# A Systematic Review of Trust in Automation and Assistance Systems for Older Persons' Overall Requirements

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*Abstract - The objective of the study was the numeric investigation of the existing literature containing the factor trust in automation as well as assistance systems for overall requirements for older people. Therefore, a systematic literature review with a total of 150 dissimilar keyword-combinations based on three different descriptors in three bibliographic online databases was performed. The study revealed that 18 articles deal with trust in healthcare or assistance systems but several of them only superficially. None of the identified studies focused explicitly on trust in Ambient Assisted Living despite of the increasing market relevance in the last decade. Older people as target group for qualitative and quantitative research in this field are detected and partially examined. Obtaining access to older persons' trust in automation in general and Ambient Assisted Living work systems need further research.*

*Keywords-Ambient Assisted Living; Assistive Technology; Automation; Elderly People; Trust.*

## I. INTRODUCTION

As a result of demographic change, the number of people in advanced age, who want to spend a self-determined, independent life at home, is growing. Unfortunately, not all elderly people are able to reach this goal without assistance. This often leads to conflicting goals. An age-related decline in physical fitness as well as physical limitations in consequence of diseases or accidents mean that elderly need support in realizing their desire for living in their familiar surroundings. This results in a tension between traditional personal care, new technical support and also affordability of individual support.

On the one hand, personal care can be provided by the family or human caregivers. Human assistance in activities of daily living (ADL) like taking a bath, preparing meal or going for a walk is a great relief for people with health restrictions. On the other hand, science deals for several decades with the research of new technologies to support people in their own home [56]. Meanwhile, innovations in the home environment offer numerous opportunities for technology-supported systems. Researchers have developed a plurality of services combined with technical support for elderly people. Terms as 'Smart House' [35], 'Smart Home' [69], 'Assistive Technology (AT)' [57] or 'Ambient Assisted Living (AAL)' [16] are just a few of the frequently used terms in this context.

In this article, the importance of trust in assistance technology for elderly people is in the center of interest. For using AAL, technology which assists an impaired person in everyday life [4], the user needs trust in this assistance system. Since in case of emergency the assistance can save lives, it can be quickly realized that trust has fundamental meaning in the consideration of development, purchase and use of AAL. The fact that older people, who are typically not grown up with technologies like personal computer, smart phone or Internet, which are often integrated in AAL [15], implies special demands towards the design of these devices.

The present study is structured as follows: The background section contains the development of AAL as effect to the demographic change and the importance of trust as influence factor in this research context. In the third section the literature review as research framework is described in detail. Following, the acquired data are analysed in its entirety and moreover, studies regarding trust in healthcare and assistance systems are considered separately. Finally, a discussion of the received results and an overview about further research activities is demonstrated.

## II. BACKGROUND

This section contains the background information about the development of AAL as reaction to the demographic change as well as trust as influence factor for AAL.

### A. Development of AAL as Reaction to the Demographic Change

According to the United Nations Department of Economic and Social Affairs (UNDESA) in the total population the proportion of people over the age of 60 years is constantly increasing [75]. Compared to more than 700 million in 2009 the number of people over the age of 60 is predicted to grow to 2 billion in the year 2050. Worldwide this would correspond to a tripling in a period of 40 years. The annual growth rate of the 'generation 60plus' amounts 2.6 per cent. This enlargement surpasses the overall population's growth rate of 1.2 per cent per annum. At the present time, over a fifth of the population in the more developed regions is 60 years of age or over. Prediction for the year 2050 show that nearly one third of the total population will belong to that age group [75]. These facts underline the economic significance of this age group.

Moreover, technological progress and a high degree of information technology are factors that gain more and more relevance in everyday life. The beginning of research in the field of Assistive Technology (AT) can be followed to the early 1970's. The so called phone chains used the standard

telephone system and were organized by a network of elderly and professionals [56]. Mutual telephone calls were used for regular control and once a member of the group did not respond, the doctor or relatives were notified. This can be regarded as the first working electronically emergency system for elderly persons.

