

SCHOOL OF COMPUTING (SOC)

IOT CA2 Step-by-step Tutorial

DIPLOMA IN BUSINESS INFORMATION TECHNOLOGY
DIPLOMA IN INFORMATION TECHNOLOGY
DIPLOMA IN INFOCOMM SECURITY MANAGEMENT

ST0324 Internet of Things (IOT)

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Prepared for: Ms Dora Chua

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Section 1

Overview of project

A. Where we have uploaded our tutorial

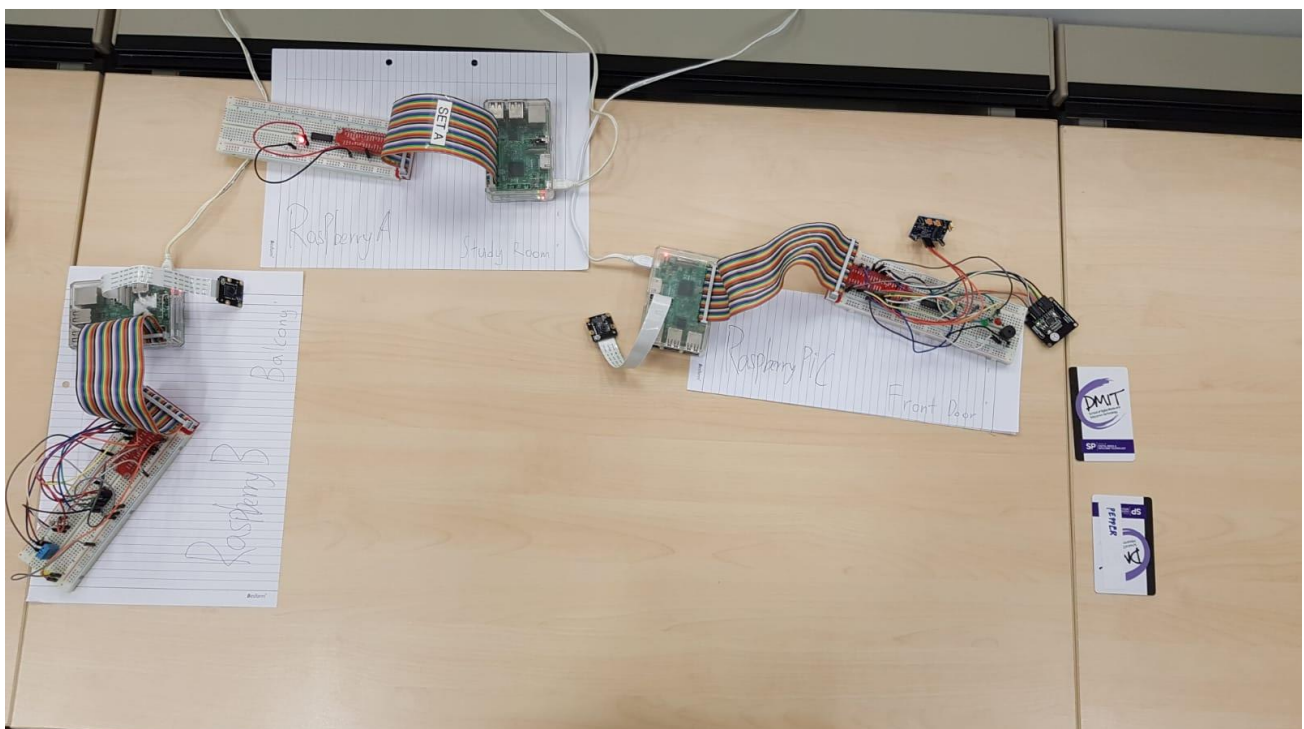
<https://youtu.be/vW1W-uVw8EY>

<https://github.com/DamianTanXianKai/Team-Basic-IOT-CA2>

B. What is the application about?

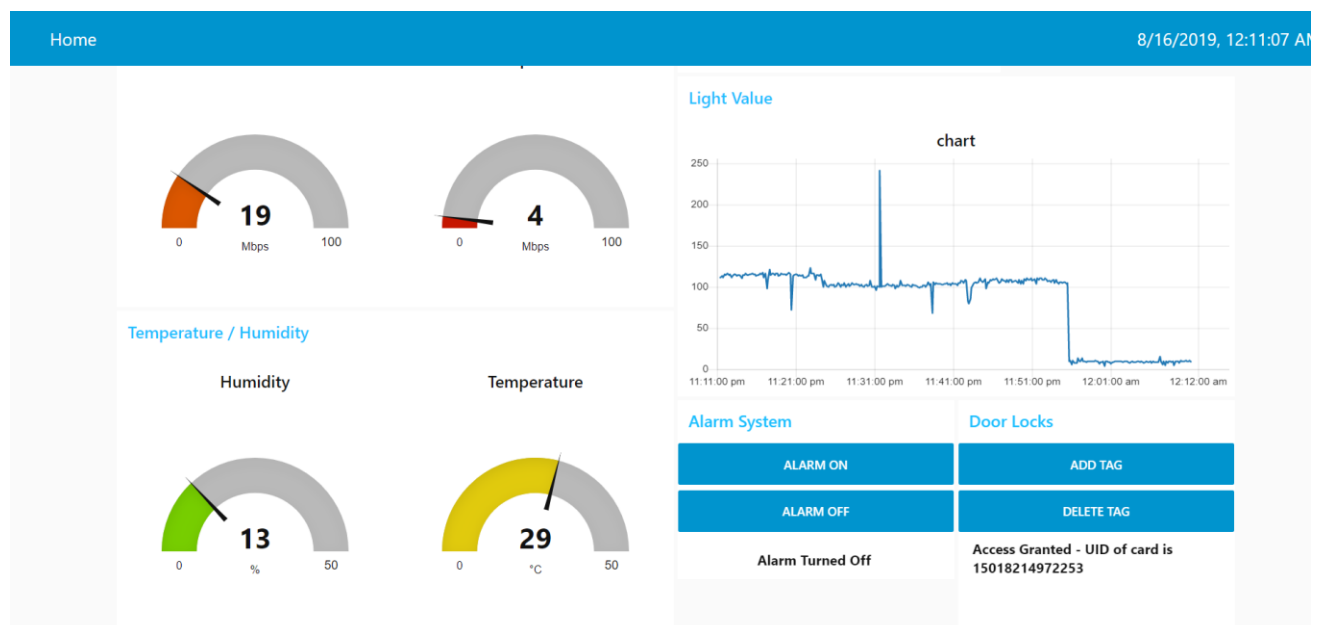
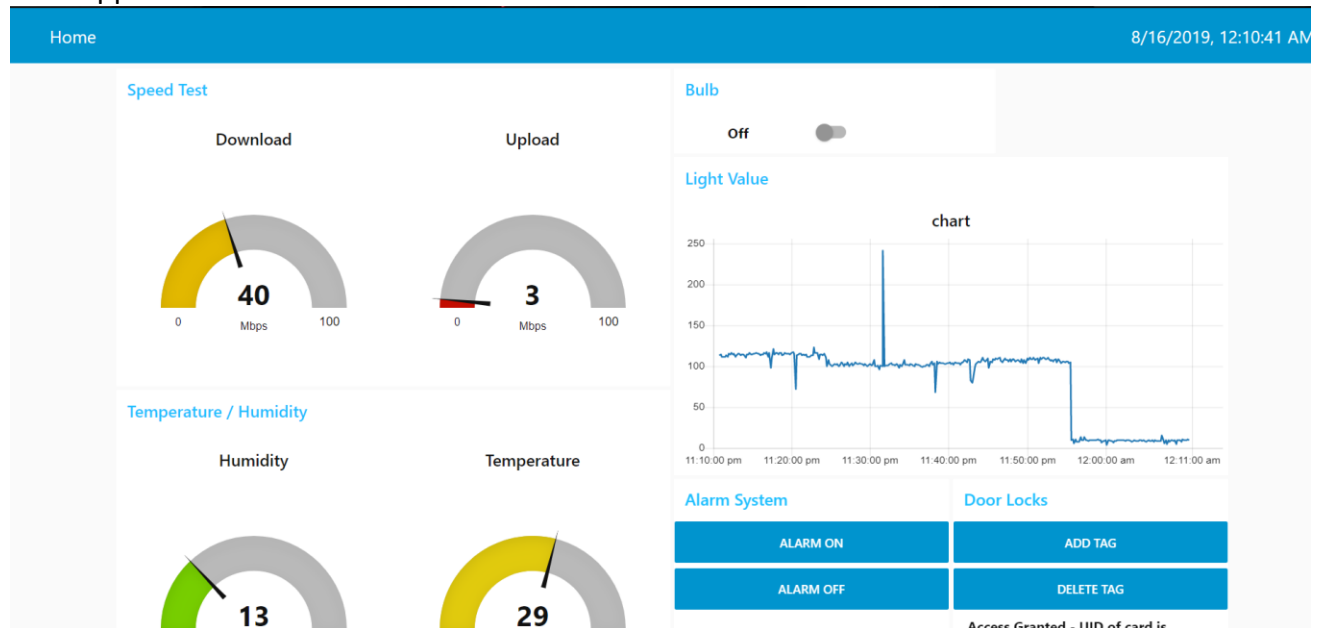
Our application aims to assist users in life. Our application has a wifi speed test, motion sensor, light detector, card reader and temperature sensor. Users can on and off their room light from the dashboard which is very convenient if the user feels that the room is dark and find their switch really far from their seats. The wifi speed test is there to ensure user has a stable connection at all times and when the wifi speed drops user will be able to see from the gauge and save their data before they get disconnected and lose all their progress. The temperature sensor is to tell user what is the temperature outside like and users will be able to gauge if it is a sunny day or a cloudy day. The card reader is to unlock the house door. Lastly, the motion sensor allows user to on the alarm which will trigger when it detects motion and then the user will receive an image on their telegram and email, and a message from twilio saying that there is an intruder

