

EVALUATING THE EFFICIENCY OF VR AND NON-VR ENVIRONMENTS FOR
UPPER EXTREMITY REHABILITATION USING BIOFEEDBACK SENSORS

By

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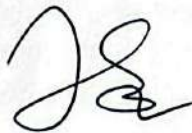
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STATEMENT BY THE AUTHOR

I hereby declare that this submission is my own work and to the best of my knowledge, it contains no material previously published or written by another person, nor material which to a substantial extent has been accepted for the award of any other degree or diploma at any educational institution, except where due acknowledgment is made in the thesis.

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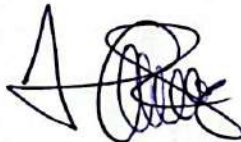


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ABSTRACT

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The increasing prevalence of neuromuscular disorders (NMD) in Indonesia remains largely overlooked, despite their significant impact on individuals' life quality, especially among the elderly. In response, NMD Physicians marks the urgency of improving early detection and proper treatment to reduce the risk of misdiagnosis by establishing the first neuromuscular center at Mandaya Royal Hospital Puri, Jakarta. This study proposes a virtual reality (VR)-based environment approach for upper extremity rehabilitation, enlightened by conventional gait treadmill systems often used in lower extremity therapy. The system integrates an IMU sensor, a pressure sensor, and the Unity game platform for engaging and interactive mobile therapy sessions. Due to limitations on NMD-specific subjects, the study involved eight consenting elderly individuals, some with NMD conditions, that are divided into a VR and a non-VR control group. Both groups follow separate daily training sessions over two weeks, with four-phase data collection. The control group uses the VR system only during the initial and final sessions to ensure unbiased comparison. Statistical process on preliminary results demonstrated which group with better improvements in motion range and grip strength tasks. These outcomes suggest VR's potential application in supporting physical restoration in elderly, including those with NMD.

Keywords: Virtual Reality, Upper Extremity Rehabilitation, Grip Strength, Motion Tracking, Motion Range Estimation, Biofeedback, Physical Performance Evaluation



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I would also like to offer my deepest credit, praise, and thankfulness to my advisor, Gerald Goenawan, S.T., M.Sc., and Aulia Arif Iskandar, S.T., M.T., for the continuous kindness, patience, reminders, advice, and assistance during the thesis execution. Their invaluable feedback, significant support, and constant approval have delivered creative insights and tips for the author to improve the thesis research workflow.

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