The next step was the development of home emergency call systems. One of the most famous was the HTS831, which had two different buttons: A red one and a green one. Moreover, the system implied a wireless transmitter, which the user can wear around the neck. In case of emergency the user can either push the button at the transmitter or the red button at the station to contact the emergency center. As a security and monitoring function, the user had to press the green button once a day [56]. In the middle of the 1990's, the first video conference system for private homes was offered. Installed TV-top boxes or a separate video telephone functioned as a user interface. Additionally, this system contains functions for personal discussions and organization of, e.g., nursing, medical or entertainment services [20]. To sum up, the effort to develop useful and coherent life assistance services which aid older persons to live longer in their home existed for several decades.

In the last few years, due to the knowledge about the growing distribution of older people and the technological progress, the construction of AAL has significantly increased in their importance. A lot of national and international Non-Governmental Organizations (NGOs) and research projects were focusing on this topic. As a result, different concepts have entered the market [7, 15, 19, 68]. For instance, by sensory floor mats which register movements in the living ambiance and react by automatically turning the lights on the risk of falling can be reduced [64]. Another example of AAL can be found in the combination of personal and technological support offered by the Fraunhofer Institute. By means of summarizing and demand-oriented analyzing of sensor data, an individualization of care as well as nursing services is possible [15]. These two examples belong to the concept of AAL (Ambient Assisted Living). Reference [16] as first defined AAL "as the use of AmI [Ambient Intelligence] in everyday live. Assisted means assistance, by technical devices as well as by technical or human services" [16]. In 2007, a more elaborate definition of AAL traces back to [4]. Hereafter, AAL delineates "living in a smart technology supported environment that reacts sensitive and adaptive to the presence of people and objects and thus provides various services to the human. The aim is to preserve, enlarge and extend the personal freedom and autonomy, by promoting and supporting the personal independence" [4; translated by the authors].

In contrast to home automation [40], AAL limited not only to life in relation to housing, but extends to all areas of life. AAL focuses on the assistance functions of an adaptive overall system while home automation deals mainly with automation and networking of devices. AAL has set itself the objective of maintaining, increasing and extending the user's personal freedom and autonomy. Summarizing, AAL

systems are intended for people with health impairments which have need for security and furthermore communication requirements to prevent loneliness. The present European research focuses on these overall requirements of elderly persons. Since the concept of AAL regards on these holistic requirements, the importance of trust in AAL needs a more profound understanding.

### B. Trust as Influence Factor for AAL

As seen in [47], trust in medical technology is empirically different from trust in other technology. Moreover, trust plays an important role in multiple user groups as patients and physicians [46]. These research findings imply that the factor trust has to be considered in the development of medical and healthcare products and has effects in the usage of AAL systems by older people. To emphasize the diversity of the construct trust there are added numerous 'trust relationships'. Inter-personal trust, social trust and trust in automation can be mentioned. Inter-personal trust comprises a human's trust with another human whereas social trust characterizes trust with a system or an institution [6]. The so called trust in automation designates a human's trust with a technology or a device [46].

It can be found that trust is an attitude toward technology that affects reliance and which can be gauged. Moreover, people have the tendency to rely on technology they have trust in and to reject technology they do not trust [33]. When people trust automation, the usage is often influenced positively [31, 32]. But also negative examples exist due to inappropriate calibration of user trust [53]. It can be mentioned that, if trust is not calibrated to the true capacity of the system, users may over rely (misuse) or under rely/ reject (disuse) on the automation [54]. Based on [46] which deal with patients and healthcare providers in obstetric work systems, important implications for trust in healthcare systems and AAL-Technology emerge. The study demonstrates that trust building in medical technology transpires - not only in a relationship between doctor and patient or patient and technology. There is a complex network of relationships, which ultimately forms a 'network of trust' in technology use.

Already [50] observed a network of trust in supervisory control systems. In addition to the system she included system designer, operators, management and society as other actors. Trust as factor given to AAL systems, is also affected by a large proportion of implicit trust in the network around the use of the actual technology. Following the 'Actor Network Theory' [8, 30], the reliance on the network located around the AAL system, is equally important for the usage of assistive technology. As an example, for [73] the use of a defibrillator implies not only trust in the product and its functions but also in the network around this product. This network includes product designer, the organization which implements the product and the coaches, explaining the technology to the inexperienced users [73]. As it were, distrust in health care provider can also lead to patients' distrust in medical technology or the hospital per

se [45]. Therefore, consideration of the social system or work system [18], which wrapped technology, is necessary for an understanding of trust. Reference [46] clarified that in case of complex medical or assistance technology, building trust in automation is more precisely building trust in a work system. Furthermore, during the use of the same system the perspectives of multiple user groups (end user, relatives, and health care provider) are various [46]. Summarizing, it can be seen that there are a lot of factors which differ in the formation of trust and which have to be considered in the development and application of AAL.

