

CLAIMS

What is claimed is:

1. A system for monitoring movement capabilities of a user using clinical mobility-based assessments, the system comprising:

a mobile device comprising an inertial measurement device, the inertial measurement device comprising:

a gyroscope; and

an accelerometer;

at least one processor; and

a memory storing processor-executable instructions, wherein the at least one processor is configured to implement the following operations upon executing the processor-executable instructions:

providing a clinical mobility-based assessment to a user;

generating, using the inertial measurement device, inertial data of the user that is indicative of movement capabilities of the user based on the clinical mobility-based assessment;

logging the inertial data of the user locally to the mobile device resulting in locally logged inertial data of the user;

processing in real-time the locally logged inertial data of the user to determine position and orientation of the mobile device during the clinical mobility-based assessment; wherein the processing in real-time of the locally logged inertial data of the user to determine position and orientation of the mobile device during the clinical mobility-based assessment comprises:

segmenting and aligning the locally logged inertial data of the user resulting in segmented and aligned inertial data of the user;

integrating angular orientation of the segmented and aligned inertial data of the user resulting in counterbalanced inertial data of the user;

determining velocity of the mobile device during the clinical mobility-based assessment using the counterbalanced inertial data of the user;

drift compensating the velocity of the mobile device during the clinical mobility-based assessment resulting in drift compensated velocity data; and

determining the position and the orientation of the mobile device during the clinical mobility-based assessment using the drift compensated velocity data;

wherein the at least one processor is further configured to implement the following operations upon executing the processor-executable instructions:

determining, using the position and the orientation of the mobile device during the clinical mobility-based assessment, a physical movement assessment of the user associated with the clinical mobility-based assessment; and

displaying at least a portion of the physical movement assessment to the user, wherein the displaying includes declines in the clinical mobility-based assessment.

2. The system as recited in claim 1, further comprising an interactive animated conversational graphical user interface displayed by the mobile device;

wherein the at least one processor is further configured to implement an operation of displaying a representation of the clinical mobility based assessment via the interactive animated conversational graphical user interface.

3. The system as recited in claim 1, wherein the clinical mobility based assessment includes one or more of a test duration, a turning duration, a sit-to-stand duration, a stand-to-sit duration, a number of sit-to-stand repetitions completed within a predetermined period of time, and a number of stand-to-sit repetitions completed within a predetermined period of time.

4. The system as recited in claim 1, wherein the inertial data of the user that is indicative of movement capabilities of the user based on the clinical mobility-based assessment comprises gyroscope data generated using the gyroscope; and accelerometer data generated using the accelerometer.

5. ~~The system as recited in claim 1, wherein the processing in real time the locally logged inertial data of the user to determine position and orientation of the mobile device during the clinical mobility based assessment comprises:~~

~~—— segmenting and aligning the locally logged inertial data of the user resulting in segmented and aligned inertial data of the user;~~

~~—— gravitational acceleration counterbalancing of the segmented and aligned inertial data of the user resulting in counterbalanced inertial data of the user;~~

~~—— determining velocity of the mobile device during the clinical mobility based assessment using the counterbalanced inertial data of the user;~~

~~—— drift compensating the velocity of the mobile device during the clinical mobility based assessment resulting in drift compensated velocity data; and~~

~~determining the position and the orientation of the mobile device during the clinical mobility based assessment using the drift compensated velocity data.~~

6. ~~The system as recited in claim 1, wherein the processing in real time the locally logged inertial data of the user to determine position and orientation of the mobile device during the clinical mobility based assessment comprises:~~

~~—— segmenting and aligning the locally logged inertial data of the user resulting in segmented and aligned inertial data of the user;~~

~~integrating angular orientation of the segmented and aligned inertial data of the user resulting in counterbalanced inertial data of the user;~~

~~—determining velocity of the mobile device during the clinical mobility based assessment using the counterbalanced inertial data of the user;~~

~~—drift compensating the velocity of the mobile device during the clinical mobility based assessment resulting in drift compensated velocity data; and~~

~~determining the position and the orientation of the mobile device during the clinical mobility based assessment using the drift compensated velocity data.~~

7.5. The system as recited in claim 1, wherein the at least one processor is further configured to implement an operation of:

determining features of functional movements of the user based on the position and the orientation of the mobile device during the clinical mobility-based assessment, the features of the functional movements including one or more of: time to completion of a task, rate to completion of a task, total repetitions of a task completed within a predetermined period of time, decay of repetitions of a task completed within a predetermined period of time, turn rate, anteroposterior sway, mediolateral sway, gait characteristics, total magnitude of displacement, vertical displacement, mediolateral displacement, and resultant displacement.

