A Prototype of Web-E-Nose Device to Be Used in Medicine Fields

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Abstract **-** A web-based system used in olfactory illness patients at home and their physician was developed. A web browser plug-in simplifies the process of capturing virtual odours and transferring it to a web site for novice computer users. The design of the virtual odours capture plug-in can be reused to acquire and securely transfer any type of data over the web. For example, readings samples from Web-E-Nose device, which can be connected directly to the Internet, can be transferred to a home E-Medicine web site. Both patients and doctors can access this web site.

Keywords: Home monitoring, E-Care and E-Survey, E-Medicine, Virtual instrumentation.

1. Introduction

As more and more physicians and patients use the Internet, E-Medicine is becoming an important tool to inform patients and keep them up to date with the latest medical advances.

The arrival of E-Medicine as an alternative to face-to-face, or even simple telephone consultations holds out potential solutions to many of the limitations of conventional medicine.

E-Medicine allows health care professionals to use "connected" medical devices in the evaluation, diagnosis and treatment of patients in other locations. These devices are enhanced through the use of telecommunications technology, network computing, video-conferencing systems and CODECs. The cost of the equipment and network bandwidth needed for this consultation has restricted E-Medicine use to contact between physicians instead of between patients and physicians. Recently, however, the wide availability of Internet connectivity and client and server software for e-mail, World Wide Web, and conferencing has made low-cost E-Medicine applications feasible. Specialized application software, data storage devices, database management software, and medical devices capable of electronic data collection, storage and transmission are all key components of the E-Medicine infrastructure.

Although synchronous videoconferencing with patients at home has been effective, asynchronous messaging could be more convenient for routine monitoring and nonurgent questions. In e-radiology, the store-and-forward model has been noted to be more practical than videoconferencing because it eliminates the need to schedule the E-Medicine contact.

This type of asynchronous E-Medicine has also been extended to home monitoring over the Internet. The systems can collects blood glucose levels in a PC application separate from the web browser and transmits the data to the central storage server using TCP/IP over the Internet. The system provides a web interface to patients. Although the home monitoring systems discussed above use a completely asynchronous approach, there is a hybrid approach where videoconferences are available, but data between conferences are also collected over the web. Along with the development of home E-Medicine systems for monitoring physiology, web sites have been developed for storing medical records that are targeted toward patients. These systems are different from web interfaces to medical records systems at hospitals. In the hospital systems, only care providers can view and add information to records.

II. Proposed Web-Based E-Medicine System Architecture

A Web-based E-Medicine System for measuring and messaging was developed that allows patients to easily send multimedia information (video, text and audio) and olfactory information to their physicians. Patients are also monitored through multiple-choice self-assessment questionnaires, implemented as web forms. To streamline the user interface and eliminate the multiple steps involved in acquiring video, saving it to a file, compressing the file, and entering the path to the file in a web

form, we have developed a Web-E-Nose device with directly to the Internet connectivity and a the software under LabVIEW environment that performs these tasks.

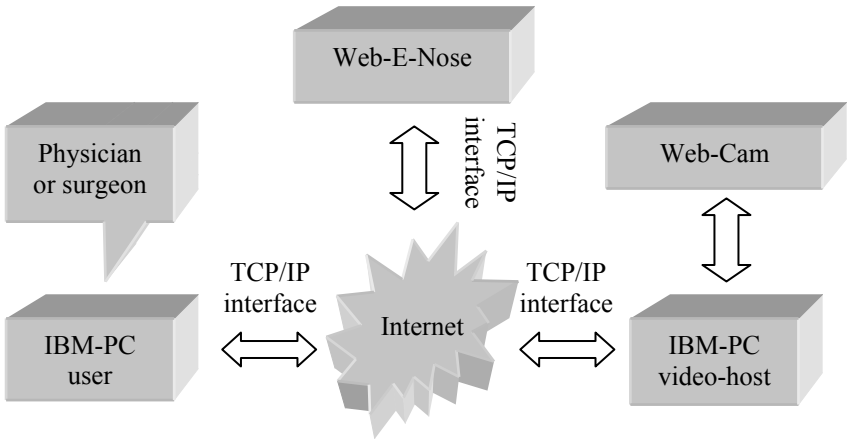

Figure1. Architecture of the proposed Web-based E-Medicine System.

Videos are necessary to help identify problems that may be developing and to assess whether they are progressing normally. Through the system, physicians can change assigned exercises and link patients to digital video on the web site demonstrating how to properly perform the exercises. The system can also remind patients about the medications they should be taking.

III. The Web-E-Nose System

The proposed Web-E-Nose system consists in three main components:

- gas sensors array,
- pattern recognition algorithm and an
- Ethernet with IP static module.

