



UNIVERSITAT POLITÈCNICA DE CATALUNYA  
BARCELONATECH

Escola Superior d'Enginyeries Industrial,  
Aeroespacial i Audiovisual de Terrassa

# Desenvolupament d'un sistema de mesura sense fil basat en sensors inercials per a l'optimització de l'entrenament de tècniques de Judo

Document:

Pressupost

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## ANNEX I Codi Arduino

```
#include <Arduino_LSM6DS3.h>
#include <WiFiNINA.h>
#include <Wire.h>
#include "wiring_private.h"
#include <Adafruit_Sensor.h>
#include <Adafruit_LSM9DS0.h>

char status;
//variables per a cada acceleració que agafarem
float accx3, accy3, accz3, gyrox3, gyroy3, gyroz3, accelx3, accely3;
float accelz3, gyrx3, gyry3, gyrz3;
//variable d'espera per a la connexio de tots els sensors
bool connexio = true;

long espera = 50; //temps d'espera entre enviament de dades

char ssid[] = "Insertar Nom Wifi"; // nom del wifi
char pass[] = "Insertar Contrasenya"; // contrasenya wifi
byte server[] = { 192, 168, 43, 84 }; // Direcció IP del servidor 192,168,0,14

TwoWire I2C(&sercom0, 6, 5); //creació de un nou canal I2C

//Configuració objecte dels dos sensors externs LSM9DS0
Adafruit_LSM9DS0 lsm = Adafruit_LSM9DS0(&Wire, 1000);
Adafruit_LSM9DS0 lsm2 = Adafruit_LSM9DS0(&I2C, 1000);

WiFiClient cliente; //objecte del wifi
//Configuració dels rangs dels dos sensors externs
void configureSensor(void)
{
  lsm.setupAccel(lsm.LSM9DS0_ACCEL_RANGE_2G);
  lsm2.setupAccel(lsm2.LSM9DS0_ACCEL_RANGE_2G);

  lsm.setupMag(lsm.LSM9DS0_MAGGAIN_2GAUSS);
  lsm2.setupMag(lsm2.LSM9DS0_MAGGAIN_2GAUSS);

  lsm.setupGyro(lsm.LSM9DS0_GYROSCALE_245DPS);
  lsm2.setupGyro(lsm2.LSM9DS0_GYROSCALE_245DPS);
}

void setup() {
  Serial.begin(115200); //Inicialitzem bus serie
  I2C.begin(5); //Inicialitzem els dos I2C
  Wire.begin(19, 18);
  pinPeripheral(6, PIO_SERCOM_ALT); //Assignem al pin 6 com a SDA
  pinPeripheral(5, PIO_SERCOM_ALT); //Assignem al pin 5 com a SCL

  // Esperem a que es faigi la connexio wifi

  while (status != WL_CONNECTED) {
    Serial.print("Attempting to connect to SSID: ");
    Serial.println(ssid);
    status = WiFi.begin(ssid, pass);

    delay(1000);
  }
  // Serial.println("connected");
}
```

```
void loop() {

  //Esperem a que es faigi la connexio amb els sensors i els configurem
  if (connexio == true) {
    Serial.println("Si");
    Espera1();
    Espera2();
    Espera3();
    configureSensor();
    connexio = false;
  }
  //Generem els objectes i llegim les dades dels LSM9DS0
  sensors_event_t accel, mag, gyro, temp;
  lsm.getEvent(&accel, &mag, &gyro, &temp);

  sensors_event_t accel2, mag2, gyro2, temp2;
  lsm2.getEvent(&accel2, &mag2, &gyro2, &temp2);

  //Llegim les dades del sensor intern de l'arduino LSM6DS3
  if (IMU.accelerationAvailable()) {
    IMU.readAcceleration(accx3, accy3, accz3);
    IMU.readGyroscope(gyrox3, gyroy3, gyroz3);
    accelx3 = accx3 * 9, 80665;
    accely3 = accy3 * 9, 80665;
    accelz3 = accz3 * 9, 80665;
    gyrx3 = gyrox3;
    gyry3 = gyroy3;
    gyrz3 = gyroz3;
  }
  Serial.println("Envio de dato, conectando...");
  //Comprovem si ens podem connectar al servidor
  if (cliente.connect(server, 80) > 0) {
    cliente.print("GET /arduino/control/conexion_arduino.php?pre_php="); // Enviem les dades per GET
    cliente.print("&accx_php=");
    cliente.print(accel.acceleration.x);
    cliente.print("&accy_php=");
    cliente.print(accel.acceleration.y);
    cliente.print("&accz_php=");
    cliente.print(accel.acceleration.z);
    cliente.print("&gyrx_php=");
    cliente.print(gyro.acceleration.x);
    cliente.print("&gyry_php=");
    cliente.print(gyro.acceleration.y);
    cliente.print("&gyrz_php=");
    cliente.print(gyro.acceleration.z);
    cliente.print("&accx2_php=");
    cliente.print(accel2.acceleration.x);
    cliente.print("&accy2_php=");
    cliente.print(accel2.acceleration.y);
    cliente.print("&accz2_php=");
    cliente.print(accel2.acceleration.z);
    cliente.print("&gyrx2_php=");
    cliente.print(gyro2.acceleration.x);
    cliente.print("&gyry2_php=");
    cliente.print(gyro2.acceleration.y);
    cliente.print("&gyrz2_php=");
    cliente.print(gyro2.acceleration.z);
    cliente.print("&accx3_php=");
    cliente.print(accelx3);
    cliente.print("&accy3_php=");
    cliente.print(accely3);
    cliente.print("&accz3_php=");
    cliente.print(accelz3);
    cliente.print("&gyrx3_php=");
    cliente.print(gyrx3);
```



```
cliente.print("&gyry3_php=");
cliente.print(gyry3);
cliente.print("&gyrz3_php=");
cliente.print(gyrz3);
cliente.println(" HTTP/1.0");
cliente.println("User-Agent: Arduino 1.0");
cliente.println();
Serial.println("Envio con exito (al archivo controller/index y models/herramienta)");

espera = millis() + 50;
while (millis() < espera) {

}
} else {
  Serial.println("Fallo en la conexion");
  delay(1);
}
if (!cliente.connected()) {
  Serial.println("Desconectando");
  delay(1);
}
cliente.stop();
cliente.flush();
}

//Funció que espera a que es faigi la connexio entre arduino i un dels LSM9DS0
void Espera1() {
  Serial.println("Dins Espera1");
  while (!lsm.begin()) {
    Serial.println("No");
    delay(1);
  }
  Serial.println("trobat");
}

//Funció que espera a que es faigi la connexio entre arduino i l'altre LSM9DS0
void Espera2() {
  Serial.println("Dins Espera2");
  while (!lsm2.begin()) {
    Serial.println("No2");
    delay(1);
  }
  Serial.println("trobat2");
}

//Funció que espera a que es faigi la connexio entre arduino i el sensor integrat
void Espera3() {
  Serial.println("Dins Espera3");
  while (!IMU.begin()) {
    Serial.println("Failed to initialize IMU!");
  }
  Serial.println("trobat3");
}

extern "C" {
  void SERCOM0_Handler(void);

  void SERCOM0_Handler(void) {
    I2C.onService();
  }
}
```

