



Petrozavodsk State University
Department of Computer Science



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Overview of R&D Activities for Mobile HealthCare in Petrozavodsk State University

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Research Seminar at Faculty of Computing, University of Latvia,
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Continuous Health Monitoring



Number of Wearable Devices

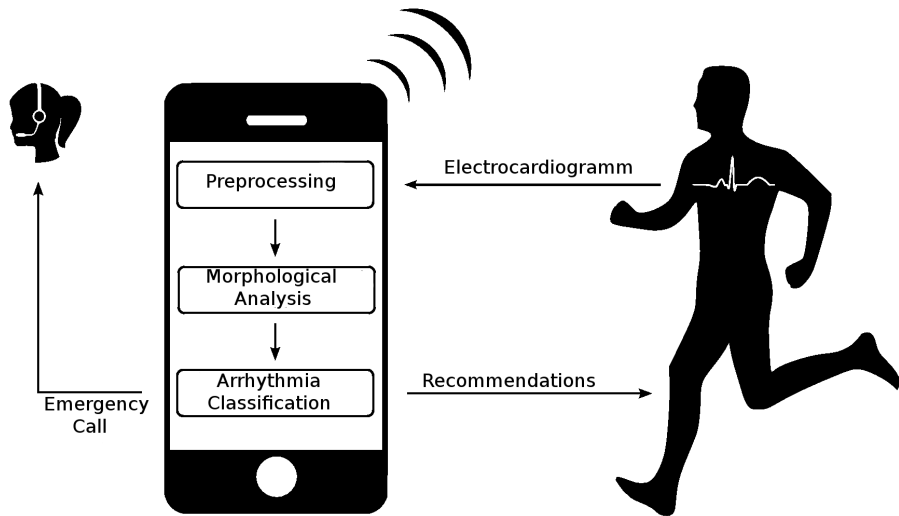


Branches of R&D in PetrSU

- Automatic arrhythmia detection algorithms
- Mobile health monitoring service
- Smart emergency service



