



[2020](#)

[International Conference On Systems Engineering](#)

ICSEng 2020: [Proceedings of the 27th International Conference on Systems Engineering, ICSEng 2020](#) pp 34-48| [Cite as](#)

A Prototype Telepresence Robot for Use in the Investigation of Ebola and Lassa Virus Threatened Villages in Nigeria

- [Authors](#)
- [Authors and affiliations](#)

- S. D. Monk
- E. Jorgensen
- A. McCulloch
- R. Peacock
- I. Sangprachatanaruk
- J. Azeta
- C. A. Bolu
- C. J. Taylor

- Conference paper
First Online: 07 January 2021

• [193](#) Downloads

Part of the [Lecture Notes in Networks and Systems](#) book series (LNNS, volume 182)

Abstract

The article investigates the idea of low-cost, telepresence-based mobile robots for eventual use within villages and rural areas in Nigeria, where diseases such as the Ebola Virus Disease (EVD) and Lassa Haemorrhagic Fever (LHF) are common, yet human intervention is constrained due to the great risk of transmission through bodily fluids. To illustrate the concept and practical issues arising, a systems design approach is taken to identify some of the engineering requirements; and, in the focus of this article, a prototype has been developed at Lancaster University. The robotic device is semi-humanoid in that the upper half features two 7-DOF manipulators, designed in part to resemble human operation, while the lower half consists of a four-wheeled base, prioritising ease of operation and reliability over the flexibility offered by a leg-based system.

Keywords

Telepresence First-Person Viewer Kinect Unsafe environment Ebola

This is a preview of subscription content, [log in](#) to check access.

Notes

Acknowledgements

This work is supported in the UK by the EPSRC project EP/R02572X/1.

References

1. 1.

World Health Organization Ebola Response Roadmap Situation Reports. <http://www.who.int/csr/disease/ebola/situation-reports/archive/en>. Accessed 26 May 2020

2. 2.

Sanchez, A., Geisbert, T.W., Feldmann H.: Filoviridae: Marburg and Ebola viruses. *Fields Virology*. 5th Edn. Lippincott Williams & Wilkins, Philadelphia, pp. 1409–1448 (2007)[Google Scholar](#)

3. 3.

Report of an International Commission: Ebola haemorrhagic fever in Zaire. *Bull. World Health Organ.* **56**(2), 271–293 (1976)[Google Scholar](#)

4. 4.

Tseng, C.P., Chan, Y.J.: Overview of ebola virus disease. *J. Chin. Med. Assoc.* **78**(1), 51–55 (2015)[CrossRef](#)[Google Scholar](#)

5. 5.

Alexander, K.A., Sanderson, C.E., Marathe, M., Lewis, B.L., Rivers, C.M., Shaman, J., Drake, J.M., Lofgren, E., Dato, V.M., Eisenberg, M.C., Eubank, S.: What factors might have led to the emergence of ebola in West Africa?. *PLOS Neglected Trop. Dis.* **9**(6) (2015)[Google Scholar](#)

6. 6.

Fauci, A.S.: Ebola-underscoring the global disparities in health care resources. *N. Engl. J. Med.* **371**(12), 1084–1086 (2014)[CrossRef](#)[Google Scholar](#)

7. 7.

Moghadam, S.R.J., Omidi, N., Bayrami, S., Moghadam, S.J., Seyed Alinaghi, S.: Ebola viral disease: a review literature. *Asian Pac. J. Trop. Biomed.* **5**(4), 260–267 (2015)[Google Scholar](#)

8. 8.

Ogbu, O., Ajuluchukwu, E., Uneke, C.J.: Lassa fever in West African sub-region: an overview. *J. Vector Borne Dis.* **44**(1), 1 (2007)[Google Scholar](#)

9. 9.

World Health Organization, Ebola Virus Disease factsheet. <http://www.who.int/news-room/fact-sheets/detail/ebola-virus-disease>. Accessed on 26 May 2020

10. 10.

Althaus, C.L., Low, N., Musa, E.O., Shuaib, F., Gsteiger, S.: Ebola virus disease outbreak in Nigeria: transmission dynamics and rapid control. *Epidemics* **11**, 80–84 (2015)[CrossRef](#)[Google Scholar](#)

11. 11.

