Telemedicine and e-health

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Definition

Telemedicine involves the use of modern information technology, especially two-way interactive audio/video communications, computers, and telemetry, to deliver health services to remote patients and to facilitate information exchange between primary care physicians and specialists at some distances from each other.

Telemedicine

E.C.: telemedicine encompasses a wide variety of services including: teleradiology, telepathology, teledermatology, teleconsultation, telemonitoring, telesurgery and teleophthalmology.

Other telemedicine services include call centres / online information centres for patients, remote consultation/e-visits or videoconferences between health professionals.

Telemonitoring

Telemonitoring is a telemedicine service aimed at monitoring the health status of patients at a distance.

Data can be collected either automatically through personal health monitoring devices or through active patient collaboration .

Telemonitoring is very useful in the case of chronic illnesses (e.g. diabetes, chronic heart failure, COPD – chronic obstructive pulmonary disease).

Elderly people need regular monitoring because of the prolonged duration of their disease, the nature of their health condition and the drugs that they are using.

Telemonitoring projects - international

At international level, telemonitoring is considered an excellent method for diagnosis and surveillance, as proven by numerous projects:
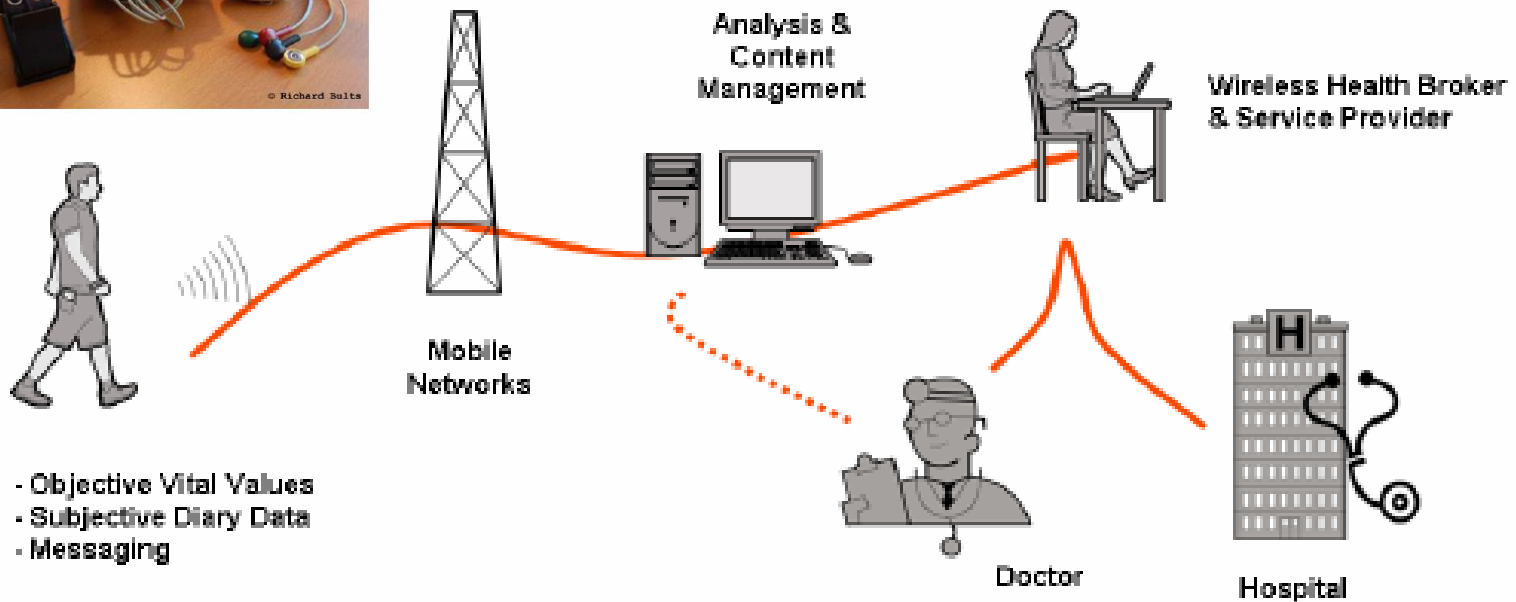
- EPI-MEDICS - Enhanced Personal, Intelligent and Mobile System for Early Detection and Interpretation of Cardiological Syndromes

- HealthService24 - Continuous Mobile Services for Healthcare

- CodeBlue (as a reference project made at Harvard University).

