

**ELECTRONIC DEVICE WITH DUST ACCUMULATION DETECTION AND
METHOD OF DETECTING DUST ACCUMULATION THEREOF**

Technical Field

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[0001] Various embodiments generally relate to an electronic device. In particular, various embodiments generally relate to an electronic device with dust accumulation detection and a method of detecting dust accumulation for an electronic device.

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Background

[0002] Conventionally, electronic devices, such as computing devices (e.g. laptop, notebook, desktop, tablet, server, all-in-one personal computer, etc.), visual display devices (e.g. monitors, television, etc.), consoles (e.g. gaming console), or audio devices, may accumulate dust inside the electronic devices after a period of use. The dust accumulation therein may cause a degradation in performance of the electronic devices. For example, the dust accumulation may trap heat and/or disrupt cooling causing degradation in the electronic components.

[0003] Accordingly, there is a need for addressing at least some of the issues identified above.

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Summary

[0004] According to various embodiments, there is provided an electronic device including a housing having an air vent; an airflow generator disposed in the housing, wherein the airflow generator is operable to generate an air flow towards the air vent so as to expel air from within the housing through the air vent of the housing to outside the housing; and a sensor component located along a path of the air flow at or before the air vent of the housing to measure one or more physical properties of the air flow.

[0005] According to various embodiments, there is provided a method of dust accumulation detection for an electronic device, the method including comparing one or more physical properties of an air flow measured by a sensor component with a reference data, the air flow being generated by an airflow generator disposed in a housing of the electronic device towards an air vent of the housing so as to expel air from within the housing through the air vent of the housing to outside of the housing, the sensor component being located along a path of the air

flow at or before the air vent of the housing, wherein a state of dust accumulation along the airflow is determined based on a result of the comparison.

Brief description of the drawings

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[0006] In the drawings, like reference characters generally refer to the same parts throughout the different views. The drawings are not necessarily to scale, emphasis instead generally being placed upon illustrating the principles of the invention. In the following description, various embodiments are described with reference to the following drawings, in which:

10 FIG. 1 shows a schematic diagram illustrating dust accumulation detection for an electronic device according to various embodiments;

FIG. 2 shows a schematic diagram illustrating dust accumulation detection for an electronic device according to various embodiments;

15 FIG. 3 shows a schematic diagram illustrating dust accumulation detection for an electronic device according to various embodiments;

FIG. 4 shows an example of the generation of the air flow by the airflow generator of the electronic device of FIG. 3 according to various embodiments;

20 FIG. 5 shows a diagram of a method (e.g. a computer implemented method) for determining dust accumulation in the electronic device of FIG. 1 to FIG. 3 according to various embodiments; and

[0007] FIG. 6 shows an expanded flow diagram of the method (e.g. a computer implemented method) of FIG. 5 for determining dust accumulation in the electronic device of FIG. 1 to FIG. 3 according to various embodiments.

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Detailed description

[0008] Embodiments described below in context of the apparatus are analogously valid for the respective methods, and vice versa. Furthermore, it will be understood that the embodiments described below may be combined, for example, a part of one embodiment may be combined with a part of another embodiment.

30 [0009] It should be understood that the terms “on”, “over”, “top”, “bottom”, “down”, “side”, “back”, “left”, “right”, “front”, “lateral”, “side”, “up”, “down” etc., when used in the following description are used for convenience and to aid understanding of relative positions or directions, and not intended to limit the orientation of any device, or structure or any part of

any device or structure. In addition, the singular terms “a”, “an”, and “the” include plural references unless context clearly indicates otherwise. Similarly, the word “or” is intended to include “and” unless the context clearly indicates otherwise.

[00010] Various embodiments relate to an electronic device. In particular, various
5 embodiments generally relate to an electronic device with dust accumulation detection and a method of detecting dust accumulation for an electronic device. According to various embodiments, the electronic device may include, but not limited to, a computing device (e.g. a laptop, a notebook, a desktop, a tablet, a server, an all-in-one personal computer, etc.), a visual display device (e.g. a monitor, a television, etc.), a console (e.g. a gaming console), or an audio
10 devices. In the various embodiments, the electronic device may be configured to detect dust accumulation. To achieve dust accumulation detection, various embodiments may be provided with a sensor component. The sensor component may be configured for detecting dust accumulation inside the electronic device.

[00011] According to various embodiments, the electronic device may be configured to
15 dissipate heat via an air flow through the electronic device. While the air flow may cool the electronic device and may remove heat from the electronic device, the air flow may result in dust being accumulated inside the electronic device. The accumulated dust may in turn obstruct the air flow and cause changes to the air flow. For example, by obstructing the air flow, one or more physical properties of the air flow, such as velocity, pressure, volume flow rate, etc., may
20 be changed. Accordingly, the electronic device may be configured to detect changes in the one or more physical properties of the air flow as a measure of detecting dust accumulation. In various embodiments, the electronic device may be configured to detect dust accumulation along a path of the air flow by monitoring or measuring or sensing the one or more physical properties of the air flow. For example, the sensor component may be disposed or located along
25 the path of the air flow, and may be configured to monitor or measure or sense the one or more physical properties of the air flow.

[00012] According to various embodiments, the sensor component may be positioned at a region of the air flow which is likely to accumulate dust causing a change in the one or more physical properties of the air flow. For example, structures prone to dust trapping, such as mesh
30 structure, net structure, fins structures, etc., may correspondingly cause a faster rate of dust accumulation and result in a relatively faster change in the one or more physical properties of the air flow when there is dust accumulation. Accordingly, the sensor component may be positioned at the region of the air flow after such structure along the flow path of the air flow for monitoring or measuring or sensing the one or more physical properties of the air flow as a

measure of detecting dust accumulation. As another example, the air flow may have a non-uniform velocity profile across a width of the air flow. At a region of higher velocity, a rate of dust accumulation may be faster. Accordingly, the sensor component may be positioned at the region of the air flow with higher velocity for monitoring or measuring or sensing the one or more physical properties of the air flow as a measure of detecting dust accumulation.

[00013] FIG. 1 shows a schematic diagram illustrating dust accumulation detection for an electronic device 100 according to various embodiments. According to various embodiments, the electronic device 100 may be, but not limited to, a computing device (e.g. a laptop, a notebook, a desktop, a tablet, a server, an all-in-one personal computer, etc.), a visual display device (e.g. a monitor, a television, etc.), a console (e.g. a gaming console), or an audio devices. According to various embodiments, the electronic device 100 may include a housing 110. The housing 110 may be an outer casing or enclosure for defining an internal space 112 to hold or protect components of the electronic device 100. The housing 110 may serve as a body of the electronic device 100 and configured to provide the look and feel of the electronic device 100. Further, the housing 110 may be provided with a user interface for a user to interact and/or operate the electronic device 100.

[00014] According to various embodiments, the housing 110 of the electronic device may include an air vent 114. The air vent 114 may be an opening or a hole or a gap or an aperture in the housing 110 such that air may exit or escape from the internal space 112 through the air vent 114 to outside the housing 110. According to an example, the air vent 114 may be a single opening or hole or aperture or slot in the housing 110. According to another example, the air vent 114 may be a series of openings or holes or apertures or slots in the housing 110. According to yet another example, the air vent 114 may be a single opening or hole or aperture or slot in the housing 110 covered with a perforated sheet or a net or a mesh.

[00015] According to various embodiments, the electronic device 100 may include an airflow generator 120. The airflow generator 120 may be disposed in the housing 110. Accordingly, the airflow generator 120 may be inside the internal space 112 of the housing 100. According to various embodiments, the airflow generator 120 may be, but not limited to, a centrifugal fan, an axial fan, an air blower, an air pump, or any suitable device for generating air movement. According to various embodiments, the airflow generator 120 may be operable to generate an air flow towards the air vent 114 of the housing 110. The air flow may then expel air from within the housing 110 through the air vent 114 of the housing 110 to outside the housing 110. Accordingly, the airflow generator 120 may be disposed in a manner so as to direct the air flow towards and through the air vent 114 of the housing 110 when the airflow generator 110 is in

operation. In the various embodiments, the air flow may be a stream of air generated by the airflow generator 120. With the air flow flowing from within the internal space 112 of the housing 110 through the air vent 114 of the housing 110 into the external environment outside the housing 110, the air flow may remove the air from within the housing 110. When the electronic device 100 is in operation, the air within the housing 110 may be heated up. Accordingly, by removing the air from within the housing 110 via the airflow generator 120 through the air vent 114 of the housing, the electronic device 100 may be cooled down. Hence, the airflow generator 120 may be part of a thermal management arrangement of the electronic device 100 (for example, see 160 of FIG. 3).

10 [00016] According to various embodiments, the airflow generator 120 may include an air outlet 122. The air flow generated by the airflow generator 120 may exit or be projected from the air outlet 122 of the airflow generator 120. In the various embodiments, the air outlet 122 of the airflow generator 120 may be directed or pointing or facing towards the air vent 114 of the housing 110 such that the air flow exiting the air outlet 122 of the airflow generator 120 may flow towards (or be directed towards) the air vent 114 of the housing 110.

15 [00017] According to various embodiments, the electronic device 100 may include a sensor component 130. The sensor component 130 may be located along a path of the air flow generated by the airflow generator 120. Hence, the sensor component 130 may be in the path of the air flow from the airflow generator 120. Further, the sensor component 130 may be at or before the air vent 114 of the housing 110. Accordingly, the sensor component 130 may be positioned within the air vent 114 of the housing 110 or be attached to the air vent 114 of the housing 110, or the sensor component 130 may be between the airflow generator 120 and the air vent 114 of the housing 110. For example, when the sensor component 130 is positioned within the air vent 114 of the housing 110 or be attached to the air vent 114 of the housing 110, the sensor component 130 may be held at the air vent 114 via attaching to a rim of the air vent 114 or via attaching to structure (such as grilles or net or mesh or grating, etc.) extending across the air vent 114 of the housing 110. As another example, when the sensor component 130 is between the airflow generator 120 and the air vent 114 of the housing 110, the sensor component 130 may be aligned to the air outlet 122 of the airflow generator 120 and the air vent 114 of the housing 110 such that the air flow from the airflow generator 120 may encounter or meet with the sensor component 130 before reaching the air vent 114 of the housing 110. According to various embodiments, the sensor component 130 may be configured to monitor or measure or sense the one or more physical properties of the air flow. According to various embodiments, the one or more physical properties of the air flow may include, but not limited

to, air flow velocity, air flow pressure, and/or volume flow rate of the air flow. Accordingly, the sensor component 130 may include one or a combination of a pressure sensing element or an anemometric sensing element or a flow rate sensing element.

