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PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
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Abstract:

This deliverable reports about the Third project workshop that was held on December 15, 2015 in Hyderabad, India.

Keyword list: eWALL workshop, AAL workshop, eWALL

Document History

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0.1	Oct, 5, 2016	Albena Mihovska	First draft
0.2	Oct 27, 2016	Albena Mihovska	Second draft
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1 Executive Summary

This deliverable 7.6.3 describes the Third project workshop held as a one-day event on December 15, 2015 in Hyderabad, India. The workshop was co-located with the Global Wireless Summit (GWS), which ensured high visibility and a large audience on an international and beyond the EU level. The workshop was under the theme “The Importance and Impact of Ambient Assisted Living Applications”.

The workshop was held as a half-day event and attracted an audience of more than forty (40) participants. In total, there were five eWALL presentations to give the viewpoint of the project perspective in the context of ambient assisted living (AAL) applications.

2 Summary of the Workshop

2.1 Overview and Motivation for the Third Project Workshop

The Global Wireless Summit (GWS) is an annual highly international event, held on various locations worldwide. GWS 2015 was held in Hyderabad, India and provided an exciting platform for the participating researchers, manufacturers, academicians, government and policy representatives, to network, present their work, and collaborate on the topic of the role and impact of Information Communication Technologies (ICT) and how these revolutionize the way we live, work, think and interconnect.

Internet of Things (IoT) is a prominent ICT paradigm, which enables information flows from/to and among highly distributed, heterogeneous, real and virtual devices (sensors, actuators, smart devices). Although, the IoT concept originated to enable communication among various types of devices (i.e., physical objects) for the provision of smart applications, IoT has evolved to enable forms of collaboration and communication between people and things, that is further to evolve as an enabler of human-bond communications. From a technical point of view, the IoT is defined as the Internet of connecting the human and things with identifiers and/or information processing capabilities. Comparing with the existing networks, the IoT has the following significant characteristics: connecting directly with the physical world without human intervention; autonomic networking of the IoT nodes; and autonomic interaction between the IoT nodes.

In an IoT scenario, ICTs are merged with traditional infrastructures to serve as platforms for the gathering of data that can be utilized to deliver personalized services to the user. Although, a subset of an IoT entails machine-to-machine (M2M) communications and applications, IoT applications have evolved to be highly personalized and to have the human user, and not the devices, as the driver of the IoT scenario dynamics. A typical IoT scenario entails a successful and cooperative interaction among things and individual users in an environment known as the 'smart home' (also, referred to as Ambient Assisted Living-AAL) and expanding beyond to the environment of a smart building and smart city. Such cooperative interaction is enabled by a large number of heterogeneous geographically distributed sensors, and Internet-enabled devices, collecting and transmitting data, to be real-time processed for the delivering of smart and personalized IoT applications. As a result, an IoT scenario needs to handle many hundreds (sometimes thousands) of sensor streams. At the center of the smart home IoT scenario is the human who is the determining factor for the number, purpose, direction and frequency of the sensor streams.

IoT was a prominent aspect of the discussions and presentations held during GWS 2015, and the event itself joined together under the theme of 'Democratizing Communications,' the 18th International Symposium on Wireless Personal Communications (WPMC), the 5th International Conference on Wireless Communication, Vehicular Technology, Information Theory and Aerospace & Electronic Systems (WirelessVITAE), The World Wide Security and Mobility Conference (WWSMC), and the 3rd International Conference on Communications, Convergence, Content and Cooperation (IC5), thus bringing together numerous renowned and international players from various IoT and AAL related areas to network and exchange ideas and visions. Fig. 1 shows a few snapshots of the participants.

Fig. 1 a) Participants community at GWS2015 and Third Project Workshop.

Therefore, the GWS 2015 platform was the right place and time to disseminate the eWALL result and their impact in the context of Internet and Things (IoT) and AAL, as well as the importance for the human user, the society and the economy.

The technical sessions of GWS 2015 were designed to include Workshops from leading research groups and technical sessions studded with papers from outstanding scientists from across the globe.

