Assessment of Domestic Well-Being: From Perception to Measurement

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Nowadays, there are plenty of sensing devices that enable the measurement of physiological, environmental, and behavioral parameters of people 24 hours a day, seven days a week and provide huge quantities of different data. Data and signals coming from sensing devices, installed in indoor or outdoor environments or often worn by the users, generate heterogeneous and complex structured datasets, most of the time not uniformly structured. The artificial intelligence (AI) algorithms applied to these sets of data have demonstrated capabilities to infer indices related to a subject's status and well-being [1]. Well-being is a key parameter in the World Health Organization (WHO) definition of health, considering its physical, mental, and social spheres. Quantitatively assessing a subject's well-being is of paramount importance if we want to assess the whole status of a person, which is particularly useful in the case of ageing people living alone. Assessment allows for continuous remote monitoring to improve people's quality of life (QoL) according to their perceptions, needs, and preferences. Technology undoubtedly plays a pivotal role in this regard, providing us new tools to support the objective evaluation of a subject's status, including her/his perception of the living environment. Its potential is huge, also in terms of support to the healthcare system and ageing people; however, there are several engineering challenges to consider, especially in terms of sensors integrability, connectivity, and metrological performance, in order to obtain reliable and accurate measurement systems.

Nowadays, technology is requiring "smartness" (just think about smartphones, smart homes, and Smart Living Environments (SLEs)); e-health and m-health (using information technologies and mobile devices) are becoming key factors when patients are not able to meet caregivers or to go to the doctor. In combination with SLEs and Assistive Technology (AT), it is possible to put in place new forms of support and activities for ageing populations, while also responding to the need to reduce outpatient visits and travels to hospitals. However, at present very few domestic environments are equipped with smart sensors and platforms that are able to connect at-home people with medical personnel when necessary.

On the other hand, the importance of ageing at home (considerable as an individual right) is evident. In fact, the house represents a familiar surrounding where people want to keep living; this provides an improvement in terms of well-being and lightens the load on the healthcare system. Therefore, it is of paramount importance to develop and diffuse age-friendly housing (AFH) to citizens. Indeed, this allows ageing people to live in environments compatible with their evolving needs and preferences, fostering their autonomy, letting them remain active and healthy as long as possible, out of institutional care settings (thus also reducing both load and costs on healthcare systems, and providing a better QoL for vulnerable citizens [2]), likewise promoting their social inclusion and engagement (Fig.1). In fact, the house is the environment where we spend most of our time, particularly after retirement; hence, it inevitably impacts on our physical, social, and mental well-being.

What is more, "silver" economy is a sector involving huge resources and attracting a lot of interest, since the population is getting older fast (together with the healthcare costs [3], [4]): in Europe, the share over 65 years was 19% in 2017 and is expected to grow to 29% by 2060.

Therefore, the existing building stock should experience major changes to become smart as well as age-friendly. Particular attention should be paid in case of diseases or disabilities, which result in a greater requirement for assistance and adaptation of housing, to foster autonomy while providing the needed support (e.g., in case of people with sensory disabilities [5]). However, most living environments in both rural and urban areas are still unfit to accommodate the needs of older people to age in place. A change of perspective is crucial to explore the needs and preferences of ageing people (identifiable with the help of informal caregivers who are closely involved in providing daily assistance). The relevant stakeholders should coordinate their actions to provide supportive and assistive home environments as an alternative to hospital care and nursing homes, pro-actively approaching older people to better understand their housing needs and provide them with specific services and solutions. It is time to focus on the development of suitable technologies and systems able to make

