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GROEP T

Programming Design Based on TCP multiple sensors

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1. Objective

- 1.1. Establish timely database reservation and data disposal.
- 1.2. Establish TCP multiple-sensor dynamic Transmission
- 1.3. Establish multiple threads and multiple processes at the same time
- 1.4. Establish double and single buffer linked list foundation

2. Description

The following is a Sensor Monitoring System, which is made up of three main parts as Figure.1, first is sensor nodes measuring the room temperature, second is a sensor gateway that received all sensor nodes and third is an SQL database to store all sensor data processed by the sensor gate. A sensor node uses a private TCP connection to transfer the sensor data to the sensor gateway. The SQL database is an SQLite System.

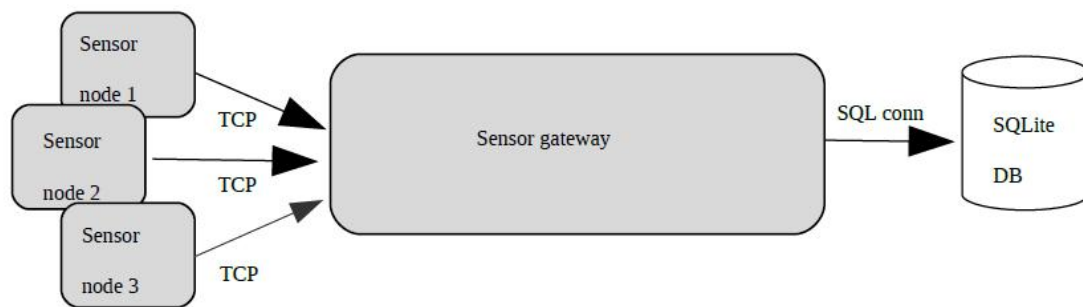


Figure.1. Sensor Monitoring System

3. Establishments

What I mainly designed is sensor gateway part, which has the functions plotted below as Figure.2. It contains the functions:

1. The sensor gateway consists of a main process and a log process. The log process is started as a child process of the main process.
2. The main process runs three threads: the connection, the data, and the storage manager thread. A shared data structure is used for communication between all threads and data can be read, written and updated under thread-safe condition.
3. The connection manager listens on a TCP socket for incoming connection requests from unknown-number new sensor nodes and captures incoming packets of connecting sensor nodes writes the data to the shared data structure
4. The data manager thread implements the sensor gateway intelligence to test the room temperature and automatically set an alarm when the temperature is out of rational range.
5. The storage manager thread reads sensor measurements from the shared data structure and inserts them in the SQL database.If the connection to the SQL database fails, the storage manager

will wait a bit before trying again. The sensor measurements will stay in shared data until the connection to the database is working again. If the connection did not succeed after 3 attempts, the gateway will close.

6. A designed log process to be shared by all threads of the main process to log out unusual information in a principled form using FIFO.

