FERMILAB-POSTER-23-252-STUDENT

Quantum Computing – Real-Time Data Processing from a Dilution Refrigerator

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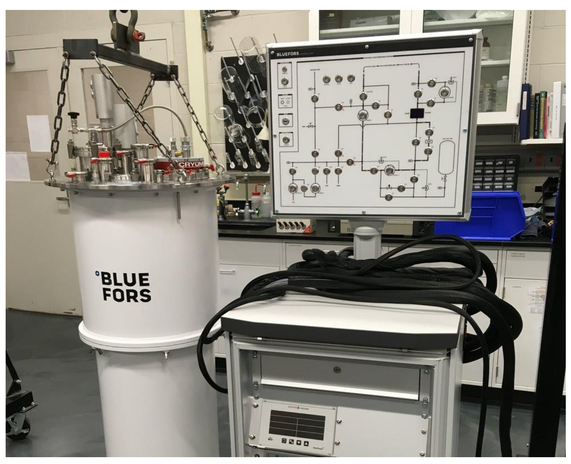
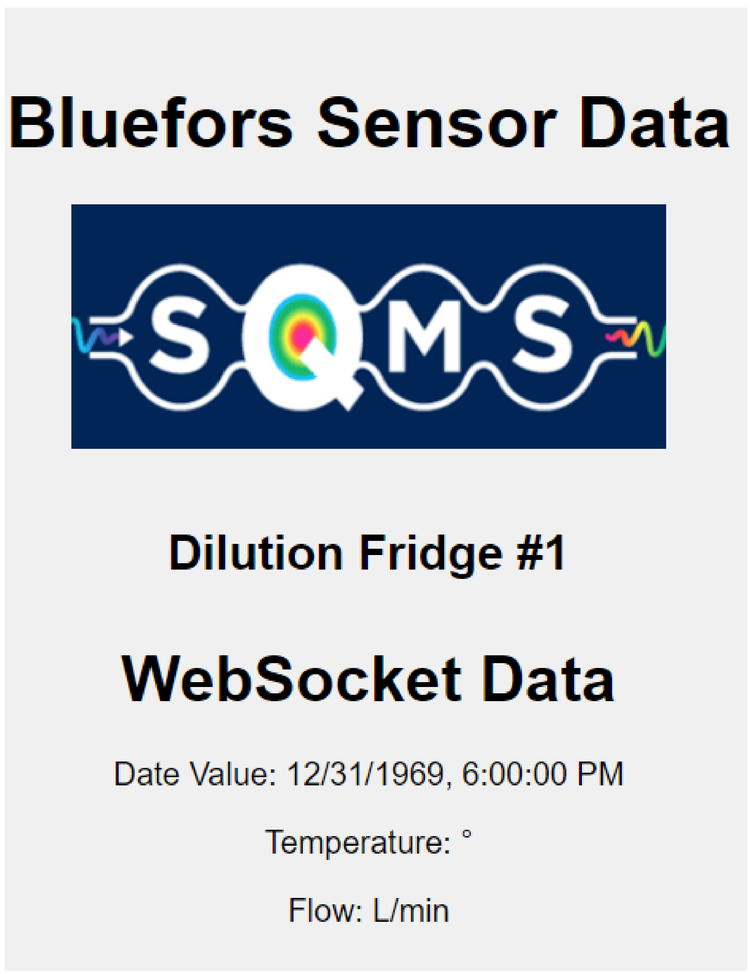
Overview of Project

- Stream data from the Bluefors Control unit to access physical quantities, such as temperature and helium flow, of the system at different points in the fridge
- Display these values, which are continuously updated, on a monitor with an aesthetic webpage
- Incorporate numerous connections of the dilution refrigerators into the WebSocket server



Bluefors Control Unit that monitors various temperatures, pressure, flow, etc., inside a dilution refrigerator.
(https://www.hybridquantumlab.com/new-blog/2019/1/3/santa-brings-lhqs-new-ld400)

The inside of dilution refrigerator that provides continuous cooling to temperatures as low as 2 mK
(https://bluefors.com/products/ld-dilution-refrigerator/)



Sample output of data exported from the Bluefors Control Unit

Note:Values are not displayed as the Bluefors Control Unit isn't on

- Prints the date, time, temperature and flow on the webpage
- Features a visually appealing and professionally designed user interface
- It is possible to add more refrigerators with similar layout

```
    if status == "SUCCEEDED":
        value = parsed_data['data']['mapper.bf.flow']['content']['latest_value']['date']
        value = str(value)
        #print(value)
        return value
    elif status == "RECEIVED":
        #print("")
        return 0

async def send_values(websocket, path):
    while True:
        if values:
            value = values.pop(0)
            await websocket.send(value)
        await asyncio.sleep(1)  # Wait for 1 second before sending the next value

async def main():
    # Start the WebSocket server to receive data
    receive_task = asyncio.create_task(receive_data())

    # Start the WebSocket server to send values
    server_uri = ""  # Update with your desired server address
    server_port = 8000  # Update with your desired server port
    async with websockets.serve(send_values, server_uri, server_port):
        print(f"WebSocket server started at ws://{server_uri}:{server_port}")
```

Python Script

- Creates a WebSocket server to establish real-time communication between the Bluefors Control Unit and the client computer
- Server receives live data from the Bluefors Unit, such as temperature and pressure readings, and parses it
- Asynchronous handling allows the server to manage multiple connections and serve multiple refrigerators simultaneously.

```
<!DOCTYPE html>
<html>
<head>
  <title>Bluefors Data</title>
  <script>
    var socket = new WebSocket("ws://131.225.94.167:8000");  // Update with your WebSocke

    socket.onmessage = function(event) {
      var value = event.data;
      updateValueDisplay("Received value: " + value);
    };

    function updateValueDisplay(content) {
      var valueDisplay = document.getElementById("value-display");
      valueDisplay.textContent = content;
    }

    setInterval(function() {
      updateValueDisplay("Waiting for new value...");
    }, 3000);  // Update the interval duration as desired (in milliseconds)
  </script>
</head>
<body>
  <h1>Bluefors Data</h1>
  <p id="value-display">Waiting for new value...</p>
</body>
</html>
```

HTML/JavaScript

- WebSocket connection listens for incoming data from the server, capturing measurements sent by the Bluefors Control Unit.
- Using JavaScript, the web page dynamically updates the displayed data as new measurements arrive, ensuring real-time visualization for the user.

Acknowledgement & Reference

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