Plastic Mannequin-Based Robotic Telepresence for Remote Clinical Ward Rounding

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• Inaccurate medical diagnosis may result to death of patients.

• Advances in Information and Communication Technologies (ICTs) can be readily exploited to solve the challenges confronting the provision of quality healthcare delivery, especially in rural areas.

• There is usually shortage of qualified medical experts in remote health facilities.
Introduction (Cont’d)

• The cost and risk associated with travelling over a long distance to seek medical attention in urban centers is also high.

• Overdependence of rural dwellers on health facilities in the cities can increase mortality rate in cases of emergency.
Introduction (Cont’d)

• It is, therefore, necessary to leverage available technologies to provide urgent solution to this problem.
• Robotic telepresence creates an impression of the physical presence of an object at a remote location.
Research Aim

- This work is aimed at reducing the cost of mobile robotic telepresence solution for remote ward rounding using plastic mannequin and solar photovoltaic technology.
System Design Method

• An IP camera was fixed in each of the eye sockets of the plastic mannequin.
  - These cameras are connected to a mini-computer embedded in the plastic mannequin.

• A Wi-Fi module establishes an Internet connection between remote physicians and rural healthcare facilities.
Figure 1: Block Diagram of Plastic Mannequin-Based Telepresence
In addition, most of these communities are not even connected to the power grid. Therefore, the system is powered by a solar photovoltaic energy source to provide a cheap and reliable power system.
• Another unique feature of this solution is that it gives the patient a better impression of the physical presence of a physician.

• This development will increase the adoption of robotic telepresence for remote clinical ward rounding in developing countries.
System Implementation

• The hardware part of the system include:
  • Two IP cameras;
  • Mini-computer;
  • Wireless network transceiver; and
  • Audiovisual system.
System Implementation (Cont’d)

Of the two cameras fixed into the eye sockets of the mannequin, one is intended to enable remote access for a distant-consultant while the other is reserved for a specialist.

This is aimed at facilitating professional collaboration to boost the quality of healthcare delivery in the rural areas of developing nations.
• The IP cameras are securely accessible to the health professionals via a web server application.

• For the audiovisual sub-system, a microphone is fixed on the neck section of the mannequin.

• Hence, the remote users can easily pick up acoustic signals from the clinical ward for effective communication.
System Implementation (Cont’d)

• The well-perforated chest part of the mannequin houses the speaker.
• A (12-volt DC motor) four-wheel movement support is designed as the base carriage.
• The program codes of the system is loaded to a mini-computer located within the plastic mannequin.
System Implementation (Cont’d)

Figure 2: Flow Chart of Web Server Operation
System Implementation (Cont’d)

• A client-server model was used for the webserver and Hypertext Transfer Protocol (HTTP) forms the webpages.
• This module links the remote user to the robotic telepresence system.
• The Apache webserver runs on a dedicated computer.
Figure 3: Plastic Mannequin-Based Robotic Telepresence
Conclusion

• We have reduced the cost of mobile robotic telepresence solution for remote ward rounding using plastic mannequin and solar photovoltaic technology.
• This successfully minimized the overall cost of the system ($456).
• Also, the system was designed to operate on solar PV system to ensure availability of required electrical power at low cost.

• After a proper authentication process, a medical consultant based in anywhere can easily log in to the web or mobile application platform.
Conclusion

• The developed system provides a cost-effective solution for patients with minimum literacy to conveniently manage their medications, taking the right dosage of medicine at the prescribed time as automated by the system.
Conclusion

• In clear departure from existing robotic telepresence systems, our solution gives a better impression of the physical presence of a medical personnel.
References


Thank You