C. How does the final RPI set-up looks like?

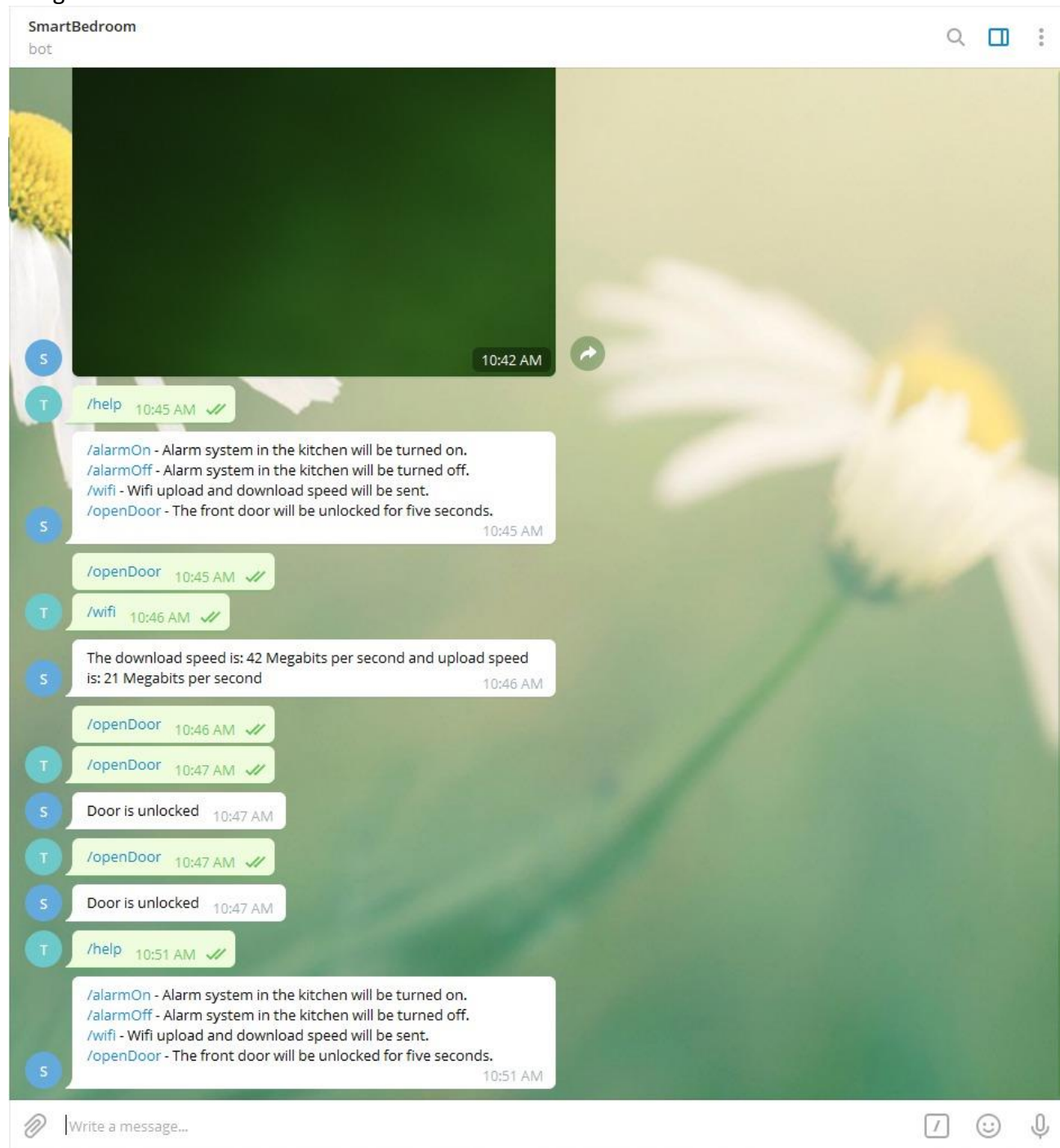


D. How does the web or mobile application look like?

Web App

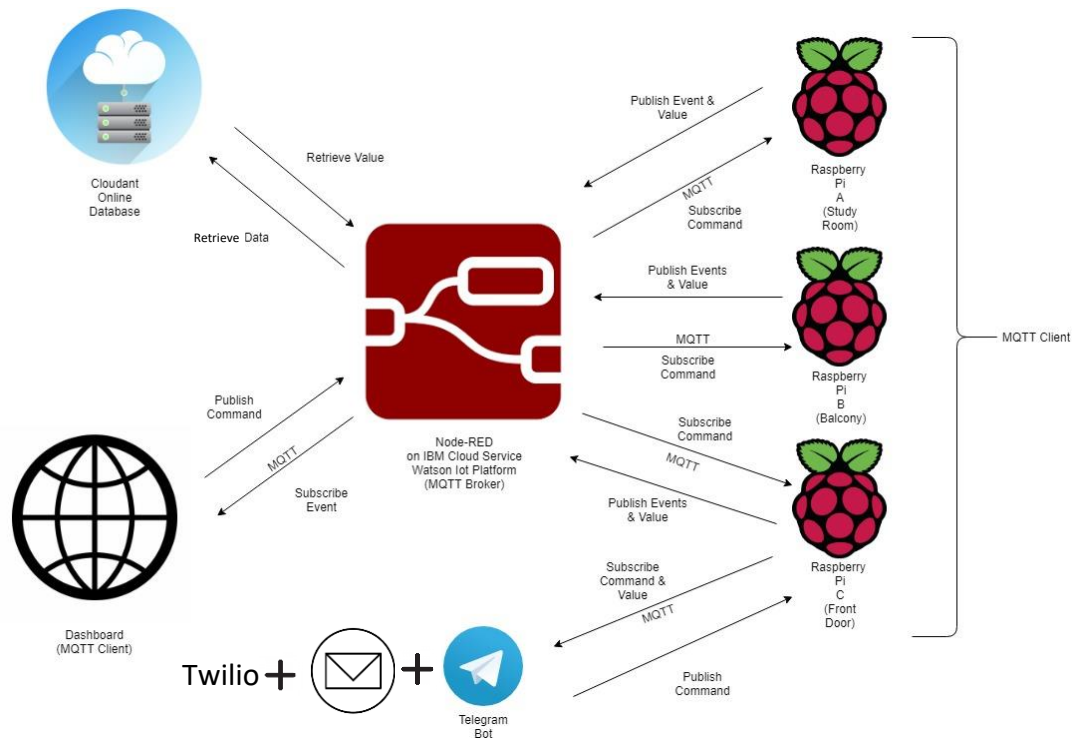


TelegramBot



E. System architecture of our system

Provide a hand-drawn or computer-drawn system architecture diagram please. Example given below.