> The objective of the present study was the numeric investigation of trust in automation and home assistance systems in the existing literature.

## III. RESEARCH FRAMEWORK

A literature review was executed to reveal the relevant scientific approaches in the context of trust in AAL, healthcare assistance systems and other automation. By means of this research method, information about how extensively the issue is previously addressed in the research can be demonstrated. To increase the precision of the literature review in this innovative and fast-moving research field, relevant articles were identified by means of computerized search in the online bibliographic databases 'Web of Science' [72] 'PubMed' [59] and 'PsycINFO' [58] starting in November 2010 up to a publication date of January 2011. The three database searches are carried out with filter. In 'Web of Science' key search terms are filtered by topic, in 'PubMed' by MeSH Terms and in 'PsycINFO' by keywords. These three different terminologies represent the generic terms for the search algorithm in the respective database.

TABLE I. KEY SEARCH TERMS

| Attributes | Auxiliaries | Population |
|---|---|---|
| Reliance Trust | Ambient Assisted Living/ AAL Assist* System/ Technology Assistive Technology Service/ ATS Automation Healthcare Intelligent/ Interactive Home Medical Technology Smart Home/ House/ Living Technology | Adult Age* Elder* Old* |

*Search included stated terms and derivates (e.g., age, aging, aged).

For investigation in the three databases, 150 dissimilar search term combinations are performed in each setting. The used key search terms are presented in Table I. The first search requests always contain a term of the categories 'Attributes' and 'Auxiliaries'. At first, the term trust has been set and was queried alternately with the keywords of the descriptor 'Auxiliaries'. After carrying out these searches, the term reliance was set and also requested with those from the second category. Then, the already carried out 30 search combinations have been linked sequentially to the

concepts of the third descriptor 'Population'. By extending the research with these four search terms and consideration of the abbreviations AAL and ATS, ultimately 150 searches per database were performed.

Due to the large number of search combinations and potentially relevant studies, the search results are already reviewed to further availability during the database search. For this, both title and abstract are considered. Afterwards, to identify the relevant full text articles a set of exclusion criteria are selected. For inclusion in the literature review articles had to fulfil the following criteria:

(1) The study described explicitly the connection between trust and automation or assistive technology, whereby trust is seen as an influence factor for the interaction with the system

(2) The article was published in a journal or presented on an international conference

(3) Studies which were first presented on a conference and afterwards published with identical findings as a journal article were only taken into consideration with the journal release

(4) The publication was written in English

(5) Due to the database research date, studies are included until January 2011.

A data form was used to remove the important information for each relevant article. After structuring the articles and integrating the data in the fact sheet, a detailed data analysis was undertaken.

## IV. DATA ANALYSIS

The previously described 150 search term combinations in each database identified in a first step 8.498 potentially relevant articles for the literature review. By means of the structural query, the database 'Web of Science' has offered 4.401 publications. The database 'PubMed' yielded 3.855 results and the search requests in 'PsycINFO' could emerge 242 studies. Owing to the consideration of the above described five exclusion criteria, after analyzing titles and abstracts of the 8.498 studies, 164 publications are factored in the next part of the review. In this step, the full-text of these 164 articles was reviewed. After analysis of the full text versions, 92 articles were included for the further literature analysis. With regard to the exclusion criteria, totally 72 of the revealed studies were excluded. Thus, 56 per cent remains of the original 164 articles. Fig. 1 gives a numerical overview about the structural sequence of the literature research.

Because of the five exclusion criteria shown above, 72 articles (44 per cent) were excluded after the full-text review. Most of the studies (48 articles) are not relevant due to the wrong topic focus. These 48 articles, among 15 studies which had focused on trust in websites or online platforms as well as trust in e-commerce applications are not followed up owing that exclusion criterion. Further 17 studies are eliminated since they were not published on a conference or in a journal. The last seven excluded articles are

published once in a journal and additionally published on a conference with almost identical results. These studies are only considered one time with the more actual journal article in our results. Thus, in the end, 92 articles were analyzed in detail in the literature review.

