

Multimedia Based Stroke Rehabilitation Methods

MEC 202

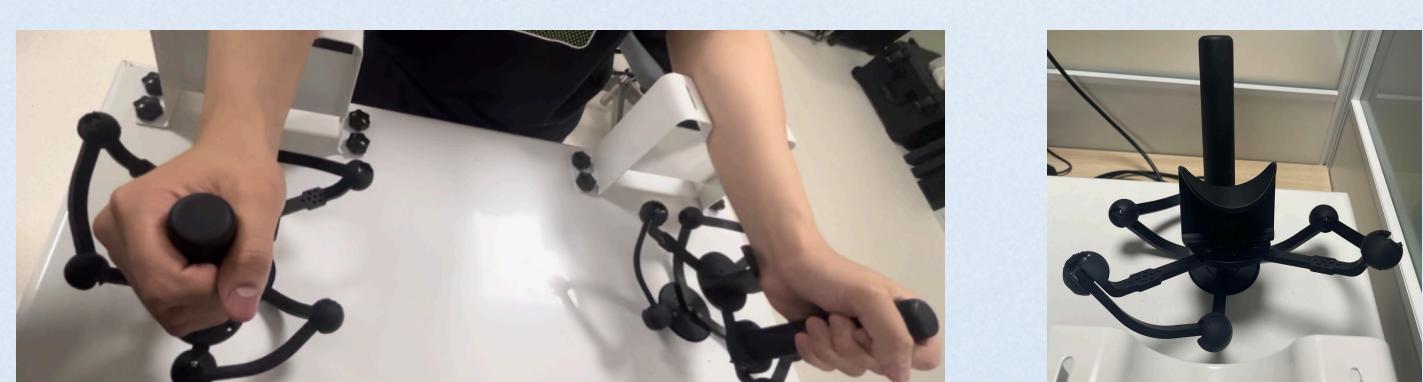
**ABSTRACT**

This project, in collaboration with **Haobotics**, is based on the company's wrist rehabilitation device and preliminary research. We designed **three types of Unity 3D games** (**Ball Maze Adventure**, **The Royal Game of Ur**, **Shadow Shift Puzzle**) for stroke patients and developed a **unified game rehabilitation platform** using QT. Field studies and discussions confirmed the project's potential and highlighted the need for data integration and multi-device management. This project not only adds fun to patients' rehabilitation exercises but also provides an efficient management solution for medical institutions, improving overall rehabilitation effectiveness.