[00018] According to various embodiments, the air flow from the airflow generator 120 may dissipate heat by expelling heated air from within the housing 110 through the air vent 114 of the housing 110. Accordingly, the electronic device 100 may be cooled by the air flow generated by the airflow generator 120. However, the air flow may cause dust to be accumulated inside the electronic device 100. The accumulated dust may in turn obstruct the air flow and cause changes to the air flow. By obstructing the air flow, the one or more physical properties of the air flow may be changed. Accordingly, changes to the one or more physical properties of the air flow may correspond to an amount (or a level) of dust accumulation. For example, when the amount of dust accumulation increases, the air flow pressure may increase and/or the air flow velocity may decrease and/or the volume flow rate of the air flow may decrease. With the sensor component 130 disposed in the path of the air flow, the sensor component may detect changes in the one or more physical properties of the air flow as a measure of detecting dust accumulation. Accordingly, dust accumulation along the path of the air flow may be detected by monitoring or measuring or sensing the one or more physical properties of the air flow via the sensor component 130.

[00019] According to various embodiments, the air flow generated by the airflow generator 120 may have a non-uniform velocity profile across a width of the air flow. At a region of relative higher velocity (e.g. maximum velocity) across the width of the air flow, a rate of dust accumulation may be faster. Accordingly, the sensor component 130 may be positioned at the region of the air flow with the relative higher velocity for monitoring or measuring or sensing the one or more physical properties of the air flow as a measure of detecting dust accumulation. For example, when a central region of the air flow is of a relatively higher velocity across the width of the air flow, the sensor component 130 may be positioned at the central region of the air flow. As another example, when a lateral fringe region of the air flow is of a relatively higher velocity across the width of the air flow, the sensor component 130 may be positioned at the lateral fringe region of the air flow. Therefore, according to various embodiments, a transverse position of the sensor component 130 with respect to the width of the air flow may correspond to a point of relatively higher air flow velocity (e.g. maximum air flow velocity) with respect to a velocity profile of the air flow along the width of the air flow. Along the region of relative higher velocity across the width of the air flow, dust may accumulate faster resulting in a corresponding faster change in the one or more physical properties of the air flow.

By positioning the sensor component 130 along said region of the air flow may enhance a sensitivity of detection of dust accumulation by the sensor component 130.

[00020] FIG. 2 shows a schematic diagram illustrating dust accumulation detection for an electronic device 200 according to various embodiments. According to various embodiments, the electronic device 200 of FIG. 2 includes all the features of the electronic device 100 of FIG. 1. Accordingly, all features, changes, modifications, and variations that are applicable to the electronic device 100 of FIG. 1 may also be applicable to the electronic device 200 of FIG. 2. Further, elements which are the same as those described earlier are assigned the same reference numerals, and repetition of their corresponding descriptions is omitted for brevity. The following descriptions focusing on the various possible additional features and details.

[00021] According to various embodiments, the electronic device 200 may, similar to the electronic device 100 of FIG. 1, include the housing 110 having the air vent 114, the airflow generator 120 and the sensor component 130. Referring to FIG. 2, according to various embodiments, the electronic device 200 may further include a thermal transfer component 140. The thermal transfer component 140 may be part of a thermal management arrangement for the electronic device 200 (for example, see 160 of FIG. 3). The thermal transfer component 140 may be disposed in the housing 110 of the electronic device 200. According to various embodiments, the thermal transfer component 140 may be, but not limited to, a heat pipe, a heat spreader, a flat heat pipe, a vapor chamber, or any suitable elements for transporting thermal energy (e.g. heat). Accordingly, the thermal transfer component 140 may serve to transport thermal energy between different parts within the housing 110 of the electronic device 200.

[00022] According to various embodiments, the thermal transfer component 140 (e.g. at least a portion of the thermal transfer component 140) may extend transversely across the air flow directed towards the air vent 114 of the housing 110 from the airflow generator 120. Accordingly, the thermal transfer component 140 (e.g. at least the portion of the thermal transfer component 140) may lie transversely across the air flow. Further, the thermal transfer component 140 (e.g. at least the portion of the thermal transfer component 140) may be between the airflow generator 120 and the air vent 114 of the housing 110. Hence, the thermal transfer component 140 (e.g. at least the portion of the thermal transfer component 140) may be disposed in an intervening space between the airflow generator 120 and the air vent 114 of the housing 110 such that the air flow from the airflow generator 120 may encounter or meet with the thermal transfer component 140 (e.g. at least the portion of the thermal transfer component 140) before reaching the air vent 114 of the housing. With the thermal transfer

component 140 (e.g. at least the portion of the thermal transfer component 140) being in the path of the air flow generated by the airflow generator 120, thermal transfer (e.g. heat exchange or heat transfer) may occur between the air flow from the airflow generator 120 and the thermal transfer component 140 (e.g. at least the portion of the thermal transfer component 140). As an example, the air flow from the airflow generator 120 may cool the thermal transfer component 140 (e.g. at least the portion of the thermal transfer component 140) when heat is transported thereto by the thermal transfer component 140 (e.g. at least the portion of the thermal transfer component 140).

[00023] According to various embodiments, the sensor component 130 may be disposed at the thermal transfer component 140 (e.g. at least the portion of the thermal transfer component 140). Accordingly, the sensor component 130 may be attached to or coupled to the thermal transfer component 140 (e.g. at least the portion of the thermal transfer component 140). With the sensor component 130 at the thermal transfer component 140 (e.g. at least the portion of the thermal transfer component 140), the sensor component 130 may monitor or measure or sense the one or more physical properties of the air flow as the air flow from the airflow generator 120 flow pass the thermal transfer component 140 (e.g. at least the portion of the thermal transfer component 140). According to various embodiments, the thermal transfer component 140 (e.g. at least the portion of the thermal transfer component 140) in the path of the air flow from the airflow generator 120 may trap dust and may cause dust accumulation, which may result in a change in the one or more physical properties of the air flow. Therefore, by disposing the sensor component 130 at the thermal transfer component 140 (e.g. at least the portion of the thermal transfer component 140), the sensor component 130 may monitor or measure or sense the one or more physical properties of the air flow as a measure of detecting dust accumulation. According to various embodiments, dust accumulation may be on a side of the thermal transfer component 140 (e.g. at least the portion of the thermal transfer component 140) proximal to the airflow generator 120 (or on the side facing the oncoming air flow). Accordingly, the sensor component 130 may be disposed at a side of the thermal transfer component 140 (e.g. at least the portion of the thermal transfer component 140) distal from the airflow generator 120 (or proximal to the air vent 114 of the housing 110). In this manner, the sensor component 130 may be more effective in monitoring or measuring or sensing a change in the one or more physical properties of the air flow for detecting dust accumulation.

[00024] According to various embodiments, the sensor component 130 may also be disposed in the housing 110 between the thermal transfer component 140 (e.g. at least the portion of the thermal transfer component 140) and the air vent 114 of the housing 110. Accordingly, the

sensor component 130 may be disposed in an intervening space between the thermal transfer component 140 (e.g. at least the portion of the thermal transfer component 140) and the air vent 114 of the housing 110 such that the air flow after passing the thermal transfer component 140 (e.g. at least the portion of the thermal transfer component 140) may encounter or meet with the sensor component 130 before reaching the air vent 114 of the housing. Hence, the sensor component 130 may monitor or measure or sense the one or more physical properties of the air flow due to dust accumulation.

[00025] According to various embodiments, the thermal transfer component 140 (e.g. at least the portion of the thermal transfer component 140) may be of an elongate shape. Accordingly, with the thermal transfer component 140 (e.g. at least a portion of the thermal transfer component 140) extending transversely across the air flow, a first longitudinal side 142 of the thermal transfer component 140 (e.g. at least a portion of the thermal transfer component 140) may be directed or facing the air outlet 122 of the airflow generator 120 and a second longitudinal side 144 of the thermal transfer component 140 (e.g. at least a portion of the thermal transfer component 140) may be directed or facing the air vent 114 of the housing 100. Accordingly, the air flow from the airflow generator 120 may flow over and across the thermal transfer component 140 (e.g. at least the portion of the thermal transfer component 140) from the first longitudinal side 142 to the second longitudinal side 144, and then towards the air vent 114 of the housing 110.

[00026] According to various embodiments, the sensor component 130 may be disposed at the second longitudinal side 144 of the thermal transfer component 140. Accordingly, the sensor component 130 may be attached to or coupled to the second longitudinal side 144 of the thermal transfer component 140. According to various embodiments, dust may be trapped at the first longitudinal side 142 of the thermal transfer component 140 as the air flow from the airflow generator 120 flow pass the thermal transfer component 140. The dust accumulation at the first longitudinal side 142 of the thermal transfer component 140 may result in a change in the one or more physical properties of the air flow flowing pass the thermal transfer component 140 towards the air vent 114 of the housing 110. Therefore, by disposing the sensor component 130 at the second longitudinal side 144 of the thermal transfer component 140, the sensor component 130 may effectively monitor or measure or sense the one or more physical properties of the air flow as a measure of detecting dust accumulation (e.g. at the first longitudinal side 144 of the thermal transfer component 140).

[00027] According to various embodiments, the thermal transfer component 140 (e.g. at least the portion of the thermal transfer component 140) may include a plurality of fins 146. The

plurality of fins 146 may be extending from a main body 148 of the thermal transfer component 140 (e.g. at least the portion of the thermal transfer component 140). The plurality of fins 146 may be respectively aligned to the air flow flowing from the airflow generator 120 to the air vent 114 of the housing 110. Accordingly, a first edge 145 (e.g. a leading edge with respect to the air flow) of a corresponding fin 146 may be directed or facing the air outlet 122 of the airflow generator 120 and a second edge 147 (e.g. a trailing edge with respect to the air flow) of the corresponding fin 146 may be directed or facing the air vent 114 of the housing 100. According to various embodiments, the plurality of fins 146 may be parallel to each other. Accordingly, the first edges 145 (e.g. leading edges with respect to the air flow) of the plurality of fins 146 may be directed or facing in a same direction towards the air outlet 122 of the airflow generator 120, and the second edges 147 (e.g. trailing edges with respect to the air flow) of the plurality of fins 146 may be directed or facing in a same direction towards the air vent 114 of the housing 100.

[00028] With the thermal transfer component 140 (e.g. at least the portion of the thermal transfer component 140) having the plurality of fins 146, the air flow from the airflow generator 120 may flow through the plurality of fins 146 to flow pass the thermal transfer component 140 (e.g. at least the portion of the thermal transfer component 140) towards the air vent 114 of the housing 110. According to various embodiments, the plurality of fins 146 may serve as a heat sink to carry away thermal energy (e.g. heat) from the main body 148 of the thermal transfer component 140 (e.g. at least the portion of the thermal transfer component 140) such that thermal exchanges may take place between the plurality of fins 146 and the air flow. Accordingly, the plurality of fins 146 may increase a surface area (or provide a larger surface area) to be in contact with the air flow from the airflow generator 120 so as to enhance transferring of thermal energy (e.g. heat) into the air flow to enhance thermal exchange with the thermal transfer component 140 (e.g. for cooling).

[00029] According to various embodiments, the sensor component 130 may be disposed at the second edge 147 (e.g. the trailing edge with respect to the air flow) of at least one fin 146 of the plurality of fins 146. Accordingly, the sensor component 130 may be attached to or coupled to the second edge 147 (e.g. the trailing edge with respect to the air flow) of the at least one fin 146 of the plurality of fins 146. According to various embodiments, as the air flow from the airflow generator 120 flows through the plurality of fins 146, dust may be trapped in the plurality of fins 146. As the dust accumulates, the dust accumulation in the plurality of fins may result in a change in the one or more physical properties of the air flow flowing through the plurality of fins of the thermal transfer component 140 towards the air vent 114 of the

housing 110. Therefore, by disposing the sensor component 130 at the second edge 147 (e.g. the trailing edge with respect to the air flow) of the at least one fin 146 of the plurality of fins 146 of the thermal transfer component 140, the sensor component 130 may effectively monitor or measure or sense the one or more physical properties of the air flow as a measure of detecting dust accumulation (e.g. at the first longitudinal side 144 of the thermal transfer component 140) in the plurality of fins 146.

[00030] According to various embodiments, the sensor component 130 may also be disposed in the housing 110 between the plurality of fins 146 of the thermal transfer component 140 (e.g. at least the portion of the thermal transfer component 140) and the air vent 114 of the housing 110. Accordingly, the sensor component 130 may be disposed in an intervening space between the plurality of fins 146 and the air vent 114 of the housing 110 such that the air flow after passing through plurality of fins 146 of the thermal transfer component 140 (e.g. at least the portion of the thermal transfer component 140) may encounter or meet with the sensor component 130 before reaching the air vent 114 of the housing 110. Hence, the sensor component 130 may monitor or measure or sense the one or more physical properties of the air flow due to dust accumulation in the plurality of fins 146.

[00031] Referring to FIG. 2, according to various embodiments, the housing 110 may include an opening 116 for air intake (or an air intake opening). According to various embodiments, the opening 116 for air intake may be at any suitable portion of the housing 110. The opening 116 for air intake may allow air from the outside the housing 110 to be drawn into the internal space 112 of the housing 110 as the air flow from the airflow generator 120 expel the air from within the housing 110 through the air vent 114 of the housing 110 to outside the housing 110. Accordingly, the opening 116 for air intake in the housing 110 may allow fresh supply of air into the housing 110. According to various embodiments, the opening 116 for air intake may be adjacent to or in close vicinity with the airflow generator 120. In this manner, the airflow generator 120 may draw air directly through the opening 116 (for air intake) in the housing 110 for generating the air flow directed towards the air vent 114 of the housing 110 for flowing through the air vent 114 of the housing 110 to outside the housing 110.

[00032] FIG. 3 shows a schematic diagram illustrating dust accumulation detection for an electronic device 300 according to various embodiments. According to various embodiments, the electronic device 300 of FIG. 3 includes all the features of the electronic device 200 of FIG. 2 and the electronic device 100 of FIG. 1. Accordingly, all features, changes, modifications, and variations that are applicable to the electronic device 200 of FIG. 2 and the electronic device 100 of FIG. 1 may also be applicable to the electronic device 300 of FIG. 3. Further,

elements which are the same as those described earlier are assigned the same reference numerals, and repetition of their corresponding descriptions is omitted for brevity. The following descriptions focusing on the various possible additional features and details.

[00033] The electronic device 300 in FIG. 3 is depicted with the housing 110 having two air vents 114 as an example to illustrate that the electronic device according to the various embodiments may include the housing 110 having one or more air vent 114 (e.g. at least one air vent 114, or two or more air vents 114, or at least two air vents 114, etc.). Similarly, the electronic device 300 in FIG. 3 is depicted to include two airflow generators 120 as an example to illustrate that the electronic device according to various embodiments may include one or more airflow generator 120 (e.g. at least one airflow generator 120, or two or more airflow generators 120, or at least two airflow generators 120). With two air flows generated by the two airflow generators 120, the electronic device 300 in FIG. 3 is depicted to include two sensor components 130 as an example to illustrate that the electronic device according to various embodiments may include one or more sensor component 130 (e.g. at least one sensor component 130, or two or more sensor components 130, or at least two sensor components 130, etc.). According to various embodiments, a number of sensor components 130 may minimally correspond to a number of air flows generated within the housing 110 such that at least one sensor component 130 is associated with at least one air flow.

[00034] Referring to FIG. 3, according to various embodiments, the electronic device 300 may include a heat-generating electronic component 150 (or at least one heat-generating electronic component 150, or one or more heat-generating electronic component 150) disposed inside the housing 110. According to various embodiments, the heat-generating electronic component 150 may be, but not limited to, a central processing unit, a graphics processing unit, or a solid state drive. The heat-generating electronic component 150 may be a heat source in the internal space 112 enclosed by the housing 110. Accordingly, the heat-generating electronic component 150 may heat up the air within the housing 110 that may lead to degradation of the performance of the electronic device 300.

[00035] According to various embodiments, the electronic device 300 may include a thermal management arrangement 160. The thermal management arrangement 160 may regulate an operating temperature within the housing 110 when the electronic device 300 is in operation. Accordingly, the thermal management arrangement 160 may facilitate dissipation of excess heat generated, for example by the heat-generating electronic component 150, so as to improve reliability and prevent degradation in the performance of the electronic device 300. According

to various embodiments, the thermal management arrangement 160 may include one or a combination of the airflow generator 120 and the thermal transfer component 140.

[00036] According to some embodiments, the thermal management arrangement 160 may include only the airflow generator 120. Accordingly, the airflow generator 120 may be disposed
5 relative to the heat-generating electronic component 150 and the air vent 114 of the housing 110 such that the airflow generator 120 may direct the airflow to flow over and across the heat-generating electronic component 150 and towards the air vent 114 of the housing 110. In such embodiments, the thermal transfer component 140 may be absent or the electronic device may be free of the thermal transfer component 140.

10 [00037] Referring back to FIG. 3, according to some embodiments, the thermal management arrangement 160 may include both the airflow generator 120 and the thermal transfer component 140. In such embodiments, a first portion 140a of the thermal transfer component 140 may be in thermal contact with the heat-generating electronic component 150 and a second portion 140b of the thermal transfer component 140 may lie in the path of the air flow generated
15 by the airflow generator 120. Accordingly, heat generated by the heat-generating electronic component 150 may be transferred to the first portion 140a of the thermal transfer component 140, transported from the first portion 140a of the thermal transfer component 140 to the second portion 140b of the thermal transfer component 140, and transferred from the second portion 140b of the thermal transfer component 140 to the air flow from the airflow generator 120,
20 which may then flow through the air vent 114 of the housing 110 to outside the housing 110. Hence, the airflow generator 120 and the thermal transfer component 140 may work cooperatively for thermal management of the electronic device 300.

[00038] According to various embodiments, the thermal transfer component 140 may be a planar heat spreader or a planar heat pipe or a vapor chamber. According to various
25 embodiments, the first portion 140a of the thermal transfer component 140 may be of a planar structure having a thermal contact surface for establishing thermal contact with the heat-generating electronic component 150. According to various embodiments, the electronic device 300 may include two or more heat-generating electronic component 150 and the first portion 140a of the thermal transfer component 140 may be sized or dimensioned such that the thermal
30 contact surface of the first portion 140a of the thermal transfer component 140 may establish contact with the two or more heat-generating electronic component 150.

[00039] According to various embodiments, the second portion 140b of the thermal transfer component 140 may be an elongate extension from the first portion 140a of the thermal transfer component 140. The second portion 140b of the thermal transfer component 140 may extend

from the first portion 140a of the thermal transfer component 140 so as to lie transversely across the air flow from the airflow generator 120.

[00040] According to various embodiments, the electronic device 300 may include two airflow generators 120 disposed in the housing 110. Accordingly, in addition to the second portion 140b of the thermal transfer component 140 lying transversely across the air flow from a first of the two airflow generators 120, the thermal transfer component 140 may include a third portion 140c. The third portion 140c of the thermal transfer component 140 may, similarly, be an elongate extension from the first portion 140a of the thermal transfer component 140. Further, the third portion 140c of the thermal transfer component 140 may extend from the first portion 140a of the thermal transfer component 140 so as to lie transversely across the air flow from a second of the two airflow generators 120.

[00041] According to various embodiments, the electronic device 300 may include at least one sensor component 130 associated with each of the two airflow generators 120. Each of the two airflow generators 120 may be operable to generate the respective air flow towards the corresponding air vent 114 of the housing 100. Accordingly, the at least one sensor component 130 may be located along the path of the respective air flow at or before the corresponding air vent 114 of the housing 100. Therefore, the at least one sensor component 130 may monitor or measure or sense a change in the one or more physical properties of the respective air flow.

[00042] According to various embodiments, the electronic device 300 may include two sensor components 130 respectively disposed at the second portion 140b of the thermal transfer component 140 and the third portion 140c of the thermal transfer component 140. Accordingly, a first of the two sensor components 130 may be in the path of the air flow from the first of the two airflow generators 120 and a second of the two sensor components 130 may be in the path of the air flow from the second of the two airflow generators 120. Hence, the first of the two sensor components 130 may monitor or measure or sense a change in the one or more physical properties of the air flow from the first of the two airflow generators 120 and the second of the two sensor components 130 may monitor or measure or sense a change in the one or more physical properties of the air flow from the second of the two airflow generators 120. Accordingly, the two sensor components 130 may respectively detect dust accumulation along the path of the air flow from the first of the two airflow generators 120 and the air flow from the second of the two airflow generators 120.

[00043] According to various embodiments, the second portion 140b of the thermal transfer component 140 may include the plurality of fins 146. According to various embodiments, the first of the two sensor components 130 may be disposed at an edge (e.g. the trailing edge with

respect to the air flow) of at least one fin 146 of the plurality of fins 146 of the second portion 140b of the thermal transfer component 140. The edge of the at least one fin 146 of the plurality of fins 146 may be facing or directed towards the corresponding air vent 114 of the housing 110. According to various embodiments, the third portion 140c of the thermal transfer component 140 may include the plurality of fins 146. According to various embodiments, the second of the two sensor components 130 may be disposed at an edge (e.g. the trailing edge with respect to the air flow) of at least one fin 146 of the plurality of fins 146 of the third portion 140c of the thermal transfer component 140. The edge of the at least one fin 146 of the plurality of fins 146 may be facing or directed towards the corresponding air vent 114 of the housing 110.

[00044] According to various embodiments, as shown in FIG. 3, the air vent 114 of the housing 110 may include an openwork structure including, but not limited to, grilles or net or mesh or grating, extending across the air vent 114 of the housing 110. Such openwork structures may prevent access into the housing 110 while allowing the air flow to exit the housing 110. Further, according to some embodiments, the sensor component 130 may also be attached to such openwork structures for monitoring or measuring or sensing the one or more physical properties of the air flow at the point of exit from the housing 110.

[00045] FIG. 4 shows an example of the generation of the air flow by the airflow generator 120 according to various embodiments. According to various embodiments, the airflow generator 120 may include a centrifugal fan 470. The centrifugal fan 470 may include a plurality of blades 472 distributed around a rotational axis 471. According to various embodiments, the plurality of blades 472 may be rotatable about the rotational axis 471. When the plurality of blades 472 are rotated about the rotational axis 471, the plurality of blades 472 of the centrifugal fan 470 may generate a swirling flow 473 around the plurality of blades 472 about the rotational axis 471. According to various embodiments, the airflow generator 120 may include a flow directing arrangement 474. The flow directing arrangement 474 may channel the swirling flow 472 into the air flow directed towards the air vent 114 of the housing 110. According to various embodiments, the swirling flow 473 and the air flow may be in a same plane that is perpendicular to the rotational axis 471.

[00046] According to various embodiments, the flow directing arrangement 474 may include a curved wall portion 476 alongside a segment of a peripheral of the centrifugal fan 470. The peripheral of the centrifugal fan 470 may be circular and the segment of the peripheral of the centrifugal fan 470 may be an arc or curved. Accordingly, the curved wall portion 476 may be next to the segment of the peripheral of the centrifugal fan 470 and bend in a manner following

the segment of the peripheral of the centrifugal fan 470. According to various embodiments, a curvature of the curved wall portion 476 may be in a manner such that there is an increasing distance between the curved wall portion 476 and the segment of the peripheral of the centrifugal fan 470 in a direction of rotation of the plurality of blades 472. According to some
5 embodiments, a curvature of the curved wall portion 476 may be such that a distance between the curved wall portion 476 and the segment of the peripheral of the centrifugal fan 470 remains the same along the length of the curved wall portion 476.

[00047] According to various embodiments, the flow directing arrangement 474 may include a straight wall portion 478. The straight wall portion 478 may extend from an end of the curved
10 wall portion 476. Accordingly, the straight wall portion 478 may be continuous from the curved wall portion 476. Hence, the curved wall portion 476 may seamlessly continue with the straight wall portion 478. According to various embodiments, the straight wall portion 478 of the flow directing arrangement 474 of the airflow generator 120 may be pointing towards the air vent 114 of the housing 100. Accordingly, the straight wall portion 478 may extend in a direction
15 away from the curved wall portion 476 and towards the air vent 114 of the housing 100.

[00048] According to various embodiments, the flow directing arrangement 474 may channel the swirling flow 473 along the curved wall portion 476 towards the straight wall portion 478. Accordingly, the curved wall portion 476 may funnel the swirling flow 473 radiating from the centrifugal fan 470 so as to concentrate or converge or merge the swirling flow 473 towards
20 the straight wall portion 478. As the swirling flow 473 concentrates or converges or merges towards the straight wall portion 478, the swirling flow 473 may become a straight flow 475. According to various embodiments, the flow directing arrangement 474 may then direct the straight flow 475, which exits the airflow generator 120 as the air flow, from the straight wall portion 478 towards the air vent 114 of the housing 110. Accordingly, the straight wall portion
25 474 may serve to guide or direct the air flow towards the air vent 114 of the housing 110. Further, the straight wall portion 478 may terminate at the air outlet 122 of the airflow generator 120. According to various embodiments, when the air flow leaves the air outlet 122 of the airflow generator 120, the air flow may continue to flow in a direction parallel to the straight wall portion 474 towards the air vent 114 of the housing 110.

30 **[00049]** According to various embodiments, the sensor component 130 may be located at a lateral fringe region 479 of the air flow from the airflow generator 120. The lateral fringe region 479 of the air flow may be an outer side of the air flow that may be streamed from an outer region of the swirling flow 473. Accordingly, the lateral fringe region 479 of the air flow may be continuous from the outer region of the swirling flow 473. The outer region of the swirling

flow 473 may be furthest from the rotational axis 471. According to various embodiments, the lateral fringe region 479 of the air flow may be aligned with the straight wall portion 478 of the flow directing arrangement 474. According to various embodiments, when the swirling flow 473 is in an anti-clockwise direction, the sensor component 130 may be located at the lateral fringe region 479 of the air flow towards a right side of the air flow with respect to a width of the air flow. According to various embodiments, when the swirling flow 473 is in a clockwise direction, the sensor component 130 may be located at the lateral fringe region 479 of the air flow towards a left side of the air flow with respect to a width of the air flow.

[00050] According to various embodiments, the flow directing arrangement 474 of the airflow generator 120 may include a volute casing or a scroll type casing. Accordingly, the centrifugal fan 470 may be disposed inside the volute casing or the scroll type casing. Further, an outlet of the volute casing or the scroll type casing may be directed towards the air vent 114 of the housing 110.

[00051] According to various embodiments, the electronic device 300 may include a processor 151. For example, referring to FIG. 3, the processor 151 may be the central processing unit, which may be one of the heat-generating electronic components 150. As another example, the processor 151 may be a separate microcontroller dedicated for determining dust accumulation. In various embodiments, the "processor" may be understood as any kind of a logic implementing entity, which may be special purpose circuitry or a processor executing software stored in a memory, firmware, or any combination thereof. Thus, in an embodiment, the "processor" may be a hard-wired logic circuit or a programmable logic circuit such as a programmable processor, e.g. a microprocessor (e.g. a Complex Instruction Set Computer (CISC) processor or a Reduced Instruction Set Computer (RISC) processor). The "processor" may also be a processor executing software, e.g. any kind of computer program, e.g. a computer program using a virtual machine code such as e.g. Java. Any other kind of implementation of the respective functions which are described in more detail throughout may also be understood as the "processor" in accordance with various embodiments. In various embodiments, the "processor" may be part of a computing system or a controller or a microcontroller or any other system providing a processing capability. According to various embodiments, such systems may include a memory which is for example used in the processing carried out by the device or system. A memory used in the embodiments may be a volatile memory, for example a DRAM (Dynamic Random Access Memory) or a non-volatile memory, for example a PROM (Programmable Read Only Memory), an EPROM (Erasable PROM), EEPROM (Electrically Erasable PROM), or a flash memory, e.g., a floating

gate memory, a charge trapping memory, an MRAM (Magneto-resistive Random Access Memory) or a PCRAM (Phase Change Random Access Memory).

[00052] According to various embodiments, the processor 151 may be electrically connected to the sensor component 130 so as to receive output signal from the sensor component 130.

5 The processor 151 may then process the output signal received from the sensor component 130 to determine the state of dust accumulation along the air flow from the airflow generator 120. Accordingly, the processor 151 may determine a state of dust accumulation along the air flow from the airflow generator 120 based on the output signal, which provides measurement relating to the one or more physical properties of the air flow, from the sensor component 130.

10 **[00053]** According to various embodiments, in processing the output signal received from the sensor component 130, the processor 151 may perform a comparison between the one or more physical properties of the air flow measured by the sensor component 130 and a reference data. Accordingly, the processor 151 may compare the one or more physical properties of the air flow measured by the sensor component 130 against the reference data. The processor 151
15 may then determine the state of dust accumulation along the airflow based on a result of the comparison.

[00054] According to some embodiments, the comparison may include a determination whether the one or more physical properties of the air flow measured by the sensor component 130 is less than or equal to or more than a predefined base threshold value. The predefined base
20 threshold value may be part of the reference data. According to various embodiments, the reference data may include a predefined base threshold value of the one or more physical properties of the air flow for each set speed of the airflow generator 120 within an operational speed range of the airflow generator 120. Accordingly, depending on the set speed of the airflow generator 120 at which the one or more physical properties of the air flow is measured
25 by the sensor component 130, the processor 151 may compare the one or more physical properties of the air flow measured by the sensor component 130 against the predefined base threshold value for said set speed so as to determine whether the one or more physical properties of the air flow measured by the sensor component 130 is less than or equal to or more than a predefined base threshold value. According to some embodiments, the set speed
30 of the airflow generator 120 may be based on a user input into the processor 151. According to some embodiments, the processor 151 may be electrically connected to the airflow generator 120 for controlling the operation of the airflow generator 120. Accordingly, the set speed of the airflow generator 120 may be based on a control signal from the processor 151 to the airflow generator 120.

- [00055] As an example, when the physical property of the air flow measured by the sensor component 130 is air flow velocity or volume flow rate of the air flow, (i) the processor 151 may determine that there is no dust accumulation when the physical property of the air flow measured by the sensor component 130 is equal to the predefined base threshold value; and/or
- 5 (ii) the processor 151 may determine that there is dust accumulation when the physical property of the air flow measured by the sensor component 130 is less than the predefined base threshold value; and/or (iii) the processor 151 may determine that the placement/position/orientation of the electronic device may not be suitable for the sensor component 130 to determine whether there is dust accumulation when the physical property of the air flow measured by the sensor
- 10 component 130 is more than the predefined base threshold value. Accordingly, the processor 151 may (i) output a dust-accumulation warning signal (for example to a display of the electronic device 300) when the physical property of the air flow measured by the sensor component 130 is determined to be less than the predefined base threshold value; and/or (ii) and/or output a no-dust-accumulated signal (for example to the display of the electronic device
- 15 300) when the physical property of the air flow measured by the sensor component is determined to be equal to the predefined base threshold value; and/or (iii) loop back to compare subsequently measured physical property of the air flow with the reference data when the physical property of the air flow measured by the sensor component 130 is determined to be more than the predefined base threshold value.
- 20 [00056] As another example, when the physical property of the air flow measured by the sensor component 130 is air flow pressure, (i) the processor 151 may determine that there is no dust accumulation when the physical property of the air flow measured by the sensor component 130 is equal to the predefined base threshold value; and/or (ii) the processor 151 may determine that there is dust accumulation when the physical property of the air flow
- 25 measured by the sensor component 130 is more than the predefined base threshold value; and/or (iii) the processor 151 may determine that the placement/position/orientation of the electronic device may not be suitable for the sensor component 130 to determine whether there is dust accumulation when the physical property of the air flow measured by the sensor component 130 is less than the predefined base threshold value. Accordingly, the processor
- 30 151 may (i) output a dust-accumulation warning signal (for example to the display of the electronic device 300) when the physical property of the air flow measured by the sensor component 130 is determined to be more than the predefined base threshold value; and/or (ii) and/or output a no-dust-accumulated signal (for example to the display of the electronic device 300) when the physical property of the air flow measured by the sensor component is

determined to be equal to the predefined base threshold value; and/or (iii) loop back to compare subsequently measured physical property of the air flow with the reference data when the physical property of the air flow measured by the sensor component 130 is determined to be less than the predefined base threshold value.

