**Environmental Monitoring**

Environmental monitoring refers to the tools and techniques designed to observe an environment, characterize its quality, and establish environmental parameters, for the purpose of accurately quantifying the impact an activity has on an environment. Results are gathered, analyzed statistically, and then published in a risk assessment and environmental monitoring and impact assessment report

**Attributes:**

**Timestamp:**

A timestamp is the current time of an event that a computer records. Through mechanisms, such as the Network Time Protocol, a computer maintains accurate current time, calibrated to minute fractions of a second. Such precision makes it possible for networked computers and applications to communicate effectively.

**Device:**

Environmental devices plug into the serial ports on Opengear console servers and enables remote monitoring using a standard web browser. Alerts are sent via email, SMS and SNMP traps. Automated response sequences can be initiated by environmental trigger events. Reports can be accessed remotely using standard web browsers and data logged with time stamps.

**CO:**

**CO monitoring** is an efficient way to prevent poisoning. It also helps detect the buildup of CO levels and provides alerts. Real-time carbon monoxide monitoring helps calculate the air quality index to deliver health advisories and formulate an action plan to meet standards.

**Humidity:**

Using humidity sensors that can detect any changes altering electrical currents or the air’s temperature. Different types of humidity sensors can monitor minute changes in the atmosphere and can calculate the level of humidity in the air by the collected data.

**Light:**

**Light sensors** are one of the types of environmental sensors that can be used for environmental monitoring. [They are used to measure the intensity of light in the environment](https://www.renkeer.com/environmental-sensors-list-and-used/). [Light sensors can be used to monitor solar radiation intensity in the environment, which can be useful for applications such as agriculture and weather forecasting.](https://www.renkeer.com/environmental-sensors-list-and-used/" \t "_blank)

**[LPG:](https://www.renkeer.com/environmental-sensors-list-and-used/" \t "_blank)**

Liquefied Petroleum Gas (LPG) is a widely used fuel in households and commercial sectors. However, gas leakages can result in serious problems in households and other areas where LPG is used. [To address this issue, an Internet of Things (IoT) based system has been developed that monitors different aspects related to LPG cylinders and keeps the consumer updated via a mobile application](https://www.ijert.org/smart-lpg-gas-level-detection-and-safety-system-using-iot).

**Motion:**

**Motion**, in [physics](https://www.britannica.com/science/physics-science), change with time of the position or orientation of a body. Motion along a [line](https://www.britannica.com/science/line-mathematics) or a curve is called [translation](https://www.britannica.com/science/translation-mathematics). Motion that changes the orientation of a body is called [rotation](https://www.britannica.com/science/rotation-physics). In both cases all points in the body have the same [velocity](https://www.britannica.com/science/velocity) (directed speed) and the same [acceleration](https://www.britannica.com/science/acceleration) (time rate of change of velocity). The most general kind of motion [combines](https://www.britannica.com/dictionary/combines) both translation and rotation.

**Smoke:**

Smoke detection represents a critical task for avoiding large scale fire disaster in industrial environment and cities. Including intelligent video-based techniques in existing camera infrastructure enables faster response time if compared to traditional analog smoke detectors.

**Temperature:**

An electronic temperature meter is another hand-held instrument that uses a calibrated sensor to measure RH at a known temperature. While they are easy to use, many of the models may be accurate only to ±3-5% and may take several minutes to react to humidity changes.

