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# Smart auto-deactivation of device airplane mode

Gregory B. Roth



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ABSTRACT

The transmitting and receiving capabilities of a device are turned off when it is put in airplane mode. As a result, a device in airplane mode is unable to transmit information about its location to an external entity, e.g., that tracks its whereabouts to help find the device when it is lost or stolen. This disclosure proposes techniques for smart auto-deactivation of airplane mode of a device without explicit user action. The auto-deactivation is based on one or more user-permitted signals, such as device sensor data, user's calendar and context, information from airline sources, time, device battery charge, etc.

KEYWORDS

- Airplane mode
- Find device
- Device location
- Smartphone location
- Location transmission
- Lost device
- Stolen device

## BACKGROUND

Users of portable devices such as smartphones, tablets, laptops, wearable devices, etc. rely on external services to track and find such devices when a device is lost or stolen. With user permission, these services operate by receiving location information transmitted periodically by such devices. However, the transmitting and receiving capabilities of a device are turned off in certain situations, e.g., when the device is put in airplane mode. As a result, a device in airplane

mode is unable to transmit information about its location to the external entity that tracks its whereabouts. Similarly, the device cannot receive information from other parties that can help a user locate the device, e.g., by making it play a sound, display a message, etc. If a user inadvertently leaves a device on a flight, it is likely that the party that finds the device turns it over to the airline's lost-and-found service without turning off airplane mode. As long as the device stays in the airplane mode, the user is unable to utilize the various services and mechanisms that help track down the device.

## DESCRIPTION

This disclosure proposes techniques for smart auto-deactivation of airplane mode of a device, such as a smartphone or tablet. To determine when a device in airplane mode should automatically exit the airplane mode (without explicit user action), the solution incorporates several techniques that are implemented with user permission.

If the user permits, a device in airplane mode utilizes various on-board sensors of the device for periodic measurements of various contextual factors such as, e.g., barometric pressure, velocity, acceleration, orientation, ambient audio, location, identifiers (SSIDs) for available WiFi networks, etc. For example, detecting an airline-specific WiFi SSID suggests that the device is inside a plane. These measurements made while the device is in airplane mode are compared to detect relevant changes that indicate that the flight may have terminated. Upon encountering such changes, the device automatically exits airplane mode.

The end of a flight (which in turn indicates that the airplane mode may be turned off) is detected based on user-permitted factors such as the user's calendar, a flight status application provided by the airline, the Application Programming Interface (API) of the in-flight WiFi

service, etc. Only such factors as permitted by the user for such determination are utilized. If the factors indicate that the flight has ended, airplane mode is automatically turned off.

For example, landing of the plane may be inferred via ambient audio patterns of plane landing, announcements of flight arrival (e.g., detected using a microphone); location beacons associated with the arrival airports (e.g., detected using a wireless receiver); changes in pressure, velocity, or acceleration (e.g., detected using pressure sensors, accelerometers, etc.). Additional indicators of the expected arrival time of the flight may be obtained from airline information sources, such as a flight status API, or from the flight information present on the user's calendar.

Further, auto-deactivation of airplane mode can be based on time or battery charge. In the former case, airplane mode may be deactivated once the device has stayed in airplane mode for an interval that exceeds a threshold value. In the latter case, airplane mode may be turned off if the device battery charge is depleted beyond a threshold value, thus ensuring that the device transmits location information prior to full depletion of the battery.