5 **[00057]** According to some embodiments, the comparison may include a determination whether the one or more physical properties of the air flow measured by the sensor component 130 is in a range from a predefined base threshold value to a predefined ceiling threshold value, or less than the predefined base threshold value, or more than the predefined ceiling threshold value. The predefined base threshold value and the predefined ceiling threshold value may be
10 part of the reference data. According to various embodiments, the reference data may include a predefined base threshold value of the one or more physical properties of the air flow and a predefined ceiling threshold value of the one or more physical properties of the air flow for each set speed of the airflow generator 120 within an operational speed range of the airflow generator 120. Accordingly, depending on the set speed of the airflow generator 120 at which
15 the one or more physical properties of the air flow is measured by the sensor component 130, the processor 151 may compare the one or more physical properties of the air flow measured by the sensor component 130 against the predefined base threshold value and the predefined ceiling threshold value for said set speed so as to determine whether the one or more physical properties of the air flow measured by the sensor component 130 is in the range from the
20 predefined base threshold value to the predefined ceiling threshold value, or less than the predefined base threshold value, or more than the predefined ceiling threshold value. According to some embodiments, the set speed of the airflow generator 120 may be based on a user input into the processor 151. According to some embodiments, the processor 151 may be electrically connected to the airflow generator 120 for controlling the operation of the
25 airflow generator 120. Accordingly, the set speed of the airflow generator 120 may be based on a control signal from the processor 151 to the airflow generator 120.

[00058] As an example, when the physical property of the air flow measured by the sensor component 130 is air flow velocity or volume flow rate of the air flow, (i) the processor 151 may determine that there is no dust accumulation when the physical property of the air flow
30 measured by the sensor component 130 is in the range from the predefined base threshold value to the predefined ceiling threshold value; and/or (ii) the processor 151 may determine that there is dust accumulation when the physical property of the air flow measured by the sensor component 130 is less than the predefined base threshold value; and/or (iii) the processor 151 may determine that the placement/position/orientation of the electronic device may not be

suitable for the sensor component 130 to determine whether there is dust accumulation when the physical property of the air flow measured by the sensor component 130 is more than the predefined ceiling threshold value. Accordingly, the processor 151 may (i) output a dust-accumulation warning signal (for example to the display of the electronic device 300) when
5 the physical property of the air flow measured by the sensor component 130 is determined to be less than the predefined base threshold value; and/or (ii) and/or output a no-dust-accumulated signal (for example to the display of the electronic device 300) when the physical property of the air flow measured by the sensor component is determined to be in the range from the predefined base threshold value to the predefined ceiling threshold value; and/or (iii)
10 loop back to compare subsequently measured physical property of the air flow with the reference data when the physical property of the air flow measured by the sensor component 130 is determined to be more than the predefined ceiling threshold value.

[00059] As another example, when the physical property of the air flow measured by the sensor component 130 is air flow pressure, (i) the processor 151 may determine that there is no
15 dust accumulation when the physical property of the air flow measured by the sensor component 130 is in the range from the predefined base threshold value to the predefined ceiling threshold value; and/or (ii) the processor 151 may determine that there is dust accumulation when the physical property of the air flow measured by the sensor component 130 is more than the predefined ceiling threshold value; and/or (iii) the processor 151 may
20 determine that the placement/position/orientation of the electronic device may not be suitable for the sensor component 130 to determine whether there is dust accumulation when the physical property of the air flow measured by the sensor component 130 is less than the predefined base threshold value. Accordingly, the processor 151 may (i) output a dust-accumulation warning signal (for example to the display of the electronic device 300) when
25 the physical property of the air flow measured by the sensor component 130 is determined to be more than the predefined ceiling threshold value; and/or (ii) and/or output a no-dust-accumulated signal (for example to the display of the electronic device 300) when the physical property of the air flow measured by the sensor component is determined to be in the range from the predefined base threshold value to the predefined ceiling threshold value; and/or (iii)
30 loop back to compare subsequently measured physical property of the air flow with the reference data when the physical property of the air flow measured by the sensor component 130 is determined to be less than the predefined base threshold value.

[00060] Referring back to FIG. 3, according to various embodiments, the electronic device 300 may include an orientation sensing component 180. The orientation sensing component

180 may be disposed in the housing 110 for determining an orientation of the housing 110. According to various embodiments, the orientation sensing component 180 may be fixedly attached or fixedly coupled to the housing 110. According to various embodiments, the orientation sensing component 180 may include, but not limited to, an accelerometer, a gyroscope, a magnetometer, or an inertial measurement unit.

[00061] According to various embodiments, the electronic device 300 may include a speed sensing component 182. The speed sensing component 182 may be disposed in the housing 110 for measuring an actual operating speed of the airflow generator 120. According to various embodiments, the speed sensing component 182 may be disposed relative to the airflow generator 120. For example, the speed sensing component 182 may be disposed to be directed at a rotating hub or a rotating shaft or a rotating axle of the airflow generator 120 for measuring the actual operating speed of the airflow generator 120. According to various embodiments, the speed sensing component 182 may include, but not limited to, optical sensor, magnetoresistive sensor, inductive sensor, variable reluctance magnetic sensor, or Hall Effect magnetic sensor.

[00062] According to various embodiments, prior to determining dust accumulation based on comparing the one or more physical properties of the air flow measured by the sensor component 130 against the reference data, the processor 151 may check whether the airflow generator 120 is operating normally or has an error (e.g. malfunctioned). Accordingly, the processor 151 may determine a state of the airflow generator 120 as a first stage, and, depending on state of the airflow generator 120 determined, decide whether to proceed with performing the comparison between the one or more physical properties of the air flow measured by the sensor component and the reference data to determine dust accumulation as a second stage. According to various embodiments, when the airflow generator 120 is not operating normally, the results of the comparison between the one or more physical properties of the air flow measured by the sensor component and the reference data may not be accurate for determining whether there is dust accumulation. Accordingly, checking whether the airflow generator 120 is operating normally as the first stage may avoid inaccurate determination of whether there is dust accumulation.

[00063] According to various embodiments, the processor 151 may determine the state of the airflow generator 120 based on the actual operating speed of the airflow generator 120 measured by the speed sensing component 182, and/or the orientation of the housing 110 determined by the orientation sensing component 180, and/or whether the air flow is obstructed (e.g. at the air vent 114 of the housing 100) based on the one or more physical properties of the

air flow measured by the sensor component 130. The airflow generator 120 may be considered to be operating normally when the actual operating speed of the airflow generator 120 measured by the speed sensing component 182 is as per specified (e.g. as per the set speed of the airflow generator 120 or within an acceptable speed range based on the set speed of the airflow generator 120). However, when the actual operating speed of the airflow generator 120 is not as per specified, it may be due to the housing 110 not being in the desired orientation, and/or the air flow is unobstructed (e.g. at the air vent 114 of the housing 100). Thus, other than measuring the actual operating speed of the airflow generator 120, a determination of the orientation of the housing 110 and/or a determination of whether the air flow is obstructed (e.g. at the air vent 114 of the housing 100) may be needed before concluding the airflow generator 120 has an error (e.g. malfunctioned) when the actual operating speed of the airflow generator 120 is not as per specified.

[00064] According to some embodiments, in determining the state of the airflow generator 120, the processor 151 may compare the actual operating speed of the airflow generator 120 measured by the speed sensing component 182 with the set speed of the airflow generator 120 so as to determine whether the actual operating speed of the airflow generator 120 measured by the speed sensing component 182 is less than or equal to or more than the set speed of the airflow generator 120.

[00065] When the actual operating speed of the airflow generator 120 measured by the speed sensing component 182 is equal to the set speed of the airflow generator 120, the airflow generator 120 may be considered to be operating normally. Accordingly, the processor 151 may proceed with performing the comparison between the one or more physical properties of the air flow measured by the sensor component 130 and the reference data to determine dust accumulation.

[00066] However, when the actual operating speed of the airflow generator 120 measured by the speed sensing component 182 is not equal to the set speed of the airflow generator 120, the processor may be required to determine the orientation of the housing 110 and/or whether the air flow is obstructed (e.g. at the air vent 114 of the housing 110) before concluding whether there is an error in the airflow generator 120.

[00067] For example, when the actual operating speed of the airflow generator 120 measured by the speed sensing component 182 is less than the set speed of the airflow generator 120, the processor 151 may proceed to determine the orientation of the housing 110 via the orientation sensing component 180. The desired orientation of the housing 110 may be an orientation in which the airflow generator 120 is supposed to be operating normally. The desired orientation

of the housing 110 may be provided to the processor 151 as a reference orientation. Accordingly, the processor may determine that the orientation of the housing 110 is in the desired orientation when the orientation of the housing 110 sensed by the orientation sensing component 180 coincide with the reference orientation. However, if the processor 151
5 determines that the actual operating speed of the airflow generator 120 measured by the speed sensing component 182 is less than the set speed of the airflow generator 120 and that the orientation of the housing 110 is in the desired orientation, it may mean that the airflow generator 120 is not working properly and the processor may output an error signal to notify that there is an error in the airflow generator 120. On the other hand, if the processor 151
10 determines that the actual operating speed of the airflow generator 120 measured by the speed sensing component 182 is less than the set speed of the airflow generator 120 and that the orientation of the housing 110 is not in the desired orientation, it may mean that the actual operating speed of the airflow generator 120 may be different from the set speed of the airflow generator 120 due to the orientation of the housing 110 not being in the desired orientation.
15 Accordingly, the processor may output a signal to notify that re-positioning/re-orienting of the housing 110 may be required.

[00068] As another example, when the actual operating speed of the airflow generator 120 measured by the speed sensing component 182 is more than the set speed of the air flow generator 120, the processor 151 may proceed to determine whether the air flow is obstructed
20 (e.g. at the air vent 114 of the housing 110) based on the one or more physical properties of the air flow measured by the sensor component 130. The air flow may be obstructed (e.g. at the air vent 114 of the housing 110) when the one or more physical properties of the air flow measured by the sensor component 130 is not equal to a threshold value or not within a threshold range associated with the set speed of the air flow generator 120 (e.g. less than less than a threshold
25 air flow velocity or threshold volume flow rate of the air flow, or more than a threshold air flow pressure). If the processor 151 determines that the actual operating speed of the airflow generator 120 measured by the speed sensing component 182 is more than the set speed of the airflow generator 120 and that the air flow is obstructed (e.g. at the air vent 114 of the housing 110), it may mean that the actual operating speed of the airflow generator 120 may be different
30 from the set speed of the airflow generator 120 due to the obstruction of the air flow. Accordingly, the processor may output a signal to notify that checking for obstruction at the air vent 114 of the housing 110 may be required.