EPI-MEDICS (2001 - 2004)
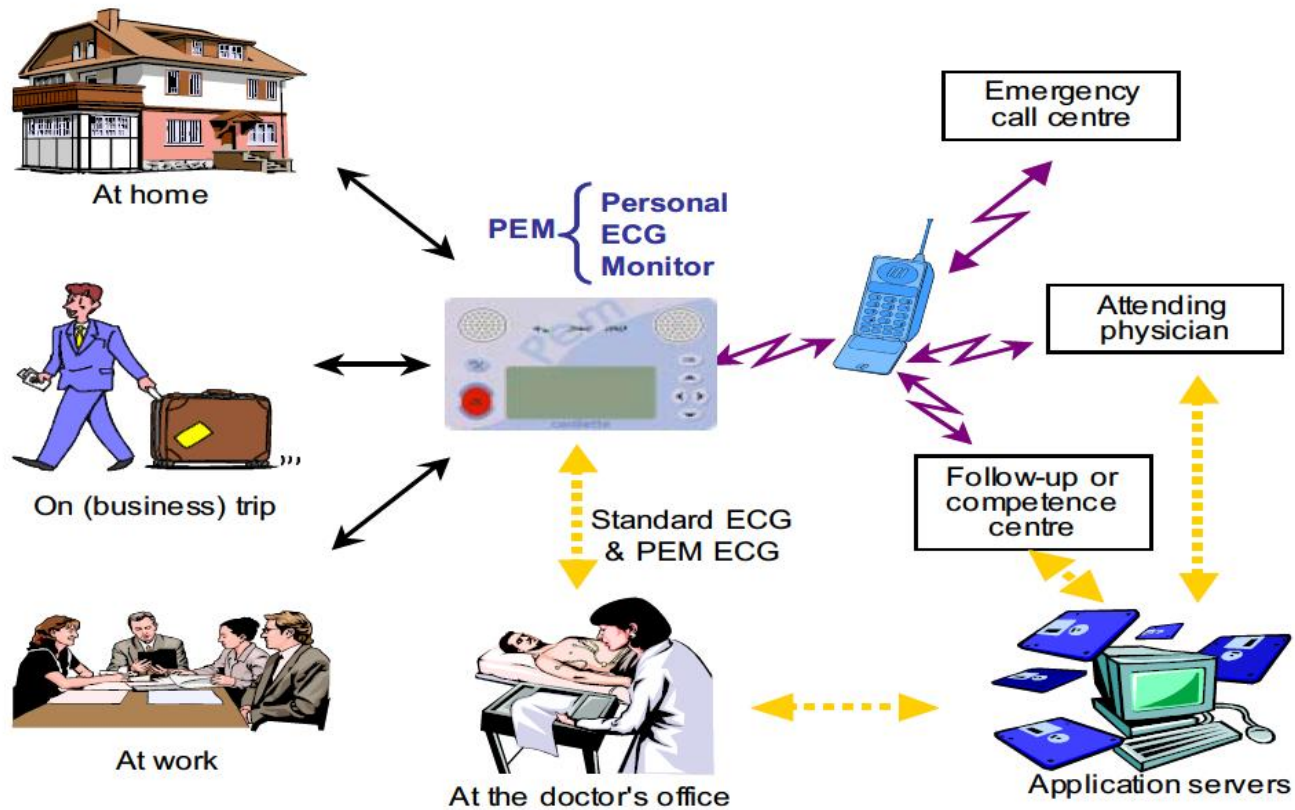
Simplified model of the EPI-MEDICS