F. Evidence that we have met basic requirements

Provide bullet list to describe how your group has met basic requirements

Requirement	Evidence
Used three sensors	Used light sensor, wifi adapter, temperature sensor, motion sensor
Used MQTT	Our MQTT endpoint. Examples will be speedtest-download, speedtest-upload Example of data sent through MQTT : Light value, Temperature value, Wifi Speed value
Stored data in cloud	Stored light data in Cloudant database in IBM cloud
Used cloud service	Hosted web server on ibm
Provide real-time sensor value / status	Show the real-time value of temperature sensor and wifi adapter
Provide historical sensor value/ status	Show historical value of light sensor
Control actuator	Placed button on webpage to control light bulb

G. Bonus features on top of basic requirements

Provide bullet list of the bonus features you have added on top of basic requirements

- a) Telegram bot can check wifi speed by pulling data from IBM
- b) Telegram bot can activate alarm.
- c) Telegram will receive image when motion is detected.
- d) Email will receive image when motion is detected.

A. Quick-start guide (Readme first)

Give a few lines of basic instructions on how I need to run your app, e.g

- 1) First connect hardware as in Section 3 for Raspberry Pi A, B and C.
- 2) Install nodes needed after copying the codes for the node red to separate devices. Copy code A for Raspberry Pi A's node red, code B for Raspberry Pi B's node red, code C for Raspberry Pi C's node red and Code IBM to IBM's node red.
- 3) Create gateways and add a device for each gateway.
- 4) Authenticate the 3 different Raspberry Pi and each Pi will be linked to one gateway and one gateway can only be linked to one Raspberry Pi.
- 5) Change all watson iot output node's credential from all Raspberry Pi and connect them with IBM's node red.
- 6) Change all watson iot input and output nodes from IBM respectively to the Raspberry Pi that sends out the values to IBM or takes the values from IBM.
- 7) Create databases from cloudant with names 'download', 'upload', 'access', 'light', 'temp' and 'hum'.
- 8) Select the service from the cloudant node to your own cloudant service
- 9) Reconfigure telegram nodes with your own Bot-Name, Token, User and Chat Id
- 10) Reconfigure email node and add your own email.
- 11) Reconfigure twilio and use your own account and add your own phone number.
- 12) Download the 3 js file and move it to Raspberry Pi C's root directory.
- 13) Reconfigure the Daemon node and add the route for the js files to the arguments.

Section 2

Hardware requirements

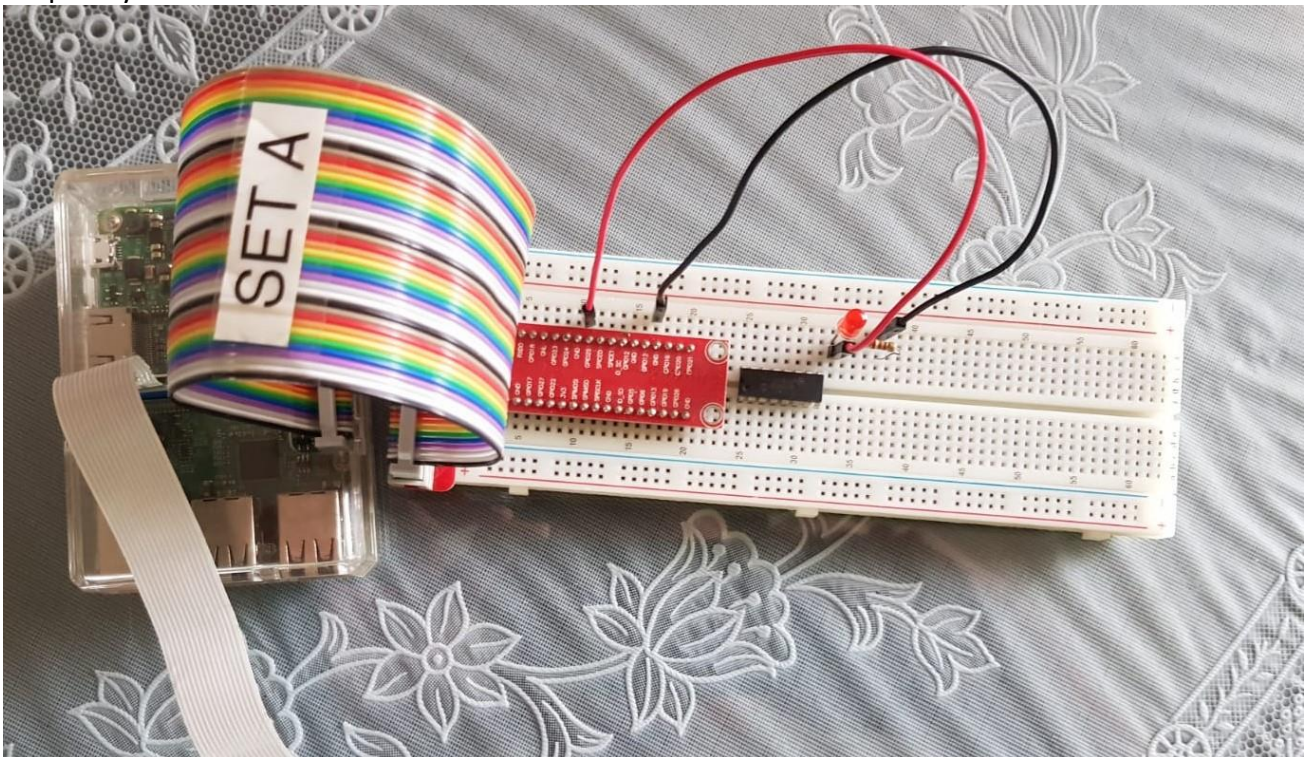
Hardware checklist

4 Bulb, 1 DHT 11, 1 LDR, 1 Motion Sensor, 1 Buzzer, 1 RFID reader, 1 RFID card,
3 Raspberry Pi 3 Model B set with NoIR Camera Board