[00069] On the other hand, if the processor 151 determines that the actual operating speed of the airflow generator 120 measured by the speed sensing component 182 is more than the set

speed of the airflow generator 120 and that the air flow is unobstructed (e.g. at the air vent 114 of the housing 110), the processor 151 may proceed to determine the orientation of the housing 110 via the orientation sensing component 180. The desired orientation of the housing 110 may be an orientation in which the airflow generator 120 is supposed to be operating normally with the air flow being unobstructed (e.g. at the air vent 114 of the housing 110). The desired orientation of the housing 110 may be provided to the processor 151 as a reference orientation. Accordingly, the processor may determine that the orientation of the housing 110 is in the desired orientation when the orientation of the housing 110 sensed by the orientation sensing component 180 coincide with the reference orientation. However, if the processor 151 determines that the actual operating speed of the airflow generator 120 measured by the speed sensing component 182 is more than the set speed of the airflow generator 120, the air flow is unobstructed (e.g. at the air vent 114 of the housing 110), and that the orientation of the housing 110 is in the desired orientation, it may mean that the airflow generator 120 is not working properly and the processor may output an error signal to notify that there is an error in the airflow generator 120. On the other hand, if the processor 151 determines that the actual operating speed of the airflow generator 120 measured by the speed sensing component 182 is more than the set speed of the airflow generator 120, the air flow is unobstructed (e.g. at the air vent 114 of the housing 110), and that the orientation of the housing 110 is not in the desired orientation, it may mean that the actual operating speed of the airflow generator 120 may be different from the set speed of the airflow generator 120 due to the orientation of the housing 110 not being in the desired orientation. Accordingly, the processor may output a signal to notify that re-positioning/re-orienting of the housing 110 may be required.

[00070] According to some embodiments, in determining the state of the airflow generator 120, the processor 151 may compare the actual operating speed of the airflow generator 120 measured by the speed sensing component 182 with a speed range based on the set speed of the airflow generator 120. The speed range based on the set speed of the airflow generator 120 may be from a minimum threshold speed to a maximum threshold speed. The minimum threshold speed may be a speed within an acceptable deviation that is less than the set speed of the airflow generator 120, and the maximum threshold speed may be a speed within the acceptable deviation that is more than the set speed of the airflow generator 120. Accordingly, the processor 151 may determine whether the actual operating speed of the airflow generator 120 measured by the speed sensing component 182 is less than the minimum threshold speed or in the speed range or more than the maximum threshold speed.

[00071] When the actual operating speed of the airflow generator 120 measured by the speed sensing component 182 is in the speed range based on the set speed of the airflow generator 120, the airflow generator 120 may be considered to be operating normally. Accordingly, the processor 151 may proceed with performing the comparison between the one or more physical properties of the air flow measured by the sensor component 130 and the reference data to determine dust accumulation.

[00072] However, when the actual operating speed of the airflow generator 120 measured by the speed sensing component 182 is in the speed range, the processor 151 may be required to determine the orientation of the housing 110 and/or whether the air flow is obstructed (e.g. at the air vent 114 of the housing 110) before concluding whether there is an error in the airflow generator 120.

[00073] For example, when the actual operating speed of the airflow generator 120 measured by the speed sensing component 182 is less than the minimum threshold speed of the speed range based on the set speed of the airflow generator 120, the processor 151 may proceed to determine the orientation of the housing 110 via the orientation sensing component 180. The desired orientation of the housing 110 may be an orientation in which the airflow generator 120 is supposed to be operating normally. The desired orientation of the housing 110 may be provided to the processor 151 as a reference orientation. Accordingly, the processor may determine that the orientation of the housing 110 is in the desired orientation when the orientation of the housing 110 sensed by the orientation sensing component 180 coincide with the reference orientation. However, if the processor 151 determines that the actual operating speed of the airflow generator 120 measured by the speed sensing component 182 is less than the minimum threshold speed of the speed range based on the set speed of the airflow generator 120 and that the orientation of the housing 110 is in the desired orientation, it may mean that the airflow generator 120 is not working properly and the processor may output an error signal to notify that there is an error in the airflow generator 120. On the other hand, if the processor 151 determines that the actual operating speed of the airflow generator 120 measured by the speed sensing component 182 is less than the minimum threshold speed of the speed range based on the set speed of the airflow generator 120 and that the orientation of the housing 110 is not in the desired orientation, it may mean that the actual operating speed of the airflow generator 120 may be different from the set speed of the airflow generator 120 due to the orientation of the housing 110 not being in the desired orientation. Accordingly, the processor may output a signal to notify that re-positioning/re-orienting of the housing 110 may be required.

[00074] As another example, when the actual operating speed of the airflow generator 120 measured by the speed sensing component 182 is more than the maximum threshold speed of the speed range based on the set speed of the air flow generator 120, the processor 151 may proceed to determine whether the air flow is obstructed (e.g. at the air vent 114 of the housing 110) based on the one or more physical properties of the air flow measured by the sensor component 130. The air flow may be obstructed (e.g. at the air vent 114 of the housing 110) when the one or more physical properties of the air flow measured by the sensor component 130 is not equal to a threshold value or not within a threshold range associated with the set speed of the air flow generator 120 (e.g. less than a threshold air flow velocity or threshold volume flow rate of the air flow, or more than a threshold air flow pressure). If the processor 151 determines that the actual operating speed of the airflow generator 120 measured by the speed sensing component 182 is more than the maximum threshold speed of the speed range based on the set speed of the airflow generator 120 and that the air flow is obstructed (e.g. at the air vent 114 of the housing 110), it may mean that the actual operating speed of the airflow generator 120 may be different from the set speed of the airflow generator 120 due to the obstruction of the air flow. Accordingly, the processor may output a signal to notify that checking for obstruction at the air vent 114 of the housing 110 may be required.

[00075] On the other hand, if the processor 151 determines that the actual operating speed of the airflow generator 120 measured by the speed sensing component 182 is more than the maximum threshold speed of the speed range based on the set speed of the airflow generator 120 and that the air flow is unobstructed (e.g. at the air vent 114 of the housing 110), the processor 151 may proceed to determine the orientation of the housing 110 via the orientation sensing component 180. The desired orientation of the housing 110 may be an orientation in which the airflow generator 120 is supposed to be operating normally with the air flow being unobstructed (e.g. at the air vent 114 of the housing 110). The desired orientation of the housing 110 may be provided to the processor 151 as a reference orientation. Accordingly, the processor may determine that the orientation of the housing 110 is in the desired orientation when the orientation of the housing 110 sensed by the orientation sensing component 180 coincide with the reference orientation. However, if the processor 151 determines that the actual operating speed of the airflow generator 120 measured by the speed sensing component 182 is more than the maximum threshold speed of the speed range based on the set speed of the airflow generator 120, the air flow is unobstructed (e.g. at the air vent 114 of the housing 110), and that the orientation of the housing 110 is in the desired orientation, it may mean that the airflow generator 120 is not working properly and the processor may output an error signal to notify

that there is an error in the airflow generator 120. On the other hand, if the processor 151 determines that the actual operating speed of the airflow generator 120 measured by the speed sensing component 182 is more than the maximum threshold speed of the speed range based on the set speed of the airflow generator 120, the air flow is unobstructed (e.g. at the air vent 114 of the housing 110), and that the orientation of the housing 110 is not in the desired orientation, it may mean that the actual operating speed of the airflow generator 120 may be different from the set speed of the airflow generator 120 due to the orientation of the housing 110 not being in the desired orientation. Accordingly, the processor may output a signal to notify that re-positioning/re-orienting of the housing 110 may be required.

10 **[00076]** According to various embodiments, the processor 151 may run the processes to determine whether there is dust accumulation in the electronic device 100, 200, 300 based on a user request, or automatically during powering up of the electronic device 100, 200, 300. According to various embodiments, the determination of dust accumulation may be programmed as a computer program, such as a self-check test program, including instructions which when
15 the computer program is executed by the processor 151, the processor 151 may run or carry out the processes as described herein to determine whether there is dust accumulation in the electronic device 100, 200, 300. According to various embodiments, a computer-readable medium may include the instructions, when executed by the processor 151, cause the processor 151 to run or carry out the processes as described herein to determine whether there is dust
20 accumulation in the electronic device 100, 200, 300.

[00077] FIG. 5 shows a diagram of a method 501 (e.g. a computer implemented method) for determining dust accumulation in the electronic device 100, 200, 300 according to various embodiments. According to various embodiments, the processor 151 may execute the computer program including instructions to cause the processor 151 to carry out the method
25 501. According to various embodiments, the processor 151 may execute instructions included in the computer-readable medium to cause the processor 151 to carry out the method 501. According to various embodiments, the method 501 may include determining the state of the airflow generator 120 of the electronic device 100, 200, 300 as the first stage 503, and determining the state of dust accumulation in the electronic device 100, 200, 300 as the second
30 stage 505 when the airflow generator 120 is determined to be operating normally. Accordingly, the method 501 may involve checking whether the airflow generator 120 of the electronic device 100, 200, 300 is operating normally before proceeding to determine the state of dust accumulation in the electronic device 100, 200, 300 in the manner as described herein.

[00078] FIG. 6 shows an expanded flow diagram of the method 501 (e.g. a computer implemented method) for determining dust accumulation in the electronic device 100, 200, 300 according to various embodiments.

[00079] According to various embodiments, the first stage 503 of determining the state of the airflow generator 120 may include, at step 513, setting a set speed for the airflow generator 120 to operate the airflow generator 120 at the set speed, and, at step 515, comparing the actual operating speed of the airflow generator 120 measured by the speed sensing component 182 with the set speed of the airflow generator 120 or with a speed range based on the set speed of the airflow generator 120. The airflow generator 120 is determined to be operating normally if the actual operating speed of the airflow generator 120 measured by the speed sensing component 182 is equal to the set speed of the airflow generator 120 or in the speed range based on the set speed of the airflow generator 120. According to some embodiments, the method 501 may determine whether the airflow generator 120 is operating normally based on a single set speed of the air flow generator 120 with a single pass between step 513 and step 515. According to some embodiments, the method 501 may repeat step 513 and step 515 for at least two different set speeds (or two or more different set speeds) before determining whether the airflow generator 120 is operating normally. In these embodiments, step 515 may require the actual operating speeds of the airflow generator 120 to match all the different set speeds before it is determined that the airflow generator 120 is operating normally. When the airflow generator 120 is determined to be operating normally at step 515 of the first stage 503, the method 501 may proceed to the second stage 504 to determine the state of dust accumulation.

