

## PRODUCT REQUIREMENTS DOCUMENT

# OccupancyAI Assistant

Intelligent AI Agent for Hotel Occupancy Platform

**Version:** 1.0

**Date:** February 5, 2026

**Product:** Hawaii Hotel Occupancy Intelligence Platform

**Phase:** MVP & Market Launch (Months 1-6)

**Status:** Draft for Review

## Agent Overview

OccupancyAI Assistant is an intelligent AI agent designed to accelerate development, enhance customer success, and provide expert guidance throughout the MVP and Market Launch phases of the Hawaii Hotel Occupancy Intelligence Platform.

The agent serves dual purposes: (1) Internal tool for engineering and product teams to streamline ML model development and data pipeline optimization, and (2) Customer-facing assistant to help hotel operators interpret forecasts, make data-driven decisions, and maximize platform value.

# Table of Contents

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- 1. Executive Summary
- 2. Agent Purpose & Context
- 3. Agent Capabilities & Features
- 4. Use Cases & Workflows
- 5. Technical Architecture
- 6. Agent Personality & Voice
- 7. Integration Points
- 8. Success Metrics
- 9. Development Roadmap
- 10. Risks & Mitigations
- 11. Training & Knowledge Base
- 12. Guardrails & Limitations

## 1. Executive Summary

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### 1.1 Vision Statement

"OccupancyAI Assistant empowers both our internal team and hotel customers with an intelligent, always-available expert that understands tourism data, forecasting models, and revenue management strategies specific to Hawaii's hospitality industry."

## 1.2 Strategic Objectives

### Accelerate Development

Reduce ML model iteration time by 40% through automated analysis and recommendations

### Improve Retention

Increase customer engagement by 60% with proactive insights and recommendations

### Enhance Onboarding

Achieve 90% self-service onboarding rate with AI-guided setup

### Scale Support

Handle 80% of customer queries without human intervention

## 1.3 Agent Personas



### DevOps Buddy

#### Internal: Engineering & Data Science Teams

ML model optimization, data pipeline debugging, performance monitoring



### Revenue Advisor

#### External: Hotel Revenue Managers

Forecast interpretation, pricing recommendations, scenario analysis



### Onboarding Coach

#### External: New Hotel Customers

Setup guidance, data upload assistance, feature education

## 1.4 Key Success Metrics

Model Training Time

**-40% ↓**

Self-Service Rate

**90% ↑**

Support Ticket  
Deflection

**80% ↑**

User Satisfaction

**4.7/5 ↑**

## 2. Agent Purpose & Context

### 2.1 Problem Statement

#### Development Challenges

- ⚠️ ML model tuning requires deep expertise and takes 2-3 weeks per iteration
- ⚠️ Data quality issues discovered late in pipeline, causing delays
- ⚠️ No automated way to explain model predictions to stakeholders
- ⚠️ Manual feature engineering is time-consuming and error-prone

#### Customer Challenges

- ⚠️ Revenue managers don't have ML expertise to interpret forecasts
- ⚠️ Complex onboarding process leads to 50%+ drop-off
- ⚠️ Customers struggle to connect platform insights to business actions
- ⚠️ Support team overwhelmed with repetitive 'how-to' questions

### 2.2 Agent's Role in Product Lifecycle

#### Phase 0: Foundation (Month 1)

- Set up infrastructure
- Build core agent capabilities
- Create knowledge base

- Internal testing

### **Phase 1: MVP (Months 2-3)**

- Customer-facing features
- Onboarding assistant
- Query interface
- Beta testing with 5 hotels

### **Phase 2: Market Launch (Months 4-6)**

- Revenue advisor
- Report generation
- Competitive intelligence
- Scale to 50+ hotels

## 2.3 Target Users

User Type	Usage Frequency	Primary Needs	Priority
Data Scientists	Daily	Model debugging, feature engineering, performance analysis	P0
Backend Engineers	Daily	Code generation, pipeline optimization, debugging	P0
Revenue Managers	Daily	Forecast interpretation, pricing advice, scenario planning	P0
General Managers	Weekly	Executive reports, strategic insights, performance summaries	P1
New Customers	One-time	Onboarding guidance, feature discovery, setup assistance	P0
Customer Success Team	Daily	Customer issue insights, usage analytics, escalation support	P1

## 3. Agent Capabilities & Features

### 3.1 Core Capabilities Overview



#### Data Analysis

Validate, clean, and analyze hotel & tourism data



#### ML Assistance

Debug models, suggest features, explain predictions



#### Natural Language

Answer questions in plain English



#### Visualization

Generate charts and reports automatically



#### Recommendations

Provide actionable pricing and strategy advice



#### Training

Guide users through platform features



#### Real-time Alerts

Proactively notify about important changes



#### Integrations

Connect to PMS, data sources, and tools

### 3.2 Phase 1 Features (MVP - Months 1-3)

#### A1: Data Quality Analyzer

P0

Automatically validates uploaded hotel data and identifies issues

##### Capabilities:

- Detect missing values, outliers, and inconsistencies
- Suggest data cleaning strategies with code examples
- Validate data schema matches requirements
- Generate data quality report with visualizations
- Recommend minimum viable dataset if incomplete

