氏 名	RADHIATUL HUSNA
授与した学位	博士
専攻分野の名称	工学
学位授与番号	博甲第 7278 号
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学位授与の要件	自然科学研究科 産業創成工学専攻
	(学位規則第4条第1項該当)
学位論文の題目	A Study of Hand Gestures for Controlling Video Games in Rehabilitation Exergame System (リハビリ目的の運動ゲームシステムにおけるゲーム操作のためのハンドジェスチャー の研究)
論文審査委員	教授 舩曵 信生 教授 田野 哲 教授 野上 保之
学位論文内容の要旨	

This thesis presents an investigation of hand gestures for controlling video games in rehabilitation exergame system.

As the first contribution of the thesis, I investigate proper hand gestures for controlling video games in the *exergame* system for hand rehabilitations. It is necessary to select easy and intuitive hand gestures for game controls so that novice users including seniors can easily play the video game in the *exergame* system.

MediaPipe Python library is adopted for real-time recognitions of the hand gestures. Through the questionnaire to participants, 10 easy gestures are selected from 32 possible simple hand gestures as the best and the second-best groups. It is noted that five hand gestures are necessary to control the implemented video game in the system. Through score comparisons between them, I confirm the properness of the five hand gestures in the best group. The *System Usability Scale (SUS)* score and *User Experience Questionnaire (UEQ)* results also support this claim.

As the second contribution of the thesis, I measure the accuracy of the recognition performance among the ten hand gestures in the implemented system. The results show that the hand gestures in the best group are more accessible than in the second-based group. The results suggest proper hand gestures for game controls and confirm the proposal's validity.

The thesis is organized as follows: Chapter 1 introduces the background, contributions, and contents of this thesis. Chapter 2 gives the overview of *exergame* system using hand gestures for rehabilitation. Chapter 3 discusses the methodology for hand gesture investigation and experiments. Chapter 4 investigates proper hand gestures for game controls. Chapter 5 shows evaluation of best hand gestures. Chapter 6 presents previous works related to this thesis. Finally, Chapter 7 concludes this thesis with some future works.

論文審査結果の要旨

In this thesis, the applicant presented the study of hand gestures for controlling video games in rehabilitation exergame system.

As the first contribution of the thesis, she investigated proper hand gestures for controlling video games in the exergame system for hand rehabilitations. It is necessary to select easy and intuitive hand gestures for game controls so that novice users including seniors can easily play the video game in the exergame system. MediaPipe Python library was adopted for real-time recognitions of the hand gestures. Through the questionnaire to participants, 10 easy gestures were selected from 32 possible simple hand gestures as the best and the second-best groups, where five hand gestures are necessary to control the implemented video game in the system. Through score comparisons between them, she confirmed the properness of the five hand gestures in the best group. The System Usability Scale (SUS)} score and User Experience Questionnaire (UEQ) results also support this claim.

As the second contribution of the thesis, she measured the accuracy of the recognition performance among the 10 hand gestures in the implemented system. The results show that the hand gestures in the best group are more accessible than in the second-based group. The results suggest the proper hand gestures for game controls and confirm the proposal's validity.

The applicant has published one journal paper and one national conference paper to present the contributions.

From the overall evaluation of this thesis, the applicant has satisfied the qualification condition for the doctor degree in Engineering from the Graduate School of Natural Science and Technology at Okayama University.