~~8.~~ 6. The system as recited in claim 1, wherein the physical movement assessment to the user includes one or more of a static stability of the user, dynamic stability of the user, postural stability of the user, balance of the user, mobility of the user, fall risk of the user, lower body muscular strength of the user, lower body muscular endurance of the user, lower body muscular flexibility of the user, upper body muscular strength of the user, and upper body muscular endurance of the user.

~~9.~~ 7. The system as recited in claim 1, wherein the at least one processor is further configured to implement operations of:

receiving the locally logged inertial data of the user and the physical movement assessment of the user;

conducting a longitude physical movement assessment analysis using the physical movement assessment of the user associated with the clinical mobility-based assessment; and

displaying at least a portion of the longitude physical movement assessment analysis to the user.

~~10.~~ 8. The system as recited in claim ~~9~~ 7, wherein the conducting the longitude physical movement assessment analysis comprises:

receiving a predetermined threshold of change in physical movement associated with a domain from a cloud-based normative data storage;

comparing the physical movement assessment of the user with the predetermined threshold of change in physical movement;

determining, based on the comparing, that the physical movement assessment exceeds the predetermined threshold of change in physical movement; and

displaying, ~~if~~ when the physical movement assessment exceeds the predetermined threshold of change in physical movement, a longitude mobility assessment to the user.

~~11.~~ 9. A method for monitoring movement capabilities of a user using clinical mobility-based assessments, the method comprising:

providing, using a mobile device comprising an inertial measurement device, a clinical mobility-based assessment to a user;

generating, using the inertial measurement device, inertial data of the user that is indicative of movement capabilities of the user based on the clinical mobility-based assessment;

logging the inertial data of the user locally to the mobile device resulting in locally logged inertial data of the user;

processing in real-time the locally logged inertial data of the user to determine position and orientation of the mobile device during the clinical mobility-based assessment; wherein the processing in real-time the locally logged inertial data of the user to determine position and orientation of the mobile device during the clinical mobility based assessment comprises:

segmenting and aligning the locally logged inertial data of the user resulting in segmented and aligned inertial data of the user;

integrating angular orientation of the segmented and aligned inertial data of the user resulting in counterbalanced inertial data of the user;

determining velocity of the mobile device during the clinical mobility-based assessment using the counterbalanced inertial data of the user;

drift compensating the velocity of the mobile device during the clinical mobility-based assessment resulting in drift compensated velocity data; and

determining the position and the orientation of the mobile device during the clinical mobility-based assessment using the drift compensated velocity data;

the method further comprising:

determining, using the position and the orientation of the mobile device during the clinical mobility-based assessment, a physical movement assessment of the user associated with the clinical mobility-based assessment; and

displaying, using the mobile device, at least a portion of the physical movement assessment to the user, wherein the displaying includes declines in the clinical mobility-based assessment.

~~12.~~ 10. The method as recited in claim ~~11~~ 9, further comprising:

displaying a representation of the clinical mobility-based assessment via an interactive animated conversational graphical user interface displayed by the mobile device.

~~13.~~ 11. The method as recited in claim ~~11~~ 9, wherein the clinical mobility-based assessment includes one or more of a test duration, a turning duration, a sit-to-stand duration, a stand-to-sit duration, a number of sit-to-stand repetitions completed within a predetermined period of time, and a number of stand-to-sit repetitions completed within a predetermined period of time.

~~14.~~ 12. The method as recited in claim ~~11~~ 9, wherein the inertial data of the user that is indicative of the movement capabilities of the user based on the clinical mobility-based assessment comprises gyroscope data generated using a gyroscope; and accelerometer data generated using an accelerometer.

