Evaluation_data

Our questionnaire for Doctor (Physiotherapist):

- How do you usually handle upper-limb rehab without digital tools? Keywords: traditional methods, manual therapy, supervision, subjective assessment
- What problems do you face with the traditional method? Keywords: low motivation, poor compliance, no home tracking, lack of visibility
- Is motivation a big issue for people doing these exercises? Keywords: engagement, adherence, monotony, burnout
- How do you track their progress right now? Keywords: goniometer, manual scoring, observation-based evaluation, no objective metrics
- Have you used any gamified or digital rehab systems before? Keywords: VR systems, Kinect, mobile apps, limited exposure
- If yes, which ones, and how did they work for you? Keywords: high cost, setup difficulty, calibration issues, low clinical depth
- What movement parameters matter the most to you? (accuracy, smoothness, range, ROM,etc.)
- Does camera-based tracking sound useful to you? What should we be careful about? Keywords: calibration, lighting, detection accuracy, ease-of-use, consistency
- How important is detecting compensatory movements like leaning or shoulder lifting? Keywords: compensatory patterns, posture, trunk leaning, shoulder elevation
- For our Arm Orchard game, what would you evaluate? Keywords: reach accuracy, grip detection, ROM utilization, completion time, fatigue
- For the shape tracing game, what should we measure? Keywords: path accuracy, trajectory smoothness, error rate, completion time, stability
- For the piano tiles game, what matters to you — reaction time, accuracy? Keywords: reaction time, fine motor control, accuracy rate, coordination, rhythm
- Do you think adaptive difficulty is necessary in such systems? Keywords: intensity matching, personalization, reducing overexertion, avoiding boredom
- Which clinical metrics would help you make decisions? Keywords: fatigue curves, ROM usage, smoothness indices, error trends, progress tracking
- What could make this system more useful in a clinic? (reports, data export, history tracking)
- Any risks or safety concerns we should keep in mind? Keywords: overexertion, tracking errors, misinterpretation, privacy, safe movement patterns

General questions for users(normal crowd):

- “Hey, when you tried it, how did it feel? Easy? Confusing? Normal?”
- “Did the camera pick up your hand okay, or did it miss it sometimes?”
- “Anything that felt annoying or tiring while playing?”
- “Was the setup fine for you -like the light, space, and camera position?”
- “If you had to use this at home, do you think you’d be comfortable with it?”
- “Did the games feel enjoyable, or too simple, or too repetitive?”
- “Anything you wish worked differently or felt more smooth?”
- “Would you change anything about the controls or the way it detects movement?”

Our Questionnaire for Caretakers

- Was it easy for you to help the person use the app?

- Did you find the setup simple or confusing?
- Would reminders or notifications help you maintain a schedule?
- Did the instructions on the screen feel clear enough?
- Was the camera positioning stressful or manageable?
- Do you think this system could help reduce your supervision workload?
- Anything you feel the app should do differently to support you?

We spoke to **11 people** from our general crowd i.e. our friends, classmates, and family members to understand how they felt while trying the system and to get an honest sense of what worked well and what didn't. Some of them got to use our application as well. We observed that they found our games engaging and fun and some even said that doing this in real time seems fun and challenging . We also got some suggestions for improvement and we have discussed those points in our project report.

Points to be focused on or kept in mind while development :-

- Tracking accuracy
- Gesture reliability (grab-release, pointing, tracing)
- False detections / missed detections
- Lag or delay in movement
- Environmental sensitivity (light, distance, angle)
- Fatigue, arm strain
- Movement complexity
- User confidence
- UI clarity
- Game pacing
- Engagement level
- Real-world relevance
- Independence / ease-of-use
- Comfort with long-term usage
- Immediate learning curve
- Potential frustration points
- Smoothness of experience
- Overall satisfaction

Category	**Keywords / Focus Areas**	**Description (What We Evaluated)**
Traditional Rehabilitation Issues	Motivation, Compliance, Visibility, Supervision, Accuracy, Fatigue	Identified gaps in existing rehab methods such as low engagement, poor home practice, and lack of tracking
Expert (Physiotherapist) Insights	ROM, Smoothness, Trajectory, Compensations, Fatigue Curves, Metrics Reliability	Collected clinical requirements for movement tracking and meaningful data for therapy decisions.

Gamified Rehab Experience	Accessibility, Calibration, Cost, Engagement, Clinical Depth	Explored the doctor's experience with VR/Kinect tools and limitations of older systems.
Game 1 (Arm Orchard) Metrics	Reach Accuracy, Grip Consistency, Completion Time, ROM Utilization, Fatigue Indicators	Evaluated movement precision, gesture consistency, spatial accuracy, and fatigue patterns.
Game 2 (Shape Tracing) Metrics	Path Accuracy, Smoothness, Error Rate, Time, Stability	Measured tracing accuracy, movement control, deviations, resets, and endurance.
Game 3 (Piano Tiles) Metrics	Reaction Time, Accuracy Rate, Fine Motor Control, Rhythm, Bilateral Use	Assessed cognitive–motor speed, hand–eye coordination, finger dexterity, and timing consistency.
Usability Observations	Ease of Use, Confusion Points, Setup Difficulty, Gesture Detection, Instructions	Observed how users understood instructions, handled controls, and interacted with the interface.
Naturalistic Behavior	Posture, Fatigue Signs, Hesitation, Movement Flow, Engagement	Watched natural user behavior, body alignment, and physical effort during tasks.
Crowd Feedback (General Users)	Accuracy Concerns, Camera Reliability, Space Constraints, Frustration, Inclusivity	Gathered non-expert perspectives on camera issues, environment limitations, and accessibility.
Caretaker Insights	Assistance, Setup Support, Instructions Clarity, Reminders	Noted the caretaker's role, ease of guiding the user, and the need for simpler instructions.
Risks Identified	Overexertion, Misinterpretation, Privacy, Tracking Errors	Listed physical, emotional, and ethical risks along with mitigation strategies.
Overall Improvement Areas	Accuracy, Adaptive Difficulty, Customization, Integration, Real-Time Feedback	Identified enhancements needed in motion tracking(for precision sensors should be used), personalization, and clinician workflow support