Although positive effects can be achieved by continuously performing preventive care and other health activities, performing the same activities every day can be a mental strain. Therefore, research has been performed on maintaining the motivation of users and encouraging them to use exercise systems by incorporating games where users can perform voluntary activities. The Kinect system developed by Microsoft is able to recognize people's posture and the three-dimensional coordinates of their joints, and work has been done to research and develop systems that use a Kinect to measure and hand and foot movements for rehabilitation purposes. Since the Kinect can detect real-world human postures, it can also be used to recognize antagonistic exercises. Recently, several Kinect-based commercial rehabilitation systems have been developed. 

Previously, we designed and developed a prototype lower-limb chair exercise support system using a depth image sensor, and evaluated the performance and usability. The system recognizes and evaluates exercises based on 3D position data and joint angles for skeletal and RGB data obtained from the Kinect sensor. In this study, we designed, implemented, and evaluated a system that supports antagonistic exercise using a depth sensor. The system recognizes exercises by using skeletal data about the user’s joints acquired from a depth sensor, and evaluates the user’s exercises to provide real-time feedback. In addition, this system uses an audiovisual display to explain the exercise procedures to the user, and displays the user’s real-time video to encourage the user to perform the exercises. It also has a rhythm game function whereby the user can exercise in time with music. This system includes four types of exercise: upper-/lower-limb antagonistic movement, upper-/lower-limb left/right antagonistic movement, rock/paper/scissors using both arms and both legs, and duple/triple-time exercises.

Comment [A1]: In American English, a comma (called serial or Oxford comma) is inserted before “and” in a series of three or more items.

Comment [A2]: When a compound adjective is used before a noun, it is connected using a hyphen. At this instance, the compound adjective “real-time” modifies the noun “video.”