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“Toughclinic” – modern medical informatics under extremer conditions

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Abstract

- Care for seriously injured persons has to be guaranteed even under bad conditions.
- Paper based documentations have disadvantages.
- “TOUGHCINIC” as a solution:
  - Electronic system for emergency patients or refugees.
  - Can be set up very fast.
  - Any facts can be documented.
  - Digital photos can be added.
  - Software components are able to be adapted locally.
- Wireless linking of many individual and extremely robust notebooks without central infrastructure.
- The three principles:
  - Simple handling,
  - possibility of total configuration by non technical personnel and
  - extremely fast operational readiness as well as toughness under extreme environmental conditions without cabling.

Introduction

- Two target groups: Seriously injured persons (like victims of catastrophes) and refugees.
- On the one hand: Paper based documentation is not resistant, copies are not automatically updated, automatically analysis is not possible.
- On the other hand: Computer based documentation is not advisable. Standard hardware is under extreme environmental conditions not reliable, computer solutions often demand expert-knowledge, extra cables add logistical problems, personnel outside the base is hardly supported and available software solutions are too complex.
- With TOUGHCLINIC target groups can be cared for fast: It supports a medical and/or administrative all-embracing care.
- **A hospital information system is a “conceptual bound”, in which single appliances develop and can be integrated as an acting whole system. The system TOUGHCLINIC offers such a bound.**

Necessary equipment

- About 50 percent of all damages of notebooks go back to transport accidents.
- The expected environmental conditions like aridity clamminess and extreme temperatures let notebooks not appear as adequate equipment in areas of catastrophes or crisis.
- Special notebooks e.g. Toughbooks of Panasonic have several mechanical protections.
- Also the photo industry made progress and offers digital waterproof and sand resistant cameras like Olympus µ720SW or Pentax Optio Wpi.

Examples of equipment

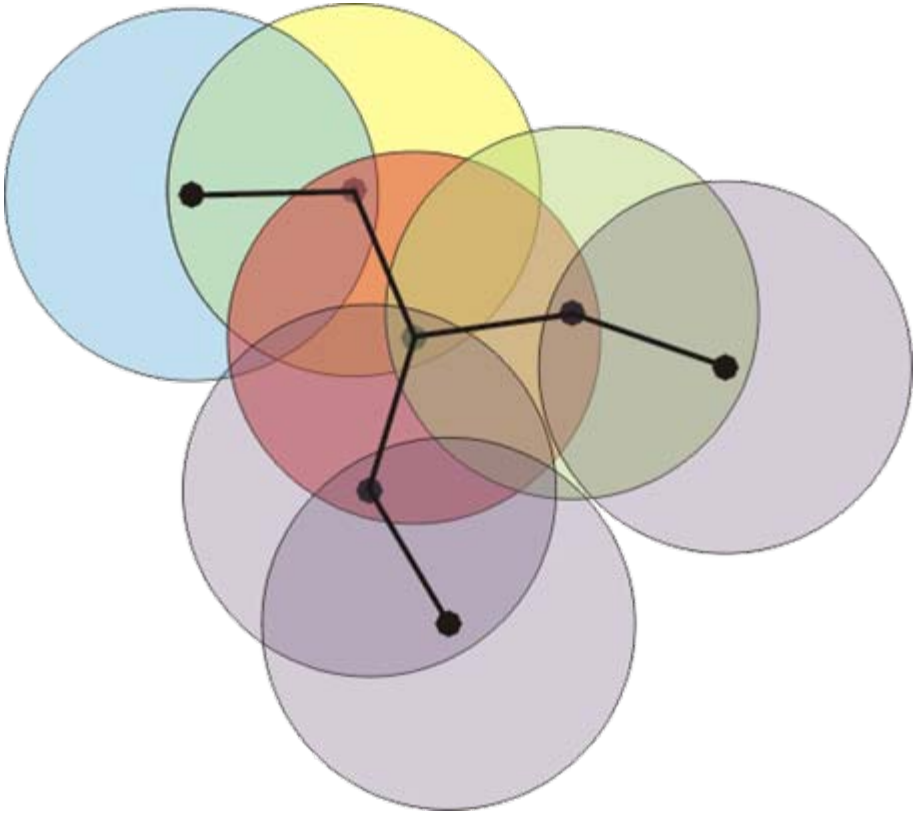
Computer language and architecture

- Modular and platform independent software concept is necessary for future flexibilty: Java with Java Runtime Environment (JRE).
- Usage of “best-practice” frameworks for easier multinational development.
- Architecture bases on a three-tier-model with data management, business logic and presentation.
- HSQLDB and Java DB as two effective Java data bank systems with support of the “embedded mode”.
- Exchange local data with every reachable co-equipment (unit, device) and to synchronize one another automatically: SyncML (Synchronization Markup Language).
- Java Foundation Classes as a comprehensive collection of GUI-components and Services.
- **Modular design leads to potential add-ons: Worldwide telemedicine or stack management.**

MANET radio communication network

- So far in a WLAN only one notebook can be connected with exactly one central router or exactly one additional notebook. → Wireless Communication is depending on central architecture and bandwidth is limited.
- Solution: Mobile ad-hoc networks (MANET).
  - Individual notebooks are nodes, which serve as a repeater for one or more other nodes.
  - The resulting network can overcome long distances, especially in uneven or challenging terrain. Furthermore MANETs are very reliable, because every node is connected with many other nodes. If a node breaks down, the surrounding nodes search for an alternative route.
  - Usage e.g. of Optimized Link State Routing Protocol (OLSR).

