Event Alignment Tool

Align implement usage signals with external telemetry (e.g., power, GPS, or engine data) for synchronized analysis.

In [1]:
```
import pandas as pd
import matplotlib.pyplot as plt

# Load implement usage summary
impl_df = pd.read_csv('../data_pipeline/implement_usage_summary.csv')
impl_df['Start'] = pd.to_datetime(impl_df['Start'])
impl_df['Stop'] = pd.to_datetime(impl_df['Stop'])
```

Load External Telemetry (e.g., power, speed, GPS)

In [3]:
```
# Example telemetry data (replace with actual CSV path)
telemetry = pd.read_csv('../data_pipeline/tractor_telemetry.csv')
telemetry['Timestamp'] = pd.to_datetime(telemetry['Timestamp'])
telemetry = telemetry.set_index('Timestamp')

telemetry.head()
```

Out[3]:

Timestamp	Engine_Load
2025-05-30 07:56:12.958842	45.236894
2025-05-30 07:56:42.958842	36.376226
2025-05-30 07:57:12.958842	61.589469
2025-05-30 07:57:42.958842	29.641715
2025-05-30 07:58:12.958842	50.775025

Align Events: Add 'Active' Flags to Telemetry Timeline

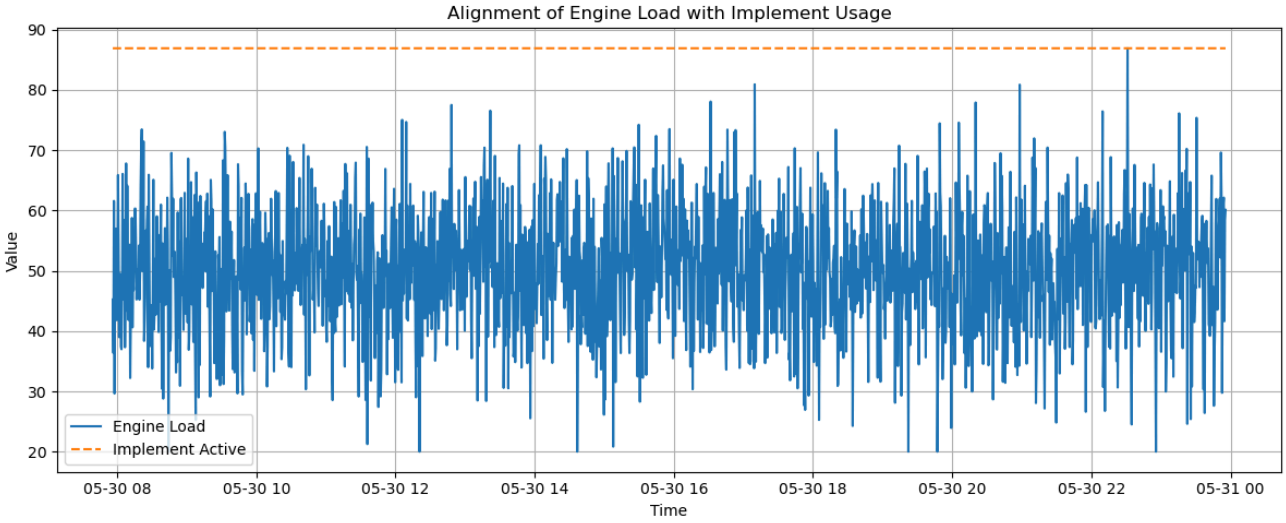
In [4]:
```
telemetry['Implement_Active'] = 0

for _, row in impl_df.iterrows():
    telemetry.loc[row['Start']:row['Stop'], 'Implement_Active'] = 1

telemetry.head()
```

Out[4]:

Timestamp	Engine_Load	Implement_Active
2025-05-30 07:56:12.958842	45.236894	1
2025-05-30 07:56:42.958842	36.376226	1
2025-05-30 07:57:12.958842	61.589469	1
2025-05-30 07:57:42.958842	29.641715	1
2025-05-30 07:58:12.958842	50.775025	1

Plot Aligned Events vs External Signal

In [5]:
```
plt.figure(figsize=(12, 5))
plt.plot(telemetry.index, telemetry['Engine_Load'], label='Engine Load')
plt.plot(telemetry.index, telemetry['Implement_Active'] * telemetry['Engine_Load'].max(), label='Implement Active', linesty
plt.legend()
plt.title('Alignment of Engine Load with Implement Usage')
plt.ylabel('Value')
plt.xlabel('Time')
plt.grid(True)
plt.tight_layout()
plt.show()
```


Alignment of Engine Load with Implement Usage
Value
Time
Engine Load
Implement Active
90
80
70
60
50
40
30
20
05-30 08
05-30 10
05-30 12
05-30 14
05-30 16
05-30 18
05-30 20
05-30 22
05-31 00

In [ ]: