

# DoReMiND - A Robotic Application for Singing with Older Adults

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**Abstract.** This work explores the possibilities of using a humanoid robot to support group singing activities for older adults in care facilities. The DoReMiND application was developed through an iterative design process involving user feedback and evaluation. The study successfully demonstrates that the robot can motivate older adults to sing, improving their well-being. However, challenges with voice recognition and group interactions were observed. The application's potential to promote emotional well-being and the positive effects of music and robotic interaction on older adults show promise for future developments in this field. Future work includes technical enhancements, shifting the target group, and addressing ethical considerations to create a more interactive and enjoyable experience for older adults.

## Introduction

The increasing demand for care services and the decreasing number of professional caregivers in industrialized countries have put significant pressure on the care system (Carros et al., 2020). To address some of these challenges, researchers have turned to robotics as a potential solution. The interest in using robots in care facilities includes projects such as robotic suits to help care workers lift patients (Sato et al., 2009) and robots that help elderly people wash independently (Werner et al., 2020). Additionally, there is research regarding how robots can provide entertainment programs and offer companionship (Carros et al., 2020).

Music has been extensively studied for its positive impact on the quality of life and well-being of older adults. Most of the literature focuses on making and experiencing music in a group setting, such as choirs and music therapy, usually led by professionals (Creech et al., 2013; Davidson et al., 2014; Galinha et al., 2021; Hays and Minichiello, 2005; Mileski et al., 2019; Mostaghel, 2016). There is strong evidence that music may continue to improve the quality of life and well-being of the elderly, regardless of cognitive capacity or musical background (Creech et al., 2013; Davidson et al., 2014; Elliott and Gardner, 2018; Mostaghel, 2016).

At the moment, however, there is a lack of research exploring the combination of music and robots in the context of elderly care. This paper aims to investigate the possibilities of using robots to support group activities like singing, focusing on the humanoid robot “Pepper”.

By combining the positive effects of music with the advantages that robots can offer, this research intends to create a more interactive and enjoyable experience for older adults, improving their quality of life and empowering them to take action.

## Technical Infrastructure and Application

The system developed for this project involves a 1.2-meter-high humanoid robot, “Pepper”, with a tablet attached to its chest. The robot has the capability to play songs through its speakers while simultaneously displaying the song lyrics on the tablet. The objective is to allow older adults to interact with the robot and use the application independently, empowering them to benefit from the positive effects associated with music without the constant assistance of care workers.

To enable older adults in care facilities to engage in group singing activities independently, a musical application called "DoReMiND" was developed. The application was designed with a focus on accessibility and ease of use for older adults, taking into consideration limited mobility and visual impairments.

The application’s design adheres to the POUR (Perceivable, Operable, Understandable, Robust) principles (WAI), ensuring that navigation is visually and audibly perceivable, and users can operate it through speech or touchscreen. High-contrast colors and simple, commonly used text were incorporated to enhance understanding. The interface consists of large, rounded buttons to facilitate ease of use.

The application is accessed through Pepper’s tablet, which displays the homepage with four genres (hiking, folksongs, christmas carols, and church hymns), a “randomize” button, and the logo (Figure 1). Users can navigate to the information pages by selecting the logo. The information pages explain the robot’s capabilities and interaction options, allowing users to return to these pages at any time using the voice command "Info".

For the singing experience, users can select a genre and either play a random song from that genre or choose from a list of three song titles. Once a song is selected, the robot announces the song title and invites the user to sing along, providing preparation time before the song starts. During the song, the lyrics are displayed on the tablet, with video covering half of the screen and showing around four lines of lyrics per page (Figure 1). Users can adjust the volume and skip to the next song using the provided buttons and via speech commands.



Figure 1. Homepage of the application and the song player.

The application emphasizes dialogue-based interactions, allowing users to control the application through voice commands. Pepper introduces itself at the start and responds to commands like "Menü" ("Menu"), "Übersicht" ("Overview"), or "Zurück" ("Back") to navigate through the application. Referencing specific genres or song titles will lead to the respective song selection or song player pages. To add an element of fun and engagement, the application includes various dialogue portions where users can ask questions or request jokes and tongue twisters from the robot. The dialogue responses are scripted, allowing the robot to provide random answers for each interaction, enhancing the user experience.

The application's technical infrastructure involves using the Pepper robot and Choregraphe 2.5.5 for development, while the prototype for the tablet application was created using programs like Microsoft PowerPoint, Adobe XD, and Figma.

Overall, the DoReMiND application provides an interactive and accessible platform for older adults in care facilities to engage in group singing activities independently, promoting their well-being and enhancing their quality of life through the combined benefits of music and robotic interaction.

## Conclusion & Outlook

The development and evaluation of the DoReMiND application for the Pepper robot have provided valuable insights into the potential benefits and challenges of using robots to motivate older adults to sing in care facilities. The results of the user studies indicate that the application was successful in engaging older adults

in singing activities, with positive feedback on the song selection and display of lyrics. However, there were several limitations and considerations that need to be addressed for future improvements.

The pre-study revealed that older adults enjoyed singing but often lacked confidence due to changes in their voice with age. The idea of singing with a robot as a private partner was met with skepticism but was recognized as a potential opportunity for engagement. The evaluation of the first prototype highlighted difficulties with tablet interaction, leading to the addition of voice commands. The final evaluation further emphasized the challenges of voice interaction, especially in group settings, and raised concerns about the robot's appearance and sound quality.

Despite these limitations, the DoReMiND application demonstrated its potential to motivate older adults to sing, and the positive reactions during the evaluations were encouraging. To further enhance the application, several areas of improvement and future work can be explored:

- **Technical Enhancements:** Improving the speech recognition capabilities of the robot can lead to better interactions. Implementing context awareness and refining voice command options could enhance the user experience and reduce frustrations.
- **Tablet Interaction:** Providing touch pens or stylus could facilitate better interaction with the tablet, ensuring accurate touch recognition, especially for older adults with limited mobility.
- **Scalability:** Streamlining the process of adding new songs and genres to the application can make it more adaptable to different care facilities.
- **Target Group Shift:** Exploring the potential of the application with other user groups, such as children or people with intellectual disabilities, could open new avenues for engagement and interaction.

Despite the challenges and limitations, the DoReMiND application successfully demonstrated the potential for robot-assisted singing activities in care facilities. The application has the potential to improve the experience of listening to music and promote emotional well-being among older adults. As voice recognition technology advances and further refinements are made to the application, the interaction between robots and older adults can become more seamless and enjoyable. In conclusion, the project has shed light on the positive effects of music and robotic interaction on older adults in care facilities. While there are technical and social challenges to address, the potential for future developments is promising. As technology continues to evolve, the DoReMiND application can pave the way for more innovative and inclusive approaches to enhancing the lives of older adults through music and robotics.

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