DataBase Assignment

NAME   Jair Pacheco   DATE: 10/14/2025

This project must be done individually!

Link to this document:
https://docs.google.com/document/d/1zhLaeiWjtqfpCTeJzd_n543yl6_SxahBxWd4IHh4srY/edit?usp=sharing

Please make sure you submit your assignment individually!

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DataBase Assignment

Assignment Overview

The purpose of this exercise is to become familiar with MySQL database and its commands.

1. Learning Objectives

- Set Up an online web page
- Learn about SQL
- Practice SQL commands
- Create a Table for sensor data
- Using Github.

2. Required Materials & Reference Information

- Signup for https://hostinger.com
- database tutorial available on the course GitHub
- Tutorial on creating an account with hostinger.com
- You can find the longitude and latitude format here
- Good tutorial: https://www.tutorialspoint.com/mariadb/mariadb_introduction.htm

3. Experiment

This experiment has TWO parts.

Part 1:
In this part of the experiment you need to signup for an account at https://hostinger.com
This will allow you to have your personal web page and database.

Part 2:
In the second part of the experiment you will need to access the database using a PHP file and visualize the data using the Chartjs library.

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PART 2

Before attempting this part make sure you review the lecture slides. Also, make sure you have downloaded the Chartjs from the course GitHub site (https://github.com/faridfarahmand/SSU/tree/main/IoTCourse/Chartjs).

All files must be placed on hostinger.com. For faster interaction with the host, use FTP (e.g., Filezilla) to upload your files.

1- Connect and Display Using PHP

In this section we are using your sensor_data and sensor_resister tables that you created in PART 1.

Write a PHP program that accesses your sensor_data and sensor_resister tables and displays the values in two separate tables similar to the figure below. **Note that your colors, background, and page format can be different. However, all the values in the database must be clearly displayed.** When displaying the values, all displayed values must be sorted by Node Name and then Time.

Welcome to SSU IoT Lab

Registered Sensor Nodes

Name	Manufacturer	etc....
Value 1	Value 2	Value 3
Value 4	Value 5	Value 6
Value 7	Value 8	Value 9
Value 10	Value 11	Value 12

Data Received

Node	Time	....
Value 1	Value 2	Value 3
Value 4	Value 5	Value 6
Value 7	Value 8	Value 9
Value 10	Value 11	Value 12

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```php
<?php
// Database connection settings
$host = 'localhost';
$dbname = 'u997870193_jairpacheco';
$username = 'u997870193_db_jairpacheco';
$password = 'Jairpacheco6075';

$conn = new mysqli($host, $username, $password, $dbname);
if ($conn->connect_error) {
    die("Connection failed: " . $conn->connect_error);
}

// Queries
$sensorDataQuery = "SELECT node_name, time_received, temperature, humidity FROM
sensor_data ORDER BY node_name ASC, time_received ASC";
$sensorRegisterQuery = "SELECT node_name, manufacturer, longitude, latitude FROM
sensor_register ORDER BY node_name ASC";

$sensorDataResult = $conn->query($sensorDataQuery);
$sensorRegisterResult = $conn->query($sensorRegisterQuery);
?>

<!DOCTYPE html>
<html>
<head>
  <title>Sensor Overview</title>
  <style>
     h1 {
        color: #3b5e34;
     }
     body {
        font-family: Arial, sans-serif;
        background-color: #eef2f5;
        padding: 20px;
     }
     h2 {
        color: #3b5e34;
     }
     table {
        border-collapse: collapse;
        width: 100%;
        margin-bottom: 40px;
     }
     th, td {
        border: 1px solid #bbb;
        padding: 10px;
        text-align: left;
     }
```

