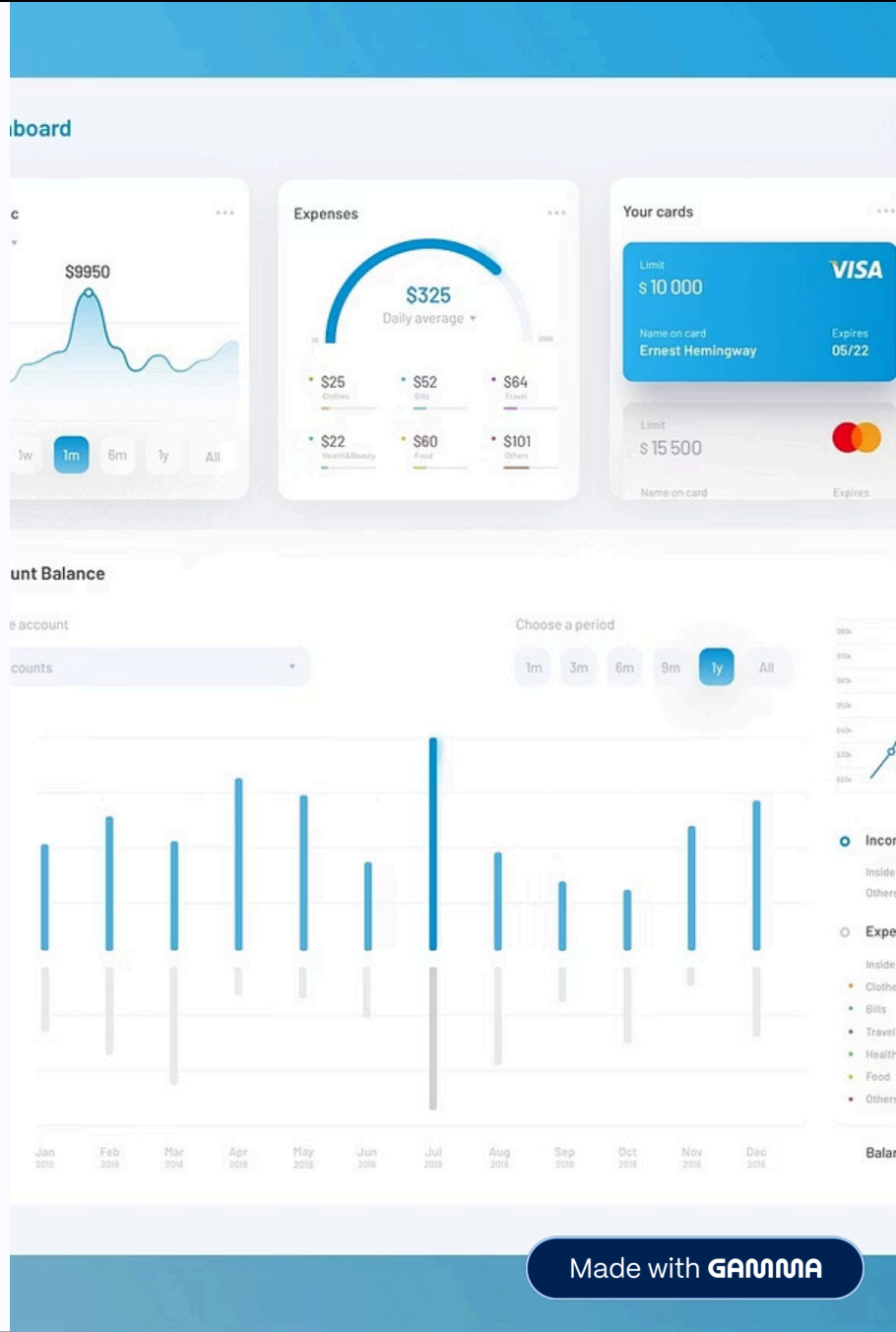
Early Risk Signal System (ERSS)

Proactive Delinquency Detection using Behavioral Lead Indicators

Prototype by Sourav Sarania | Tech Stack: Java Spring Boot & Docker



The Problem: "Too Little, Too Late"

Lag Indicator Dependence

Banks rely on "30 Days Past Due" metrics that only trigger after customers have already missed payments and entered financial distress.

Reactive Intervention

Collections teams mobilize only after damage is done, making recovery efforts expensive and often unsuccessful.

Revenue Impact

High "Roll Rates" from Stage 1 to Stage 2 delinquency result in significant Net Interest Income (NII) losses and provisioning increases.

The Shift: Detecting the "Smoke Before Fire"

Old Way: Reactive Response

- Wait for missed payments
- React to credit bureau alerts
- Intervene after default begins
- High recovery costs

New Way: Proactive Detection

- Detect behavioral stress 30 days early
- Analyze spending pattern drops
- Monitor cash withdrawal spikes
- Prevent defaults before they occur

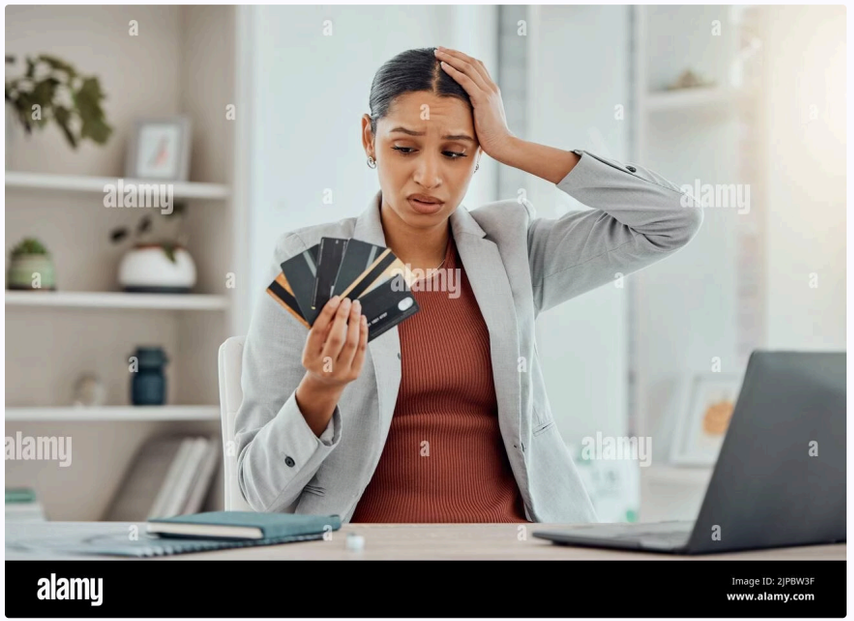
Data Insights: The Hidden Risk Personas

Advanced behavioral analytics reveal two distinct patterns that consistently appear weeks before default events occur in credit portfolios.

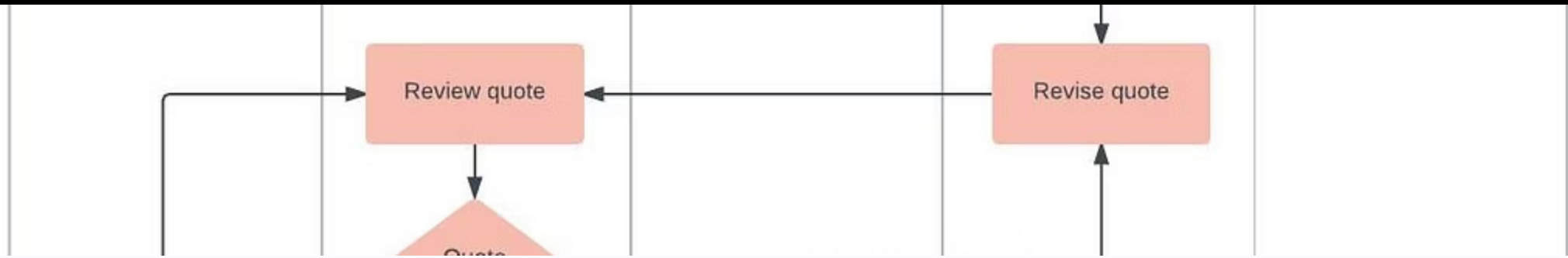
Persona A: The Silent Quitter

- Spending drops by 20% or more within 30 days
- Stops discretionary purchases completely
- Hoarding cash for upcoming payment obligations
- High probability of missing next payment cycle

Persona B: The Debt Trap



- Consistently pays only minimum due (>50% frequency)
- Credit utilization exceeds 80% persistently
- Revolving balance grows month-over-month
- Approaching maximum capacity with declining ability to pay



The Logic Engine: Transparent Rule-Based Decisioning

Unlike opaque machine learning models, ERSS uses explainable business rules that credit risk teams can understand, validate, and trust.

1

Data Input Layer

Transaction history, payment patterns, utilization metrics, and cash withdrawal behavior from core banking systems.

2

Red Flag Logic

IF (Spending Drop < -20% **AND** Cash Withdrawal > 8%) **THEN** assign RED risk flag for immediate intervention.

3

Amber Flag Logic

IF (Credit Utilization > 80% **OR** Minimum Due Payment Frequency > 50%) **THEN** assign AMBER for monitoring.

4

Risk Flag Output

Actionable prioritized lists with confidence scores, customer IDs, and recommended intervention strategies for operations teams.

The Solution Architecture

Built on modern cloud-native principles with stateless microservice design for horizontal scalability and enterprise-grade reliability.

Core Engine

Java 25 with Spring Boot 4 framework providing robust transaction processing and business logic execution.

Containerization

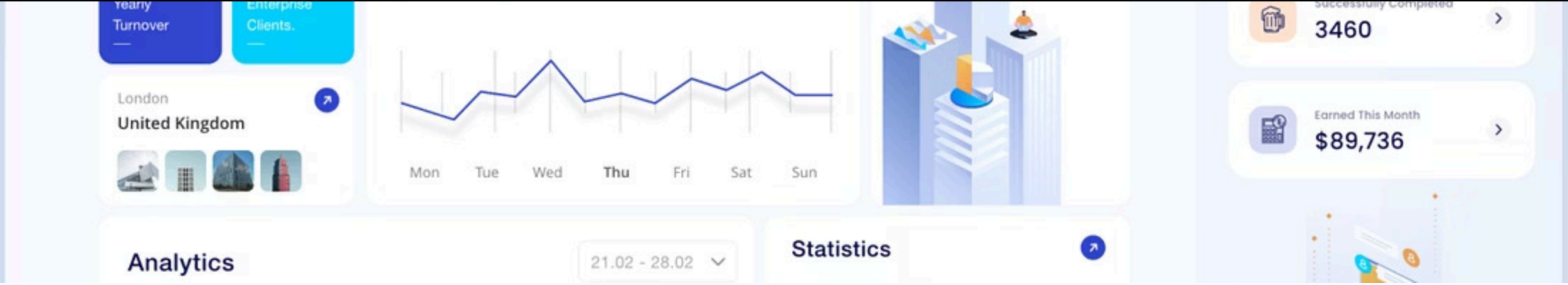
Docker containers ensure "build once, run anywhere" portability across development, testing, and production environments.

Batch Processing

Efficient CSV file ingestion with validation, transformation, and enrichment pipelines for large-scale data processing.

API Output

RESTful JSON endpoints delivering structured risk flags with metadata for seamless integration with existing systems.



Prototype Demo: Operational Dashboard

01

Simple Upload Interface

Operations teams drag and drop CSV files containing customer transaction data without technical expertise required.

02

Real-Time Processing

Engine analyzes thousands of customer records in seconds, applying risk logic and generating prioritized alerts instantly.

03

Visual Prioritization

Dashboard displays RED flags at the top for immediate action, followed by AMBER warnings for proactive monitoring.

04

Actionable Exports

Downloadable reports formatted for dialer systems, CRM platforms, and collections workflow tools with one-click integration.

Case Study: Predicting Default for Customer C015

Day 0: Signal Detection

1

Spending dropped 23% below baseline, cash withdrawals spiked to 9% of credit limit. ERSS flagged RED immediately.

Day 15: Intervention Opportunity

2

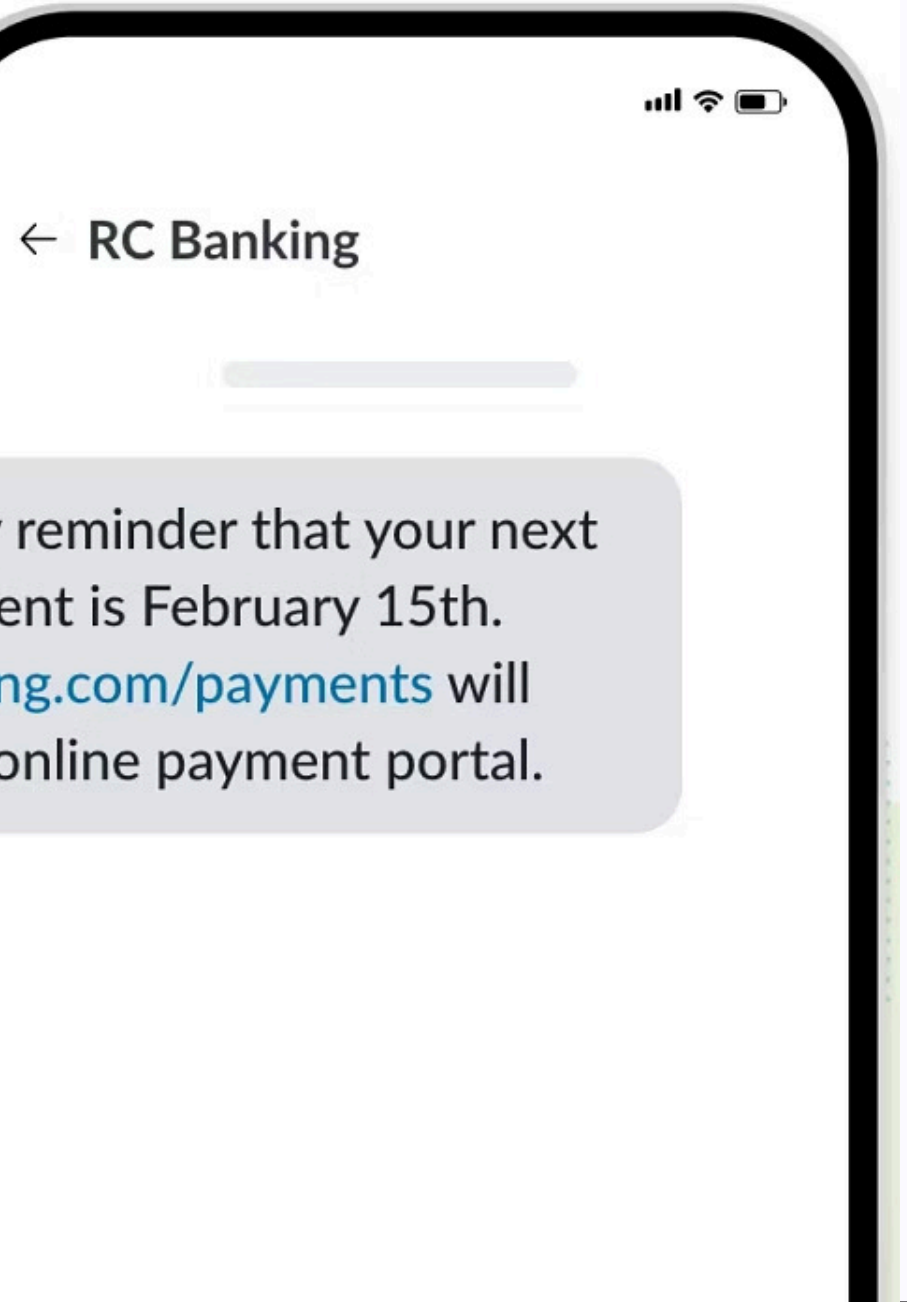
Collections team contacted customer, offered payment restructuring plan before account entered delinquency status.

Day 30: Actual Outcome

3

Without intervention, customer missed payment and went delinquent. **ERSS prediction confirmed with 30-day lead time.**

Success Metric: We caught the risk signal 30 days before default occurred, creating a critical intervention window that traditional models completely missed.



Strategic Interventions: Turning Insights into Action

Risk flags enable targeted interventions that protect both customer relationships and bank profitability through personalized engagement strategies.

RED Flag Response

Temporarily freeze credit limit increases and proactively offer loan restructuring, EMI holidays, or payment plans to prevent default.

AMBER Flag Response

Send personalized "nudge" notifications about interest accumulation, suggest balance transfer options, and educate on financial wellness.

Strategic Goal

Protect principal amount through early intervention rather than maximizing short-term fee income that increases long-term credit losses.

Future Roadmap & Impact

Scalability Vision

- Migrate to AWS Lambda for serverless architecture
- Handle 10M+ customer portfolios in real-time
- Integrate with Kafka for streaming data ingestion
- Deploy ML models for continuous learning

Expected Business Impact

15%

Roll Rate Reduction

Estimated decrease in Stage 1 to Stage 2 progression

30

Early Detection Days

Average lead time before default events

$2M

Annual Savings

Projected NII protection per 100K portfolio

Status: Prototype is production-ready and available for immediate pilot implementation with selected credit portfolios.