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│ 92 articles included │
│ into the literature  │
│ analysis             │
└──────────────────────┘
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         │              ┌──────────────────────────┐
         │─────────────▶│ 72 articles (44%)        │
         │              │ rejected based on the    │
         │              │ exclusion criteria       │
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│ 164 articles         │
│ retrieved for full   │
│ text review          │
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         ▲
         │              ┌──────────────────────────┐
         │─────────────▶│ 8.334 articles (98%)     │
         │              │ excluded based on        │
         │              │ analyzing titles and /   │
         │              │ or abstracts             │
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│ 8.498 articles found │
│ as search results in │
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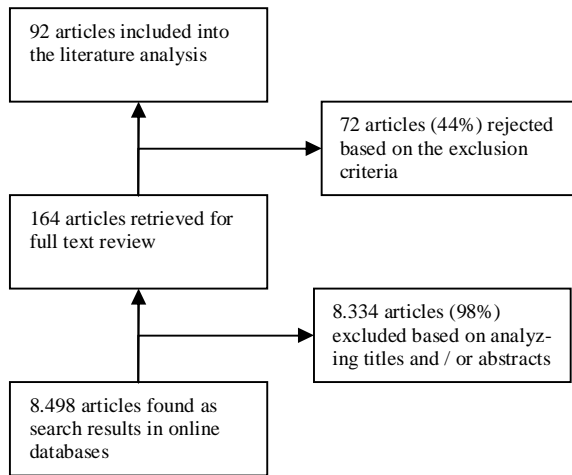
Figure 1. Literature research sequence diagram (authors design)

These articles comprise the topics trust in **automotive** [1, 10, 28, 34, 60, 70], **aviation** [2, 5, 23, 29, 37, 38, 53, 63, 78], **combat identification** [13, 61, 62, 77, 80], **general design advancement** [25, 33, 36, 49, 55], **supervisory control systems** [3, 31, 32, 39, 48, 79], **healthcare and assistance systems** [21, 22, 42, 43, 44, 66] and **others** [14, 41].

### A. Data analyses of overall results

In the next step, the data sheet with the overall studies has been analyzed (A) and compared with the results from the topic trust in healthcare and assistance systems (B).

#### (1) Publication date

Between 1987 and 1991 only two studies are published in this context [49, 67] The first experiment of trust in a human-machine supervisory control system was realized by [31]. Whereas, until 1999, 15 studies are published in total, from 2000 to 2010, 77 articles with regard to trust in technology and assistance systems can be found. Since 2003, every year six studies or more are indicated. In 2008, a maximum of 11 relevant articles can be revealed.

#### (2) Type of study

In a next step, the distinction between conceptual and empirical/experimental articles can be examined. From the overall 92 reviewed studies, 22 consider conceptual and 70 empirical methods for their research. These conceptual articles comprise former summaries and literature reviews (12 articles) as well as articles with the focus on framework, model or questionnaire development (10 articles). The 70 empirical articles can be differentiated into quantitative and qualitative research methods. Since 1987, viewed overall 62 quantitative studies (including experiments, online, postal or paper standardized questionings or a combination of ex-

periment and questioning) were identified. It can be observed, that solely five studies include questionings only. In contrast, 57 studies used experiments or a combination of experiments and questionnaires for measuring trust. By comparison, eight articles with qualitative methods as qualitative interviews, workshops and focus group interviews were considered.

#### (3) Participants characteristics

In a next step, the participants' age distribution should be considered. In order to receive a better understanding of the participants in experiments or surveys, a clustering in five age groups was conducted. These groups were subdivided into 'participants younger than 30 years' 'participants from 30 to 60 years', as well as 'participants older than 60 years'. Moreover, one age group comprised a combination of younger (< 30 years) as well as older (> 60 years) participants. Further studies performed experiments or interviews without age differentiation.

Regarding the 70 empirical studies, in 22 of the studies and hence 31 per cent, there was no age differentiation declared. In 35 surveys participants were younger than 30 years and in five surveys between the age of 30 and 60 years. Only in eight surveys (16 per cent of overall) participants were older than 60 years. In five articles the participants exclusively belong to the age group over 60 years. In three further studies both, younger participants (< 30 years) and people over the age of 60 were examined.

