Lecture Notes in Electrical Engineering
Volume 398, 2017, Pages 385-394
9th International Conference on Robotic, Vision, Signal Processing and Power Applications, RoViSP 2016; ; Malaysia; 2 February 2016 through 3 February 2016; Code 184869

An assistive robotic hand based on human computer interface (HCI) and shape memory alloy (SMA) actuator (Conference Paper)

Ba Hamid, A., Makhdoomi, M., Saleh, T.

Department of Mechatronics Engineering, International Islamic University Malaysia, Gombak, Malaysia

Abstract

View references (13)

Rehabilitation and assistive robotics is an emerging field of research where researchers are trying to develop tailored made robotic devices to address the challenge of disability. This paper presents a study on feedback controlled wearable robotic hand for grasping. The proposed design is compact and sufficiently light to be used as an assistive hand. It is tendon driven and joint-less structure that has the potential to be used as an assistive device for stroke patients. The concept has been implemented for index and thumb fingers as a first prototype to enable grasping. Shape memory alloy (SMA) actuator and bias force mechanism are used for the purpose of hand's flexion and extension. This paper describes the mechatronic design of the wearable hand, simulation, modeling, and development of the actuation unit and sensory system. Experiments of open loop controller were conducted to understand the hand characterization and grip force provided by index finger. A feedback controller (proportional controller) was implemented for this prototype with gripping force as the feedback parameter. It was observed that approximately 2.25 A current caused 4 cm displacement for SMA actuator. The maximum temperature of the SMA actuator was achieved to be 100 °C. The attainable gripping force was around 2 N for a load free finger. The conducted experiments showed promising results that encourages further development on this. © Springer Science+Business Media Singapore 2017.

Author keywords

Assistive hand Electromyography EMG Shape memory alloy SMA Wearable technology

Indexed keywords

Engineering controlled terms: Actuators Computer vision Controllers Electromyography Human computer interaction Microactuators Robotic arms Robotics Shape memory effect Signal processing Wearable technology

Compendex keywords Assistive Feedback controller Feedback parameters Human computer interfaces Maximum temperature Open loop controllers Proportional controller Shape memory alloy actuators

Engineering main heading: Feedback

ISSN: 18761100
ISBN: 978-981101719-3
Source Type: Book series
Original language: English
DOI: 10.1007/978-981-10-1721-6_42
Document Type: Conference Paper
Volume Editors: Ibrahim H.,Iqbal S.,Teoh S.S.,Mustaffa M.T.

Sponsors:
Publisher: Springer Verlag

References (13)

View in search results format >

All | Export | Print | E-mail | Save to PDF | Create bibliography

1 Kamarudin, A.
ELIQUIS® (Apixaban) approved
(2014) *Malaysia for Prevention of Stroke and Venous Thromboembolism (VTE), Kuala Lumpur*, pp. 1-6.

2 (2012) *Management of Ischaemic Stroke. Ministry of Health Malaysia*
Putrajaya

3 Why hands matter

(2008) *Mechanical Engineering*, 130 (7), pp. 24-29. Cited 2 times.

4 Heo, P., Gu, G.M., Lee, S., Rhee, K., Kim, J.
Current hand exoskeleton technologies for rehabilitation and assistive engineering

(2012) *International Journal of Precision Engineering and Manufacturing*, 13 (5), pp. 807-824. Cited 134 times.
http://www.springerlink.com/content/b47516627662qml5/fulltext.pdf
doi: 10.1007/s12541-012-0107-2

View at Publisher

5 Bundhoo, V.
(2009) *Design and Evaluation of a Shape Memory Alloy-Based Tendon-Driven Actuation System for Biomimetic Artificial Fingers*. Cited 5 times.
Master thesis, University of Victoria

6 Lin, Li-Ren, Huang, Han-Pang
Mechanism design of a new multifingered robot hand

(1996) *Proceedings - IEEE International Conference on Robotics and Automation*, 2, pp. 1471-1476. Cited 30 times.

7 Butterfaß, J., Grebenstein, M., Liu, H., Hirzinger, G.
DLR-Hand II: Next generation of a dextrous robot hand

(2001) *Proceedings - IEEE International Conference on Robotics and Automation*, 1, pp. 109-114. Cited 532 times.

8 Alba, D., Armada, M., Ponticelli, R.
An introductory revision to humanoid robot hands
(2005) *In: Climbing and Walking Robots*. Cited 5 times.

9 Accessed 28 Oct 2014
http://www.shadowrobot.com

10 Xing, K., Huang, J., Xu, Q., Wang, Y.
Design of a wearable rehabilitation robotic hand actuated by pneumatic artificial muscles
(2009) *In: The 7Th Asian Control Conference*

11 Takami, M., Fukui, K., Saitou, S., Sugiyama, I., Terayama, K.
Application of a shape memory alloy to hand splinting

(1992) *Prosthetics and Orthotics International*, 16 (1), pp. 57-63. Cited 2 times.
doi: 10.3109/03093649209164309

View at Publisher

12 Morales, M.
(2011) *Influence of Tendon-Pulley Friction on an Index Finger Model*
Master thesis, Swiss Federal Institute of Technology

13 Chao, E., An, K., Cooney, W.P., Linscheid, R.
(1989) *Biomechanics of the Hand.*
World Scientific Publishing Co., Pte. Ltd., Teaneck

Saleh, T.; Department of Mechatronics Engineering, International Islamic University Malaysia, Gombak, Malaysia; email:tanveers@iium.edu.my

Back to results | 1 of 1 Top of page