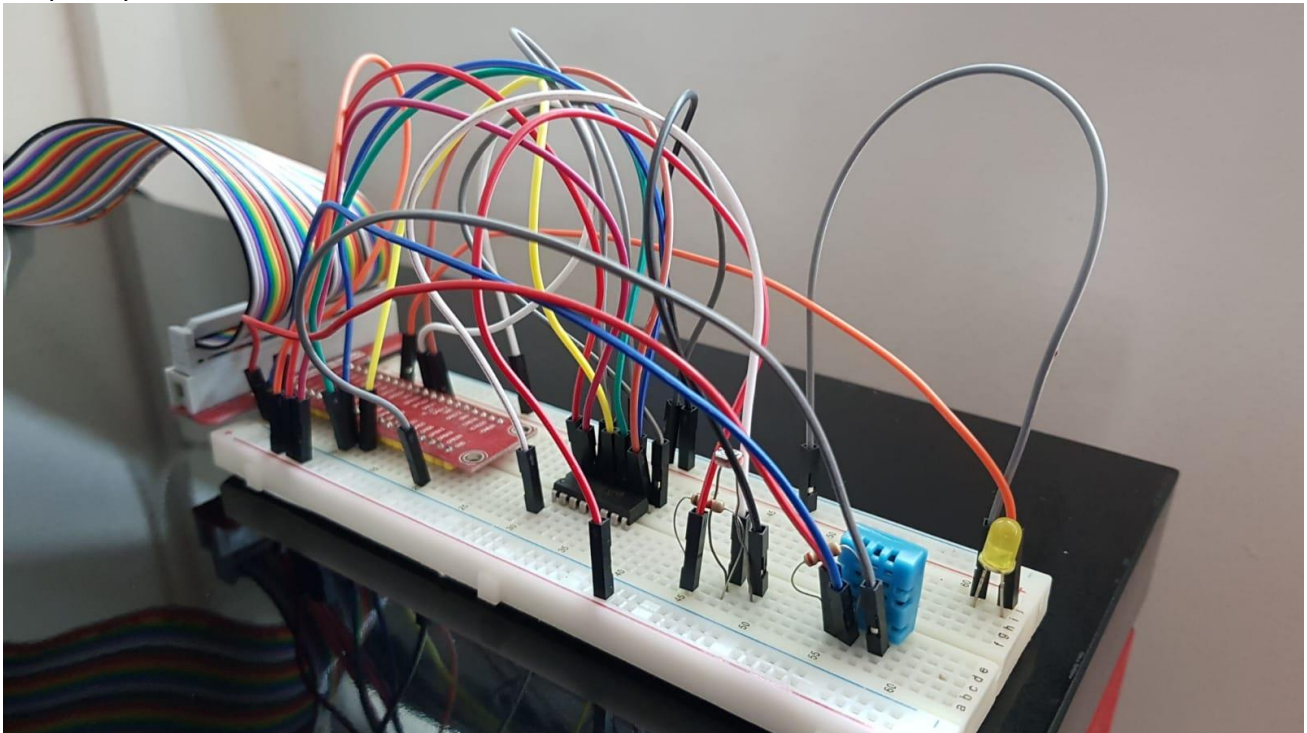
Section 3

Setup

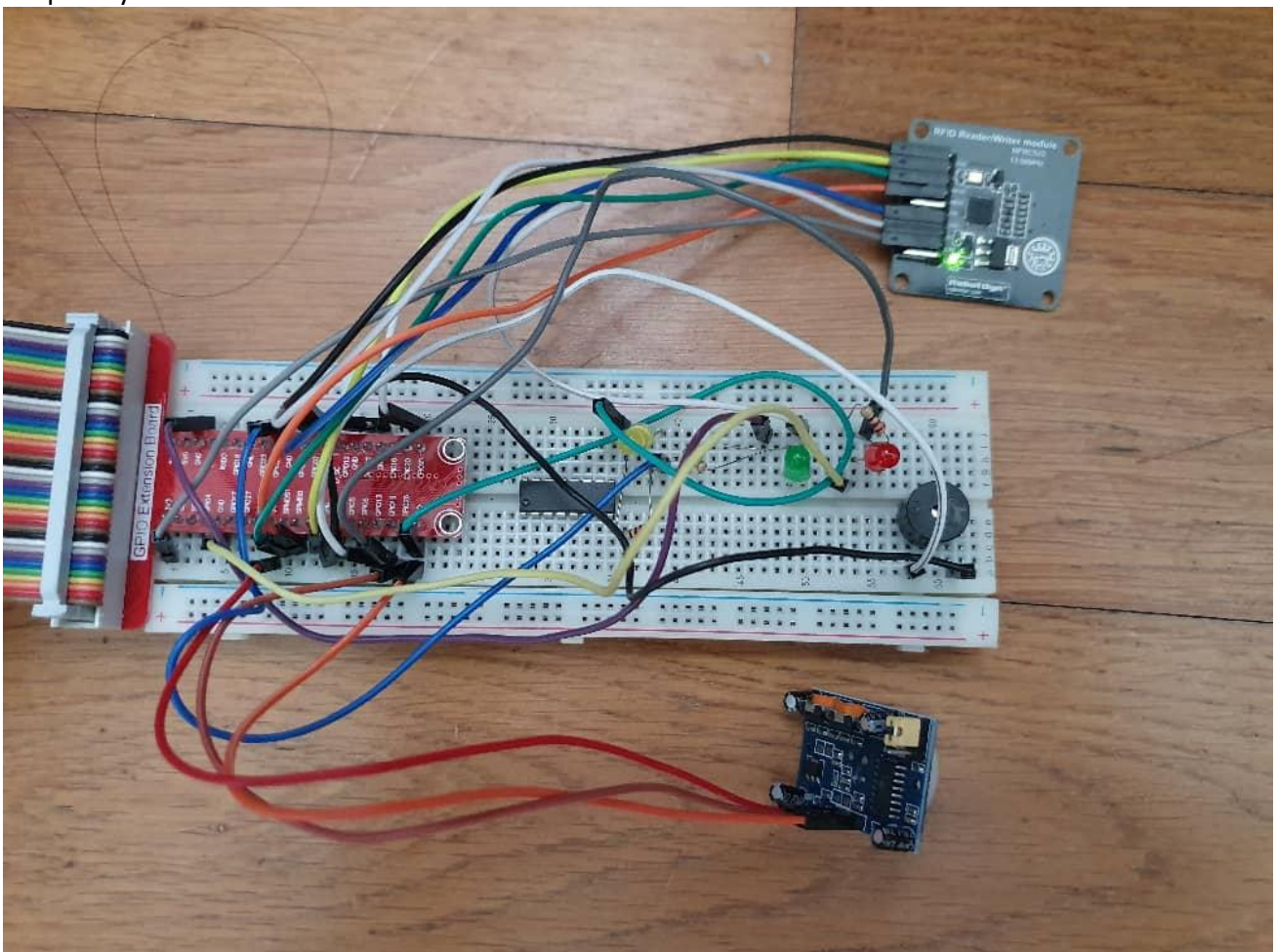
Raspberry Pi A



Raspberry Pi B



Raspberry Pi C



Section 4

Node red codes

Raspberry Pi A's Node Red Code:

```
[{"id":"13a78b57.773d35","type":"tab","label":"Raspberry Pi A","disabled":false,"info":"","{
  "id":"7498066b.0fd4b8","type":"inject","z":"13a78b57.773d35","name":"Poll for internet speed every 15s","topic":"","payload":"","payloadType":"date","repeat":"15","crontab":"","once":false,"onceDelay":0.1,"x":180,"y":60,"wires":[["46536ca5.b4cff4"]]},{"id":"b80eb915.d38688","type":"function","z":"13a78b57.773d35","name":"set download values","func":"var download = msg.payload.speeds.download;\n\nmsg.payload = Math.ceil(download);\n\nglobal.set('downloadval', msg.payload)\n\nreturn msg;","outputs":1,"noerr":0,"x":580,"y":80,"wires":[["f5320a92.50f7b8"]]},{"id":"ffc8b466.bd1238","type":"inject","z":"13a78b57.773d35","name":"Send upload value to Bluemix","topic":"","payload":"","payloadType":"date","repeat":"30","crontab":"","once":false,"onceDelay":0.1,"x":670,"y":160,"wires":[["43d9f408.fbdb4c"]]},{"id":"43d9f408.fbdb4c","type":"function","z":"13a78b57.773d35","name":"Format msg for speedtest","func":"speed2 = global.get('uploadval')\n\nmsg.payload = speed2\n\nreturn msg;","outputs":1,"noerr":0,"x":650,"y":220,"wires":[["8bea1e7a.778d3","39402e8f.f6ca22"]]},{"id":"f5320a92.50f7b8","type":"debug","z":"13a78b57.773d35","name":"","active":true,"tosidebar":true,"console":false,"tostatus":false,"complete":"payload","targetType":"msg","x":770,"y":80,"wires":[[]]},{"id":"8bea1e7a.778d3","type":"debug","z":"13a78b57.773d35","name":"","active":true,"tosidebar":true,"console":false,"tostatus":false,"complete":"false","x":870,"y":280,"wires":[[]]},{"id":"739f96c.1fe7868","type":"inject","z":"13a78b57.773d35","name":"Send download value to Bluemix","topic":"","payload":"","payloadType":"date","repeat":"30","crontab":"","once":false,"onceDelay":0.1,"x":180,"y":160,"wires":[["15875458.e7b1bc"]]},{"id":"15875458.e7b1bc","type":"function","z":"13a78b57.773d35","name":"Format msg for speedtest","func":"speed1 = global.get('downloadval')\n\nmsg.payload = speed1\n\nreturn msg;","outputs":1,"noerr":0,"x":150,"y":220,"wires":[["9c521b1e.3d2cd8","f78a0afc.c678e8"]]},{"id":"9c521b1e.3d2cd8","type":"debug","z":"13a78b57.773d35","name":"","active":true,"tosidebar":true,"console":false,"tostatus":false,"complete":"false","x":370,"y":280,"wires":[[]]},{"id":"ceb9174a.f3add8","type":"function","z":"13a78b57.773d35","name":"set