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METHODS AND SYSTEMS FOR DIAGNOSING PROJECTION DEVICE FAILURE

5 [001] This application claims priority on co-pending United States provisional patent application serial number 60/601,310 filed on August 13, 2004, which is incorporated herein by reference in its entirety.

BACKGROUND OF THE INVENTION

1. Field of the Invention

10 [002] This invention relates generally to projection devices, and more particularly to methods and systems for diagnosing projection device failure.

2. Description of the Related Art

15 [003] Projection devices include projectors that use projection lamps to display images on a wall or other suitable viewing surface. Such projectors may be configured to display images provided by analog and digital connections that are compatible with PC, television and video standards. Projectors may be provided with a lamp sensor that monitors lamp current and triggers a lamp failure light if the projector lamp fails to ignite when powered on (*e.g.*, after four ignition attempts). When other power indicators of the projector are illuminated and the projector fan is running, the illuminated lamp failure
20 light indicates to the user that the projector lamp has failed and needs to be replaced. A replacement lamp may then be ordered by the user or may be shipped to the user by the manufacturer, *e.g.*, when still covered under warranty. Projectors may also be provided with an end of life indicator that notifies a user when the lamp has reached its end of life.

25 [004] A projector lamp failure light does not distinguish between a failed projector lamp and a failed ignitor circuit. Thus, a failure in the ignitor circuit will be viewed by a user as a lamp failure, and may result in a failed attempt to restore projector operation by



purchasing and installing a new replacement lamp. For projector products still covered under warranty, a new projector lamp may be shipped to the user in a wasted attempt to restore operation of a projector with a failed ignitor circuit.

SUMMARY OF THE INVENTION

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[005] Disclosed herein are methods and systems for diagnosing projection device failure and for preventing incorrect projection lamp failure notification by sensing improper operation of projection lamp ignitor circuitry and providing an indication of the same. Such incorrect lamp failure notification may occur when a lamp failure light is activated
10 due to a failure in the ignitor circuitry (ballast circuit), rather than due to a defective or burned out projection lamp. In one embodiment, the disclosed methods and systems may be implemented using a separate indicator circuit that monitors the input to the projector lamp by sensing the ignition voltage to the projector lamp. If the ignition voltage is below a specified value, an ignitor failure indicator may be activated by the indicator
15 circuit, *e.g.*, a light emitting diode (“LED”) indicator light that turns on and stays on.

[006] In one embodiment, a projector may be equipped with both lamp failure and ignitor failure indicator systems to facilitate proper diagnosis of projector failure. In a case where only the projector lamp fails (*i.e.*, the ignitor circuitry is functioning properly), the lamp failure indicator (*e.g.*, a first LED light) is activated, while the ignitor
20 failure indicator (*e.g.*, a second LED light) remains off. Activation of only the lamp failure indicator allows for easy identification that the projector lamp has encountered a failure and needs to be replaced. However, in a case where the ignitor circuitry supplies insufficient voltage (or no voltage) for projector lamp ignition, both the ignitor failure indicator and lamp failure indicators are activated. Activation of both lamp failure and
25 ignitor failure indicators is an indication that a projector failure is due to an electronics failure in the ignitor circuitry, and that the projector needs to be repaired. With the advantage of this indication of ignitor circuitry failure, wasted time and efforts associated with unsuccessful attempts to replace the projector lamp may be avoided.

[007] Thus, in one respect disclosed herein is a method of sensing lamp ignitor circuitry failure in a projection device, including the steps of: sensing operation of the lamp ignitor circuitry; and providing an indication of ignitor failure based on a sensed failure in said operation of said lamp ignitor circuitry. The step of sensing operation of the lamp ignitor circuitry may include measuring lamp ignitor voltage provided by the lamp ignitor circuitry to a projector lamp of the projection device; and the method may include activating an ignitor failure indicator based on a magnitude of the measured lamp ignitor voltage. The method may further include comparing a magnitude of the measured lamp ignitor voltage to a specified voltage magnitude; and activating the ignitor failure indicator if the measured voltage magnitude is less than the specified voltage magnitude. The method may further include the steps of: attempting to ignite the projector lamp; sensing whether the projector lamp is ignited; and activating a lamp failure indicator if the projector lamp fails to ignite. In one embodiment of this method, the ignitor failure indicator may only be activated if the lamp failure indicator is activated. In another embodiment, the step of sensing operation of the lamp ignitor circuitry may be performed after the step of activating the lamp failure indicator. The method may be implemented with a projection device that is configured to display information based on signals received from an information handling system.