```
    th {
        background-color: #345e3e;
        color: white;
    }
    tr:nth-child(even) {
        background-color: #f9fcff;
    }
    </style>
</head>
<body>
<h1>Jair's Sensor Data Tables</h1>
<h2>Sensor Data Table</h2>
<table>
    <tr>
        <th>Node Name</th>
        <th>Time Received</th>
        <th>Temperature</th>
        <th>Humidity</th>
    </tr>
    <?php
    if ($sensorDataResult->num_rows > 0) {
        while ($row = $sensorDataResult->fetch_assoc()) {
            echo "<tr>";
            echo "<td>" . htmlspecialchars($row['node_name']) . "</td>";
            echo "<td>" . htmlspecialchars($row['time_received']) . "</td>";
            echo "<td>" . htmlspecialchars($row['temperature']) . "</td>";
            echo "<td>" . htmlspecialchars($row['humidity']) . "</td>";
            echo "</tr>";
        }
    } else {
        echo "<tr><td colspan='4'>No sensor data found.</td></tr>";
    }
    ?>
</table>

<h2>Sensor Register Table</h2>
<table>
    <tr>
        <th>Node Name</th>
        <th>Manufacturer</th>
        <th>Longitude</th>
        <th>Latitude</th>
    </tr>
    <?php
    if ($sensorRegisterResult->num_rows > 0) {
        while ($row = $sensorRegisterResult->fetch_assoc()) {
            echo "<tr>";
            echo "<td>" . htmlspecialchars($row['node_name']) . "</td>";
            echo "<td>" . htmlspecialchars($row['manufacturer']) . "</td>";
```

```php
            echo "<td>" . htmlspecialchars($row['longitude']) . "</td>";
            echo "<td>" . htmlspecialchars($row['latitude']) . "</td>";
            echo "</tr>";
        }
    } else {
        echo "<tr><td colspan='4'>No sensor register data found.</td></tr>";
    }
    ?>
</table>

</body>
</html>

<?php
$conn->close();
?>
```

Show your PHP Code.

Jair's Sensor Data Tables

Sensor Data Table

Node Name	Time Received	Temperature	Humidity
node-1	2022-10-01 11:00:00	84	25
node-1	2022-10-01 11:30:00	88	24
node-1	2022-10-01 12:00:00	94	23
node-1	2022-10-01 12:30:00	90	20
node-1	2025-10-09 05:12:00	75	30
node-1	2025-10-09 05:15:00	75	30
node-2	2022-10-01 11:00:00	30	25
node-2	2022-10-01 11:30:00	38	30
node-2	2022-10-01 12:00:00	44	28
node-2	2022-10-01 12:30:00	49	30
node-3	2022-10-01 11:00:00	69	20
node-3	2022-10-01 11:30:00	72	23
node-3	2022-10-01 12:00:00	76	22
node-3	2022-10-01 12:30:00	74	21
node-4	2022-10-01 11:00:00	0	10
node-4	2022-10-01 11:30:00	-2	7
node-4	2022-10-01 12:00:00	3	9

Snapshot of your website

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https://jairpacheco.com/sensordata.php
Link to your website

2- Insert Data

Modify your PHP file such that every time the page is displayed you also get an average of all the values that are in the database for one of the nodes. Choose any node you like. One will be sufficient, In this case, I am choosing Node 1.

Data Received

Node	Time	....
Value 1	Value 2	Value 3
Value 4	Value 5	Value 6
Value 7	Value 8	Value 9
Value 10	Value 11	Value 12

The Average Temperature for node 1 has been: 45 F
The Average Humidity for node 1 has been: 22 %

node-2	2022-10-01 11:30:00	38	30
node-2	2022-10-01 12:00:00	44	28
node-2	2022-10-01 12:30:00	49	30
node-3	2022-10-01 11:00:00	69	20
node-3	2022-10-01 11:30:00	72	23
node-3	2022-10-01 12:00:00	76	22
node-3	2022-10-01 12:30:00	74	21
node-4	2022-10-01 11:00:00	0	10
node-4	2022-10-01 11:30:00	-2	7
node-4	2022-10-01 12:00:00	3	9
node-4	2022-10-01 12:30:00	8	11
node-5	2022-10-01 11:00:00	75	30
node-5	2022-10-01 11:30:00	80	28
node-5	2022-10-01 12:00:00	84	24
node-5	2022-10-01 12:30:00	89	27

Average temperature (Node-1): 84.33 F
Average Humidity (Node-1): 25.33 %

Sensor Register Table

Node Name	Manufacturer	Longitude	Latitude
node-1	sysben	-100.000052	25.256789
node-2	tomtech	-170.010927	73.251709

Snapshot of your page with average.

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EE 470 - Introduction to the Internet of Things- Fall 2024 / Version: V2

Insert data into your database by using the GET method. You can use your browser and use something like this:
https://ff.net/firstphp_db_insert.php?nodeId=node_3&timeReceived=12-2-2024 12:00:32&nodeTemp=34 (not a working link - just an example; see the lecture for more information)

Make sure the data is accepted.