HealthService24 (2005 - 2006)
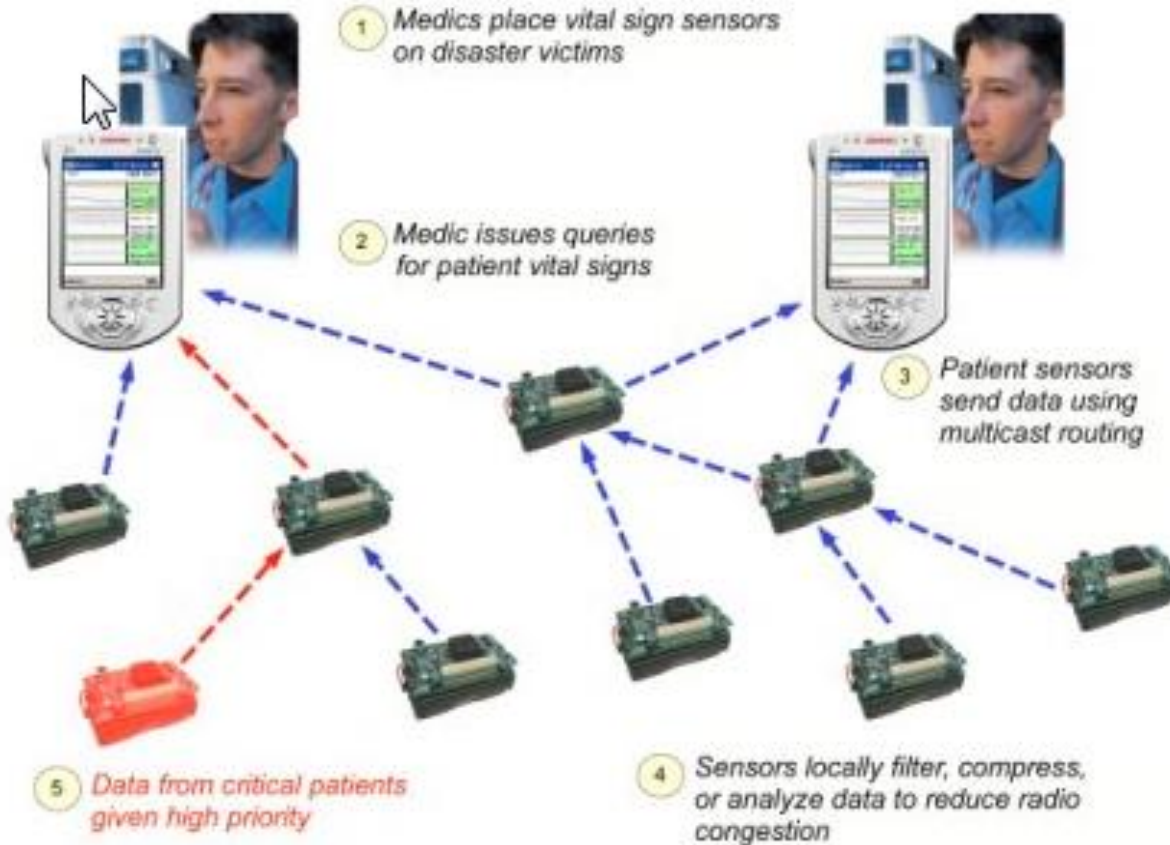

System architecture
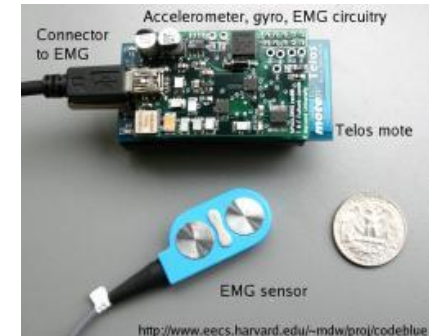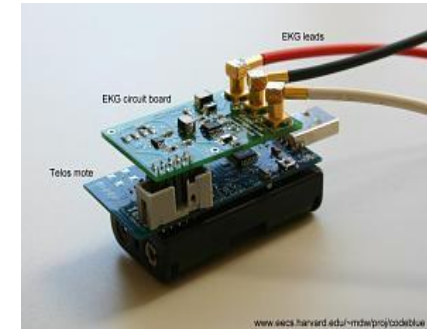
HealthService24 (2005 - 2006)

