IMU Tilt Detection

Motivation

When the robot is working autonomously, some bad things can happen: It could fall down somewhere or somebody could turn the robot upside down.

- We need to detect when somebody is tilting the robot (lifting up one side)
- We need to detect when the robot is upside down (maybe it fell)

Task

- Create a C++ ROS2 package called `tilt_detection`
- Create a node which does tilt detection by using an IMU's accelerometer
  - The node should publish a custom message `tilt_detection/TiltStatus` at topic `tilt/status`
  - **The node can only use the accelerometer**
    (Reason: On the real robot, we don't have access to the orientation data)
- Bonus
  - Create unit tests for the node

Input

- `/imu/data_raw` : `sensor_msgs/Imu`
  - Accelerometer data from the IMU

Output

- `/tilt/status` : `tilt_detection/TiltStatus`
  - Custom message with a boolean field `tilted` indicating if the robot is currently tilted
  - The field `tilted` should be `True` when the robot is detected to be tilted > 15°
  - The field `tilted` should be `False` otherwise
- `/diagnostics` : `DiagnosticArray`
  - Optional: KeyValue pairs for debugging

How to Work on This

- Use ROS2 Humble on Ubuntu 22.04
- If you don't have this platform, you can use Docker
- You can use any other tool you are comfortable with