## ANNEX II Codi connexió arduino-base de dades

```
<?php
class conexion
{
    private $servidor;
    private $usuario;
    private $contrasena;
    private $basedatos;
    public $conexion;

    public function __construct(){
        $this->servidor = "localhost";
        $this->usuario = "root";
        $this->contrasena = "";
        $this->basedatos = "tfg";
    }

    function conectar(){
        $this->conexion = new PDO("mysql:host=$this->servidor;dbname=$this->basedatos", "$this->usuario", "$this->contrasena");
    }

    function cerrar(){
        $this->conexion->close();
    }
}
?>
```



## ANNEX III Codi per introduir dades a la base de dades

```

<?php

require_once("herramienta_introducir_datos.php");

$herramienta = new Herramienta();
$ingresar_dato = $herramienta->ingresar_datos($_GET["accx_php"],
    $_GET["accy_php"],$_GET["accz_php"],$_GET["gyrx_php"],
    $_GET["gyry_php"],$_GET["gyrz_php"],$_GET["accx2_php"],
    $_GET["accy2_php"],$_GET["accz2_php"],$_GET["gyrx2_php"],
    $_GET["gyry2_php"],$_GET["gyrz2_php"],$_GET["accx3_php"],
    $_GET["accy3_php"],$_GET["accz3_php"],$_GET["gyrx3_php"],
    $_GET["gyry3_php"],$_GET["gyrz3_php"]);

?>

<?php
class Herramienta{
    private $conexion;

    function __construct(){
        require_once("conexion_privada.php");
        $this->conexion = new conexion();
        $this->conexion->conectar();
    }

    public function ingresar_datos($accx_php, $accy_php, $accz_php, $gyrx_php,
        $gyry_php, $gyrz_php, $accx2_php, $accy2_php, $accz2_php, $gyrx2_php,
        $gyry2_php, $gyrz2_php, $accx3_php, $accy3_php, $accz3_php, $gyrx3_php,
        $gyry3_php,$gyrz3_php){
        $sql = " insert into tabla_sensor values (null, ?, ?, ?, ?, ?, ?, ?, ?,
        ?, ?, ?, ?, ?, ?, ?, ?, ?, ?, now(3)) ";
        $stmt = $this->conexion->conexion->prepare($sql);

        $stmt->bindValue(1, $accx_php);
        $stmt->bindValue(2, $accy_php);
        $stmt->bindValue(3, $accz_php);
        $stmt->bindValue(4, $gyrx_php);
        $stmt->bindValue(5, $gyry_php);
        $stmt->bindValue(6, $gyrz_php);
        $stmt->bindValue(7, $accx2_php);
        $stmt->bindValue(8, $accy2_php);
        $stmt->bindValue(9, $accz2_php);
        $stmt->bindValue(10, $gyrx2_php);
        $stmt->bindValue(11, $gyry2_php);
        $stmt->bindValue(12, $gyrz2_php);
        $stmt->bindValue(13, $accx3_php);
        $stmt->bindValue(14, $accy3_php);
        $stmt->bindValue(15, $accz3_php);
        $stmt->bindValue(16, $gyrx3_php);
        $stmt->bindValue(17, $gyry3_php);
        $stmt->bindValue(18, $gyrz3_php);

        if($stmt->execute()){
            echo "Ingreso Exitoso";
        }else{
            echo "no se pudo registrar datos";
        }
    }
}
?>

```

## ANNEX IV Codi cos pàgina web

```
<!DOCTYPE html>
<html>
<head>
  <meta http-equiv="Content-Type" content="text/html; charset=utf-8">
  <title>Acceleracions</title>
  <style>
    #myFrame { width:100%; height:450px; }
  </style>
</head>
<body>
  <iframe src="grafico_ACC_canell.php" id="myFrame" frameborder="0"></iframe>
  <?php
  ?>
  <br />
  <br />
  <iframe src="grafico_GIR_canell.php" id="myFrame" frameborder="0"></iframe>
  <?php
  ?>
  <br />
  <br />
  <iframe src="grafico_ACC_colze.php" id="myFrame" frameborder="0"></iframe>
  <?php
  ?>
  <br />
  <br />
  <iframe src="grafico_GIR_colze.php" id="myFrame" frameborder="0"></iframe>
  <?php
  ?>
  <br />
  <br />
  <iframe src="grafico_ACC_espatlla.php" id="myFrame" frameborder="0"></iframe>
  <?php
  ?>
  <br />
  <br />
  <iframe src="grafico_GIR_espatlla.php" id="myFrame" frameborder="0"></iframe>
  <?php
  ?>
  <br />

</body>
</html>
```

## ANNEX V Codi connexió base de dades-pàgina web

```
<?php
$connection = mysqli_connect("localhost","root","","tfg");
?>
```

```
<?php
class dbObj{
    /* Comença connexió amb la base de dades */
    var $dbhost = "localhost";
    var $username = "root";
    var $password = "";
    var $dbname = "tfg";
    var $conn;
    function getConnstring() {
        $con = mysqli_connect($this->dbhost, $this->username, $this-
        >password, $this->dbname) or die("Connection failed: " .
        mysqli_connect_error());

        /* Comprova la connexió */
        if (mysqli_connect_errno()) {
            printf("Connect failed: %s\n", mysqli_connect_error());
            exit();
        } else {
            $this->conn = $con;
        }
        return $this->conn;
    }
}
?>
```

