

Recommendation Service for Smart Space-based Personalized Healthcare System

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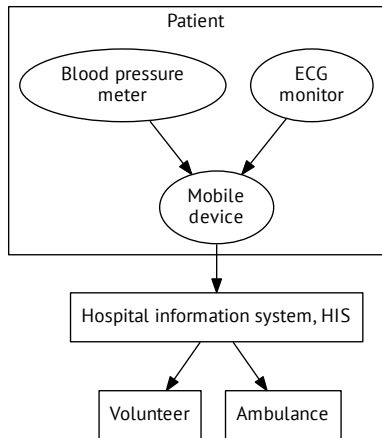
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Personalized healthcare system

System targets people with high risk of cardiovascular disease

- Mobile sensors provide vital signs measurements
- Mobile device processes and transmits data to the HIS
- In case of emergency HIS sends ambulance and volunteers to aid the patient
- Regular monitoring using questionnaires



Recommendations for m-health system

Application areas for recommendations

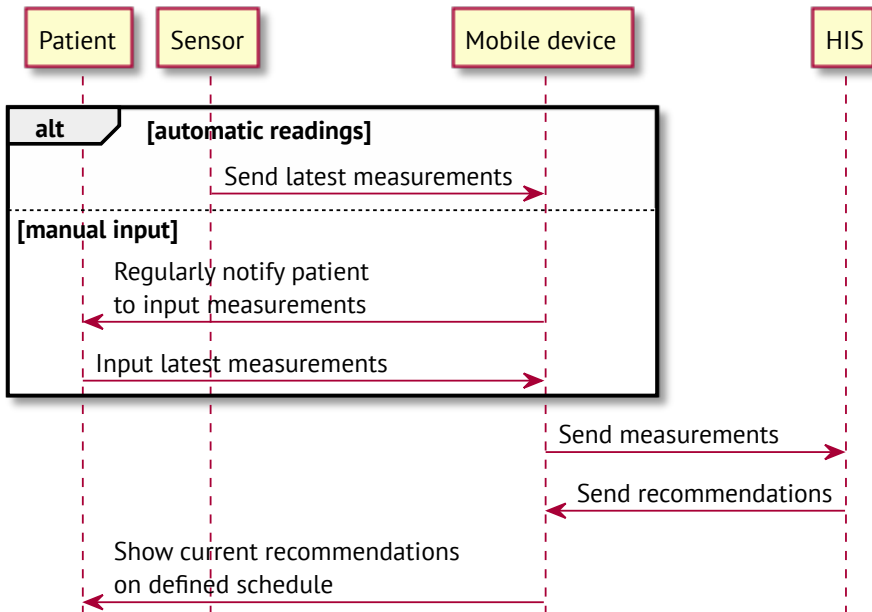
- Life style management
- Increase adherence to the treatment

Requirements for recommendations

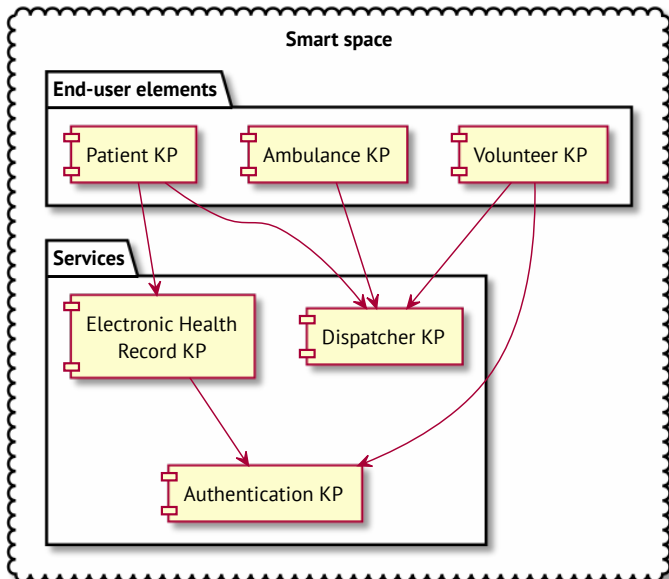
Patients are the target audience for recommendations

- System must not provide any medical suggestions (drugs, procedures or modification of prescribed treatment)
- Recommendations should be accessible
- They should correspond to the current state of health
- They should be regular, but not annoying
- Recommendation set should be expandable by the doctor

