

Mobile personal system for monitoring ill and endangered people (Medical Personal Watcher)

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Abstract— Description of a development and function of a mobile system monitoring personal health. Patients are continuously being localized by GPS in connection with an easy-to-use web application and GSM/GPRS network. Their medical data, e.g. temperature, ECG, etc., are collected from body-worn sensors, and transferred by wireless protocols. Special statistical software helps to assess health risks and supports medical staff in establishing diagnoses.

I. INTRODUCTION

The proposed system is based on an award winning product Personal Watcher (GALIELO Masters 2005), originally designed for kids and endangered people. This product has the following features:

- Localizes user via built in GPS/EGNOS receiver (position error less than 5 m);
- Communicates (55kbit/s) via GSM/GPRS built-in modem with dispatching center;
- Monitors vital functions of the user via inertial motion sensor;
- Collects data from personal biomedical sensors via ZigBee or ISM communication module;
- Raises an alert alarm;
- Lets the user initiate an alarm by pressing Panic button;
- Uses voice and data communication via external interfaces (hands-free with Bluetooth).

The system allows to monitor ill people (e.g. with acute cardiovascular diseases) not only “anytime” like many other devices, but also “anywhere”. The highest CARDIO version is using leading-edge plaster ECG sensors SENSIMUM from Toumaz, Ltd., UK, and consists of the following components:

- Personal unit - “Personal Watcher” - developed entirely in-house (GALILEO Masters Award 2005);
- GIS SW module – “WEB DISPATCHER” - Internet based localization and tracking web server;
- Medical module – “CLUSTARS” - remote medical data analysis and decision making SW module;

- Encryption method – next generation encryption algorithm based on “SignBox” - (IST Prize 1999).

This system allows to monitor people in 24/7 regime in any country covered with GSM (or CDMA) network. Version for “mobile WiMAX” has also been developed. Thanks to its very low price, this system is targeted towards mass application and could save lives in different groups of ill, handicapped and endangered people.

II. PERSONAL WATCHER

ICE Company involved in the EU project SCORE (Service of Coordinated Operational Emergency & Rescue using EGNOS) used particular project outputs of another consortium member ALCATEL ALENIA SPAZIO, combined it with its own non-GPS positioning methods based on inertial motion sensors, and integrated it in a handy battery-operated device equipped with wireless communication capabilities covering GSM/GPRS, Bluetooth or ISM.

MEDICAL PERSONAL WATCHER is one of the first commercial products on the market using core EGNOS technology and providing real A-GNSS. As in the next generation of Personal Watcher, position will be calculated from raw satellite data and there will be a possibility of software switch between different satellite networks (GALILEO, GPS, GLONASS). Two basic user operating modes are pre-configured, real time tracking with position sending in requested period (typically 30s) or on-alert operating mode, where the position is sent if one of the following alerts is activated: Emergency Alert from panic button or Fall-Down Alert when the wearer has moved beyond the preset boundaries. The device features emergency call buttons either for simply sending location information or for establishing two-way voice communication to predefined numbers.

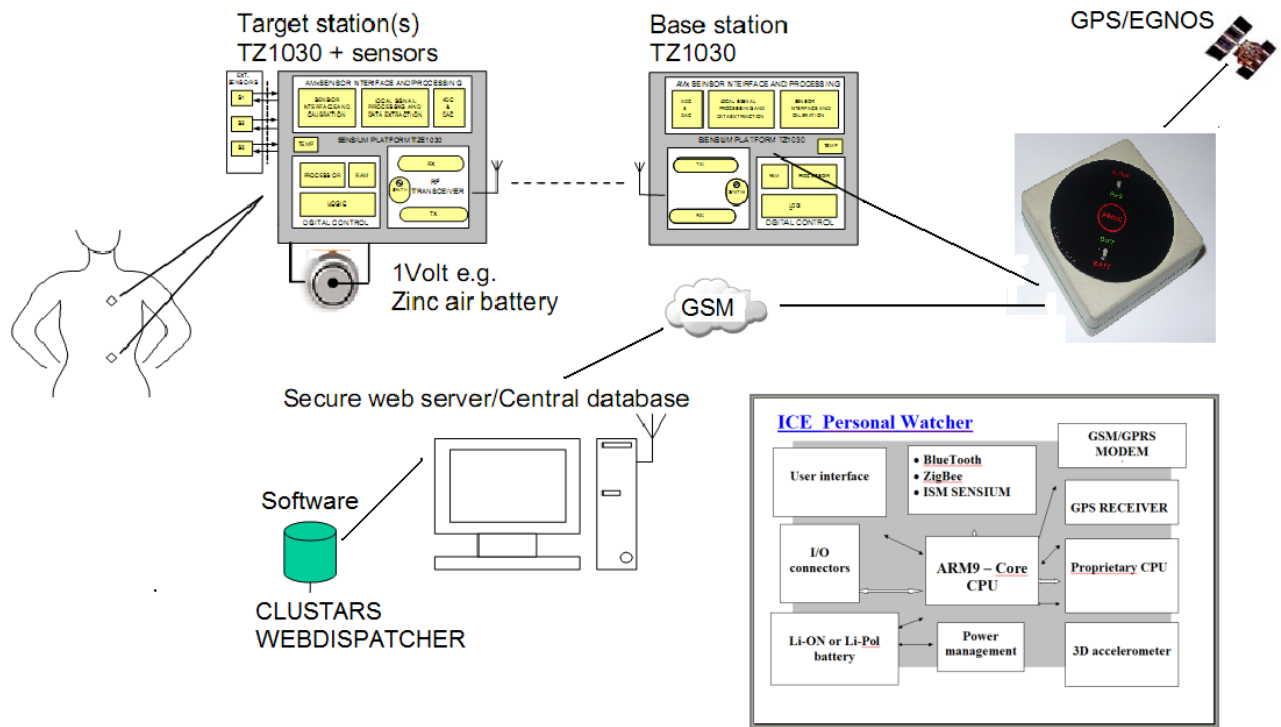


Fig. 1 Functional chart of Personal Watcher deployment

III. WEB DISPATCHER

This web application solves concerns over efficiency of deployment of GSM/GPS mobile units. Its revolutionary approach brings the capabilities of subject tracking all over the world and in real time to the fingertips of any user at practically no cost. Internet access is all what is needed.

