TVS EPIC 7.0 - Analytics Challenge
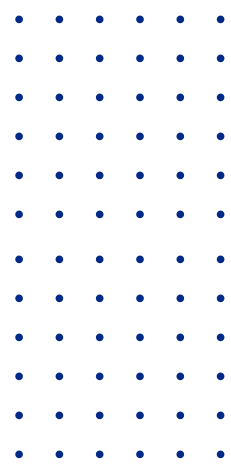
Analytics Collection Analytics
Case Competition

~ Dhriti Singh
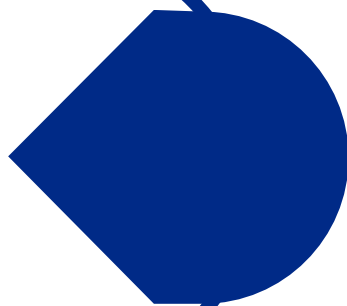
Transforming Loan Collections

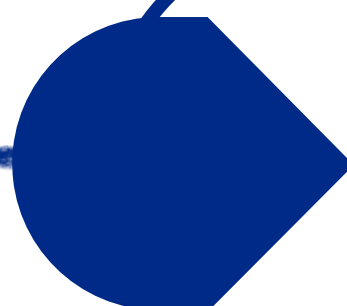## From Inefficient Outreach to an AI-Powered, Proactive System

Inefficient Collections:
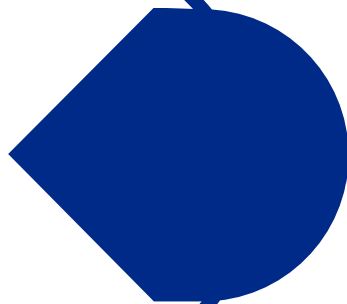Agents waste time on low-risk customers while high-risk ones are missed.

High-Accuracy Prediction:
A 98.6% AUC model pinpoints likely defaulters, focusing agent effort where it matters most.
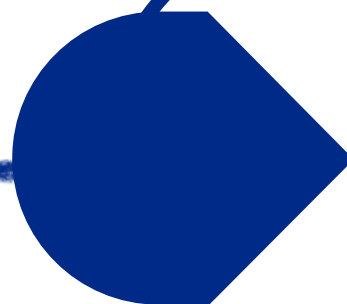
Customer Dissatisfaction:
A generic, "one-size-fits-all" approach damages customer relationships and leads to formal complaints.

Data-Driven Personas:
We segment customers into unique personas (e.g., Struggling, Aggrieved) to understand their context.

Hidden Financial Risk:
The current system is reactive and fails to identify "hidden risk"—customers with good payment histories who show signs of an imminent default.
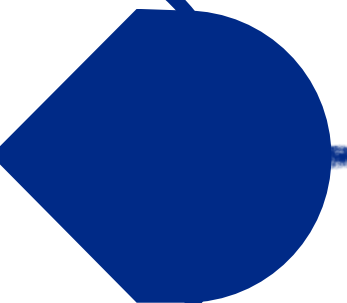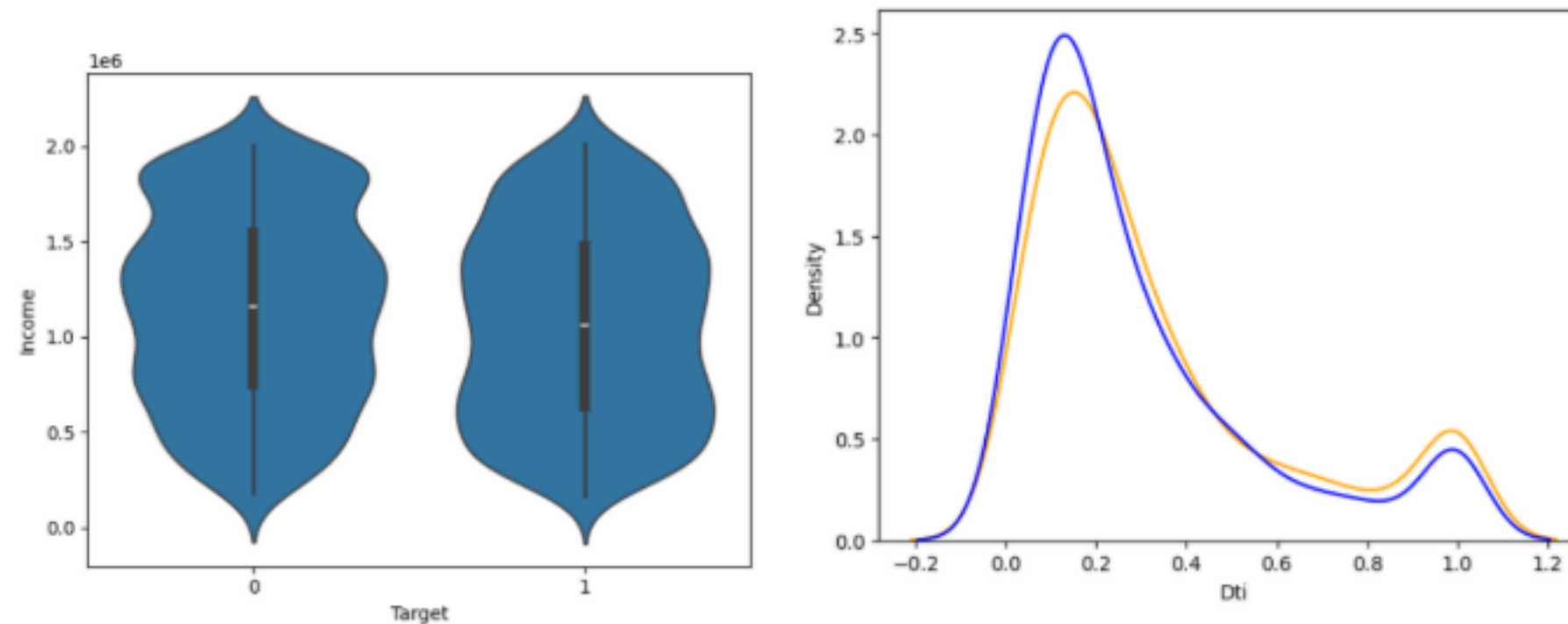
A Dynamic, Intelligent Chatbot:
An automated assistant that adapts its tone, offers real solutions, and knows when to escalate to a human.
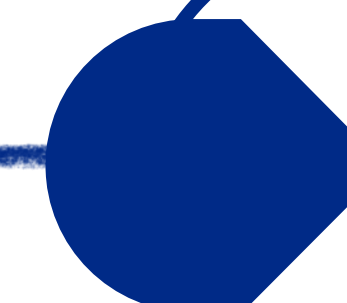
Uncovering the Drivers of Default

