NON-INVASIVE BATTERY SAVER FOR ANDROID SMARTPHONE

COMPUTER SCIENCE: EXERCISES

2021/1/29

82023140 FRANCESCO LEONE

Introduction

- The quality of the batteries installed in the smartphones has significantly improved
- Even the best battery ever may not suit your needs if you are not careful about the background work of the smartphone
- Limiting the processes running in background is necessary to improve the efficiency of the battery
- Android native battery saver is very invasive
- FLBatterySaver: a less aggressive battery saver

Android native battery saver[1]

- Limits applications in background
- Limits some features (e.g., location service, notifications)
- Limits some visual and hardware effects (e.g., brightness, vibration)

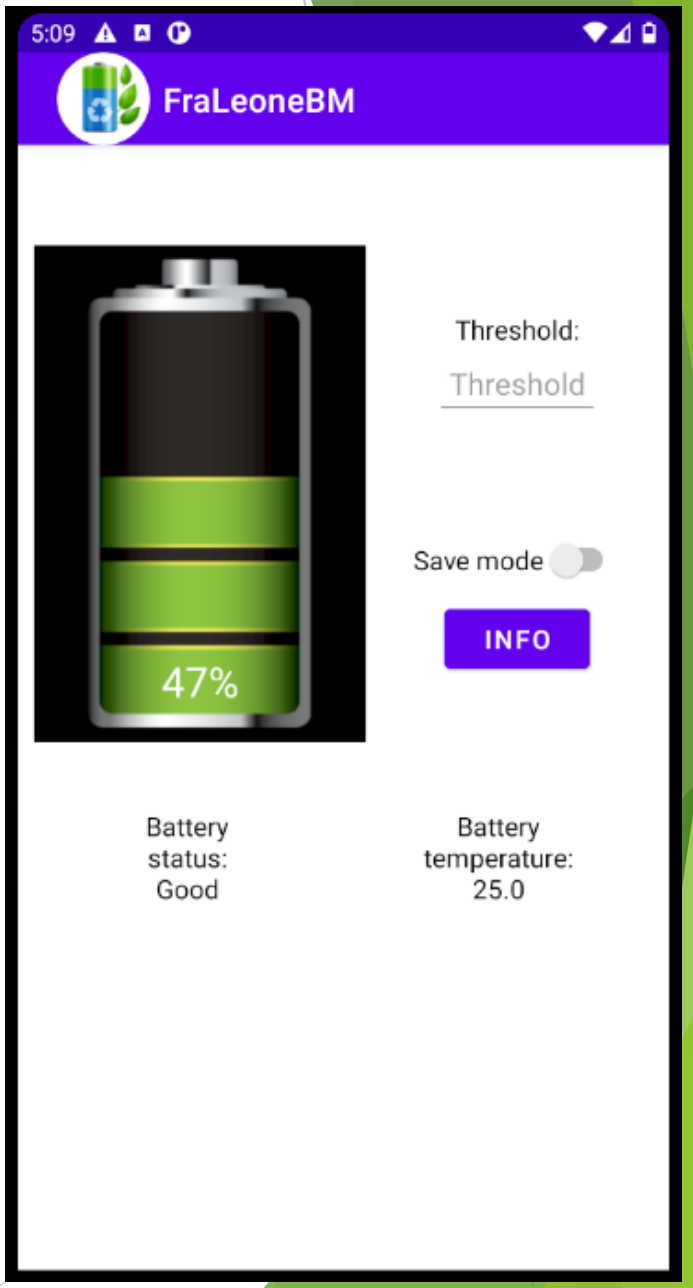
Differences with my app

- No third-party application could ever be as effective as Android native battery saver because of lack of system permissions
- Better to implement a different approach and give a different possibility to the user
- Android BS extends the battery life as much as possible in the last span of its charge
- FLBatterySaver works for a longer period in a less invasive way

[1] https://support.google.com/pixelphone/answer/6187458?hl=en#zippy=

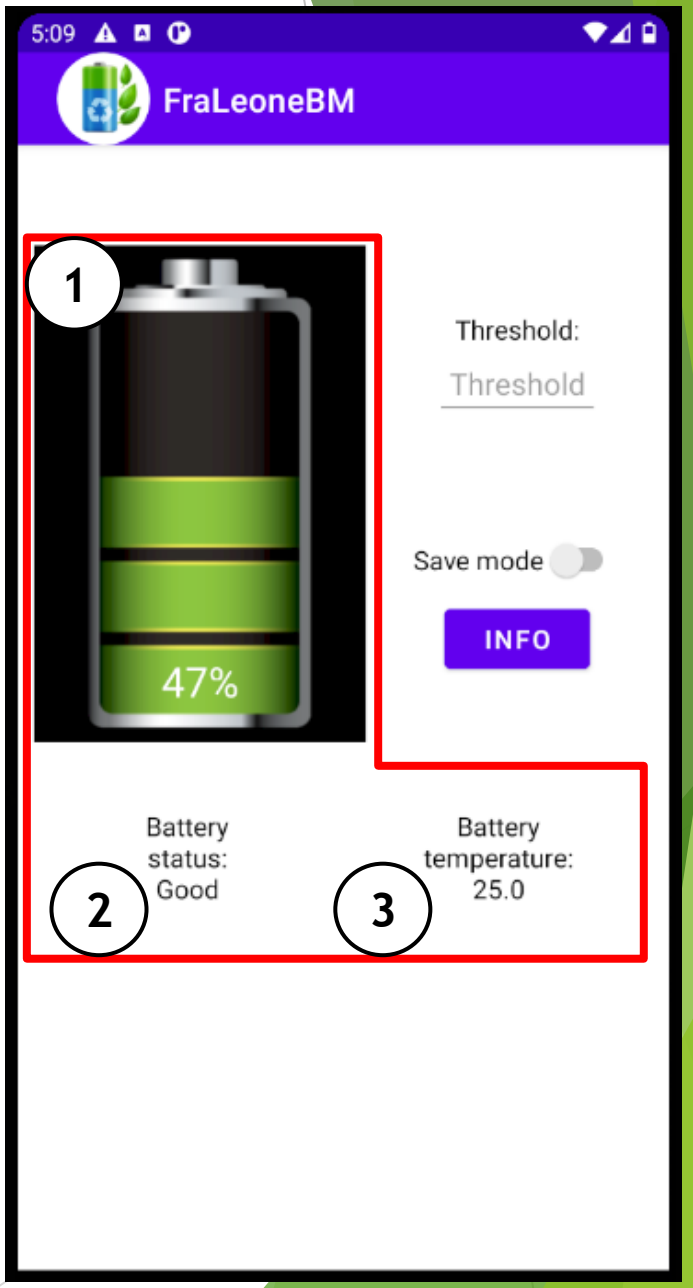
What the app does

- Shows basic info about battery
- Save mode: reduces processes running in background
- Threshold: allows the user to set the threshold for battery percentage at which save mode starts working



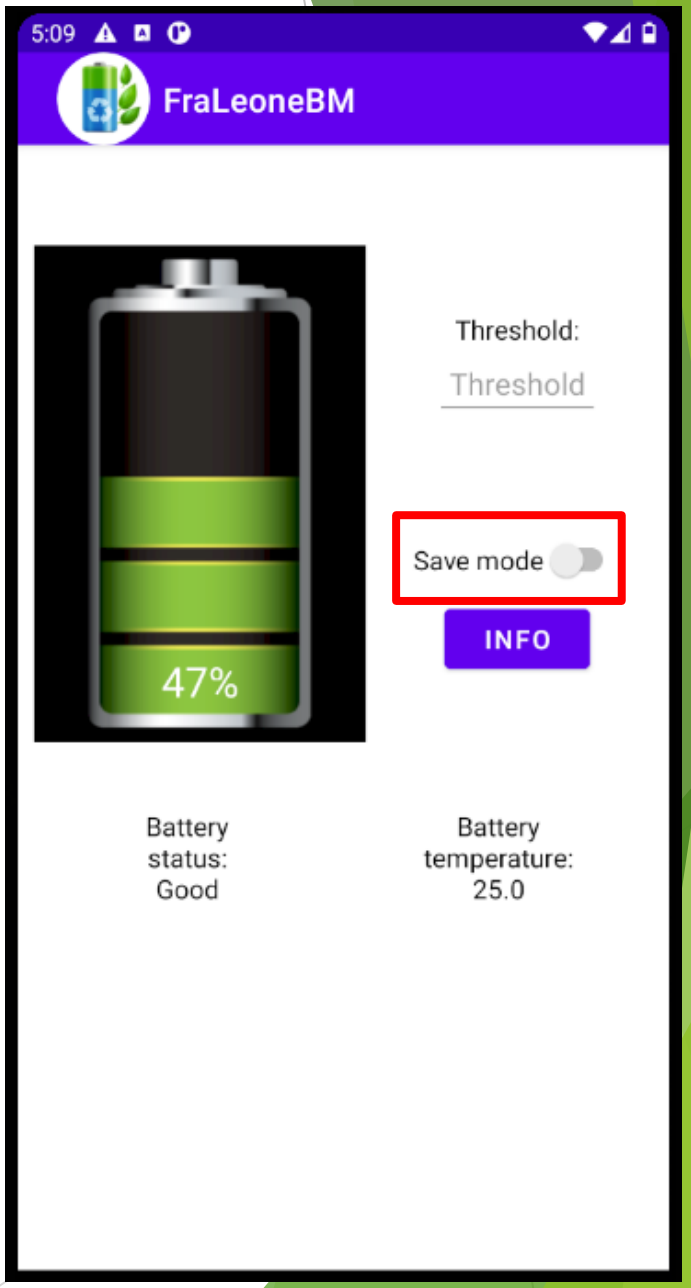
Battery Info

- Battery percentage (1)
- Battery's status, seven possible values (2)
  - Good, Dead, Cold, Overheat, Overvoltage, Unknown, Unspecified failure
- Battery temperature (3)



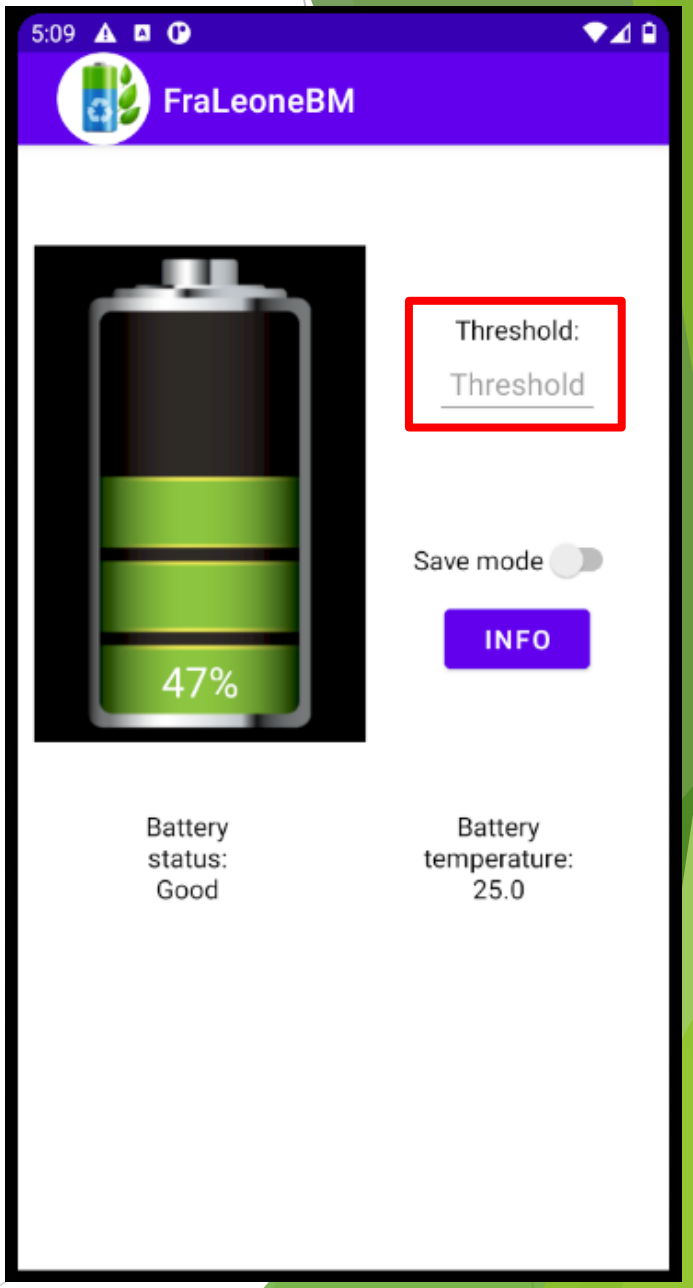
Save mode

- Periodically kills all killable background processes
  - Killable: not OS-related, not related to any application in foreground
- Continues working even if the device is restarted
- Stops working if the battery percentage is higher than the threshold or the device is charging