Users: Data Engineers Hotel Operators

## A2: Model Performance Explainer

P0

Translates ML model outputs into human-readable insights

Capabilities:

- Explain forecast predictions in plain English
- Identify key factors driving occupancy changes
- Show confidence levels and uncertainty sources
- Compare actual vs. predicted with root cause analysis
- Generate sharable summary reports

Users: Data Scientists Revenue Managers GMs

## A3: Interactive Onboarding Assistant

P0

Guides new customers through setup with conversational interface

Capabilities:

- Step-by-step data upload with real-time validation
- Answer questions about platform features
- Provide contextual help based on user progress
- Troubleshoot common setup issues
- Personalize onboarding based on hotel type/size

Users: New Hotel Customers Customer Success Team

## A4: Natural Language Query Interface

P1

Allows users to ask questions in plain English

**Capabilities:**

- Answer questions about forecasts: 'Why is occupancy low next week?'
- Retrieve historical data: 'Show me last year's March performance'
- Compare metrics: 'How do I compare to Maui average?'
- Explain terminology: 'What is RevPAR?'
- Provide quick calculations: 'What's my projected revenue for Q2?'

Users: All Users

P1

## A5: Smart Alert Generator

Proactively identifies important trends and sends contextual alerts

**Capabilities:**

- Detect unusual patterns in forecast or actual data
- Prioritize alerts by business impact
- Suggest actionable responses to each alert
- Learn user preferences for alert frequency/type
- Summarize multiple alerts into daily digest

Users: Revenue Managers GMs

P0

## 3.3 Phase 2 Features (Market Launch - Months 4-6)

### A6: Revenue Strategy Advisor

Provides personalized pricing and revenue optimization recommendations

**Capabilities:**

- Suggest optimal pricing strategies based on forecast
- Recommend inventory allocation by room type
- Identify upsell/cross-sell opportunities

- Model 'what-if' scenarios with revenue projections
- Benchmark against competitive set with improvement actions

Users: Revenue Managers GMs

P0

## A7: Automated Report Generator

Creates executive-ready reports and presentations

### Capabilities:

- Generate weekly/monthly performance summaries
- Create custom reports based on user queries
- Format reports for specific audiences (board, operations, finance)
- Include narrative insights alongside data visualizations
- Export to PDF, PowerPoint, or Excel

Users: GMs Owners/Executives

P1

## A8: Competitive Intelligence Analyst

Provides market insights and competitive positioning

### Capabilities:

- Analyze market trends affecting hotel performance
- Compare hotel metrics to island/competitive set averages
- Identify market share opportunities
- Alert to competitor pricing changes
- Recommend positioning strategies

Users: Revenue Managers GMs Sales Directors

## A9: Developer Assistant

P1

Helps internal team with code generation and debugging

**Capabilities:**

- Generate data pipeline code for new data sources
- Debug ML model performance issues
- Suggest feature engineering strategies
- Optimize database queries
- Generate unit tests and documentation

**Users:** Engineers Data Scientists

## A10: Training & Knowledge Bot

P2

On-demand training and best practices guidance

**Capabilities:**

- Answer revenue management methodology questions
- Provide tutorials for platform features
- Share industry best practices for Hawaii hospitality
- Recommend learning resources based on user role
- Track user skill progression and suggest next steps

**Users:** All Users

## 4. Use Cases & Workflows

### 4.1 Internal Use Cases (Engineering Team)

#### Use Case 1: ML Model Performance Debugging

**Actor:** Data Scientist (Sarah)

**Trigger:** Model accuracy drops from 93% to 87% after retraining

**Workflow:**

1. Sarah asks agent: 'Why did model accuracy decrease?'
2. Agent analyzes recent data, model params, and feature distributions
3. Agent identifies: 'New data includes COVID recovery period with unusual patterns not in training set'
4. Agent suggests: 'Add time-based feature for pandemic recovery period' with code example
5. Sarah implements suggestion, accuracy improves to 91%
6. Agent documents the issue and solution in knowledge base

**Outcome:** Reduced debugging time from 2 days to 2 hours

#### Use Case 2: Data Pipeline Optimization

**Actor:** Backend Engineer (Mike)

**Trigger:** Daily forecast generation taking 45 minutes (target: <10 min)

**Workflow:**

1. Mike: 'Why is the forecast pipeline so slow?'
2. Agent profiles the pipeline and identifies bottleneck: 'MongoDB aggregation query on line 127 taking 35 min'
3. Agent provides optimized query with proper indexing
4. Mike implements the change
5. Pipeline now completes in 8 minutes
6. Agent adds performance monitoring alert for future regressions

Outcome: 80% performance improvement, meets SLA requirements

### Use Case 3: Feature Engineering Assistance

**Actor:** Data Scientist (Sarah)

**Trigger:** Need to improve forecast accuracy for holiday periods

**Workflow:**

1. Sarah: 'What features would improve holiday forecasting?'
2. Agent analyzes historical data and suggests: 'Add 7-day holiday indicator, days-until-holiday counter, and previous-year-same-holiday occupancy'
3. Agent generates feature engineering code with unit tests
4. Sarah reviews and integrates the features
5. Model accuracy for holiday periods improves by 4%
6. Agent tracks feature importance over time