Initial data exploration revealed that financial strain and past behavior are the strongest predictors of default.

Key Insight 1: Financial Strain

A thorough analysis showed a strong correlation between financial distress and the likelihood of default. Key indicators included a high Debt-to-Income (DTI) ratio and the customer's employment status, which became foundational elements for the feature engineering.

Key Insight 2: Behavioral History
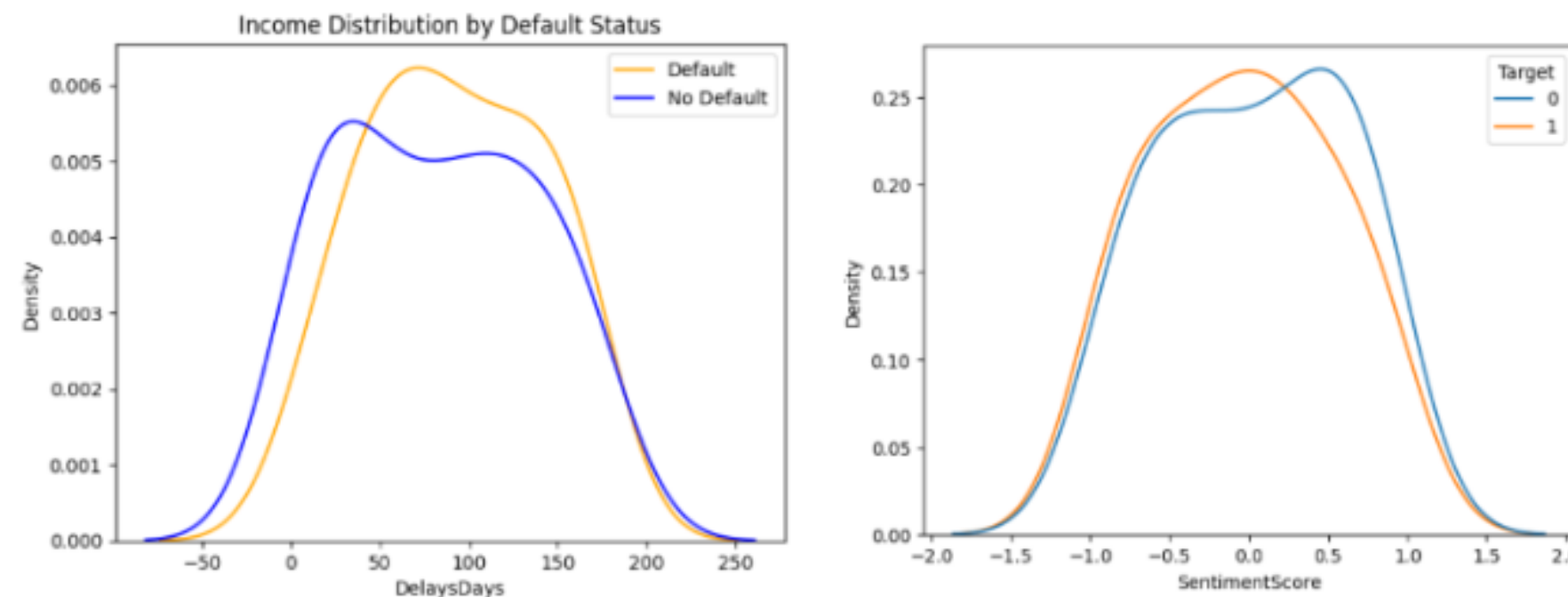
Past payment behavior proved to be a powerful predictor of future actions. We found that the number of DelaysDays and a negative SentimentScore from previous interactions were clear red flags that directly informed the predictive modeling.