## ANNEX VI Codi gràfiques acceleracions lineals

### Canell

```
<?php
require_once("conexion.php");
?>
<!DOCTYPE HTML>
<html>
  <head>
    <meta http-equiv="Content-Type" content="text/html; charset=utf-8">
    <script type="text/javascript">
      setTimeout('document.location.reload()',30000)//especifiquem els milisegons en que la
pàgina es recarga
    </script>
    <title>Highcharts Example</title>

    <script type="text/javascript" src="../resources/jquery.js"></script>
    <style type="text/css">
      ${demo.css}
    </style>
    <script type="text/javascript">
      $(function () {
        $('#container').highcharts({
          title: {
            text: 'Canell',
            x: -20 //center
          },
          subtitle: {
            text: 'Acceleracions',
            x: -20
          },
          xAxis: {
            categories: [
              <?php
                $sql = " select fecha_hora from tabla_sensor order by id desc limit 250 ";
                $result = mysqli_query($connection, $sql);
                while($registros = mysqli_fetch_array($result)){
              ?>
                '<?php echo $registros["fecha_hora"]?>',
              <?php
            ]
          },
          yAxis: {
            title: {
              text: 'm/s^2'
            },
            plotlines: [{
              value: 0,
              width: 1,
              color: '#808080'
            }]
          },
          tooltip: {
            valueSuffix: ''
          },
          legend: {
            layout: 'vertical',
            align: 'right',
            verticalAlign: 'middle',
            borderWidth: 0
          },
          series: [
            {
              name: 'Acc X',
              data: [
                <?php
                  $query = " select Ac_X from tabla_sensor order by id desc limit 250 ";
                  $resultados = mysqli_query($connection, $query);
                  while($rows = mysqli_fetch_array($resultados)){
                ?>
              ]
            }
          ]
        });
      });
    </script>
  </head>
  <body>
    <div id="container">
      <img alt="Highcharts chart showing acceleration data for 'Canell'." data-bbox="142 169 837 912"/>
    </div>
  </body>
</html>
```

```

        <?php echo $rows["Ac_X"]?>,
        <?php
    }
    ?>
    ]
  },
  {
    name: 'Acc Y',
    data: [
      <?php
        $query = " select Ac_Y from tabla_sensor order by id desc limit 250 ";
        $resultados = mysqli_query($connection, $query);
        while($rows = mysqli_fetch_array($resultados)){
          ?>
            <?php echo $rows["Ac_Y"]?>,
            <?php
          }
        ?>
      ]
    },
    {
      name: 'Acc Z',
      data: [
        <?php
          $query = " select Ac_Z from tabla_sensor order by id desc limit 250";
          $resultados = mysqli_query($connection, $query);
          while($rows = mysqli_fetch_array($resultados)){
            ?>
              <?php echo $rows["Ac_Z"]?>,
              <?php
            }
          ?>
        ]
      }
    ]
  });
</script>
</head>
<body>
<script src="../../resources/highcharts.js"></script>
<script src="../../resources/exporting.js"></script>

<div id="container" style="min-width: 310px; height: 400px; margin: 0 auto"></div>

</body>
</html>

```

## Colze

```
<?php
require_once("conexion.php");
?>
<!DOCTYPE HTML>
<html>
  <head>
    <meta http-equiv="Content-Type" content="text/html; charset=utf-8">
    <script type="text/javascript">
      setTimeout('document.location.reload()',30000)
      //especifiquem els milisegons en que la pàgina es recarga
    </script>
    <title>Highcharts Example</title>

    <script type="text/javascript" src="../resources/jquery.js"></script>
    <style type="text/css">
      ${demo.css}
    </style>
    <script type="text/javascript">
      $(function () {
        $('#container').highcharts({
          title: {
            text: 'Colze',
            x: -20 //center
          },
          subtitle: {
            text: 'Acceleracions',
            x: -20
          },
          xAxis: {
            categories: [
              <?php
                $sql = " select fecha_hora from tabla_sensor order by id desc limit 250 ";
                $result = mysqli_query($connection, $sql);
                while($registros = mysqli_fetch_array($result)){
```

```

        ?>
        '<?php echo $registros["fecha_hora"]?>',
        <?php
    }
    ?>
    ]
},
yAxis: {
    title: {
        text: 'm/s^2'
    },
    plotLines: [{
        value: 0,
        width: 1,
        color: '#808080'
    }]
},
tooltip: {
    valueSuffix: ''
},
legend: {
    layout: 'vertical',
    align: 'right',
    verticalAlign: 'middle',
    borderWidth: 0
},
series: [
{
    name: 'Acc X',
    data: [
        <?php
            $query = " select Ac_X_2 from tabla_sensor order by id desc limit 250 ";
            $resultados = mysqli_query($connection, $query);
            while($rows = mysqli_fetch_array($resultados)){
                ?>