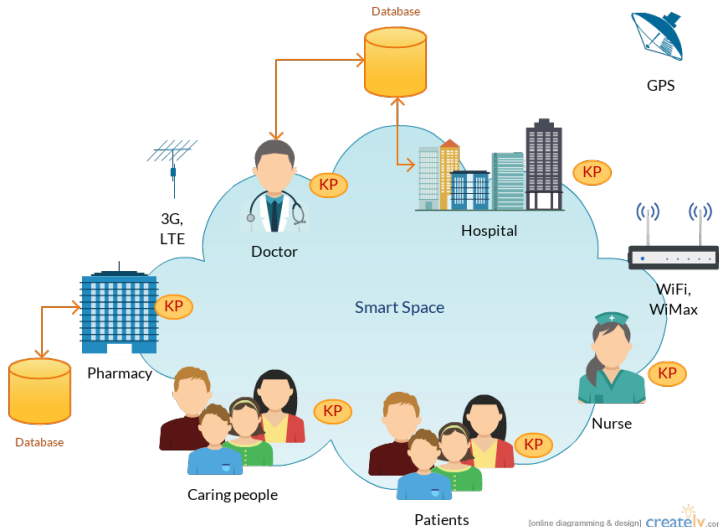
Rhythm Anomalies Detection



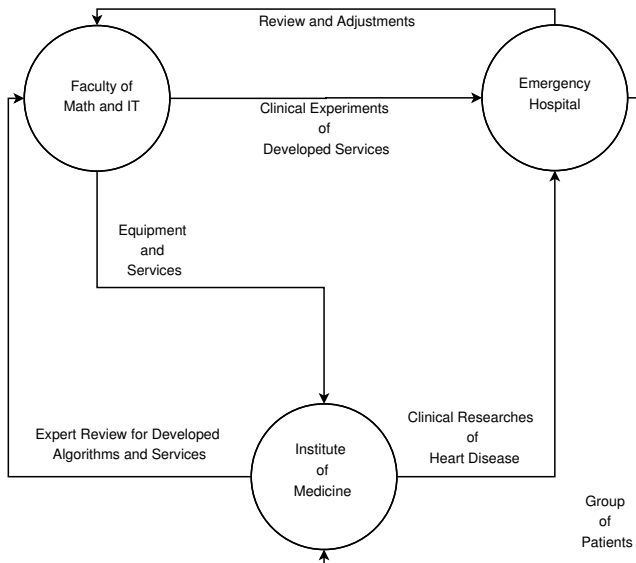
Mobile Health Monitoring Service



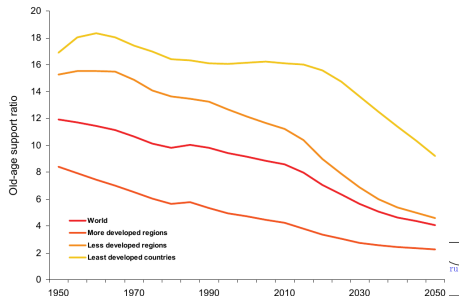
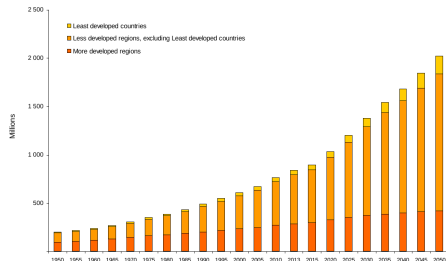
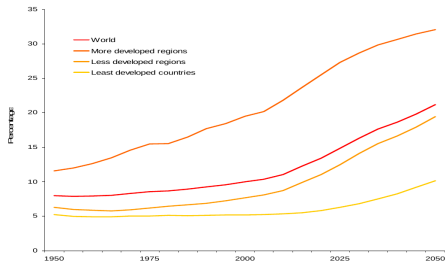
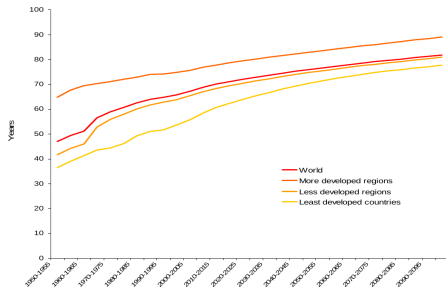
Idea of Emergency Service Based On SmartSpaces



Collaboration with Emergency Hospital



World Population Ageing (from UN report, 2013)



Motivation

- Number 1 cause of death globally (31% of all global deaths in 2012)¹
- Can be prevented by addressing behavioural risk factors (tobacco use, unhealthy diet, obesity, physical inactivity, etc.)
- Need early detection and management

- Contribution of CVDs to mortality in CIS (percents)

| | |
|------------|----|
| Georgia | 67 |
| Ukraine | 64 |
| Azerbaijan | 60 |
| Russia | 57 |
| Moldova | 56 |
| Belorussia | 53 |
| Kazakhstan | 50 |
| Armenia | 50 |
| Kyrgyzstan | 49 |
| Tajikistan | 39 |

¹Source: WHO

Significance of Confident R Peak Detection

■ Normal sinus rhythm



■ Sinoatrial block



■ Sinus tachycardia



■ Atrial flutter



■ Sinus bradycardia



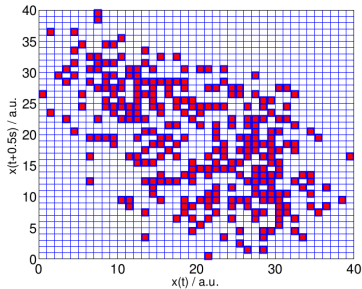
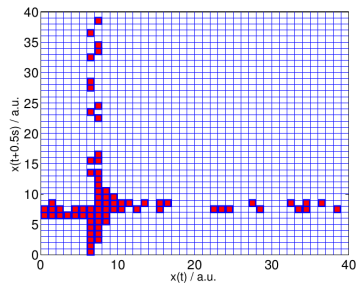
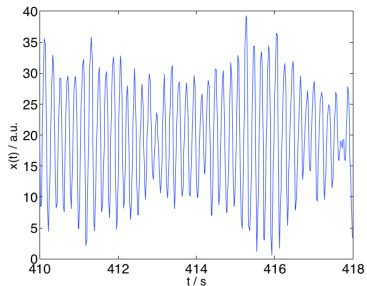
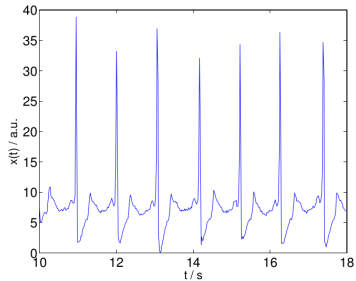
■ Wolff-Parkinson-White syndrome