A High-Performance, Fully Transparent Model

My model delivers exceptional predictive accuracy, and I can explain exactly how it arrives at each decision.

Model Accuracy

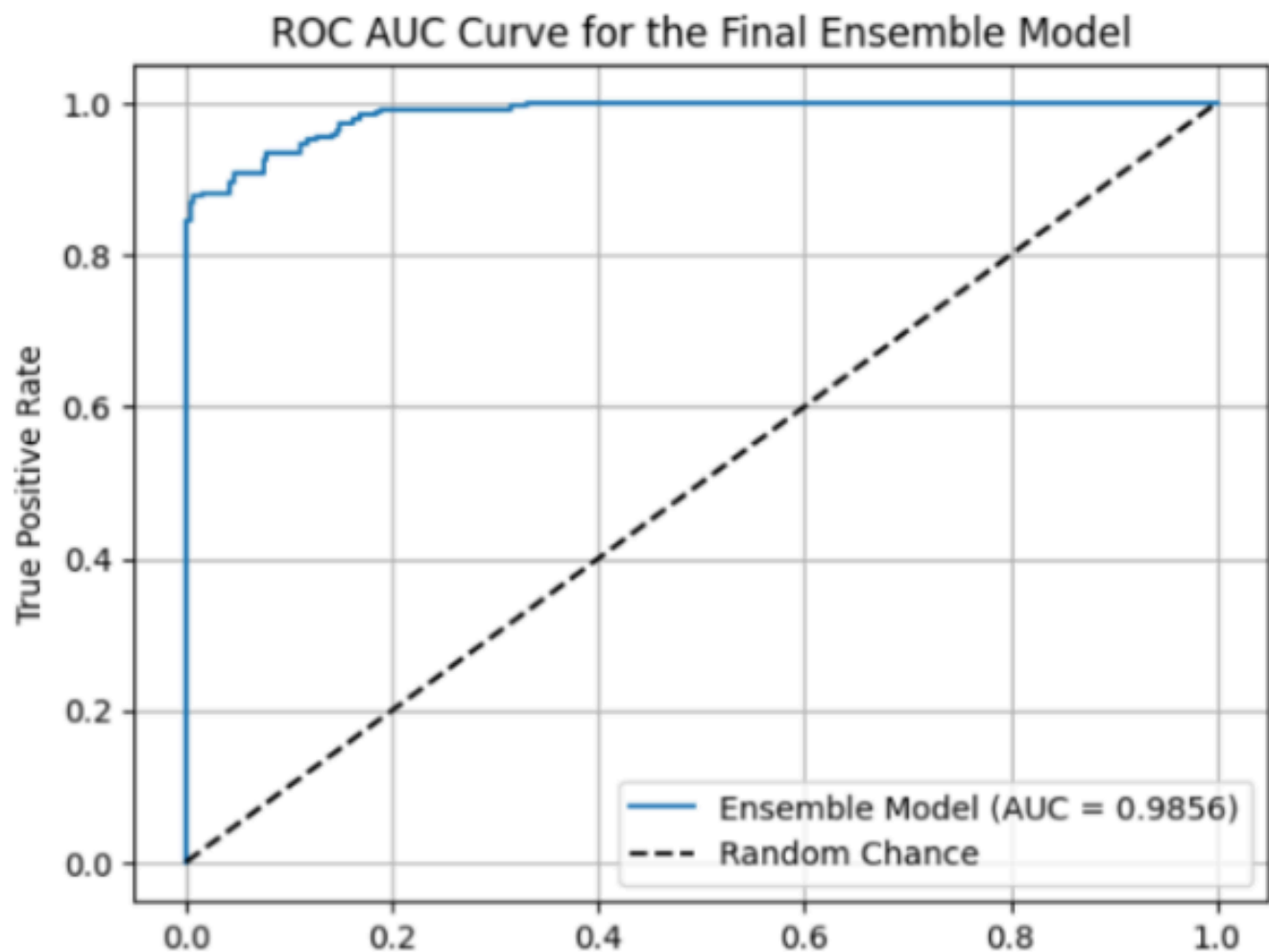
The final ensemble model achieved an Area Under the Curve (AUC) of 0.9856, a whopping 6.6% jump from 0.92 without feature engineering indicates a near-perfect ability to distinguish between defaulters and non-defaulters. A Recall score of 93% confirms its business value by successfully identifying the vast majority of at-risk customers, ensuring that proactive strategies are targeted at the right audience.