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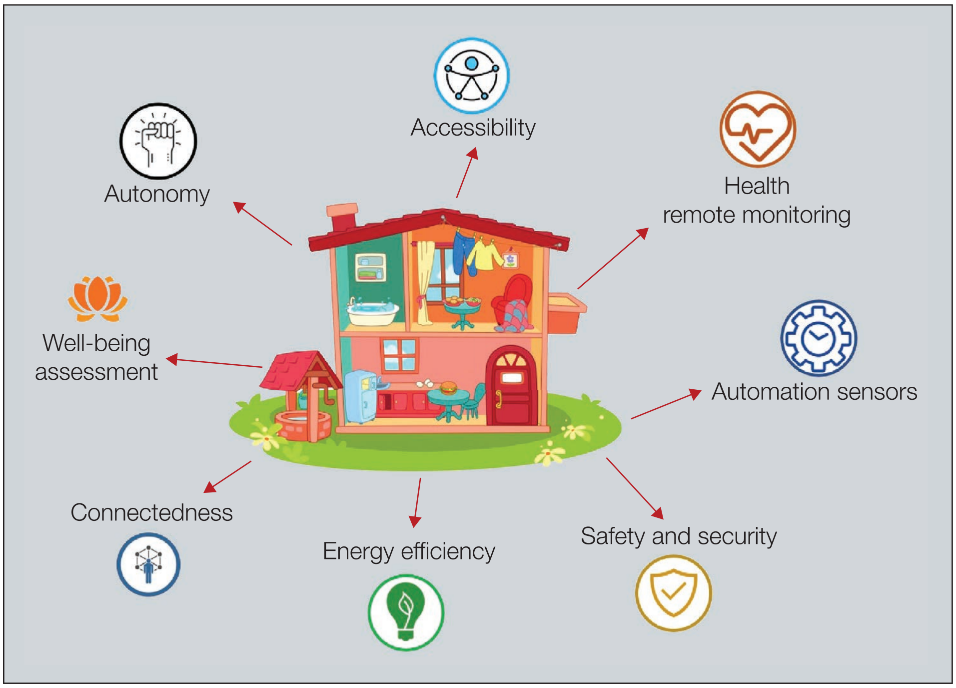

Fig. 1. Fundamental proprieties of a smart housing.

to adapt living environments to deal with this type of emergency, ensuring the measurement of health, socialization, well-being, comfort, and hygiene of inhabitants [7]. Alongside, it is paramount to implement the remote monitoring of people at home, through tele-assistance and measured data shared via cloud, thus ensuring timely health assistance, while maintaining social distancing and, therefore, reducing the risk of contagion.

The final objective of AFH is the delivery of total care in the home environment (being more cost-efficient and effective in terms of health outcome), especially when real world social and physical interactions are not possible for prolonged periods. This includes the cases of COVID-19 quarantine and people requiring particular protection from a potentially harmful infection (e.g., people with co-morbidities like cancer or diabetes), who constantly need proper care assistance. SLEs can provide significant contributions to the management of an emergency, not only for healthcare delivery, but also from a social point of view, as described in Table 1.

living environments "smart": sensors and monitoring tools undoubtedly play a key role in this (digital solutions can support health, well-being, social connectedness, and fun across the life course [6]). Moreover, it is also important to introduce these technologies following widely accepted certification schemes, to regularize these environments and have standard systems that can be managed according to shared procedures. In this way, a big amount of data, particularly coming from ageing people, would be available and could be analyzed (thoroughly taking into account privacy, data protection and management matters, in compliance to the "General Data Protection Regulation – GDPR, Regulation (EU)2016/679"). This would lead to the development of data-driven healthcare and digital health services that could be extremely useful for the whole healthcare system, also allowing the delivery of personalized medicine. AFH should become a key public policy, and a certification scheme could help the stakeholders become aware of the issues in the present buildings. Moreover, this strategy would help to define proper tools and policy frameworks to support healthy and independent living.

