

## CLAIMS:

1. A method of controlling cleaning effectiveness comprising:
  - detecting, by a wearable computing device that is worn by an individual performing cleaning on a target surface, movement associated with the wearable device during a cleaning event;
  - determining, based on the movement associated with the wearable computing device, a quality of cleaning for the target surface by at least comparing movement data generated by the wearable device with reference movement data associated with a threshold quality of cleaning for the target surface,
  - responsive to determining that the target surface has not been effectively cleaned to the threshold quality of cleaning, performing, by the wearable computing device, an operation.
2. The method of claim 1, further comprising, responsive to determining that the target surface has been effectively cleaned to the threshold quality of cleaning, storing cleaning validation information associated with the target surface and a time of the cleaning event.
3. The method of claim 1, wherein:
  - detecting movement associated with the wearable computing device comprises receiving, from at least one sensor of the wearable computing device, movement data, and
  - determining the quality of cleaning for the target surfaces comprises:
    - determining at least one signal feature for the movement data, and
    - comparing the at least one signal feature for the movement data to reference signal feature data associated with cleaning of the target surface.
4. The method of claim 3, wherein
  - receiving movement data comprises receiving, from at least a first sensor of the wearable computing device, first movement data corresponding to an acceleration of the wearable computing device and receiving, from at least a second sensor of the wearable computing device, second movement data corresponding to an angular velocity of the wearable computing device; and

determining at least one signal feature for the movement data comprises determining at least one signal feature for the first movement data and at least one signal feature for the second movement data.

5. The method of claim 3, wherein the threshold quality of cleaning for the target surface corresponds to at least one of a magnitude and a frequency of the at least one signal feature.

6. The method of claim 3, wherein the reference signal feature data is generated from movement data obtained during one or more training episodes in which a trainer cleans the target surface or an equivalent thereof while wearing the wearable computing device or an equivalent thereof.

7. The method of claim 3, wherein the reference signal feature data is generated from movement data obtained during one or more training episodes in which the individual performing cleaning cleans the target surface or an equivalent thereof while wearing the wearable computing device or an equivalent thereof.

8. The method of claim 1, wherein the determining the quality of cleaning for the target surface comprises at least:

associating a portion of the movement data received during the cleaning event with a time when the target surface is being cleaned,

determining at least one signal feature indicative of the quality of cleaning for the portion of the movement data corresponding to when the target surface is being cleaned, and

comparing the at least one signal feature indicative of the quality of cleaning for the portion of movement data to reference signal feature data associated with the quality of cleaning.

9. The method of claim 1, wherein determining the quality of cleaning for the target surface comprises at least:

associating a portion of the movement data received during the cleaning event with a time when the target surface is being cleaned,

determining an area of cleaning performed on the target surface, and

comparing the area of cleaning determined to be performed on the target surface to reference area data associated with the target surface.

10. The method of claim 1, wherein performing the operation comprises issuing an alert via the wearable computing device indicating that the quality of cleaning of the target surface is less than the threshold quality of cleaning, the alert being issued in substantially real-time with the target surface being cleaned by the individual performing cleaning.

11. A wearable computing device comprising:

at least one sensor configured to detect movement associated with the wearable computing device;

at least one processor; and

a memory comprising instructions that, when executed, cause the at least one processor to:

receive, from the at least one sensor, movement data for the wearable computing device while an individual wearing the wearable computing device performs a cleaning operation on a target surface during a cleaning event;

determine, based on the movement data, a quality of cleaning for the target surface by at least comparing movement data with reference movement data associated with a threshold quality of cleaning for the target surface,

responsive to determining that the target surface has not been effectively cleaned to the threshold quality of cleaning, perform an operation.

12. The device of claim 11, wherein the instructions, when executed, cause the at least one processor to store cleaning validation information associated with the target surface and a time of the cleaning event.

13. The device of claim 11, wherein the instructions, when executed, cause the at least one processor to determine the quality of cleaning by at least:

determining at least one signal feature for the movement data, and

comparing the at least one signal feature for the movement data to reference signal feature data associated with cleaning of the target surface.

14. The device of claim 13, wherein

the at least one sensor comprises a first sensor configured to generate first movement data corresponding to an acceleration of the wearable computing device and a second sensor configured to generate second movement data corresponding to an angular velocity of the wearable computing device; and

the instructions, when executed, cause the at least one processor to determine the at least one signal feature for the movement data by at least determining a first signal feature for the first movement and a second signal feature for the second movement data.

15. The device of claim 13, wherein the threshold quality of cleaning for the target surface corresponds to at least one of a magnitude and a frequency of the at least one signal feature.

16. A method of total hygiene management comprising:

determining, based on movement of a wearable computing device, at least one feature of movement that indicates a wearer of the wearable computing device is performing a cleaning action, thereby distinguishing movement of the wearable computing device during non-cleaning actions;

determining, based on comparison of the feature of movement with reference to movement data associated with different types of cleaning actions, a specific type of cleaning action performed by the wearer of the wearable computing device;

determining a quality of cleaning for the specific type of cleaning action performed by at least comparing movement data generated by the wearable device during the specific type of cleaning action with reference movement data associated with a threshold quality of cleaning for the specific type of cleaning action,

responsive to determining that the specific type of cleaning action performed by the wearer of the wearable computing device does not satisfy the threshold quality of cleaning, performing, by the wearable computing device, an operation.

17. The method of claim 16, wherein the specific type of cleaning action is selected from the group consisting of a floor surface cleaning action, an equipment cleaning action, and a hand hygiene cleaning action.

18. The method of claim 16, further comprising detecting, by the wearable computing device, movement associated with the wearable device during performance of a plurality of different types of cleaning actions.

19. The method of claim 18, wherein one of the plurality of different types of cleaning actions is a hand hygiene cleaning action and at least one other of the plurality of different types of cleaning actions is selected from the group consisting of a floor surface cleaning action, an equipment cleaning action, and combinations thereof.

20. The method of claim 19, wherein determining the quality of cleaning for the specific type of cleaning action performed comprises determining the quality of cleaning for each of the plurality of different types of cleaning actions performed.

21. The method of claim 19, determining, based on the movement associated with the wearable computing device, a cleaning order in which the plurality of different types of cleaning actions were performed;

comparing the cleaning order to a target order in which the plurality of different types of cleaning actions are expected to be performed; and

responsive to determining that the plurality of different types of cleaning actions were not performed in the target order, at least one of:

issuing, by the wearable computing device, a user alert; and

storing cleaning order information associated with the plurality of different types of cleaning actions.

22. The method of claim 21, wherein the target order has the hand hygiene cleaning action following the other of the plurality of different types of cleaning actions.

23. The method of claim 16, wherein determining, based on movement of the wearable computing device, at least one feature of movement that indicates the wearer of the wearable computing device is performing the cleaning action comprises:

receiving movement data from at least a first sensor of the wearable computing device, first movement data corresponding to an acceleration of the wearable computing device and

receiving, from at least a second sensor of the wearable computing device, second movement data corresponding to an angular velocity of the wearable computing device; and

determining at least one signal feature of the movement data comprises determining at least one signal feature for the first movement data and at least one signal feature for the second movement data.

24. The method of claim 16, wherein the threshold quality of cleaning corresponds to at least one of a magnitude and a frequency of the at least one signal feature.

25. The method of claim 16, wherein the reference movement data associated with different types of cleaning actions and the reference movement data associated with the threshold quality of cleaning for the specific type of cleaning action are each generated from movement data obtained during one or more training episodes in which the wearer of the wearable computing device performs the specific type of cleaning action while wearing the wearable computing device or an equivalent thereof.