Model Interpretability
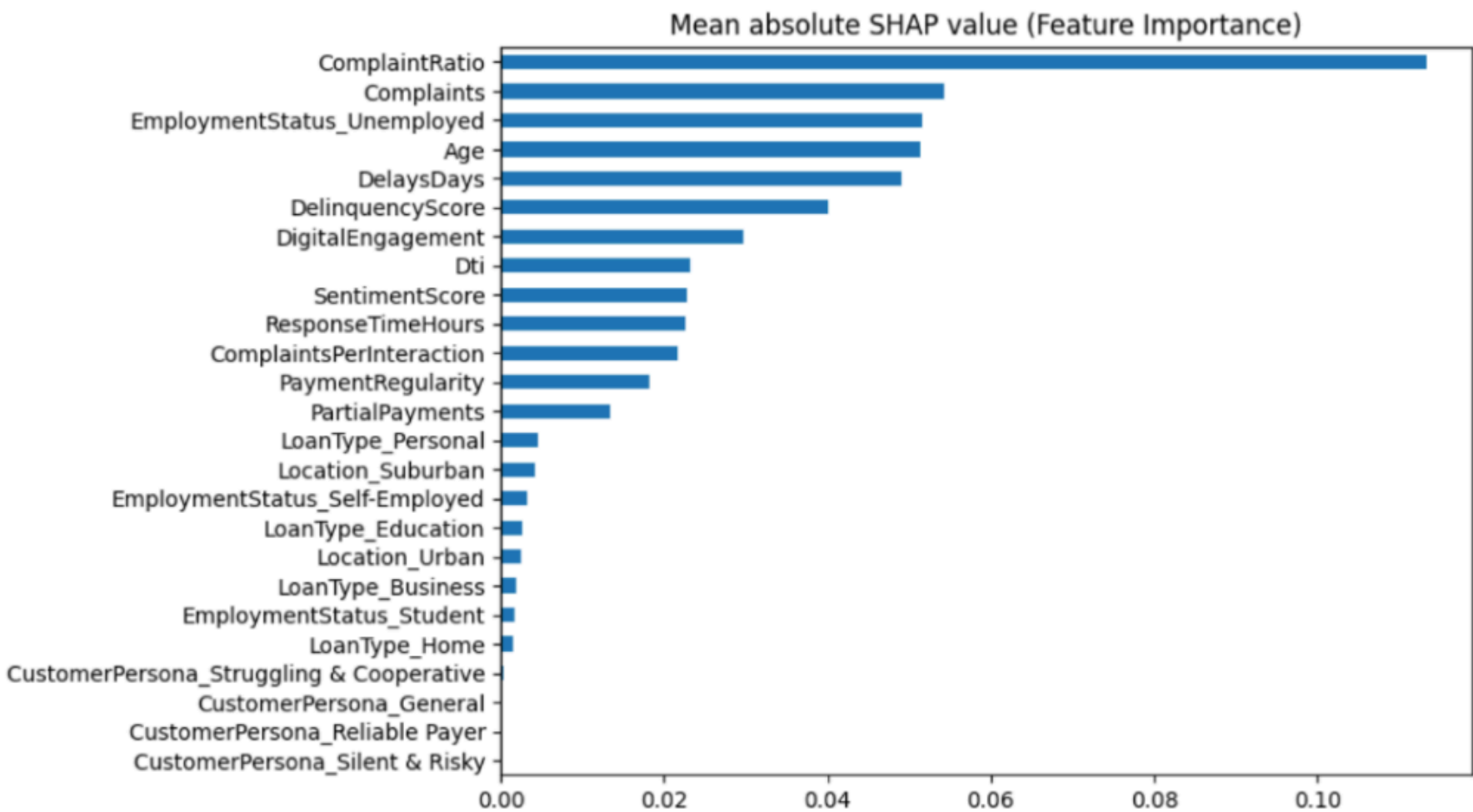
To ensure full transparency, I used SHAP (SHapley Additive exPlanations) to open the model's "black box." The analysis confirmed that the features I engineered—particularly DTI and DelinquencyScore—were the most influential drivers. This not only builds trust in the model but also provides valuable business insights into the key drivers of default.