Weyer, J., Grobbelaar, A., Blumberg, L.: Ebola virus disease: history, epidemiology and outbreaks. *Curr. Infect. Dis. Rep.* **17**(5), 21 (2015)[CrossRef](#)[Google Scholar](#)

12. 12.

Sheridan, T.: Human supervisory control of robot systems. In: *Proceedings of the IEEE International Conference on Robotics and Automation*, vol. 3, pp. 808–812. IEEE (1986)[Google Scholar](#)

13. 13.

Harless, M., Donath, M.: An intelligent safety system for unstructured human/robot interaction. In: Proceedings of the Robots Conference and Exposition, 117–120 (1985)[Google Scholar](#)

14.14.

Murphy, R.R.: Rescue robotics for homeland security. *Commun. ACM* **47**(3), 66–68 (2004)[CrossRef](#)[Google Scholar](#)

15.15.

Murphy, R.R.: A decade of rescue robots. In: IEEE/RSJ International Conference on Intelligent Robots and Systems, pp. 5448–5449. IEEE (2012)[Google Scholar](#)

16.16.

Kristoffersson, A., Eklundh, K.S., Loutfi, A.: Measuring the quality of interaction in mobile robotic telepresence: a pilot's perspective. *Int. J. Soc. Robot.* **5**(1), 89–101 (2013)[CrossRef](#)[Google Scholar](#)

17.17.

Paulos, E., Canny, J.: Designing personal tele-embodiment. In: Proceedings of the IEEE International Conference on Robotics and Automation, pp. 3173–3178 (1998)[Google Scholar](#)

18.18.

Paulos, E., Canny, J.: Social tele-embodiment: understanding presence. *Auton. Robots* **11**(1), 87–95 (2001)[zbMATH](#)[CrossRef](#)[Google Scholar](#)

19.19.

Adalgeirsson, S.O., Breazeal, C.: MeBot: a robotic platform for socially embodied presence. In: Proceedings of the 5th ACM/IEEE International Conference on Human-Robot Interaction (HRI), Osaka, Japan, pp. 15–22 (2010)[Google Scholar](#)

20.20.

Burgard, W., Trahanias, P., Hähnel, D., Moors, M., Schulz, D., Baltzakis, H., Argyros, A.: Tele-presence in populated exhibitions through web-operated mobile robots. *Auton. Robots* **15**(3), 309–316 (2003)[Google Scholar](#)

21.21.

Chaudary, B., Paajala, I., Keino, E., Pulli, P.: Tele-guidance based navigation system for the visually impaired and blind persons. In: eHealth vol. 360, pp. 9–16. Springer, Cham (2017)[Google Scholar](#)

22.22.

Double robotics website. <https://www.doublerobotics.com/>. Accessed on 26 May 2020

23.23.

IEEE Spectrum article. <https://spectrum.ieee.org/automaton/robotics/humanoids/toyota-gets-back-into-humanoid-robots-with-new-thr3>. Accessed 26 May 2020

24.24.

Toyota website. <https://newsroom.toyota.co.jp/en/detail/19666346>. Accessed 26 May 2020

25.25.

Whitney, J.P., Chen, T., Mars, J., Hodgins, J.K.: A hybrid hydrostatic transmission and human-safe haptic telepresence robot. In: IEEE International Conference on Robotics and Automation, Stockholm, Sweden, pp. 690–695 (2016)[Google Scholar](#)

26.26.

Bodner, J., Wykypiel, H., Wetscher, G., Schmid, T.: First experiences with the da Vinci™ operating robot in thoracic surgery. Eur. J. Cardio-thoracic Surg. **25**(5), 844–851 (2004)[CrossRef](#)[Google Scholar](#)

27.27.

Quinetiq Dragon Runner. <https://www.qinetiq-na.com/products/unmanned-systems/dragon-runner>. Accessed 26 May 2020

28.28.

Xsens website. <https://www.xsens.com/cases/robo-sally-bomb-disposal-robot>. Accessed on 26 May 2020

29.29.

Abe, K., Shiomi, M., Pei, Y.C., Zhang, T.Y., Ikeda, N., Nagai, T.: ChiCaRo: tele-presence robot for interacting with babies and toddlers. Adv. Robot. **32**(4), 176–190 (2018)[CrossRef](#)[Google Scholar](#)

30.30.

