Installation Guide

This document provides a guide to the installation and initial setup of the GNSS and RPM sensors.

General Safety Instructions

Before beginning the installation of the sensors, please note the following safety instructions:

1. **Electrical Safety:**
    - The sensors operate with low voltage (3.3V to 5V), but caution is still required.
    - Ensure all connections are properly insulated, especially in damp environments.
    - If uncertain about the electrical connection, consult a qualified electrician.
2. **Waterproofing:**
    - The sensor housings provide basic splash protection, but are not completely waterproof.
    - For use in wet environments, additional waterproofing measures should be taken.
3. **Mounting:**
    - Ensure that all components are mounted securely to prevent them from coming loose during operation.
    - Avoid extreme vibrations that could damage the electronics.

GNSS Sensor Installation

Prerequisites

- A suitable mounting location with good view of the sky
- Power supply: 5V DC via USB or direct power connection
- Mounting materials (screws, cable ties, etc.)

Installation Steps

1. **Select the Mounting Location**
    - Choose a location with minimal obstruction to the sky for optimal GPS reception.
    - The sensor should be protected from direct exposure to rain and splashing water.
2. **Mounting the Housing**
    - Use the four mounting holes in the housing to attach it to a suitable base.
    - Ensure that the housing is mounted horizontally to ensure proper antenna orientation.
3. **Connecting the Power Supply**
    - Connect a 5V power supply to the sensor via USB or the designated power terminals.
    - If using direct power, ensure correct polarity (red = positive, black = negative).
4. **Inserting the SD Card**

- Format the SD card (max. 16 GB) to FAT32 format.
- Insert the formatted SD card into the SD card slot on the sensor.

5. **Initial Power-Up**

- Apply power to the sensor.
- The green LED should light up, indicating normal operation.
- The yellow LED flashes when writing to the SD card.
- The red LED indicates an error (e.g., no SD card found, GPS signal problems).

Verify Functionality

1. After the initial startup, wait about 5 minutes for the GPS to acquire a valid position.
2. The green LED should blink regularly, indicating that position data is being received.
3. After 15-20 minutes of operation, turn off the sensor and check the SD card on a computer:
   - There should be a log file with the naming pattern `YYYYMMDD.csv`.
   - The file should contain rows of GPS data with time, position, and speed information.

RPM Sensor Installation

Prerequisites

- A suitable mounting location near the rotating part to be measured
- Power supply: 5V DC via USB or direct power connection
- Mounting materials for the sensor box and Hall sensor
- TPU sleeve with sixteen neodymium magnets (4 sets of 4 magnets each)
- TPU sleeve for mounting the magnets (3D-printed from files in GitHub repository)

Installation Steps

1. **Mount the RPM Sensor Box**

   - Select a location that is protected from direct water exposure.
   - Mount the box using the mounting brackets and suitable screws.

2. **Install the Hall Sensor**

   - Mount the Hall sensor in a waterproof housing at a distance of up to 18-20mm from the path of the magnets (thanks to the strong neodymium magnets used in this project).
   - Route the Hall sensor cable to the main box.

3. **Prepare the Rotating Part**

   - Attach the TPU sleeve with the sixteen integrated magnets (4 sets of 4 neodymium magnets) to the rotating part.
   - Ensure that all magnets have the same orientation toward the Hall sensor.
   - The magnets should be evenly distributed around the circumference.

4. **Connect the Hall Sensor**

   - Connect the Hall sensor to the designated terminals in the main box.

- Ensure a secure connection and strain relief for the cable.

5. **Insert the SD Card**
   - Format the SD card (max. 16 GB) to FAT32 format.
   - Insert the formatted SD card into the SD card slot.
6. **Connect Power**
   - Connect a 5V power supply to the sensor via USB or the designated power terminals.
   - Ensure correct polarity if using direct power connection.

Initial Setup

1. **Power Up the Sensor**
   - Apply power to the sensor.
   - The OLED display should show the startup screen followed by the main display.
2. **Set the Date and Time**
   - Press and hold the SET button (yellow) for 3 seconds to enter the settings menu.
   - Use the PLUS (blue) and MINUS (white) buttons to adjust the values.
   - Press SET briefly to confirm each value and move to the next setting.
   - The sequence is: year, month, day, hour, minute, second.
3. **Calibrate the RPM Sensor**
   - Start the calibration by manually rotating the part at a known speed.
   - Compare the displayed RPM with the known value.
   - If necessary, adjust the number of magnets in the settings menu (if not using the standard 4 magnets).

Verify Functionality

1. Rotate the part manually or under power.
2. The display should show the current RPM.
3. The RPM data will be automatically stored on the SD card and in the EEPROM.
4. To verify data logging:
   - Remove the SD card after a test run.
   - Check for CSV files with the naming pattern `rpm_log_YYYY-MM-DD_HH-MM-SS.csv`.
   - The file should contain rows with date, time, RPM, and temperature data.

Troubleshooting

GNSS Sensor Issues

Problem	Possible Cause	Solution
Red LED constantly on	SD card missing or unreadable	Check SD card, reformat if necessary

Problem	Possible Cause	Solution
No green LED blinking	No power or GPS module failure	Check power connection, check GPS module wiring
Green LED on but no data logged	Poor GPS reception	Move to location with better sky view, wait longer for fix

RPM Sensor Issues

Problem	Possible Cause	Solution
No display	Power issue	Check power supply and connections
Display works but no RPM readings	Hall sensor problem or magnet issue	Check hall sensor connection, verify magnet positioning
Inaccurate RPM readings	Wrong number of magnets configured	Adjust magnet count in settings, check magnet spacing
Data not logging	SD card issue	Check SD card, reformat if necessary

Software Updates and Maintenance

Updating Firmware

1. Connect the sensor to a computer using a USB cable.
2. Use PlatformIO to upload the latest firmware (available from GitHub).
3. After updating, restart the device and verify functionality.

Preventive Maintenance

- Periodically check all connections for corrosion or damage.
- Check the waterproof seals of the housings.
- Backup data from the SD card regularly.
- Replace the RTC battery (CR2032) in the RPM sensor every 2-3 years.

GitHub Repositories

Complete documentation, source code, and 3D printing files (.3mf) for the housings and components are available in the following GitHub repositories:

GNSS Sensor

Repository: github.com/hansratzinger/GnssSensor

RPM Sensor

Repository: github.com/hansratzinger/RpmSensor

In the `/3d` folder of both repositories, you will find .3mf files for 3D printing all required housing parts, mounts, and other components.

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