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TIAN et al.(10) **Pub. No.: US 2014/0147289 A1**(43) **Pub. Date: May 29, 2014**(54) **FAN CONTROL CIRCUIT****Publication Classification**(71) Applicants: **HONG FU JIN PRECISION INDS**
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A control circuit controls a fan to cool an integrated base-board management controller (iBMC) in a server. The control circuit includes a state determination module. When the server is powered off and the iBMC is operating, the system power signal from a power supply unit (PSU) of the server is at a low level, the state signal from the iBMC is at a low level signal, the fan operates. When the server and the iBMC are powered off, the system power signal from the PSU is at a low level, and the state signal from the iBMC is at a high level, the fan is powered off. When the server is operating, the system power signal from the PSU is at a high level, the fan is powered off.

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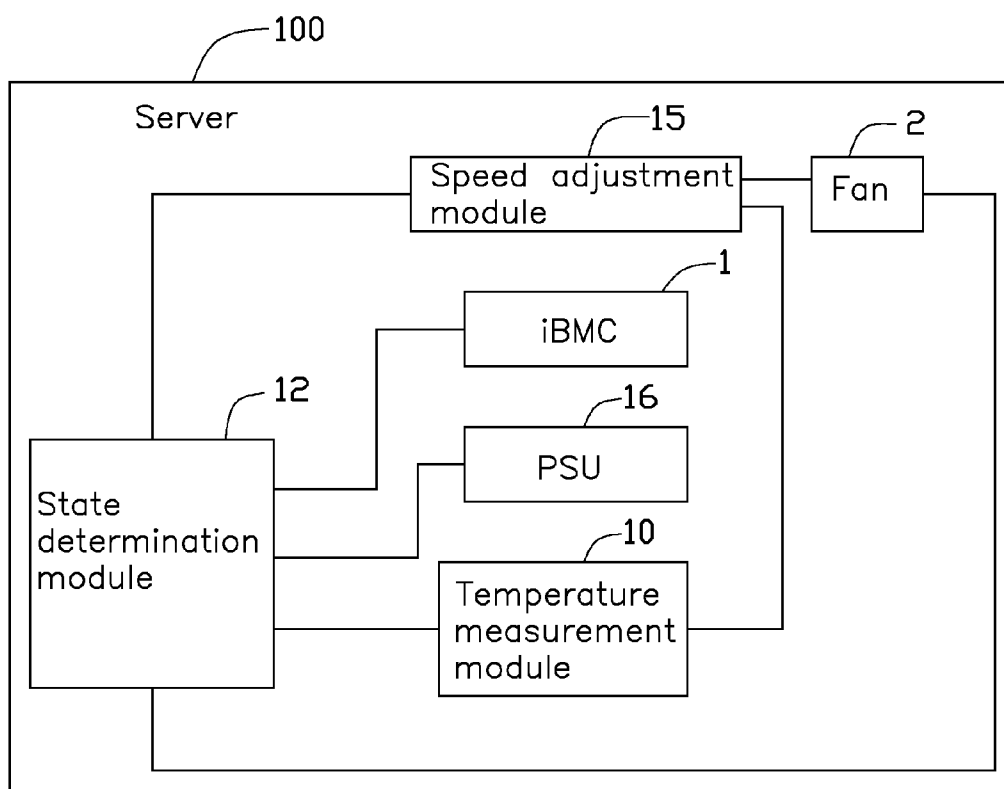


