* **Thesis title**: Pinching Function of Human-like Robotic Hand using McKibben Muscles

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ABSTRACT

Human hand has amazing capability in manipulating objects with arbitrary shapes. The function of human hands to form multiple gestures is unique which requires perfect coordination between its anatomical parts, bone, ligaments and muscles. The current available robotic hands simplified the hand's function which limits the number of DOF and mainly controlled using DC motor. In this project, we propose a new type of Human-like Robotics Hand (HR-Hand) focusing on index and thumb fingers for pinching gesture. The hand design is intended to closely replicate the human finger anatomy in terms of bones, ligaments, muscles, tendon and pulley system. The merit of the research is to use thin multifilament McKibben actuators to replicate the muscles for the hand actuation. Only the extrinsic Muscles of both fingers are considered and fabricated with 4.0 mm McKibben type. The total numbers of extrinsic muscles according to the anatomy of these fingers are 7 muscles. The hand model is fabricated using 3B Scientific hand bone model, artificial ligaments using silicone and tendons using Dyneema material. The fabricated finger motion is modelled using OpenSim simulation software and validated by experimental analysis for pinching gesture. Three objects with different sizes and weight are used for the pinching gesture experiment and force required are recorded. The performance of the pinching motion is analysed using motion capture software, Tracker^{TM} to compare the results in OpenSim. The McKibben muscles is controlled by pneumatic system at 300 KPa. Using the developed HR-Hand, one can better understand the human fingers' pinching function and may use it for training and for modelling the human fingers.