SLEs: Benefits for Ageing People, Also During Pandemic Emergency

The measurement of well-being, which includes personal, physical, social, mental, and health parameters, has become a need in the last several months, during the lockdown period due to COVID-19 emergency. As a matter of fact, fragile people should be protected, and smart technologies can limit the risk of contagion, also supporting the social relations of at-home people. Indeed, the COVID-19 pandemic has increased the interest of government, authorities, and public and private healthcare systems in SLEs for ageing people. There is an urgency

Role of Measurements and Sensors in SLEs for Ageing People

Once the housing needs of ageing people are understood, it is necessary to identify the measurement process, to extract the parameters of interest using sensors suitable for their measurement and the appropriate data analysis that will allow remote monitoring (Fig. 2). Analyzing the (big) data gathered by these measurement systems (which could be also merged to clinical data contained in the patient's Electronic Health Record (EHR)), it is possible to derive indicators of the inhabitant's health and well-being status. This can help to understand the proper way to adapt the environment conditions to the dweller's needs, improving well-being perception and QoL. In particular, the SLE offers remote monitoring and social connection opportunities, providing data to be processed through AI algorithms, deriving useful parameters to support decision-making (which we can also refer to as "Data-Driven Decision making," D^3M [9]) by healthcare providers and caregivers. The confidence of the decision will surely depend on the quality of the input information, which in turns depends on the measurement accuracy of the data provided to the AI algorithms (whose accuracy contribute to the provided output) and, hence, on the sensors uncertainties. Indeed, poor

Table 1 – SLEs' functionalities in supporting the management of an emergency like COVID-19

Situation of pandemic emergency	How SLEs can support
Importance of remote monitoring of the epidemic contagion considering the analysis of big data in the measurement process.	AI algorithms represent a paramount approach in this scenario, together with big data analysis and cloud computing [8].
Relevance of monitoring of people in quarantine, also when symptoms are not so evident. Contacts between the healthcare providers and these people should be avoided to limit contagion risk.	Healthcare providers can access the data measured within the SLE to know the health, mental, and social status of people in quarantine, without any risks of contagion, making early diagnosis possible.
Prohibition of going outside without good justification (e.g., work reason). Hospitals should be avoided, as well as congregations of people (especially if chronic or immunocompromised) in medical waiting rooms. Medical home visits are not recommended.	Tailored coaching services are identified to improve the QoL of at-home people, who are able to remotely connect with healthcare providers in case of need. The measurement of emotion recognition and well-being can provide more tailored services.
Many visits and treatments are postponed, with the risk of delaying early diagnosis of a disease or decreasing the quality of therapy, thus making treatment and care more difficult and less effective.	Data from the SLE are analyzed through AI algorithms to promote early diagnosis and prompt clinicians' intervention.
High risk of loneliness and social isolation, which can worsen the well-being status of fragile people. Rural/remote areas in particular should have the same opportunities as others.	SLEs can tackle social isolation, helping ageing and fragile people to stay connected with their family, friends, and communities of interest. Equal access and quality of care are guaranteed through remote monitoring.

information quality will lead to wrong decisions (Garbage-In-Garbage-Out principle, GIGO). Metrology can surely help in this field, acting as "the science of information quality," to support the identification of different sources of uncertainties at different levels of the D^{3}M process, namely measuring, processing, and decision uncertainties [9]. Numerical simulation, such as the Monte Carlo method, can help to estimate the measurement uncertainty of the whole system (expressed as reported in the Guide to the Expression of Uncertainty in Measurement – GUM) and determine how input uncertainties propagate through the measurement chain, until arriving to the final output of decision-making process.

The smart environment is also endorsed by other smart city technologies, such as smart logistics (e.g., automatic vehicles to properly distribute food and medicines, or robots to reduce contacts with infected people in a hospital during routine patient assessment or to perform diagnostic testing [10]), smart education, smart infrastructure, etc. [11]. Wearable sensors obviously play a pivotal role in these situations, providing the ability to measure (and transfer) vital parameters of interest (e.g., HR, body temperature) [12].

Different types of measurement devices can be deployed in a SLE to configure a proper monitoring system of both environment and the dweller [13], [14]:

- Physiological sensors, depicting the person's health status;
- Environmental sensors, to measure environment characteristics, parameters related to energy efficiency and comfort perception and detect certain behaviors/activities performed by the inhabitant;
- Wearable devices, to continuously monitor certain physiological parameters or the level of activity;
- Smart objects, to help the tracking of the activities performed by the subject.

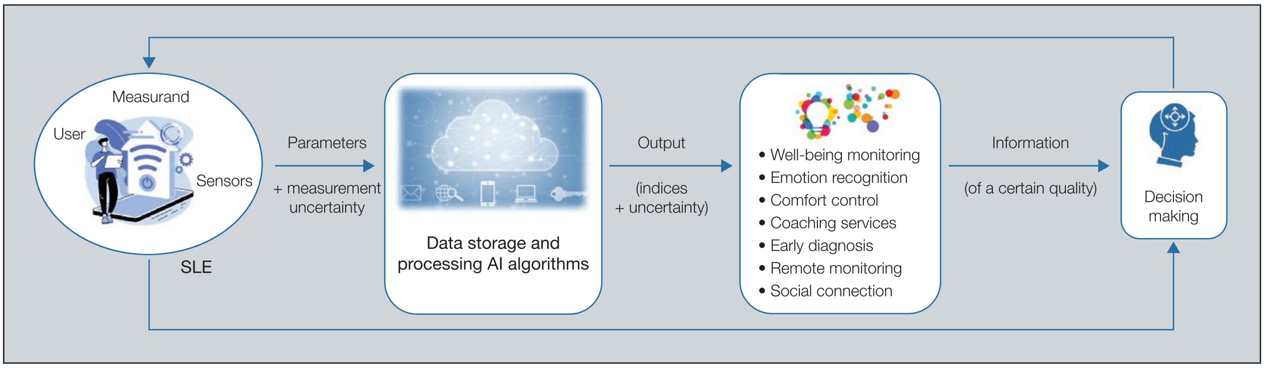

Fig. 2. Smart Living Environment measurement process.

Fig. 3. Examples of sensors useful in SLEs.

Some useful sensors that can be deployed in a SLE are reported in Fig. 3 and in Table 2, where the measured parameters, the required measurement range, and the required accuracy are also reported.

Therefore, it is possible to derive indices related to the well-being of inhabitants, which are significant measures of their physiological, mental, and social status and can be quantified in an objective manner with a determined level of accuracy, depending on the uncertainty of the sensors constituting the network. This is important to adopt timely interventions aimed at improving the dwellers' QoL.

Nowadays the choice of sensors is mainly directed to the unobtrusiveness of the sensors and favors non-contact and minimally invasive ones (i.e., smartwatch, which is not different from a common watch). In fact, if proper non-invasive sensors are used, the inhabitants can perform daily activities as usual, without the influence of the measurement devices employed in the SLE where they live. This is important, for example, in the case of emotion recognition: if cameras were used, users could be reluctant to freely give space to emotions, and, on the contrary, they would be induced to hide them (and privacy issues would inevitably arise). On the other hand, if no sensors hinder activities in the environment, everything is more adherent to natural behavior. Also, the assessment and the recognition of the Activities of Daily Living (ADLs) can be useful to evaluate the well-being and identify eventual abnormalities possibly linked to some health issues. Wearable technologies play an important role in this field, but, despite their rapid diffusion, it is necessary to take into account their measurement properties [15], obviously influencing the output (e.g., in terms of ADL classification accuracy [16]). All these aspects related to sensors should be included in a certification scheme for AFH, to define a sort of checklist for those who design these environments, such as architects and engineers.

Measurement of Personal Well-being in a SLE: A Step Further Thanks to the AI Approach

The measurement of well-being indices can be extremely useful to classify a person's physical, mental, and social status. To this aim, the sensors deployed within the SLE are fundamental to provide big data determining these parameters; AI can provide a huge contribution in this analysis, not limiting the processing to single sensor data but properly fusing the information from different sensors and considering the different weights attributed to the various parameters in a specific training phase. This allows suitable actions to be tailored to improve the person's QoL.

In the training phase, it is important to provide the AI algorithms significant information about the parameters mostly

Table 2 – Examples of sensors that can be introduced in SLEs and related parameters and measurement range			
Sensor type	**Sensor**	**Measured parameter**	**Required accuracy (f.s. stands for full scale)**
Physiological sensors	Blood pressure meter	Blood pressure	< ±5% (f.s.)
	Body weight scale	Body weight	< ±1% (f.s.)
	Oximeter	Oxygen saturation	<±1% (f.s.)
Environmental sensors	PIR	Person presence	ON-OFF sensor
	Light sensors	Light on/off	ON-OFF sensor
	Door sensors	Door opening/closing	ON-OFF sensor
	Thermal-hygrometer	Air temperature	< ±0.1 °C
		Air relative humidity	< ±5%
	Surface temperature sensor	Floor temperature	< ±0.15 °C
		Roof temperature	< ±0.15 °C
		Wall temperature	< ±0.15 °C
	Black globe radiant temperature	Mean Radiant temperature	< ±0.15 °C
	Hot wire anemometer	Air Velocity	< ±0.05 m/s
	CO_2 sensor	CO_2 concentration	< ±50 ppm
	Luxmeter	Illuminance	< ±5 %
	Comfort sensors	Predicted Mean Vote	±0.1
	Smart fridge	Fridge opening/closing	ON-OFF sensor
Wearable devices	Smartwatch	Heart Rate (HR) Steps Walked distance Energy expenditure	< ±10% (f.s.) < ±5% (f.s.) < ±5% (f.s.) < ±10% (f.s.)

influencing well-being and conversely those playing only a marginal role, to realize a robust system that is able to provide significant outputs. For example, housing quality surely influences well-being, as well as social interactions and performed activities [17]. Therefore, it is fundamental to monitor and try to improve these aspects, as well as vital signs undoubtedly influencing physiological well-being. Behavioral patterns can be taken into account to classify the activities performed by the dwellers, identifying any abnormalities in time to promptly act (e.g., by means of a simple advice about activities to perform, or by contacting the healthcare provider in case of a health emergency). In this field, coaching is gaining more and more interest to foster a healthy and autonomous lifestyle in ageing people, setting progressive daily goals and providing appropriate feedback [18].

It is fundamental to consider the accuracy of the obtained indices, starting from the sensor uncertainty and its propagation in the measurement chain, and involving also the processing strategies (e.g., AI algorithms or features extraction techniques [19]) adopted for the computation of the indices if interest [20]. The required accuracy will surely depend on the final application of the computed parameters [21]; for example, it is unquestionable that higher accuracy is necessary to take a medical decision than to give advice about a leisure activity to improve the mental well-being.

Starting from the mentioned well-being-related indices, it is possible to foresee different services being provided to the users, with the support of distinct actors (e.g., an informal caregiver, a healthcare provider, or an emergency service), depending on the topic of the alert and on the severity of the alarm generated. Indeed, a SLE should give the dwellers the possibility to keep in contact not only with informal caregivers or a general practitioner, but also with different types of healthcare providers, including medical specialists, for example, a psychologist when a support of this type is necessary (e.g., social isolation during a pandemic emergency).

The authors of this paper are involved in several national/international projects in the field of ATs and Ambient Assisted Living (AAL) where AI approaches are used (Table 3); since the developed models and algorithms can appear vague, it is also important to use explainable AI (XAI) models [22] that support the decisions deriving from AI, thus increasing trust and usability in medical and coaching fields.

Within the frame of the Health@Home project, AI algorithms have been applied to measure the well-being (considered as user's health and mental status based on personal feelings/perceptions and daily physical activities during their normal routine) in the case of multi-resident housing, to try to discriminate among multiple dwellers [23]. The participants were asked to complete a daily survey based

Table 3 – Examples of projects dealing with AAL approaches involving AI algorithms