Participation rates range from an experiment with six [26] or a qualitative interview with nine participants [76] to a postal survey with 1187 participants [9]. In total, in 43 of the articles (61 per cent) less than 50 participants have taken part in the surveys to trust in automation or assistance systems. In eight studies between 51 and 100 and in 16 studies between 101 and 500 participants were involved. Reference [9] was the only study with more than 500 participants. In two articles there was no participant number specified. Moreover, only three out of the surveys contained a limitation with regard to the gender. One study by [43] questioned 24 women, or rather 24 mothers who have recently given birth. In two other articles, only male participants, once pilots [71] and one time male students [51] were regarded. In 38 surveys both gender were examined and 29 surveys had not make an explicit distinction.

#### (4) Publication type

Another study detail can be carried out by the differentiation between 'conference vs. journal publication'. Among the 92 examined articles, 18 articles (20 per cent) were presented at a corresponding conference and 74 articles published in a journal. The journal with the most publications and major interest in the research of trust and automation was 'Human Factors' with a total of 21 articles (23 per cent). By far, the journal 'Ergonomic' with eight relevant articles, the 'International Journal of Industrial Ergonomics' with four and several journals with three studies are following.

*B.      Data analysis of studies regarding trust in health-
care and assistance systems'*

This rising relevance of the concept trust which can be
found in the different research topics can also be supported
through the numbers of relevant articles in trust and
'healthcare and assistance systems'. In this field of research
the interest is growing in the last decade.

(1) **Publication date**

The first published paper related to trust in healthcare
automation was presented in 2002. The conference paper by
[42] was the first article that emphasizes the factor trust.
From this point on until January 2011, 18 articles can be
found. These articles deal with reliance on healthcare,
medical or household assistance systems. In the years 2003,
2004 and 2006 no publications within this context can be
found, whereas since 2007, every year articles are consid-
ered. In 2010, the largest number with five studies in this
context can be found. Fig. 2 gives a detailed overview
about the annual distribution of the found studies in the
cluster 'healthcare and assistance systems' in comparison to
the other topics. As can be seen, the importance of a con-
scious handling and perception of the concept trust in com-
bination with automation and particularly healthcare and
assistance systems is increasing in the last years. The first
study with regard to trust in automation and human-
machine interaction was published in 1987 [49]. In contrast,
the first publication regarding trust as variable for develop-
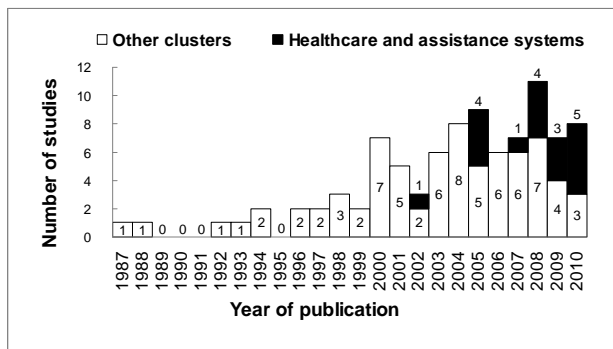ing healthcare systems for older persons was presented in
2002 [42].



Figure 2. Year distribution of studies in 'healthcare and assistance sys-
tems' vs. other topics (authors design)

(2) **Type of study**

Four of the 18 articles in this cluster used conceptual
methodologies. Three articles focused on framework or
model development [21, 42, 44] and one study summarized
the relevance of training in technology used by tele-home
care nurses [66]. Moreover, 14 articles included empirical
research– seven used quantitative and seven qualitative
methods. The publications with quantitative methodologies
are divided into three studies with a combination of ques-
tionnaire and experimental design, two studies with exclu-

sive questionnaire surveys and two experiments. The quali-
tative research exclusively consists of articles with qualita-
tive interviews.

In comparison, within the other topics quantitative
studies with a number of 55 studies predominate. In par-
ticular, in new research areas qualitative surveys are util-
ized to get a detailed understanding of the topic. For this
comprehension, the focus is set on qualitative interviews as
occurred in the research area of trust in healthcare and as-
sistance systems. Seven of the overall 18 studies (39 per
cent) included qualitative interviews with individuals or
workshop and focus group discussions. In 2010, four stud-
ies used qualitative interviews which show that researchers
are still in the process of developing a detailed understand-
ing. Given, that general research on trust in human-machine
interaction has started in 1987 [49] and to this day ambigui-
ties in this context exist [23, 29, 52] it is understandable
that qualitative interviews are still used in the present re-
search area.