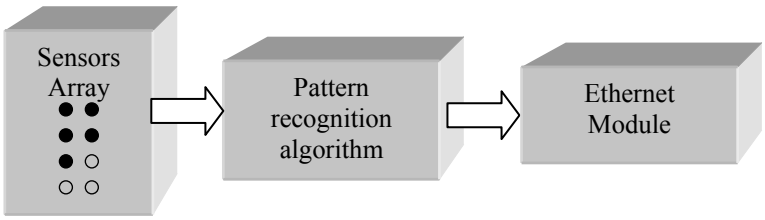

Figure2. The main components of the proposed Web-E-Nose.

Using *gas sensors* with low selectivity, in case of Figaro TGS can be an advantage with Web-E-Nose. We use SHT11 humidity and temperature sensor, for temperature and humidity compensation.

Sensor array "sniffs" the vapours from a sample and provides a set of measurements. The pattern-recognizer compares the pattern of the measurements to stored patterns for known materials. The Ethernet module having a static IP, give the possibility to share, over the World Wide Web, information's about "remote odours".

The result obtainable by a Web-E-Nose can be viewed as a chemical image of a given combination of volatile compounds. It can be used for odour characterization, but also for the quantitative determination of the concentrations of individual molecules in complex environment

The response of the sensor is numerical converted using a prototype data acquisition system SADI (integrated data acquisition system). This response is registered in microcontroller like smell patterns and compared with predefined one, recognized. This operation takes place at microcontroller level. The microcontroller is the Web-E-Nose "brain" and communicates with SADI or with Tibbo-Ethernet module server by serial interface.

In many markets, a health care delivery infrastructure exists, but telemedicine is being used to deliver health care services of comparable or higher quality at a lower cost. Successful implementation of the Web-E-Nose model requires a careful examination of all costs, direct and indirect, and the medical outcomes, over time. As one example, home care providers are turning to E-Medicine to reduce home visit rates and to continuously monitor chronic medical conditions with the goal of

reducing costly hospital utilization. As another example, prisons have used E-Medicine to lower the cost of health care delivery, principally through elimination of security, transportation costs and unnecessary emergency department utilization. Tertiary care providers are using E-Medicine to monitor changes in medical condition without the need of the patient to physically appear at the office of the consulting professional.

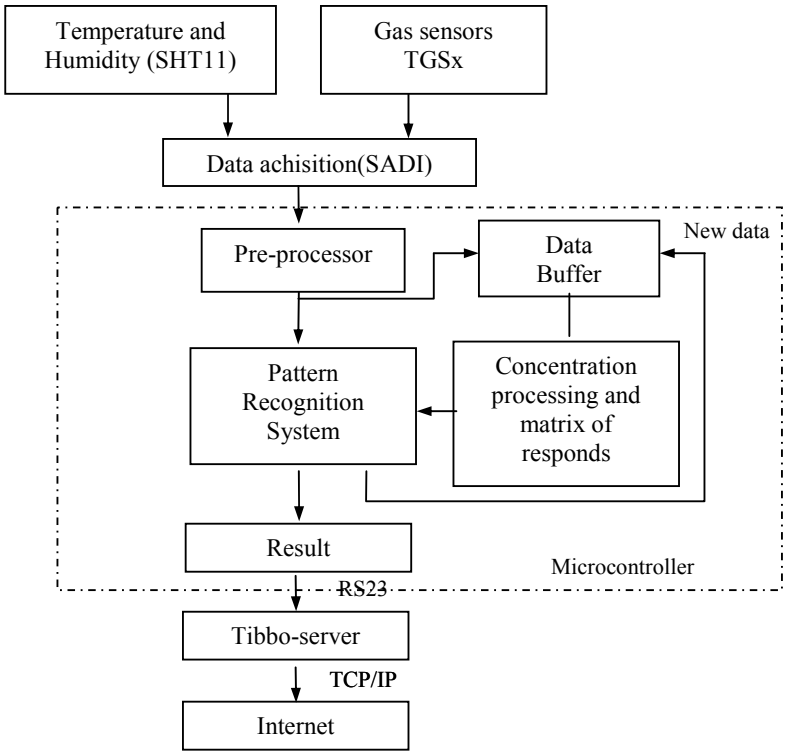

Figure3. Web-E-Nose architecture.

IV. Conclusion

This application includes a miniature portable system developed by our research team. We have demonstrated that the Web-E-Nose odour identification device can be used with success in E-Medicine filed offering to patients a real solution for improve their health. It was demonstrated too the concept of virtual smell and olfactory input in a virtual reality environment. This electronic nose has worked well in identifying several common household chemicals and foods. Our research will involve the construction of an automated odour sensing system that can identify odours generated by the human body and demonstrate the importance of virtual-smell in E-Medicine and E-surgery.

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