Source: Medical Training and Simulation LLC
<http://www.practicalclinicalskills.com>



Atrial Fibrillation Detection Algorithm



Sinus Arrhythmia Detection and Classification



RR-intervals detection
Pan-Tompkins Algorithm

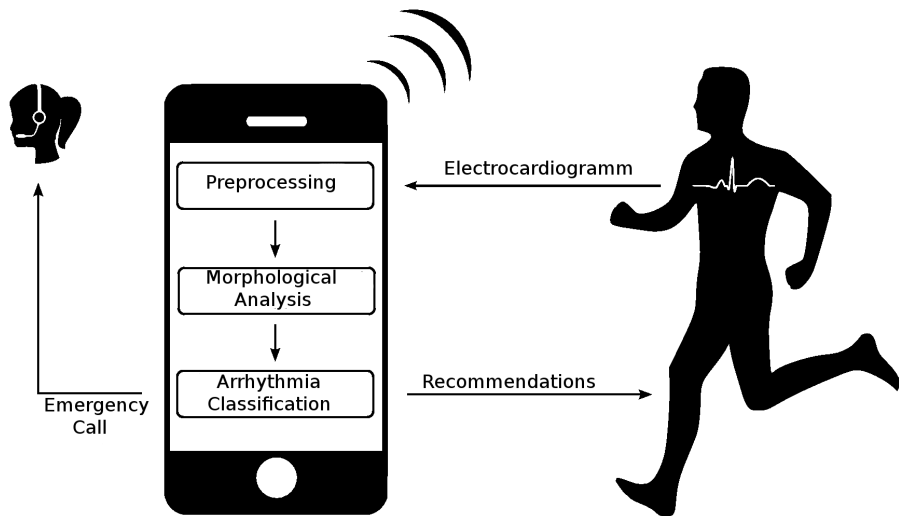
RR-interval Classification
Tcporas Algorithm

Abnormality Class

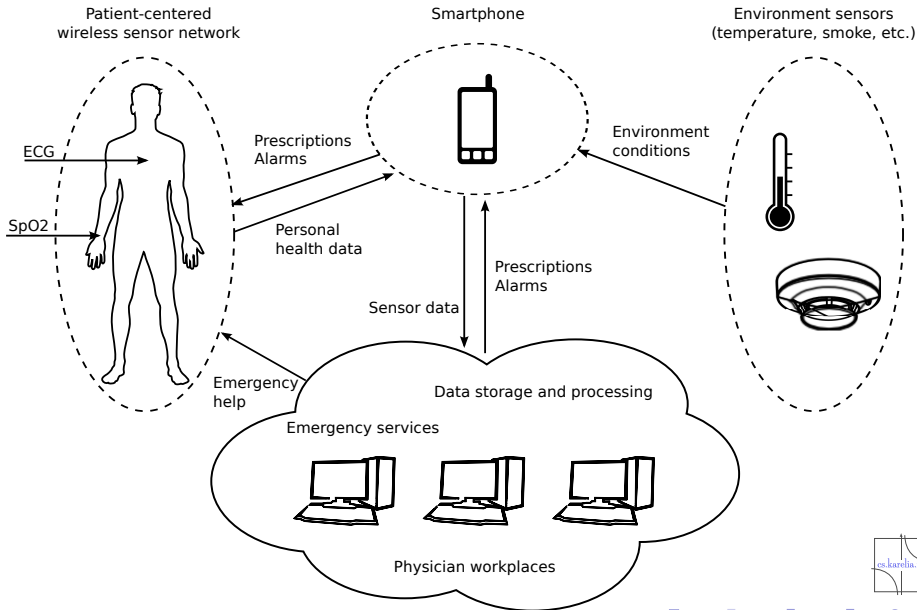
| Class Code | Description |
|------------------------------------|-----------------------------|
| N, P, f, p, Q, , +, s, t, ~, L, R | Norma |
| A, a, J, S | Atrial premature beats |
| V, F | Ventricular premature beats |
| e, j, n, E | Extraordinary beats |
| [, !,] | Ventricular fibrillation |