ECG and respiration acquisition devices

CodeBlue (2005 - 2010)

CodeBlue network Infrastructure

Telemonitoring projects - Romanian

At national level, efforts in the field of telemonitoring, which is a technology of medical interest, are still in the early stage:

- CardioNET - Integrated system for continuous surveillance in e-health intelligent network of the patients with cardiac diseases
- TELEASIS - Complex system, on NGN support – Next Generation Networking – for home senior teleassistance
- MEDCARE – Internet remote monitoring system for cardiac diseases
- TELMES - Multimedia platform for complex medical teleservices
- TELEMON - Telemonitoring real time integrated system for patients and seniors.
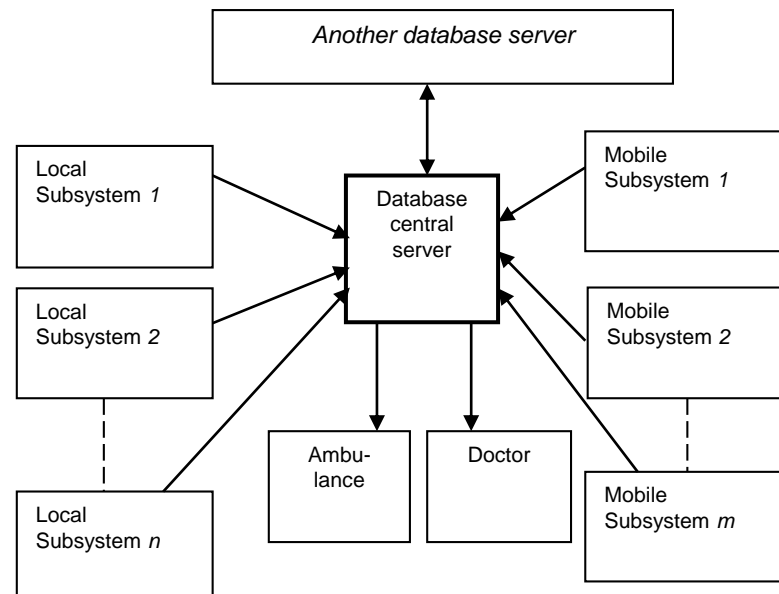
TELEMON (2007 - 2010)

TELEMON - integrated system, composed by the following components:

- a personal network of wireless devices (BAN) on the ill person;

- a data multiplexing block and a personal computer.

The salient data are transmitted via of Internet to the database server;
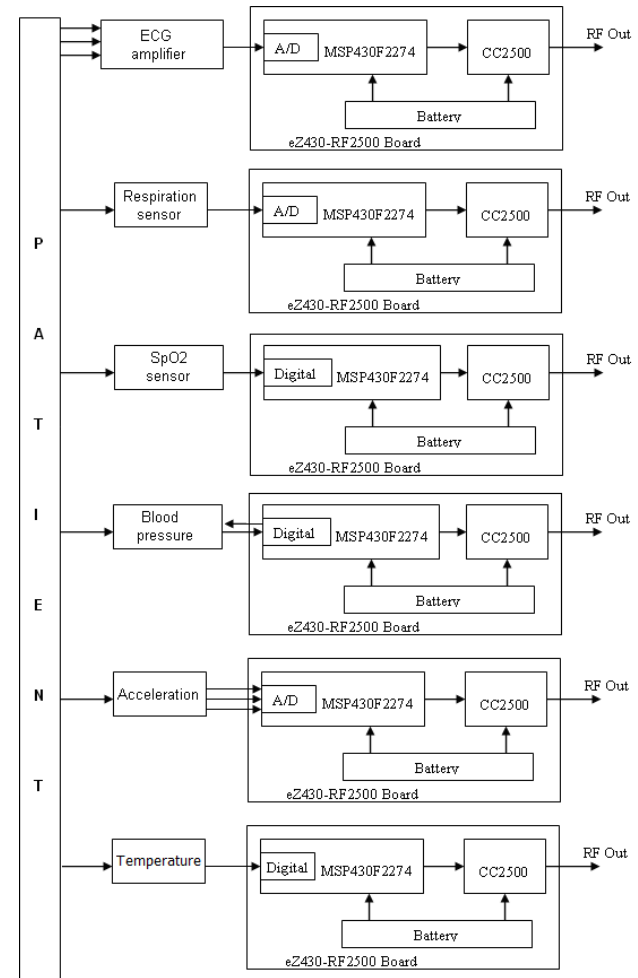
The data processing will be done by a PDA;

TELEMON (2007 - 2010)

The BAN includes medical devices for vital signs:

- ECG, heart rate, arterial pressure, oxygen saturation, body temperature;
- a fall detection module, a respiration one.