This Internet monitoring application transfers the whole dispatcher's workplace to the web platform with very easy and intuitive controls.

The user can work with subjects on-line and in real time from everywhere, foreign countries included. He/she can sort the subjects into groups, centers, etc., evaluating various statistical reports at the same time. So-called "control points" can be specified, e.g. loading/unloading of cargo; when they are reached, anybody else can be informed by a message to the mobile phone.

This service also covers the need for continuous availability of information – so-called "mobile office". The button "Optimized for PDA" will show pages with identical contents in lower resolution. The desktop will be organized in different

way, showing the subject tree as well as the map fitted to the full display size.



Fig. 2 Web Dispatcher: tracking of a patient driving a car

IV. CLUSTARS

Program CLUSTARS is very efficient statistical software package specifically designed for and focusing on differential diagnostics of various groups of diseases. It is based on multivariate analysis of biochemical and other paraclinical data. Diagnosing itself is done from the *a priori* knowledge of chosen biochemical parameters, which are obtained from reference groups of probands. The program analyses concrete biochemical parameters of a patient, and suggests particular diagnosis at the end. BioAnalyst is unique mainly because its new, original calculation methods of discrimination analysis, which are very efficient if compared to other standard methods.

As the standardization of biochemical and paraclinical methodologies is very difficult and could cause errors in results at different places, the possibility of modification and preparation of basic *a priori* data at individual workstations becomes unavoidable. This is why as a part of the package are included procedures enabling users to create their own "primary methodology files" that contain data about groups of probands. These procedures also provide for working out a new, more efficient or simpler methodologies that ensure inexpensive but reliable differential diagnostics.

Goal of the program development was to make a robust system, which would allow users to classify an unknown object as one of the previously known diagnoses of the client. These diagnostics data should disjunctively cover the area of interest.

Compared to presently available classification programs, this one provides better efficiency of diagnosis classification particularly in the "grey area".

Use of CLUSTARS in the Medical Personal Watcher solution has two applications:

- To analyze personal biochemical data off-line for decision support concerning the risk factor of the patient;
- To analyze on-line ECG diagrams of the monitored persons and to inform 24/7 call center about their current pHealth situation.

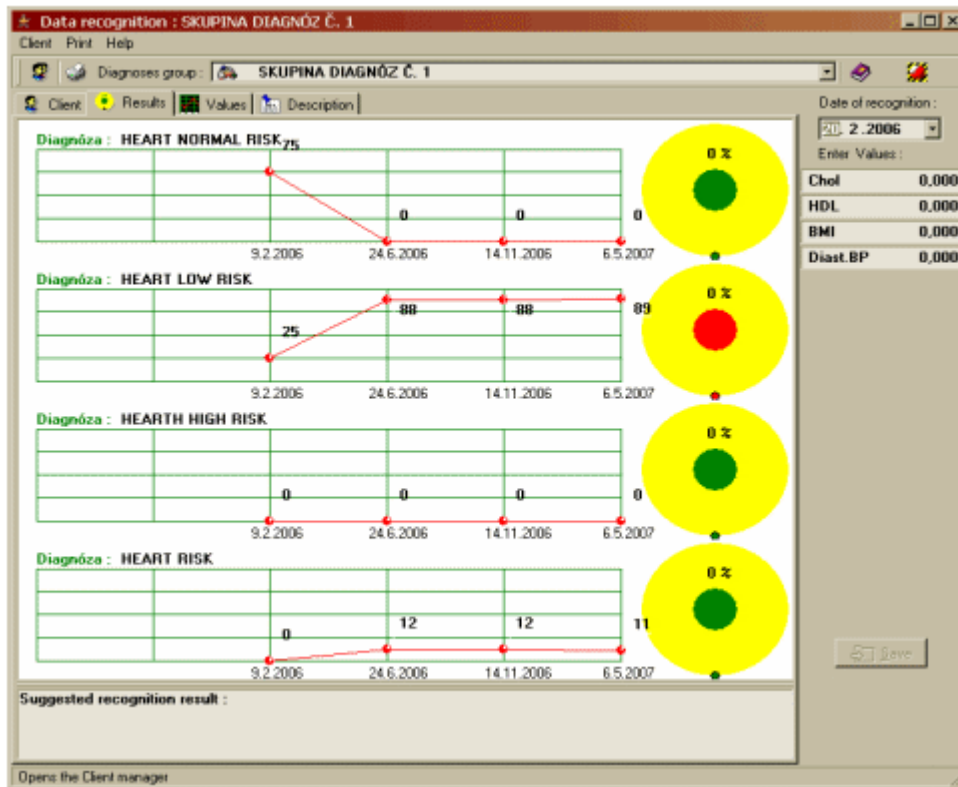


Fig. 3 Program CLUSTARS charts for risk evaluation

V. CONCLUSIONS

A complex working system for monitoring of personal health has been introduced. Notwithstanding its rich functionality covering all the most important aspects of personal health we expect that it can be produced and distributed at reasonable cost.