Project	Type	Brief description	Web link
Health@Home: Smart communities for citizens' wellness	Italian Smart Cities project	Integrated health, social services, and interoperable devices for health at home.	-
eWare – Early Warning (by lifestyle monitoring) Accompanies Robotics Excellence	AAL	Integration of lifestyle monitoring with social robotics to improve the lifestyle of people with dementia and their caregivers.	http://www.aal-europe.eu/projects/eware/
Guardian	AAL	Care robot supporting seniors and caregivers thanks to remote monitoring capabilities.	http://www.aal-europe.eu/projects/guardian/
Resilien-T	AAL	ICT solutions to support self-monitoring and self-management for people with Mild Cognitive Impairment (MCI).	http://www.aal-europe.eu/projects/resilien-t/

on a reliable measurement of human well-being, from which three indices were derived, i.e., physical, mental, and general health indices. ML algorithms (mainly Regression Tree and Random Forest) were used to extract patterns from behavioral (domotic) data, considering that they are influenced by the users' well-being, providing the users' response as output. The mean absolute error (MAE) reported was equal to 32%, 13% and 17% for physical, mental, and general health indices, respectively. The intra- and the inter-subject variabilities surely play a heavy role in the definition of uncertainty. Both the environment and the user's parameters have been monitored (by means of automation sensors—light status, thermostat, and PIR sensors—and biomedical/wearable/unobtrusive sensors—the Bioharness 3.0 multiparametric chest-belt for HR and breathing rate, respectively) in order to develop domestic technological solutions aimed at improving the citizens' QoL [24]. The Bioharness system has been characterized by the authors, identifying a measurement uncertainty of ±2.1 and ±2.8 bpm for HR in static and dynamic tests and of ±2.1 bpm in the measurement of breathing values with respect to standard equipment [25].

In the eWare project [26], AI algorithms were introduced in home-based research in the network of the living environment to measure the ADLs of ageing people with dementia to improve their QoL. Social robotics was added to support communication, hence endorsing a person-centered care model and acting as an interface between the user and her/his caregiver. This is intended to reduce the distress of both users and caregivers, thus enhancing QoL. In particular, PIR and open/close sensors (Sensara lifestyle monitoring, whose PIR sensor results to monitor the sleep efficiency with a statistic conference of 4.7%—coverage parameter k = 2—with respect to a reference ballistocardiographic sensor [27]) and social robotic technology (Tinybots) were combined to realise the eWare ecosystem. The system included a Cloud for data storage, a mobile application for caregivers, and an API as interface between Sensara/Tinybots technologies and the eWare ecosystem.

In the Guardian project, sensors are on-board the robot that is being developed to support seniors and caregivers; in particular, the robot is intended to decrease the workload of professional nurses. These social robots in Guardian are equipped with sensors that are able to map the living environment and can establish audio/visual connection between dwellers and a remote caregiver (providing a helping hand and reducing burden of both professional nurses and informal caregivers), that seems extremely useful, for example, in case of a fall. The Guardian social robot endorses the sustainability of care, provides remote monitoring data and also is persuasive and motivating since the user adopts personalized interaction approaches, hence promoting autonomy and increasing QoL. Data are stored in a Cloud and both a web and mobile application are available for caregivers to communicate with/through the robot.

Finally, the Resilien-T project [28] aims to develop an ICT solution to support self-monitoring and self-management of people with mild cognitive impairment. Resilien-T (with smart wearable gadgets and lifestyle monitoring systems) wants to be a coach that acts in many dimensions, e.g., nutrition, physical and social activities, and cognitive training. The iHealth wave watch was identified from a list of 32 commercial smartwatches to monitor the user's physical activity and sleep patterns, useful for the physical activity coaching dimension.

Certification Schemes for Ageing in Place

The creation of AFH suitable for residents to age in place can have multiple advantages: improving health and well-being of the inhabitants, which are strongly influenced by the housing; fighting against social isolation and promoting social networks and activities within the community; enhancing the cost-effectiveness of care delivery (in the UK the Health Foundation assessed savings for public services equal to double the investment made in housing support to vulnerable people),

Table 4 – Factors influencing the development of AFH		
Influencing factor	**State of the art**	**Future perspectives**
Regulatory framework and policies	Not clear at the moment.	Regulations to be defined.
Existing know-how	Very limited and scarcely transferred.	Official guidance (handbooks, standards, and other specifications) and dedicated organisations could help for awareness-raising and diffusion of information and knowledge.
Financial incentives and investments	Very limited.	Grants and reductions (to support the switch from a standard to an age-friendly environment) could push towards a greater retrofitting and new AFH, whose value will be superior to standard dwellings.
Housing governance	The responsibilities are not clear and there are competing priorities.	Housing market and its needs should be thoroughly analyzed.

as well as the health outcomes; promoting the sustainability of public costs for long-term care (LTC), which is expected to double by 2070; and stimulating innovation in the building sector, creating knowledge and new job opportunities. In this context, the EU is already active in the promotion of the Smart Readiness Indicators to improve the energy efficiency of buildings.

Given the trend to design AFH and retrofit the existing buildings and the absence of currently widely accepted standards in the design of these environments, the EU is promoting the development of a European certification scheme for age-friendly environments through the H2020 project Homes4Life (http://www.homes4life.eu/, GA no. 826295). The aim is to support health and well-being during ageing in place, in an era when society is rapidly ageing and suitable living environments that integrate both construction and digital solutions are needed to respond to this challenge in a holistic life-course approach. This certification scheme considers not only new buildings but also existing structures, in order to achieve a substantial and widespread presence of AFH in 2040, thus addressing the challenge of ageing in place for older people. AFH is influenced by many factors, as reported in Table 4.

A certification scheme can stimulate investments in AFH, providing comfort and security to stakeholders in both public and private sectors. The information provided in this documentation should be clear and easily comprehensible to both inhabitants and stakeholders (co-owners of the certification itself), besides evidencing the huge potentials of AFH.

A complete certification scheme should contain also detailed information about the management (transmission and access) of data gathered from the SLE, which should be regulated according to ethical and legal international and national laws and conventions. Suitable protective measures against infiltration should be adopted and the data handling should be standardised and properly regulated under appropriate confidentiality agreements, in order to contribute to the realization of a secure and standardised e-health ecosystem.

Conclusive Remarks

Measurement processes that include instrumentation, sensors, and AI strategy applied to a heterogeneous and complex dataset can play a pivotal role in the development of effective AFH models. It is beyond doubt that there is still plenty of room for research that aims to answering big technical and engineering challenges, such as sensors integrability and interoperability, connectedness (both for data transmission and power supply), system robustness, sensor miniaturization, durability (also in view of their integration in buildings), and costs management.

Accurate AFH models can provide remote monitoring capabilities and furnish objective elements for decision making, offering a proper supportive background to the whole healthcare system. The inclusion of such metrological aspects in the certification schemes would raise the interest of a wider group of stakeholders to promote the development of suitable strategies to increase the dwellers' QoL, especially when they are ageing people (frail or in particular social conditions, e.g., COVID-19 pandemic emergency). A properly designed SLE can provide a reliable measurement of the inhabitants' well-being (measured including physical, mental, and social spheres, evaluated by merging the subject's feelings, perception, and performed activities), and, at the same time, it is fundamental to complement its quantification with the measurement uncertainty. Many factors interact to define the uncertainty value, and among the most critical we can surely count the sensors accuracy, the AI algorithms performance, and the intra-/inter-subject variabilities. With respect to the traditional assessment of well-being, often performed through periodic surveys, AI is able to provide an assessment from a wider and more pervasive perspective, combining data from multiple spheres (including personal, physical, social, and health quantities) and fine-tuning the algorithms through the training with big data.