~~15. — The method as recited in claim 11, wherein the processing in real time the locally logged inertial data of the user to determine position and orientation of the mobile device during the clinical mobility based assessment comprises:~~

~~—— segmenting and aligning the locally logged inertial data of the user resulting in segmented and aligned inertial data of the user;~~

~~—— gravitational acceleration counterbalancing of the segmented and aligned inertial data of the user resulting in counterbalanced inertial data of the user;~~

~~—— determining velocity of the mobile device during the clinical mobility based assessment using the counterbalanced inertial data of the user;~~

~~—— drift compensating the velocity of the mobile device during the clinical mobility based assessment resulting in drift compensated velocity data; and~~

~~determining the position and the orientation of the mobile device during the clinical mobility based assessment using the drift compensated velocity data.~~

16. ~~The method as recited in claim 11, wherein the processing in real time the locally logged inertial data of the user to determine position and orientation of the mobile device during the clinical mobility based assessment comprises:~~

~~—— segmenting and aligning the locally logged inertial data of the user resulting in segmented and aligned inertial data of the user;~~

~~—— integrating angular orientation of the segmented and aligned inertial data of the user resulting in counterbalanced inertial data of the user;~~

~~—— determining velocity of the mobile device during the clinical mobility based assessment using the counterbalanced inertial data of the user;~~

~~drift compensating the velocity of the mobile device during the clinical mobility based assessment resulting in drift compensated velocity data; and~~

~~determining the position and the orientation of the mobile device during the clinical mobility based assessment using the drift compensated velocity data.~~

~~17.~~ 13. The method as recited in claim ~~11~~ 9, further comprising:

determining features of functional movements of the user based on the position and the orientation of the mobile device during the clinical mobility-based assessment, the features of functional movements including one or more of: time to completion of a task, rate to completion of a task, total repetitions of a task completed within a predetermined period of time, decay of repetitions of a task completed within a predetermined period of time, turn rate, anteroposterior sway, mediolateral sway, gait characteristics, total magnitude of displacement, vertical displacement, mediolateral displacement, and resultant displacement.

~~18.~~ 14. The method as recited in claim ~~11~~ 9, wherein the physical movement assessment to the user includes one or more of a static stability of the user, dynamic stability of the user, postural stability of the user, balance of the user, mobility of the user, fall risk of the user, lower body muscular strength of the user, lower body muscular endurance of

the user, lower body muscular flexibility of the user, upper body muscular strength of the user, and upper body muscular endurance of the user.

~~19.~~ 15. The method as recited in claim ~~11~~ 9, further comprising:

receiving the locally logged inertial data of the user and the physical movement assessment of the user;

conducting a longitude physical movement assessment analysis using the physical movement assessment of the user associated with the clinical mobility-based assessment; and

displaying at least a portion of the longitude physical movement assessment analysis to the user.

~~20.~~ 16. A non-transitory computer readable medium having embodied thereon instructions being executable by at least one processor to perform a method for monitoring movement capabilities of a user using clinical mobility-based assessments, the method comprising:

providing, using a mobile device comprising an inertial measurement device, a clinical mobility-based assessment to a user;

generating, using the inertial measurement device, inertial data of the user that is indicative of movement capabilities of the user based on the clinical mobility-based assessment;

logging the inertial data of the user locally to the mobile device resulting in locally logged inertial data of the user;

processing in real-time the locally logged inertial data of the user to determine position and orientation of the mobile device during the clinical mobility-based assessment; wherein the processing in real-time the locally logged inertial data of the user to determine position and orientation of the mobile device during the clinical mobility-based assessment comprises:

segmenting and aligning the locally logged inertial data of the user resulting in segmented and aligned inertial data of the user;

integrating angular orientation of the segmented and aligned inertial data of the user resulting in counterbalanced inertial data of the user;

determining velocity of the mobile device during the clinical mobility based assessment using the counterbalanced inertial data of the user;

drift compensating the velocity of the mobile device during the clinical mobility-based assessment resulting in drift compensated velocity data; and

determining the position and the orientation of the mobile device during the clinical mobility-based assessment using the drift compensated velocity data;

the method further comprising:

determining, using the position and the orientation of the mobile device during the clinical mobility-based assessment, a physical movement assessment of the user associated with the clinical mobility-based assessment; and

displaying, using the mobile device, at least a portion of the physical movement assessment to the user, wherein the displaying includes declines in the physical movement assessment.