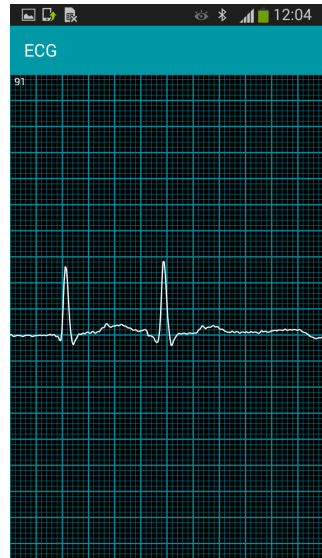
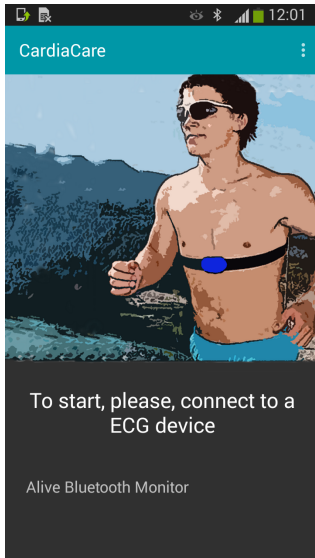
Rhythm Anomalies Detection



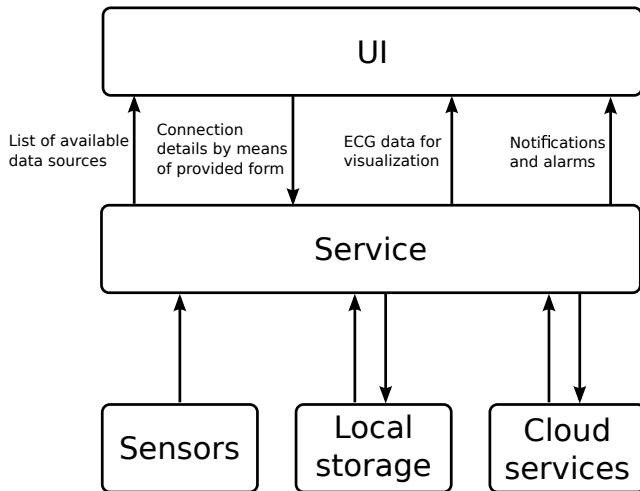
Continuous Health Monitoring System Operation



CardiaCare Application



A Top Level App Architecture



Remote Access for Doctor



Doctor Web Application

О НАС

ПРИЛОЖЕНИЯ

CARDIACARE

ВОЙТИ

РЕГИСТРАЦИЯ

ПАЦИЕНТ

Имя: Egor
Возраст:
Город: Петрозаводск
Телефон: 111-111-11-11
email: 11111@1111

РЕДАКТИРОВАТЬ

ECG



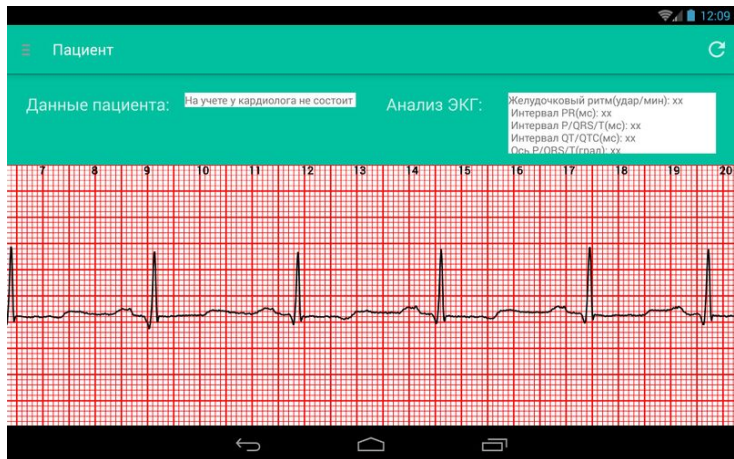
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СПИСОК СОБЫТИЙ

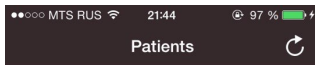
Аритмия!