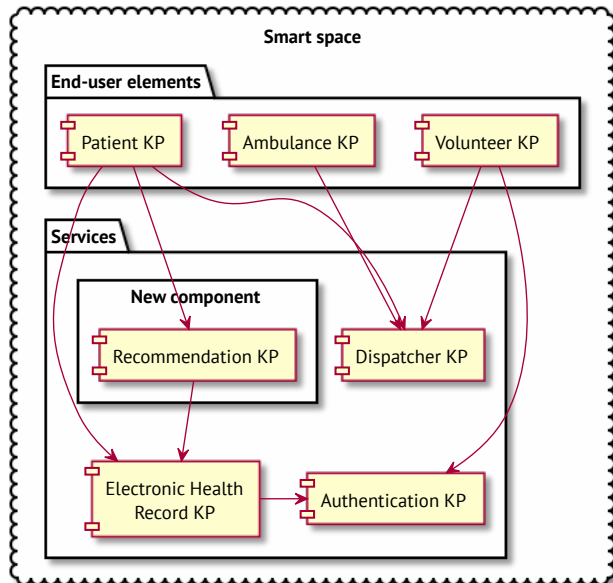
Recommendations reference scenario



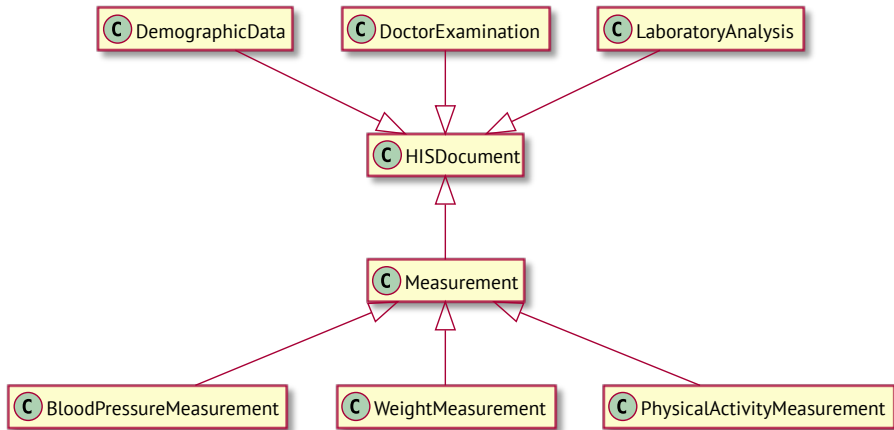
The architecture of the system



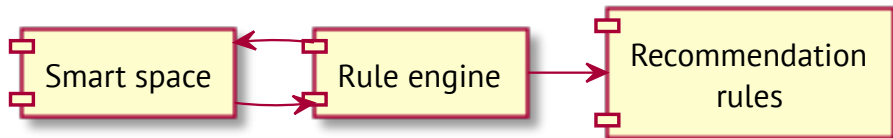
Updated architecture with recommendation KP



Electronic health record documents taxonomy



Architecture of recommendation KP



- Smart space integration module allows to get data from EHR
- Rule engine processes data according to the rules
- Recommendations are then published in the smart space

In our prototype we used Drools rule execution engine

Rules for recommendation KP

Recommendation rules were formed according to JNC 7

- Negative trend in blood pressure and prehypertension → Lifestyle management required
- Negative trend in blood pressure and hypertension → Consult the doctor to improve blood pressure management
- ...

Preprocessing data for rule engine

Document preprocessing is required to ease rule development

- Methods for calculating average / total value for recent period
- Methods for checking availability of certain types of documents
- Similar methods for values of certain parameters

Example of a rule

```
rule "weight management (physical activity)"  
when  
  SimpleFact(name="Lifestyle management required")  
  EHR(  
    averageValueForRecentPeriod("WeightMeasurement",  
      "BMI", 30) > 25 &&  
    totalValueForRecentPeriod("PhysicalActivity",  
      "moderateActivityMinutes", 7) < 150  
  )  
then  
  patient.addRecommendation("Exercise more")  
end
```

Results and future work

Results

- A prototype solution of recommendation service is created
- Recommendation rules according to JNC 7 were formed and tested using a set of real-world blood pressure records

Future work

- Integration with real-time measurements
- Simplification of recommendation rules syntax
- Support for treatment adherence recommendations