**Data Quality Enhancement Plan - Signal Generation System**

**🔍 PROBLEM IDENTIFIED:**

During signal generation scanning, some stocks show warnings:

* "EMA analysis: Need at least 50 price points, got 29"
* "MACD: Need at least 35 price points, got 29"
* "S/R analysis: Need at least 50 data points, got 38"

This happens because some stocks (new IPOs, low volume stocks, or incomplete API data) don't have sufficient historical data for proper technical analysis.

**🎯 SOLUTION APPROACH: Smart Data Quality Handling**

**Phase 1: Pre-Filtering Enhancement**

Before processing any stock, check data availability:

* Count available data points for each timeframe (1H, 4H, 1D, 1W)
* Only process stocks that have minimum required data:
  + RSI: 15+ data points (14 + 1 buffer)
  + MACD: 36+ data points (26 + 9 + 1 buffer)
  + EMA: 51+ data points (50 + 1 buffer)
  + Bollinger Bands: 21+ data points (20 + 1 buffer)
  + Support/Resistance: 51+ data points (50 + 1 buffer)
  + Volume: 21+ data points (20 + 1 buffer)

**Phase 2: Adaptive Analysis**

For stocks with limited but usable data:

* If 30-49 data points: Use shorter periods (EMA 20 instead of 50, reduced S/R analysis)
* If 20-29 data points: Skip complex indicators, focus on RSI + Volume + basic trend
* If < 20 data points: Skip stock entirely (insufficient for any meaningful analysis)

**Phase 3: Data Quality Scoring**

Add data quality indicators to each signal:

* **Excellent**: All indicators have full data (50+ points)
* **Good**: Most indicators have full data (35-49 points)
* **Limited**: Some indicators have reduced data (20-34 points)
* **Insufficient**: Skip entirely (< 20 points)

**Phase 4: Enhanced Logging**

Instead of warning messages, provide informative logs:

* "✅ AAPL: Excellent data quality (89 data points) - Full analysis"
* "⚠️ PSA: Limited data quality (38 data points) - Adaptive analysis"
* "❌ NEWSTOCK: Insufficient data (12 data points) - Skipped"

**🚀 IMPLEMENTATION PLAN:**

**Step 1: Enhance Stock Scanner**

Add data quality check function in stock-scanner.ts:

* checkDataQuality(priceData) function
* Return quality rating before processing
* Filter out insufficient stocks early

**Step 2: Modify Technical Indicators**

Update technical-indicators.ts:

* Add dataQuality field to all indicator results
* Implement adaptive parameter selection
* Graceful degradation for limited data

**Step 3: Update Scoring Engine**

Modify scoring-engine.ts:

* Adjust confidence scores based on data quality
* Weight high-quality data more heavily
* Flag signals with limited data quality

**Step 4: Enhance Signal Processor**

Update signal-processor.ts:

* Pre-filter stocks by data quality
* Provide better logging messages
* Track data quality statistics

**📊 EXPECTED RESULTS:**

**Before Enhancement:**

* 150 stocks scanned
* 4 signals generated with warnings
* Some indicators failing due to insufficient data

**After Enhancement:**

* 150 stocks checked for data quality
* ~120 stocks pass quality filter
* 8-12 high-quality signals generated
* No warning messages
* Clear data quality indicators
* Better overall signal reliability

**🛡️ SAFETY REQUIREMENTS:**

1. **Don't change existing parameters** (RSI 14, MACD 12,26,9, etc.) - keep industry standards
2. **Don't modify working scoring weights** - only add data quality handling
3. **Preserve existing functionality** - enhance, don't replace
4. **Test thoroughly** - ensure no regression in signal generation

**🎯 SUCCESS CRITERIA:**

* ✅ No more warning messages during scanning
* ✅ Clear data quality indicators for each signal
* ✅ Improved signal reliability
* ✅ Better user experience with informative logging
* ✅ Same or better number of quality signals generated
* ✅ All existing functionality preserved

**📋 FILES TO MODIFY:**

1. src/lib/signals/stock-scanner.ts - Add data quality checking
2. src/lib/signals/technical-indicators.ts - Add adaptive analysis and quality ratings
3. src/lib/signals/scoring-engine.ts - Incorporate data quality into scoring
4. src/lib/signals/signal-processor.ts - Add pre-filtering and better logging

**🚨 CRITICAL NOTES:**

* This is an enhancement, not a rewrite
* Existing signal generation system is working perfectly
* Focus on data quality handling only
* Keep all proven parameters and weights unchanged
* Maintain professional logging and user experience standards