Understanding the Ambient Assisted Living systems: concepts, architectural trends and challenges

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***Abstract*—As a novel field of research AAL (Ambient Assisted Living) is still lacking a common understanding. The field is devoted to serve elder people and those with special disabilities to make their daily life tasks easier and controllable. Many efforts have been done to develop reliable systems capable of responding to the needs of the stakeholders in acceptable budget. The reusability, the integration and the implementation issues are the main concerns of the developers. For this purpose, this paper addresses the AAL systems due to their importance in the technological and societal fields. We highlight the need and urge for such systems. We also define various aspects of AAL such as the field itself and the related applications. The technical view of ALL systems will be given, along with the technologies and the tools. We discuss also in this paper the AAL architectural trends and the systems' requirements. Finally, we investigate some of the challenges facing the developments of AAL.**

***Keywords*— Ambient Assisted Living, Applied computing, Health informatics , Software system structures.**

I. Introduction

The substantial increase in the population's average age leads to an exceeded number of older persons comparing with the number of any other age group [1]. Where usually the added years are spent with multiple disabilities [2] [3]. Statistics show that the world population from the age of 65 and above, had increased by more than 360 million person [4], representing over 8.5 % of the world population [5].

All the above, made a forceful impact on the community requirements. The need for caregiving, home assistance, rehabilitation and physical support higher the expenses of countries in the healthcare domain[6]. For example, in the united states the cost of healthcare rose to $2.3 trillion in 2008[1]. Which urges affording suitable assistance systems to improve the quality of life of older people [7] and help them live an active and productive aging with an affordable cost [8].

One of the most significant social transformation of the twenty first century is the gigantic change in demography. The world population is aging. In 1980, the number of older people aged 60 and over was 382 million worldwide. By the year of 2017, this number had doubled by nearly three times, making 962 million older persons in the global population. Between 2000 and 2016, the average number, of 65+ years old people, outcome all the other age groups as illustrated in Figure . This number is expected to double by 2050, with a projection of 2.1 billion[9].

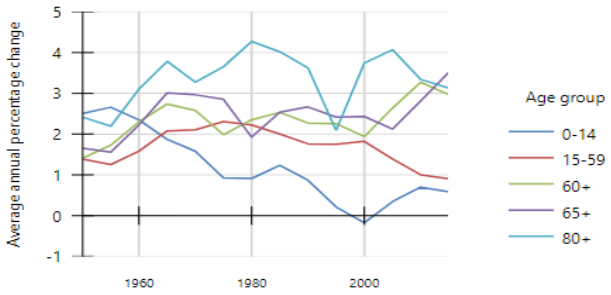

Figure 1: Average Annual percentage change between 1960 and 2016 worldwide (United Nations Department of Economic and social affairs, Population Division)

In Europe is even worst as the Figure 2 show. In 2016, the number of older people has exceeded the number of children between the age of 0 and 14 years old.

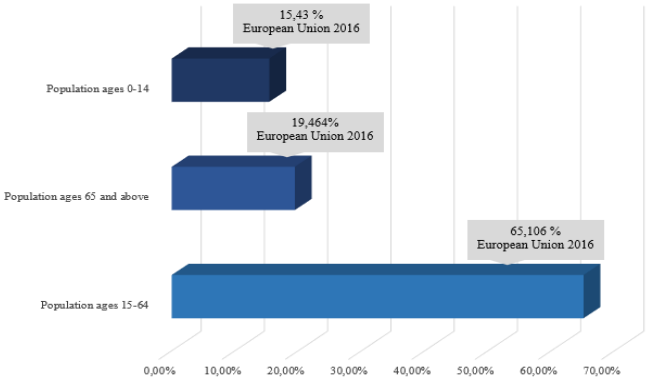

Figure 2: Population ages 65 and above (percentage of total), European Union 2016 (The World Bank, IBRD DATA)

In Morocco, this age group had doubled its size in less than 30 years. In 1990 there were one million Moroccan person aging over 65, where in 2016 this number reaches 2.4 million (The World Bank, IBRD DATA).

