

Concept and development of teaching modules in the context of artificial intelligence with focus on the fields of service robotics and smart home

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ABSTRACT

Within the context of the here described master thesis, an application was developed which combines the fields of smart home and service robotics utilizing artificial neural networks (ANN), in order to learn the behavioral patterns of a person in their home and monitor them for significant deviations. Additionally, a learning tool comprising educational building sets was developed for groups of students in upper secondary education, to convey the functional principles of ANN.

KEYWORDS

artificial neural network; artificial intelligence; service robot; smart home; MOMBI;

1 INTRODUCTION

The focus of this work is to conceive, evaluate and implement a processing unit, which is able to learn and monitor the behavioral patterns of a person in their home by using tools of Artificial Intelligence (AI). Why is this of interest?

Most elderly people in Germany want to live at home as long as possible [1]. In 2014, only one third of the elderly over 65 years in Germany lived alone at their home [2]. The demographic change in Germany will increase the number of elderly people, which want to live safely in their own home, and the need of a suitable solution for a self-determined life for them.

Another focus of this work is the development of a learning kit, including learning modules for students in upper secondary education. These modules deal with the topic *service robotics*, *smart home* and *Artificial Intelligence*.

2 EVALUATION & IMPLEMENTATION

In the planning of this work, various AI tools were studied, like the programming language PROLOG, artificial neural networks (ANN) or expert systems like *Watson*. In Addition, other projects with similar goals like the project CASAS "a smart home in a

box"¹ or the early warning system SAMDY² were analyzed. As basis for the learning tool, the teaching strategy MOMBI³ was examined and adapted to the own needs.

In the implementation, ANN were used for learning the behavioral patterns of a person at home. The developed application works as follows. Via a serial interface, sensors can be connected to the processing unit, called *Smarter Home*, and send sensor data to the unit via ZigBee. Over a webservice, connected to the processing unit, the current state of the monitored person can be retrieved by service robots. The learning kit contains the three learning modules *theory*, *practice* and *consolidation*, handling and conveying the functional principles of ANN. Therefore, a prototype consisting of LEGO bricks was constructed, which represents a bedroom, including sensors, a fictional person named Karin and the possibility to connect and communicate with *Smarter Home* for learning and monitoring the sleeping behavior of Karin. During the testing phase, a first scenario which enables the monitoring of a person's sleep patterns for irregularities was successfully completed.

3 CONCLUSION

This is a work in progress which is continued. A pilot has shown that neural networks are a good fit for monitoring regular behavior. The next steps will be to extend the range of activities to be monitored, as well as considering the utilization of additional AI tools.

REFERENCES

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- [2] Statistisches Bundesamt. 2015. *Generation 65+ in Deutschland*; Stand: Juli 2015 DOI: https://ibk-kubia.de/IBK-Dateien/PDFs/Nachrichten/Pressebrochuere_generation65.pdf

¹ CASAS: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3886862/>

² SAMDY: <https://www.inhaus.fraunhofer.de/de/Geschaeftsfelder/Health-und-Care/samdy.html>

³ MOMBI: Model Of Model-Based Instruction