system in wireless network environment is intended.

Keywords: Haptic Feedback, Steer By Wire, Teleoperation, Unmanned Ground Vehicle