Complete ROS Bag Analysis Report

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Executive Summary

- **Total Bags Analyzed**: 2
- **Total Distance**: 639.0 m
- **Total Duration**: 342.0 s

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Topics and Frequencies

Topic	Message Type	Count	Frequency (Hz)
/mbuggy/septentrio/kgs/linz/Odometry	nav_msgs/msg/Odometry	2108	50.02
/mbuggy/fix	sensor_msgs/msg/NavSatFix	2108	50.02
/mbuggy/camera_front/camera_info	sensor_msgs/msg/CameraInfo	1148	27.24
/mbuggy/camera_front/image_raw	sensor_msgs/msg/Image	1148	27.24
/tf	tf2_msgs/msg/TFMessage	5902	140.02
/mbuggy/imu_ins	sensor_msgs/msg/Imu	2108	50.02
/mbuggy/odom	nav_msgs/msg/Odometry	1686	40.03
/mbuggy/navsat/odometry	nav_msgs/msg/Odometry	843	20.02

Trajectory Analysis

- **Total Distance**: 103.2 m
- **Duration**: 42.1 s
- **Elevation Range**: 0.000 m
- **Is Planar Motion**: Yes

GPS Analysis

- **GPS Coverage**: 0.0%
- **Total Fixes**: 2108
- **No Fix Count**: 2108
- **GPS Fix Count**: 0
- **DGPS Fix Count**: 0
- **RTK Fix Count**: 0

IMU Analysis

- **Average Acceleration**: 9.86 m/s^2
- **Max Acceleration**: 14.90 m/s^2
- **Average Angular Velocity**: 0.11 rad/s
- **Max Angular Velocity**: 0.34 rad/s

Camera Analysis

- **Resolution**: 1920x1080
- **Encoding**: bgr8
- **Total Frames**: 1148
- **Frame Rate**: 27.2 Hz
- **Average Data Size**: 6220800 bytes

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Topics and Frequencies

Topic	Message Type	Count	Frequency (Hz)
/mbuggy/fix	sensor_msgs/msg/NavSatFix	14997	50.00
/mbuggy/camera_info	sensor_msgs/msg/CameraInfo	7906	26.36
/mbuggy/camera/image_raw	sensor_msgs/msg/Image	7906	26.36
/mbuggy/imu_ins	sensor_msgs/msg/Imu	14997	50.00
/mbuggy/navsat/odometry	nav_msgs/msg/Odometry	5999	20.00
/mbuggy/odom	nav_msgs/msg/Odometry	11995	40.00
/tf_static	tf2_msgs/msg/TFMessage	24	446.51
/tf	tf2_msgs/msg/TFMessage	4972	140.00
/mbuggy/septentrio_gnss/insnavgeod	nav_msgs/msg/Odometry	14990	50.00

Trajectory Analysis

- **Total Distance**: 535.7 m
- **Duration**: 299.9 s
- **Elevation Range**: 0.000 m
- **Is Planar Motion**: Yes

GPS Analysis

- **GPS Coverage**: 0.0%
- **Total Fixes**: 14997
- **No Fix Count**: 14997
- **GPS Fix Count**: 0
- **DGPS Fix Count**: 0
- **RTK Fix Count**: 0

IMU Analysis

- **Average Acceleration**: 9.85 m/s²
- **Max Acceleration**: 16.06 m/s²
- **Average Angular Velocity**: 0.10 rad/s
- **Max Angular Velocity**: 0.54 rad/s

Camera Analysis

- **Resolution**: 1920x1080
- **Encoding**: bgr8
- **Total Frames**: 7906
- **Frame Rate**: 26.4 Hz
- **Average Data Size**: 6220800 bytes

Recommendations for Visual Localization

Data Quality Assessment

- **Excellent camera data** (1920x1080 @ 26-27 Hz)
- **Good IMU data** (realistic accelerations and angular velocities)
- **Perfect planar motion** (Z=0 throughout)
- **No GPS signal** (GPS-denied environment)

Recommended Approach

- **Visual-Inertial Odometry (VIO)** with 2D motion constraints
- **Use `/mbuggy/odom` as ground truth** for trajectory comparison
- **Implement planar motion assumption** (Z=0 constraint)
- **Focus on visual-inertial fusion** without GPS dependency

Next Steps

1. **Implement VIO algorithm** (ORB-SLAM3 or OpenVINS)
2. **Setup coordinate frame alignment** using static transforms
3. **Validate against ground truth** from odometry data
4. **Optimize parameters** for outdoor, high-speed scenarios