ARC'14
مؤتمر مؤسسة قطر السنوي للبحوث
QATAR FOUNDATION ANNUAL RESEARCH CONFERENCE
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A Guideline Compliant Clinical Decision Support System In Mobile And Smart Environments For Diagnosing Medical Conditions

10.5339/qfarc.2014.HBPP0599

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Abstract

Background & Objectives:
Integration of Clinical Decision Support Systems (CDSS) in mobile and smart environments helps to improve the quality of life of people with health problems.
CDSS are used to derive clinical conclusions from patient data, in order to automate and help the process of diagnosing and treating the patient.
One way that CDSS can be implemented is to formalize a clinical guideline (document detailing best practices for diagnosing and treating patients) and use it on a knowledge base containing the patient's data.
An interesting perspective is to use CDSS in a smart home (SH) setting, where data for the remote CDSS can be obtained from SH services and mobile devices using ambient and wearable sensors.
However, in order to maintain minimum quality of service for CDSS decision support, the CDSS decision process must be deployed locally as a SH service an on mobile devices.
An ideal example domain for this integration scenario is the diagnosis of sleep apnea.
Sleep Apnea has several symptoms that include recurrent awakening, loud snoring, choking episodes, non-restorative sleep and daytime sleepiness.
Usually, an individual with sleep apnea is not aware of having difficulty breathing, and is often recognized by others witnessing the individual during sleep apnea episode or is suspected because of the observed symptoms.
Sensors could detect such episodes automatically without the need for a human intervention, or recognitions of said symptoms.
The objectives are to illustrate the feasibility of CDSS as SH service and on mobile devices by using the Sleep Apnea CDSS.

Methods:
The sleep apnea CDSS decision process uses Semantic Web tools and rule-based reasoning, in order to formalize the current Canadian guideline for the recognition of sleep apnea. A total of 9 rules were derived. A patient dataset comprises health factors related to sleep apnea, including clinically relevant personal information, clinical measures and observations, and symptoms specific to sleep apnea.
To validate the decision process of a CDSS integrated with smart homes, we implemented the Sleep Apnea CDSS decision process on an Android smartphone (Samsung Galaxy SIII). For this validation, we assume that we have received data from the patient diary application, the SH services or local smartphone monitoring services.
We generated datasets containing clinical data (measurements), whereby fact values were created based on ranges encompassing both clinically normal situations as well as abnormal situations. We have 7 dataset configurations (1 to 7 days of data), with 10 generated datasets by configuration (70 datasets).