**Dataset:**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **No** | **ts** | **device** | **co** | **humidity** | **light** | **lpg** | **motion** | **smoke** | **temp** |
| 0 | **(epoch)** | **(string)** | **(ppm)** | **(percentage)** | **(boolean)** | **(ppm%)** | **(boolean)** | **(%ppm)** | **(Fahrenheit)** |
| 1 | **1.59E+09** | **b8:27:eb:bf:9d:51** | **0.004956** | **51** | **FALSE** | **0.00765** | **FALSE** | **0.02041127** | **22.7** |
| 2 | **1.59E+09** | **00:0f:00:70:91:0a** | **0.00284** | **76** | **FALSE** | **0.00511** | **FALSE** | **0.01327484** | **19.7** |
| 3 | **1.59E+09** | **b8:27:eb:bf:9d:51** | **0.004976** | **50.9** | **FALSE** | **0.00767** | **FALSE** | **0.02047513** | **22.6** |
| 4 | **1.59E+09** | **1c:bf:ce:15:ec:4d** | **0.004403** | **76.8** | **TRUE** | **0.00702** | **FALSE** | **0.01862823** | **27** |
| 5 | **1.59E+09** | **b8:27:eb:bf:9d:51** | **0.004967** | **50.9** | **FALSE** | **0.00766** | **FALSE** | **0.02044762** | **22.6** |
| 6 | **1.59E+09** | **1c:bf:ce:15:ec:4d** | **0.004391** | **77.9** | **TRUE** | **0.00701** | **FALSE** | **0.01858891** | **27** |
| 7 | **1.59E+09** | **b8:27:eb:bf:9d:51** | **0.004976** | **50.9** | **FALSE** | **0.00767** | **FALSE** | **0.02047517** | **22.6** |
| 8 | **1.59E+09** | **00:0f:00:70:91:0a** | **0.002938** | **76** | **FALSE** | **0.00524** | **FALSE** | **0.01362752** | **19.7** |
| 9 | **1.59E+09** | **1c:bf:ce:15:ec:4d** | **0.004345** | **77.9** | **TRUE** | **0.00696** | **FALSE** | **0.01843978** | **27** |
| 10 | **1.59E+09** | **b8:27:eb:bf:9d:51** | **0.00497** | **50.9** | **FALSE** | **0.00767** | **FALSE** | **0.02045682** | **22.6** |
| 11 | **1.59E+09** | **b8:27:eb:bf:9d:51** | **0.00496** | **50.9** | **FALSE** | **0.00766** | **FALSE** | **0.02042486** | **22.6** |
| 12 | **1.59E+09** | **1c:bf:ce:15:ec:4d** | **0.004383** | **78** | **TRUE** | **0.007** | **FALSE** | **0.01856286** | **27** |
| 13 | **1.59E+09** | **b8:27:eb:bf:9d:51** | **0.004972** | **50.9** | **FALSE** | **0.00767** | **FALSE** | **0.02046124** | **22.6** |
| 14 | **1.59E+09** | **1c:bf:ce:15:ec:4d** | **0.004451** | **78** | **TRUE** | **0.00708** | **FALSE** | **0.01878649** | **27** |
| 15 | **1.59E+09** | **b8:27:eb:bf:9d:51** | **0.004965** | **50.9** | **FALSE** | **0.00766** | **FALSE** | **0.02043872** | **22.6** |
| 16 | **1.59E+09** | **00:0f:00:70:91:0a** | **0.002905** | **75.8** | **FALSE** | **0.0052** | **FALSE** | **0.01350873** | **19.7** |
| 17 | **1.59E+09** | **b8:27:eb:bf:9d:51** | **0.004976** | **50.9** | **FALSE** | **0.00767** | **FALSE** | **0.02047503** | **22.6** |
| 18 | **1.59E+09** | **b8:27:eb:bf:9d:51** | **0.00496** | **50.9** | **FALSE** | **0.00766** | **FALSE** | **0.02042486** | **22.6** |