All these components have radio micro-transmitters, which allows an autonomic movement of the subject;
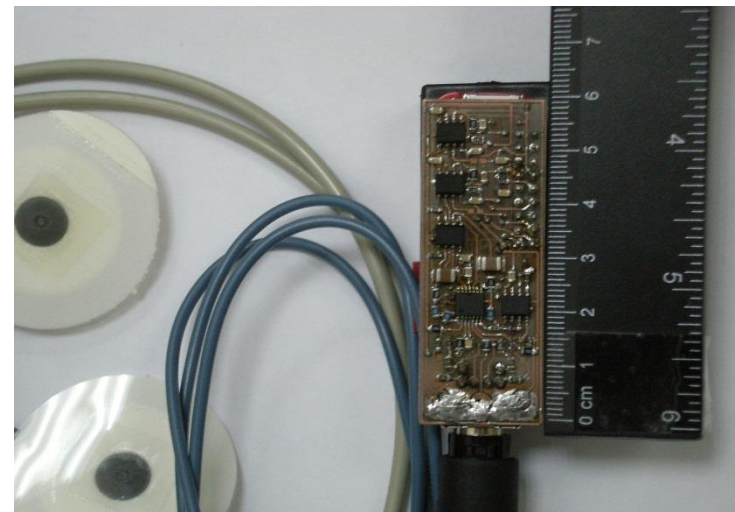

The local subsystem

TELEMON (2007 - 2010)

It has for each channel a gain of 500, is DC coupled and has a band limited to 35 Hz;

The high common mode rejection (>90dB), high input impedance (>10 M□), the fully floating patient inputs are other features of the ECG amplifier;

The ECG amplifier is powered by two AAA 1.2V NiMH battery
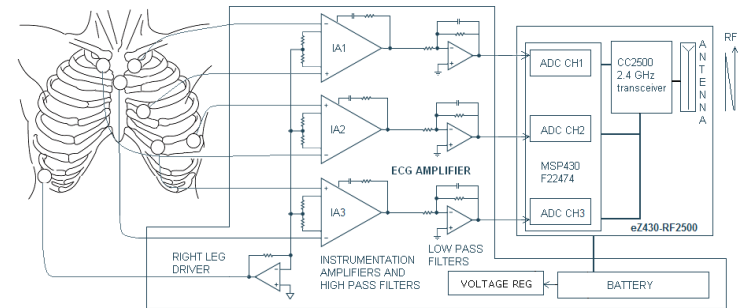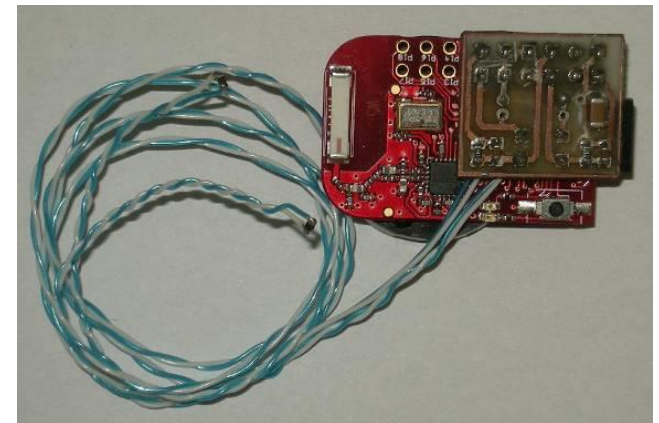

ECG amplifier

ECG module

TELEMON (2007 - 2010)

The respiration sensor uses a thermistor for long-time monitoring during the normal activity;

A thermistor placed in front of a nose detects breathing as a temperature change.

