

CPS System Design - CSE2034HTTP Server CreationExperiment - 2

There is a chemical factory that do research and development in fertilisers. They deploy various sensors to monitor the air quality inside the factory premises and near to the plant. You as a CPS engineer, need to develop a CoAP Client device that fetches the values of the following sensors namely: Particle Matter, Hydro Carbons, Carbon Monoxide, Nitrous Oxide and Carbon Di oxide. You need to do the research on the permissible levels of all these sensors and device a NodeJS script and test the client using either Cu Plugin or any terminal based CoaP Client.

```
rohit@rohit-VirtualBox: ~  
rohit@rohit-VirtualBox:~$ sudo apt update  
[sudo] password for rohit:  
Hit:1 http://in.archive.ubuntu.com/ubuntu jammy InRelease  
Get:2 http://in.archive.ubuntu.com/ubuntu jammy-updates InRelease [114 kB]  
Get:3 http://security.ubuntu.com/ubuntu jammy-security InRelease [110 kB]  
Get:4 http://in.archive.ubuntu.com/ubuntu jammy-backports InRelease [99.8 kB]  
Fetched 324 kB in 2s (203 kB/s)  
Reading package lists... Done  
Building dependency tree... Done  
Reading state information... Done  
249 packages can be upgraded. Run 'apt list --upgradable' to see them.  
rohit@rohit-VirtualBox:~$ sudo apt upgrade  
Reading package lists... Done  
Building dependency tree... Done  
Reading state information... Done  
Calculating upgrade... Done
```

```
rohit@rohit-VirtualBox: ~  
rohit@rohit-VirtualBox:~$ sudo apt install nodejs npm  
[sudo] password for rohit:  
Reading package lists... Done  
Building dependency tree... Done  
Reading state information... Done  
The following packages were automatically installed and are no longer required:  
  libflashrom1 libftdi1-2  
Use 'sudo apt autoremove' to remove them.  
The following additional packages will be installed:  
  binutils binutils-common binutils-x86-64-linux-gnu build-essential dpkg-dev  
  fakeroot g++ g++-11 gcc gcc-11 git git-man gyp javascript-common  
  libalgorithm-diff-perl libalgorithm-diff-xs-perl libalgorithm-merge-perl
```




```
rohit@rohit-VirtualBox: ~  
rohit@rohit-VirtualBox:~$ npm install coap  
  
added 22 packages, and audited 23 packages in 7s  
  
3 packages are looking for funding  
  run 'npm fund' for details  
  
found 0 vulnerabilities  
rohit@rohit-VirtualBox:~$
```

js file

```
coap.js
1 var coap = require('coap'); //to include CoAP library
2 var portNum = 5683;
3
4 //define a random function to send random int values
5 function randInt(min, max){
6     return (Math.random()*(max-min)+min).toFixed(2);
7 }
8
9 coap.createServer(function (req, res){
10     console.info("Client request is %s", req.url);
11
12     switch(req.url){
13         case "/co2":
14             displayOut(res, {'Carbon Dioxide':randInt(1000, 2000)+' ppm'})
15             break;
16
17         case "/pm":
18             displayOut(res, {'Particulate Matter':randInt(0, 2.5)+' ppm'})
19             break;
20
21         case "/hc":
22             displayOut(res, {'Hydrocarbons':randInt(0, 1500)+' ppm'})
23             break;
24
25         case "/co":
26             displayOut(res, {'Carbon Monoxide':randInt(0, 50)+' ppm'})
27             break;
28
29         case "/nox":
30             displayOut(res, {'Nitrous Oxide':randInt(0, 0.3)+' ppm'})
31             break;
32     }
33 }).listen(portNum);
34
35 console.log("CoAP server started at port %s.", portNum);
36
37 function displayOut(res, content){
38     if(content){
39         res.setOption('Content-Format', 'application/json');
40         res.code="2.05";
41         res.end(JSON.stringify(content));
42     }else{
43         res.code="4.04";
44         res.end();
45     }
46 }
```

Using CU for Chrome




Payload

 Incoming  Rendered  Outgoing

```
{"Carbon Monoxide": "26.55 ppm"}
```

coap://localhost:5683/co




Payload

 Incoming  Rendered  Outgoing

```
{"Carbon Dioxide": "1447.34 ppm"}
```

coap://localhost:5683/co2




Payload

 Incoming  Rendered  Outgoing

```
{"Particulate Matter": "1.68 ppm"}
```

coap://localhost:5683/pm


Payload

 Incoming  Rendered  Outgoing

```
{"Nitrous Oxide": "0.26 ppm"}
```

coap://localhost:5683/nox

Payload

 Incoming

 Rendered

 Outgoing

```
{"Hydrocarbons": "1464.48 ppm"}
```

coap://localhost:5683/hc

Using Terminal

Client Side

```
rohit@rohit-VirtualBox: ~/node-v18.13.0-linux-x64/bin
rohit@rohit-VirtualBox:~/node-v18.13.0-linux-x64/bin$ coap-client -m get -t json
coap://localhost:5683/co2
{"Carbon Dioxide": "1880.86 ppm"}
rohit@rohit-VirtualBox:~/node-v18.13.0-linux-x64/bin$ coap-client -m get -t json
coap://localhost:5683/pm
{"Particulate Matter": "0.52 ppm"}
rohit@rohit-VirtualBox:~/node-v18.13.0-linux-x64/bin$ coap-client -m get -t json
coap://localhost:5683/hc
{"Hydrocarbons": "1208.41 ppm"}
rohit@rohit-VirtualBox:~/node-v18.13.0-linux-x64/bin$ coap-client -m get -t json
coap://localhost:5683/co
{"Carbon Monoxide": "13.86 ppm"}
rohit@rohit-VirtualBox:~/node-v18.13.0-linux-x64/bin$ coap-client -m get -t json
coap://localhost:5683/nox
{"Nitrous Oxide": "0.24 ppm"}
rohit@rohit-VirtualBox:~/node-v18.13.0-linux-x64/bin$
```

Server Side

```
rohit@rohit-VirtualBox: ~/node-v18.13.0-linux-x64/bin
rohit@rohit-VirtualBox:~/node-v18.13.0-linux-x64/bin$ ./node /home/rohit/coap.js
CoAP server started at port 5683.
Client request is /co2
Client request is /pm
Client request is /hc
Client request is /co
Client request is /nox
```