```
Windows PowerShell                                                          —  □  ✕
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

Install the latest PowerShell for new features and improvements! https://aka.ms/PSWindows

PS C:\Users\jairp> curl "https://jairpacheco.com/sensordata_dBInsert.php?node_name=node-3&temperature=34&humidity=45"


StatusCode        : 200
StatusDescription : OK
Content           : Data inserted successfully.
RawContent        : HTTP/1.1 200 OK
                    Connection: Keep-Alive
                    Keep-Alive: timeout=5, max=100
                    platform: hostinger
                    panel: hpanel
                    Content-Security-Policy: upgrade-insecure-requests
                    alt-svc: h3=":443"; ma=2592000, h3-29="...
Forms             : {}
Headers           : {[Connection, Keep-Alive], [Keep-Alive, timeout=5, max=100], [platform, hostinger], [panel,
                    hpanel]...}
Images            : {}
InputFields       : {}
Links             : {}
ParsedHtml        : mshtml.HTMLDocumentClass
RawContentLength  : 27


PS C:\Users\jairp>
```

node-3	2022-10-01 11:00:00	69	20
node-3	2022-10-01 11:30:00	72	23
node-3	2022-10-01 12:00:00	76	22
node-3	2022-10-01 12:30:00	74	21
node-3	2025-10-14 07:34:11	34	45

Important requirements:
1. You can have multiple entries for each registered node.
2. If a node is not registered no new data should be received.
3. No duplicate date for the same node must be accepted to the database.
4. When displaying the values, data entries must be sorted according to the node's name.
5. If the values are not within the accepted range the data must not be accepted. See Section 1.2 regarding the data constraints.
6. If the time is not included in the URL it must automatically be time stamped by the database.

DataBase Assignment

Insert data into your database by using the GET method. You can use your browser and use something like this:
https://ff.net/firstphp_db_insert.php?nodeId=node_3&timeReceived=12-2-2024 12:00:32&nodeTemp=34 (not a working link - just an example; see the lecture for more information)

Make sure the data is accepted.

```
Windows PowerShell                                                          —  □  ✕
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

Install the latest PowerShell for new features and improvements! https://aka.ms/PSWindows

PS C:\Users\jairp> curl "https://jairpacheco.com/sensordata_dBInsert.php?node_name=node-3&temperature=34&humidity=45"


StatusCode        : 200
StatusDescription : OK
Content           : Data inserted successfully.
RawContent        : HTTP/1.1 200 OK
                    Connection: Keep-Alive
                    Keep-Alive: timeout=5, max=100
                    platform: hostinger
                    panel: hpanel
                    Content-Security-Policy: upgrade-insecure-requests
                    alt-svc: h3=":443"; ma=2592000, h3-29="...
Forms             : {}
Headers           : {[Connection, Keep-Alive], [Keep-Alive, timeout=5, max=100], [platform, hostinger], [panel,
                    hpanel]...}
Images            : {}
InputFields       : {}
Links             : {}
ParsedHtml        : mshtml.HTMLDocumentClass
RawContentLength  : 27