[008] In another respect, disclosed herein is a system for sensing lamp ignitor circuitry failure in a projection device, including: ignitor detection circuitry configured to sense operation of the lamp ignitor circuitry; and an ignitor failure indicator coupled to the ignitor detection circuitry. In one embodiment, the ignitor detection circuitry may be configured to sense operation of the lamp ignitor circuitry by measuring lamp ignitor voltage provided by the lamp ignitor circuitry to a projector lamp of the projection device; and to activate the ignitor failure indicator based on a magnitude of the measured lamp ignitor voltage. In this regard, the ignitor detection circuitry may be configured to compare a magnitude of the measured lamp ignitor voltage to a specified voltage magnitude; and to activate the ignitor failure indicator if the measured voltage magnitude is less than the specified voltage magnitude. In one embodiment, the system may further include: lamp ignition detection circuitry configured to sense whether the projector lamp

is ignited; and a lamp failure indicator coupled to the lamp ignition detection circuitry. In one embodiment, the ignitor detection circuitry may be configured to only activate the ignitor failure indicator if the lamp failure indicator is activated. In another embodiment, the ignitor detection circuitry may be configured to sense operation of the lamp ignitor
5 circuitry after the lamp failure indicator is activated. The system may be implemented with a projection device configured to display information based on signals received from an information handling system.

[009] In another respect, disclosed herein is a projection device, including a projection lamp, lamp ignitor circuitry coupled to the projection lamp, ignitor detection circuitry
10 configured to sense operation of the lamp ignitor circuitry, and an ignitor failure indicator coupled to the ignitor detection circuitry. In one embodiment, the ignitor detection circuitry may be configured to sense operation of the lamp ignitor circuitry by measuring lamp ignitor voltage provided by the lamp ignitor circuitry to the projector lamp of the projection device; and to activate the ignitor failure indicator based on a magnitude of the
15 measured lamp ignitor voltage. In this regard, the ignitor detection circuitry may be configured to compare a magnitude of the measured lamp ignitor voltage to a specified voltage magnitude; and to activate the ignitor failure indicator if the measured voltage magnitude is less than the specified voltage magnitude. In one embodiment, the projection device may further include: lamp ignition detection circuitry configured to
20 sense whether the projector lamp is ignited; and a lamp failure indicator coupled to the lamp ignition detection circuitry. In one embodiment, the ignitor detection circuitry may be configured to only activate the ignitor failure indicator if the lamp failure indicator is activated. In another embodiment, the ignitor detection circuitry may be configured to sense operation of the lamp ignitor circuitry after the lamp failure indicator is activated.
25 The projection device may be configured to display information based on signals received from an information handling system.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] FIG. 1 is a flow diagram illustrating methodology according to one embodiment of the disclosed methods and systems.

5 [0011] FIG. 2 is a flow diagram illustrating methodology according to another embodiment of the disclosed methods and systems.

[0012] FIG. 3 is a simplified block diagram of a projection device according to one embodiment of the disclosed methods and system

DESCRIPTION OF ILLUSTRATIVE EMBODIMENTS

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[0013] Figure 1 is a flow diagram illustrating methodology that may be implemented to diagnose projector failure in one exemplary embodiment of the disclosed methods and systems. The projector is turned on in step 110, and the ignition circuitry attempts to light the projector lamp (*e.g.*, mercury vapor lamp) in step 112. Lamp ignition detection
15 circuitry determines whether the projector lamp was successfully ignited in step 114, *e.g.*, by sensing lamp current. If the projector lamp ignites, then the projector is powered on successfully as indicated in step 116. However, if it is determined in step 114 that the projector lamp was not successfully ignited, then one or more additional attempts (*e.g.*, for a total of four attempts) may be optionally made to ignite the projector lamp as
20 indicated by optional return flow path 119 from step 118 to step 112. If the projector lamp ignites during any one of these additional attempt/s, then the projector is powered on as indicated in step 116. After a specified number of one or more unsuccessful attempts to ignite the projector lamp have been made, then a lamp failure indicator (*e.g.*, a first LED light or first state of a tri-state LED light) may be activated in step 120.

25 [0014] Still referring to Figure 1, ignitor circuitry (ballast circuit) voltage may be monitored in step 122, *e.g.*, by a voltage detector circuit in one exemplary embodiment. If the ignitor voltage supplied by the ignitor circuitry is less than a specified voltage (*e.g.*,

the voltage required to successfully ignite the projector lamp), then an ignitor failure indicator (*e.g.*, a second LED light or second state of a tri-state LED light) may be activated in step 124, and the projector power may be optionally turned off (*e.g.*, automatically or manually by the projector operator) in step 126. At this point, both the lamp failure and ignitor failure indicators will be activated, indicating a failure has occurred in the ignition circuitry and that the projector needs to be repaired.

[0015] However, if the ignitor voltage is found to be equal to or greater than the specified voltage in step 122, then the ignitor failure indicator is not activated and the projector power optionally turned off (*e.g.*, automatically by automatic shut-down circuitry or manually by the projector operator) in step 126. At this point, only the lamp failure indicator is activated, indicating that the projector lamp has failed or is defective and needs to be replaced.

[0016] Figure 2 illustrates an optional embodiment in which the ignitor circuitry is optionally shutoff (*e.g.*, in addition to the performance of steps 122 to 124 of Figure 1 as indicated in outline by dashed line 150) to prevent further ignition tries. In this embodiment, ignitor circuitry voltage may be monitored in step 122 in a manner as previously described. If the ignitor voltage supplied by the ignitor circuitry is less than the specified voltage and the ignitor failure indicator is activated in step 124, then the ignitor circuitry is shut off to prevent further ignition tries as indicated by step 125 of Figure 2.

[0017] Figure 1 illustrates one exemplary embodiment in which the methodology of steps 122 to 126 follows the methodology of steps 110 to 120. In this regard, it will be understood that in another embodiment the methodology of steps 122 to 126 may be implemented separately, simultaneously and/or independently to the methodology of steps 110 to 120, and that steps 110 to 120 need not be present. It will also be understood that lamp failure and/or ignitor failure indicators may be implemented using any suitable form of indicating mechanism/s other than separate indicator lights, *e.g.*, using a single multi-state indicator such as multi-state LED capable of displaying a different respective

color to reflect each of lamp failure or ignitor circuit failure. Furthermore, although one embodiment for sensing operation of ignitor circuitry is described herein in which a separate indicator circuit is employed to monitor the input to a projector lamp by sensing the ignition voltage to the projector lamp, it will be understood that any other methodology and/or configuration of one or more circuits that is suitable for sensing proper operation of ignitor circuitry may be employed.

[0018] Figure 3 is a simplified block diagram of projection device 300 configured according to one exemplary embodiment of the disclosed methods and systems, *e.g.* to implement the methodology of Figure 1 and/or 2. As shown in Figure 3, projection device 300 is coupled to receive image signals 315 from an image source 301, for example, an information handling system such as described further herein. In the illustrated exemplary embodiment, projection device 300 includes lamp ignitor circuitry 303 that is coupled via lamp power connection 309 to projector lamp 302 which may be, for example, a mercury vapor lamp.

[0019] In the exemplary embodiment of Figure 3, ignitor detection circuitry 304 is configured to sense operation of lamp ignitor circuitry 303, *e.g.*, by measuring lamp ignitor voltage provided by lamp ignitor circuitry 303 to projector lamp 302 via lamp power connection 309. An ignitor failure indicator 307 (*e.g.*, LED light or other suitable indicator) is shown coupled to display an indication of lamp ignitor circuitry failure upon receipt of ignitor failure signal 313 provided by ignitor detection circuitry 304 upon detection of failure of lamp ignitor circuitry 303. Optional ignitor shutdown circuitry 310 is also shown present for receiving ignitor failure signal 308 and for in turn providing an ignitor shutdown signal 312 to shut down lamp ignitor circuitry 303. In this regard, it will be understood that an ignitor failure signal may be a separate signal 308 as shown, or may alternatively be the same signal as signal 313.

[0020] Still referring to Figure 3, optional lamp ignition detection circuitry 305 may be provided that is configured to sense whether projector lamp 302 is ignited *e.g.*, by measuring current provided by lamp ignitor circuitry 303 to projector lamp 302 via lamp

power connection 309. A lamp failure indicator 306 (*e.g.*, LED light or other suitable indicator) is shown coupled to display an indication of projector lamp failure upon receipt of lamp failure signal 311 from lamp ignition detection circuitry 305.

[0021] In the practice of the disclosed methods and systems, features of ignitor detection circuitry 304, optional lamp ignition detection circuitry 305 and/or optional ignitor shutdown circuitry 310 may be implemented using any suitable configuration of one or more circuits. For example, in one embodiment, one or more features of circuitry 304, 305 and 310 may be implemented using a controller (*e.g.*, microprocessor and associated firmware) that is integral to projector 300 or using any other suitable configuration of microprocessor, firmware and/or software that interfaces with projection device circuitry/components. Discrete circuit devices may also be employed, *e.g.*, ignitor detection circuitry 304 may be implemented using a comparator circuit or other suitable discrete circuit configuration.

[0022] The disclosed methods and systems may be implemented with any type of projection device that utilizes one or more projector lamps, *e.g.*, table top projectors, projection televisions, *etc.* In one exemplary embodiment, the disclosed methods and systems may be implemented with projection devices that are configured to display images based on signals received from an information handling system. For purposes of this disclosure, an information handling system may include any instrumentality or aggregate of instrumentalities operable to compute, classify, process, transmit, receive, retrieve, originate, switch, store, display, manifest, detect, record, reproduce, handle, or utilize any form of information, intelligence, or data for business, scientific, control, or other purposes. For example, an information handling system may be a personal computer, a network storage device, or any other suitable device and may vary in size, shape, performance, functionality, and price. The information handling system may include random access memory (RAM), one or more processing resources such as a central processing unit (CPU) or hardware or software control logic, ROM, and/or other types of nonvolatile memory. Additional components of the information handling system may include one or more disk drives, one or more network ports for communicating with

external devices as well as various input and output (I/O) devices, such as a keyboard, a mouse, and a video display. The information handling system may also include one or more buses operable to transmit communications between the various hardware components.

- 5 **[0023]** While the invention may be adaptable to various modifications and alternative forms, specific embodiments have been shown by way of example and described herein. However, it should be understood that the invention is not intended to be limited to the particular forms disclosed. Rather, the invention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the invention as defined
- 10 by the appended claims. Moreover, the different aspects of the disclosed methods and systems may be utilized in various combinations and/or independently. Thus the invention is not limited to only those combinations shown herein, but rather may include other combinations.

CLAIMS

1. A method of sensing lamp ignitor circuitry failure in a projection device, comprising:
providing a projection device comprising lamp ignitor circuitry that is coupled by a
5 power connection to a projector lamp;
attempting to ignite said projector lamp using said lamp ignitor circuitry;
sensing operation of said lamp ignitor circuitry while attempting to ignite said projector
lamp coupled to said lamp ignitor circuitry by a power connection by measuring lamp
ignitor voltage provided by said lamp ignitor circuitry to said projector lamp through
10 said power connection; and
providing an indication of ignitor failure based on a sensed failure in said operation of
said lamp ignitor circuitry.
2. The method of claim 1, further comprising providing a controller integral to said
15 projection device; and wherein said step of sensing operation of said lamp ignitor
circuitry comprises using said controller to measure lamp ignitor voltage provided by
said lamp ignitor circuitry to a projector lamp of said projection device; and wherein
said providing an indication of ignitor failure comprises using said integral controller to
activate an ignitor failure indicator based on a magnitude of said measured lamp ignitor
20 voltage.
3. The method of claim 2, further comprising comparing a magnitude of said measured
lamp ignitor voltage to a specified voltage magnitude; and activating said ignitor failure
indicator if said measured voltage magnitude is less than said specified voltage

magnitude.

4. The method of claim 2, further comprising: attempting to ignite said projector lamp;
sensing whether said projector lamp is ignited; and activating a lamp failure indicator if
5 said projector lamp fails to ignite.

5. The method of claim 4, wherein said step of sensing operation of said lamp ignitor
circuitry is performed after the step of activating said lamp failure indicator.

10 6. The method of claim 1, further comprising providing a controller integral to said
projection device; and using said integral controller to shut down said lamp ignitor
circuitry based on a sensed failure in said operation of said lamp ignitor circuitry.

7. The method of claim 1, wherein said projection device is configured to display
15 information based on signals received from an information handling system.

8. A system for sensing lamp ignitor circuitry failure in a projection device having lamp
ignitor circuitry coupled to a projection lamp by a power connection, said system
comprising:

20 ignitor detection circuitry configured to sense operation of said lamp ignitor circuitry
while said lamp ignitor circuitry is coupled to said projection lamp by said power
connection; and
an ignitor failure indicator coupled to said ignitor detection circuitry.

9. The system of claim 8, wherein said ignitor detection circuitry is configured to sense operation of said lamp ignitor circuitry by measuring lamp ignitor voltage provided by said lamp ignitor circuitry to said projector lamp of said projection device; and to activate said ignitor failure indicator based on a magnitude of said measured lamp
5 ignitor voltage.

10. The system of claim 9, wherein said ignitor detection circuitry is configured to compare a magnitude of said measured lamp ignitor voltage to a specified voltage magnitude; and to activate said ignitor failure indicator if said measured voltage
10 magnitude is less than said specified voltage magnitude.

11. The system of claim 10, wherein said ignitor failure indicator comprises an ignitor failure indicator light.

15 12. The system of claim 9, further comprising: lamp ignition detection circuitry configured to sense whether said projector lamp is ignited; and a lamp failure indicator coupled to said lamp ignition detection circuitry.

13. The system of claim 12, wherein said ignitor detection circuitry is configured to
20 sense operation of said lamp ignitor circuitry after said lamp failure indicator is activated.

14. The system of claim 8, further comprising ignitor shutdown circuitry coupled to said ignitor detection circuitry and to said lamp ignitor circuitry, said ignitor shutdown

circuitry being configured to shut down said lamp ignitor circuitry based on a sensed failure in said operation of said lamp ignitor circuitry.

15. The system of claim 8, wherein said projection device is configured to display
- 5 images based on signals received from an information handling system.