upload values","func":"var upload = msg.payload.speeds.upload;\n\nmsg.payload = Math.ceil(upload);\n\nglobal.set('uploadval', msg.payload)\n\nreturn msg;","outputs":1,"noerr":0,"x":570,"y":40,"wires":[["494cd6e1.b66318"]]},{"id":"494cd6e1.b66318","type":"debug","z":"13a78b57.773d35","name":"","active":true,"tosidebar":true,"console":false,"tostatus":false,"complete":"payload","targetType":"msg","x":770,"y":40,"wires":[[]]},{"id":"de2a6cb3.e1b37","type":"rpi-gpio out","z":"13a78b57.773d35","name":"LED","pin":"22","set":true,"level":"0","freq":"","out":"out","x":590,"y":360,"wires":[[]]},{"id":"c71af0a1.30e7f","type":"debug","z":"13a78b57.773d35","name":"","active":true,"tosidebar":true,"console":false,"tostatus":false,"complete":"false","x":610,"y":400,"wires":[[]]},{"id":"caaaebb3.f80f48","type":"function","z":"13a78b57.773d35","name":"Filter the
```

```
command","func":"msg.payload = msg.payload.led\nreturn
msg;","outputs":1,"noerr":0,"x":410,"y":360,"wires":[["de2a6cb3.e1b37","c71af0a1.30e7f"]],{"id":
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"y":60,"wires":[["b80eb915.d38688","ceb9174a.f3add8"]],{"id":"d4514f9a.ef6cf","type":"wiotp
in","z":"13a78b57.773d35","authType":"g","deviceKey":"4615215c.6cf4d","deviceType":"","devicel
d":"","command":"Bulb","commandType":"g","qos":"1","name":"Listen to LED command from
IBM","x":170,"y":360,"wires":[["caaaebb3.f80f48"]],{"id":"39402e8f.f6ca22","type":"wiotp
out","z":"13a78b57.773d35","authType":"g","qs":"false","qsDeviceId":"","deviceKey":"4615215c.6c
f4d","deviceType":"gw-p1804375","deviceId":"gwid-p1804375","event":"speedtest-
upload","format":"String","qos":"1","name":"Sending To
IBM","x":620,"y":280,"wires":[],{"id":"f78a0afc.c678e8","type":"wiotp
out","z":"13a78b57.773d35","authType":"g","qs":"false","qsDeviceId":"","deviceKey":"4615215c.6c
f4d","deviceType":"gw-p1804375","deviceId":"gwid-p1804375","event":"speedtest-
download","format":"String","qos":"1","name":"Sending To
IBM","x":120,"y":280,"wires":[],{"id":"4615215c.6cf4d","type":"wiotp-
credentials","z":"","name":"","org":"k6be3c","serverName":"k6be3c.messaging.internetofthings.ib
mcloud.com","devType":"gw-p1804375","devId":"gwid-
p1804375","keepalive":"60","cleansession":true,"tls":"","usetls":false}}
```

