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Battery charge level based on power source availability

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ABSTRACT

Maintaining the voltage of a consumer-device battery at near-maximum levels causes premature battery degradation. If kept fully charged for excessive amounts of time, the battery can swell, damaging the device enclosure and causing safety problems. However, users legitimately fear the draining of device batteries before a power socket is available, and hence keep devices plugged in beyond recommended durations.

The techniques of this disclosure monitor the availability of a power source, and accordingly set the maximum charge level such that battery life is optimized. For example, if power sources are amply available, the maximum allowed charge level is relatively low. If power sources are relatively scarce, the maximum allowed charge level is moved upwards.

KEYWORDS

- smartphone
- charge level
- battery degradation
- battery life
- battery management
- charging
- power source

BACKGROUND

Per commonly used battery recharge logic for battery powered devices, a battery powered device stop charging once battery is fully charged. The device is then powered by the power

source (wired or wireless), but battery voltage drops slowly and once a programmed low battery state of charge level is reached the charging resumes to charge the battery back to full.

If kept fully charged for excessive amounts of time, the battery can swell, damaging the enclosure and causing safety problems. Device manufacturers and resellers currently recommend using software modes that prevent overcharging based on a user-defined mode. Nevertheless, even if a battery does not overcharge, the hovering of battery voltage at near-maximum levels is enough to reduce battery lifetime. Besides, the software mode that prevents overcharging is often not auto-detected, and therefore, does not take effect in case a device is connected to a power source (wired or wireless) for a prolonged period of time.

DESCRIPTION

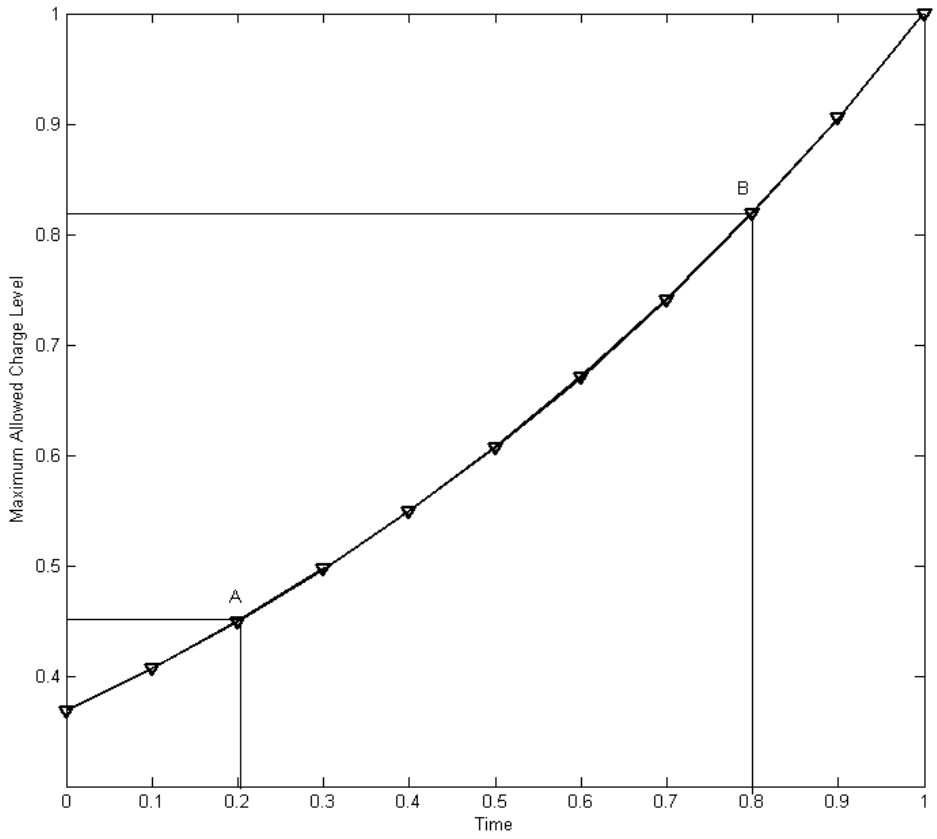

Fig. 1: Maximum permissible charge level as a function of time since last recharge

Per the techniques of this disclosure (as illustrated in Fig. 1), the maximum allowed charge level is a function of the time since last recharge (number of observed away-from-power-source hours). For example, at point A, the time since the last recharge is relatively low (0.2 units, e.g., one-fifth of a day), implying easy availability of power sources (or user tendency to recharge frequently). The maximum allowed charge level is therefore set relatively low, to 45%. On the other hand, at point B, the time since the last recharge is relatively high (0.8 units), and the maximum allowed charge level is therefore correspondingly high (83%). The curve of Fig. 1 can be of varied form, but advantageously it is exponentially increasing.

Per the techniques of this disclosure, a battery manager, which is a software component, monitors over time the availability of a wired or wireless power source. After a predefined number of hours, the battery manager sets the charge level to maximum. The battery manager is notified when a power source is lost and ramps up the maximum allowed charge level based on an exponentially increasing curve similar to Fig. 1. In this manner, a device connected to a power source for a prolonged length of time controls the maximum charge (voltage) level to optimize battery lifetime. The battery manager described herein can be incorporated as part of an operating system, e.g., for a portable device such as a smartphone, tablet, wearable device, etc.

Once the maximum allowed charge level is set by the battery manager, an exponentially decreasing current is used to reach that charge level, further maximizing battery life while optimizing time-to-charge.

Per the techniques of this disclosure, the user retains the ability to overwrite battery manager settings and to remove time-based limitations on the maximum allowed charge level.

CONCLUSION

The techniques of this disclosure monitor the availability of a power source and accordingly set the maximum charge level such that battery lifetime is maximized. For example, if power sources are amply available, the maximum allowed charge level is relatively low. If power sources are relatively scarce, the maximum allowed charge level is moved upwards.

REFERENCES

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