Outcome: Faster iteration, data-driven feature selection

## 4.2 External Use Cases (Hotel Customers)

### Use Case 4: New User Onboarding

**Actor:** Revenue Manager (Lisa) at 120-room Maui Resort

**Trigger:** First login to platform

**Workflow:**

1. Agent greets Lisa: 'Welcome! Let's get your hotel set up. First, tell me about your property.'
2. Lisa provides: hotel name, location, room count
3. Agent: 'Great! Now let's upload your historical occupancy data. Need help formatting your CSV?'
4. Lisa uploads file, agent detects 3 data quality issues
5. Agent explains each issue with suggested fixes

6. Lisa corrects and re-uploads
7. Agent: 'Perfect! Your model is training now (5-8 minutes). While we wait, let me show you the dashboard...'
8. Agent provides interactive tour of key features
9. Model training completes, agent shows Lisa her first 90-day forecast
10. Agent: 'I notice occupancy dips in 3 weeks. Want to explore why?'

**Outcome:** 30-minute self-service onboarding (previously 2+ hours with support)

## Use Case 5: Forecast Interpretation

**Actor:** Revenue Manager (Lisa)

**Trigger:** Receives alert: 'Low occupancy predicted Mar 15-18'

**Workflow:**

1. Lisa clicks alert, asks agent: 'Why is occupancy low these dates?'
2. Agent analyzes and responds: 'Three factors: (1) Mid-week period (-10%), (2) Below-average visitor arrivals from Japan (-5%), (3) No major events scheduled (-3%)'
3. Lisa: 'What should I do about it?'
4. Agent: 'I recommend: (1) Run a 3-night package promotion targeting West Coast families, (2) Reduce rates 12-15% for direct bookings, (3) Reach out to corporate accounts for mid-week stays'
5. Lisa: 'Show me a scenario with 12% discount'
6. Agent runs scenario: 'With 12% discount, projected occupancy increases from 58% to 68%, revenue impact: +\$8,400'
7. Lisa implements the pricing strategy
8. Agent monitors actual performance and provides update in real-time

**Outcome:** Data-driven pricing decision made in 10 minutes vs. 1-2 days of analysis

## Use Case 6: Executive Reporting

**Actor:** General Manager (Robert)

**Trigger:** Needs to prepare monthly board presentation

**Workflow:**

1. Robert: 'Create a board report for February performance and March forecast'
2. Agent: 'I'll create a presentation. What should I emphasize?'
3. Robert: 'Focus on revenue growth and competitive positioning'
4. Agent generates 12-slide PowerPoint with: Executive summary, KPI dashboard, Revenue trends, Occupancy analysis, Market comparison, March forecast, Strategic recommendations
5. Agent includes narrative insights: 'February RevPAR exceeded budget by 8% due to strong Valentine's weekend and successful direct booking campaign'
6. Robert reviews and asks: 'Add slide on staffing implications'
7. Agent adds slide with recommended staffing levels based on occupancy forecast
8. Robert exports presentation in 15 minutes

**Outcome:** Report creation time reduced from 4 hours to 15 minutes

**Use Case 7: Troubleshooting**

**Actor:** Revenue Manager (Lisa)

**Trigger:** Forecast seems incorrect for upcoming holiday weekend

**Workflow:**

1. Lisa: 'The Easter weekend forecast looks wrong - showing 75% but we're already at 92% booked'
2. Agent: 'Let me check. When did you last update your actual occupancy data?'
3. Lisa: 'Last upload was 2 weeks ago'
4. Agent: 'That's the issue. The model hasn't seen your recent bookings. Upload your latest PMS data and I'll retrain the model.'
5. Lisa uploads updated CSV
6. Agent retrains model in 6 minutes
7. Agent: 'Updated forecast now shows 96% for Easter weekend. Much better!'
8. Agent: 'Pro tip: Connect your PMS API for automatic daily updates. Want help setting that up?'

**Outcome:** Issue resolved in 10 minutes, customer learns best practice

## 4.3 Conversation Flows

### Example 1: Natural Language Query



User

How's my hotel performing compared to last year?



Agent

Great question! Let me pull up your year-over-year comparison. For the same period last year (Jan-Feb 2025), your occupancy was 76.2% with an ADR of \$268. This year you're at 78.5% occupancy (+2.3 points) with ADR of \$285 (+\$17). Your RevPAR improved from \$204 to \$224, that's a 9.8% increase! 🚀

Your strongest improvement is in weekend occupancy, which is up 5.2 points. This aligns with the overall Maui market trend – leisure travel is strong.



User

What's driving the higher ADR?



Agent

Three main factors:

1. \*\*Market demand\*\* (60% of increase): Overall visitor demand to Maui is up 12% YoY, allowing higher pricing
2. \*\*Your revenue strategy\*\* (30%): You've successfully increased direct bookings (now 45% vs 38% last year), which have higher rates than OTA bookings
3. \*\*Room mix\*\* (10%): You're selling more ocean-view rooms this year (42% vs 38%)

You're actually outperforming the Maui market average ADR increase of \$12. Nice work! 🚀



User

Should I push rates higher for March?