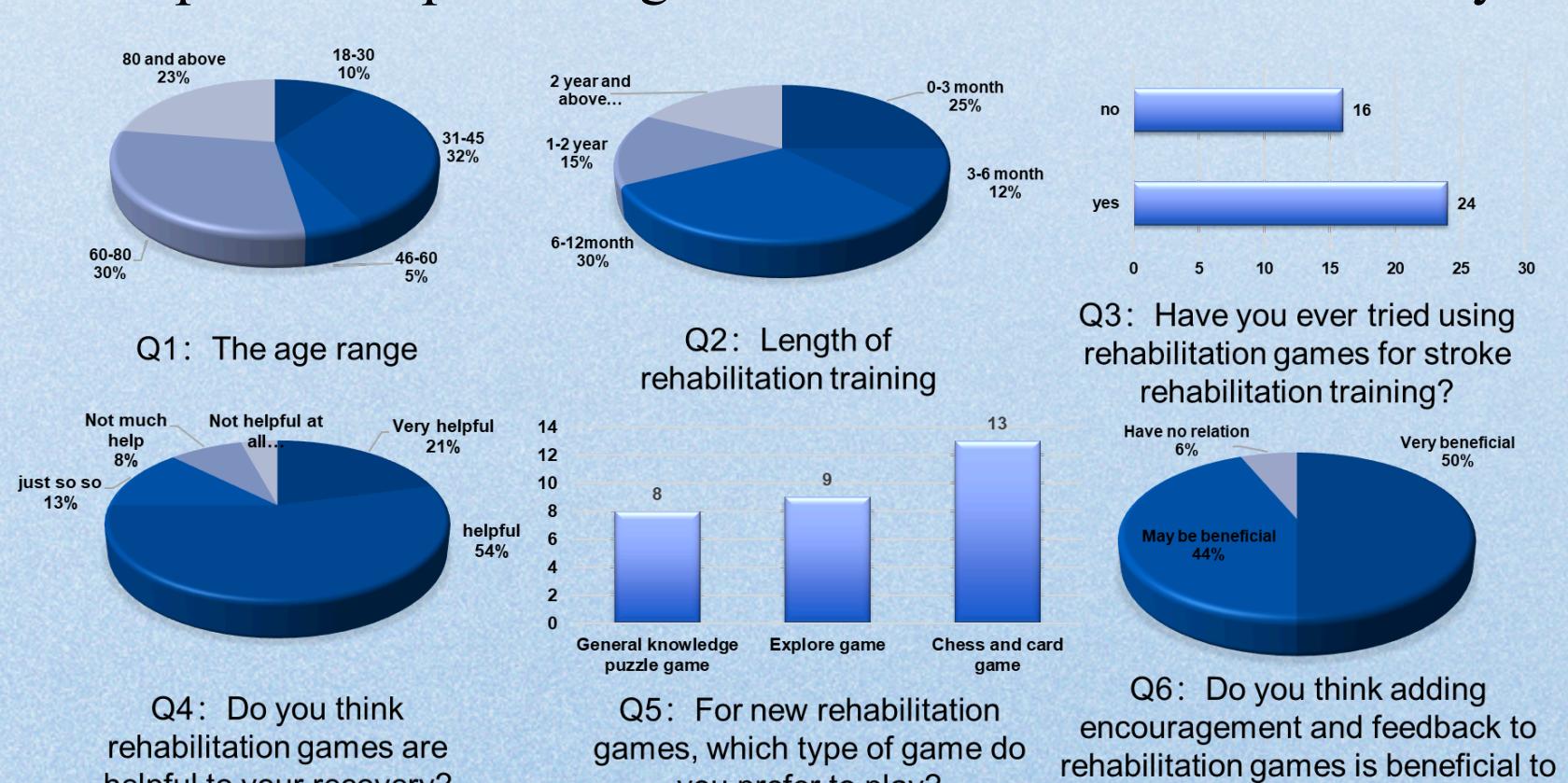
INTRODUCTION

Stroke Rehabilitation: According to the World Stroke Organization (WSO) 2022 data, stroke has a high incidence globally and is one of the leading causes of severe disability, with about 12.2 million new cases each year [1]. Stroke often leads to motor function loss on one side of the body, known as hemiparesis. Wrist rehabilitation often uses assistive devices where the unaffected side helps the affected side. Gamified rehabilitation is important here, as it adds interactivity and fun, increasing patient engagement and effectiveness [2].

Medical Machine: **Haobotics** focuses on wrist rehabilitation and has designed a medical device that supports current rehab methods. This device is a special mechanical linkage that allows both wrists to work together, making the affected side follow the movement of the unaffected side.

**REQUIREMENTS**

Our team conducted research at Rugao Hospital and Suzhou Recovery Center. Surveys and interviews with patients and experts revealed significant challenges like staff shortages and limited resources. Patients strongly desire therapies to improve cognitive abilities and wrist mobility.

