Digital Assistance Services for Emergency Situations in Personalized Mobile Healthcare: Smart Space based Approach

Dmitry Korzun, Alexander Borodin, Ivan Timofeev, Ilya Paramonov, Sergey Balandin

Petrozavodsk State University (PetrSU), Petrozavodsk, Russia

P. G. Demidov Yaroslavl State University (YarSU), Yaroslavl, Russia

FRUCT Oy, Helsinki, Finland

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Motivation

- IoT + HealthCare market is estimated in $117 bln. by 2020
- Govermental programs in most developed countries
- Continuous health monitoring and personalized medicine.
CardiaCare app: an example of continuous health monitoring

To start, please, connect to a ECG device
Simple continuous health monitoring is useful, as well.
### Intelligence of m-Health services

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
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<tbody>
<tr>
<td>Service ubiquity</td>
<td>Digital healthcare services are available anywhere and anytime. Patients are mobile clients, which can be out of hospital.</td>
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<td>Multisource data</td>
<td>Services can apply various data sources; medical and non-medical, personal and collective.</td>
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<td>Context-awareness</td>
<td>Services exploit contextual and situational information obtained from various medical and environment sensors.</td>
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<td>Knowledge reasoning</td>
<td>Services utilize knowledge deduced from a large data collection, which can be dynamic and fragmented.</td>
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<td>Service construction</td>
<td>In contrast to pure transfer of a fixed healthcare service from MIS to a remote user, available healthcare services are discovered and composed into a service to best fit the situation.</td>
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Personalized assistance: the scope of the system
Scenario of emergency case detection
Scenario of emergency case notification

1. Calculate nearest volunteers
2. Prepare bed, medical apparatus, operation room and hospital staff
3. Send patient's location
4. Send patient's location, analysis and EMC
5. Send instructions
6. Confirm participation
7. Play loud sound if patient is fainted

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Scenario of first aid and accompany care

- First aid, transport to hospital
- Write all actions performed
- Moral support, first aid
- Send additional instructions
- Examine patient’s data
- Buy drugs

First aid, transport to hospital → Hospitalization
Examine patient’s data → Buy drugs → First aid
Send additional instructions → Moral support, first aid → Write all actions performed
Multi-agent m-Health system architecture
A volunteer is rushing to reach the patient: construction of the basic service.
A volunteer is rushing to reach the patient:
construction of an advanced service.
Querying external geolocation services
Construction of the first aid service

- **Ambulance KP**
  - First aid guidance
  - Symptoms
  - Recommendations for self care actions

- **First Aid KP**
  - Algorithm of the first aid
  - Symptoms

- **Patient KP**
  - Symptoms

- **Volunteer KP**
  - Symptoms

- **Dispatching KP**
  - Patient-to-Volunteer assignment
Assistance in taking medications: information on nearby pharmacies

- Pharmacy location and working hours
- Patient location
- Route to the patient
- Volunteer location
- Drug and equipment requirements
- Symptoms
- First Aid KP
- Volunteer KP
- Patient KP
- Positioning KP
Integration with the Electronic Health Record

Physician KP

Anamneses, sensor data

Modification of the disease treatment plan

Health Record KP

Anamneses, contraindications

Patient KP

Sensor data

First Aid KP

Symptoms

First aid actions
Conclusion

1. The role and evidence of the service intelligence in m-Health scenarios have been identified
2. A generic vision on a smart m-Health service has been proposed
3. Several reference m-Health scenarios have been introduced where such services become evident and demanded
4. The services support personalized digital assistance in emergency cases with remote and mobile patients
5. And smart space based solutions have been proposed for implementing the reference scenarios in modern IoT environments