FIG. 1

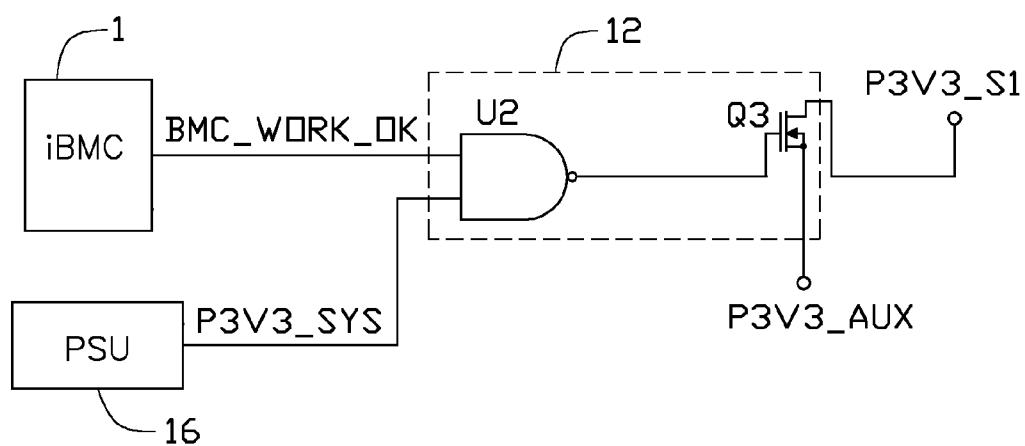


FIG. 2

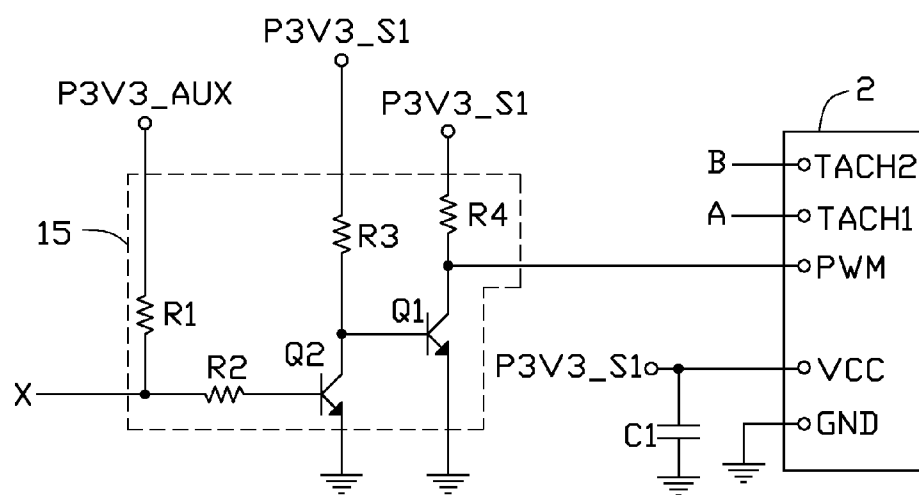


FIG. 3

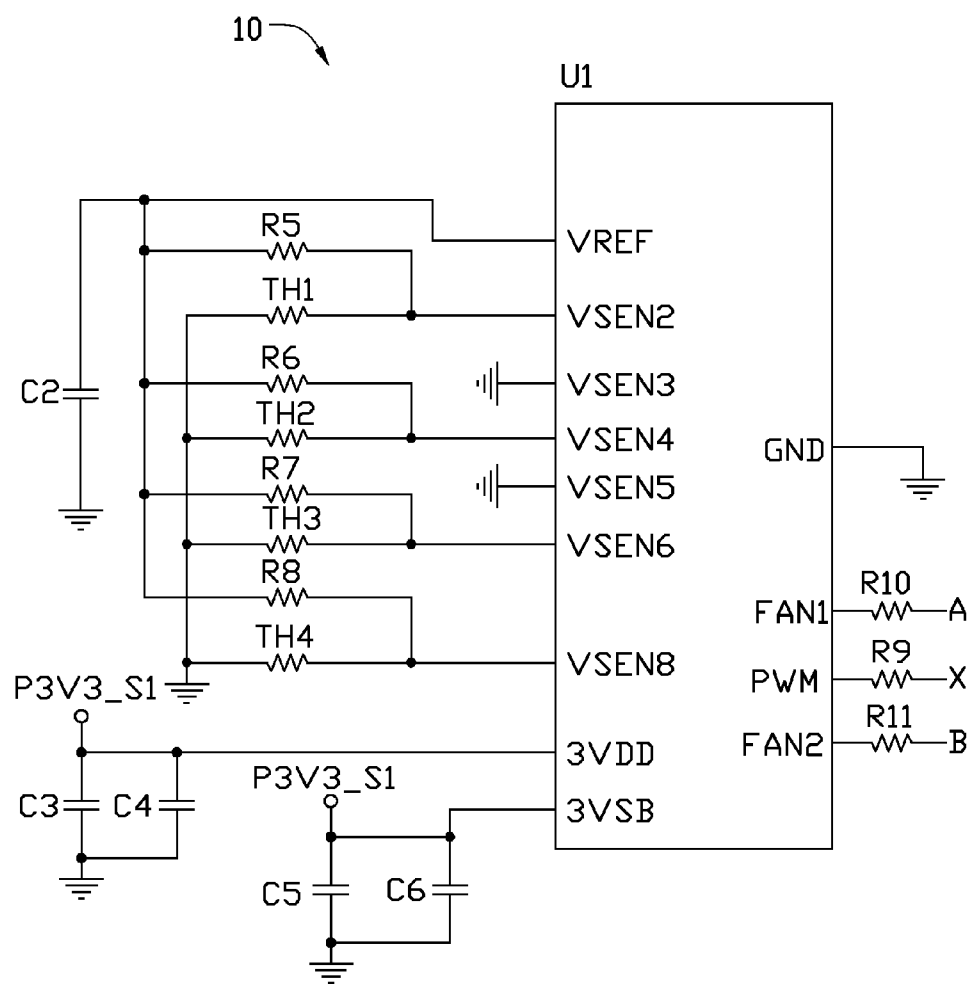


FIG. 4

FAN CONTROL CIRCUIT

BACKGROUND

[0001] 1. Technical Field

[0002] The present disclosure relates to a circuit for controlling a fan.

[0003] 2. Description of Related Art

[0004] In current servers, integrated baseboard management controllers (iBMCs) are often used. However, there are no special fans to cool the iBMCs. This may result in overheating of the iBMCs.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] Many aspects of the embodiments can be better understood with reference to the following drawing. The components in the drawings are not necessarily drawn to scale, the emphasis instead being placed upon clearly illustrating the principles of the present embodiments. Moreover, in the drawings, like reference numerals designate corresponding parts throughout the view.

[0006] FIG. 1 is a block diagram of an exemplary embodiment of a control circuit for a fan.

[0007] FIGS. 2-4 are circuit diagrams of the different components of the control circuit of FIG. 1.

DETAILED DESCRIPTION

[0008] The disclosure, including the accompanying drawings, is illustrated by way of examples and not by way of limitation. It should be noted that references to “an” or “one” embodiment in this disclosure are not necessarily to the same embodiment, and such references mean at least one.

[0009] FIG. 1 shows an embodiment of a control circuit. The control circuit is to control a fan 2 for cooling an integrated baseboard management controller (iBMC) 1 in a server 100. The control circuit includes a temperature measurement module 10, a state determination module 12, and a speed adjustment module 15.

[0010] The state determination module 12 is connected to the iBMC 1 and a power supply unit (PSU) 16 of the server 100, to determine states of the iBMC 1 and the server 100, and outputs corresponding determination signals. The state determination module 12 further supplies power to the fan 2 as needed according to the determination result. The state determination module 12 is further connected to the temperature measurement module 10 and the speed adjustment module 15. The state determination module 12 further supplies power to the temperature measurement module 10 and the speed adjustment module 15 as needed according to the determination result.

[0011] The temperature determination module 10 is to measure ambient temperature in the vicinity of the iBMC 1. The temperature determination module 10 outputs corresponding pulse-width modulation (PWM) signals to the speed adjustment module 15 for controlling the fan 2. In the embodiment, the PSU 16 supplies a standby power signal P3V3_STBY.

[0012] Referring to FIG. 2, the state determination module 12 includes a NOR gate U2 and a metal oxide semiconductor field effect transistor (MOSFET) Q3. A first input terminal of the NOR gate U2 is connected to the iBMC 1 for receiving a state signal BMC WORK OK from the iBMC 1. A second input terminal of the NOR gate U2 is connected to the PSU 16 for receiving a system power signal P3V3_SYS from the PSU

16. An output terminal of the NOR gate U2 is connected to a gate of the MOSFET Q3. A source of the MOSFET Q3 is connected to a dual power signal P3V3_AUX. A drain of the MOSFET Q3 is to supply a power signal P3V3_S1 to the fan 2 and the temperature measurement module 10. In the embodiment, the dual power signal P3V3_AUX is converted from the system power signal P3V3_SYS or the standby power signal P3V3_STBY.

[0013] Referring to FIG. 3, the speed adjustment module 15 includes two bipolar junction transistors (BJTs) Q1 and Q2. A base of the BJT Q2 is connected to the source of the MOSFET Q3 through resistors R2 and R1 in that order, to receive the dual power signal P3V3_AUX. A node between the resistors R2 and R1 is connected to the temperature measurement module 10. An emitter of the BJT Q2 is grounded. A collector of the BJT Q2 is connected to the drain of the MOSFET Q3 through a resistor R3. The collector of the BJT Q2 is further connected to a base of the BJT Q1. An emitter of the BJT Q1 is grounded. A collector of the BJT Q1 is connected to the drain of the MOSFET Q3 through a resistor R4. The collector of the BJT Q2 is further connected to a pulse pin PWM of the fan 2. A power pin VCC of the fan 2 is connected to the drain of the MOSFET Q3 for receiving the power signal P3V3_S1. A ground pin GND of the fan 2 is grounded. Speed pins TACH1 and TACH2 of the fan 2 are connected to the temperature measurement module 10.

