Smart Lighting Project

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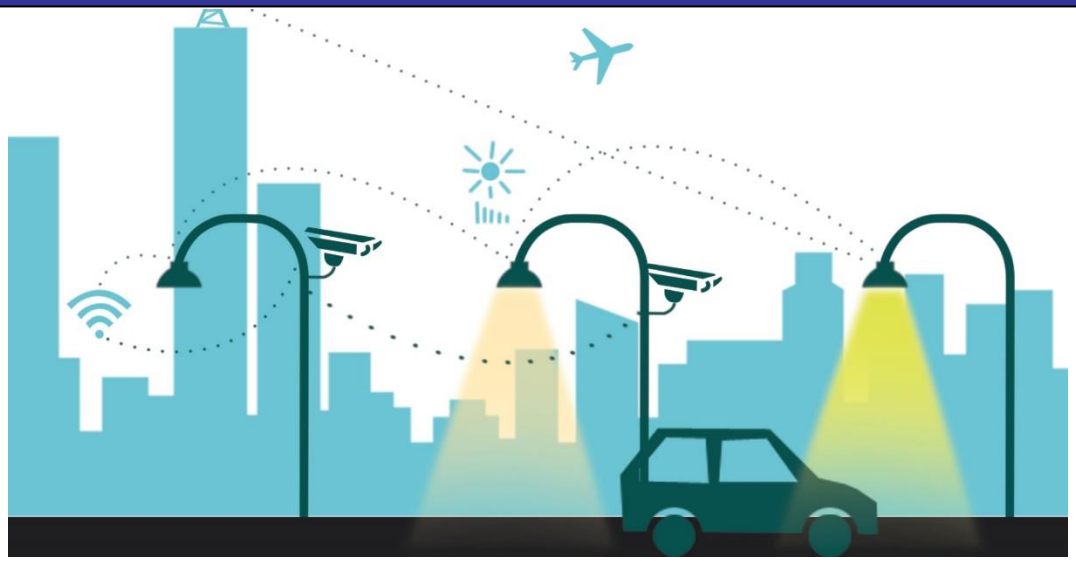