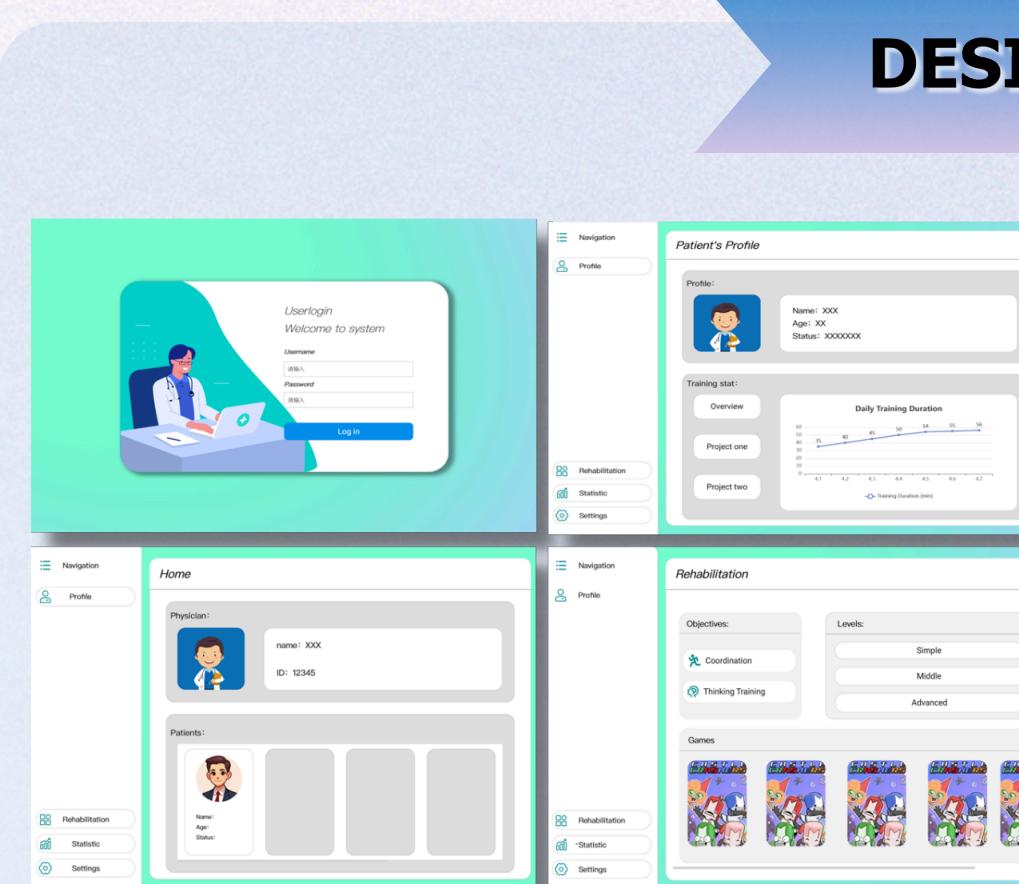


To address these needs, we will focus on:

- Gamified Rehabilitation Training:** Designing three types of games to make rehabilitation engaging, helping patients improve cognitive and wrist skills. These include chess, puzzle and exploration games to boost patient interest and participation.
- Game Management Platform:** Developing a platform to integrate games and training data. This platform will record and analyze patient data, assist doctors in creating personalized plans, and optimize resource allocation.

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**DESIGN & PROTOTYPE****Rehabilitation Game Platform**

The rehabilitation platform, developed using Qt, enables physicians to effectively manage patients and recovery sessions. It employs a MySQL database for data storage. Physicians can create accounts, directly access rehabilitation games from the platform, initiate training sessions, and review patient statistics. This integrated system enhances rehabilitation management efficiency and improves patient outcomes.

Three Types of Games**USER FEEDBACK**

After combining the game with the medical device, we were unable to conduct practical tests as the device is still in the iteration and upgrade stage. Our team conducted on-site research at **Suzhou City Hospital Rehabilitation Center** by having patients and doctors watch demonstration videos.

Patients**Advantages:**

- The passive function aids rehabilitation, especially when combined with games, increasing enjoyment and reducing monotony.
- Games like mazes improve training accuracy and offer prompts during sessions.

Improvements:

- The device lacks tension management; intervals should be added to relieve tension and improve control.
- Adding hand-foot coordination through pneumatic gloves and other devices is suggested to enhance overall rehabilitation.

Doctors**Advantages:**

- Effectively trains hand and upper arm movements, aiding targeted rehabilitation.
- Fills gaps in current rehabilitation training, offering more recovery options.

Improvements:

- Adjust spatial configuration to better train upper arm movements.
- Add a visual feedback system in games to enhance user interaction and training effectiveness. This would make the rehabilitation process more engaging and effective.

CONCLUSION & FUTURE DEVELOPMENT

This project combined games with medical devices, validated through research for stroke rehabilitation effectiveness. The device's passive function, combined with games, increased the fun and engagement of training. Suggested improvements include optimizing spatial configuration, adding visual feedback, and incorporating hand-foot coordination.

Future Development: 1. Optimize device design and functionality. 2. Conduct more clinical tests. 3. Integrate with other rehabilitation devices for comprehensive solutions.

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