Core Innovation: Data-Driven Customer Personas

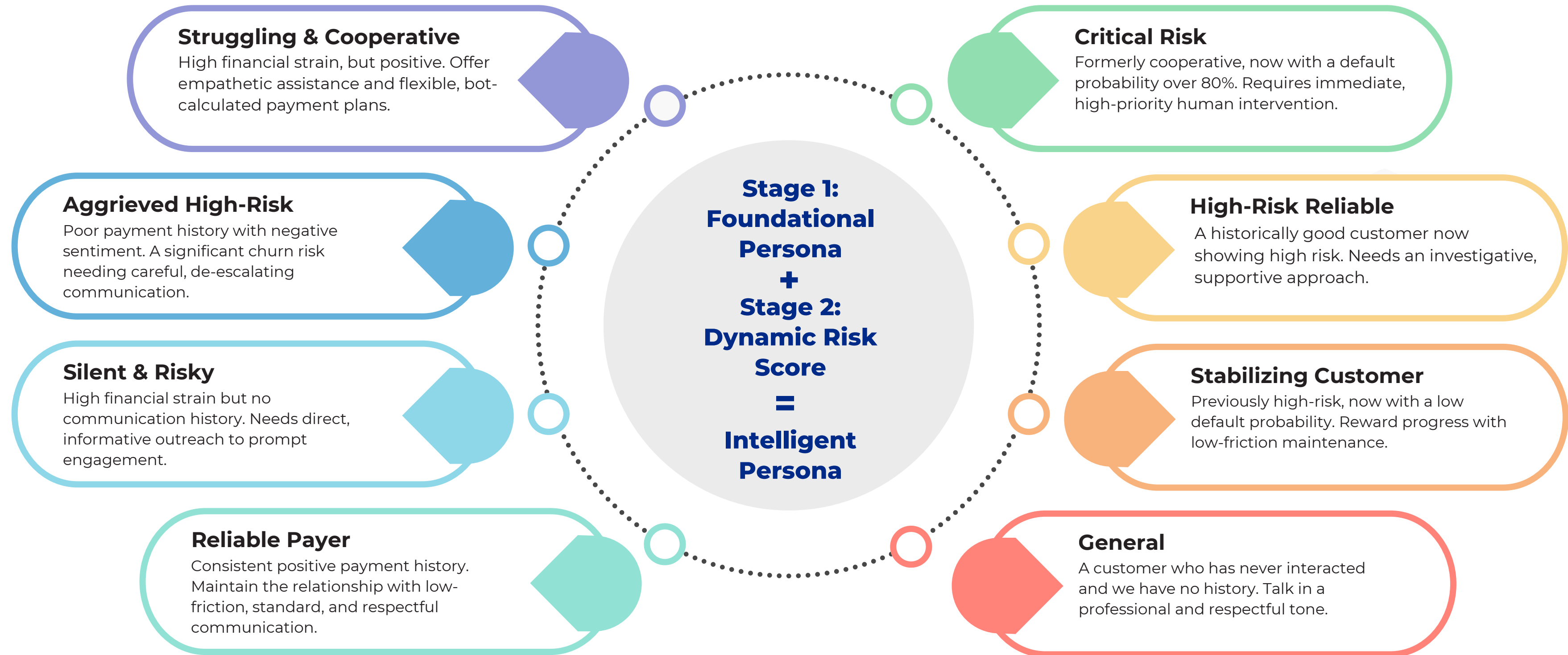I combined static behavioral clustering with a dynamic, real-time risk overlay to create a uniquely adaptive strategy.

Struggling & Cooperative
High financial strain, but positive. Offer empathetic assistance and flexible, bot-calculated payment plans.

Critical Risk
Formerly cooperative, now with a default probability over 80%. Requires immediate, high-priority human intervention.

Aggrieved High-Risk
Poor payment history with negative sentiment. A significant churn risk needing careful, de-escalating communication.

High-Risk Reliable
A historically good customer now showing high risk. Needs an investigative, supportive approach.

Stage 1:
Foundational
Persona
+
Stage 2:
Dynamic Risk
Score
=
Intelligent
Persona

Silent & Risky
High financial strain but no communication history. Needs direct, informative outreach to prompt engagement.

Stabilizing Customer
Previously high-risk, now with a low default probability. Reward progress with low-friction maintenance.

Reliable Payer
Consistent positive payment history. Maintain the relationship with low-friction, standard, and respectful communication.

General
A customer who has never interacted and we have no history. Talk in a professional and respectful tone.