| 19 | **1.59E+09** | **1c:bf:ce:15:ec:4d** | **0.004439** | **77.9** | **TRUE** | **0.00707** | **FALSE** | **0.01874678** | **27** |
| 20 | **1.59E+09** | **b8:27:eb:bf:9d:51** | **0.004956** | **50.9** | **FALSE** | **0.00765** | **FALSE** | **0.02041185** | **22.6** |
| 21 | **1.59E+09** | **00:0f:00:70:91:0a** | **0.002938** | **75.8** | **FALSE** | **0.00524** | **FALSE** | **0.01362752** | **19.7** |
| 22 | **1.59E+09** | **1c:bf:ce:15:ec:4d** | **0.004391** | **77.9** | **TRUE** | **0.00701** | **FALSE** | **0.01858891** | **27** |
| 23 | **1.59E+09** | **b8:27:eb:bf:9d:51** | **0.004952** | **50.8** | **FALSE** | **0.00765** | **FALSE** | **0.02039788** | **22.6** |
| 24 | **1.59E+09** | **00:0f:00:70:91:0a** | **0.00284** | **76** | **FALSE** | **0.00511** | **FALSE** | **0.01327484** | **19.7** |
| 25 | **1.59E+09** | **b8:27:eb:bf:9d:51** | **0.004962** | **50.9** | **FALSE** | **0.00766** | **FALSE** | **0.02042944** | **22.6** |
| 26 | **1.59E+09** | **00:0f:00:70:91:0a** | **0.00284** | **76** | **FALSE** | **0.00511** | **FALSE** | **0.01327484** | **19.8** |
| 27 | **1.59E+09** | **1c:bf:ce:15:ec:4d** | **0.004381** | **77.9** | **TRUE** | **0.007** | **FALSE** | **0.01855637** | **27** |
| 28 | **1.59E+09** | **b8:27:eb:bf:9d:51** | **0.004926** | **50.9** | **FALSE** | **0.00762** | **FALSE** | **0.02031659** | **22.6** |
| 29 | **1.59E+09** | **1c:bf:ce:15:ec:4d** | **0.004344** | **78.3** | **TRUE** | **0.00695** | **FALSE** | **0.01843334** | **27** |
| 30 | **1.59E+09** | **b8:27:eb:bf:9d:51** | **0.004942** | **50.9** | **FALSE** | **0.00763** | **FALSE** | **0.0203661** | **22.6** |
| 31 | **1.59E+09** | **00:0f:00:70:91:0a** | **0.002905** | **75.9** | **FALSE** | **0.0052** | **FALSE** | **0.01350873** | **19.7** |
| 32 | **1.59E+09** | **b8:27:eb:bf:9d:51** | **0.00496** | **50.9** | **FALSE** | **0.00766** | **FALSE** | **0.02042486** | **22.6** |
| 33 | **1.59E+09** | **1c:bf:ce:15:ec:4d** | **0.004391** | **78.6** | **TRUE** | **0.00701** | **FALSE** | **0.01858891** | **27** |
| 34 | **1.59E+09** | **00:0f:00:70:91:0a** | **0.00284** | **76** | **FALSE** | **0.00511** | **FALSE** | **0.01327484** | **19.8** |
| 35 | **1.59E+09** | **b8:27:eb:bf:9d:51** | **0.004914** | **50.9** | **FALSE** | **0.0076** | **FALSE** | **0.02027645** | **22.6** |
| 36 | **1.59E+09** | **b8:27:eb:bf:9d:51** | **0.004975** | **50.9** | **FALSE** | **0.00767** | **FALSE** | **0.02047044** | **22.7** |
| 37 | **1.59E+09** | **1c:bf:ce:15:ec:4d** | **0.004391** | **78.3** | **TRUE** | **0.00701** | **FALSE** | **0.01858891** | **27** |
| 38 | **1.59E+09** | **00:0f:00:70:91:0a** | **0.002872** | **76** | **FALSE** | **0.00516** | **FALSE** | **0.01339118** | **19.8** |
| 39 | **1.59E+09** | **b8:27:eb:bf:9d:51** | **0.00497** | **50.9** | **FALSE** | **0.00767** | **FALSE** | **0.02045691** | **22.7** |