[0014] Referring to FIG. 4, the temperature determination module 10 includes a temperature sensor U1. Voltage sensing pins VSEN2, VSEN4, VSEN 6, and VSEN8 of the temperature sensor U1 are grounded through thermistors TH1, TH2, TH3, and TH4 respectively. The voltage sensing pins VSEN2, VSEN4, VSEN 6, and VSEN8 of the temperature sensor U1 are further connected to a first terminal of a capacitor C2 through resistors R5, R6, R7, and R8 respectively. A second terminal of the capacitor C2 is grounded. Voltage sensing pins VSEN3 and VSEN5 of the temperature sensor U1 are grounded. A first ground pin VREF of the temperature sensor U1 is grounded through the capacitor C2. A second ground pin GND of the temperature sensor U1 is grounded. A first power pin 3VDD of the temperature sensor U1 is connected to the drain of the MOSFET Q3 for receiving the power signal P3V3_S1, and is further grounded through a capacitor C3. A capacitor C4 is connected to the capacitor C3 in parallel. A second power pin 3VSB of the temperature sensor U1 is connected to the drain of the MOSFET Q3 for receiving the power signal P3V3_S1, and is further grounded through a capacitor C5. A capacitor C6 is connected to the capacitor C5 in parallel.

[0015] A pulse pin PWM of the temperature sensor U1 is connected to the node between the resistors R1 and R2 through a resistor R9. A first control pin FAN1 of the temperature sensor U1 is connected to the speed pin TACH1 of the fan 2 through a resistor R10. A second control pin FAN2 of the temperature sensor U2 is connected to the speed pin TACH2 of the fan 2 through a resistor R11. The temperature sensor U1 measures a voltage difference of the thermistors TH1-TH4 to obtain any temperature changes, and outputs corresponding PWM signals.

[0016] When the server 100 is operating, the system power signal P3V3_SYS from the PSU 16 is at a high level. When the server 100 is powered off, the system power signal P3V3_SYS from the PSU 16 is at a low level. When the iBMC 1 is operating, the state signal BMC_WORK_OK from the iBMC

1 is at a low level. When the iBMC 1 is powered off, the state signal BMC_WORK_OK from the iBMC 1 is at a high level.

[0017] In the embodiment, the temperature sensor U1 is located near the iBMC 1 for measuring a temperature of the iBMC 1.

[0018] When the server 100 is powered off and the iBMC 1 is operating, the state signal BMC_WORK_OK from the iBMC 1 is at a low level, and the system power signal P3V3_SYS is at a low level. As a result, the input terminals of the NOR gate U2 receive low level signals. The MOSFET Q3 is turned on. The standby power signal P3V3_STBY is transmitted to the temperature measurement module 10 and the fan 2 through the MOSFET Q3. The temperature measurement module 10 measures the temperature of the iBMC 1, and outputs corresponding PWM signals, according to the temperature, to the speed adjustment module 15. The speed adjustment module 15 controls the fan 2 according to the PWM signals. In addition, a speed of the fan 2 is feedback to the temperature sensor U1 through the speed pins TACH1 and TACH2 of the fan 2. The temperature sensor U1 adjusts the fan 2 accordingly.

[0019] When the server 100 and the iBMC are powered off, the state signal BMC_WORK_OK from the iBMC 1 is at a high level, and the system power signal P3V3_SYS from the PSU 16 is at a low level. As a result, the output terminal of the NOR gate U2 outputs a low level signal. The MOSFET Q3 is turned off. The fan 2 is not operating.

[0020] When the server 100 is operating, the system power signal P3V3_SYS from the PSU 16 is at a high level. In this state, whether the iBMC 1 is operating or powered off, the NOR gate U5 outputs a low level signal. The MOSFET Q3 is turned off. The fan 2 is powered off. Under these circumstances, the server 100 is operating, and a system fan (not shown) of the server 100 is operating, so the iBMC 1 can be cooled by airflow from the system fan of the server 100. The fan 2 is powered off to save power.

[0021] In other embodiments, if the refinement of speed control is not needed, the speed adjustment module 15 and the temperature measurement module 10 can be omitted. In other words, the control circuit could activate or deactivate the fan 2, but not adjust the speed of the fan 2. In addition, the BJTs Q1 and Q2, and the MOSFET Q3 function as electronic switches.

[0022] The foregoing description of the exemplary embodiments of the disclosure has been presented only for the purposes of illustration and description and is not intended to be exhaustive or to limit the disclosure to the precise forms disclosed. Many modifications and variations are possible in light of disclosure above. The embodiments were chosen and described in order to explain the principles of the disclosure and their practical application so as to enable others of ordinary skill in the art to utilize the disclosure and various embodiments and with various modifications as are suited to the particular use contemplated. Alternative embodiments will become apparent to those of ordinary skills in the art to which the present disclosure pertains without departing from its spirit and scope. Accordingly, the scope of the present disclosure is defined by the appended claims rather than the foregoing description and the exemplary embodiments described therein.

