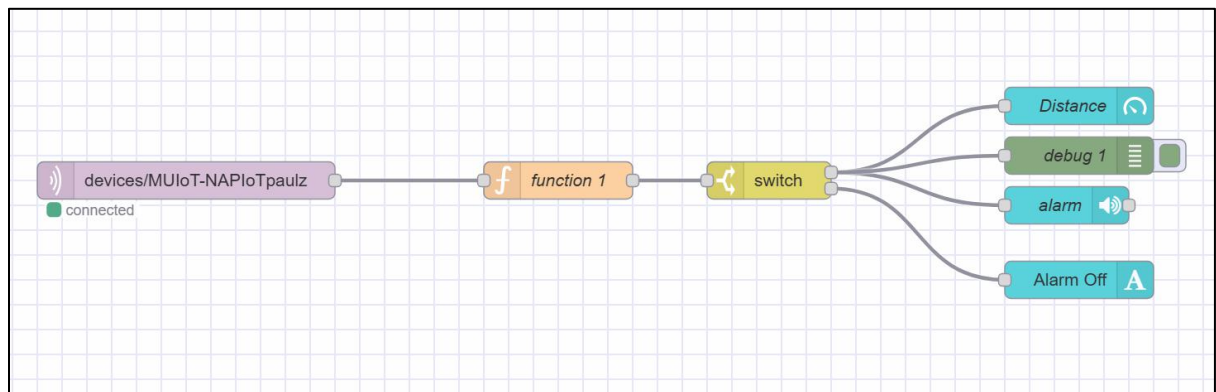


## Tilt Sensor Integration Overview

The Milesight EM310 Tilt Sensor was integrated into our cloud computing framework to mimic the behavior of an MPU6500 Inertial Measurement Unit (IMU), specifically for monitoring the heel angle or tilt of a vessel. The initial setup involved simulated device behavior to validate communication and logic flows before engaging the physical sensor. This allowed for streamlined testing and rapid development without dependency on hardware. The EM310 was selected due to its precise tilt detection capabilities and suitability for marine applications, where accurate heel angle measurements are crucial for monitoring vessel stability and safety. Sensor data is transmitted using MQTT, a lightweight and reliable messaging protocol that ensures smooth data flow from the sensor to our Node-RED-based cloud platform running on FlowFuse. When the measured tilt exceeds a set threshold, the system triggers an alarm to indicate a potential safety hazard; otherwise, the alarm remains deactivated.



## Data Processing and Visualization

As the system transitions from simulation to full real-world deployment, the EM310 Tilt Sensor continuously communicates its data via LoRaWAN, which is then bridged to MQTT for compatibility with our existing Node-RED infrastructure. The data is formatted and published to specific MQTT topics, where Node-RED, hosted on FlowFuse, subscribes and processes the live stream. The platform dynamically updates the dashboard to visualize real-time heel angle values. When a critical tilt is detected (indicating excessive heeling), Node-RED processes the event and activates a warning signal or visual alert. This real-time monitoring solution supports safer marine navigation and provides a scalable approach to integrating industrial-grade sensors into an IoT-powered vessel management system.