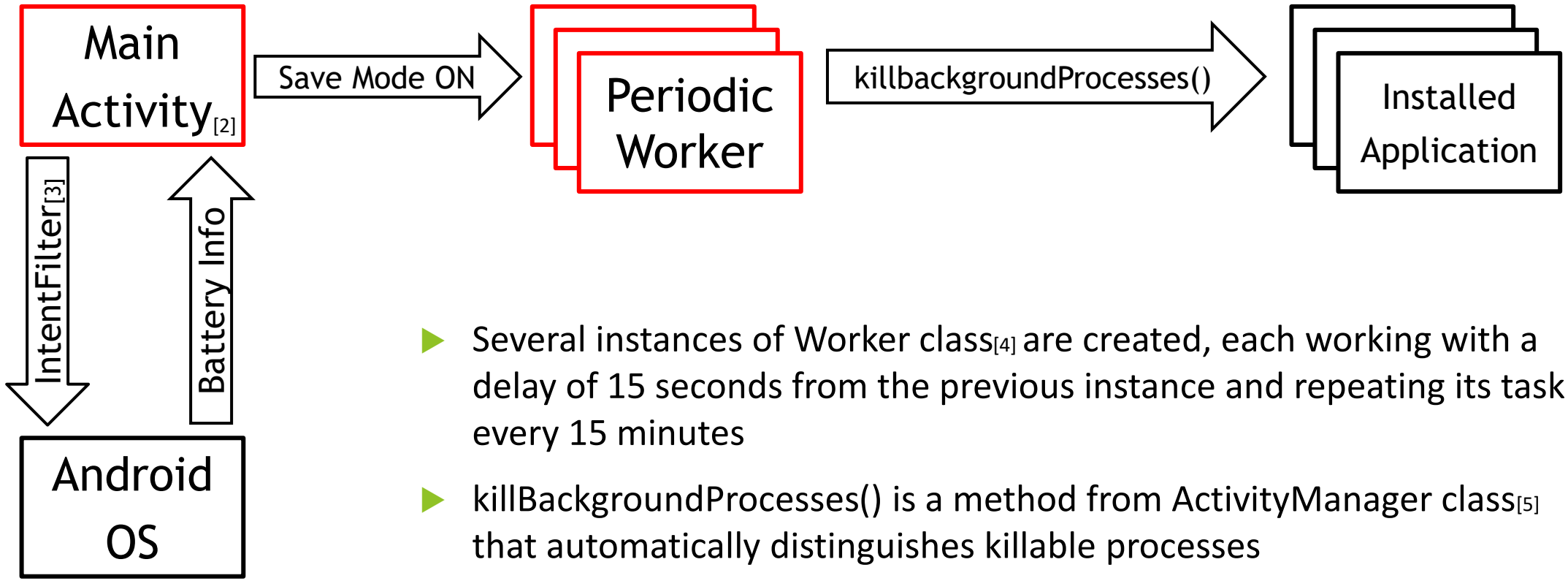


Threshold

- Indicates battery percentage at which save mode starts working, if enabled
- It is saved by the application and remains valid as long as it is not modified
- The default threshold is 40%



Implementation diagram



- Several instances of Worker class[4] are created, each working with a delay of 15 seconds from the previous instance and repeating its task every 15 minutes
- killBackgroundProcesses() is a method from ActivityManager class[5] that automatically distinguishes killable processes

[2] https://developer.android.com/reference/android/app/Activity
[3] https://developer.android.com/training/monitoring-device-state/battery-monitoring#java
[4] https://developer.android.com/topic/libraries/architecture/workmanager/how-to/managing-work
[5] https://developer.android.com/reference/android/app/ActivityManager

Evaluation

- Tested on two different environments:
  - Android Studio emulator to test stability and compatibility
    - Google Pixel 3a, Nexus 5, Nexus 6
  - Real smartphone to test effectiveness
    - Huawei P20 lite

Results

- Metric: amount of RAM used by applications
- Memory used on average by applications before installing FLBatterySaver: 700MB
- Memory used on average by applications with save mode disabled: 700MB
- Memory used on average by applications with save mode enabled: 400MB

Conclusion

- Good alternative to Android native battery saver to extend the battery life in a non-invasive way
- Positive effect in limiting the background processes
- To save a decent amount of battery charge over a long period, rather than to save the highest amount possible in a short period

Future work should focus on :

- Testing the effectiveness of the save mode over long periods
- Finding the optimal delay for workers to kill background processes

THANK YOU