PS C:\Users\jairp>
```

node-3	2022-10-01 11:00:00	69	20
node-3	2022-10-01 11:30:00	72	23
node-3	2022-10-01 12:00:00	76	22
node-3	2022-10-01 12:30:00	74	21
node-3	2025-10-14 07:34:11	34	45

Important requirements:
1. You can have multiple entries for each registered node.
2. If a node is not registered no new data should be received.
3. No duplicate date for the same node must be accepted to the database.
4. When displaying the values, data entries must be sorted according to the node's name.
5. If the values are not within the accepted range the data must not be accepted. See Section 1.2 regarding the data constraints.
6. If the time is not included in the URL it must automatically be time stamped by the database.

7. 5- Using CURL command you should be able to send data to your database. For example: `curl`

https://crcampbell.net/PHPCRUD/db_insert.php?node_name=node-1&time_received=2024-10-01%201:40:00&temperature=1&humidity=1

curl
"https://jairpacheco.com/sensordata_dBInsert.php?node_name=node-3&temperature=3000&humidity=25&time_received=2022-10-01%2015:00:00"

2.1 Using POSTMAN

POSTMAN is a great tool to execute different methods of HTTP (GET, PUT, POST, etc.). Let's use POSTMAN to inject data into our database.

Download POSTMAN (https://www.postman.com/downloads/). Using GET method send data to your server.

Answer the following questions:

1- Do you see the returned data? Y/N?

Yes you can

2- Can you use POST to send the data? Y/N?

Yes you can

3- Can you use PUT to send the data? Y/N?

Yes you can

4- Using POST method select HEADER and then CODE. Can you see the Header Request sent to the Server? Take a snapshot of the header.

```
POST /sensordata_dBInsert.php?node_name=node-2&temperature=34&humidity=45&time_received=2025-10-14%2000:44:00 HTTP/1.1
User-Agent: PostmanRuntime/7.48.0
Accept: */*
Postman-Token: 779169c8-b370-48f4-af10-5a09b0d9e764
Host: jairpacheco.com
Accept-Encoding: gzip, deflate, br
Connection: keep-alive
Content-Length: 0

HTTP/1.1 200 OK
Connection: Keep-Alive
Keep-Alive: timeout=5, max=100
X-Powered-By: PHP/8.2.29
Content-Type: text/html; charset=UTF-8
Content-Length: 31
Content-Encoding: br
Vary: Accept-Encoding
Date: Tue, 14 Oct 2025 08:12:50 GMT
Server: LiteSpeed
platform: hostinger
panel: hpanel
Content-Security-Policy: upgrade-insecure-requests
alt-svc: h3=":443"; ma=2592000, h3-29=":443"; ma=2592000, h3-Q050=":443"; ma=2592000, h3-Q046=":443"; ma=2592000, h3-Q043=":443"; ma=2592000, quic=":443"; ma=2592000; v="43,46"
```

Snapshot of the post.

5- How long did it take to send your request and get a response to/from the database?

Your Answer: 318 (ms)

3- Plot Data

In this section we would like to plot the data from the database. Before attempting this part make sure you review the lecture slides. Also, make sure you have downloaded the Chartjs from the course GitHub site (https://github.com/faridfarahmand/SSU/tree/main/IoTCourse/Chartjs).

Plot the data for **only one of your sensors**. The x-axis must be time and the y-axis must represent the temperature. Note that the tile of your graph must be Sensor Node …., as shown below.
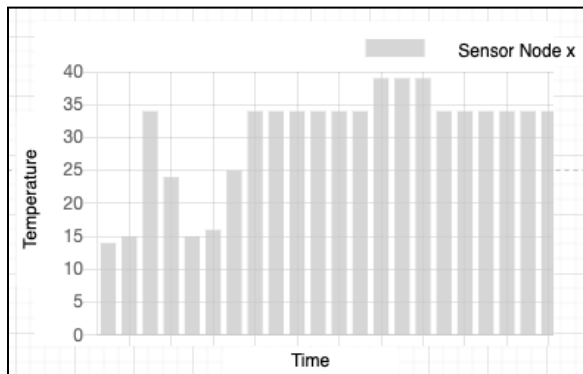
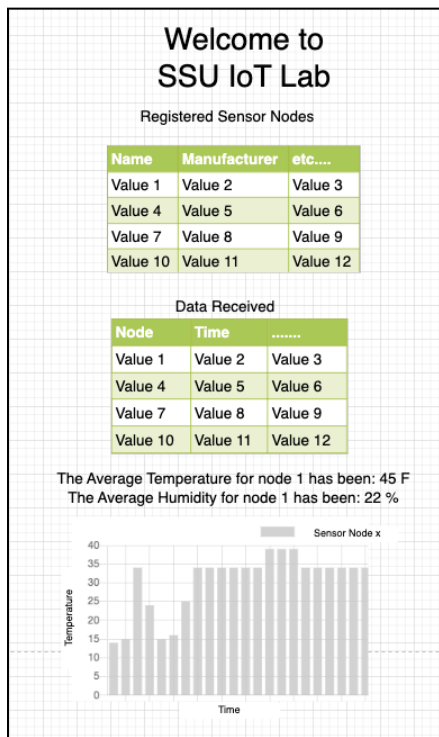Add the new graph to your original webpage:

Read the comments in app.js file. Answer the following questions.

1- How can you change the bar graph to a line graph? What did you change?

YOUR ANSWER:

```
 var barGraph = new Chart(ctx, {
      type: 'line',   //Chart Type
      data: chartdata
    });
```

I would just make it say line instead of bar.

2- Change the graph such that it is GREEN. You can use the rgbs color scheme here: https://rgbacolorpicker.com/. What did you change?

YOUR ANSWER:

You would change the rgba lines to say
rgba(22, 255, 69, 0.87);

3- Show one of your node's data in JSON format.

{

```
  "node_name": "node-1",
  "readings": [
    {
      "time_received": "2022-10-01 11:00:00",
      "temperature": 84,
      "humidity": 25
    },
    {
      "time_received": "2022-10-01 11:30:00",
      "temperature": 88,
      "humidity": 24
    },
    {
      "time_received": "2022-10-01 12:00:00",
      "temperature": 94,
      "humidity": 23
    },
    {
      "time_received": "2022-10-01 12:30:00",
      "temperature": 90,
      "humidity": 20
    },
    {
      "time_received": "2025-10-09 05:12:00",
      "temperature": 75,
      "humidity": 30
    },
    {
      "time_received": "2025-10-09 05:15:00",
      "temperature": 75,
      "humidity": 30
    }
  ]
}
```

Node 1 data in JSON format

4- Encryption

Change your PHP program in the previous section such that the program receives a BASE64 encoded message and then it should be able to parse it correctly. For example, you should be able to send the following message and your program must parse correctly and enter the appropriate values in the database.

https://faridfarahmand.net/PHPCRUD/firstphp_db_insert.php?bm9kZUlkPW5vZGVfMyZub2RllVGVtcD0zNCZ0aW1lUmVjZWl2ZWQ9MjAyMi0xMC0wMSUyMDEwOjI1OjAx

Results:

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nodeId=node_3
nodeTemp=34
timeReceived=2022-10-0 2010:25:01

Note: You must include Time as part of the URL!

https://jairpacheco.com/sensordata.php
Link to your page

https://jairpacheco.com/sensordata_dBInsert.php?bm9kZV9uYW1lPW5vZGUtNCZ0ZW1wZXJhdHVyZT0yNyZodW1pZGl0eT0yNSZ0aW1lIX3JlY2VpdmVkPTIwMjQtMTAtMDElMjAxNTowMDowMA==
Sample URL with encoded parameters and the displayed variables on the browser