In terms of location, the GWS2015 platform provided a timely and useful venue to disseminate the eWALL project results outside of the boundaries of the European Union, and in addition on target in a quickly developing country, in a moment when AAL, smart cities, and e-Health services have taken a high priority with the Indian national policies, thus enabling an ideal platform for exploiting and deploying the eWALL technology and results in real life in a global context. Further, the chosen location, also allowed for carrying out further some of the policy objectives of the EU-funded research, namely, promoting and strengthening the EU research.

2.2 Workshop Program in a Glance

The Workshop Program featured the following eWALL presentations and participants.

1570224200	Improving the Trustworthiness of Ambient Assisted Living Applications; **Elias Z. Tragos[1], Pavlos Charalampidis[1], Alexandros Fragkiadakis[1], George Lambropoulos[2] , Sofoklis Kyriazakos[2];** [1]FORTH-ICS,[2] Converge SA**; Greece**
1570224206	Requirements and Challenges in Evaluation of Systems for Independent Living of Senior Citizens; **Antun Kerner, Antonija Marinčić, Ana Koren, Dina Šimunić ,Ramjee Prasad**; *Faculty of Electrical Engineering and Computing, University of Zagreb*, **Croatia**
1570224166	Virtual sensing environment for care at home; **Aristodemos Pnevmatikakis;** *Athens Information Technology, IRIS Laboratory, Athens*, **Greece**
1570224167	Expression recognition using graph based feature selection; **Krasimir Tonchev, Nikolay Neshov, Agata Manolova ,Vladimir Poulkov**; Technical University of Sofia, **Bulgaria**
1570213206	Participatory Heuristic Evaluation of the First Iteration of the eWALL Interface Application**; Clara Schaarup[1], Louise Bilenberg Pape-Haugaard[1], Stine Veje Hangaard[1], Albena Mihovska[2] ,Ole Hejlesen[1]; [1]Department of Health Science and Technology, [2]Center for TeleInfrastruktur;** *Aalborg University, Aalborg*, **Denmark**
1570195309	Non Audio-Video gesture recognition system; **Razvan Craciunescu, A. Mihovska ; Center for TeleInfrastruktur;** *Aalborg University, Aalborg*, **Denmark**

All featured presentations have been published in IEEE Xplore (://ieeexplore.org), one of the largest and most prestigious publication databases in the world, thus, providing a permanent dissemination record for the eWALL research and related results. Fig.2 Panel discussions with eWALL representatives Prof Dina Simunic and Prof Ramjee Prasad.

Fig. 2 shows a snapshot of the workshop audience during discussions.

2.3 Outcomes of the Workshop Discussions

At the center of the smart home, in general, and e-Health, in particular, IoT scenario is the human who is the determining factor for the number, purpose, direction and frequency of the sensor streams. Therefore, we refer to this scenario as a human-centric sensing (HCS) scenario. Jointly, with the benefits of the eWALL technology, arise a number of critical challenges, namely, the fact that the underlying elements and infrastructures are highly heterogeneous (e.g., sensors, RFID, smart phones, etc), are location-specific, and resource-constrained. In addition, with the continuous growth of Internet-enabled devices, comes the challenge of complexity and scalability of the HCS-based IoT networks that would grow exponentially with the growth of Internet-enabled devices. These challenges require a new approach to modeling the IoT networks that also reflects on the dynamics of the topology that comes from the unpredictability of the possible IoT connectivity links that may occur in a period of time. This obviously makes the network topology highly variable, and therefore, the currently proposed models are not able to reflect correctly on the resulting implications in terms of the efficiency of the resource provisioning, routing, quality of service (QoS) and security mechanisms, to mention the most critical ones.

The dynamics and complexity of the e-Health personal network topology is determined by the user needs. A healthy individual may use only one or two wearable devices (sensors, smart watch) to monitor his/her sports performance (e.g., the Adidas mi-sensor shoe technology) or out of curiosity (e.g., fitbit). An elderly or a chronically ill patient (e.g., suffering from asthma, COPD, diabetes, heart disease or in rehabilitation after a brain hemorrhage or a spinal cord injury), would require a more elaborate monitoring, thereby, increasing the complexity of the personal e-health network. In an AAL scenario, there would be a minimum of one such network, and the maximum number of possible personal networks will depend on the number of individuals forming a household, while the expected individual personal network complexity will be dependent on the health status of each AAL household member. It would be safe to assume that in a household of two healthy adults and their healthy children, the personal network will be of minimum and even in some cases zero complexity (if the users are not interested in daily statistics about their physical activity). In a smart-home or in-building (e.g., hospital) environment, it can be expected that several personal networks will be co-existing and cooperating.