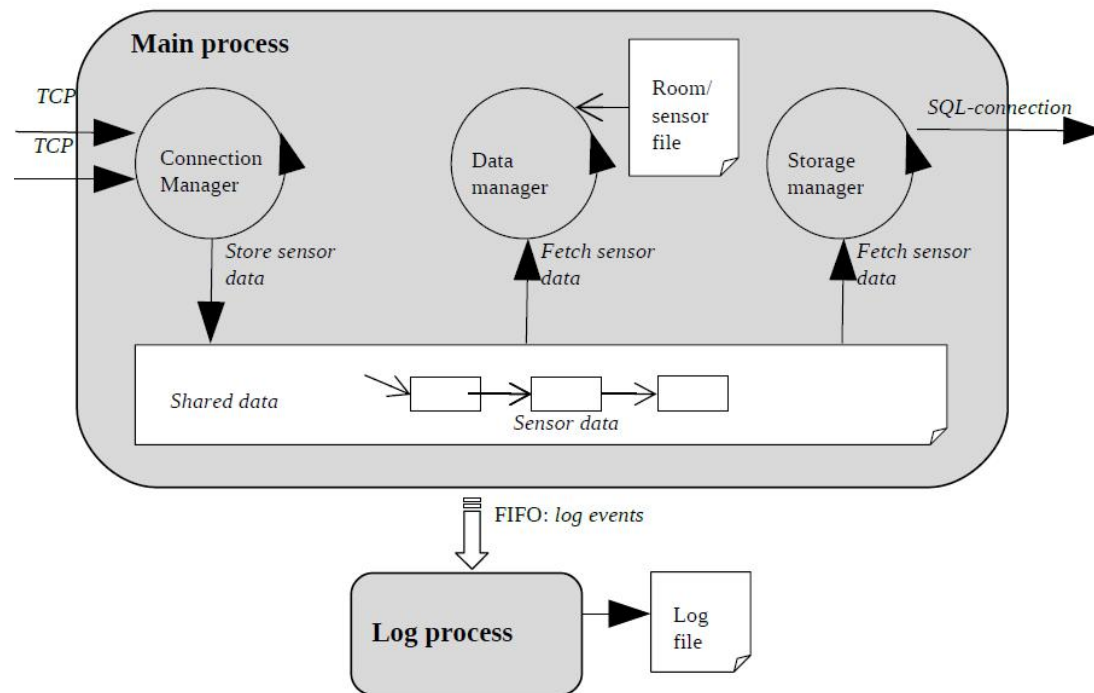


Figure.2. Overall Structure of Sensor Gateway

4. Setup

You can make “makefile” in the package to run the whole project. You can change the last part in “makefile” to change the port, IP, frequency and the number of information of sensor nodes.

The log information can be found in output file “gateway.log”.

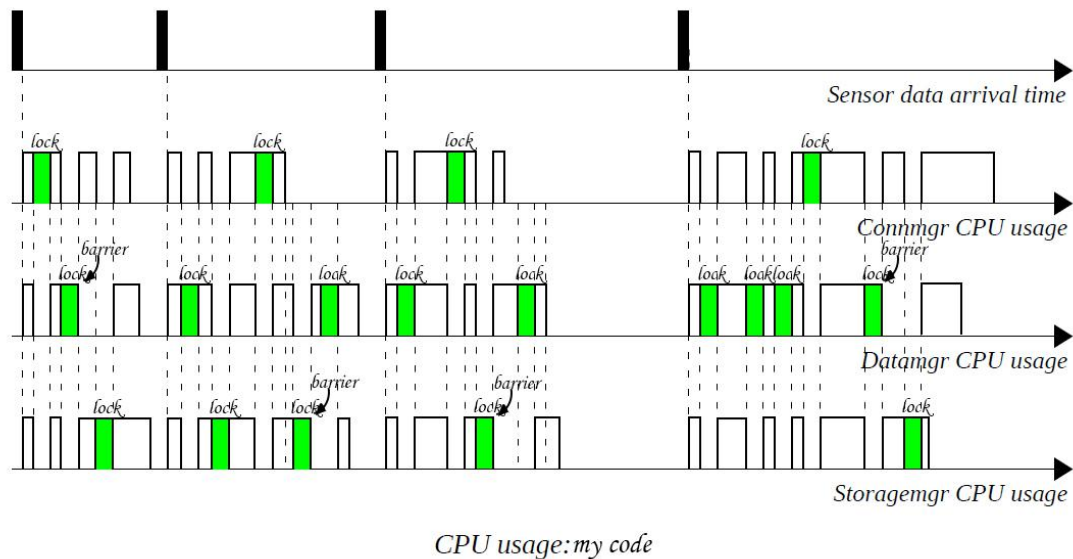
5. Performance

5.1 Memory Layout

Please refer to MemoryLayout.pdf for detailed memory layout.

5.2 General CPU usage of all threads

The following is one of possibilities that CPU will work. It can have many other different usage possibilities.



5.3 Basic Test

1. Scalability Test: Can handle at least 5 sensor nodes running concurrently and with different send frequencies and terminating in a different order as they were started
2. Stress Test: Can handle at least 5 sensor nodes nodes running concurrently at high send frequencies (≥ 10000 Hz)
3. Durability Test: Can handle at least 5 sensor nodes running at least 60 minutes