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Service Robots for Context Recognition in Smart Environments

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Abstract. Background: A new concept for context recognition involves a smart home system, wearables, and service robots. Objectives: To find the best suited robot platform for the given use case. Methods: An assessment of available service robots based on various factors is carried out. Results: The OpenBot is best suited for the further development of this concept. Conclusion: The new concept will increase the precision and reliability in context recognition.

Keywords. Active assisted living (AAL), service robots, context recognition

1. Introduction

Ensuring a self-determined and healthy living for people in their familiar surroundings for as long as possible is an important task of active assisted living (AAL) research. This is supported by using connected ambient assistance systems. Precise and reliable context recognition helps to differentiate between daily routine and emergencies. [1, 2]

To achieve the best possible information about the context, we have developed a new concept, that uses data from three different sources. The first one consists of the smart home system. The second source are wearable devices, such as smartwatches, which can be used for recording vital signs and for fall detection [3]. The third source is mobile robot platforms. These can verify previously made assumptions based on the other data sources. Service robots are subjects of various projects in the research fields of healthcare and AAL since they usually offer a high degree of mobility, telecommunication services, programmability, and the opportunity for user interaction. Furthermore, they can be equipped with additional sensors and thus be used for remote sensing of vital signs. [4, 5]

2. Methods

To find the most suitable robot for the new concept of context recognition, we assess available service robots by evaluating their equipped hardware, navigation performance, economic factors, usability, interoperability, reliability, and suitability for the given use cases. Therefore, we analyze the technical documentation, interview experts of the domain,

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and consider the findings from previous work. In this work, we evaluate the open-source robot platform OpenBot and the telepresence robot Double 3 and compare the results to existing experiences with the robots Temi, Pepper, and Sanbot [1].

3. Results

The OpenBot differentiates itself by low acquisition costs compared to other service robots. In addition, it provides high flexibility due to its open-source approach. Since the robot is based on the Android platform, the resulting software from the practical implementation of the new concept will partially be transferable to other Android-compatible service robots like Temi or Sanbot. The OpenBot is noticeable smaller than most other robots, especially in terms of height.

The Double 3 has several times higher acquisition costs compared with the OpenBot. Since it is a virtual avatar, it comes with a built-in telepresence functionality. That includes functionality for video calls and remote control of the robot. It allows running custom native applications on its Linux-based OS with access to most of the robot's sensors. Consequently, it is less compatible with the other, most Android-based systems. The height of the Double 3 is adjustable and roughly comparable to Temi and Pepper.

4. Discussion

The OpenBot is the most promising platform for the given requirements. Especially its low acquisition costs and high customizability, as well as the possibility to transfer the resulting Android-based software to other robots, are the convincing factors. However, the small size of the robot might limit the functionality in communicating with the user. This is because the UI, which is the screen of the integrated smartphone, is positioned very close to the ground and complicates face-to-face conversations in video calls.

The new concept will increase the precision and reliability of this task. This will be another step to enable people to live self-determined, healthy, and safely in their familiar homes for as long as possible.

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