[00080] According to various embodiments, during step 515 of the first stage 503 of determining the state of the airflow generator 120, if the actual operating speed of the airflow generator 120 measured by the speed sensing component 182 is less than the set speed of the airflow generator 120 or less than the minimum threshold speed of the speed range based on the set speed of the airflow generator 120, the method 501 may proceed with determining the orientation of the housing 110 via the orientation sensing component 180 at step 517. During step 517, the orientation of the housing 110 sensed by the orientation sensing component 180 may be compared with the reference orientation to determine whether the orientation of the housing 110 sensed by the orientation sensing component 180 coincides with the reference orientation. The reference orientation may be the desired orientation of the housing 110 in which the airflow generator 120 should be operating normally. Accordingly, if the orientation of the housing 110 sensed by the orientation sensing component 180 is determined to coincide with the reference orientation at step 517, the method 501 may proceed with generating a fan

error warning at step 519. This is because, the housing 110 of the electronic device 100, 200, 300 is already in the desired orientation for the airflow generator 120 to be operating normally but the actual operating speed of the airflow generator 120 measured by the speed sensing component 182 at step 513 is still less than the set speed of the airflow generator 120 or less than the minimum threshold speed of the speed range based on the set speed of the airflow generator 120, which may likely be due to an error in the airflow generator 120.

[00081] According to various embodiments, during step 517, if the orientation of the housing 110 sensed by the orientation sensing component 180 is determined to be different from the reference orientation, the method 501 may proceed with looping back to a starting step 511 along with generating a message to recommend re-positioning/re-orienting of the electronic device 100, 200, 300 (together with the housing 110). Subsequently, step 513 and step 515 may be repeated to determine the state of the airflow generator 120 after re-positioning/re-orienting of the electronic device 100, 200, 300.

[00082] According to various embodiments, during step 515 of the first stage 503 of determining the state of the airflow generator 120, if the actual operating speed of the airflow generator 120 measured by the speed sensing component 182 is more than the set speed of the airflow generator 120 or more than the maximum threshold speed of the speed range based on the set speed of the airflow generator 120, the method 501 may proceed with determining whether the air flow is obstructed (e.g. at the air vent 114 of the housing 110) based on the one or more physical properties of the air flow measured by the sensor component 130 at step 521. The air flow may be obstructed (e.g. at the air vent 114 of the housing 110) when the one or more physical properties of the air flow measured by the sensor component 130 is not equal to a threshold value or not within a threshold range associated with the set speed of the air flow generator 120 (e.g. less than a threshold air flow velocity or threshold volume flow rate of the air flow, or more than a threshold air flow pressure). At step 521, if the air flow is determined to be obstructed (e.g. at the air vent 114 of the housing 110), the method 501 may proceed with looping back to the starting step 511 along with generating a message to recommend checking and resolving the obstruction to the air flow. Subsequently, step 513 and step 515 may be repeated to determine the state of the airflow generator 120 after checking and resolving the obstruction to the air flow.

[00083] According to various embodiments, at step 521, if the air flow is determined to be unobstructed, the method 501 may proceed with determining the orientation of the housing 110 via the orientation sensing component 180 at step 523. During step 523, the orientation of the housing 110 sensed by the orientation sensing component 180 may be compared with the

reference orientation to determine whether the orientation of the housing 110 sensed by the orientation sensing component 180 coincides with the reference orientation. The reference orientation may be the desired orientation of the housing 110 in which the airflow generator 120 should be operating normally when the air flow is unobstructed. Accordingly, if the orientation of the housing 110 sensed by the orientation sensing component 180 is determined to coincide with the reference orientation at step 521, the method 501 may proceed with generating a fan error warning at step 525. This is because, the housing 110 of the electronic device 100, 200, 300 is already in the desired orientation for the airflow generator 120 to be operating normally without any obstruction in the air flow, but the actual operating speed of the airflow generator 120 measured by the speed sensing component 182 at step 515 is still more than the set speed of the airflow generator 120 or more than the maximum threshold speed of the speed range based on the set speed of the airflow generator 120, which may likely be due to an error in the airflow generator 120.

[00084] According to various embodiments, during step 523, if the orientation of the housing 110 sensed by the orientation sensing component 180 is determined to be different from the reference orientation, the method 501 may proceed with looping back to a starting step 511 along with generating a message to recommend re-positioning/re-orienting of the electronic device 100, 200, 300 (together with the housing 110). Subsequently, step 513 and step 515 may be repeated to determine the state of the airflow generator 120 after re-positioning/re-orienting of the electronic device 100, 200, 300.

[00085] According to some embodiments, the second stage 505 may commence with setting a predetermined set speed for dust accumulation detection at step 527. Subsequently, the method 501 may proceed with, at step 529, comparing the one or more physical properties of the air flow measured by the sensor component 130 against the reference data. When the one or more physical properties of the air flow measured by the sensor component 130 is determined to be equal to the predefined base threshold value or in the range from the predefined base threshold value to the predefined ceiling threshold value, the method 501 may proceed with generating an output indicating that there is no dust accumulation at step 531.

[00086] According to various embodiments, during step 529, when the physical property of the air flow measured by the sensor component 130 is air flow velocity or volume flow rate of the air flow and if the one or more physical properties of the air flow measured by the sensor component 130 is determined to be less than the predefined base threshold value or less than the predefined base threshold value of the range from the predefined base threshold value to the predefined ceiling threshold value, the method 501 may proceed with generating a dust-

accumulation warning at step 533. According to various embodiments, when there is dust accumulation along the air flow, the air flow velocity or volume flow rate of the air flow may correspondingly decrease. Hence, when the air flow velocity or volume flow rate of the air flow is determined to be less than desired at step 529, it may be concluded that there is dust accumulation. Thus, the method may proceed to generate the dust-accumulation warning at step 533.

[00087] According to various embodiments, during step 529, when the physical property of the air flow measured by the sensor component 130 is air flow velocity or volume flow rate of the air flow and if the one or more physical properties of the air flow measured by the sensor component 130 is determined to be more than the predefined base threshold value or more than the predefined ceiling threshold value of the range from the predefined base threshold value to the predefined ceiling threshold value, the method 501 may proceed with looping back to the starting step 511 at the first stage 503 of the method 501 along with generating a message to recommend re-positioning/re-orienting of the electronic device 100, 200, 300 (together with the housing 110). Subsequently, the method 501 may proceed with the first stage 503 again before proceeding with the second stage 505.

[00088] According to various embodiments, during step 529, when the physical property of the air flow measured by the sensor component 130 is air flow pressure and if the one or more physical properties of the air flow measured by the sensor component 130 is determined to be more than the predefined base threshold value or more than the predefined ceiling threshold value of the range from the predefined base threshold value to the predefined ceiling threshold value, the method 501 may proceed with generating a dust-accumulation warning at step 533. According to various embodiments, when there is dust accumulation along the air flow, the air flow pressure may correspondingly increase. Hence, when the air flow pressure is determined to be more than desired at step 529, it may be concluded that there is dust accumulation. Thus, the method may proceed to generate the dust-accumulation warning at step 533.

[00089] According to various embodiments, during step 529, when the physical property of the air flow measured by the sensor component 130 is air flow pressure and if the one or more physical properties of the air flow measured by the sensor component 130 is determined to be less than the predefined base threshold value or less than the predefined base threshold value of the range from the predefined base threshold value to the predefined ceiling threshold value, the method 501 may proceed with looping back to the starting step 511 at the first stage 503 of the method 501 along with generating a message to recommend re-positioning/re-orienting of

the electronic device 100, 200, 300 (together with the housing 110). Subsequently, method 501 may proceed with the first stage 503 again before proceeding with the second stage 505.

[00090] According to various embodiments, there is provided a method of dust accumulation detection for an electronic device. The method may include comparing one or more physical properties of an air flow measured by a sensor component with a reference data, the air flow being generated by an airflow generator disposed in a housing of the electronic device towards an air vent of the housing so as to expel air from within the housing through the air vent of the housing to outside of the housing, the sensor component being located along a path of the air flow at or before the air vent of the housing, wherein a state of dust accumulation along the airflow may be determined based on a result of the comparison.

[00091] According to various embodiments, comparing the one or more physical properties of the air flow measured by the sensor component with the reference data may include determining whether the one or more physical properties of the air flow measured by the sensor component is less than or equal to or more than a predefined base threshold value.

[00092] According to various embodiments, the method may further include generating a dust-accumulation warning signal when the one or more physical properties of the air flow measured by the sensor component is determined to be less than the predefined base threshold value, and/or generating a no-dust-accumulated signal when the one or more physical properties of the air flow measured by the sensor component is determined to be equal to the predefined base threshold value. The one or more physical properties of the air flow measured by the sensor component may include an air flow velocity or a volume flow rate of the air flow.

[00093] According to various embodiments, the method may further include comparing subsequently measured one or more physical properties of the air flow with the reference data when the one or more physical properties of the air flow measured by the sensor component is determined to be more than the predefined base threshold value.

[00094] According to various embodiments, comparing the one or more physical properties of the air flow measured by the sensor component with the reference data may include determining whether the one or more physical properties of the air flow measured by the sensor component is in a range from a predefined base threshold value to a predefined ceiling threshold value, or less than the predefined base threshold value, or more than the predefined ceiling threshold value.

[00095] According to various embodiments, the method may further include generating a dust-accumulation warning signal when the one or more physical properties of the air flow measured by the sensor component is determined to be less than the predefined base threshold

value, and/or generating a no-dust-accumulated signal when the one or more physical properties of the air flow measured by the sensor component is determined to be in the range from the predefined base threshold value to the predefined ceiling threshold value. The one or more physical properties of the air flow measured by the sensor component may include the air flow velocity or the volume flow rate of the air flow.

[00096] According to various embodiments, the method may further include comparing subsequently measured one or more physical properties of the air flow with the reference data when the one or more physical properties of the air flow measured by the sensor component is determined to be more than the predefined ceiling threshold value.

[00097] According to various embodiments, the method may further include, prior to comparing the one or more physical properties of the air flow measured by the sensor component with the reference data, determining a state of the airflow generator based on an actual operating speed of the airflow generator measured by a speed sensing component associated with the airflow generator, and/or an orientation of the housing determined by an orientation sensing component associated with the housing, and/or the one or more physical properties of the air flow measured by the sensor component.

[00098] According to various embodiments, determining the state of the airflow generator may include comparing the actual operating speed of the airflow generator measured by the speed sensing component with a set speed of the airflow generator so as to determine whether the actual operating speed of the airflow generator measured by the speed sensing component is less than or equal to or more than the set speed of the air flow generator.

[00099] According to various embodiments, when the actual operating speed of the airflow generator measured by the speed sensing component is equal to the set speed of the air flow generator, the one or more physical properties of the air flow measured by the sensor component may be compared with the reference data.

[000100] According to various embodiments, when the actual operating speed of the airflow generator measured by the speed sensing component is less than the set speed of the air flow generator, an orientation of the housing may be determined by an orientation sensing component associated with the housing. When the orientation of the housing is determined to be in a reference orientation, an error signal may be generated.

[000101] According to various embodiments, when the actual operating speed of the airflow generator measured by the speed sensing component is more than the set speed of the air flow generator, the airflow may be checked whether it is obstructed based on the one or more physical properties of the air flow measured by the sensor component. When the air flow is

determined to be unobstructed, an orientation of the housing may be determined by an orientation sensing component associated with the housing. When the orientation of the housing is determined to be in a reference orientation, an error signal may be generated.

5 [000102] According to various embodiments, determining the state of the airflow generator may include comparing the actual operating speed of the airflow generator measured by the speed sensing component with a speed range based on a set speed of the airflow generator, whereby the speed ranges is from a minimum threshold speed to a maximum threshold speed, so as to determine whether the actual operating speed of the airflow generator measured by the speed sensing component is less than the minimum threshold speed or in the speed range or
10 more than the maximum threshold speed.

[000103] According to various embodiments, when the actual operating speed of the airflow generator measured by the speed sensing component is in the speed range, the one or more physical properties of the air flow measured by the sensor component may be compared with the reference data.

15 [000104] According to various embodiments, when the actual operating speed of the airflow generator measured by the speed sensing component is less than the minimum threshold speed, an orientation of the housing may be determined by an orientation sensing component associated with the housing. When the orientation of the housing is determined to be in a reference orientation, an error signal may be generated.

20 [000105] According to various embodiments, when the actual operating speed of the airflow generator measured by the speed sensing component is more than the maximum threshold speed, the airflow may be checked whether it is obstructed based on the one or more physical properties of the air flow measured by the sensor component. When the air flow is determined to be unobstructed, an orientation of the housing may be determined by an orientation sensing
25 component associated with the housing. When the orientation of the housing is determined to be in a reference orientation, an error signal may be generated.

[000106] According to various embodiments, there is provided a computer program including instructions which, when the program is executed by a computer, cause the computer to carry out the method as described herein.

30 [000107] According to various embodiments, there is provided a computer-readable medium including instructions which, when executed by a computer, cause the computer to carry out the method as described herein.

[000108] Various embodiments have provided an electronic device capable of detecting dust accumulation therein. In the various embodiments, the user may be informed of the state of

dust accumulation in the electronic device and take action to clear the dust or clean the electronic device to maintain the performance of the electronic device.

- [000109]** While the invention has been particularly shown and described with reference to specific embodiments, it should be understood by those skilled in the art that various changes, modification, variation in form and detail may be made therein without departing from the scope of the invention as defined by the appended claims. The scope of the invention is thus indicated by the appended claims and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced.

Claims

1. An electronic device comprising
a housing having an air vent;
an airflow generator disposed in the housing, wherein the airflow generator is operable to generate an air flow towards the air vent so as to expel air from within the housing through the air vent of the housing to outside the housing; and
a sensor component located along a path of the air flow at or before the air vent of the housing to measure one or more physical properties of the air flow.
2. The electronic device according to claim 1, wherein the one or more physical properties of the air flow include air flow pressure or air flow velocity.
3. The electronic device according to claim 1, wherein the sensor component comprises one or a combination of a pressure sensing element or an anemometric sensing element.
4. The electronic device according to claim 1, wherein a transverse position of the sensor component with respect to a width of the air flow correspond to a point of maximum air flow velocity with respect to a velocity profile of the air flow along the width of the air flow.
5. The electronic device according to claim 1, wherein the airflow generator comprises a centrifugal fan having a plurality of blades rotatable about a rotational axis to generate a swirling flow around the plurality of blades about the rotational axis, and a flow directing arrangement to channel the swirling flow into the air flow directed towards the air vent of the housing.
6. The electronic device according to claim 5, wherein the flow directing arrangement comprises a curved wall portion alongside a segment of a peripheral of the centrifugal fan and a straight wall portion extending from an end of the curved wall portion so as to point towards the air vent of the housing for channeling the swirling flow along the curved wall portion towards the straight wall portion and directing the air flow from the straight wall portion towards the air vent of the housing.

7. The electronic device according to claim 6, wherein the sensor component is located at a lateral fringe region of the air flow aligned with the straight wall portion of the flow directing arrangement.
8. The electronic device according to claim 6, wherein the flow directing arrangement comprises a volute casing or scroll type casing.
9. The electronic device according to claim 1, further comprising a thermal transfer component extending transversely across the air flow between the airflow generator and the air vent.
10. The electronic device according to claim 9, wherein the sensor component is disposed at the thermal transfer component.
11. The electronic device according to claim 9, wherein the thermal transfer component comprises a plurality of fins and the sensor component is disposed on the plurality of fins.
12. The electronic device according to claim 1, further comprising a processor configured to perform a comparison between the one or more physical properties of the air flow measured by the sensor component and a reference data, wherein a state of dust accumulation along the airflow is determined based on a result of the comparison.
13. The electronic device according to claim 12, wherein the comparison comprises a determination whether the one or more physical properties of the air flow measured by the sensor component is less than or equal to or more than a predefined base threshold value.
14. The electronic device according to claim 13, wherein the one or more physical properties of the air flow includes an air flow velocity or a volume flow rate of the air flow,
wherein the processor is configured to output a dust-accumulation warning signal when the one or more physical properties of the air flow measured by the sensor component is determined to be less than the predefined base threshold value, and/or
wherein the processor is configured to output a no-dust-accumulated signal when the one or more physical properties of the air flow measured by the sensor component is determined to be equal to the predefined base threshold value.

15. The electronic device according to claim 14, wherein the processor is configured to perform the comparison for subsequently measured one or more physical properties of the air flow with the reference data when the one or more physical properties of the air flow measured by the sensor component is determined to be more than the predefined base threshold value.

16. The electronic device according to claim 12, wherein the comparison comprises a determination whether the one or more physical properties of the air flow measured by the sensor component is in a range from a predefined base threshold value to a predefined ceiling threshold value, or less than the predefined base threshold value, or more than the predefined ceiling threshold value.

17. The electronic device according to claim 16, wherein the one or more physical properties of the air flow includes an air flow velocity or a volume flow rate of the air flow, wherein the processor is configured to output a dust-accumulation warning signal when the one or more physical properties of the air flow measured by the sensor component is determined to be less than the predefined base threshold value, and/or

wherein the processor is configured to output a no-dust-accumulated signal when the one or more physical properties of the air flow measured by the sensor component is determined to be in the range from the predefined base threshold value to the predefined ceiling threshold value.

18. The electronic device according to claim 17, the processor is configured to perform the comparison for subsequently measured one or more physical properties of the air flow with the reference data when the one or more physical properties of the air flow measured by the sensor component is determined to be more than the predefined ceiling threshold value.

19. The electronic device according to claim 12, further comprising an orientation sensing component disposed in the housing for determining an orientation of the housing.

20. The electronic device according to claim 19, further comprising a speed sensing component disposed in the housing for measuring an actual operating speed of the airflow generator.

21. The electronic device according to claim 20, wherein, prior to performing the comparison between the one or more physical properties of the air flow measured by the sensor component and the reference data, the processor is configured to determine a state of the airflow generator based on the actual operating speed of the airflow generator measured by the speed sensing component, and/or the orientation of the housing determined by the orientation sensing component, and/or the one or more physical properties of the air flow measured by the sensor component.

22. The electronic device according to claim 21, wherein the processor is configured to compare the actual operating speed of the airflow generator measured by the speed sensing component with a set speed of the airflow generator so as to determine whether the actual operating speed of the airflow generator measured by the speed sensing component is less than or equal to or more than the set speed of the air flow generator.

23. The electronic device according to claim 22, wherein the processor is configured to proceed with performing the comparison between the one or more physical properties of the air flow measured by the sensor component and the reference data when the actual operating speed of the airflow generator measured by the speed sensing component is equal to the set speed of the air flow generator.

24. The electronic device according to claim 22,
wherein the processor is configured to determine the orientation of the housing via the orientation sensing component when the actual operating speed of the airflow generator measured by the speed sensing component is less than the set speed of the air flow generator,
wherein the processor is configured to output an error signal when the orientation of the housing is in a reference orientation.

25. The electronic device according to claim 22,
wherein the processor is configured to determine whether the airflow is obstructed based on the one or more physical properties of the air flow measured by the sensor component when the actual operating speed of the airflow generator measured by the speed sensing component is more than the set speed of the air flow generator,

wherein the processor is configured to determine the orientation of the housing via the orientation sensing component when the air flow is determined to be unobstructed.

26. The electronic device according to claim 21, wherein the processor is configured to compare the actual operating speed of the airflow generator measured by the speed sensing component with a speed range based on a set speed of the airflow generator, whereby the speed range is from a minimum threshold speed to a maximum threshold speed, so as to determine whether the actual operating speed of the airflow generator measured by the speed sensing component is less than the minimum threshold speed or in the speed range or more than the maximum threshold speed.

27. The electronic device according to claim 26, wherein the processor is configured to proceed with performing the comparison between the one or more physical properties of the air flow measured by the sensor component and the reference data when the actual operating speed of the airflow generator measured by the speed sensing component is in the speed range.

28. The electronic device according to claim 26,
wherein the processor is configured to determine the orientation of the housing via the orientation sensing component when the actual operating speed of the airflow generator measured by the speed sensing component is less than the minimum threshold speed,
wherein the processor is configured to output an error signal when the orientation of the housing is in a reference orientation.

29. The electronic device according to claim 26,
wherein the processor is configured to determine whether the airflow is obstructed based on the one or more physical properties of the air flow measured by the sensor component when the actual operating speed of the airflow generator measured by the speed sensing component is more than the maximum threshold speed,
wherein the processor is configured to determine the orientation of the housing via the orientation sensing component when the air flow is determined to be unobstructed.

30. The electronic device according to claim 1,
wherein the housing comprises at least two air vents,

wherein at least two airflow generators are disposed in the housing, each airflow generator operable to generate a corresponding air flow towards a corresponding air vent,

wherein at least two sensor components are provided, each sensor component being located along a path of the corresponding air flow at or before the corresponding air vent of the housing.

31. A method of dust accumulation detection for an electronic device, the method comprising:

comparing one or more physical properties of an air flow measured by a sensor component with a reference data, the air flow being generated by an airflow generator disposed in a housing of the electronic device towards an air vent of the housing so as to expel air from within the housing through the air vent of the housing to outside of the housing, the sensor component being located along a path of the air flow at or before the air vent of the housing,

wherein a state of dust accumulation along the airflow is determined based on a result of the comparison.