Android Application



iOS Application



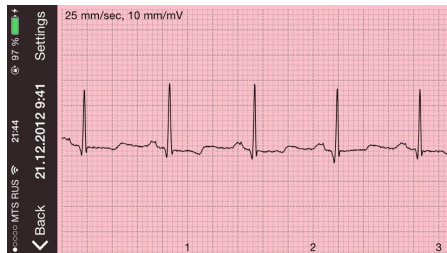
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Петров Петр Петрович >

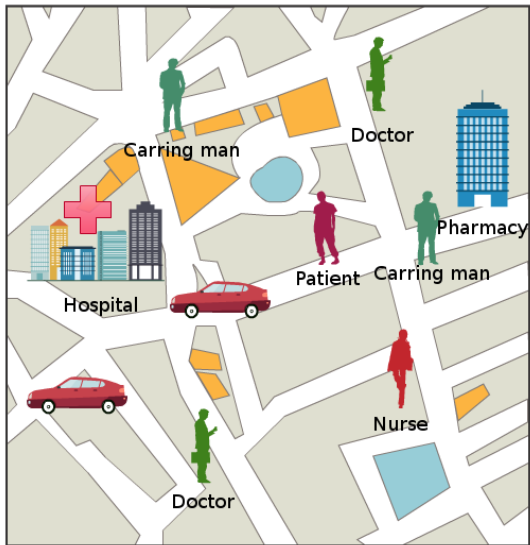
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Сергеев Сергей Сергеевич >

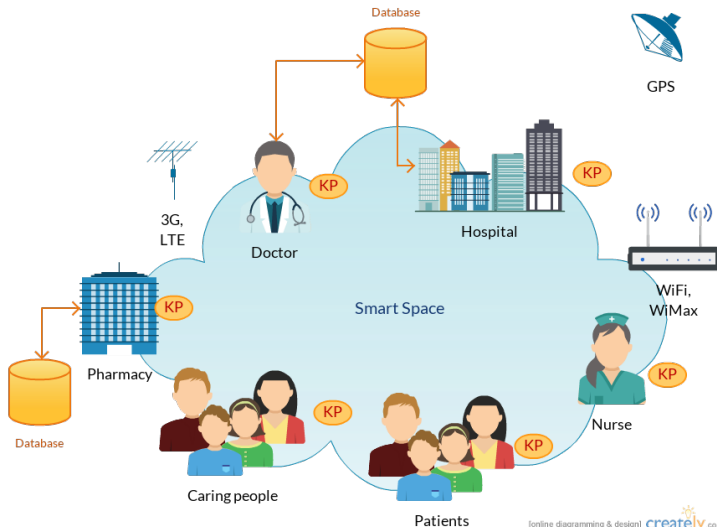
Егоров Егор Егорович >



Idea of Emergency Service Based On SmartSpaces



Design of Smart Emergency Service



[online diagramming & design] createely.com

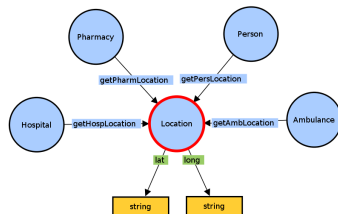
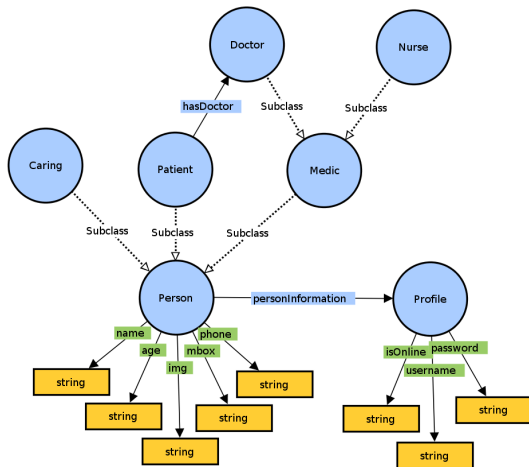