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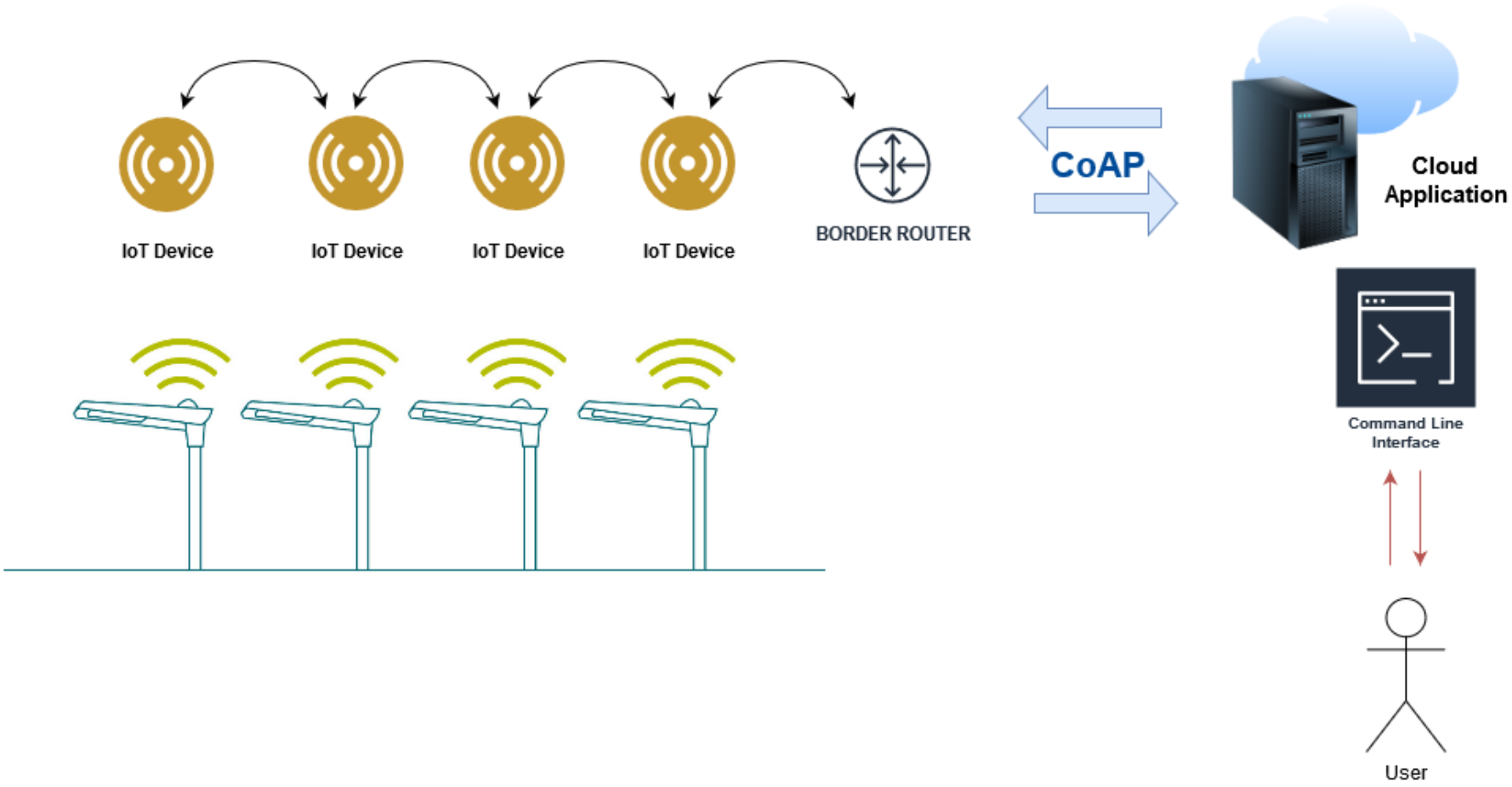
Introduction

This project develops a smart lighting system, based on sensors and actuators installed in **streetlights** all over the city.

These devices are able to interface with a cloud application, that collects their data and offers to the user the possibility of changing their status.

System scheme and structure



Each streetlight is equipped with:

- A **light sensor** that constantly collects data about the light intensity in its area.
  - The light is measured in percentage of luminosity (value from 0 to 100).
- A **light actuator** that controls the bulb of the streetlights, turning it on or off.
  - The bulb can be controlled in a *manual mode*, from the application user, or in an *automatic mode* from the device.
- Both these devices are controlled in a single smart **node**, installed on the streetlight.

All the nodes are managed by a **border router**.