| 40 | **1.59E+09** | **1c:bf:ce:15:ec:4d** | **0.004391** | **78.2** | **TRUE** | **0.00701** | **FALSE** | **0.01858891** | **27** |
| 41 | **1.59E+09** | **b8:27:eb:bf:9d:51** | **0.004976** | **50.9** | **FALSE** | **0.00767** | **FALSE** | **0.02047503** | **22.6** |
| 42 | **1.59E+09** | **00:0f:00:70:91:0a** | **0.002905** | **75.9** | **FALSE** | **0.0052** | **FALSE** | **0.01350873** | **19.7** |
| 43 | **1.59E+09** | **1c:bf:ce:15:ec:4d** | **0.004351** | **78.2** | **TRUE** | **0.00696** | **FALSE** | **0.01845912** | **27** |
| 44 | **1.59E+09** | **b8:27:eb:bf:9d:51** | **0.004942** | **50.9** | **FALSE** | **0.00764** | **FALSE** | **0.02036619** | **22.6** |
| 45 | **1.59E+09** | **b8:27:eb:bf:9d:51** | **0.00497** | **50.9** | **FALSE** | **0.00767** | **FALSE** | **0.02045682** | **22.6** |
| 46 | **1.59E+09** | **1c:bf:ce:15:ec:4d** | **0.004391** | **78.4** | **TRUE** | **0.00701** | **FALSE** | **0.01858891** | **27** |
| 47 | **1.59E+09** | **00:0f:00:70:91:0a** | **0.002872** | **76** | **FALSE** | **0.00516** | **FALSE** | **0.01339118** | **19.8** |
| 48 | **1.59E+09** | **b8:27:eb:bf:9d:51** | **0.004966** | **50.9** | **FALSE** | **0.00766** | **FALSE** | **0.02044304** | **22.6** |
| 49 | **1.59E+09** | **1c:bf:ce:15:ec:4d** | **0.004427** | **78.7** | **TRUE** | **0.00705** | **FALSE** | **0.01870716** | **27** |
| 50 | **1.59E+09** | **b8:27:eb:bf:9d:51** | **0.004955** | **50.9** | **FALSE** | **0.00765** | **FALSE** | **0.02040705** | **22.6** |
| 51 | **1.59E+09** | **00:0f:00:70:91:0a** | **0.00284** | **75.9** | **FALSE** | **0.00511** | **FALSE** | **0.01327484** | **19.7** |
| 52 | **1.59E+09** | **b8:27:eb:bf:9d:51** | **0.004989** | **50.9** | **FALSE** | **0.00769** | **FALSE** | **0.02051615** | **22.6** |
| 53 | **1.59E+09** | **1c:bf:ce:15:ec:4d** | **0.004357** | **78.6** | **TRUE** | **0.00697** | **FALSE** | **0.01847853** | **27** |
| 54 | **1.59E+09** | **00:0f:00:70:91:0a** | **0.00284** | **76.2** | **FALSE** | **0.00511** | **FALSE** | **0.01327484** | **19.8** |
| 55 | **1.59E+09** | **b8:27:eb:bf:9d:51** | **0.004967** | **50.9** | **FALSE** | **0.00766** | **FALSE** | **0.02044771** | **22.6** |
| 56 | **1.59E+09** | **1c:bf:ce:15:ec:4d** | **0.004383** | **78.5** | **TRUE** | **0.007** | **FALSE** | **0.01856286** | **27** |
| 57 | **1.59E+09** | **b8:27:eb:bf:9d:51** | **0.004946** | **50.9** | **FALSE** | **0.00764** | **FALSE** | **0.02037965** | **22.6** |
| 58 | **1.59E+09** | **00:0f:00:70:91:0a** | **0.002905** | **76.1** | **FALSE** | **0.0052** | **FALSE** | **0.01350873** | **19.8** |
| 59 | **1.59E+09** | **b8:27:eb:bf:9d:51** | **0.00496** | **50.9** | **FALSE** | **0.00766** | **FALSE** | **0.02042554** | **22.6** |
