Open-source Teleconsulting System for International Cooperative Medical Decision Making in Congenital Heart Diseases

Andrea Gori*, Alessandro Taddei, Alessio Ciregia, Debora Mota, Paolo Marcheschi, Nadia Assanta, Bruno Murzi and Giorgio Ricci

Medical Informatics, CNR Institute of Clinical Physiology, Massa, Italy

A project was developed by Heart Hospital in Massa, supported by Cuore un Mondo Association and Tuscany Region, for medical cooperation with Balkan Countries in diagnosis and care of congenital heart diseases. First step was to set up a telemedicine network aimed at multi-center cooperative medical decision making. While echography studies allow to recognize abnormalities in newborns or in the fetus, operators are not sufficiently skilled in many remote hospitals. Frequently it is necessary to transfer urgently to specialized cardiac units newborns suffering by critical cardiac disorders while early care planning, possibly before delivery, would limit both risks and costs. Teleechocardiography was initially implemented at pediatric clinical centres of Banja Luka, Rijeka and Tirana, using videoconference equipment for transmitting over Internet sequences of medical images. Upload network transfer rate of 512 kbps was provided for achieving real time transmission without significant loss of diagnostic information. Actually videoconference systems are expensive, use proprietary technology and have limited functions. To overcome these limitations we developed a low-cost device using Open-Source software and standard hardware. This system allows both real time and off-line teleconsultation as well as videoconference interconnection. Mini-ITX low-power motherboard was chosen to achieve small size equipment. LAMP frame-work was implemented (Open Source software bundle consisting of Linux operating system/Apache web server/MySQL RDBMS database/PHP scripting language). Ekiga (open source application supporting both H323 and SIP protocols over Internet) was applied for enabling on-line operator interaction. Real time transmission of medical images was achieved by VLC (free media player supporting common audio/video codecs and file formats as well as protocols for streaming over network). DCM4CHE (Open Source Clinical Image and Object Management software) was implemented for storage and distribution of DICOM image studies provided by imaging equipment. Flash Video format was applied to deliver not-DICOM images over the Internet, using buffering for limiting loss of information.