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Teleoperation of a Tendon Driven Robotic Hand

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Abstract

Background: Robots and machines have become an integral part of our lives. The robots are fast and efficient when compared to humans and can perform tasks that are hazardous to humans [1]. Teleoperated robots can perform highly complex tasks in collaboration with humans [2]. In this paper, we have developed a five-finger robotic hand that can perform the work remotely. The robotic hand has five fingers and is tendon-driven, thus making it a dexterous manipulator.

Objectives: Certain jobs for instance: handling harmful chemicals, radioactive substances, etc. requires a teleoperated robotic system that is controlled remotely by a human operator. Research in this domain has grown over time and many robotic systems are teleoperated to perform tasks [3, 4]. To make the work more intuitive we have developed a robotic hand that is a replica of a human hand having tendon-driven fingers to perform the dexterous nature of work. The robotic hand can be controlled by a mechatronics glove worn by an operator. The robotic hand mimics the operator's hand gestures in real-time thus allowing him to perform the task whilst keeping a safe distance.

Methodology: A robotic hand is developed to achieve this objective. This can be deployed at the target location and can be controlled using the hand glove by a human operator. The device contains microcontrollers and communication sensors to command a remote robotic hand. The hand has tendon-driven actuators that reflex to the glove flex sensors. The signal from the glove is processed to eliminate the noise propagation by using a 4th order Butterworth filter that makes the model robust.

Results and discussion: The developed robotic hand was tested to mimic the operator's hand motion while it was teleoperated. The operation performed by the robotic hand had an accuracy of 3.41 mm but had a certain degree of latency and can be reduced by incorporating better control.

Conclusions: The robotic hand acts as an extended part of the human body. It has various applications including handling harmful chemicals, hazardous substances, and can be customized for the desired operation.

Future Work: Further improvements can be introduced to the device by switching to force-based controls and further improving accuracy and latency.

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