```

```
        <?php echo $rows["Ac_X_2"]?>,<br>
    <?php<br>
    }<br>
    ?><br>
    ]<br>
},<br>
{ name: 'Acc Y',<br>
  data: [<br>
    <?php<br>
    $query = " select Ac_Y_2 from tabla_sensor order by id desc limit 250 ";<br>
    $resultados = mysqli_query($connection, $query);<br>
    while($rows = mysqli_fetch_array($resultados)){<br>
        ?><br>
        <?php echo $rows["Ac_Y_2"]?>,<br>
        <?php<br>
        }<br>
    ?><br>
    ]<br>
},<br>
{ name: 'Acc Z',<br>
  data: [<br>
    <?php<br>
    $query = " select Ac_Z_2 from tabla_sensor order by id desc limit 250";<br>
    $resultados = mysqli_query($connection, $query);<br>
    while($rows = mysqli_fetch_array($resultados)){<br>
        ?><br>
        <?php echo $rows["Ac_Z_2"]?>,<br>
        <?php<br>
        }<br>
    ?><br>
    ]<br>
}<br>
];<br>
});<br>
</script><br>
</head><br>
<body><br>
<script src="../resources/highcharts.js"></script><br>
<script src="../resources/exporting.js"></script><br>
<div id="container" style="min-width: 310px; height: 400px; margin: 0 auto"></div>
</body>
</html>
```



## Espatlla

```

<?php
require_once("conexion.php");
?>
<!DOCTYPE HTML>
<html>
  <head>
    <meta http-equiv="Content-Type" content="text/html; charset=utf-8">
    <script type="text/javascript">
      setTimeout('document.location.reload()',30000)
      //especifiquem els milisegons en que la pàgina es recarga
    </script>
    <title>Highcharts Example</title>

    <script type="text/javascript" src="../resources/jquery.js"></script>
    <style type="text/css">
      ${demo.css}
    </style>
    <script type="text/javascript">
      $(function () {
        $('#container').highcharts({
          title: {
            text: 'Espatlla',
            x: -20 //center
          },
          subtitle: {
            text: 'Acceleracions',
            x: -20
          },
          xAxis: {
            categories: [
              <?php
                $sql = " select fecha_hora from tabla_sensor order by id desc limit 250 ";
                $result = mysqli_query($connection, $sql);
                while($registros = mysqli_fetch_array($result)){
                  ?>
                    '<?php echo $registros["fecha_hora"]?>',
                  <?php
                }
              ?>
            ]
          },
          yAxis: {
            title: {
              text: 'm/s^2'
            },
            plotLines: [{
              value: 0,
              width: 1,
              color: '#808080'
            }]
          },
          tooltip: {
            valueSuffix: ''
          },
          legend: {
            layout: 'vertical',
            align: 'right',
            verticalAlign: 'middle',
            borderWidth: 0
          },
          series: [
            { name: 'Acc X',
              data: [
                <?php
                  $query = " select Ac_X_3 from tabla_sensor order by id desc limit 250 ";
                  $resultados = mysqli_query($connection, $query);
                  while($rows = mysqli_fetch_array($resultados)){
                    ?>

```

```
        <?php echo $rows["Ac_X_3"]?>,
        <?php
    }
    ?>
    ]
},
{
    name: 'Acc Y',
    data: [
        <?php
            $query = " select Ac_Y_3 from tabla_sensor order by id desc limit 250 ";
            $resultados = mysqli_query($connection, $query);
            while($rows = mysqli_fetch_array($resultados)){
                ?>
                <?php echo $rows["Ac_Y_3"]?>,
                <?php
            }
        ?>
    ]
},
{
    name: 'Acc Z',
    data: [
        <?php
            $query = " select Ac_Z_3 from tabla_sensor order by id desc limit 250";
            $resultados = mysqli_query($connection, $query);
            while($rows = mysqli_fetch_array($resultados)){
                ?>
                <?php echo $rows["Ac_Z_3"]?>,
                <?php
            }
        ?>
    ]
}
    ]
});
</script>
</head>
<body>
<script src="../../resources/highcharts.js"></script>
<script src="../../resources/exporting.js"></script>

<div id="container" style="min-width: 310px; height: 400px; margin: 0 auto"></div>

</body>
</html>
```