```
17    // Extract and decode raw BASE64 query string
18    $params = [];
19    $query = $_SERVER['QUERY_STRING'] ?? '';
20
21    function isBase64($string) {
22        $decoded = base64_decode($string, true);
23        return $decoded !== false && base64_encode($decoded) === $string;
24    }
25
26    if (!empty($query) && isBase64($query)) {
27        $decoded = urldecode(base64_decode($query));
28        parse_str($decoded, $params);
29    } else {
30        parse_str($query, $params); // fallback to plain query string
31    }
```

Show your BASE64 decoding code in the PHP file.

https://github.com/J-PachEE/SSU_EE/blob/main/EE470/hwAssignments/sensordata.php https://github.com/J-PachEE/SSU_EE/blob/main/EE470/hwAssignments/sensordata_dBInsert.php
Place all your codes on your GITHUB page and add the link here.

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EE 470 - Introduction to the Internet of Things- Fall 2024 / Version: V2

NOTE: All projects must be shown in class! If you cannot demonstrate your project, you do not receive a grade!

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5- Demonstration Requirements

Your demonstration will be assessed based on the following.

1. When correct data is inserted the values must be inserted into the database, displayed on the table in a sorted way (sorted by name name and then time) and then plotted properly.
   https://ff.net/firstphp_db_insert.php?nodeId=node_3&timeReceived=12-2-2024 12:00:32&nodeTemp=34
2. For the purpose of the demonstration, the microcontroller should always send the time.
   a. If there is no time in the URL, the received data must be automatically time stamped: https://ff.net/firstphp_db_insert.php?nodeId=node_3&nodeTemp=34
3. If the URL includes a node that is not registered the database, plot, and table must not be updated.
4. If the URL includes values that are out of range then the database, plot, and table must not be updated.
5. Make sure you can register a new node and then it will accept new data from the URL.
6. Make sure you can send data using CURL command from the terminal
7. **Make sure you can clearly explain how your code works! You will not receive a grade if you cannot clearly explain how your code operates! Review your code before demonstrating.**

6. Conclusions

In two-three paragraphs in your own words explain what you learned in this activity. What was interesting?

I learned about how to configure a website in order to access and update dynamically with database values. I also learned about how to send data using a link to a website, I never knew how that worked before. I had some issues trying to get the graph to work but now that it's done, it is very cool seeing how it all updates.

I liked knowing about how the encryption works but I can't say that I liked adding that feature to my code. It was kind of annoying but now I can do either the initial method or the encrypted one. Postman is now a cool new app I can use and I'm surprised ive never heard of it because it provides a lot of cool information that makes running and resending data way easier. Also it gave me a refresher as to what each part of CRUD does.

https://jairpacheco.com/sensordata_dBInsert.php?node_name=node-1&temperature=40&humidity=35&time_received=2026-10-01%2019:00:00

You may be asked to demonstrate your setup and explain how the protocol analyzer operates.

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7. Quick Survey

1. How much time did you spend completing this activity?	☐ Less than 1 hour ☐ 1–2 hours ☐ 2–3 hours X More than 3 hours
2. On a scale of 1–10, how much did you learn from this activity?	(1 = very little, 10 = learned a lot) ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 x 9 ☐ 10

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Appendix A

Welcome to SSU IoT Lab

Registered Sensor Nodes

node_name	manufacturer	longitude	altitude
node_1	google	50.726024000000	-6.619468000000
node_2	amazon	51.607783000000	59.869286000000

Data Received

node_name	time_received	temperature	humid
node_1	2022-10-03 11:11:20	40	50
node_2	2022-10-02 11:11:11	30	80
node_1	2022-10-04 11:11:11	44	70
node_1	2022-10-05 10:05:33	34	40
node_2	2022-10-17 10:45:33	38	70
node_1	2022-10-22 02:05:03	34	66
node_2	2022-10-22 02:05:03	34	66
node_1	2022-10-23 02:05:03	45	66
node_1	2022-10-22 11:11:11	44	60
node_1	2022-10-23 11:11:23	50	50
node_2	2022-10-23 11:11:23	50	50
node_2	2022-10-23 11:11:23	20	70
node_2	2022-10-23 09:00:00	26	76

The Average Temperature for node_1 has been: 41.57142857142857F
The Average Humidity for node_1 has been: 57.42857142857143%