

Shri Ramdeobaba College of Engineering and Management, Nagpur

**IPR CELL
PATENT REQUISITES DRAFT**

1. Full Name and Address of the inventor(s) and applicant(s) (if different).

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2. What is the suggested title of the invention?

TheraCanvas system for rehabilitation therapy of patients

3. The relevant prior art/existing technology and its disadvantages.

- **Traditional Physical Therapy** relies on repetitive exercises that can be monotonous, leading to poor patient engagement. These methods lack real-time feedback and fail to provide quantitative progress tracking, limiting personalization and effectiveness.
- **Existing Digital Solutions** often require painful physical contact with devices, clinical supervision, and expensive specialized equipment. These factors reduce accessibility for home-based therapy and limit patient participation.
- **Gaming-Based Rehabilitation** offers engagement but lacks customization for specific injuries, progressive difficulty adjustments, and precise movement tracking, which are essential for effective rehabilitation. These systems also lack adequate medical oversight.
- **Additional Issues** include a lack of personalization and adaptation to individual recovery needs, poor patient compliance due to monotonous routines, and limited integration with healthcare providers for remote monitoring and feedback. Furthermore, many systems do not offer detailed real-time performance analytics, hindering accurate progress tracking.
- **Technological Gaps:** Many solutions fail to leverage emerging technologies such as AI, machine learning, or augmented reality, which could enhance feedback, monitor fine motor skills, and simulate real-life scenarios for rehabilitation.

These shortcomings emphasize the need for a more accessible, engaging, and personalized rehabilitation system that integrates modern technology for better patient outcomes.

4. What are the objectives/advantages of your invention?

TheraCanvas provides an engaging, gamified approach that uses air gesture recognition for interaction. It ensures precise measurement of movement accuracy and progress, enabling tailored therapy plans with progressive difficulty levels to meet individual needs. The system facilitates remote monitoring by healthcare professionals, reducing the dependency on constant physical therapist presence while enhancing accessibility and convenience for patients.

Problems solved by your invention.

- **Patient Engagement**

The system transforms repetitive rehabilitation exercises into interactive challenges, making therapy more engaging and enjoyable for patients. It maintains motivation throughout the recovery process. Additionally, the system provides immediate feedback and progress tracking, allowing patients to see their improvements in real time, which further boosts their commitment to the therapy.

- **Treatment Effectiveness**

With precise movement tracking and pattern matching, the system ensures that exercises are performed correctly, maximizing therapeutic benefits. It adapts to the patient's capabilities by offering progressive difficulty levels, making the exercises challenging yet achievable. Furthermore, the system allows for the customization of exercise patterns to cater to various injury types, ensuring a personalized approach to rehabilitation.

- **Accessibility**

The HandGesture Rehabilitation System is designed for home-based use, enabling patients to continue their therapy without frequent hospital visits. This not only reduces the time and cost associated with traveling to healthcare facilities but also makes rehabilitation more accessible to those in remote areas. Additionally, it offers a cost-effective alternative to traditional rehabilitation equipment, making it a practical choice for a wider range of patients.

- **How is the invention different from already patented or made inventions?**

Unlike traditional systems, it supports home-based use with customizable therapy plans, diverse input devices. Its flexible processing options and mobile app interface ensure accessibility, cost-effectiveness, and adaptability, addressing gaps in existing rehabilitation solutions.

5. A complete description of the invention is supported with line diagrams. The description should include all the elements of the invention and their construction concerning other elements and functions thereof. (List all parts of your invention or steps in the process if you have a process and how the parts or steps relate to each other).

Our creation is a smart exercise game designed for individuals recovering from hand injuries or motor skill challenges. It integrates gesture-based interaction and gamified rehabilitation to facilitate recovery through structured and engaging exercises. The system comprises an AI-driven gesture recognition model that evaluates patient movements against displayed patterns, ensuring accurate assessment and adaptive progression.

The system begins by displaying a visual pattern on a screen, which the patient must mimic using hand gestures. A motion-tracking sensor or camera captures the patient's gesture, and the AI model processes it to determine its accuracy. Based on the results, the patient either progresses to the next pattern or repeats the current one. This approach helps in systematically improving motor skills and provides a fun and interactive recovery process.

This entails the subsequent primary actions:

1. Recognizing hand gestures through a camera or sensor.
2. Processing gestures and matching them to predefined patterns.
3. Calculating accuracy and providing immediate feedback.
4. Managing progression through levels based on the performance threshold.

Technology:

- **Gesture Recognition:** Computer vision algorithms and motion-tracking sensors.
- **AI Model:** Machine learning-based accuracy evaluation and feedback system.
- **Programming Language:** Python for system logic and gesture processing.