Supporting Services

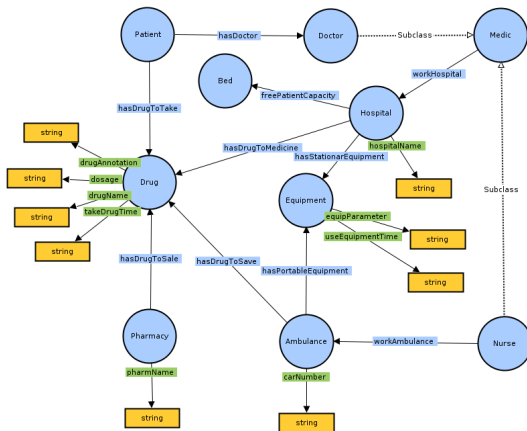
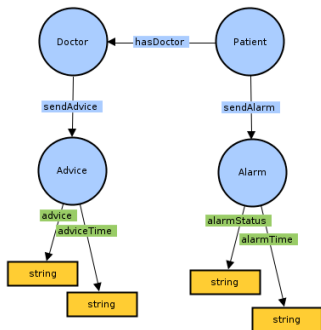
- Authorization Service
 - ▶ Providing interaction with Medical Information System in Hospital
- Dispatching Service
 - ▶ Control Patient-Volunteer interaction
- First Aid Service
 - ▶ Building recommendations based on symptoms
- Positioning Service
 - ▶ Build route to the patient



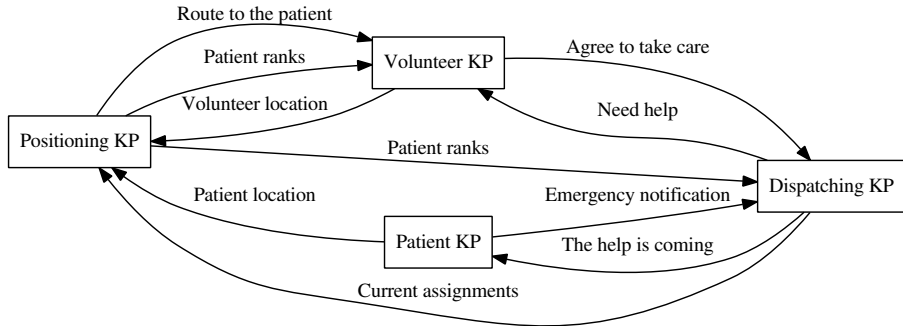
Ontology Fragments



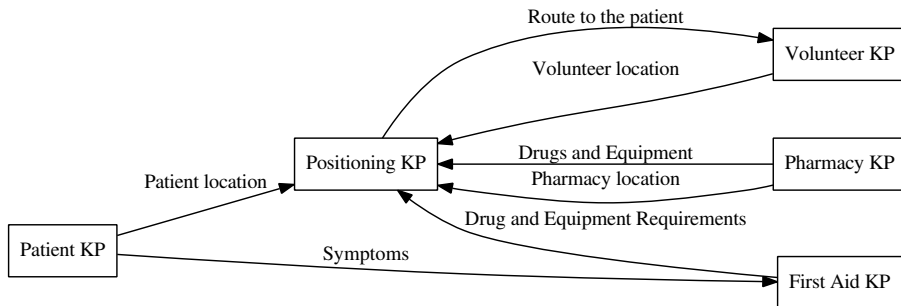
Ontology Fragments



KP Interaction 1



KP Interaction 2



Conclusion

- Heart function monitoring Service was developed
- The architecture of a CardiaCare app facing the challenge of multiple simultaneous health data sources was designed
- Design of SmartSpaces based emergency care service was developed