Life expectancy at age 65 increased from 11.4 years in 1955 to 16.2 years in 2010, with a gain of 4.8 years (Population Facts, UN). These added years are usually spent with

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multiple disabilities, which urges the need for multiple different types of senior care with significant costs such as:

- Non-Medical Home Care: it helps with personal hygiene, laundry and transportation;
- Home Health Care: it concerns Checking patients' pulse, temperature and respiration and assisting with medical equipment such as ventilators;
- Adult Day Care: provide supervision and social activities;
- Assisted Living & Memory Care: Patients requiring Alzheimer's or dementia care in memory care homes costs, on average, an additional $1,100 per month, for a monthly total of $4,8004 in the USA.
- Nursing Homes: Skilled nursing residences offer 24/7 care for all patients.

Table 1: Average Senior Care Costs by Type and Duration in the USA in 2017[10]

Type of Senior Care	Hour	Day	Month	Year
Home Care Aide Cost	$20	$160 (8 hrs. / day)	$3,520 (22 workdays / mo.)	$40,000 (250 workdays / yr.)
Home Health Aide Cost	$21	$168 (8 hrs. / day)	$3,696 (22 workdays / mo.)	$42,000 (250 workdays / yr.)
Adult Day Care Cost	-	$71	$1,562 (22 workdays / mo.)	$17,750 (250 workdays / yr.)
Assisted Living Cost	-	$123	$3,750	$45,000
Skilled Nursing Home Cost	n/a	$227	$6,810	$82,855

By taking in consideration these demographic and social shifts, governments starts by implementing arrangements and strategies to address the needs and interests of older persons[9] including those related to health care, social integration, and other forms of security and prosperity. Yet, the costs of providing such services are beyond the government's financial investment.

Many challenges face society and healthcare systems because of this demographic change as illuminated by Figure . It started with the increase in age-related diseases, which are mostly incurable such as Alzheimer's, Parkinson's…etc. The elderly become much reliant on others and in need of regular assistance. Working forces of the healthcare field suffer from shortage of professionals trained to fulfil the caregiving to these stakeholders. Which results in many complications regarding the high level of pressure and physical difficulties related to supporting the elders. Consequently, the cost of healthcare increases. Economists believe that Providing shelter, hospitals, nursery houses and assistive facilities is not the suitable solution anymore. This also makes an impact on healthcare systems that will have to cope with increasing requirements, both in quality and quantity of the offered services, and so lead to increasing expenses[11]. Additionally, 89% of the older adults prefer to stay in the comfort of their own homes[8].

Figure 3 : Social impact of the demographic change

Consequently, it is imperative to develop technologies that help older adults to age in place, provide them independency and enhance their autonomy in a human-free assistance. Therefore, Ambient Assisted Living emerges as a solution of providing all these services, with a reduced cost and high quality benefits.

II. Ambient Assisted Living

A. *Definitions*

Efforts to find solutions for mastering the demographic change have processed Ambient Assisted Living (AAL) as a novel technology discipline. It represents the new generation of senior care technologies.

Despite the fact that AAL has no universal definition[12], This concept, seen as one innovation[13], has been described as a field of exploiting communication technologies and systems' engineering, in favor of supporting individuals to maintain and continue their everyday lifestyle and enable their engagement to social activities.

AAL concept has been defined as products and services aim to constitute intelligent environments for the goal of prolonging independency, providing a valuable aging and answering to the needs of different target groups of stakeholders whom have different demands.

AAL includes theories and technologies from Ambient Intelligence (focuses on the perception of the environment), Smart Homes & domotics (focuses on controlling devices, privacy and security) and eHealth (provides necessary concepts and methodologies to integrate health related services into existing systems)[8].

The progress in several fields such as (health sensing, wireless communication, assistive robotics, Internet of things…etc.) has essentially helped the vision of AAL to become a reality.

AAL technologies have the ability to anticipate and respond to the changing needs of older adults[14]. The domain is divided into several sub-domains in order to cover all aspects of their needs[7],[15]. Person-centered, health management systems, home safety & security, activity management are all different sub-domains with different natures and different objectives. Using all above technologies AAL platforms had the ability to evolve rapidly in a disorganized and unstructured manner.

Although, most of the revolutionary platforms respect the most common AAL quality attributes such as: interoperability, scalability, confidentiality and maintainability. There is a huge gap in finding a pattern or a common structure to follow while developing such systems. Regarding the fact that many critical attributes should be

respected to achieve a satisfactory level of security, reliability, integrity and a trustful performance.

The objectives of the field:
The field of Ambient Assisted Living determined mush objectives to ensure in the systems construction covering:
The insurance for the elderly and for other special groups of peoples with different health complications and known disabilities an environment where they can peruse their social interactions actively;
It helps them increase their independency in a comfortable and secure space;
Regulate their healthcare daily needs;
Used as a facilitator for operational optimization of care services;
Influence the physical, mental and social dimensions of their quality of life;
Enhance QOL by enabling autonomy in their familiar surroundings[16];
Easing self-determined daily life tasks;
Transmit vital signs data (such as blood pressure to health care facilities), updating the person's medical records and providing key early alerts to changes in health status;

- Enhance the comfort of the user;
- simplify the daily life tasks;
- Use all the provided functionality of the environment by themselves;
- Enhance the autonomy and the mobility in the selected environment;
- Improve functionalities to insure remaining longer in their usual surroundings.

Figure 4 : Scope of AAL systems

The main scope of the AAL concept is to provide an interactive environment where the users can continue their daily life tasks and improve their social interaction all by ensuring the comfort and security. Thus, healthcare and regulating routines are highly supported all in favor of these special groups of users as illustrated in Figure . Sensing and responding to the emergencies and urgent situations is included as the prior goals of the domain.

B. AAL application area

Although its immaturity, the AAL field has embraced many objectives. The main ones are answering the needs of elderly people. Many application areas have been defined in the scope of providing better living standards such as: Safety/Security, Mobility and social interaction. These scopes are divided in three different levels. The first one is implicated with the hardware sensing and WSN. The second one concerns the data capture, data safety and IT integration. The third one is dealing with the application-oriented processes and the services[17]. Table 2 presents some examples associated to multiple application areas of AAL.

Table 2 : AAL Application Areas[8]

Application Area	Examples
Cognitive orthotics	Daily Reminders, Medication Reminders, Navigators, Wandering prevention Tools, Planners…
Continuous Health Monitoring	Vital Signs Monitoring, Sleep Monitoring, ADL Monitoring , Tele Health Systems, Tele Rehabilitation Systems
Emergency Detection	Fall Detection, Medical Emergency Detection, Hazard Detection
Emotional wellbeing	Social Connectedness, Facilitating Communication
Persuasive Applications	Well-being Promotion, Medical Compliance

C. Classification of AAL services

Having a clear classification of living assistance services is a necessity to determine the target stakeholders, and establish a model of the particular environment, to be able to draw a clear vision of the architectural model for such systems.
Designing and building a stable and an evaluative Ambient Assistance Living system needs a clear classification for the AAL services. The main concern is to determine the living assistance domains and classifying them, in order to include every assistive service that may eases daily life in all aspects. The ''classification scheme'' in Table structures these domains into nine classes.

The primary classification category starts by dividing living assistance into ''indoor'' and ''outdoor''. Indoor assistance services are the ones presented in a determined space: in apartments, homes, cars, hospitals, and elderly care homes. They can be built upon a well-known hardware/software installation in the specified location, thereby providing a stable environment.

Outdoor assistance services aim to support persons during activities outside their homes. It is also divided into two classes (i) firstly at work: to allow an active and productive aging for elderly people and suitable environment for those with physical disabilities in a defined workplace and a stable environment (ii) in the community: while shopping, transportation, and during other social activities. These services have to face with highly unstable environmental conditions such as special equipment and technical installations [15].

Table 3 : Classification of AAL services [15]

	Indoor	Outdoor	
		Community	At Work
Emergency Treatment	Prediction Detection Prevention Action		
Autonomy Enhancement	- Drinking - Eating - Cleaning - Cooking - Dressing - Medication - Scheduling	- Mobility - Social Activities - Social Interaction - Shopping - Traveling - Banking	- Collaboration - Mobility - Information - Learning
Comfort	-Safety - Security - Privacy - Logistics	- Activity Management - Social Inclusion - Entertainment - Navigation	- Process Awareness - Transportation - Adjust Workplaces

Other dimensions can be used to specify the type of service provided. According to Table the attention is given to three types of services:

1. ‘’Emergency treatment’’ services that predict and react toward critical conditions that results in an emergency situation;
2. ‘’Autonomy enhancement ‘’ services which increase the independence of the assisted persons;
3. ‘’Comfort’’ These services ease the daily life, but are not necessarily required. In addition, they cover all areas that do not fall into the other presented categories.

Stakeholders have different capabilities and needs which can develop over time, these needs can change and determine the categories and types of services. Therefore, this can change the presented classification. Moreover, ‘’emergency treatments’’ are considered as the main core of any AAL service portfolio, due to the increasing of emergencies coupled with the decreasing need to deal with such circumstances.

III. AAL SYSTEMS

To meet the requirements of stakeholders, answer to their needs and meanwhile respect the circumstances’ change, AAL systems evolves significantly [6]. An AAL system by definition is a socio-technical system affording intelligent environments for the wellbeing of the stockholders , mostly by means of networked artefacts embedded in AAL spaces[18],[12],[13].

AAL systems embrace different spheres of application [6], and group them into categories of services based on the variation of location and the main purpose of the core system[7].

The scenarios that AAL is supposed to address are complex. A key source of this complexity is the inherent heterogeneity of the end-user population, their housing arrangements [6], and their physical limitations[8]. Nevertheless, Designing AAL systems requires the respect of several characteristics and norms[14] [15]. It should be adjustable. It has to adapt to certain capabilities and to react to the dynamic changes in devices. As well as it should adjust to the environmental limitations.

AAL platforms should have the ability of anticipating the user’s desires as far as possible. Sensors and perception devices should be affordable likewise the actuators of the system. Non-invasive or invisible devices are not recommended. Many core functionalities should be highlighted while the conception. The system should be able to sense, reason and act over its environment. The ability to communicate and interact with the surrounding area are highly suggested.

The diversity, the divergence and the multiplicity of AAL systems engineering, results from the lack of proceeding with a unified model and a standardized architecture to implement and pursue while the construction of such systems. AAL systems must provide support for acting in a context-aware and personalized way which urges the reaction and the proaction as two examples of adaptive response that must be emphasized in order for the system to live up to what AAL requires.

The main task of the assistive systems is to design a patient-centered applications that require the understanding of the health related activities [19].

A. The systems requirements:

The majority of the existing personal emergency response systems uses emergency push buttons that can be inconvenient in critical emergencies, such as falling or unconsciousness[20]. This provokes the need of systems that do not require the involvements of the user. Therefore, there is a significant trend to AAL systems, based on ‘’Auto-Sensing’’ (Using Wireless Sensors Network and other sensing equipment) and ‘’Auto-Acting’’ (Using Actuators such as alarms, phone calls, robots…etc.) which should be able to scan the local environment, obtain useful data, process this data and act according to the assembled knowledge built out of treating the collected information.

This field of research aims to provide the monitoring and tracking of Activities of Daily Living (ADL) by the use of smart devices embedded in the end-users space[8]. It acquires awareness of common ADL such as falls, stair negotiation and sitting, in order to provide the users with a suitable degree of assistance[21]. These are the reasons behind the need for systems that allowed the fastest reactions to deal with real time changes. Furthermore, they have to sense the presence of the stakeholder.

AAL Systems need to be affordable, considering that affording a caregiver in not an available option of all stakeholders. They also should depend on the special needs of each user because of the enormous variation of demands between elderly people and people with physical disabilities, such as the visually and hearing impaired.

The heterogeneity of stakeholders gave a strong motivation for engineers to aim for a standard architecture to stand AAL systems on, so they can be easily adapted and maintained, giving the fact that AAL systems rely on various technologies and mismatched equipment. Thus, Personalization is a highly demanded requirement. The incorporation between the characteristics and preferences of each stakeholder is mandatory when serving the user in the virtual realm [18].

To help structuring a solid, reliable AAL system many requirements and major developments should be proceeded in different fields of research, among them[7]:

- Sensing : in AAL applications, there is a need of intelligent and innovative sensors "smart sensors" capable of collecting data, such as measuring physical and electrical quantities, miniaturized, made of low cost materials, able of taking place in anything, anywhere, anytime (home, outdoors, vehicles, public places, etc.) and qualified to perform some processing on the node level in the network.
- Reasoning: a process that extracts knowledge by processing data collected by sensors and converting it into useful information to learn from it. This feature allow not only the detection of activities (such as motions and the detection of emergencies), but also to predict and anticipate possible status and provide support in decision-making.
- Event definition: adapt an event driven architecture to endorse the production, the detection and the consumption of reactions to events. The design of AAL systems should be able to transmit events among loosely coupled software components and services.
- Acting: systems and services, which acts proactively (based on the knowledge resulted from the reasoning) to prevent, compensate, support and provide well-being and increase the independence of senior persons.

Finally, many primary conditions are also important and not to be neglected, such as affordability, dependability, heterogeneity, usability, suitability, extensibility, adaptivity and resource efficiency. The main characteristics of such a system should also contains these conditions.

By respecting all of the quoted earlier standards, the main work can be driven toward a comprehensive and complete vision of the desirable system to be implemented.

B. AAL technologies

The development of ambient intelligence systems demands an interdisciplinary approach, borrowing methods and techniques from computing fields, such as:

Ubiquitous / Pervasive Computing,
Context-aware Computing,
Human-Computer Interaction (HCI)
Artificiel Intelligence (AI) [18]
Home Care Robotics and Automation
Interaction Technologies (such as voice output, eye-tracking)

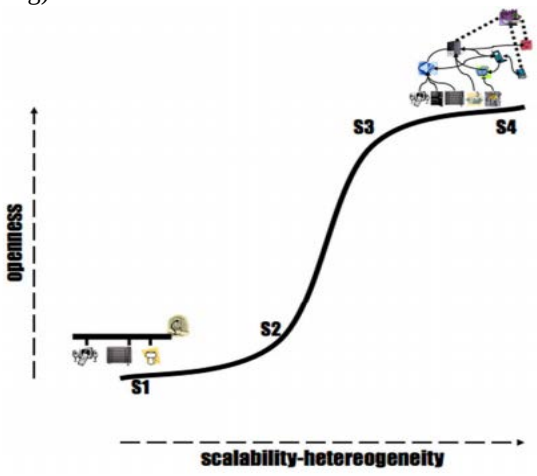

Figure 6 : the evolution of domotics technology[22]

The evolution of many other technologies had encouraged the AAL domain to be a reality, such as the tracking systems, the domotics technologies…etc. All these technologies can be robustly exploited for different purposes in order to come up with a reliable AAL environment.

C. AAL tools

From a physical perspective: the topology of the AAL system consists of tens to hundreds of different interacting nodes (using the sensors) ranging from tiny sensor nodes (with low computational power) up to powerful machines interacting together.