The Power of an Adaptive Persona: One Bot, One Context, Two Tones

This chatbot shifts its strategy and tone in real-time based on the customer's pre-identified persona.
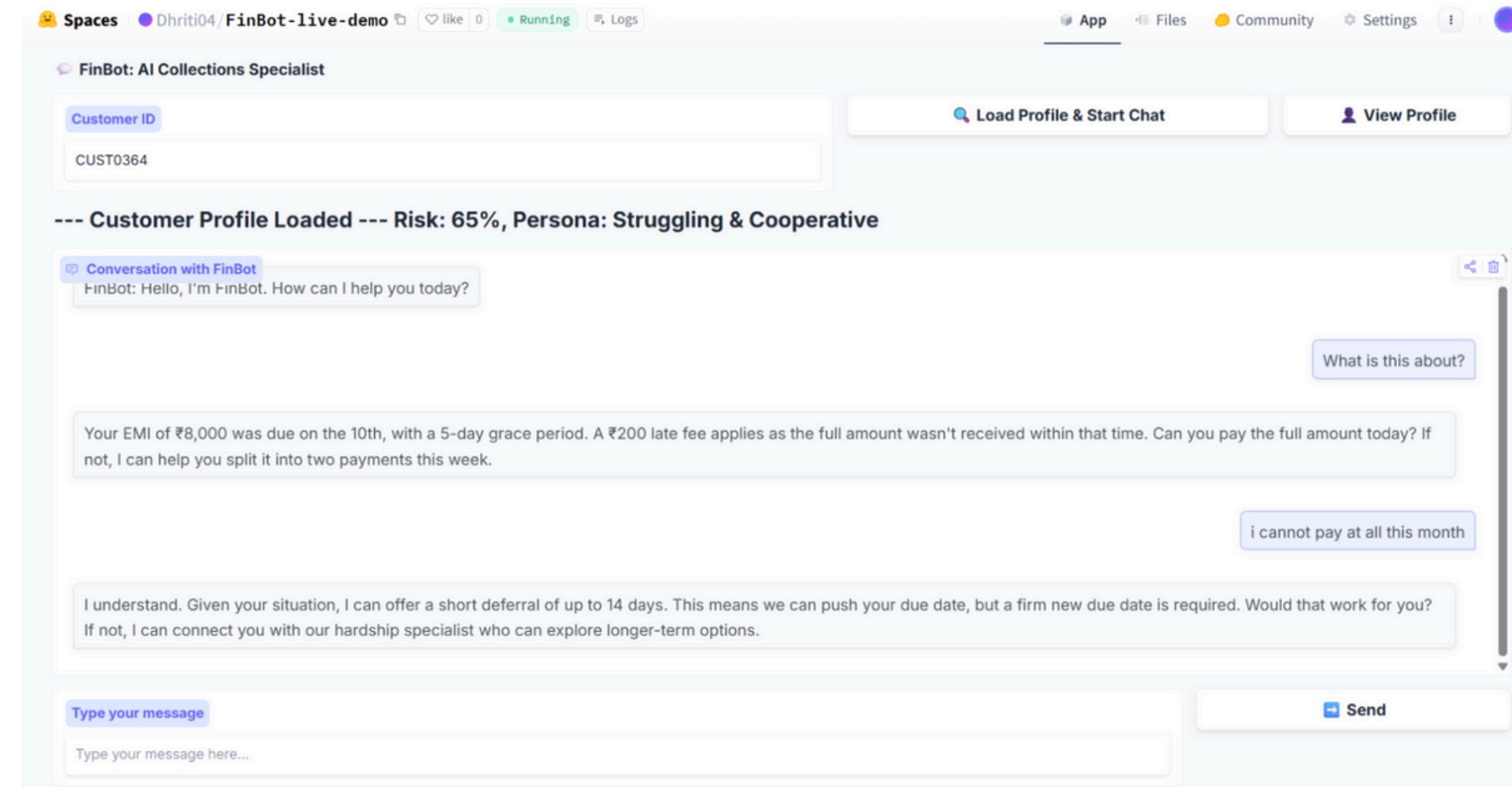
EMPATHETIC & SUPPORTIVE TONE

