Audiovisual Assistance for the Elderly - An Overview of the FEARLESS Project

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Abstract. This paper gives an overview of the recently granted AAL-JP project FEARLESS which stands for “Fear Elimination As Resolution for Loosing Elderly’s Substantial Sorrows”. The proposed project aims to reduce elderly’s fears within their homes. As elderly potentially refuse or forget to wear any additional sensors to activate alarm calls, FEARLESS will visually and acoustically detect and handle risks by contacting the relatives or care taker organization automatically - without the need of any user intervention. This is done by using only one single type of sensor making the system affordable for everyone. It increases the feeling of safety, reduces fears, enhances the self-efficacy and thus enables elderly to be more active, independent and mobile in today’s self-serve society.

Keywords: ambient assisted living, automatic risk detection, elderly.

1 Introduction

Emergency systems for elderly contain at least one sensor (button or accelerometer) which has to be worn or pressed in case of emergency. These emergency call buttons are provided by care taker organizations having the main drawback that no information about an occurred incident prior the button is pressed is available. Moreover, people have to wear these buttons which they tend to forget or even refuse. In case of an emergency and if elderly are able to press the button, they have to tell the operator which kind of incident happened. If the elderly is not able to talk to the operator for any reason, there is no information about the type of incident. This causes false alarms as well as ambulance deployments, although there is no emergency situation at all. To ensure the detection of emergency situations where the elderly is not able to actively raise an alarm (e.g. due to the lost of consciousness), sensors acting autonomously are needed.

Autonomously acting sensors are used in the field of smart homes to fulfill core functions defined in [6]: the control of the system, emergency help, water and energy monitoring, automatic lighting, door surveillance, cooker safety, etc.. Due to various reasons summarized in [2], smart homes are not established yet.

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One of the reasons mentioned in [2] are the costs: it is easier and less expensive to integrate smart home technology into new buildings than it is for already existing buildings. This results in the demand of a robust system, which can be integrated into existing buildings. Moreover, one of the outcome of the former project MuBisA [17] is that elderly accept technical assistance only if the system is not discernible for third persons (i.e. visitors).

Considering these facts, a computer vision approach is feasible as it is able to overcome the limitations of other sensor types [11]. Furthermore, not only falls can be detected but also other events where help is needed (e.g. fire, flooding, . . .). By the use of a vision based system the detection of emergency situations is done by software, meaning that this system is extendable as only the respective algorithms need to be developed or adopted. A wide variety of computer vision algorithms for different applications exist (e.g. [3, 4, 14, 15]), but there is no “perfect” algorithm for detecting emergencies in elderly’s homes yet.

As falls are considered to be a major risk for elderly, there has been done research on automatic fall detection [12]. Not only the fall itself but also the consequences of a fall are a great risk for elderly. Noury et al. [13] have shown that getting help quickly after a fall reduces the risk of death by over 80% and the risk of hospilization by 26%. Hence, FEARLESS is able to provide emergency service – if needed – immediately.

2 Event Detection

The goal of this project is to detect a wide range of risks with a single sensor unit, enhancing mobility and enabling elderly to take active part in the self-serve society by reducing their fears. In order to detect reduced mobility, a long-term tracking of the elderly is considered in the FEARLESS system. Another main focus of this project is the lack of expertise at the supplier side and thus the integration of important parts of the supply chain (i.e. network of electricians and electric shops). To ensure a holistic approach, the project consortium does not only consist of technical members, but also of psychologists, medical scientists and companies being able to transfer the knowledge from research to economy. Furthermore, the integration of end-user organizations ensures that end-user’s wishes and needs are considered throughout the whole project.

The FEARLESS system uses cameras equipped with microphones as sensors, allowing for the combined visual and acoustic detection of risks. Furthermore, we make use of a late fusion approach developed during the former project MuBisA, performing analysis of the scene on each camera individually and then combining the individual results to get an overall decision [18], as shown in Figure 1. In contrast to other works (e.g. [1]), our system is not vulnerable to low-quality images, as only some basic information (e.g. silhouettes) are extracted from the image. We define empirical, semantic driven rules using features with fuzzy boundaries introduced in [5] to analyze the scene and make the decisions.

To be able to visually detect risks, the following steps are applied: