Light Intensity over Distance

Purpose

To use the "AP-Sensor" app to investigate the light intensity of a single light source over the distance from it.

Theory

- The light intensity of a fixed light source at a distance obeys inverse-square law, where the measured light intensity is inversely proportional to the square of the distance from it, i.e. $I \propto \frac{1}{d^2}$.

- On every typical modern mobile device, a light sensor is installed on the front side in order to detect surrounding light intensity. The screen brightness will be automatically adjusted in order to protect user's eyes.

- The unit "lumen (lm)" is used to define luminous flux, which is the amount of visible light emitted by the light source per unit time. In the mobile device, the unit "lux (lx)" is used to represent the amount of visible light per unit time perceived *per unit area*, known as **illuminance**. The reason behind inverse-square law is the relationship of illuminance against the area of the spherical plane on which the sensor is located.

- With the use of AP Sensor app developed by PolyU, the light intensity of a light source measured at different distances can be detected by a mobile device.

Apparatus

- Mobile device with "AP-Sensor" app
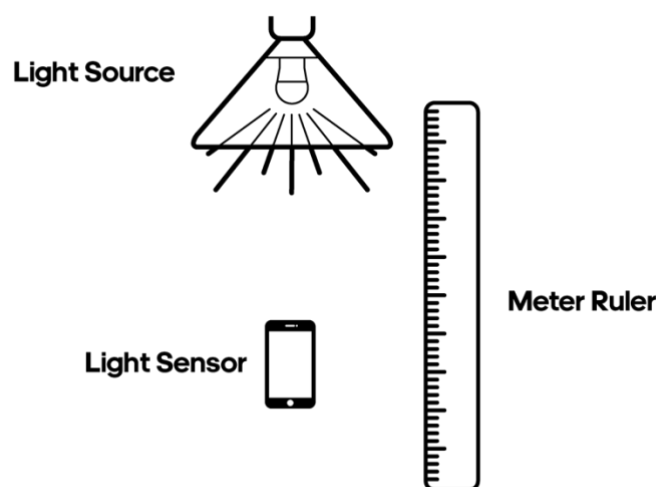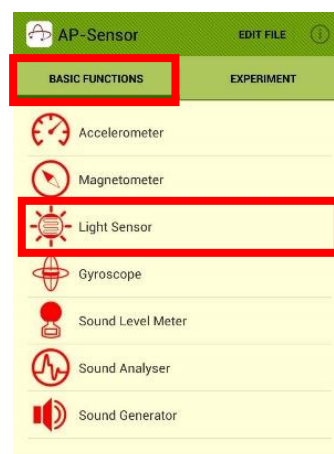- A light source
- A meter ruler

Fig 1

Procedure:

<u>Set up the experiment</u>

1. Set up the experiment as shown in Fig 1.
2. Run the app "AP-Sensor". In the "Basic Function" tab, press "Light Sensor" to enter into the monitor page (Fig 2).

<u>Cancel the offset</u>

3. Keep the light source off. Measure and record the background light intensity. The data would be more accurate if the measurements are taken in complete darkness.

Fig 2

<u>Start experiment</u>

4. Hold the mobile device 20cm away from the light source, with the light sensor facing toward the light source such that the light rays perpendicularly hit the sensor.
5. Turn on the light source. Record the light intensity measured by the app.
6. Repeat the measurement at 20cm interval up to 100cm.
7. Plot a graph of the light intensity against the inverse-square of the distance between light sensor and light source.
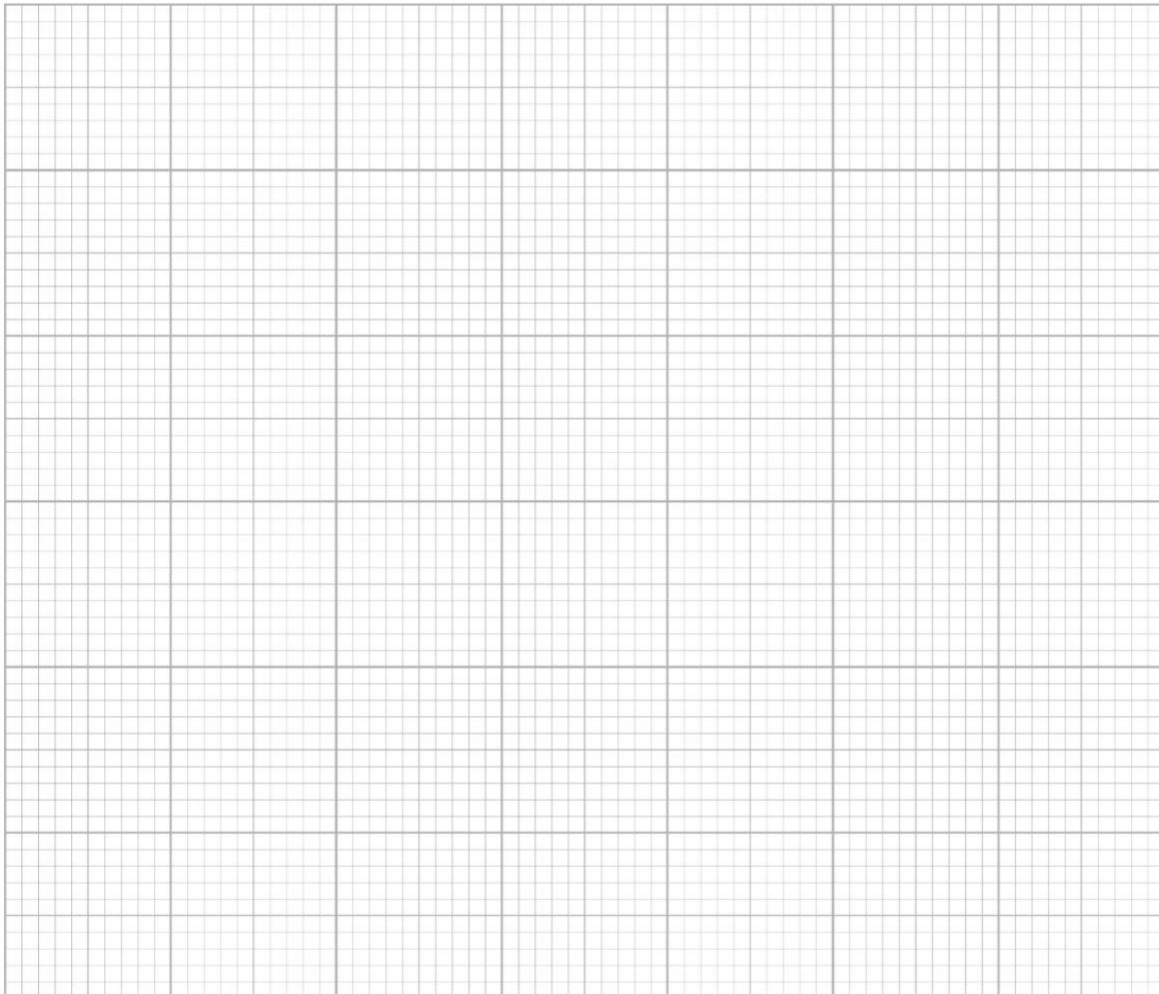
Data

Record the data in the following tables and make analysis.

Distance (m)	Inverse-square of Distance (m^{-2})	Illuminance (lx)
Background Light Intensity		

Plot a graph of the light intensity against the inverse-square of the distance between light sensor and light source.

Discussion

1. What are the possible errors of the experiment?
2. What are the possible sources of background light intensity?
3. What is the relationship between the illuminance and the square distance of the light sensor from the light source?