| 60 | **1.59E+09** | **1c:bf:ce:15:ec:4d** | **0.004391** | **78.4** | **TRUE** | **0.00701** | **FALSE** | **0.01858891** | **27** |
| 61 | **1.59E+09** | **b8:27:eb:bf:9d:51** | **0.004946** | **50.9** | **FALSE** | **0.00764** | **FALSE** | **0.02037974** | **22.6** |
| 62 | **1.59E+09** | **1c:bf:ce:15:ec:4d** | **0.004395** | **78.4** | **TRUE** | **0.00701** | **FALSE** | **0.01860212** | **27** |
| 63 | **1.59E+09** | **00:0f:00:70:91:0a** | **0.00284** | **76** | **FALSE** | **0.00511** | **FALSE** | **0.01327484** | **19.8** |
| 64 | **1.59E+09** | **b8:27:eb:bf:9d:51** | **0.004986** | **51** | **FALSE** | **0.00768** | **FALSE** | **0.02050705** | **22.7** |
| 65 | **1.59E+09** | **b8:27:eb:bf:9d:51** | **0.004985** | **51** | **FALSE** | **0.00768** | **FALSE** | **0.02050258** | **22.7** |
| 66 | **1.59E+09** | **00:0f:00:70:91:0a** | **0.00288** | **76** | **FALSE** | **0.00517** | **FALSE** | **0.01342056** | **19.7** |
| 67 | **1.59E+09** | **1c:bf:ce:15:ec:4d** | **0.004391** | **79.1** | **TRUE** | **0.00701** | **FALSE** | **0.01858891** | **27** |
| 68 | **1.59E+09** | **b8:27:eb:bf:9d:51** | **0.004942** | **51** | **FALSE** | **0.00764** | **FALSE** | **0.02036619** | **22.7** |
| 69 | **1.59E+09** | **1c:bf:ce:15:ec:4d** | **0.004391** | **78.2** | **TRUE** | **0.00701** | **FALSE** | **0.01858891** | **27** |
| 70 | **1.59E+09** | **00:0f:00:70:91:0a** | **0.002905** | **76** | **FALSE** | **0.0052** | **FALSE** | **0.01350873** | **19.8** |
| 71 | **1.59E+09** | **b8:27:eb:bf:9d:51** | **0.004938** | **50.9** | **FALSE** | **0.00763** | **FALSE** | **0.02035272** | **22.7** |
| 72 | **1.59E+09** | **00:0f:00:70:91:0a** | **0.00284** | **76.2** | **FALSE** | **0.00511** | **FALSE** | **0.01327484** | **19.8** |
| 73 | **1.59E+09** | **b8:27:eb:bf:9d:51** | **0.00497** | **50.9** | **FALSE** | **0.00767** | **FALSE** | **0.02045682** | **22.6** |
| 74 | **1.59E+09** | **1c:bf:ce:15:ec:4d** | **0.004349** | **78.3** | **TRUE** | **0.00696** | **FALSE** | **0.01845267** | **27** |
| 75 | **1.59E+09** | **b8:27:eb:bf:9d:51** | **0.004942** | **50.9** | **FALSE** | **0.00763** | **FALSE** | **0.0203661** | **22.6** |
| 76 | **1.59E+09** | **1c:bf:ce:15:ec:4d** | **0.004359** | **78.2** | **TRUE** | **0.00697** | **FALSE** | **0.01848499** | **27** |
| 77 | **1.59E+09** | **00:0f:00:70:91:0a** | **0.002905** | **76** | **FALSE** | **0.0052** | **FALSE** | **0.01350873** | **19.7** |
| 78 | **1.59E+09** | **b8:27:eb:bf:9d:51** | **0.004926** | **50.8** | **FALSE** | **0.00762** | **FALSE** | **0.02031659** | **22.6** |
| 79 | **1.59E+09** | **1c:bf:ce:15:ec:4d** | **0.004451** | **78.2** | **TRUE** | **0.00708** | **FALSE** | **0.01878649** | **27** |
| 80 | **1.59E+09** | **00:0f:00:70:91:0a** | **0.00284** | **76.2** | **FALSE** | **0.00511** | **FALSE** | **0.01327484** | **19.8** |