Ilias, B., Shukor, S.A., Yaacob, S., Adom, A.H., Razali, M.M.: A nurse following robot with high speed kinect sensor. ARPN J. Eng. Appl. Sci. **9**(12), 2454–2459 (2014)[Google Scholar](#)

31.31.

Ardanuy, P., Otto, C., Head, J., Powell, N., Grant, B., Howard, T.: Telepresence enabling human and robotic space exploration and discovery: antarctic lessons learned. In: Space, Long Beach California, USA, p. 6756 (2005)[Google Scholar](#)

32.32.

Kron, A., Schmidt, G., Petzold, B., Zah, M., Hinterseer, P., Steinbach, E.: Disposal of explosive ordnances by use of a bimanual haptic telepresence system. In: IEEE International Conference on Robotics and Automation, New Orleans, LA, USA, vol. 2, pp. 1968–1973 (2004)[Google Scholar](#)

33.33.

Talha, M., Ghalamzan, E.A.M., Takahashi, C., Kuo, J., Ingamells, W., Stolkin, R.: Towards robotic decommissioning of legacy nuclear plant: Results of human-factors experiments with tele-robotic manipulation, and a discussion of challenges and approaches for decommissioning. In: IEEE International Symposium on Safety, Security, and Rescue Robotics, Lausanne, Switzerland, pp. 166–173 (2016)[Google Scholar](#)

34.34.

West, C., Monk, S., Montazeri, A., Taylor, C.J.: A vision-based positioning system with inverse dead-zone control for dual-hydraulic manipulators. In: UKACC 12th International Conference on Control, Sheffield, UK, IEEE (2018)[Google Scholar](#)

35.35.

Tsitsimpelis, I., Taylor, C.J., Lennox, B., Joyce, M.J.: A review of ground-based robotic systems for the characterization of nuclear environments. *Progress Nuclear Energy* **111**, 109–124 (2019)[CrossRef](#)[Google Scholar](#)

36.36.

Colgate, E., Bicchi, A., Peshkin, M.A., Colgate, J.E.: Safety for physical human-robot interaction. In: Springer Handbook of Robotics pp. 1335–1348. Springer (2008)[Google Scholar](#)

37.37.

Kulić, D., Croft, E.: Pre-collision safety strategies for human-robot interaction. *Auton. Robots* **22**(2), 149–164 (2007)[CrossRef](#)[Google Scholar](#)

38.38.

RIA/ANSI R15.06—1999 American National Standard for Industrial Robots and Robot Systems—Safety Requirements. American National Standards Institute. New York [Google Scholar](#)

39.39.

Hussein, M.A., Ali, A.S., Elmisery, F., Mostafa, R.: Motion control of robot by using kinect sensor. Res. J. Appl. Sci. Eng. Tech. **8**(11), 1384–1388 (2014) [CrossRef](#) [Google Scholar](#)

40.40.

Marturi, N., Rastegarpanah, A., Takahashi, C., Adjigble, M., Stolkin, R., Zurek, S., Kopicki, M., Talha, M., Kuo, J.A., Bekiroglu, Y.: Advanced robotic manipulation for nuclear decommissioning: a pilot study on tele-operation and autonomy. In: Proceedings of the International Conference on Robotics and Automation for Humanitarian Applications, Kerala, India, pp. 1–8 (2016) [Google Scholar](#)

Copyright information

© Springer Nature Switzerland AG 2021

Notes in Networks and Systems, vol 182. Springer, Cham.
https://doi.org/10.1007/978-3-030-65796-3_4

- **First Online** 07 January 2021
- **DOI** https://doi.org/10.1007/978-3-030-65796-3_4
- **Publisher Name** Springer, Cham
- **Print ISBN** 978-3-030-65795-6
- **Online ISBN** 978-3-030-65796-3
- **eBook Packages** [Intelligent Technologies and Robotics](#) [Intelligent Technologies and Robotics \(R0\)](#)
- [Reprints and Permissions](#)

Chapter

EUR 24.95

Price excludes VAT (Nigeria)

- DOI: [10.1007/978-3-030-65796-3_4](https://doi.org/10.1007/978-3-030-65796-3_4)

r

[eBook](#)

EUR 160.49

[Softcover Book](#)

[Springer Nature](#)

© 2020 Springer Nature Switzerland AG. Part of [Springer Nature](#).

Not logged in Not affiliated 165.73.223.226