Agent

Let me check March forecast conditions...

I'd recommend a \*cautious\* approach for March:

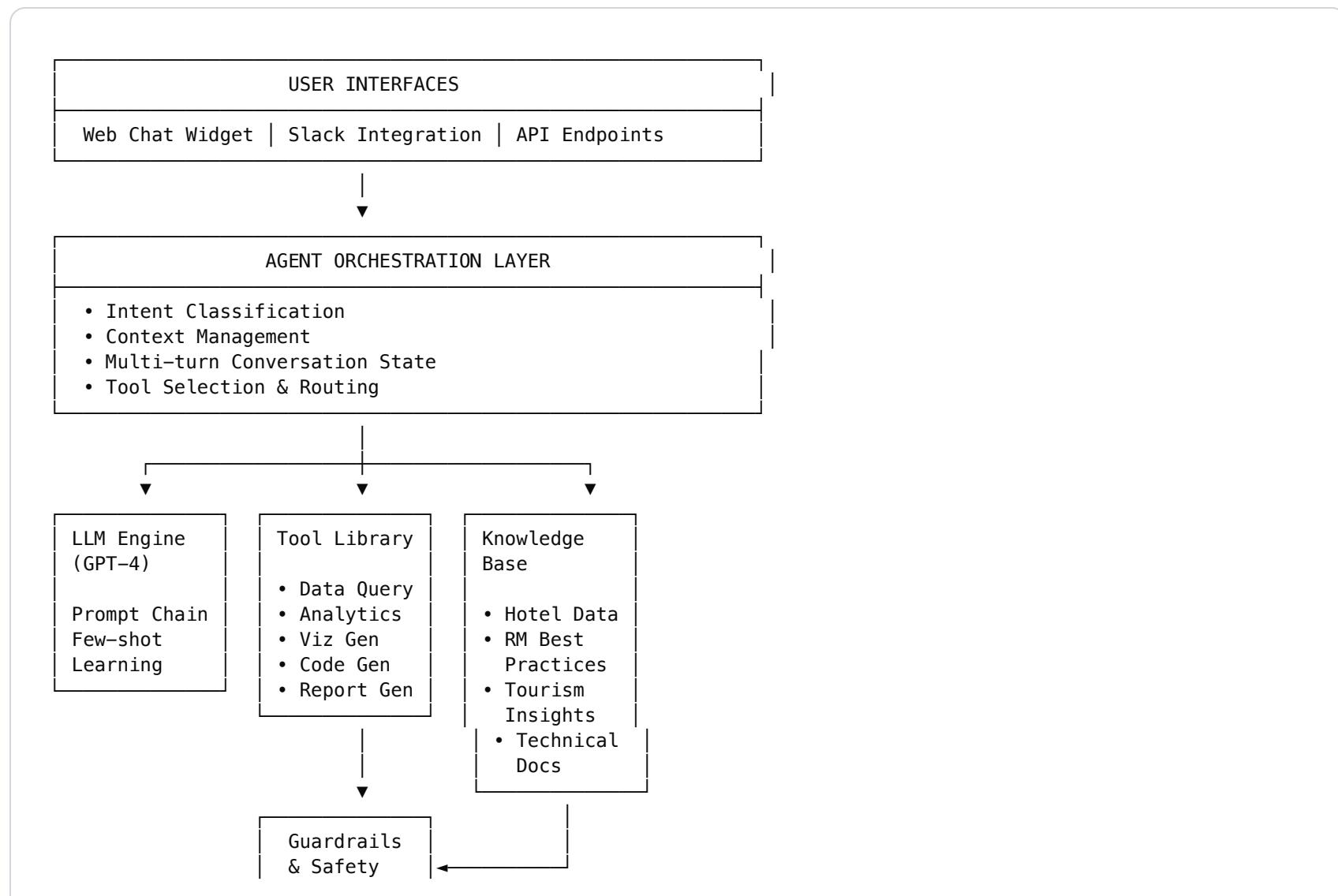
**\*\*Weeks 1-2 (Mar 1-14)\*\*:** Yes, you have room to increase by 5-8%. Demand is strong and you're currently 20% below your dynamic pricing ceiling.