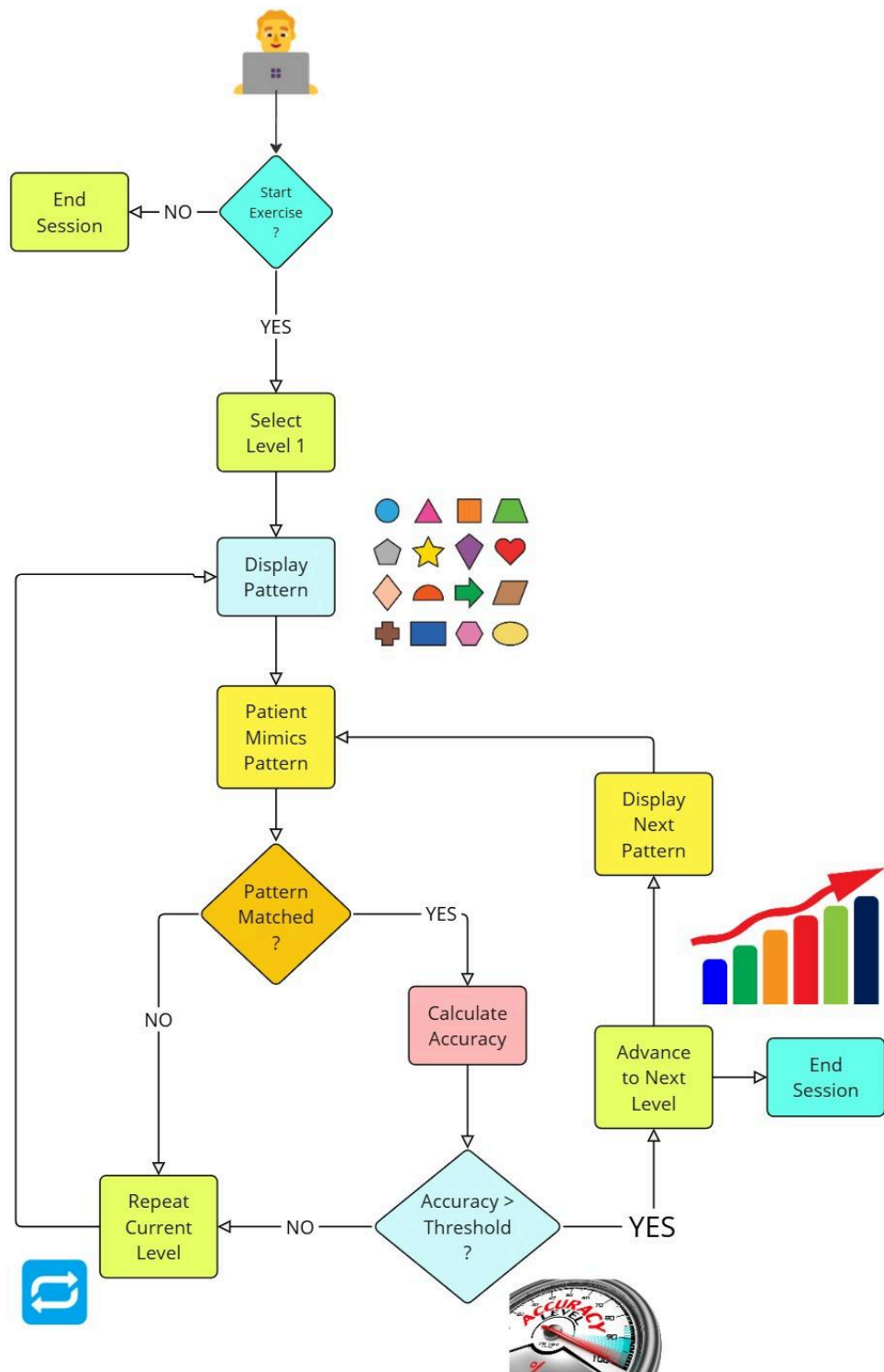


Figure 1: Line Diagram

6. How does your invention work?

- **User Identification and Reports Management:**
Each user is assigned a unique personal ID. All their medical reports, including details about hand-related injuries and progress data, are securely stored and dynamically analyzed by the system.
- **Dynamic Level Creation:**
Based on the user's reports and injury specifics, the system generates personalized rehabilitation levels. These levels are designed to address the user's condition and promote gradual recovery.
- **Hand Gesture Recognition:**
A camera is used to capture the user's hand movements. The system then evaluates these movements using advanced AI models trained to recognize and analyze gestures.
- **Interactive Exercise Interface:**
Patterns or designs corresponding to rehabilitation exercises are displayed on the screen. Users are required to replicate these patterns through hand gestures in the air. If the user matches the pattern with a performance score above a predefined threshold, a new pattern is displayed.
- **Progressive Levels:**
Each level consists of multiple patterns, increasing in complexity as the user progresses. After completing a level, the system provides a detailed analysis, including a performance score, areas of improvement, and the level of problem resolution achieved.
- **Real-Time Feedback and Motivation:**
The system provides real-time feedback on accuracy and efficiency during exercises. Gamified features, such as performance percentages and achievements, keep users motivated and engaged.
- **Advanced Monitoring and Reports:**
After completing each level, detailed reports are generated, outlining the user's progress, improvements, and remaining challenges. These reports can be accessed by the user and shared with therapists for further guidance.
- **Error Detection and Adjustment:**
If the system detects inaccuracies in gesture replication, it provides corrective feedback to help the user perform the exercise correctly.

7. What are the uses of your invention and state any different ways that your invention can achieve the desired result?

- **Post-surgery Rehabilitation**

Following hand or wrist surgery, patients require carefully structured rehabilitation programs to regain functionality. This is particularly valuable in cases of tendon repair, joint replacement, or reconstructive surgery where precise movement control is crucial.

- **General Motor Skill Improvement**

This application can be used by elderly individuals seeking to maintain hand dexterity, professionals requiring fine motor control (such as surgeons or craftspeople), or individuals looking to improve hand-eye coordination.

- **Mental Health and Stress Relief**

The system can serve as a therapeutic tool for managing stress and anxiety.

8. Alternatives for any components/materials/steps of the invention, e.g. bolt can be replaced by rivets or adhesives.

- Smartphone-based motion tracking for basic versions
- Machine learning for pattern recognition
- Different input devices (depth sensors, infrared cameras)
- Cloud-based or local processing options