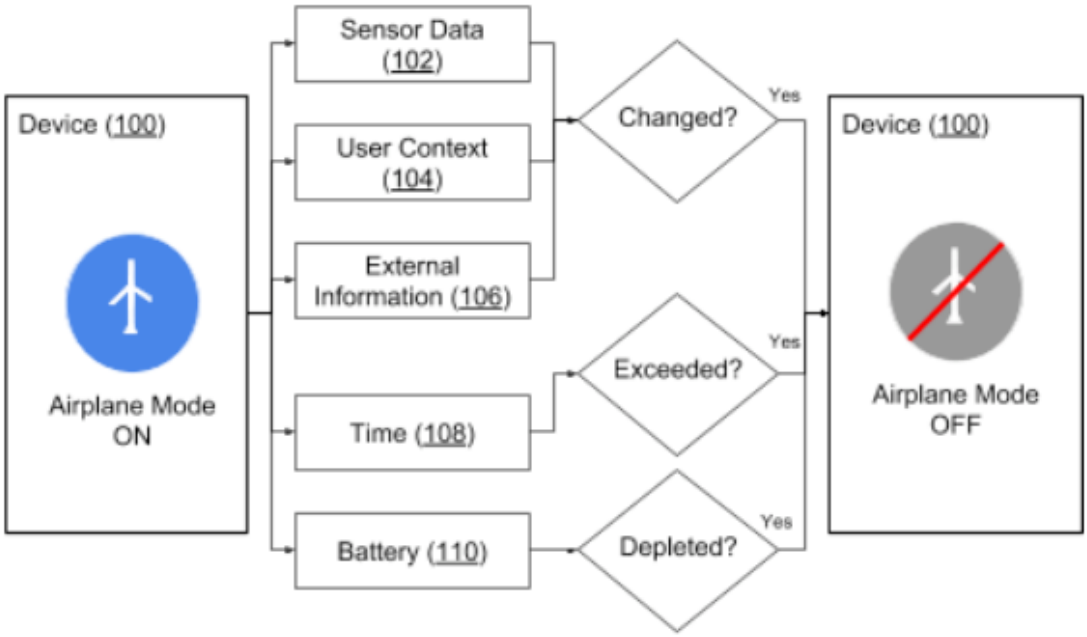


**Fig. 1: Automatically deactivating device airplane mode**

Fig. 1 shows an illustration of the techniques presented in this disclosure. A user has activated airplane mode on a device (100). During the airplane mode, the device periodically measures and monitors one or more of the various indicators mentioned above, as permitted by the user. The measurement of the indicators may be based on device sensors (102); obtained via other sources that provide contextual information of the user (104), such as the user's calendar; external factors (106), such as airline provided apps and services, current time (108), and device battery level (110). The device automatically exits the airplane mode if measurements from the device sensor, user contextual information, or external signals indicate that the flight has terminated, if time elapsed since activation of the airplane mode exceeds a threshold value, if the device battery charge falls below a threshold value, etc. Upon exiting the airplane mode, the device can transmit its location to an external entity that provides the service of locating the device.

When the device battery charge is lower than a specified threshold or when the interaction between the user and the device is low, such measurements have low power consumption, thus saving battery power. The respective threshold values corresponding to the maximum time permissible in airplane mode, battery charge level for auto-deactivating airplane mode, and battery charge level to activate reduced power operation can be specified by the device manufacturer, device operating system, etc. The values can be further adjusted dynamically during operation of the device, depending on the various contextual signals with user permission and/or can be specified and adjusted directly by the user.

Further, factors such as passage of time, or sensor values such as detected pressure, detected sounds or motion, etc. may be used to trigger the evaluation of whether to change device mode, rather than to directly determine whether to change the mode. Further, in some

instances, instead of turning the airplane mode off, the device is configured to provide a notification. While the foregoing discussion refers to the "airline mode," the techniques can also be used for automatic update of other device modes, e.g., a do-not-disturb mode, a silent mode, etc.

Further to the descriptions above, a user may be provided with controls allowing the user to make an election as to both if and when systems, programs or features described herein may enable collection of user information (e.g., information about a user's social network, social actions or activities, profession, a user's preferences, or a user's current location), and if the user is sent content or communications from a server. In addition, certain data may be treated in one or more ways before it is stored or used, so that personally identifiable information is removed. For example, a user's identity may be treated so that no personally identifiable information can be determined for the user, or a user's geographic location may be generalized where location information is obtained (such as to a city, ZIP code, or state level), so that a particular location of a user cannot be determined. Thus, the user may have control over what information is collected about the user, how that information is used, and what information is provided to the user.

## CONCLUSION

This disclosure provides techniques for smart auto-deactivation of airplane mode of a device without explicit user action. With user permission, a device in the airplane mode utilizes various device sensors for periodic measurements of various contextual factors. With user permission, the end of a flight may be detected based on consulting additional signals, such as the user's calendar, a flight status application provided by the airline, the in-flight WiFi service, etc. If it is determined based on one or more of the factors the flight has ended, airplane mode is

automatically turned off. Further, auto-deactivation of airplane mode may be based on time elapsed since airplane mode was switched on, battery charge remaining, etc.