

Quality of Air Sensors Emulator

(Alfonso García de Prado, UCASE Software Engineering Group, University of Cádiz)

The emulator created can generate pseudorandom values for several motes and sensors related to air quality and send it to different channels in ThingSpeak IoT platform.

When the emulator is launched, we can add as many motes as we wish (by clicking ADD in Figure 1). A new mote is created with a set of predefined default sensors. At any point in time we can activate or deactivate data submission to ThingSpeak, as well as Save and Load a mote configuration. We can also manually introduce data at any time, in case we want to test a particular situation.

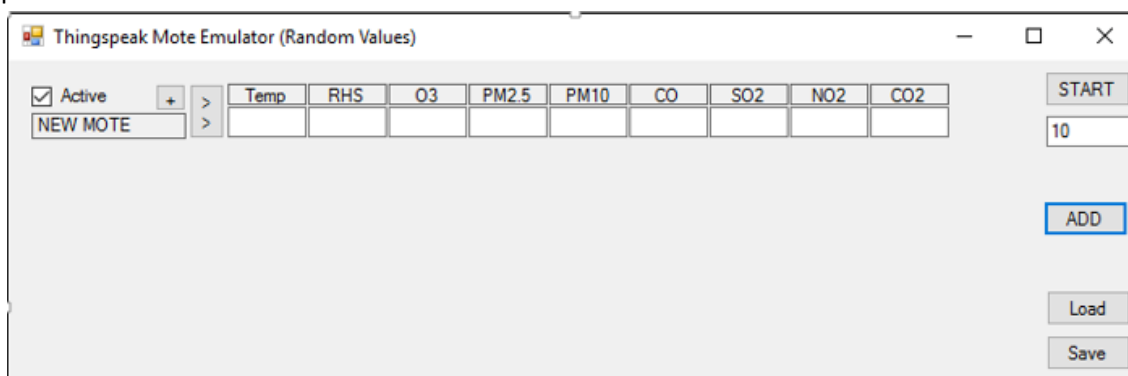


Figure 1. New mote created with the emulator

By clicking on NEW MOTE under each mote we can configure the data to be submitted to ThingSpeak. It is important to highlight that the interface is prepared to be connected to other platforms which might be accessed using a path, optionally a port and an API Key (see Figure 2). The emulator also requires a description for the emulation and how frequently we want to generate and send data from this mote: frequency will take a random value between FROM and TO and a fixed value if both are the same.

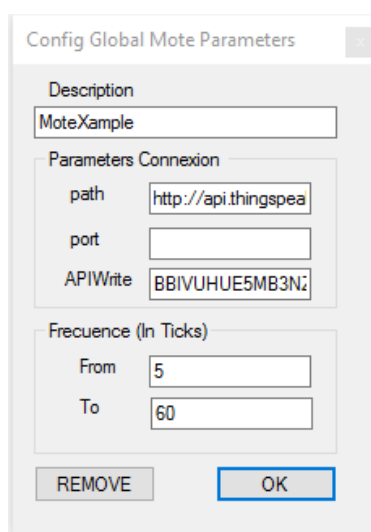


Figure 2. Mote data submission configuration in the emulator

Once we have a flow, we can configure or delete any of the sensors by clicking on them. When clicking, for instance, on Temperature, we would see the configuration window as shown in Figure 3:

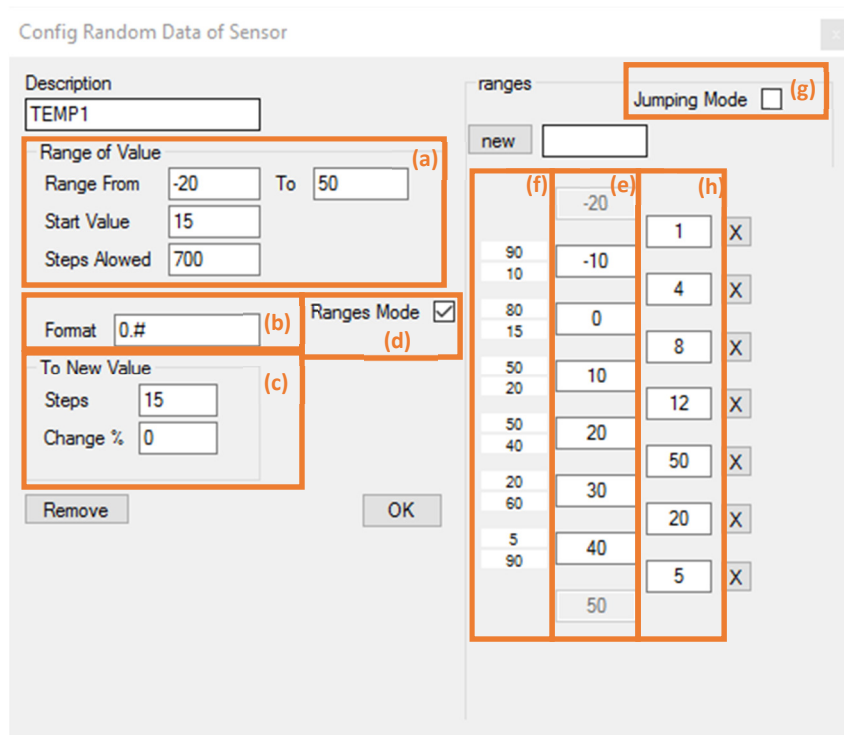


Figure 3. Configuration of a Temperature sensor in the emulator

- **Range Of Value.** It establishes a minimum and maximum value for the random numbers generation ((a) in the illustration).
- **from, to.** Minimum and maximum values.
- **Start Value.** First value; if it is out of the interval, the midpoint will be the first value.
- **Steps Allowed.** Number of values that can be taken between minimum and maximum: some sensors can work with tens, hundreds, quarters or simply 2 or 3 decimals.
- **Format.** Output format (number of decimals, et cetera) ((b) in the illustration).
- **To New Value.** We will obtain the next value by using this number of steps to soften the curves, that is if we are on number 1 and the next random number is 6 and we have 15 steps, we will go from 1 to 6 using 15 increasing random numbers in between ((c) in the illustration). These steps do not have a fixed length.
 - **Step.** If we introduce a negative value, the number of steps can be variable producing sharper peaks; with a large positive value, curves will be softer.
 - **Change.** It indicates the probability of breaking the tendency in every step and generating a new target point. Its value will usually be 0 (we will not break the tendency, but we can change it in order to use this option in conjunction with the previous one and generate softer curves with strong tendency breaks).

- **RangeMode.** If the range mode ((d) in the illustration) is selected, this option will use the sub-range percentages, as explained below; otherwise random numbers are generated completely randomly.
 - The central column in sub-ranges ((e) in the illustration) identifies the different bands in which values can be placed, that is from -10 to 0, from 0 to 10, et cetera.
 - **Jumping mode not selected:** the next random number can only jump to a range adjacent to the last generated one; the left column provides the probabilities of jumping to adjacent ranges above or below ((f) in the illustration). For instance, if the current value is between -10 and 0, the probability of obtaining a number between 0 and 10 is 80%, 10% between -10 and -20 and the remaining 10% would show the probability of obtaining another value between -10 and 0 again.
 - **Jumping mode selected:** when jumping mode is selected ((g) in the illustration) the random number can be generated for any of the sub-ranges. In this case, the right column ((h) in the illustration) identifies the probabilities for each range; for example 1% for -10 to -20, 4% for 10 to 0, et cetera.

Once all sensors are configured, we would start simulation and submission by clicking on START.