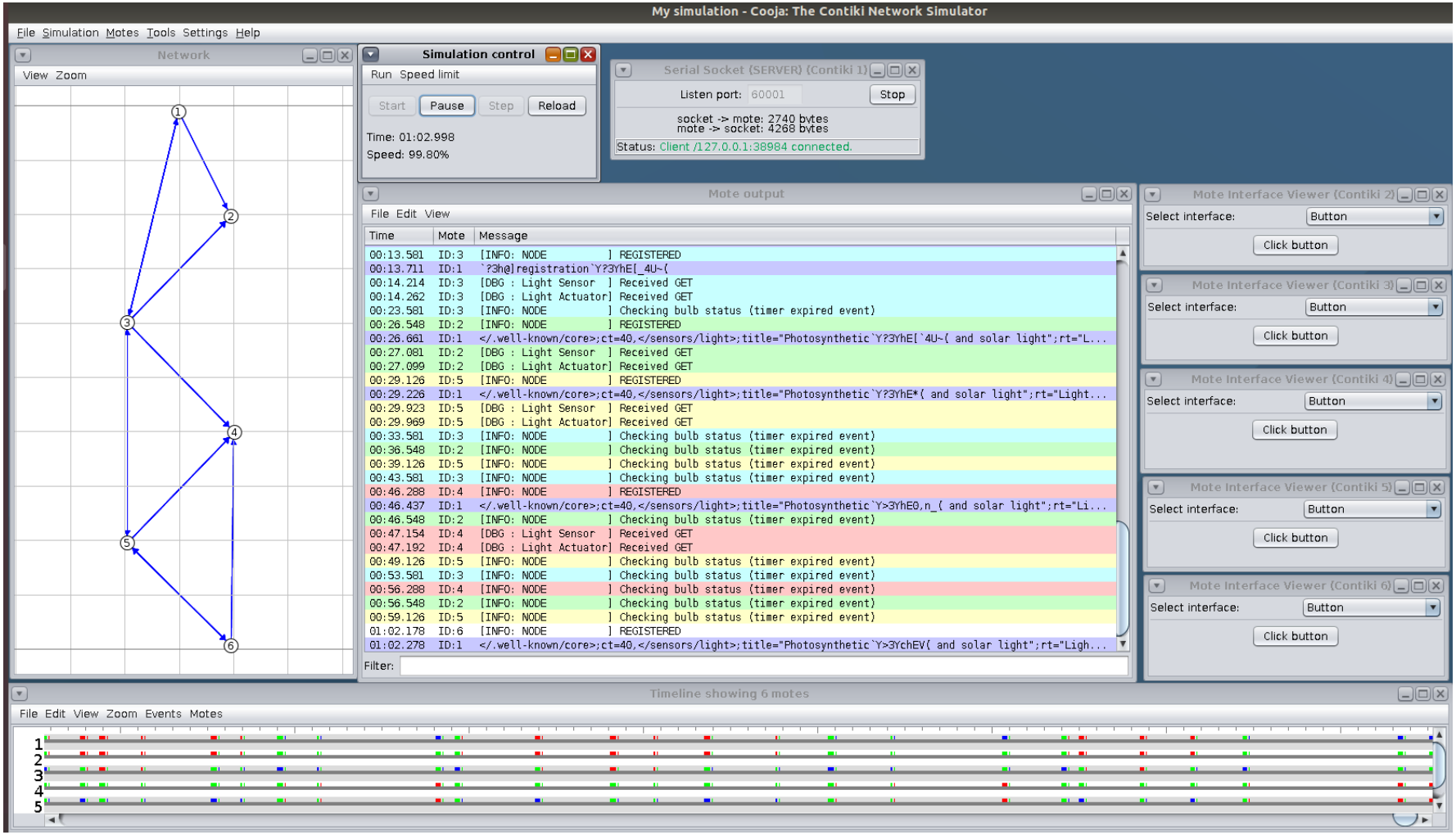
If the actuators are in **automatic mode**, then each node automatically turns on or off the bulb depending on the luminosity detected by the sensor.

On the other hand, if the actuators are in **manual mode**, then they switch the bulbs only after a request from the cloud application.

Each node has a **button** to switch between modes.

In addition, the user can change modes via an interface command.

Cooja Simulation



Cloud Application

The cloud application has:

- A **CoAP server** that registers the smart nodes and starts monitoring them through the CoAP observing.
- A **command line interface** that the user can exploit to send request to each node of the network:

```
osboxes@osboxes:~/contiki-ng/IoT-project/app$ java -jar target/app-0.0.1-SNAPSHOT.jar
--------------------------------------------------------------------------------------------------------------

TYPE ONE OF THE FOLLOWING COMMANDS AND PRESS ENTER:
"resources"             -> to get the available resources and their addresses
"ON $index"             -> to switch on the bulb at the corresponding index (-1 for all bulbs)
"OFF $index"            -> to switch off the bulb at the corresponding index (-1 for all bulbs)
"AUTO $index"           -> to automate the bulb at the corresponding index (-1 for all bulbs)
"MANUAL $index"         -> to disable automatic mode for the bulb at the corresponding index (-1 for all bulbs)
"sensor $index"         -> to print the status of the $index sensor (-1 for all sensors)
"actuator $index"       -> to print the status of the $index actuator (-1 for all actuators)
"exit"                  -> to close the application
```