In order to have a comprehensive view of what can be the future of SLEs and AFH, it is necessary to consider the trends in terms of socioeconomics, demography, technology, and environment, so as to adopt adequate measures to reach more sustainable societies in a 20-year period. An older population inevitably results in more disabilities and chronic diseases, which may necessitate a shift from hospital-based to home-based care systems and from acute treatments to prevention and health promotion, for more sustainable care delivery. Thanks to new digital technologies, remote monitoring can also guarantee equal access to healthcare and quality of care for people living in rural/remote areas. The creation of SLEs should be regulated by policies that allow the accessibility by the whole population, both in urban and rural areas, with different cultures or socioeconomic status, considering that the needs vary with the population peculiarities and the influence of factors like health, culture, income, and education level across all ages. Therefore, a user-centred approach should be adopted when developing new solutions for AFH. No citizens should feel alone because of ageing, and AFH could improve health and well-being, support flexible working, create new jobs, and support the shift to homecare. The digitalization of vital signs and monitoring data useful to depict a person's global health status would be particularly useful for ageing people living at home. This would contribute to reducing the burden on the healthcare system itself as well as care delivery costs, which are the main items of the public spending. Public incentives are surely fundamental to push towards a significant change in this field, including incentives for the energy renovation of existing buildings (not only single dwellings, but also apartment blocks and also entire neighborhoods, for a more complete plan of renovation and innovation) would be very important to further accelerate the process of significant innovation targets to be reached within 20 years. In addition, environmental sustainability should be deemed, given that according to the European Construction Technology Platform (ECPT) 97% of buildings are energy inefficient and they are responsible for 40% of energy consumption (corresponding to 36% greenhouse gas emissions). At present, according to the WHO, 20% of European people live in buildings that are not sufficiently protected against excessive heat during summer, and 13% report insufficiently warm housing during winter.

On the other hand, the increase in life expectancy brings the need for policies that promote longer working lives, as well as more flexible working arrangements and new employment models. This also involves houses equipped with Information and Communication Technologies (ICT) solutions that respect the regulatory, technical, and functional constraints for the installation of devices within living environments and implement dwelling modelling (Building Information Modelling, BIM). This provides a better delivery of quality home care services for ageing people, helping them to feel secure, socially connected, and always supported in terms of health and care services, in a SLE that implements an adequate level of sensors, spaces organization, equipment, and environmental quality, hence improving the inhabitants' well-being. The best available technologies (BATs, including comfort control and management, energy efficiency, digital tools—e.g., Wi-Fi, PC, tablet, interoperability of the technological system installed in the housing, wearable sensors to constantly and remotely monitor health status and performed activities, communication devices to keep in contact with family, friends, and healthcare providers) would spread in a higher percentage of the buildings designed for older people, since currently 40-65% of them live in dwellings not fitting their conditions [29].

It is necessary to raise the awareness and the sensitivity of stakeholders and of the community in general, focusing on the possible impact of these solutions in the economic and societal wellness of any country and on the potential benefits linked to certain investments. To this aim, the release of a commonly shared and accepted certification scheme would pave the way to an increase in the construction sector attentive to the needs of ageing people. This would help to highlight the importance and the potential benefits of AFH, leading to the acquisition of skills and resources to face the big challenge of supporting health and well-being in ageing in place, also with suitable policies and incentives to meet the real AFH need. Each involved stakeholder should own an appropriate level of operational readiness, including integration of new technologies and processes in the production process, financial tools to access to finance for retrofitting or building new AFH, suitable planning procedures, health and social care policies, increase of ICT expertise in terms of home comfort and services, and higher demand of community services. The transferred know-how should represent a real support for engineers, architects, owners, and builders.

Acknowledgment

This research activity was carried out within the following projects: Homes4Life, funded by the European Union's Horizon 2020 research and innovation programme under grant agreement no. 826295; Italian Smart-Cities Project Health@Home, funded by the Italian Ministry of Education, University and Research, under grant no. SCN_00558; Guardian (Guardian - The social robot to support independent living), Resilien-T (Technology driven self-management for building resilience among people with early stage cognitive impairment), and eWare (Early Warning (by lifestyle monitoring) Accompanies Robotics Excellence), part of the Active & Assisted Living Programme (AAL Programme) that was approved by the European Parliament and the Council of the European Union, co-financed by the consortium national funding agencies.

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