An intelligent power saving device for electrical devices such as televisions which have a standby mode. The power saving device comprises an AC power measuring circuit to derive the state of the connected device by measuring its power consumption, a switch to control output power, a motion or presence detector and either controlling logic or a microcontroller. The invention disconnects the mains power from the electrical device while there is no person present, but only if the device is in its standby mode.

**Figure 1 Block diagram**
Figure 1 Block diagram
Figure 2 State machine
Intelligent standby power saving for electrical devices

This invention relates to an intelligent mains electricity switch which can be connected between a consumer device and the electrical main supply; specifically devices with a built in standby mode such as a TV. The invention may be used to eliminate mains power to the device whilst the unit is unused in this standby mode; so indirectly saving money and the production of greenhouse gases.

Many devices, e.g. TV, Set-top box, DVD players now include a standby mode of operation, and many of these still consume 5 to 20 watts of power in this mode. The standby mode is convenient for the user since the functions of the device may be controlled by a remote control. Other methods of saving power whilst retaining use of the remote control have been tried, such as Timer Switches. These have disadvantages of needing manual intervention if the device is required to be used during a programmed ‘OFF’ period or frequent manual intervention for Daylight Saving Time and holidays.

The object of this invention is to provide a device which automatically disconnects the mains power from the device only when it is standby mode and returns it to standby mode when a person is present in the room by use of a PIR or motion detector. Power is saved whenever the room is unoccupied and the user is unaware that the device has been off while they were away.

Accordingly, this invention comprises a unit to be connected between the electrical device and the mains circuit. The invention includes a power detection circuit which can detect when the device is in standby by measuring the power consumption of the device. It also includes a switch which can turn off power to the device and a PIR or motion detector which is used to detect that a person is present in the room and therefore may want the device to be ready to use. Finally the device requires intelligence in the form of a microcontroller or specific custom logic to take these decisions.

The preferred embodiment of this device would be in a package with a standard mains electricity plug (male) connector on one side and a standard mains electricity socket (female) connector on the other for connection of the electrical device. The PIR detector may be built into the main casing or may be on an extended cable to allow the PIR device to 'see' a larger area of the room for detection of a human presence.

Figure 1 shows a block diagram of the functional parts of the invention. These comprise a low current Power Supply for the invention (1), an AC Power measuring circuit (2), a controllable switch (3), a Micro Controller (4), a PIR motion detector (5) and a calibration button (6).

Figure 2 shows the state behaviour of the device. The four main states are Calibrate (7), On (8), Standby (9) and Off (10). The states On (8), Standby (9) and Off (10) relate to the perceived state of the electrical device as seen by the invention. All states except Off (10) allow full mains electricity to the TV.
As shown in figure 1, the invention is controlled by a micro controller which can measure the power being used by the electrical device and which can control the power switch to the device. The microcontroller also knows if there has been movement in the room or if there is a need to calibrate the unit.

Figure 2 describes the states for the controlling logic or microcontroller.

The operation of the invention is as follows. When the unit is installed the owner places his TV in standby and presses the calibrate button. The unit goes into the state Calibrate (7). In this state the invention will learn and store the power consumed by the TV in standby mode. An indication is given to the device user that calibration has been successful. When calibration is complete the invention switches to Standby state (9).

In state Standby (9) the invention continually monitors the power consumption of the unit and the PIR detector. If the unit has been on Standby for a preset time (a few minutes), and there has been no motion in the room, then the power to the TV is switched off and the state moves to Off (10). If the invention detects a larger power consumption during the Standby (9) mode, it assumes the TV is being used and it changes to state On (8).

In state On (8) the invention assumes the TV or electrical device is in full use and does not switch off the power supply to it.

In state Off (10) the power to the TV or other electrical device is switched off by the use of switch (3) of figure 1 under control of the controlling logic or microcontroller. This is the power saving mode and is the only state in which input power is disconnected from the output. Consumption of power by the invention will be vastly less than the power used by the device in standby mode (less than 1 watt) thus leading to a large net saving of power. While the system is in the Off (10) state, the controller continually checks the PIR motion detector. On seeing an active state signifying a presence in the room, reconnects the power, therefore allowing the TV or other device back into its standby mode for immediate use by the user with the remote control.

At any time the unit can be recalibrated by pressing the calibrate button while the electrical device is in standby.
The following is a description of the events on figure 2 which drive the state of the unit:

E1: Initial power up when not calibrated. The system is calibrated (learns standby current) in state Calibrate (7).

E2: The user presses the calibrate button. The system is calibrated (learns standby current) in state Calibrate (7).

E3: Calibration complete. The system enters the Standby state (9) and starts a presence timer.

E4: Standby current is detected. The system enters the Standby state (9) and starts a presence timer.

E5: On current is detected. The system enters the On state (8).

E6: The system is powered up when calibrated. The system enters the Standby (9) state and starts a presence timer.

E7: Motion detected in Standby (9). The presence timer is reset and the state remains Standby (9).

E8: Motion detection in Off state (10). The system enters the Standby (9) state and starts a presence timer. The power to the device is enabled.

E9: Presence timer expires in Standby (9). The system enters the Off state (10) and the power to the device is disabled.
Claims

1. An intelligent power saving switch for a electrical device (e.g. TV or other) comprising an AC power measuring circuit, a controllable switch, a PIR motion detector and a state machine to control the electricity power supply to the said device during its standby.

2. An intelligent power saving switch as in claim 1 which can turn off the power to a electrical device which is in standby mode and turn on the power again when a person enters the room.

3. An intelligent power saving switch as in claim 1 where the control may be performed by a microcontroller or discrete electronics.

4. An intelligent power saving switch as in claim 1 where the PIR detector may be remotely connected by a cable to provide a greater area of movement detection or may be integral to the device.

5. An intelligent power saving switch as in claim 1 which is enhanced by indicators (LEDs) or a LCD (Liquid Crystal Display) to tell the user what state it is in.

6. An intelligent power saving switch as in claim 1 which has a built in power saving readout, in the form of a Liquid Crystal Display, displaying Power, Current, money saved or other useful data.

7. An intelligent power saving switch as in claim 1 where the detection of the person may be by a motion detector, PIR or Pressure switch or Door Switch.

8. An intelligent power saving switch as in claim 1 where the an interface is made to a Security Alarm system, which allows information about the human presence in various rooms of a house to be passed to the said device

9. An intelligent power saving switch as in claim 1 where the device may pass the data on the amount of power or money saved to a personal computer or other similar device via means of serial, USB, mains signalling or any other interface.
Application No: GB0613415.9
Claims searched: All
Examiner: Mr Rowland Hunt
Date of search: 9 October 2006

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

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