



CSE 4074
Computer Networks
Project Report

Remote Sensing Application

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Project Summary

The project involves the implementation of a networked system consisting of two sensors (a temperature sensor and a humidity sensor), a gateway, and a server. The sensors generate values periodically and send them to the gateway, which then forwards the data to the server. The server stores the received data and provides a web interface for accessing it.

Solution Approach

The system was implemented using Java and socket programming. Each component of the system (the sensors, the gateway, and the server) was implemented as a separate Java class. The temperature sensor and the gateway communicate via TCP, while the humidity sensor and the gateway communicate via UDP. The gateway and the server communicate via TCP.

A handshake protocol was implemented between the gateway and the server. When a connection is established, the gateway sends a “HANDSHAKE_REQ” message to the server, which responds with a “HANDSHAKE_ACK” message.

The temperature sensor generates a random temperature value every second and sends it to the gateway. The humidity sensor generates a random humidity value every second, but only sends it to the gateway if the value exceeds 80. Otherwise, it sends an “ALIVE” message.

The gateway forwards the received data to the server and monitors the activity of the sensors. If it doesn't receive any data from a sensor for a certain amount of time, it sends a ‘SENSOR OFF’ message to the server.

The server stores the received data in a ConcurrentHashMap and provides a web interface for accessing it. The server uses Java's built-in HttpServer class to create an HTTP interface. This interface includes two contexts, “/temperature” and “/humidity”, each handled by a separate handler class (TemperatureHandler and HumidityHandler). These handlers respond to HTTP requests with the current temperature and humidity data, respectively. This allows users to access the sensor data through a web browser or other HTTP client. The server starts listening on port 8080 for incoming HTTP requests as soon as it is started. This HTTP interface provides a user-friendly way to monitor the sensor data in real-time.

Encountered Problems and Solutions

One problem encountered during the implementation was the `java.net.BindException:`

`Address already in use: bind` error. This error occurs when the port you're trying to bind to is already in use by another process. The solution was to ensure that all running instances of the application were stopped before starting it again, and to check that no other applications were using the port.

Another problem was the `java.net.ConnectException: Connection refused:`

`connect` error. This error occurs when there is no server listening on the port you're trying to connect to. The solution was to ensure that the server was running and listening on the correct port before starting the client, and to check that the server and client were using the same port number.

Unresolved Issues

One unresolved issue in this project is that the server is not able to receive temperature data from the temperature sensor via the gateway. Despite the temperature sensor generating data and sending it to the gateway, the server does not seem to receive this data. This issue could be due to a variety of factors such as network issues, software bugs, or compatibility issues between the server and the gateway. Further investigation and debugging are required to identify and resolve this issue. Potential solutions could involve checking the network connections, reviewing the code for potential bugs, or updating the software components to ensure compatibility. As of now, this issue remains unresolved.

Usage Explanation

To use this project, start the server first, then the gateway, and finally the sensors. The server will start listening for connections on ports 6000 (for the gateway) and 8080 (for the HTTP interface). The gateway will start listening for connections from the sensors on ports 5000 (for the temperature sensor) and 5001 (for the humidity sensor). The sensors will start generating data and sending it to the gateway.

Protocol Details

The protocol used between the server and the gateway is a simple handshake protocol implemented over TCP. When a connection is established, the gateway sends a “HANDSHAKE_REQ” message to the server. The server responds with a “HANDSHAKE_ACK” message, indicating that the handshake was successful. After the handshake, the gateway can start sending data to the server. The data is sent as plain text, with each piece of data sent as a separate line.