The acquired signal is amplified and transmitted to the Personal Server.
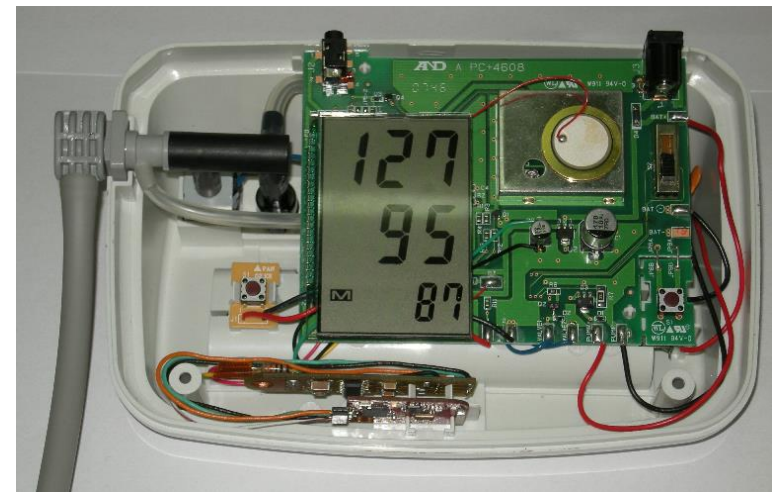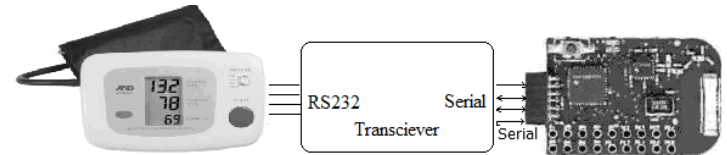
Respiration module

TELEMON (2007 - 2010)

Blood pressure measurements were performed by using a commercially available A&D UA-767PC BPM;

It has been connected to wireless module through bi-directional serial port;

Once the readings are received, the wireless module communicates with the network and transmits them to the Personal Server.
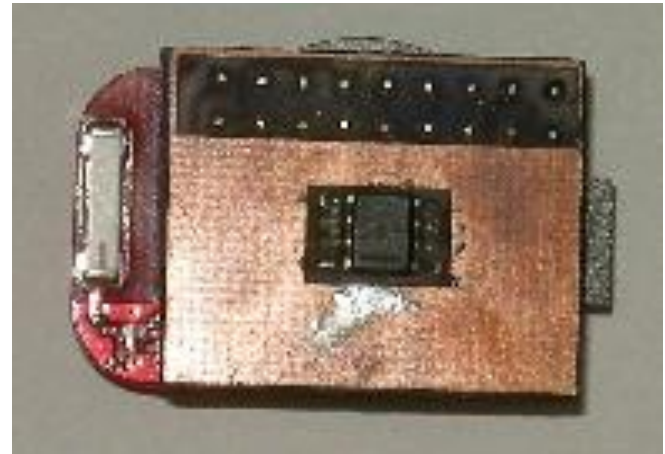

The blood pressure module

TELEMON (2007 - 2010)

For the body temperature measurement we use the TMP275 temperature sensor;