ASSERTIVE & DIRECT TONE
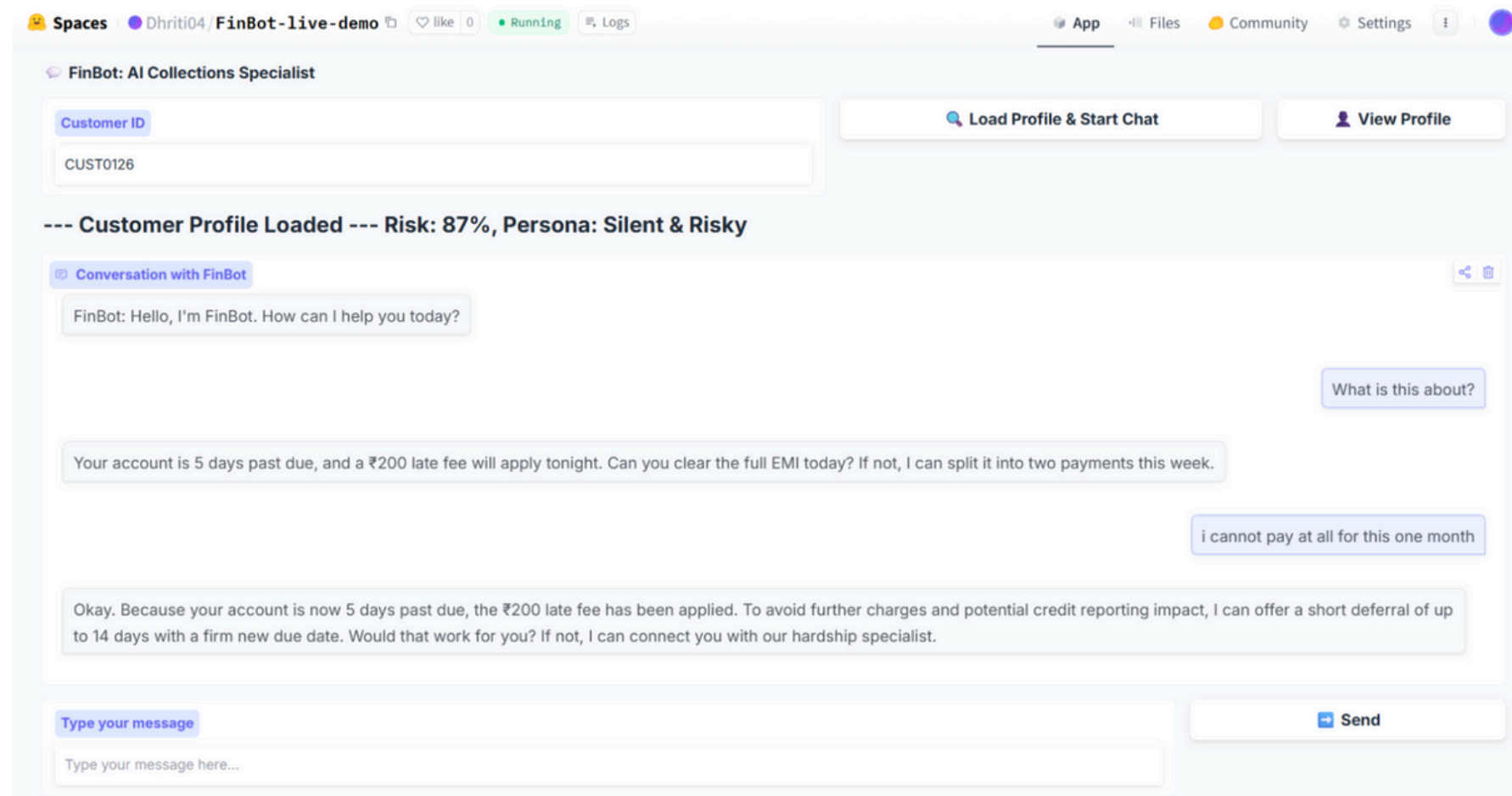
For a "Struggling & Cooperative" User

The bot builds trust by validating the user's situation and proactively offers a helpful, tangible solution, turning a negative interaction into a positive one.

For a "Silent & Risky" User

The bot immediately establishes urgency with a direct, informative script to prompt a response from a disengaged, high-risk customer.

Unlike generic bots that follow a rigid script, my solution is a dynamic, intelligent agent. By integrating a two-stage persona engine, it doesn't just respond—it understands, adapts, and executes the precise strategy for each unique customer, transforming it from a simple notification tool into a sophisticated negotiation and de-escalation system.
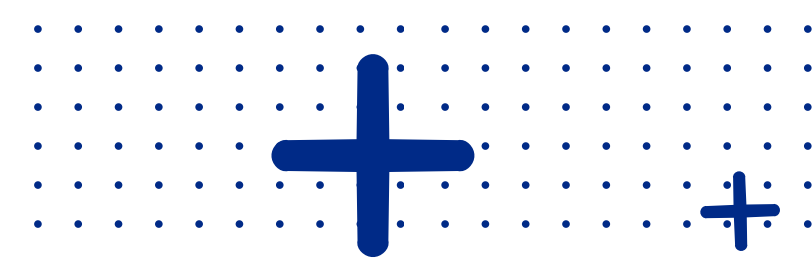
Key Innovations & Capabilities

The "Intelligent Persona" Engine

Our key innovation. By fusing the live risk score with historical rules, FinBot creates dynamic personas like "High-Risk Reliable" and "Stabilizing Customer," allowing for a level of strategic nuance that is impossible for simpler systems.

Advanced Crisis Management

FinBot is built for the real world. It has proven, flawless protocols for handling high-stakes scenarios including fraud claims, formal complaints, and legal threats, mitigating company risk.

"Firm-but-Fair" Negotiation Logic

The bot deploys a data-driven, tiered negotiation ladder. It remains firm on policy with high-risk users to prevent revenue leakage but offers appropriate flexibility to cooperative customers to protect the relationship.