(3) **Participants characteristics**

For the 14 empirical articles an age group differentia-
tion was performed. In three of the studies, participants are
younger than 30 years and in one study they are between 30
and 60 years. Moreover, five of the articles consider par-
ticipants over the age of 60 years. Further two studies con-
sider a combination of younger and older participants and
three surveys give no information about age differentiation.
In case of the work system in healthcare and assistance sys-
tems as AAL, the end user most time is over the age of 60.
Therefore, it is of immense relevance that this target group
will be considered in the research. Fig. 3 displays the previ-
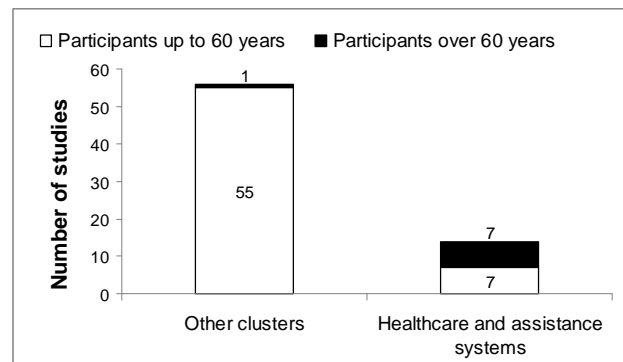ous study numbers in which participants over 60 years were
involved.



Figure 3. Age differences of study participants in the different clusters
(authors design)

As can be seen, in the other clusters the target group of
people over the age of 60 plays only a subordinate role.
Only one author has considered elderly persons' trust in a
human-decision aid system and compared the results to
people younger than 30 years [14].

In contrast, in the healthcare sector researchers have
focused more on the age group over 60 years. Of the total

of eight studies that have dealt with participants over 60 years, seven studies (88 per cent) are located in this cluster. Two studies have taken a differentiation of younger and elderly persons into account [22, 65]. Moreover, five articles have exclusively focused on people over 60 years [11, 17, 24, 27, 76]. With a percentage rate of 50 per cent of the overall studies which are analyzing the factor trust in healthcare and assistance systems by experiments or surveys, the age group over 60 years is strongly represented.

Concerning the number of participants in the topic 'healthcare and assistance systems', in nine of the studies the participant rate has amounted less than 50 participants. In two studies the participant rate ranged from 51 to 100 persons and three articles take more than 100 participants into account. These articles also include the reference [9] with a postal questionnaire of 1187 people. With reference to the participant rate it can be highlighted that the study with the most participants [9] as well as one of the studies with the less participants (n=9) [76] belong to the topic trust in healthcare and assistance systems.

Regarding the gender distinction within the different methodological designs, 12 articles have regarded both sexes; one article made no differentiation and one study [43] viewed only female participants. This study with solely female participants interviewed 24 women who recently have given birth. They were questioned in a qualitative interview to analyze trust in medical technology and obstetrics work system [43]. For the observation of this complex work system additionally interviews with care providers were conducted [46]. Furthermore, it can be said that healthcare and technical support for elderly persons are themes which concern men and women equally. Therefore, it seems logical that most of the studies deal with both genders.

### (4) Publication type

Moreover, among the 18 studies, six articles (33 per cent) are presented as conference papers and 12 articles (67 per cent) were published in journals. The journal 'Ergonomics' with two publications was the only one which was represented several times. The author Enid Montague with four research studies since 2009 has taken a pioneering role in context of trust and healthcare technology [43, 44, 46, 47]. Additionally, Coughlin et al. [11, 12] and Ho et al. [21, 22] are listed with two articles.

Due to the actuality of the research field, the distribution of articles presented on conferences and published in journals can be explained. From the overall 18 studies in the healthcare cluster, 12 were published in journals and six studies were presented on conferences. By comparison, from 74 articles within the other topics, 62 were published in journals and 12 studies, thus 16 per cent, were presented on conferences.