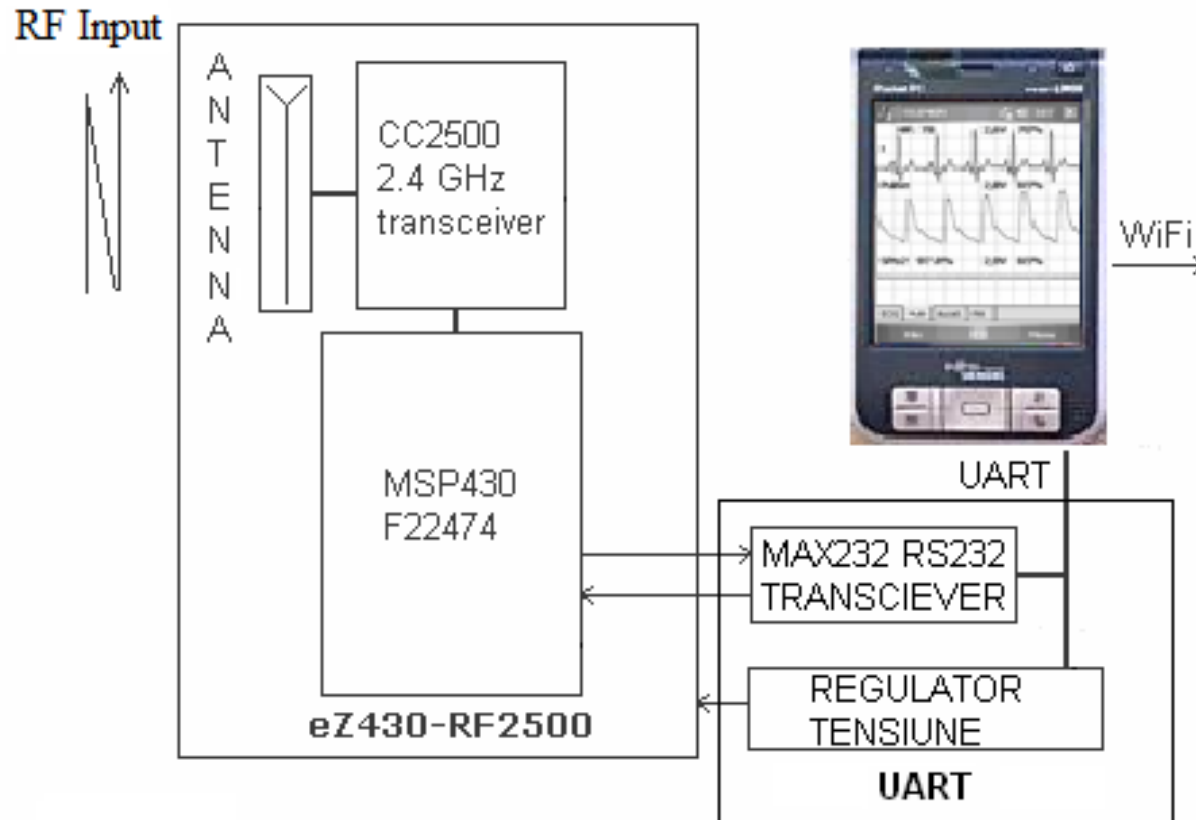The TMP275 is capable of reading temperatures with a resolution of 0,0625°C;

The accuracy for the 35-45°C interval is below 0,2 °C and the conversion time for 12 data bits is around 200ms.
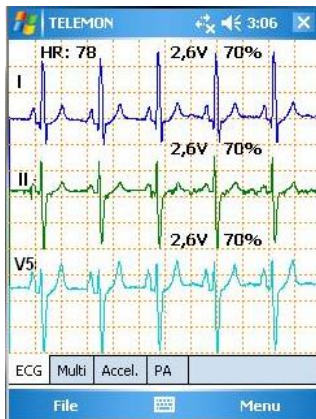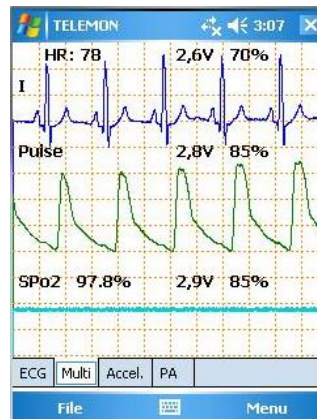

The temperature module

TELEMON (2007 - 2010)
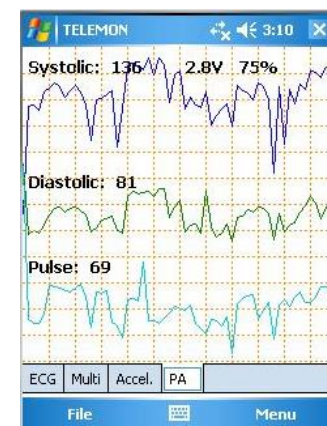

The Personal Server

TELEMON (2007 - 2010)

