

CLAIMS:

1. A method of reducing illnesses and infections caused by ineffective cleaning through tracked cleaning efficacy, the method comprising:

detecting, by a wearable computing device that is worn by an individual performing cleaning on a plurality of target surfaces, movement associated with the wearable device during a cleaning event;

determining, based on the movement associated with the wearable computing device, whether the individual has performed a cleaning operation on each of the plurality of target surfaces by at least comparing movement data generated by the wearable device with reference movement data associated with cleaning of each of the plurality of target surfaces;

responsive to determining that the individual has not performed the cleaning operation on at least one of the plurality of target surfaces, performing, by the wearable computing device, an operation.

2. The method of claim 1, further comprising, responsive to determining that the cleaning operation has been performed on each of the plurality of target surfaces, storing cleaning validation information associated with the plurality of target surfaces and a time of the cleaning event.

3. The method of claim 1, wherein performing the operation comprises issuing a user alert indicating that the individual has not performed the cleaning operation on at least one of the plurality of target surfaces.

4. The method of claim 3, wherein issuing the user alert comprises outputting, by the wearable computing device, information identifying one of the plurality of target surfaces that the user has not performed the cleaning operation on.

5. The method of claim 1, wherein the plurality of target surfaces include floor surfaces and non-floor surfaces.

6. The method of claim 5, wherein the cleaning operation comprises a first cleaning operation for a first one of the plurality of target surface and a second cleaning operation different than the first cleaning operation for a second one of the plurality of target surfaces.
7. 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 whether the individual performing cleaning has performed the cleaning operation on each of the plurality of 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 each of the plurality of target surfaces.
8. The method of claim 7, wherein the reference signal feature data is generated from movement data obtained during one or more training episodes in which at least one trainer performs the cleaning operation on each of the plurality of target surfaces or equivalents thereof while wearing the wearable computing device or an equivalent thereof.
9. The method of claim 7, wherein the reference signal feature data is generated from movement data obtained during one or more training episodes in which the individual performs the cleaning operation on each of the plurality of target surfaces or equivalents thereof while wearing the wearable computing device or an equivalent thereof.
10. The method of claim 7, 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 and at least one signal feature for the second movement data.

11. The method of claim 1, further comprising:

determining, based on the movement associated with the wearable computing device, a surface cleaning order in which the cleaning operation was performed on each of the plurality of target surfaces;

comparing the surface cleaning order to a target order in which the plurality of target surfaces are expected to be cleaned; and

responsive to determining that the individual has not performed the cleaning operation on the plurality of target surfaces 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 cleaning event.

12. The method of claim 1, further comprising determining, based on the movement associated with the wearable computing device, a quality of cleaning for each of the plurality of target surfaces on which the individual has performed the cleaning operation.

13. The method of claim 12, wherein determining the quality of cleaning for each of the plurality of target surfaces on which the individual has performed the cleaning operation comprises determining a duration of cleaning for each of the plurality of target surfaces on which the individual has performed the cleaning operation.

14. The method of claim 12, wherein determining the quality of cleaning for each of the plurality of target surfaces on which the individual has performed the cleaning operation comprises determining the quality of cleaning for each of the plurality of target surfaces on which the individual has performed the cleaning operation by at least:

associating different portions of the movement data received during the cleaning operation with a particular one of each of the plurality of target surfaces on which the individual has performed the cleaning operation,

determining at least one signal feature indicative of the quality of cleaning for each associated different portion of the movement data corresponding to the particular one of each of the plurality of target surfaces on which the individual has performed the cleaning operation, and

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

15. The method of claim 12, wherein determining the quality of cleaning for each of the plurality of target surfaces on which the individual has performed the cleaning operation comprises:

associating different portions of the movement data received during the cleaning operation with a particular one of each of the plurality of target surfaces on which the individual has performed the cleaning operation,

determining an area of cleaning performed on the particular one of each of the plurality of target surfaces on which the individual has performed the cleaning operation, and

comparing the area of cleaning for each associated different portion of movement data to reference area data associated with the particular one of each of the plurality of target surfaces on which the individual has performed the cleaning operation.

16. The method of claim 12, wherein performing the operation comprises issuing an alert via the wearable computing device indicating that the quality of cleaning of a particular one of the plurality of target surfaces on which the individual has performed the cleaning operation is less than a threshold quality of cleaning, the alert being issued in substantially real-time with the individual performing the cleaning operation on the particular one of the plurality of target surfaces.

17. 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 plurality of target surfaces during a cleaning event;

determine, based on the movement data, whether the individual has performed the cleaning operation on each of the plurality of target surfaces by at least comparing movement data with reference movement data associated with cleaning of each of the plurality of target surfaces;

responsive to determining that the individual has not performed the cleaning operation on at least one of the plurality of target surfaces, perform an operation.

18. The device of claim 17, wherein the instructions, when executed, cause the at least one processor to perform the operation by at least issuing a user alert indicating that the individual has not performed the cleaning operation on at least one of the plurality of target surfaces.

19. The device of claim 17, wherein the instructions, when executed, cause the at least one processor to determine whether the individual has performed the cleaning operation on each of the plurality of target surfaces 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 each of the plurality of target surfaces.

20. The device of claim 19, 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.

21. The device of claim 17, wherein the instructions, when executed, cause the at least one processor to:

determine, based on the movement data, a surface cleaning order in which the cleaning operation was performed on each of the plurality of target surfaces;

compare the surface cleaning order to a target order in which the plurality of target surfaces are expected to be cleaned;

responsive to determining that the individual has not performed the cleaning operation on the plurality of target surfaces in the target order, at least one of:

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

store cleaning order information associated with the cleaning event in the memory.

22. The device of claim 17, wherein the instructions, when executed, cause the at least one processor to determine, based on the movement data, a quality of cleaning for each of the plurality of target surfaces on which the individual has performed the cleaning operation.

23. A method of establishing a customer-specific system for tracking cleaning efficacy, the method comprising:

performing, by an individual wearing a wearable computing device, a cleaning operation on each of a plurality of target surfaces, the plurality of target surfaces being selected as target surfaces of which cleaning is desired to be tracked in connection with subsequent cleaning events;

generating, by the wearable computing device, movement data associated with movement of the wearable device during the cleaning operation performed on each of a plurality of target surfaces;

associating different portions of the movement data generated during the cleaning operation with a particular one of each of the plurality of target surfaces on which the individual has performed the cleaning operation;

determining, for each of the plurality of different target surfaces, reference data indicative of the cleaning operation being performed from the associated different portion of movement data for each of the plurality of different target surfaces;

storing the reference data for each of the plurality of different target surfaces for use in connection with subsequent cleaning events.

24. The method of claim 23, wherein determining reference signal data comprises:

determining at least one signal feature for each associated different portion of movement data indicative of the cleaning operation being performed on the particular one of the plurality of target surfaces corresponding to the associated different portion of movement data.

25. The method of claim 24, wherein determining at least one signal feature for each associated different portion of movement data comprises determining a first signal feature indicative of the cleaning operation being performed on a first of the plurality of target surfaces and a second signal feature different than the first signal feature indicative of the cleaning operation being performed on a second of the plurality of target surfaces.