### V. DISCUSSION

The significant increase of elderly persons due to the demographic change and the resulting rise in purchasing power affects the development of reliable AAL systems [74]. Since 2005 the European and national sponsoring programs for AAL steadily increase and the relevance of supported living in home environment which enlarges and promotes the personal independence growth up. Moreover, it is difficult to understand that AAL has absolutely no consideration in connection with measuring trust so far. The search combinations 'reliance or trust' and 'Ambient Assisted Living/ AAL' yielded none results in the current literature study. Until January 2011, there was no study explicitly examining trust in AAL systems. Moreover, the relevance of measuring trust in healthcare technology and assistance systems is not prominent within the research results. It can be seen that the consideration of trust in connection with healthcare, medical technology or assistance systems is still in an initial stage. A few studies considered trust in intelligent home systems [12], smart home [11], telemedicine systems [24], as well as automation [65] or technology [76] at home. Furthermore, it must be noticed, that there is no consistent terminology for assistance systems for elderly persons. None systematic approach and documentation as well as a uniform technology and understanding exist in research, which complicated measuring trust.

One the one hand, these results could imply that the topic is not relevant for the scholarship. On the other hand, due to the increasing number of studies in the last decade this statement can be disproved. Analyzing the publication date shows that all relevant articles are composed in this period. It can be seen that the research focus has gained in importance in the last decade.

Another interesting fact can be found in the different frequency distribution of quantitative and qualitative studies. In the analysis of the type of study it can be highlighted that researchers who are regarding trust in healthcare and assistance systems use qualitative as well as quantitative methodologies. The fact that trust in 'healthcare and assistance systems depends not only on the single technology but furthermore on a complex work system [46, 73], underlines the relevance of more research in this topic.

Moreover, researchers have recognized that participants' characteristics of elderly have been taken into account. An analysis of trust in this sector can only be realized with the integration of people over the age of 60. Seven articles in the last decade consider older participants' trust in healthcare and home assistance systems. The increasing demand and importance of AAL due to the higher life expectancy and demographic shift clarify a considerable backlog demand in measuring elderly persons' trust in AAL. Moreover, it requires more research in this age group to close the gap of the few studies and less quantitative results.

Finally, it can be summarized that by reason of the novelty of the research of measuring trust as influence factor for using healthcare and assistance systems the exact influence of trust cannot be quantified. Only 18 articles which cover that topic were found owing to the literature

review. Initial developments reveal that trust in healthcare and medical technology differs from reliance on other technologies [47] Reference [44] examined a tool to measure patients' trust in medical technology, which may be useful for further quantitative research. Actually, a small number of studies had examined the complex network of trust in the equally complex subject AAL for elderly persons. Both, qualitative and quantitative research is required to meet the high demand of the next years. Furthermore, elderly persons as participants must take more into account for measuring and understanding trust in an AAL work system. For obtaining access to elderly persons' trust in an AAL work system a deeper understanding of their needs as well as fears and worries is essential. Additionally, trust of reference persons may have influence in using AAL. For researchers and designers of AAL recognizing the influence factor trust will support the development of marketable solutions.

The knowledge gained by the literature review provides potential for further research. In the following, a multidimensional model of trust in AAL will underline the significance of this research area. Based on different types of trust interacting in an AAL service network, a generally accepted model due to the existing literature and a requirement analysis with older people and service provider will be developed. Furthermore, a questionnaire distributed with the support of a healthcare service provider will be performed to validate the theoretical trust model. Experiments in different surroundings and various AAL test designs will be implemented afterwards to evaluate the influence factor trust in AAL.

## LIMITATIONS

The systematic review had to fight some limitations in the research process. First, the selection of online databases should be considered. Literature for trust in automation and healthcare can be seen as an interdisciplinary field. Therefore three bibliographic databases were used. 'Web of Science' comprised interdisciplinary content across 256 disciplines the database 'PubMed', focuses on healthcare content and 'PsycINFO', psychological literature. Due to this selection, articles which are not integrated in these databases are excluded for the review. Second, the information provided in the articles is very heterogenic. Some include a specific description about the experimental design, while other studies fail to provide detailed information. Third, due to the fact, that only English language articles were included into the review, a distorted picture is drawn, because the studies found and included focus on English-speaking authors. Fourth and finally, the studies included in the literature review were screened until January 2011. Thus, articles which were published afterwards are not considered for this systematic review.

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