Sophisticated NLP & Empathy

FinBot demonstrates a deep understanding of user intent. It has been tested to successfully parse sarcasm, handle ambiguity, and even take full accountability for its own errors, a critical feature for building trust.
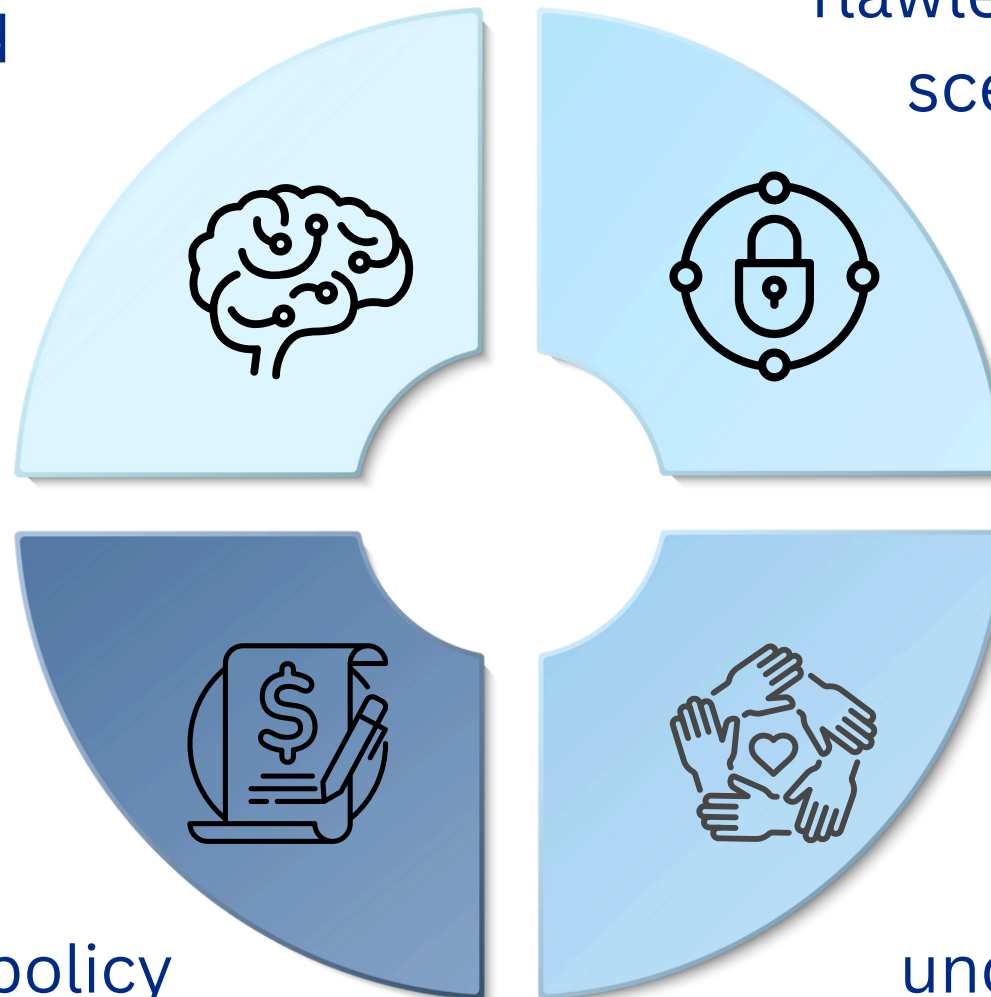
The Business Impact: A Clear Return on Investment

This solution is designed to deliver tangible value across the entire collections lifecycle.

Projected annual benefit exceeding ₹84,00,000 from a conservative 10,000-account model.
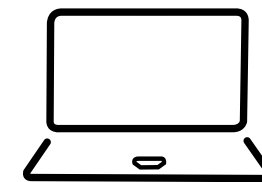
Higher Recovery

Focusing skilled agent effort on the 93% of true defaulters leads to more effective negotiations.
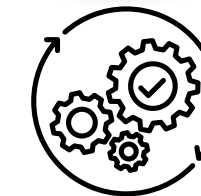
Reduced Costs

Automating thousands of routine interactions with the chatbot significantly reduces agent hours and operational expenses.

Better CX

Personalized, empathetic communication reduces complaints and builds long-term loyalty by respecting the customer's unique situation.

Improved Efficiency

The chatbot handles mundane tasks, freeing human agents to focus on high-value, complex negotiation scenarios.

Scalable Growth

The automated system allows the collections department to handle a growing customer base without increasing headcount.

Conclusion and Future Potential

This solution is a complete blueprint for transforming the collections process. By integrating a high-accuracy predictive model, a two-stage persona engine, and an intelligent chatbot, it moves beyond simple automation to create a proactive, efficient, and customer-centric operation. It's designed to drive profitability while building stronger customer relationships.

This system also provides the foundation for future growth. Next steps include A/B testing chatbot strategies and integrating response data back into the model to create a continuously learning and optimizing collections system.