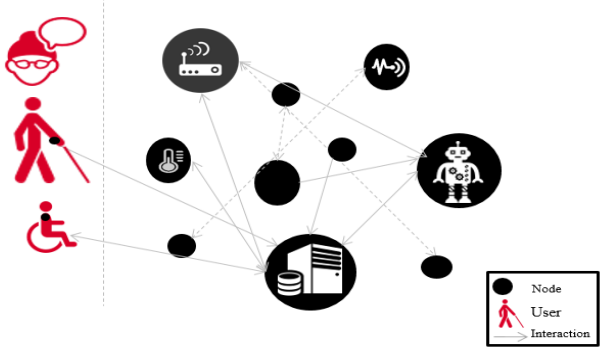

Figure 5. Physical perspective of AAL System

Figure presents generally a physical overview of an AAL system with its major elements, the observation leads us to the fact that an AAL system relies on using several nodes presenting the sensors, actuators and data servers in a direct interaction between one another and toward the user.

Several AAL systems proposals based their performances on different types of sensors to measure weight, blood pressure, glucose, oxygen, temperature, location, and position. Each system is deployed using a communication technology such as Bluetooth, USB, and Ethernet, among others[20]. In addition, the most used interfaces are developed for tablets and smartphones, although applications for health systems or set-top boxes can be found. Generally, these kinds of systems are focused on solving basic issues in services such as healthcare provision, disease management, diet and fitness, personal health records, and person location.

The overall system is based on the interaction between the sensors and the actuators and their impact on the end user. Sensors are the items responsible for collecting data from the stakeholder's environment. The measures collected helps identifying the context and triggers several actions of the actuators. Based on different services and process actuators reacts on the users' space to provide suitable actions in appropriate timing.

IV. Architectural Trends for AAL Systems

By definition, the architecture of a system gives an overview of the anticipated system to be implemented, it is the cornerstone design that defines quality requirements such as dependability, cost, performance…etc. of the overall solution. It plays an essential role for the quality achievement. Furthermore, it comprises software elements (externally visible), properties of those elements and the relationships among them. For the time being, there is no commonly accepted architecture of AAL systems [23], different approaches are used to meet the functional and quality requirements in such systems[24].

AAL systems provide assistance that has two facets:
An easy access for the assisted person to autonomy enhancement or comfort services, home control, social interaction…etc.

The anticipatory assistance of the assisted person with proactive emergency treatment such as automatic alarms, home automation, notifications…etc. The system should also be kind of closed loop controller that senses its environment and especially the persons living therein and influences the environment with its actuators.

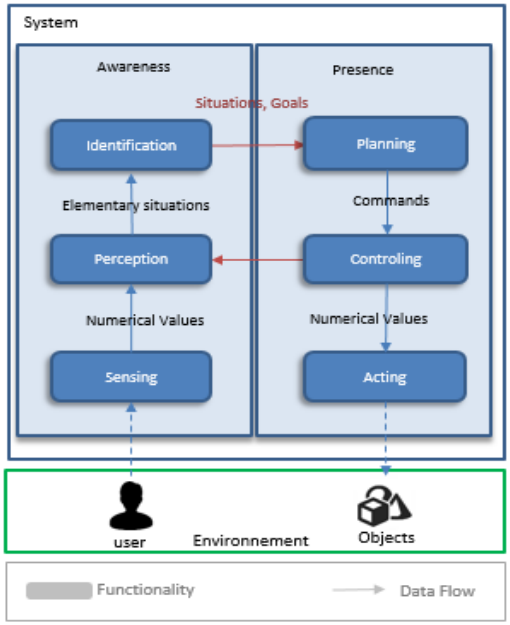

Figure 7 : Functional Blocks of AAL system[15]

Awareness of the system can be decomposed in three functional blocks: Sensing, Perception and Identification. While the presence is decomposed into Planning, Controlling and Acting. This decomposition is clear in the following Figure presentation. In which the system should exchange data with the surrounded environment and the target stakeholder while facing the mentioned challenges and respecting the required principals.