What is claimed is:

1. A control circuit set in a server, the control circuit controls a fan to cool an integrated baseboard management controller (iBMC) in the server, the control circuit comprising:

a state determination module, comprising a NOR gate and a first electronic switch, wherein two input terminals of the NOR gate are respectively connected to the iBMC and a power supply unit (PSU) of the server, for receiving a state signal of the iBMC and a system power signal from the PSU, an output terminal of the NOR gate is connected to a control terminal of the first electronic switch, a first terminal of the first electronic switch is connected to the PSU, a second terminal of the first electronic switch is connected to a power pin of the fan;

wherein when the server is powered off and the iBMC is operating, the system power signal from the PSU is at a low level, the state signal from the iBMC is at a low level signal, the NOR gate outputs a high level signal, the first terminal of the first electronic switch is connected to the second terminal of the first electronic switch, to connect the PSU and the fan, the fan operates;

when the server and the iBMC are powered off, the system power signal from the PSU is at a low level, and the state signal from the iBMC is at a high level, the NOR gate outputs a low level signal, the first terminal of the first electronic switch is disconnected from the second terminal of the first electronic switch, the PSU is disconnected from the fan, the fan is powered off; and

when the server is operating, the system power signal from the PSU is at a high level, the NOR gate outputs a low level signal, the first terminal of the first electronic switch is disconnected from the second terminal of the first electronic switch, the PSU is disconnected from the fan, the fan is powered off.

2. The control circuit of claim 1, wherein the first electronic switch is a metal oxide semiconductor field effect transistor (MOSFET), a gate of the MOSFET is the control terminal of the first electronic switch, a source of the MOSFET is the first terminal of the first electronic switch, and a drain of the MOSFET is the second terminal of the first electronic switch.

3. The control circuit of claim 1, further comprising:

a temperature measurement module connected to the state determination module, wherein when the server is powered off and the iBMC is operating, the state determination module further connects to the PSU and the temperature measurement module, the temperature measurement module measures temperature of the iBMC and outputs corresponding pulse-width modulation (PWM) signals; and

a speed adjustment circuit connected to the temperature measurement module and the fan, wherein the speed adjustment circuit adjusts a speed of the fan according to the PWM signals from the temperature measurement module.

4. The control circuit of claim 3, wherein the speed adjustment module comprises:

a second electronic switch comprising a control terminal connected to the temperature measurement module, a first terminal grounded, and a second terminal connected to the state determination module through a first resistor; and

a third electronic switch comprising a control terminal connected to the second terminal of the second electronic switch, a first terminal grounded, and a second terminal connected to the state determination module through a second resistor, and connected to a control pin of the fan.

5. The control circuit of claim 4, wherein the second electronic switch is a bipolar junction transistor (BJT), a base of the BJT is the control terminal of the second electronic switch, an emitter of the BJT is the first terminal of the second electronic switch, and a collector of the BJT is the second terminal of the second electronic switch.

6. The control circuit of claim 4, wherein the third electronic switch is a bipolar junction transistor (BJT), a base of the BJT is the control terminal of the third electronic switch, an emitter of the BJT is the first terminal of the third electronic switch, and a collector of the BJT is the second terminal of the third electronic switch.

7. The control circuit of claim 4, wherein the temperature measurement module is further connected to speed pins of the fan for receiving speed signals of the fan, and adjusting the PWM signals from the temperature measurement module to adjust the speed of the fan.

8. The control circuit of claim 7, wherein the temperature measurement module comprises a temperature sensor, first to fourth voltage sensing pins of the temperature sensor are

grounded through first to fourth thermistors respectively, the first to fourth voltage sensing pins of the temperature sensor are further connected to a first terminal of a first capacitor through third to sixth resistors respectively, a second terminal of the first capacitor is grounded; a first ground pin of the temperature sensor is grounded through a second capacitor, a second ground pin of the temperature sensor is grounded; a first power pin of the temperature sensor is connected to the second terminal of the first electronic switch, and is further grounded through a third capacitor; a second power pin of the temperature sensor is connected to the second terminal of the first electronic switch, and is further grounded through a fourth capacitor; a pulse pin of the temperature sensor is connected to the control terminal of the second electronic switch through a seventh resistor; a first control pin of the temperature sensor is connected to a first speed pin of the fan through an eighth resistor, a second control pin of the temperature sensor is connected to a second speed pin of the fan through a ninth resistor.

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