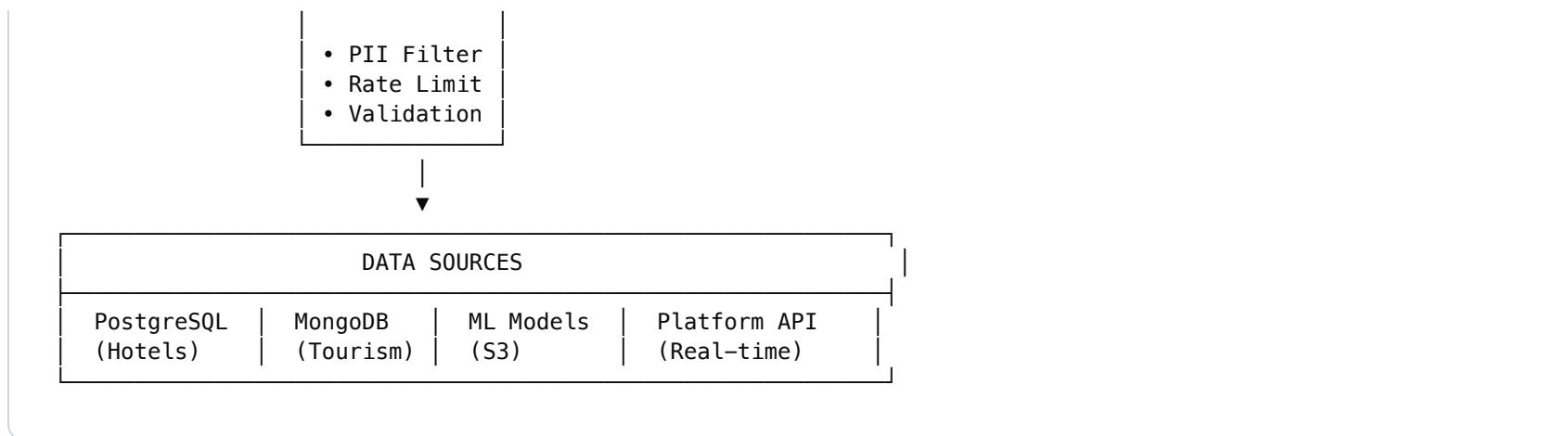
**\*\*Weeks 3-4 (Mar 15-28)\*\*:** Hold rates. My forecast shows softening demand (spring break ends, shoulder season begins). Market-wide occupancy expected to drop to 65-70%.

Want me to run a pricing scenario to show the revenue impact?

## 5. Technical Architecture

### 5.1 System Architecture





## 5.2 Technology Stack

Component	Technology	Rationale
LLM Core	OpenAI GPT-4 Turbo	State-of-art reasoning, tool use, function calling
Orchestration	LangChain / LlamaIndex	Agent framework, tool management, memory
Vector DB	Pinecone / Weaviate	Knowledge base embedding search
Application	Python FastAPI	High-performance async API
Frontend Widget	React + TypeScript	Embedded chat interface
Caching	Redis	Reduce LLM calls, improve latency
Monitoring	LangSmith / Weights & Biases	Agent performance tracking
Safety	NeMo Guardrails / Custom	Content filtering, PII protection

## 5.3 Agent Intelligence Pipeline

### 1 User Input

Receive query via chat, API, or Slack

### 2 Intent Classification

Determine user goal and required tools

### 3 Context Retrieval

Fetch relevant knowledge from vector DB

### 4 Tool Execution

Run database queries, analytics, or code generation

### 5 Response Generation

LLM synthesizes natural language response

### 6 Safety Check

Validate response passes guardrails

### 7 Response Delivery

Return to user with formatting and actions

## 5.4 Tool Library Specifications

Tool Name	Purpose	Inputs	Outputs
<code>query_database</code>	Fetch hotel/tourism data	SQL-like natural language	Structured data
<code>generate_forecast</code>	Run ML prediction	Hotel ID, date range	Forecast data with confidence
<code>analyze_performance</code>	Calculate metrics & KPIs	Metric name, time period	Statistical summary
<code>create_visualization</code>	Generate charts	Data + chart type	Chart image/config
<code>run_scenario</code>	Model what-if scenarios	Variables to change	Projected outcomes
<code>generate_report</code>	Create formatted documents	Report type, data range	PDF/PPTX/Excel
<code>search_knowledge</code>	Query knowledge base	Question	Relevant docs/answers
<code>generate_code</code>	Create code snippets	Task description	Python/SQL code

## 5.5 Knowledge Base Structure

```

📁 knowledge_base/
  📄 platform_features.md - Feature documentation
  📄 revenue_management_101.md - RM best practices
  📄 hawaii_tourism_insights.md - Market intelligence
  📄 ml_model_docs.md - Model explanations
  📄 api_reference.md - Technical docs
  📄 troubleshooting_guide.md - Common issues
  📄 glossary.md - Hospitality terminology
  📁 examples/
    
```

-  sample\_queries.json – Example Q&A
-  conversation\_templates.json – Response patterns

## 6. Agent Personality & Voice

### 6.1 Personality Traits

#### Expert but Approachable

Knowledgeable about hospitality and ML, but explains complex concepts simply

*'Let me break down what RevPAR means in plain English...'*

#### Proactive & Helpful

Anticipates user needs and offers relevant suggestions

*'I noticed you're looking at March data - would you like me to compare it to last year?'*

#### Patient & Encouraging

Never condescending, celebrates user successes

*'No worries if this is confusing at first - revenue management takes practice!'*

#### Data-Driven

Always backs recommendations with specific numbers and evidence

*'Based on 23 similar low-occupancy periods, price reductions of 10-15% increased bookings by 40%'*