Schematic representation of a MANET wireless network



Structure of the electronic file and the form based additional documentation

- A root-appliance and a plug-in-architecture make the adding and changing of new content containers (modules and plug-ins) easily possible.
- Every installation of TOUGHCLINIC can be pre arranged with a standard set of modules and plug-ins.
- The record structure can include forms as basic modules:
  - Basic type of mask.
  - A special component enables the administration of forms.
  - Changes and add-ons can be made locally even by IT-laymen.
  - Aim: Cover as many possible intended uses, especially to cover the non-planable.
- English language and international personnel:
  - Preferably input masks should be done by selection boxes or depend on annotatable graphic illustrations of body parts.

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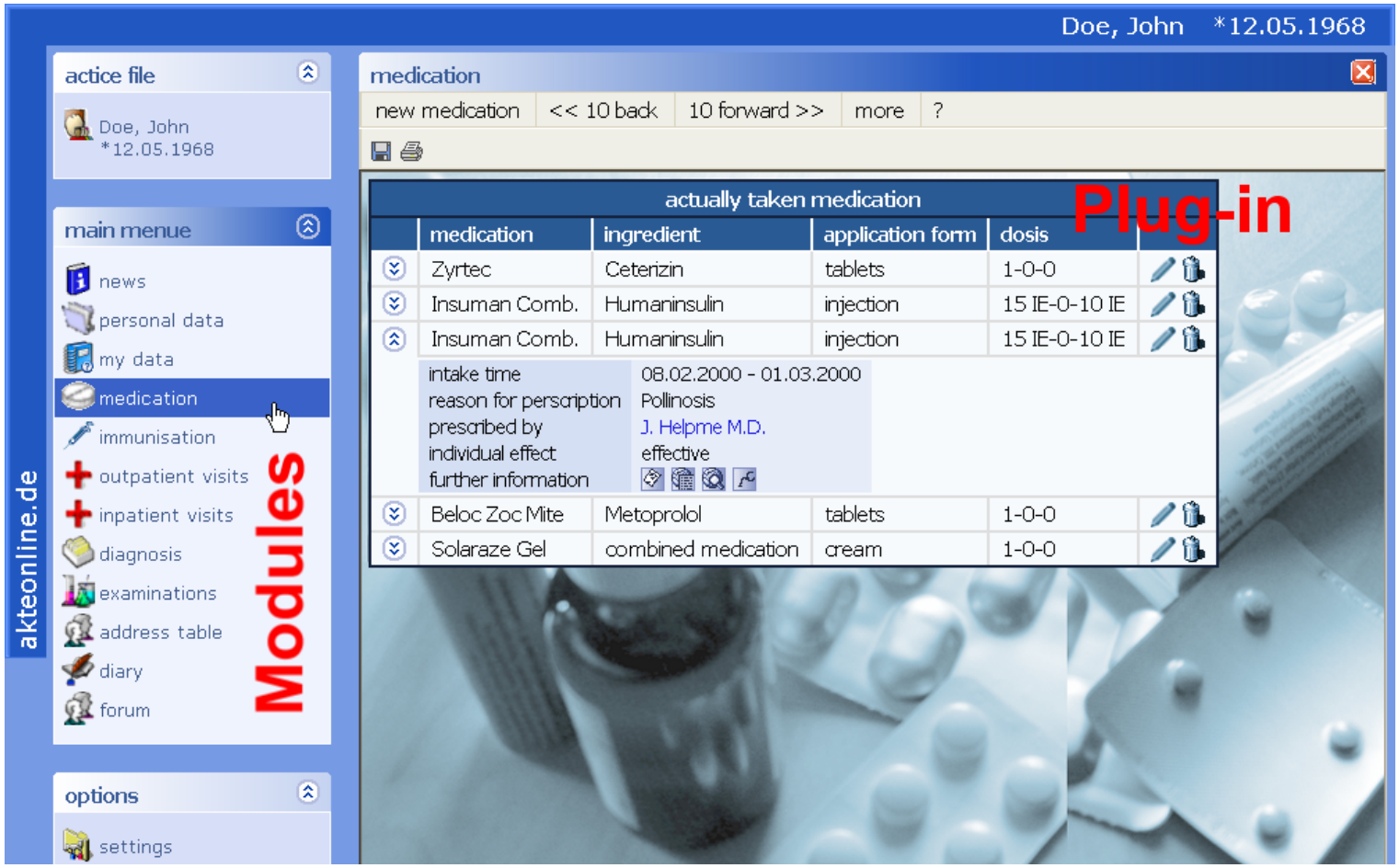
Presentation of modules and plug-ins with an example



Results

- Many circumstances can be securely documented. Software components are adjustable for the specific intended use on-site.
- Wireless networking of individual, extremely tough computers without any infrastructure.
- Breakdown of one component does not affect others.
  - It can even be replaced immediately by another one (without bothering about manually restoring or copying of data).
- Used applications in wireless reach are synchronized automatically with the others and so they always receive an actual dataset.
  - Especially helpful for notebook usage outside the base: At return the data synchronization will be done automatically.
- No central hardware effort necessary.
- Due to encryption loosing of one of the workstation is limited to the financial loss.
- Language barriers between employees from different countries are reduced.
- Three principles are met.
- **At the actual early status of development cooperation partners for processing and use are sought-after, as well as sponsors.**

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