| 81 | **1.59E+09** | **b8:27:eb:bf:9d:51** | **0.004965** | **50.8** | **FALSE** | **0.00766** | **FALSE** | **0.02043872** | **22.6** |
| 82 | **1.59E+09** | **b8:27:eb:bf:9d:51** | **0.004963** | **50.8** | **FALSE** | **0.00766** | **FALSE** | **0.02043402** | **22.6** |
| 83 | **1.59E+09** | **00:0f:00:70:91:0a** | **0.002872** | **76** | **FALSE** | **0.00516** | **FALSE** | **0.01339118** | **19.7** |
| 84 | **1.59E+09** | **1c:bf:ce:15:ec:4d** | **0.004451** | **78.2** | **TRUE** | **0.00708** | **FALSE** | **0.01878649** | **27** |
| 85 | **1.59E+09** | **b8:27:eb:bf:9d:51** | **0.00496** | **50.9** | **FALSE** | **0.00766** | **FALSE** | **0.02042534** | **22.6** |
| 86 | **1.59E+09** | **b8:27:eb:bf:9d:51** | **0.004966** | **50.9** | **FALSE** | **0.00766** | **FALSE** | **0.0204433** | **22.6** |
| 87 | **1.59E+09** | **00:0f:00:70:91:0a** | **0.002872** | **76.1** | **FALSE** | **0.00516** | **FALSE** | **0.01339118** | **19.8** |
| 88 | **1.59E+09** | **1c:bf:ce:15:ec:4d** | **0.004468** | **78.2** | **TRUE** | **0.0071** | **FALSE** | **0.01883983** | **27** |
| 89 | **1.59E+09** | **b8:27:eb:bf:9d:51** | **0.004976** | **50.9** | **FALSE** | **0.00767** | **FALSE** | **0.02047513** | **22.6** |
| 90 | **1.59E+09** | **00:0f:00:70:91:0a** | **0.002872** | **76** | **FALSE** | **0.00516** | **FALSE** | **0.01339118** | **19.8** |
| 91 | **1.59E+09** | **b8:27:eb:bf:9d:51** | **0.004999** | **51** | **FALSE** | **0.0077** | **FALSE** | **0.02054828** | **22.7** |
| 92 | **1.59E+09** | **1c:bf:ce:15:ec:4d** | **0.004439** | **78.2** | **TRUE** | **0.00707** | **FALSE** | **0.01874678** | **27** |
| 93 | **1.59E+09** | **00:0f:00:70:91:0a** | **0.002793** | **76** | **FALSE** | **0.00505** | **FALSE** | **0.01310381** | **19.8** |
| 94 | **1.59E+09** | **b8:27:eb:bf:9d:51** | **0.004928** | **51** | **FALSE** | **0.00762** | **FALSE** | **0.02032131** | **22.7** |
| 95 | **1.59E+09** | **00:0f:00:70:91:0a** | **0.002872** | **76** | **FALSE** | **0.00516** | **FALSE** | **0.01339118** | **19.7** |
| 96 | **1.59E+09** | **b8:27:eb:bf:9d:51** | **0.004966** | **51** | **FALSE** | **0.00766** | **FALSE** | **0.02044304** | **22.7** |
| 97 | **1.59E+09** | **1c:bf:ce:15:ec:4d** | **0.00446** | **78** | **TRUE** | **0.00709** | **FALSE** | **0.01881314** | **27** |
| 98 | **1.59E+09** | **b8:27:eb:bf:9d:51** | **0.004952** | **51** | **FALSE** | **0.00765** | **FALSE** | **0.02039812** | **22.6** |
| 99 | **1.59E+09** | **00:0f:00:70:91:0a** | **0.00284** | **76.1** | **FALSE** | **0.00511** | **FALSE** | **0.01327484** | **19.8** |
| 100 | **1.59E+09** | **1c:bf:ce:15:ec:4d** | **0.004427** | **78** | **TRUE** | **0.00705** | **FALSE** | **0.01870716** | **27** |