The software displays temporal waveforms and the status of each sensor (the battery voltage and RSSI from the Personal Server).
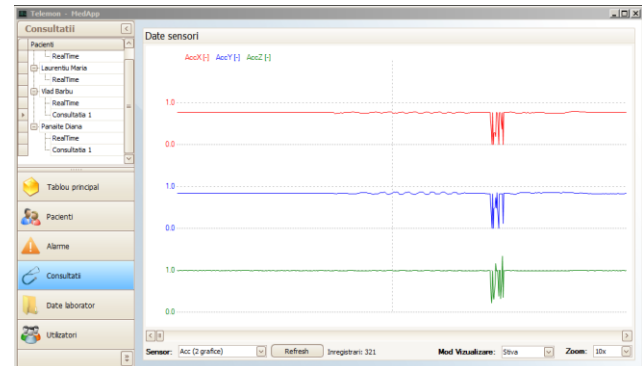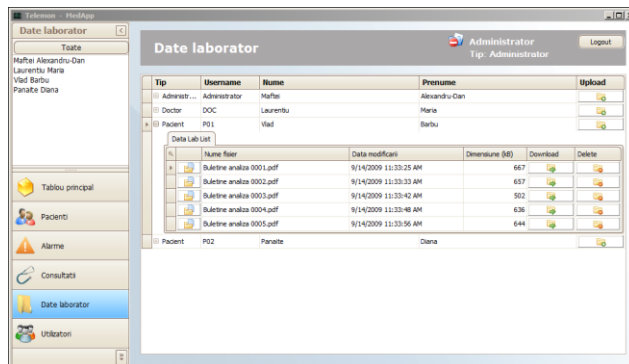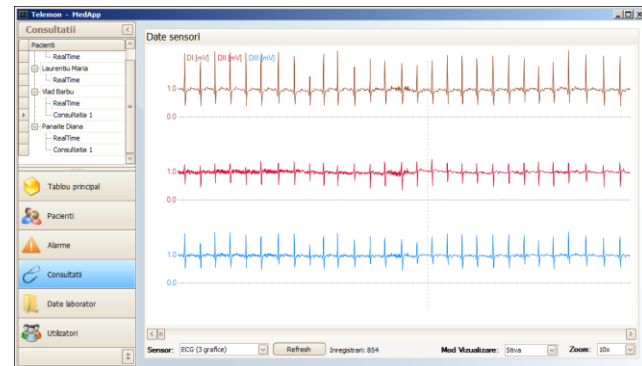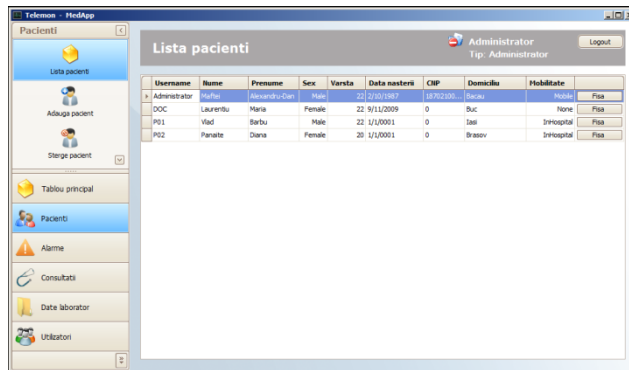

ECG traces

One ECG trace, pulse waveform and SpO2

Systolic and diastolic pressure from BPM

TELEMON (2007 - 2010)

The software working on the TELEMON Server was written by using VS.NET 2008 and SQL LITE.

The TELEMON Server - medic application

References

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[2] Malan D., Thaddeus R.F. et al., CodeBlue: An Ad Hoc Sensor Network Infrastructure for Emergency Medical Care, Proceedings of the MobiSys 2004 Workshop on Applications of Mobile Embedded Systems, 2004;

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[4] Rubel P., Fayn J et al., "Toward personal eHealth in cardiology. Results from the EPI-MEDICS telemedicine project", Journal of Electrocardiology, Vol. 38, Issue 4, pp. 100-106, 2005;