Raspberry Pi B's Node Red Code:

```
[{"id":"c03da4a.c92c858","type":"tab","label":"CA2","disabled":false,"info":""},{"id":"11ccae22.d87
7f2","type":"function","z":"c03da4a.c92c858","name":"store light value","func":"global.set('light',
msg.payload)","outputs":1,"noerr":0,"x":600,"y":80,"wires":[["382200f0.61e7f"]],{"id":"b329c567.
605718","type":"inject","z":"c03da4a.c92c858","name":"poll for light values every 3
secs","topic":"","payload":"","payloadType":"date","repeat":"","crontab":"","once":false,"onceDela
y":0.1,"x":130,"y":80,"wires":[["fcc6e6bc.4af258"]],{"id":"fcc6e6bc.4af258","type":"pimcp3008","z
":"c03da4a.c92c858","name":"","dev":"3008","pin":0,"dnum":0,"bus":0,"x":390,"y":80,"wires":[["1
1ccae22.d877f2"]],{"id":"382200f0.61e7f","type":"debug","z":"c03da4a.c92c858","name":"","activ
e":true,"tosidebar":true,"console":false,"tostatus":false,"complete":false,"x":800,"y":80,"wires":[
],{"id":"c0051b6a.ffa68","type":"wiotp
out","z":"c03da4a.c92c858","authType":"g","qs":"false","qsDeviceId":"","deviceKey":"bafc303a.c5c
a9","deviceType":"gw-p1828555","deviceId":"gwid-
p1828555","event":"light","format":"json","qos":"0","name":"Send Light Value to
IBM","x":790,"y":200,"wires":[],{"id":"478ac592.37374c","type":"debug","z":"c03da4a.c92c858","n
ame":"","active":true,"tosidebar":true,"console":false,"tostatus":false,"complete":"payload","targe
tType":"msg","x":750,"y":260,"wires":[],{"id":"91a8f62c.bd2d08","type":"function","z":"c03da4a.c
92c858","name":"format the msg","func":"light = global.get('light')\nmsg.payload = {'d': {'light':
light}}\nreturn
msg;\n","outputs":1,"noerr":0,"x":400,"y":220,"wires":[["2b9fec80.d9e214"]],{"id":"fa35ee58.353
7b","type":"inject","z":"c03da4a.c92c858","name":"Send light values to IBM
Cloud","topic":"","payload":"","payloadType":"date","repeat":"10","crontab":"","once":false,"once
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z":"c03da4a.c92c858","name":"","property":"payload","action":"","pretty":false,"x":590,"y":220,"w
ires":[["c0051b6a.ffa68","478ac592.37374c"]],{"id":"256cef5f.c68f5","type":"debug","z":"c03da4
a.c92c858","name":"","active":true,"tosidebar":true,"console":false,"tostatus":false,"complete":"tr
ue","targetType":"full","x":570,"y":340,"wires":[],{"id":"b102330b.c2bf3","type":"rpi-
dht22","z":"c03da4a.c92c858","name":"","topic":"rpi-
```



```

dht22","dht":"11","pintype":"0","pin":4,"x":380,"y":340,"wires":[["256cef5f.c68f5","d503cdd2.319
38","9adac46d.7a18f8"]],{"id":"a8ab7be.74c0388","type":"debug","z":"c03da4a.c92c858","name":
":"","active":true,"tosidebar":true,"console":false,"tostatus":false,"complete":"false","x":730,"y":440
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":"d503cdd2.31938","type":"function","z":"c03da4a.c92c858","name":"humidity","func":"msg.payload
ad=msg.humidity;\nreturn
msg;","outputs":1,"noerr":0,"x":520,"y":500,"wires":[["a6da5c31.630e9","4915662a.554eb8"]],{"id
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a9","deviceType":"gw-p1828555","deviceId":"gwid-
p1828555","event":"temperature","format":"String","qos":"0","name":"Send Temperature Value
to IBM","x":790,"y":380,"wires":[]},{"id":"4915662a.554eb8","type":"wiotp
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p1828555","event":"humidity","format":"String","qos":"0","name":"Send humidity Value to
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msg;","outputs":1,"noerr":0,"x":550,"y":420,"wires":[["a8ab7be.74c0388","12e946d2.5d1ae9"]],{"i
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secs","topic":"","payload":"","payloadType":"date","repeat":"5","crontab":"","once":false,"onceDel
ay":0.1,"x":160,"y":340,"wires":[["b102330b.c2bf3"]],{"id":"bd48a069.ace49","type":"wiotp
in","z":"c03da4a.c92c858","authType":"g","deviceKey":"bafc303a.c5ca9","deviceType":"","deviceId
":"","command":"led","commandType":"g","qos":0,"name":"Recieve LED Status FROM
IBM","x":150,"y":620,"wires":[["fc261bd5.064838"]],{"id":"fc261bd5.064838","type":"function","z
":"c03da4a.c92c858","name":"Convert","func":"msg.payload = msg.payload.led\nreturn
msg;\n","outputs":1,"noerr":0,"x":360,"y":620,"wires":[["c6593605.fb1da8","389ff4f4.aa3f8c"]],{"i
d":"389ff4f4.aa3f8c","type":"debug","z":"c03da4a.c92c858","name":"","active":true,"tosidebar":tr
ue,"console":false,"tostatus":false,"complete":"false","x":570,"y":620,"wires":[]},{"id":"c6593605.fb
1da8","type":"rpi-gpio out","z":"c03da4a.c92c858","name":"LED
OUTPUT","pin":"12","set":false,"level":"0","freq":"","out":"out","x":580,"y":680,"wires":[]},{"id":"b
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Gateway","org":"k6be3c","serverName":"k6be3c.messaging.internetofthings.ibmcloud.com","devT
ype":"gw-p1828555","devId":"gwid-
p1828555","keepalive":"60","cleansession":true,"tls":"","usetls":false}]

