Voice Controlled Maze Game

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Abstract.

The Voice-Controlled Maze Game lets players navigate a virtual maze using speech recognition, providing real-time feedback and guidance. It enhances accessibility and showcases the potential of voice interfaces in interactive entertainment.

1. INTRODUCTION

By using voice recognition and auditory feedback in place of manual controls, the Voice-Controlled Maze Game in MATLAB improves accessibility and user engagement. For all participants, it fosters independence, inclusion, and problem-solving skills.

2. LITERATURE SURVEY

Developments in digital signal processing, game design, and speech recognition are all expanded upon in the Voice-Controlled Maze Game. The theoretical underpinnings for putting voice commands into practice are provided by Juang & Rabiner (1993), while Chan & Chong (2015) present a MATLAB-based framework for real-time speech recognition. Digital signal processing methods that are crucial for managing voice signals, like filtering and spectrum analysis, are examined by Manolakis & Proakis (2006). Furthermore, described in MathWorks' MATLAB Speech Processing Tools Reference (2023) is the Audio Toolbox, which facilitates smooth voice interaction by allowing real-time speech-to-text conversion.

Accessibility and game design are also important factors. Interactivity, feedback mechanisms, and usability guidelines that improve the maze game's design are covered by Salen & Zimmerman (2004). To increase accessibility for players with disabilities, Yuan & Folmer (2008) emphasize non-traditional interfaces including voice and tactile feedback. Voice-controlled game interface usability is examined by Brown & Roberts (2018), which informs the project's user-centered methodology. The game seeks to give all players an enjoyable and inclusive experience by utilizing these findings.

3. METHODOLOGY

The Voice-Controlled Maze Game adheres to a methodical approach that emphasizes system architecture, tools, strategies, and execution. Key components of the system include voice command processing, which captures and analyses user speech, maze representation, which defines walls and paths using a 2D matrix, and a game engine, which modifies player movement in response to recognized orders. Numerical calculations, audio processing, and visualization are all done with MATLAB. Voice inputs are converted into standardized text using the speech2text function, and accuracy is increased by preprocessing methods including spectrogram analysis and Mel Frequency Cepstral Coefficients (MFCCs). Recognition models such as Hidden Markov Models (HMMs) and Deep Neural Networks (DNNs) process speech, enabling real-time command execution. With three difficulty settings—easy, medium, and hard—the maze is dynamically updated and visually represented in response to player input.

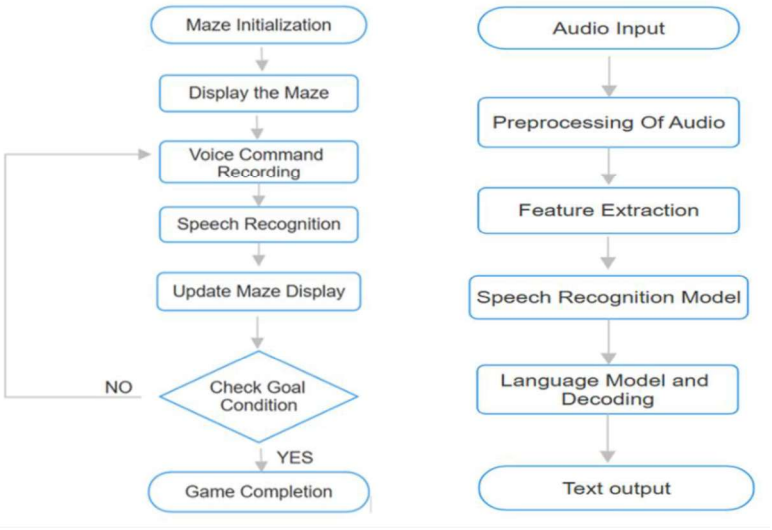

Fig. 1 Flow Chart of the game **Fig. 2 Flow Chart of Speech Recognition**

The game is executed in a methodical manner, beginning with the initialization of the maze, which sets the start, goal, barriers, and paths. Voice commands like "up" and "left," which are captured by a microphone and processed by pattern recognition and language models for precise interpretation, are used by players to traverse the maze. The player's location is continuously updated by the system, which also verifies if the goal has been completed. The player stays motionless and receives remedial feedback if a command is deemed invalid. To guarantee an intuitive experience, the game provides dynamic graphics, error management, real-time interaction, and accessibility improvements. Unit testing of functions, edge case scenarios such as erroneous commands, and movement limits are all part of the testing and validation process to guarantee robustness. The game is deemed finished when the player achieves the objective, providing an interesting and participatory experience.

4. RESULTS

The voice-controlled maze game exhibited effective responsiveness, as players effectively navigated the increasing complexity of the game as they progressed through the difficulty levels.

Below are the results of the easy level voice controlled maze game:

Movements of the player from start (green block) to end (red block)

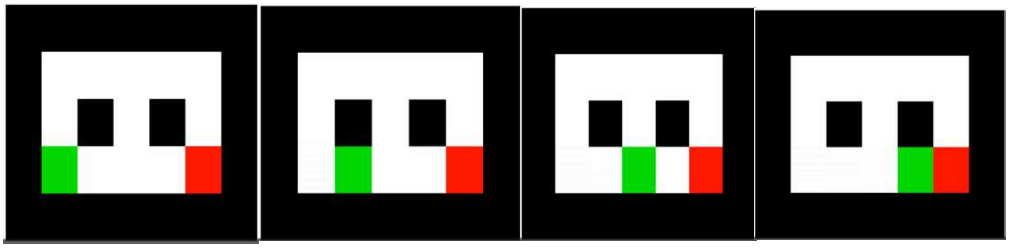

Fig. 3. Movement of the player towards the goal (red block)

By limiting wall collisions and providing feedback for commands that were deemed invalid, logical navigation was guaranteed. The results confirm the reliability of the voice-based controls and the degree of engagement of the game.

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Please say your command ("up", "down", "left", or "right")
    "Recognized Command:"    "right"
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Fig. 5. Commands that can be given by the user and the recognized command

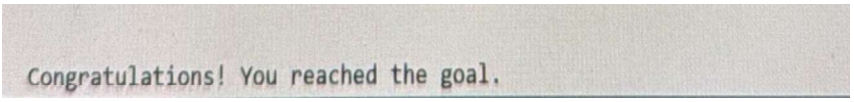

Fig. 6 . Maze Completion message (Displayed when player reaches the goal)

5. CONCLUSION

This project mixes interactive gameplay with voice recognition technology, allowing players to navigate a maze through voice instructions. By eliminating the need for traditional input devices such as keyboards and controllers, it provides a more natural and accessible experience, which is especially beneficial to people with disabilities.

Advanced speech recognition can enhance the game's capacity to understand different accents, making it more accessible to a global audience. Customizable voice commands can improve personalization, and multiplayer modes.

6. REFERENCES

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Biographies

Dr. Hindumathi Voraganti received the B.Tech. degree in electronics and communication engineering from the Jawaharlal Nehru Technological University, Hyderabad, India, in 2003 and the M.Tech. degree in Wireless and Mobile Communications from the Jawaharlal Nehru Technological University, Hyderabad, India, in 2008. She received Ph.D. degree in Electronics and Communication Engineering from Jawaharlal Nehru Technological University, Hyderabad, India, in 2021. Presently working as an associate professor at BVRIT HYDERABAD College of Engineering for Women, Hyderabad. Her research interests are in the area of Wireless communications and networks.

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