Figure 9: SOA general concepts

Many architectural frameworks, models and patterns were introduced as suitable infrastructures for AAL systems [23]. The overall problem that appears from using directly these technologies is the ambiguity revealed when the space is embedded with several systems in order to introduce a system-of-systems. In our previous researches we caught in the middle of the heterogeneity problem when we embraced SOA (Service Oriented Architecture in Figure) as a reference for AAL systems' architectures[7].
The description of services and the interaction between the service requester and provider facilitates the distribution of tasks. What we discovered during the process of implementing the infrastructure is the numerous types of patterns, which gives many different directions in constructing the systems. The EDA (Event Driven Architecture) is also a promising pattern for AAL due to the notifications that relies in the event triggering as presented in Figure 10.

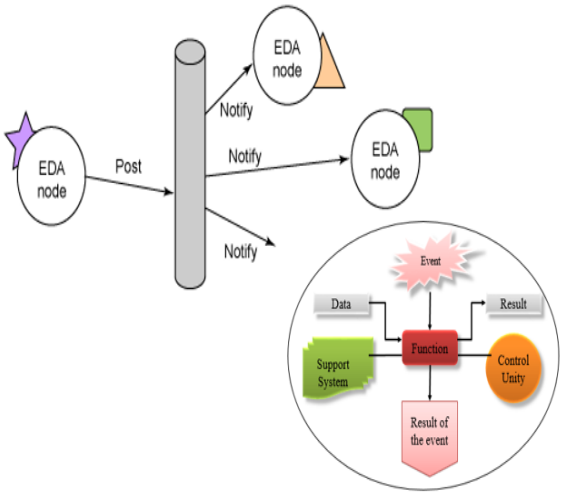

Figure 8: General vision of an EDA node system

These patterns present the interactions of the system from the weakly coupled one to the decoupled ones, as well as the one to one communication in the SOA case and the many to many in the EDA case. Even the synchronization of the system is chosen between the synchronous and the asynchronous one. Where in an AAL space there is a need of

these different types of communications all at ones. Some services of the system require a synchronous communication type due to the emergency of the situation and the need for the fast action from the actuators. Other services should have an asynchronous communication to preserve resources and do not waste energy and higher the expenses of the system. We discovered that even if the real time responses are inevitable there is a huge need for some separated services. Where comes the SOA 2.0 as a new generation combining the two concepts under the same umbrella. The CEP (Complex event processing) is also a promising pattern for AAL applications where the real time events are processed with the help of historical data to detect and predict situations.

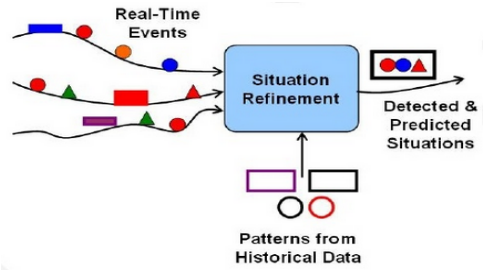

Figure 10: CEP real time events processing

Technologies such as PaaS, FaaS, IaaS and SaaS reduces the complexity of building and maintaining the infrastructures of the applications. Thus, there is also the complexity of combining them together to come up with a complete smart environment where the costs of maintaining are lower and the scalability is higher.

- Architectural patterns :

In software architecture, many patterns are proven as a structural organization schema for the software system.
Layers pattern helps structuring the applications that can be decomposed into groups of subtasks each of which is at a particular level of abstraction. The Client-Server pattern is composed of a server component that provides services to a number of client components. This pattern may also be considered as a layered pattern with two layers where the clients are being the higher level and server is the lower level. The Master-Slave pattern that support parallel computation where the work is distributed from the master to the slaves, which is widely applied in embedded systems, and fault tolerant system. Otherwise the pipe filter pattern provides a structure for the system that produce a stream of data where each processing step is encapsulated in a filter component and data is passed in pipes. This pattern divides the task of a system into several processing steps these steps are connected by the data flow [25].
All these patterns provide a rich background to implement AAL applications. Thus, the diversity and the divergence of each of those structures restrict the scalability and narrows the possibilities of integration. The overall views of the system architecture are hazy for developers due to this ambiguity and the complexity of AAL environments.

- Architectural Patterns Vs. Design Patterns

The architectural patterns are structural organization schema for software systems where the design patterns offer a common solution for a common problem in the form of classes working together. Design patterns do not influence the fundamental structure of a system. It only affects a subsystem and it may help implementing an architectural pattern.

V. AAL CHALLENGES

A. User & Environmental challenges

The main purpose of AAL systems is to aid handling the regular basic tasks for the stakeholders within an environment. Therefore, many challenges should be taken into consideration, evaluated and treated, in order to design an efficient, suitable and stable system. The challenges are divided into two groups: user related challenges and environment related ones.

Some of the main conceptual confrontations of the system are the heterogeneous capabilities, needs and habits that vary from one stockholder to another; elderly people have particular needs different from users with physical disabilities. Some of the individuals have an incremented demand for regular assistance due to the changing conditions in each particular situation. Moreover, this specific group of users do not handle well the technical problems nor have tolerance to the technical complications. The assisted person should also be able to control the system and not reverse. Although, the system should share the user data with data centers and institutions such as hospitals, involved organizations…etc, but at the same time, it must preserve privacy and secure information and data of the relevant user. It should also maintain his safety and conserve a highly protected space[26]. The system should also be fair in terms of space, lifetime and budget. It has to be highly efficient despite of the limited resources of the system.
The particularity of the end users implies other challenges to the interface designers. In addition, numerous details are fundamental such as Human-computer interaction, where the designer is supposed to take advantage of the interactive technologies in order to simplify the communication between users and the system, effectively and in an ergonomic way. Therefore, Usability and accessibility to the system are both critical claims of all stakeholders[27]. Lastly, the designer should take into account the information architecture and saving policy in order to structure and organize the data within the system itself and with the connected devices, data centers, edge applications…etc.
However, there are still many challenges facing the implementation of such environments. Starting by the divergence of capabilities, needs and habits that vary from one stockholder to another. Moreover, users usually are not friendly to the technical problems and they do not show tolerance to the technical complications[7]. Environmental challenges are also present. The nature of homes, workplaces, hospitals…etc. may vary considerably. Some of these targeted environments may integrate an AAL infrastructure while others would not have such an ability.

Setting up a complex AAL space consists of gathering software and hardware elements under the supervision of deployers with expertise and have a fundamental knowledge of the field. They have to be capable of maintaining the resulted AAL system and keep it up to date.

B. Design and implementation challenges

The implementation of AAL systems requires a strategy of applying to be adopted, in order to create an optimal yet a flawless design. A successful design can be achieved only by following predefined practices, fundamental methods and suitable proceedings.

The general structure of information and technology systems have an impact on their reliability, trustability, performance, maintainability and therefore its lifetime. AAL systems are highly valuable. Which recalls of the major role of maintainability and the ability to integrate novel devices and several technologies among the same system structure.

Complications in the interaction between the user and system interface should not be present. Implemented devices should be able to reach requested services easily using an adequate mapping service [28]. The system should also be fair in terms of space, lifetime and budget. Finally, how to encourage people to join a mutual assistance, community and put their trust on its confidentiality, security and safety are the biggest challenge of them all.

VI. CONCLUSION

The recent statistics shows that earth population grow older day after day, and it forecasts that this situation will be worst in the future. Therefore, the world is relying on ALL field to face the issue and reduce its effects on the economy and well-being of the humanity. In this paper, we present the general aspect related to the AAL systems and the technical characteristics. We also, presented the latest paradigms and architectural trends related to AAL. Like any other technologies, the AAL field is facing challenges that hinder it development. Challenges related to users, environments, design and the implementation of the systems. These challenges should be addressed in research in unify and standardize the architectures and the models of AAL systems and applications.

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