## ANNEX VII Codi gràfiques acceleracions angulars

### Canell

```

<?php
require_once("conexion.php");
?>
<!DOCTYPE HTML>
<html>
  <head>
    <meta http-equiv="Content-Type" content="text/html; charset=utf-8">
    <script type="text/javascript">
      setTimeout('document.location.reload()',30000)
      //especifiquem els milisegons en que la pàgina es recarga
    </script>
    <title>Highcharts Example</title>

    <script type="text/javascript" src="../resources/jquery.js"></script>
    <style type="text/css">
    ${demo.css}
    </style>
    <script type="text/javascript">
$(function () {
  $('#container').highcharts({
    title: {
      text: 'Canell',
      x: -20 //center
    },
    subtitle: {
      text: 'Acceleracions angulars',
      x: -20
    },
    xAxis: {
      categories: [
        <?php
          $sql = " select fecha_hora from tabla_sensor order by id desc limit 250 ";
          $result = mysqli_query($connection, $sql);
          while($registros = mysqli_fetch_array($result)){
            ?>
              '<?php echo $registros["fecha_hora"]?>',
            <?php
          }
        ?>
      ]
    },
    yAxis: {
      title: {
        text: 'graus/s'
      },
      plotLines: [{
        value: 0,
        width: 1,
        color: '#808080'
      }]
    },
    tooltip: {
      valueSuffix: ''
    },
    legend: {
      layout: 'vertical',
      align: 'right',
      verticalAlign: 'middle',
      borderWidth: 0
    },
    series: [
      { name: 'Acceleracio Angular X',
        data: [
          <?php
            $query = " select Gir_X from tabla_sensor order by id desc limit 250 ";
            $resultados = mysqli_query($connection, $query);
            while($rows = mysqli_fetch_array($resultados)){
              ?>

```

```
                <?php echo $rows["Gir_X"]?>,<br>
            <?php<br>
        }<br>
    ?>]<br>
},<br>
{ name: 'Acceleracio Angular Y',<br>
  data: [<br>
    <?php<br>
    $query = " select Gir_Y from tabla_sensor order by id desc limit 250";<br>
    $resultados = mysqli_query($connection, $query);<br>
    while($rows = mysqli_fetch_array($resultados)){<br>
        ?><br>
        <?php echo $rows["Gir_Y"]?>,<br>
        <?php<br>
    }<br>
    ?>]<br>
},<br>
{ name: 'Acceleracio Angular Z',<br>
  data: [<br>
    <?php<br>
    $query = " select Gir_Z from tabla_sensor order by id desc limit 250";<br>
    $resultados = mysqli_query($connection, $query);<br>
    while($rows = mysqli_fetch_array($resultados)){<br>
        ?><br>
        <?php echo $rows["Gir_Z"]?>,<br>
        <?php<br>
    }<br>
    ?>]<br>
    }<br>
  ]<br>
});<br>
</script><br>
</head><br>
<body><br>
<script src="../../resources/highcharts.js"></script><br>
<script src="../../resources/exporting.js"></script><br>
<div id="container" style="min-width: 310px; height: 400px; margin: 0 auto"></div>
</body>
</html>
```

## Colze

```

<?php
require_once("conexion.php");
?>
<!DOCTYPE HTML>
<html>
  <head>
    <meta http-equiv="Content-Type" content="text/html; charset=utf-8">
    <script type="text/javascript">
      setTimeout('document.location.reload()',30000)
      //especifiquem els milisegons en que la pàgina es recarga
    </script>
    <title>Highcharts Example</title>

    <script type="text/javascript" src="../resources/jquery.js"></script>
    <style type="text/css">
      ${demo.css}
    </style>
    <script type="text/javascript">
$(function () {
  $('#container').highcharts({
    title: {
      text: 'Colze',
      x: -20 //center
    },
    subtitle: {
      text: 'Acceleracions angulars',
      x: -20
    },
    xAxis: {
      categories: [
        <?php
          $sql = " select fecha_hora from tabla_sensor order by id desc limit 250 ";
          $result = mysqli_query($connection, $sql);
          while($registros = mysqli_fetch_array($result)){
            ?>
              '<?php echo $registros["fecha_hora"]?>',
            <?php
          }
        ?>
      ]
    },
    yAxis: {
      title: {
        text: 'graus/s'
      },
      plotLines: [{
        value: 0,
        width: 1,
        color: '#808080'
      }]
    },
    tooltip: {
      valueSuffix: ''
    },
    legend: {
      layout: 'vertical',
      align: 'right',
      verticalAlign: 'middle',
      borderWidth: 0
    },
    series: [
      { name: 'Acceleracio Angular X',
        data: [
          <?php
            $query = " select Gir_X_2 from tabla_sensor order by id desc limit 250 ";
            $resultados = mysqli_query($connection, $query);
            while($rows = mysqli_fetch_array($resultados)){
              ?>

