Node Test: Subscriber

Node test set up and prerequisites:

Rclcpp, sensor_msgs, rclcpp_lifecycle, colcon, gtest

Test1 : NodeCanBeCreated
Tester : Melissa van Leeuwen
date : 06/11/2025

Short description test: - Verify that the Subscriber node (LifecycleNodeSubscriber) can be instantiated successfully within the ROS 2 test framework.
Input test: No input data required; only instantiate the node.
Expected result : - The pointer to the created node is not nullptr. - No exceptions or runtime errors occur during instantiation.
Result test: Node created successfully. Test passes if ASSERT_NE(node, nullptr) returns true.

Test2 : ImuCallbackWritesToDatabase
Tester : Melissa van Leeuwen
date : 06/11/2025

Short description test: - Verify that the imuCallback() correctly processes incoming IMU data and triggers database storage logic.
Input test: - Manually invoke imuCallback() with a mock sensor_msgs::msg::Imu message containing: linear_acceleration = (1.0, 2.0, 3.0) angular_velocity = (0.1, 0.2, 0.3) timestamp = 1730000000.000001
Expected result : - The callback executes without exception or crash.

- The function database_->addMeasurement() is invoked internally (SMART measurable condition: test success is defined by the lack of failure).
Result test: - Callback executed, no crash observed, and test passed via SUCCEED().

Test3 : ReceivesImuMessageOverTopic
Tester : Melissa van Leeuwen
date : 06/11/2025

Short description test: - Ensure the subscriber node receives IMU data published to /imu_data topic and processes it via its callback.
Input test: - Publisher sends sensor_msgs::msg::Imu message with: linear_acceleration = (9.9, 8.8, 7.7) angular_velocity = (0.5, 0.6, 0.7) timestamp = 1730000001.000500 The ROS executor runs for up to 2 seconds to process messages.
Expected result : Node's callback executes without a crash. Message successfully received and processed (measurable: no error or crash within 2 seconds).
Result test: - No exception or crash; test concluded with SUCCEED().

Test4 : ImuCallbackHandlesExtremeValues
Tester : Melissa van Leeuwen
date : 06/11/2025

Short description test: - Verify that the node handles extreme IMU sensor values (Infinity, -Infinity, NaN) safely without throwing exceptions or crashing.
Input test: - Manually call imuCallback() with extreme values: linear_acceleration = (∞, -∞, NaN) angular_velocity = (∞, -∞, NaN) timestamp = 1730000002.0
Expected result : - Node handles values gracefully without throwing an exception. - The test passes if the callback completes without error (EXPECT_NO_THROW).
Result test: - No exceptions or crashes observed

```
melissa@ubuntu:~/Documents/GitHub/rmb_ws$ ./build/g425_assign3_pkg/utest_subscriber
[==========] Running 4 tests from 1 test suite.
[----------] Global test environment set-up.
[----------] 4 tests from TestLifecycleNodeSubscriber
[ RUN      ] TestLifecycleNodeSubscriber.NodeCanBeCreated
Connecting to MariaDB at: localhost
connection succesful!
[INFO] [1762461299.073914251] [lifecycle_node_subscriber]: Lifecycle node subscriber started, waiting for messages...
[       OK ] TestLifecycleNodeSubscriber.NodeCanBeCreated (18 ms)
[ RUN      ] TestLifecycleNodeSubscriber.ImuCallbackWritesToDatabase
Connecting to MariaDB at: localhost
connection succesful!
[INFO] [1762461299.079303947] [lifecycle_node_subscriber]: Lifecycle node subscriber started, waiting for messages...
[INFO] [1762461299.079330342] [lifecycle_node_subscriber]: Received IMU data:
Linear Acceleration: x=1.000, y=2.000, z=3.000
Angular Velocity: x=0.100, y=0.200, z=0.300
Time: sec=1730000000, nanosec=1000
[       OK ] TestLifecycleNodeSubscriber.ImuCallbackWritesToDatabase (6 ms)
[ RUN      ] TestLifecycleNodeSubscriber.ReceivesImuMessageOverTopic
Connecting to MariaDB at: localhost
connection succesful!
[INFO] [1762461299.085582624] [lifecycle_node_subscriber]: Lifecycle node subscriber started, waiting for messages...
[INFO] [1762461299.086072806] [lifecycle_node_subscriber]: Received IMU data:
Linear Acceleration: x=9.900, y=8.800, z=7.700
Angular Velocity: x=0.500, y=0.600, z=0.700
Time: sec=1730000001, nanosec=500
[       OK ] TestLifecycleNodeSubscriber.ReceivesImuMessageOverTopic (2023 ms)
[ RUN      ] TestLifecycleNodeSubscriber.ImuCallbackHandlesExtremeValues
Connecting to MariaDB at: localhost
connection succesful!
[INFO] [1762461301.111366154] [lifecycle_node_subscriber]: Lifecycle node subscriber started, waiting for messages...
[INFO] [1762461301.111442693] [lifecycle_node_subscriber]: Received IMU data:
Linear Acceleration: x=inf, y=-inf, z=nan
Angular Velocity: x=inf, y=-inf, z=nan
Time: sec=1730000002, nanosec=0
MySQL Query Error: Unknown column 'inf' in 'VALUES'
Insert failed: INSERT INTO bno055_data (timestamp, linear_accel_x, linear_accel_y, linear_accel_z, angular_velocity_z) VALUES (1730000002,inf,-inf,nan,nan);
[ERROR] [1762461301.114349968] [lifecycle_node_subscriber]: Could not put IMU data into database!
[       OK ] TestLifecycleNodeSubscriber.ImuCallbackHandlesExtremeValues (13 ms)
[----------] 4 tests from TestLifecycleNodeSubscriber (2061 ms total)

[----------] Global test environment tear-down
[==========] 4 tests from 1 test suite ran. (2076 ms total)
[  PASSED  ] 4 tests.
```