Home Monitoring of Health: Virtual Home Health Station

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Abstract. This work presents the vision for the development of virtual home health station to monitor well-being of people in a long term sense. We aim to provide a concept for the integrated health solution with possible research directions to constantly monitor patient’s current health condition, emotional and environmental state with ensuring the continuity of care and to provide immediate guidance in case of significant changes on their health conditions. This system will empower people to take a more active role in the management of their own personal health for the better health conditions.

Keywords. Vital signs monitoring, home healthcare, patient guidance

Introduction

Home healthcare has been growing since the late 1980's due to the aging population in many countries [1] and the number of in-home care providers is steadily increasing. The reason for the popularity of this area is that most people prefer to remain in their familiar surroundings than to move to a more institutional environment for their health. Although such home monitoring approaches are promising, there are several problems and challenges regarding the retrieval of data and analysis of this contextual data for the development of a full solution. Additionally, there is also a lack of feedback by the healthcare professionals to guide the patients for their actions based on the analyzed health data. To address these challenges, we introduce a virtual home health station to provide a full solution combining home monitoring environment by addressing mentioned challenges above and proactive feedback by the healthcare professionals to the patients based on their current health status which can be inferred by analyzing various parameters on the available health data.

Virtual home health station will be based on the network of sensors by providing a standardized middleware where available sensor based solutions in the market can be used to retrieve data about vital signs of patient as well as their observable activities of daily living. On top of available data via this middleware, our system will include data analysis techniques to infer meaningful actions from the available data. At the end, healthcare professionals will be able to see the inferred results from the data analysis and confirm the convenience of the actions for patient guidance to provide feedback through a decision support system.

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1. Challenges and Methods

First of all, to provide interoperable middleware for the data aggregation between different sensor-based solutions available in the market, semantic modeling and annotation of sensor data to create a unified model with the available Semantic Sensor Web (SSW) data standards and guidelines will be in focus as a starting point. As a secondary data source to further improve the contextual data, we need to retrieve observable activities of daily living of patients (like exercising or eating habits) in an efficient and effective way. To retrieve data from such kinds of activities, a human-centered approach will be followed to create easy-to-use mobile applications that can accurately monitor the routine of the people in their daily living. This research on the Human-Computer Interaction field can also be applied to adapt patients to follow the guidance to be provided by virtual home health station system at the end after analyzing data and creating meaningful results out of it.

From the medical informatics point of view, main challenge here after retrieving data is to analyze patterns and relations on the recorded patient health data. This process requires the utilization of probabilistic models (such as Dynamic Bayesian Networks or Hidden Markov Models) to create mathematically and computationally feasible unified model as well as taking the existing works and challenges on the pattern analysis [2], activity and context recognition [3] research areas into an account to further improve this model by contextual data by increasing the probability to create meaningful information. After having the meaningful results out of this data analysis phase, to provide proactive guidance to the patients by creating a link between the health observations of patients and health knowledge by the healthcare professionals, the service oriented application-centric decision support system will be in focus.

2. Expected Results and Conclusion

Throughout this paper, we have presented our vision with challenges and possible research directions to create virtual home health station as a full system to monitor health status of patients based on several parameters and provide guidance to them for required actions. Another contribution of this work would be on the application of research results to different informatics domains. Utilizing the existing probabilistic approaches with further contextualized data to provide more accurate results on top of recorded health data can be used to infer meaningful patterns from the data retrieved from the other domains (such as -omics sciences) with the usage of big data analytics. In this respect, this development would be an important and promising milestone to retrieve meaningful knowledge from the medical informatics domain.

References