#### Action-Oriented

Provides concrete next steps, not just information

*'Here are 3 things you can do right now to improve next week's occupancy...'*

#### Aloha Spirit

Warm, friendly, respectful of Hawaiian culture

*'Aloha! Let's find ways to welcome more guests to your property'*

## 6.2 Communication Guidelines

Guideline	<input checked="" type="checkbox"/> Do	<input type="checkbox"/> Don't
Clarity	Use simple language, avoid jargon	Use technical terms without explanation
Conciseness	Get to the point, use bullet points	Write long paragraphs
Actionability	Provide specific next steps	Give information without guidance
Empathy	Acknowledge user feelings/frustrations	Ignore emotional context
Transparency	Admit when uncertain, show confidence levels	Pretend to know or make up information

## 6.3 Tone by User Type

User Type	Tone	Example
Data Scientists	Technical & Collaborative	'Your MAPE increased by 3%. Let's debug together. Looking at feature importance...'
Revenue Managers	Expert & Advisory	'Based on analysis of 47 similar periods, I recommend a 12% rate reduction...'
General Managers	Executive & Strategic	'Bottom line: March RevPAR will be down 5% YoY, but we can mitigate with...'
New Users	Patient & Educational	'Great question! Let me explain what occupancy forecast means in simple terms...'

## 6.4 Example Responses

User asks unclear question

**Bad Response:**

"I don't understand."

**Good Response:**

"I want to help! Could you clarify - are you asking about occupancy forecast, historical performance, or pricing strategy? Or something else?"

### Agent doesn't know answer

**✗ Bad Response:**

"I cannot answer that question."

**✓ Good Response:**

"That's a great question, but I don't have that specific data right now. Let me connect you with our support team who can help. In the meantime, I can help you with..."

### User reports error

**✗ Bad Response:**

"There is an error in your data."

**✓ Good Response:**

"I found an issue in the uploaded data: Row 45 has a negative occupancy value (-12%). This is likely a data entry error. Would you like me to show you how to fix it?"

## 7. Integration Points

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### 7.1 Platform Integration

Platform Component	Integration Method	Trigger
Dashboard UI	Embedded chat widget in bottom-right corner	Always available, context-aware
Onboarding Flow	Agent guides each step	Activated on first login
Alert System	Agent generates alert messages	When thresholds met
Report Builder	Natural language report requests	User asks for report
Data Upload	Agent validates and troubleshoots	During CSV upload process

### 7.2 Third-Party Integrations

Service	Purpose	Priority	Phase
Slack	Team notifications & queries	P1	Phase 2
PMS Systems (Opera, Cloudbeds)	Automatic data sync	P0	Phase 2
Zapier	Workflow automation	P2	Phase 3
Google Sheets	Data export/import	P1	Phase 2

### 7.3 API Specifications

```
POST /api/agent/chat
```

Request:

```
{  
  "message": "Why is occupancy low next week?",  
  "user_id": "user_123",  
  "hotel_id": "hotel_456",  
  "context": { "current_page": "/dashboard" }  
}
```

Response:

```
{  
  "response": "Three factors are driving low occupancy...",  
  "confidence": 0.92,  
  "suggested_actions": [...],  
  "conversation_id": "conv_789"  
}
```

#### **GET /api/agent/suggestions**

Response:

```
{  
  "suggestions": [  
    "Review your March forecast",  
    "Compare to last year's performance",  
    "Run pricing scenario for Easter weekend"  
  ]  
}
```

## 8. Success Metrics & KPIs

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### 8.1 Internal Team Metrics (Phase 1)

Metric	Baseline	Target	Measurement
ML Model Iteration Speed	2-3 weeks	< 1 week	Time from idea to deployed model
Data Quality Issue Detection	Manual, 2-3 days	Automated, <1 hour	Time to identify data problems
Code Generation Accuracy	N/A	>85% usable	% of generated code used without major edits
Developer Satisfaction	N/A	>4.5/5	Weekly team survey

### 8.2 Customer Success Metrics (Phase 1 & 2)

Metric	Baseline	Target	Measurement
Onboarding Completion Rate	45%	90%	% of signups who complete setup
Time to First Forecast	4 hours	<30 min	Time from signup to first useful forecast
Support Ticket Deflection	0%	80%	% of inquiries handled by agent vs human
Agent Query Resolution Rate	N/A	>85%	% of questions answered satisfactorily
Feature Discovery Rate	30%	70%	% of users who discover advanced features
User Engagement (DAU/MAU)	35%	60%	Daily active users / Monthly active

## 8.3 Agent Performance Metrics

Metric	Baseline	Target	Measurement
Response Time	N/A	<2 seconds	P95 latency for agent responses
Response Accuracy	N/A	>95%	% of factually correct responses (human eval)
Conversation Success Rate	N/A	>90%	% of conversations where user achieves goal
Escalation Rate	N/A	<15%	% of conversations requiring human handoff
User Satisfaction (CSAT)	N/A	>4.5/5	Post-conversation survey rating