```

Raspberry Pi C's Node Red Code:

```

[{"id":"34cba1ea.36adbe","type":"tab","label":"Flow
1","disabled":false,"info":""},{"id":"929ddf3d.c9b9a","type":"tab","label":"Telegram Bot and Alarm
System","disabled":false,"info":""},{"id":"cb977296.ed02","type":"tab","label":"RFID
Reader","disabled":false,"info":""},{"id":"53fc2239.01438c","type":"wiotp-
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p1843059","keepalive":"60","cleansession":true,"tls":"","usetls":false},{"id":"57e1ff01.60da9","typ
e":"wiotp-credentials","z":"","name":"pi-maeve-
alex","org":"u4oper","devType":"RaspberryPi","devId":"pi-maeve-

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IBM's Node Red Code:

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  "type": "tab",
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  "disabled": false,
  "info": "",
  "id": "2d231251.1597be",
  "type": "tab",
  "label": "Flow B",
  "disabled": false,
  "info": "",
  "id": "248e193f.1584f6",
  "type": "ui_tab",
  "z": "",
  "name": "Home",
  "icon": "dashboard",
  "disabled": false,
  "hidden": false,
  "id": "c5f2b6c0.6b2b48",
  "type": "ui_group",
  "z": "",
  "name": "Speed Test",
  "tab": "248e193f.1584f6",
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  "collapse": false,
  "id": "511cd361.6efb4c",
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      "edited": true,
      "reset": false
    },
    "darkTheme": {
      "default": "#097479",
      "baseColor": "#097479",
      "baseFont": "-apple-system,BlinkMacSystemFont,Segoe UI,Roboto,Oxygen-Sans,Ubuntu,Cantarell,Helvetica Neue,sans-serif",
      "edited": false
    },
    "customTheme": {
      "name": "Untitled Theme 1",
      "default": "#4B7930",
      "baseColor": "#4B7930",
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          "edited": false
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          "edited": false
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        "widget-background-color": {
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        "widget-border-color": {
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          "edited": false
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  "type": "ui_tab",
  "z": "",
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98.49;\nvar latitude1 = 29.42;\n\n// Array of pseudo random temperatures\nvar temp1 =
[15,17,18.5,20,21.5,23,24,22.2,19,18];\n\n// Array of pseudo random relative humidities\nvar
humidity1 = [50,55,61,68,65,60,53,49,45,47];\n\n// Counter to select from array.\nvar counter1 =
context.get('counter1') || 0;\ncounter1 = counter1+1;\nif(counter1 > 9) counter1 =
0;\ncontext.set('counter1',counter1);\n\n// Create MQTT message in JSON\nmsg = {\n payload:
JSON.stringify(\n {\n d:{\n \"temp\" : temp1[counter1],\n \"humidity\" :
humidity1[counter1],\n \"location\" :\n {\n \"longitude\" : longitude1,\n
\"latitude\" : latitude1\n },\n }\n }\n }\n );\nreturn
msg;\n","outputs":1,"noerr":0,"x":320,"y":120,"wires":[["cbe1a0b7.cd877","805c97ee.3ed9e8"]]],{
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configured to send on click or on an automatic interval.\n\n\n#Prerequisite\nOutput node device
type and device ID need to match a device that it registered in a running IBM Watson IoT Platform
service.\n\n\n# Watson IoT Platform docs\n[Connecting
devices](https://www.bluemix.net/docs/services/IoT/iotplatform_task.html)","x":100,"y":40,"wires
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```

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msg;\n", "outputs": 1, "noerr": 0, "x": 420, "y": 60, "wires": [{"5ca5f96d.4083f8"}], {"id": "5ca5f96d.4083f
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$('#clock').remove();\n  var toolbar = $('.md-toolbar-tools');\n  \n  var div = $('<div/>');\n  var p
= $('<p/ id='clock'>');\n  \n  div.append(p);\n  div[0].style.margin = '5px 5px 5px auto';\n
toolbar.append(div);\n\n  function displayTitle(lh) {\n    p.text(lh);\n  }\n\n  function
upTime() {\n    var d = new Date();\n    p.text(d.toLocaleString());\n  }\n\n  if(document.clockInterval){\n    clearInterval(document.clockInterval);\n
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-- End of CA2 Step-by-step tutorial --