```

```
        <?php echo $rows["Gir_X_2"]?>,
    <?php
    }
    ?>]
},
{
    name: 'Acceleracio Angular Y',
    data: [
    <?php
        $query = " select Gir_Y_2 from tabla_sensor order by id desc limit 250";
        $resultados = mysqli_query($connection, $query);
        while($rows = mysqli_fetch_array($resultados)){
            ?>
                <?php echo $rows["Gir_Y_2"]?>,
            <?php
            }
        ?>]
},
{
    name: 'Acceleracio Angular Z',
    data: [
    <?php
        $query = " select Gir_Z_2 from tabla_sensor order by id desc limit 250";
        $resultados = mysqli_query($connection, $query);
        while($rows = mysqli_fetch_array($resultados)){
            ?>
                <?php echo $rows["Gir_Z_2"]?>,
            <?php
            }
        ?>]
    ]
}
]);
</script>
</head>
<body>
<script src="../../resources/highcharts.js"></script>
<script src="../../resources/exporting.js"></script>

<div id="container" style="min-width: 310px; height: 400px; margin: 0 auto"></div>

</body>
</html>
```

## Espatlla

```

<?php
require_once("conexion.php");
?>
<!DOCTYPE HTML>
<html>
  <head>
    <meta http-equiv="Content-Type" content="text/html; charset=utf-8">
    <script type="text/javascript">
      setTimeout('document.location.reload()',30000)
      //especificuem els milisegons en que la pàgina es recarga
    </script>
    <title>Highcharts Example</title>

    <script type="text/javascript" src="../resources/jquery.js"></script>
    <style type="text/css">
      ${demo.css}
    </style>
    <script type="text/javascript">
$(function () {
  $('#container').highcharts({
    title: {
      text: 'Colze',
      x: -20 //center
    },
    subtitle: {
      text: 'Acceleracions angulars',
      x: -20
    },
    xAxis: {
      categories: [
        <?php
          $sql = " select fecha_hora from tabla_sensor order by id desc limit 250 ";
          $result = mysqli_query($connection, $sql);
          while($registros = mysqli_fetch_array($result)){
            ?>
              '<?php echo $registros["fecha_hora"]?>',
            <?php
          }
        ?>
      ]
    },
    yAxis: {
      title: {
        text: 'graus/s'
      },
      plotlines: [{
        value: 0,
        width: 1,
        color: '#808080'
      }]
    },
    tooltip: {
      valueSuffix: ''
    },
    legend: {
      layout: 'vertical',
      align: 'right',
      verticalAlign: 'middle',
      borderWidth: 0
    },
    series: [
      { name: 'Acceleracio Angular X',
        data: [
          <?php
            $query = " select Gir_X_2 from tabla_sensor order by id desc limit 250 ";
            $resultados = mysqli_query($connection, $query);
            while($rows = mysqli_fetch_array($resultados)){
              ?>

```

```
        <?php echo $rows["Gir_X_2"]?>,
    <?php
    }
    ?>]
},
{
    name: 'Acceleracio Angular Y',
    data: [
    <?php
        $query = " select Gir_Y_2 from tabla_sensor order by id desc limit 250";
        $resultados = mysqli_query($connection, $query);
        while($rows = mysqli_fetch_array($resultados)){
            ?>
            <?php echo $rows["Gir_Y_2"]?>,
            <?php
            }
            ?>]
},
{
    name: 'Acceleracio Angular Z',
    data: [
    <?php
        $query = " select Gir_Z_2 from tabla_sensor order by id desc limit 250";
        $resultados = mysqli_query($connection, $query);
        while($rows = mysqli_fetch_array($resultados)){
            ?>
            <?php echo $rows["Gir_Z_2"]?>,
            <?php
            }
            ?>]
    }
    ]
});
</script>
</head>
<body>
<script src="../../resources/highcharts.js"></script>
<script src="../../resources/exporting.js"></script>

<div id="container" style="min-width: 310px; height: 400px; margin: 0 auto"></div>

</body>
</html>
```