## 8.4 Business Impact Metrics

### Customer Churn Reduction

**30% reduction**

Agent increases engagement and perceived value

### Support Cost Savings

**\$50K/year**

80% ticket deflection, less support headcount needed

### Engineering Velocity

**+25%**

Faster iteration on ML models and features

### Customer LTV Increase

**+20%**

Higher retention + more feature adoption

### Net Promoter Score (NPS)

**+15 points**

Improved user experience and success

### Time to Value

**-75%**

Faster onboarding and insight generation

## 9. Development Roadmap

### Phase 1: MVP Foundation (Months 1-3)

#### Month 1: Agent Core & Data Quality

##### Week 1-2

- Set up LLM infrastructure (OpenAI API integration)
- Design agent architecture and tool library framework
- Create initial prompt templates and few-shot examples
- Build data quality analyzer tool (A1)

##### Week 3-4

- Implement conversation state management
- Build knowledge base ingestion pipeline
- Create model performance explainer (A2)
- Internal testing with data science team

##### ⌚ Milestones:

- Agent can analyze data quality and explain model predictions

#### Month 2: Customer-Facing Features

##### Week 5-6

- Build interactive onboarding assistant (A3)

- Create chat widget UI component
- Implement natural language query engine (A4)
- Add context-aware help system

### Week 7-8

- Build smart alert generator (A5)
- Implement conversation history & context
- Add guardrails and safety filters
- Beta testing with 5 pilot hotels

#### ⌚ Milestones:

- Agent can guide customer onboarding and answer platform questions

## Month 3: Polish & Launch Prep

### Week 9-10

- Refine agent personality and voice
- Expand knowledge base with hotel-specific content
- Implement feedback collection system
- Performance optimization (<2s response time)

### Week 11-12

- Complete integration testing
- Create agent documentation and training materials
- Launch agent to all Phase 1 users
- Monitor and iterate based on usage data

**Milestones:**

- Agent live for 20+ hotels, 80%+ query resolution rate

## Phase 2: Advanced Capabilities (Months 4-6)

### Month 4: Revenue Intelligence

**Week 13-14**

- Build revenue strategy advisor (A6)
- Implement pricing recommendation engine
- Create scenario modeling interface
- Add competitive benchmarking tools

**Week 15-16**

- Build automated report generator (A7)
- Create report templates (executive, operational, financial)
- Implement export to PDF/PowerPoint/Excel
- Add narrative generation for reports

**Milestones:**

- Agent provides actionable revenue recommendations

### Month 5: Intelligence & Developer Tools

### Week 17-18

- Build competitive intelligence analyst (A8)
- Integrate market data sources
- Create developer assistant (A9)
- Add code generation capabilities

### Week 19-20

- Build training & knowledge bot (A10)
- Create interactive tutorials
- Add skill progression tracking
- Implement personalized learning paths

#### Milestones:

- Full feature set complete, 90%+ customer satisfaction

## Month 6: Scale & Optimization

### Week 21-22

- Performance optimization at scale
- Advanced caching strategies
- Multi-language support (Japanese)
- Voice interface prototype (Alexa/Google)

### Week 23-24

- Agent analytics dashboard for internal team
- A/B testing framework for prompt optimization

- Cost optimization (model selection, caching)
- Prepare for Phase 3 (enterprise features)

**⌚ Milestones:**

- Agent serving 50+ hotels, <\$0.50 cost per conversation

## 9.1 Resource Requirements

Role	Allocation	Duration	Responsibilities
ML Engineer	100%	Months 1-6	Agent architecture, tool integration, model optimization
Backend Engineer	50%	Months 1-6	API development, database integration
Frontend Engineer	25%	Months 2-4	Chat widget, UI integration
Data Scientist	25%	Months 1-3	Knowledge base creation, prompt engineering
Product Manager	25%	Months 1-6	Requirements, testing, iteration

## 10. Risks & Mitigations

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Risk	Probability	Impact	Mitigation Strategy
LLM Hallucinations	High	High	Strict guardrails, fact-checking against database, confidence thresholds, human review for critical decisions
High API Costs	Medium	Medium	Aggressive caching, prompt optimization, use smaller models for simple queries, rate limiting
Poor Agent Responses	Medium	High	Extensive testing, feedback loops, A/B testing prompts, human-in-loop for first 1,000 interactions
Privacy/Security Issues	Medium	Critical	PII detection and redaction, data encryption, audit logs, SOC 2 compliance
User Over-Reliance	Medium	Medium	Clear limitations disclosure, confidence indicators, encourage human verification for important decisions
Integration Complexity	High	Medium	Start with simple integrations, phased rollout, comprehensive testing

# 11. Training & Knowledge Base

## 11.1 Knowledge Base Content

Category	Content Items	Volume
Platform Documentation	<ul style="list-style-type: none"><li>• Feature guides</li><li>• API reference</li><li>• Data schemas</li><li>• Troubleshooting guides</li></ul>	~50 pages
Revenue Management	<ul style="list-style-type: none"><li>• RM fundamentals</li><li>• Pricing strategies</li><li>• Forecasting basics</li><li>• KPI definitions</li></ul>	~30 pages
Hawaii Tourism Intelligence	<ul style="list-style-type: none"><li>• Market trends</li><li>• Seasonal patterns</li><li>• Visitor demographics</li><li>• Event calendars</li></ul>	~20 pages
ML Model Documentation	<ul style="list-style-type: none"><li>• Model architecture</li><li>• Feature importance</li><li>• Prediction explanations</li><li>• Performance metrics</li></ul>	~15 pages
Example Q&A	<ul style="list-style-type: none"><li>• Common questions</li><li>• Conversation flows</li><li>• Response templates</li></ul>	~500 examples

