

Online to the doctor

The inhabitants of islands or other remote areas will be able to enjoy professional medical care in the future. A new appliance is now available that collects clinical data by ultrasound and transmits it elsewhere. Specialists then evaluate the information, make a diagnosis and suggest treatment.



Ultrasound data of patients in Kazakhstan, Uganda, the Azores, and Tenerife are transmitted to Portugal via TeleInViVo. Experts evaluate it and provide suggestions for correct medical treatment.

A young Kazakh woman has been suffering from pains in her lower abdomen for days. A decision is finally made to carry out an ultrasound examination to determine the cause of the pains. The attending gynecologist at the Almaty Diagnostic Center slides the sonar scanner over the woman's abdomen. He closely studies the ultrasound images and makes note of a change in the liver. Since he is not sure of how to interpret his findings, he decides to ask a specialist colleague in Portugal. A quarter of an hour later, the doctor at the University Hospital in Coimbra has the ultrasound data on his monitor. He, too, carefully examines the images. The diagnosis is then determined. The young mother-to-be has a cyst on her liver.

"In difficult cases, we consult with our colleagues in Portugal. The experts there are technically better equipped, they have more radiological experience, and can draw all the necessary information from the images," says Dr. Ashat Abzhanov from the Diagnostic Center. The ultrasound data is sent from Kazakhstan via Internet, telephone, or satellite to faraway Coimbra. The specialists there evaluate the images and can determine whether an unusual finding

in the liver is a parasite, a tumor, or a cyst. "We then jointly discuss the diagnosis in a chat and decide on a course of treatment for the patient," the Kazakh doctor continues.

TeleInViVo - a portable telemedical appliance

This is made possible by the TeleInViVo, a portable telemedical appliance. It has an integrated 3D ultrasound scanner, batteries and a computer that can transmit and receive data by way of any telecommunications channels. The equipment is contained in a handy aluminum case. "This appliance lets us gather data from patients anywhere in the world, examine the findings in 3D and transmit it elsewhere," explains Professor Georgios Sakas from the Fraunhofer Center for Computer Graphics Research IGD.

His team together with the other TeleInViVo consortium partners developed the application to improve medical care especially in poorer or thinly populated countries. Thanks to this convenient piece of equipment, patients in the jungles of Africa or in a small village in Kazakhstan can benefit

from the specialized knowledge of medical experts from around the world. The attending physician examines the patient locally and uses TeleInViVo to record ultrasonic images. Integrated Wavelet data compression considerably reduces the size of the datasets, which can then be transmitted to another specialist via Internet, LAN, ISDN, analog modem, satellite or GSM cell phone. The experts can then use the 3D data to visualize the series of "slices" on their computers as with computer tomography, enlarge any conspicuous areas, or dye certain parts of an organ in order to identify abnormalities. A dongle on the PC, cryptographic methods and encrypted Wavelet compression protect sensitive patient data from unauthorized use. This ensures observance of rules governing personal privacy.

"The great advantage of TeleInViVo is the fact that the patient no longer needs to go to the doctor, but instead, the patient data is simply transmitted to the specialist," Sakas stresses. Great distances can be quickly overcome in this manner, which can save lives in remote regions. Aralsk in Kazakhstan is a good example. The town lies over 1,100 miles from the nearest city, Almaty, without any flight connection. Until now, patients had to put up with an ex-

hausting 36-hour trip for an examination with specialists in Almaty. "But hardly anyone could afford the trip," Dr Ainura Sadu-akasova of the Aralsk hospital points out. In addition, precious time is wasted, which often meant that medical assistance came to late.

Since last year, patients no longer need to journey to Almaty. Instead, it's their data that does the traveling. In a cooperation with UNESCO, the hospital in Aralsk was equipped with a mobile TeleInVivo unit. "Now we just record the ultrasonic images ourselves and transmit the information to

ances. Moreover, doctors in the Azores and the Canary Islands are also working with TeleInVivo. In difficult cases, they, too, contact the specialists at the University Hospital of Coimbra. By now, these helpful suitcases are already operating in eight locations on three continents. And with considerable success: Over the past 18 months, local doctors have consulted around 600 times with their colleagues in Portugal - and in

After the ultrasound examination data are transmitted to specialists.

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the specialists in Almaty or Coimbra. Within no time, we receive a detailed diagnosis as well as suggestions for treatment," Dr Sadu-akasova adds, describing the advantages of the telemedical equipment. It allows the doctors of Aralsk themselves to quickly come to their patients' assistance.

Operations at eight different locations

Besides Aralsk and Almaty, two hospitals in Uganda were also equipped with the appli-

about 96 percent of cases, the physicians jointly made the correct diagnosis. Sakas' reaction is unequivocal: "This means that the system has passed its practical exam." He and his colleagues were awarded the "Grand Prize of European Information Technologies 2001." This IT Oscar is worth 200,000 euro. The interdisciplinary project, which was jointly implemented by engineers, IT experts and medical doctors, was praised by the jury as an "outstanding example of a transnational, European and international cooperation ideally combining

TeleInVivo

The Fraunhofer Institute for Computer Graphics Research IGD in Darmstadt implemented the TeleInVivo project in cooperation with the Center for Computer Graphics (ZGDV) in Darmstadt (Zentrum für Graphische Datenverarbeitung) and the CCG in Coimbra, Portugal (Centro Computação Gráfica). Other consortium partners were DSC Dr. Stärk Computer GmbH in Langen and PIE Medical in Maastricht, Holland. The project was clinically validated by the University Hospital in Coimbra, Portugal, CATAI on Tenerife (Spain), La Palma Hospital on the Canary Islands (Spain), the Hospital of Ponta Delgada, Azores (Portugal), the UNESCO ITU Telecenter, and Nakaseke Hospital in Nakaseke (Uganda), Mulago Hospital in Kampala (Uganda), Central Regional Hospital in Aralsk (Kazakhstan) and Almaty Diagnostic Center in Almaty (Kazakhstan). UNESCO in Paris, France, coordinated the work outside Europe.



igd.fhg.de/teleinvivo

market potential and social components." Yet Sakas does not want to rest on his laurels: After the successful testing of the DM 40,000 prototype, this apparatus, weighing 30 kilograms and with the dimensions of a pilot's case, will be made lighter and more manageable. In the future, the appliances will be no larger than laptops and will cost a maximum of DM 15,000. This is technically possible, according to the Fraunhofer scientist. "But we are still looking for partners and investors to continue developing the prototypes to create a marketable product."

There is a large market for this type of medical appliance. The TeleInVivo system is suitable not only for remote regions, islands, crisis or catastrophe areas, or the military, for that matter, but it could also guarantee medical care on ships, oil rigs, on long-distance flights, and at outlying research facilities, etc. So young Kazakh mothers and their families are not the only beneficiaries: Engineers, business travelers, soldiers, and research scientists will also be able to depend on the swift and reliable help from Dr Online.

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