

Electronic Doctor's Bag: A mobile communications system for home-visit medical services to overcome shortage of doctors and regional healthcare disparity



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Completed the last half of the doctoral course of the School of Engineering, Tohoku University in 1978. Ph.D. in engineering. Worked as Research Associate and then Associate Professor at the Faculty of Engineering, Tohoku University. Then, assumed the positions of Associate Professor at the Faculty of Engineering, Toyohashi University of Technology, and then, Associate Professor at the Graduate School of Information Science, Tohoku University. Appointed as Professor at the Information Synergy Center, Tohoku University in 2006, and then, at the Cyberscience Center in 2008. Worked as Visiting Researcher at the Johns Hopkins Medical Institution of Medicine, Baylor College of Medicine, in 1999. Also a member of the Society of Instrument and Control Engineers, a member of Japanese Society for Medical and Biological Engineering, and an advisory committee member of IEEE Engineering in Medicine and Biology Society.

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In Japan, regional health disparity is getting larger and larger. Many central hospitals in rural areas are short of doctors. Applications of information and communication technology (ICT) in the medical field are drawing attention as they may be effective for solving those problems.

Professor Makoto Yoshizawa and his colleagues set up the Consortium for Medical Information Communication Systems in the Mobile Environment, together with Professor Tomoyuki Yambe of the Institute of Development, Aging and Cancer, and concerned business enterprises, in 2009. Then they undertook the development of a mobile health check system, called the "Electronic Doctor's Bag," that takes advantage of a mobile communication system to easily transmit not only sounds and high-quality video images but also biological information such as an electrocardiography (ECG) and blood pressure data. Its features are broadly as follows:

- 1) With encrypted communication of high-quality video images, sounds and biological information, remote medical practice is made possible with almost the same security as face-to-face medical practice.
- 2) Applicable via mobile communication systems (PHS and mobile phone), in other words, in places without Internet lines (e.g., patients' homes, ambulance car, site of disaster, etc.)
- 3) Makes it possible to combine bio-measurement terminals without restrictions, and thus, can be operated flexibly according to the purpose, e.g., home medicine, fast aid treatment, and health care.
- 4) Enables electronic control of patient data.

An Electronic Doctor's Bag contains communication equipment including a PC, video camera and mobile phone, and medical equipment including an ultrasonography, blood pressure meter, and ECG, and can be easily carried. The intended usage scenario is that a nurse visits a patient's home, carrying this Bag, and takes an ECG graph and measures blood pressure, communicating with a doctor at a hospital and transmitting the medical information to the doctor by means of ICT. Thus, it is designed to achieve a virtual environment for face-to-face medical practice through a video camera.

This will make it possible for medical institutions to cover many more patients in areas with a scarce number of doctors. For emergency medical care, it will allow for emergency medical technicians to send measurement data on a patient to doctors, and thereby obtain an exact and quick diagnosis from them.

This system is expected to play a great role in medical practice in rural areas or on disaster sites once necessary legal arrangements and cooperation with medical institutions are put in place. This work was supported by the Sendai Area Knowledge Cluster Initiative founded by the Japanese Ministry of Education, Science, Sports and Culture.



Images are highly compressed, while maintaining high definition, so that a doctor at a distance from a patient can check the patient's face complexion, presence of skin diseases, edema, actions, way of walking, etc. In addition, diagnostic data is encrypted to prevent any leak of a patient's personal information, and transmitted to doctors at a hospital/clinic via a PHS or a mobile phone.



A nurse sends biological information on a patient to a doctor at a medical institution. Necessary measurements are made by means of the biological measuring terminals (an electrocardiography, blood pressure meter, ultrasonography, etc.) according to the type of disease. The obtained measurement data is stored in a USB memory card or the main unit of the Bag via wireless LAN, and thus, it can be encrypted and transmitted to the medical institution by extremely simple operations.



The Electronic Doctor's Bag contains a PC, video camera, mobile phone, ultrasonography, blood pressure meter, ECG, etc. It is expected to use a tablet-shaped PC such as the iPad.



Members of Yoshizawa Laboratory. Their fields of research widely range from artificial hearts, to virtual reality, to biomedical control engineering

My favorite

Karaoke is the best stress relief for Prof. Yoshizawa. His favorite song is *Hymne a l'amour*. He has a large repertoire of songs. His nice singing voice is well known to the members of his laboratory. He also works as a coordinator for the Tohoku University Science Café.

