Demonstration of a Micro-Services Based Multi-Purpose Sensor Platform for Supporting Ambient Assisted Living Systems

Stefan Wagner
Aarhus University
Finlandsgade 22
8200 Aarhus, Denmark
sw@eng.au.dk

Esben Hunnerup
Aliviate Development
Sindalsvej 29
8240 Risskov, Denmark
esben.hunnerup@aliviate.dk

Jorge Miranda
Aliviate Development
Sindalsvej 29
8240 Risskov, Denmark
jorge.miranda@aliviate.dk

ABSTRACT

This paper demonstrates the CARIOT platform and how it interacts with third party ambient assisted living and telemedicine systems. CARIOT is a multi-purpose ambient sensor platform that supports telehealth, telemedicine, and telecare product integration through both cloud and internet of things (IoT) channels, while also supporting closed-network servers and even local-embedded storage for maximum privacy. The aim of this paper is to demonstrate how the CARIOT platform can seamlessly integrate with third party ambient assisted living and telemedicine systems, including: 1) The CAMI LINKWATCH platform, and 2) the OpenTele platform, both using web-services for integration. Also, the paper demonstrates how CARIOT can integrate with other platforms using a micro-services-based approach combined with open communication protocols.

CCS CONCEPTS

• Applied computing → Life and medical sciences → Health informatics

KEYWORDS

Ambient assisted living, telemedicine, eHealth, pervasive health

1 INTRODUCTION

Ambient assisted living and telemedicine systems have achieved widespread adoption and are quickly maturing in terms of delivering enhanced features and support-services, increasing the efficiency and effectiveness of caregivers, and enhancing citizen self-care. As part of this maturation process, a need exists for supporting new features and services without replacing the already installed hardware and software platforms used by caregiver-organizations. One of the widely implemented telemedicine systems in Denmark is the OpenTele system developed in Denmark as a national reference and open source implementation of telemedicine [1,2]. As an example, the standard telemedicine features found in OpenTele are not sufficient to support the new generation of context-aware self-care systems that are emerging [3]. OpenTele was designed to be open for integration with third party sensor platforms, thus allowing it to be extendable. Also, the CAMI LINKWATCH platform which is an emerging cloud-based platform for assisted living is likewise designed to integrate with third-party sensor platforms [4]. The aim of this paper is to demonstrate how the CARIOT platform can seamlessly integrate with ambient assisted living and telemedicine systems, including: 1) The CAMI LINKWATCH platform, and 2) the OpenTele platform, using regular web-service interfaces. Also, the paper demonstrates how CARIOT can integrate with other platforms using a micro-services-based approach combined with open communication protocols.

2 METHODS

2.1 CARIOT platform

The CARIOT platform, developed by Aliviate and Ecotopias, enables non-internet connected healthcare devices such as blood pressure, saturation, and weight devices used for traditional telemedicine and telehealth applications, to become internet-of-things (IoT) enabled. This include support for the open source "The Things Network" IoT Cloud platform, as well as support for commercial IoT platforms such as "Loriot". This integration is achieved using 4G, LoraWAN, and/or WiFi communication channels, depending on the specific usage-scenario.

Several healthcare devices are already supported, and the CARIOT platform can easily be extended with additional healthcare devices. Besides telehealth and telemedicine devices and services, the CARIOT platform supports a range of telecare and personalized medicine devices and services. These include traditional telecare and ambient assisted living services such as medication adherence tracking, fall prevention and detection, and sleep quality, but also generalized support for tracking user activity-levels and activities of daily living using both wearables and ambient sensors [4].

2.2 The OpenTele platform

The OpenTele platform is an open source telemedicine ecosystem [1,2]. According to the 4S organization, OpenTele is: "a complete telemedical platform for handling patient recorded outcome data and measurements from personal health devices. The platform comprises a server part and a tablet app installed on a tablet located in the home of the citizen. Using this tablet, the citizen can answer questionnaires, perform measurements and exercises, and communicate with the general practitioner or hospital staff. The server exposes a web portal where a clinician can handle – and communicate with – patients and review the data they collected." [1]. OpenTele is open source, component-based, and highly adaptable and extendable [2]. It is built using the Java programming language for the server side and HTML5 and JavaScript for the web clients (Figure 1). The database is based on the popular MySQL database server, while a REST interface is provided for integration with third party systems using JSON (Java Script Object Notation) encoding [2].
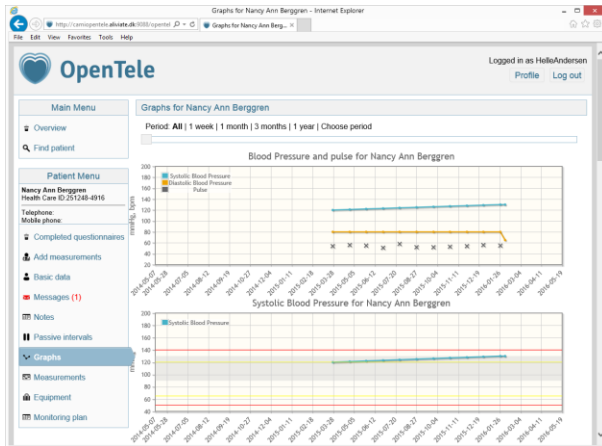

Figure 1. The OpenTele open source telemedicine platform.

2.3 The CAMI and LINKWATCH platforms

CAMI is a "Companion with Autonomously Mobile Interface" in an "Artificially intelligent ecosystem for self-management and sustainable quality of life in Ambient Assisted Living". CAMI aims at creating a framework relying on Artificial Intelligence (AI) and allowing a seamless integration of any number of sensors and home appliances with commercial robotic platforms [4]. CAMI's aim is to pave the road of "robots" into the field of ambient assisted living and in settings characterized by a substantial human-machine interaction. CAMI offers a fully integrated AAL solution at the overlap of telecare and telehealth, smart homes and robotics by offering services for social care, home care, and mobility. The LINKWATCH platform is one of several web-based interfaces supported by CAMI allowing caregivers and end-users to access the CAMI platform data and receive notifications from the decision support engine of CAMI (Figure 2).

Figure 2. The CAMI LINKWATCH web site showcasing data from the CAMI cloud-based platform, generated by the CARIOT platform. CAMI supports several interfaces.

3 PLANNED DEMONSTRATION

A range of CARIOT's services will be demonstrated, including medication adherence, activity, and dehydration trackers, fall detection, as well as dental and body hygiene. Also, CARIOT's medico device integration features will be demonstrated using a blood pressure device and an oximeter. The demonstration will showcase how CARIOT can send data using either 4G, WiFi or LoraWAN radio communications to the OpenTele and CAMI LINKWATCH systems. Also, CARIOT's ability to store data locally in a secure manner, avoiding cloud-based storage scenarios, will be demonstrated.

ACKNOWLEDGMENTS

REFERENCES

[1] 4S organization. OpenTele. Retrieved April 5th 2017 from http://4s-online.dk/wiki/doku.php?id=opentele:overview

[2] Wagner, S., 2017. Telemedicine with OpenTele. Medivate Publishing.

[3] Memon, M.; Wagner, S.R.; Pedersen, C.F.; Beevi, F.H.A.; Hansen, F.O. Ambient assisted living healthcare frameworks, platforms, standards, and quality attributes. Sensors 2014, 14, 4312–4341.

[4] The CAMI consortium. Retrieved March 27th 2018 from http://www.camiproject.eu/