

First Order:

Real-Time

Situational

Awareness

Platform

For: ModelX Competition

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Team

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1. EXECUTIVE SUMMARY

In the volatile economic landscape of Sri Lanka, business leaders often struggle to make timely decisions due to fragmented information. Critical signals such as currency fluctuations, fuel price trends, and emerging social unrest are scattered across financial terminals, news outlets, and social media.

First Order is an AI-powered intelligence dashboard designed to solve this "information asymmetry." By aggregating real-time data from resilient sensors (RSS feeds, Reddit API, Yahoo Finance) and processing it through a multi-tier intelligence layer, First Order provides a unified, real-time view of the national operating environment. The system not only displays data but interprets it, offering actionable "AI Commander" alerts tailored for Finance, Supply Chain, and HR departments.

2. SYSTEM ARCHITECTURE

First Order follows a modular **3-Tier Architecture**, designed for resilience and low latency.

2.1 Tier 1: The Resilient Sensor Layer (Ingestion)

This layer is responsible for gathering raw unstructured and structured data. It employs fault-tolerant "Ingestors" that operate independently.

- **NewsIngestor:**
 - **Source:** AdaDerana, DailyMirror (via RSS).
 - **Mechanism:** Polls feed every 60 seconds.
 - **Resilience:** Uses feedparser with error catching for broken XML structures.
- **SocialPulseIngestor:**
 - **Source:** Reddit (r/srilanka).
 - **Mechanism:** Queries the JSON API for the "New" and "Hot" endpoints.
 - **Focus:** Captures grassroots public sentiment that often precedes mainstream news (e.g., early reports of fuel queues).

- **MarketDataIngestor:**
 - **Source:** Yahoo Finance API (yfinance).
 - **Assets Tracked:**
 - LKR=X (USD/LKR Exchange Rate) for import/export risk.
 - BZ=F (Brent Crude Oil) for logistics and energy cost forecasting.

2.2 Tier 2: The Intelligent Processing Layer (Analytics)

Raw data is normalized and passed through three distinct analytical engines:

- 1. Statistical Trend Engine (STL):**
 - a. Applied to volatile commodities (Oil).
 - b. Separates the "True Trend" from daily market noise to prevent false alarms.
- 2. Unsupervised Anomaly Engine (Isolation Forest):**
 - a. Applied to Forex markets.
 - b. Detects "Black Swan" events—deviations that are statistically improbable based on recent history.
- 3. Natural Language Processing (NLP) Engine:**
 - a. Applied to News and Social Text.
 - b. Uses **VADER (Valence Aware Dictionary and sEntiment Reasoner)** to score text polarity (Positive/Negative) and extract named entities (keywords like "Protest", "Curfew").

2.3 Tier 3: The Insight Generation Layer (Presentation)

- **Framework:** Streamlit (Python).
- **Design Philosophy:** "Traffic Light" cognitive design. Users are presented with Red (Risk) or Green (Opportunity) signals immediately, reducing cognitive load.
- **Refresh Rate:** 100-second heartbeat loop (via `st_autorefresh` or manual fallback).

3. ALGORITHMIC METHODOLOGY

3.1 Anomaly Detection: Isolation Forest

- **Why used?** Standard thresholding (e.g., "Alert if USD > 300") is rigid. Isolation Forest is dynamic; it learns what "Normal" looks like over a rolling 30-day window.
- **Logic:** It isolates observations by randomly selecting a feature and then randomly selecting a split value. Anomalies are susceptible to isolation and have shorter path lengths in the decision tree.
- **Implementation:** `sklearn.ensemble.IsolationForest(contamination='auto')`.

3.2 Trend Analysis: STL Decomposition

- **Why used?** To differentiate between a daily price spike and a sustained inflationary trend.
- **Logic:** Deconstructs the time series into:

$$Y_t = T_t + S_t + R_t$$

(Where T = Trend, S = Seasonality, R = Remainder).

- **Application:** We calculate the **Slope** of the T_t component. A slope >1.5 indicates a verified upward cost trend, triggering a Supply Chain alert.

3.3 Sentiment Analysis: VADER & Social Velocity

- **Why VADER?** Unlike Transformers (BERT), VADER is computationally light and specifically tuned for social media contexts (handling capitalization, emojis, and slang).
- **Social Velocity Metric:**
 - We do not just count posts; we measure **Engagement Intensity**.

$$Velocity_h = \sum (Upvotes + Comments)_h$$

If $Velocity_{current} > 1.5 \times MovingAverage_{24h}$, a "Viral Spike" alert is triggered

4. KEY PERFORMANCE INDICATOR: THE SL-BSI

The **Sri Lanka Business Stability Index (SL-BSI)** is a proprietary composite score (0-100) developed to give executives a single "health score" for the nation.

Formula Breakdown

$$SL-BSI = Base(100) - \sum \text{Penalties} + \text{Bonus}$$

Component	Condition	Weight Impact	Rationale
Forex Volatility	Anomaly Detected	-20	Currency instability freezes imports/exports.
Social Unrest	Sentiment < -0.2	-20	Unrest disrupts physical operations/staffing.
Social Spike	Volume > 1.5x Avg	-15	Viral panic often leads to real-world queues/strikes.
Oil Inflation	Trend Slope > 1.5	-15	Direct impact on transport and energy costs.
Positive Sentiment	Sentiment > 0.2	+10	Indicates consumer confidence or stability recovery.

- **Stable Zone:** Score > 75
- **Caution Zone:** Score 50-75
- **Critical Risk Zone:** Score < 50

5. DECISION SUPPORT MATRIX ("AI COMMANDER")

First Order translates metrics into role-specific advice using a deterministic rule engine. This ensures interpretability and consistency.

Trigger Event	Department	Alert Level	Recommended Action
LKR Anomaly	Finance (CFO)	🔴 Critical	Halt non-essential USD payments. Hedge immediate exposure.
Oil Trend UP	Logistics (COO)	🔴 Critical	Lock in forward transport rates. Top up fuel inventory.
Oil Trend DOWN	Logistics (COO)	🟢 Opportunity	Renegotiate 3PL (Third Party Logistics) contracts for next month.

Social Spike	HR / Security	● Critical	Issue travel advisories to staff. Prepare remote work protocols.
BSI > 80	Strategy	● Opportunity	Safe window for Capital Expenditure (CapEx) and expansion.

6. TECHNOLOGY STACK & JUSTIFICATION

Component	Tool / Library	Justification
Language	Python 3.9+	Dominant ecosystem for Data Science & ML.
Frontend	Streamlit	Rapid prototyping, native support for Pandas/Charts, auto-refresh capabilities.
Data Scraping	requests, feedparser	Lightweight, robust, and easy to error-handle compared to heavy frameworks like Scrapy.
ML Models	scikit-learn, statsmodels	Industry-standard, efficient, and explainable models.
Sentiment	vaderSentiment	Optimized for social text; requires no training data (lexicon-based).

7. ETHICAL CONSIDERATIONS & LIMITATIONS

Data Privacy: First Order aggregates public data only. No private user data (names, IDs) from Reddit is stored or processed, ensuring compliance with general privacy standards.

Platform Citizenship: The scrapers implement strict rate-limiting (fetching only every 60s) and use User-Agent headers to identify the bot, respecting the target servers' resources.

Bias Limitation: VADER sentiment analysis is English-centric. Sinhala/Tamil transliterated sentiment is a current limitation (e.g., "Meka hari na" might not be scored correctly).