## 11.2 Training Data Sources



### Historical Support Tickets

1,000+ actual customer questions and support responses  
**Usage:** Few-shot examples, intent classification training



### Revenue Management Textbooks

Industry-standard RM methodology and best practices  
**Usage:** Knowledge base content, methodology guidance



### Platform Usage Logs

Real user interactions, feature usage patterns  
**Usage:** Context-aware suggestions, personalization



### Tourism Research Papers

Academic research on Hawaii tourism trends  
**Usage:** Market intelligence, trend analysis

## 11.3 Continuous Learning Strategy

### 1 User Feedback Collection

👍👎 ratings on every response, optional detailed feedback

### 2 Conversation Analysis

Daily review of low-rated interactions, identify failure patterns

### 3 Knowledge Base Updates

Add new Q&A examples, update outdated information weekly

**4 Prompt Optimization**

A/B test prompt variations, adopt better-performing versions

**5 Model Fine-tuning**

Quarterly fine-tuning on domain-specific data (optional, Phase 3)

## 12. Guardrails & Limitations

### 12.1 Safety Guardrails

#### 🛡️ Content Safety

- No offensive/harmful content
- No medical/legal advice
- No political opinions

#### 🛡️ Data Privacy

- PII detection and redaction
- No storage of sensitive data
- Comply with GDPR/CCPA

#### 🛡️ Accuracy

- Fact-check against database
- Confidence thresholds (>80%)
- Admit uncertainty when appropriate

#### 🛡️ Rate Limiting

- Max 100 queries/hour per user
- Max 10 concurrent conversations
- Progressive delays for excessive use

#### 🛡️ Scope Boundaries

- Stay within hospitality domain
- Don't impersonate humans

- Don't make financial transactions

## 12.2 Known Limitations

### ⚠ Known Limitations

- Cannot access real-time web data (only knowledge base + database)
- Limited context window (~8K tokens, ~6-8 conversation turns)
- May struggle with highly complex multi-step reasoning
- Cannot execute actions outside platform (e.g., send emails, book rooms)
- Response quality depends on knowledge base completeness
- May occasionally produce confident-sounding but incorrect responses
- English primary language (Japanese support in Phase 2, limited accuracy)

## 12.3 Escalation Criteria

Escalation Trigger	Action
User explicitly requests human help	Immediate handoff to support team
Agent confidence <50% for 2+ consecutive responses	Offer human assistance
User expresses frustration (detected via sentiment)	Apologize and offer escalation
Query involves financial transactions or legal matters	Decline and redirect to appropriate channel
Technical error or system unavailability	Provide status and estimated resolution time
Conversation exceeds 15 turns without resolution	Suggest alternative approach or human help

## 12.4 Privacy & Compliance

### 🔒 Data Handling

- ✓ Conversation logs retained 90 days
- ✓ PII automatically redacted
- ✓ User can request data deletion
- ✓ No data sold to third parties

### 🔒 Security Measures

- ✓ End-to-end encryption in transit
- ✓ At-rest encryption (AES-256)
- ✓ SOC 2 Type II compliance
- ✓ Regular security audits

### 🔒 User Rights

- ✓ Right to access conversation history
- ✓ Right to delete data (GDPR)
- ✓ Opt-out of conversation logging
- ✓ Transparent AI disclosure

### 🔒 Compliance Standards

- ✓ GDPR (EU data protection)
- ✓ CCPA (California privacy)
- ✓ Hawaii data privacy laws
- ✓ Industry best practices

## 13. Approval & Next Steps

Role	Name	Signature	Date
Product Lead	[Name]	_____	__/__/__
Engineering Lead	[Name]	_____	__/__/__
ML/AI Lead	[Name]	_____	__/__/__
Data Science Lead	[Name]	_____	__/__/__

### Immediate Next Steps

1. **Week 1:** Review and approve PRD, allocate resources
2. **Week 2:** Set up LLM infrastructure, design agent architecture
3. **Week 3:** Begin development on A1 (Data Quality Analyzer)
4. **Week 4:** Start building knowledge base content
5. **Month 2:** Internal alpha testing with engineering team
6. **Month 3:** Beta launch to 5 pilot hotels

### Success Criteria for Phase 1 Launch

#### Internal Metrics:

- Data quality issues detected in <1 hour

#### Customer Metrics:

- 90% onboarding completion rate

- Model explanations rated useful by DS team (>4/5)
- 50+ agent-generated code snippets used in production
- 85% query resolution without human help
- 4.5+ CSAT rating from users
- <2 second average response time

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**OccupancyAI Assistant** - Product Requirements Document v1.0

For Hawaii Hotel Occupancy Intelligence Platform

*Building intelligent agents for smarter hospitality*