

Do smartphone Apps Provide Accurate Illumination Measurements for Occupational Health and Safety applications?

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Background

- Smartphones and their advanced technology have been extremely developed in the past few years. They are considered as our daily companion and frequently used in almost every aspects of life.
- Smartphone applications have been developed to be used for illumination measurement in occupational workplace settings using light lux meter applications.
- Illumination is defined as the total energy from a source of light over a given surface area.¹
- However, the reliability of these applications is not confirmed compared to professional Lux Meter devices.



Objectives & Hypothesis

Objectives

- To evaluate the accuracy of smart phones illumination applications versus accurate digital Lux meter device and to test their efficiency for professional illumination assessments in occupational health and safety field.
- To compare the accuracy of different IOS and Android operating systems among different cellphone models.
- To identify fluctuations among readings of same cellphone model and within the same smartphone operating system.

Hypothesis

- There will be no significant difference among the measurements of digital Lux meter device and cellphones .

Methods and Materials

- 70 participants were recruited with 21 different smart phone models of which 7 models were IOS and 14 Android.
- SMART SENSOR AR823 Digital Lux Meter was used as a reference.
- For each smartphone operating system, three free light meter applications were downloaded on each cellphone.
- IOS applications: Lux Meter & Fotometer, Megaman and Lux Meter.
- Android applications: Lux Meter (Light Meter), Lux Meter (Crunchy ByteBox) and Lux Meter (Waldau-bdesign).
- Light source was placed vertically at 0.65 m height above the cellphones and digital lux meter.
- An average of three readings per application per cellphone were recorded and compared simultaneously to the digital lux meter readings.
- Microsoft Excel was used to analyze the data.



Results and Discussion

- Significant difference was found between the findings of the Apps and standard lux meter ($P < 0.01$).
- Measurements were inconsistent among same cellphone model and deviated significantly within the same operating system.
- From Figure 1, 2 and 3, measurements recorded by IOS operating system applications were far from being accurate or close to the average of digital Lux meter except for Lux Meter application, iPhone 8 cellphone model measurement was 711.22 Lx which was the closest to the average of 694.27 Lx.
- Figure 4,5 and 6, most cellphone models' measurements were to a greater extent closer to the average of the digital lux meter.
- This experiment had some limitations due to lack of Digital Lux meter calibration, as well as limited number of smartphone models.
- Furthermore, only few light meter applications were tested, however more updated application versions may provide extra features or accuracy that must be investigated.
- Based on our findings, Android Lux meter applications provided much better measurements than IOS applications.
- However, these results confirm that accurate illumination measurements should always be conducted through professional lux meter devices .
- The smartphone applications are not a reliable tool to be used for occupational health and safety applications.
- Further research is required under more strict testing conditions to control illumination in the testing location with more precise illumination levels.^{1,2}
- Accuracy of Light meter applications should still be improved.

References

1. Cerqueira D., Carvalho F., Melo R.B. (2018) Is it Smart to Use Smartphones to Measure Illuminance for Occupational Health and Safety Purposes?. In: Arezes P. (eds) Advances in Safety Management and Human Factors. AHFE 2017. Advances in Intelligent Systems and Computing, vol 604. Springer, Cham
2. Luxmeter App versus measuring device: Are smartphones suitable for measuring illuminance., retrieved from <https://www.dial.de/en/blog/article/luxmeter-app-versus-measuring-device-are-smartphones-suitable-for-measuring-illuminance>

Results

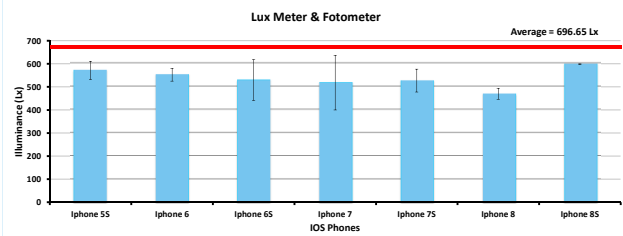


Figure 1. Lux meter & Fotometer IOS application measurements compared to average LUX meter reading

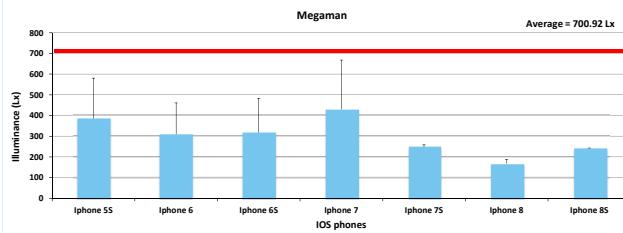


Figure 2. Megaman IOS application measurements compared to average LUX meter reading

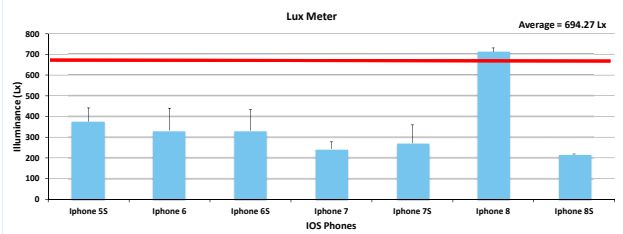


Figure 3. Lux meter IOS application measurements compared to average LUX meter reading

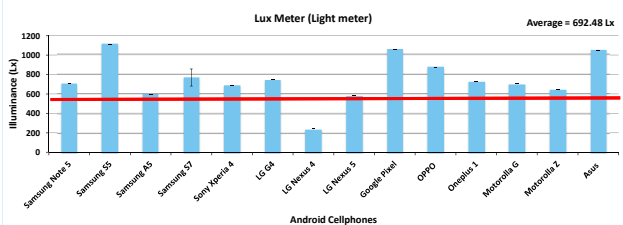


Figure 4. Lux meter (Light Meter) Android application measurements compared to average LUX meter reading

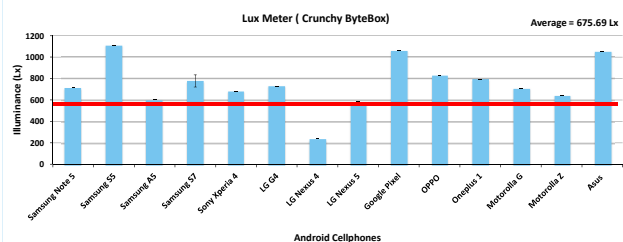


Figure 5. Lux Meter (Crunchy ByteBox) Android application measurements compared to average LUX meter reading

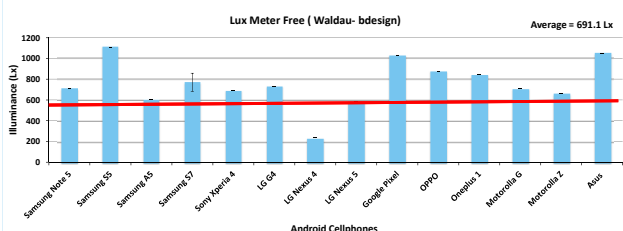


Figure 6. Lux meter Free (Waldau-Bdesign) Android application measurements compared to average LUX meter reading