The smartphone collects the meaningful data aggregations from the body sensors. Data interaction may be initiated directly by the user (e.g., to check the real-time step counts and the percentage of the physical activity goal completion) or by the AAL system (e.g., to trigger alarms based on real-time processing of the aggregated data). The second type of interaction would require a rea-time communication link to external (i.e., secondary) users enabling two sets of functionalities, namely, service and parameter configuration and complex monitoring.

A real-time signal processing node, also known as a 'fog node' (in Fig. 2, the smart phone can be the fog node) would receive and process the data collected by the sensors and delivered as sensor streams. Such data would be used for immediate reasoning and decision taking about the user's health status. Some data would be collected periodically to be delivered via a wireless hub and a gateway, as meta-data stream to the cloud where it can be used for building personalized user applications and retrieved on-demand. The scenario of Fig. 2 allows for the personal networks (e.g., S-BAN) also to cooperate for the purpose of resource and common information sharing. Cooperating S-BANs will be formed on-demand, as the opportunity and need arises to support a user's personal applications. Therefore, an S-BAN may comprise of personal and foreign devices, interconnected through various communication technologies, which can be termed as the human-centric sensing network (HCS-N)

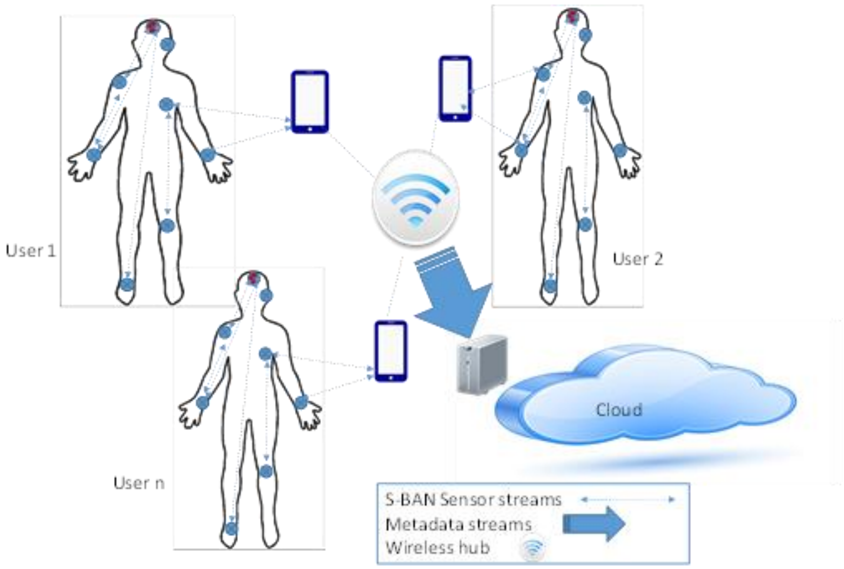

Fig. 3 Personal networks interacting in the context of e-Health and AAL.

One challenge related to personal network connectivity is driven by the fact that most of the devices would be operating in an unlicensed band. The advent of cognitive radio supposes that these devices would be able on occasions to also use unoccupied licensed spectrum. This has intensified the research towards use of non-RF technologies, such as visible light communications (VLC), making it another e-Health network connectivity enabler. VLC has the potential to release the burden of over-occupied licensed and unlicensed RF spectrum, and has the additional advantage of being security resilient, which is extremely important for an e-Health scenario. Another open issue is the need for radio channel modeling that reflects the effect of the human body and tissues on the RF signal propagation in order to enable efficient and reliable transmission of vital data.

3 Conclusions

It can be concluded that the Third eWALL workshop was a successful event, providing the basis for further exploitation of the project objectives and results. Several joint research publications on eWALL related topics can be reported as a post-workshop outcome. Currently, a spin-off project idea based on the eWALL platform is being elaborated towards national funding.