Command Line Interface

```
"exit"                  -> to close the application

resources
INDEX    RESOURCE INFO
(0)      Node: fd00:0:0:0:203:3:3:3, Path: sensors/light, title="Photosynthetic and solar light";rt="Light Sensor";obs
(1)      Node: fd00:0:0:0:203:3:3:3, Path: actuators/bulb, title="Bulb controller: ?POST/PUT mode=ON|OFF automatic=ON|OFF";rt="Light Control";obs
(2)      Node: fd00:0:0:0:202:2:2:2, Path: sensors/light, title="Photosynthetic and solar light";rt="Light Sensor";obs
(3)      Node: fd00:0:0:0:202:2:2:2, Path: actuators/bulb, title="Bulb controller: ?POST/PUT mode=ON|OFF automatic=ON|OFF";rt="Light Control";obs
(4)      Node: fd00:0:0:0:205:5:5:5, Path: sensors/light, title="Photosynthetic and solar light";rt="Light Sensor";obs
(5)      Node: fd00:0:0:0:205:5:5:5, Path: actuators/bulb, title="Bulb controller: ?POST/PUT mode=ON|OFF automatic=ON|OFF";rt="Light Control";obs
(6)      Node: fd00:0:0:0:204:4:4:4, Path: sensors/light, title="Photosynthetic and solar light";rt="Light Sensor";obs
(7)      Node: fd00:0:0:0:204:4:4:4, Path: actuators/bulb, title="Bulb controller: ?POST/PUT mode=ON|OFF automatic=ON|OFF";rt="Light Control";obs
(8)      Node: fd00:0:0:0:206:6:6:6, Path: sensors/light, title="Photosynthetic and solar light";rt="Light Sensor";obs
(9)      Node: fd00:0:0:0:206:6:6:6, Path: actuators/bulb, title="Bulb controller: ?POST/PUT mode=ON|OFF automatic=ON|OFF";rt="Light Control";obs

sensor -1
(0) Node 3 sensors/light        TIMESTAMP               VALUE
                                2020-06-25 13:18:50.0   49.61
                                2020-06-25 13:19:50.0   41.42
                                2020-06-25 13:20:50.0   48.97
                                2020-06-25 13:21:50.0   49.59
                                2020-06-25 13:22:50.0   44.63

(2) Node 2 sensors/light        TIMESTAMP               VALUE
                                2020-06-25 13:19:02.0   45.93
                                2020-06-25 13:20:03.0   35.86
                                2020-06-25 13:21:03.0   45.27
                                2020-06-25 13:22:03.0   30.61

(4) Node 5 sensors/light        TIMESTAMP               VALUE
                                2020-06-25 13:19:05.0   38.13
                                2020-06-25 13:20:05.0   41.74
                                2020-06-25 13:21:05.0   46.15
                                2020-06-25 13:22:05.0   41.73

(6) Node 4 sensors/light        TIMESTAMP               VALUE
                                2020-06-25 13:19:23.0   41.82
                                2020-06-25 13:20:25.0   33.32
                                2020-06-25 13:21:25.0   29.76
                                2020-06-25 13:22:25.0   25.48

(8) Node 6 sensors/light        TIMESTAMP               VALUE
                                2020-06-25 13:19:39.0   54.0
                                2020-06-25 13:20:39.0   53.62
                                2020-06-25 13:21:39.0   46.61
                                2020-06-25 13:22:39.0   44.31
```