# Design and implementation of a dexterous anthropomorphic robotic typing (DART) hand

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## Abstract

This paper focuses on design and implementation of a biomimetic dexterous humanoid hand. Several design rules are proposed to retain human form and functionality in a robotic hand while overcoming the difficultly of actuation within a confined geometry. Size and weight have been optimized in order to achieve human-like performance with the prime objective of typing on a computer keyboard. Each

finger has four joints and three degrees of freedom (DOF) while the thumb has an additional degree of freedom necessary for manipulating small objects. The hand consists of 16 servo motors dedicated to finger motion and three motors for wrist motion. A closed-loop kinematic control scheme utilizing the Denavit–Hartenberg convention for spatial joint positioning was implemented. Servo motors housed in the forearm act as an origin for wires to travel to their insertion points in the hand. The dexterity of the DART hand was measured by quantifying functionality and typing speed on a standard keyboard. The typing speed of a single DART hand was found to be 20 words $min^{-1}$. In comparison, the average human has a typing speed of 33 words $min^{-1}$ with two hands.

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