# Multi-Agent Business Management System Documentation

## System Overview

This documentation covers a comprehensive multi-agent system designed for Small to Medium Enterprise (SME) management, consisting of two primary agents working in coordination.

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# Customer Service Agent Documentation

## Agent Overview

### Name

**Customer Service Agent** (`customer_service_agent`)

### Description

A comprehensive AI-powered customer service agent designed to manage customer interactions for Small to Medium Enterprises (SMEs). The agent operates through Telegram to provide automated customer support, order management, and business information services.

## Technology Stack

- **AI Framework**: Google ADK (Application Development Kit) Agents
- **Language Model**: Gemini 2.0 Flash
- **Database**: SQLAlchemy with MySQL/PostgreSQL
- **Messaging Platform**: Telegram Bot API (AsyncTeleBot)
- **Programming Language**: Python
- **Session Management**: Custom session utilities
- **Environment Management**: python-dotenv

## Core Capabilities

### 1. Chatbot Services

- **Business Information**: Provides factual information about the business and its products/services
- **Product Catalog**: Displays available products with prices in Nigerian Naira
- **Customer Recognition**: Identifies returning customers and provides personalized greetings
- **Knowledge Base**: Responds only with verified business information from the database

## 2. Order Management System

- **New Customer Onboarding**: Collects customer details (name, age, gender) for first-time orders
- **Order Processing**: Handles product selection, quantity, and pricing
- **Discount Negotiation**: Manages bargaining while respecting minimum selling prices
- **Order Confirmation**: Presents order summary before final confirmation
- **Order Tracking**: Monitors and updates order status
- **Automated Notifications**: Sends order updates to customers and business owners

## 3. Customer Relationship Management

- **Customer History**: Maintains comprehensive purchase history
- **Visit Logging**: Records customer interactions and visit summaries
- **Order Status Updates**: Real-time order tracking and status notifications
- **Personalized Service**: Provides tailored responses based on customer history

## 4. Security Features

- **Self-Service Prevention**: Prevents business owners from placing orders for themselves
- **Customer Verification**: Validates customer identity through Telegram ID and username
- **Session Management**: Secure session handling with automatic resets

# Agent Tools

## Business Information Tools

- `get_business_info(business_id)`: Retrieves basic business information including name, description, contact details, and address
- `get_products_info(business_id)`: Fetches all products offered by the business with pricing and inventory details
- `get_specific_product_info(business_id, product_id, product_name)`: Searches for specific products by ID or name

## Customer Management Tools

- `get_customer_details(id)`: Retrieves customer profile information
- `upload_customer_details(...)`: Registers new customers in the database
- `get_customer_visits(business_id, customer_id, start_date)`: Fetches customer visit history from a specific date

- `get_all_customer_visits(business_id, customer_id)`: Retrieves complete customer visit records
- `log_customer_visit(...)`: Records customer interaction sessions

## Order Management Tools

- `get_customer_orders(business_id, customer_id, start_date)`: Retrieves customer orders from a specific date
- `get_all_customer_orders(business_id, customer_id)`: Fetches complete customer order history
- `upload_customer_order(...)`: Creates new customer orders in the database

## General Database Tools

- `list_tables()`: Lists all available database tables
- `describe_table(table_name)`: Describes table structure
- `execute_query(query)`: Executes custom SQL queries
- `get_single_value(...)`: Retrieves single values from database
- `get_rows_with_exact_column_values(...)`: Finds rows with exact matches
- `get_rows_with_matching_column_values(...)`: Finds rows with partial matches

## Communication Tools

- `run(contact)`: Sends messages to business administrators

# Subagents

This system operates as a single comprehensive agent without subagents. However, it integrates with:

- **Bizmate Agent Bot**: Receives order notifications and business communications
- **Business Administration System**: Handles owner notifications and alerts

# Key Features

## Automated Customer Support

- 24/7 availability through Telegram
- Multilingual support (primarily English with Naira currency support)
- Contextual responses based on customer history
- Automated greeting and business introduction

## Order Processing Workflow

1. **Customer Verification**: Checks if customer exists in database
2. **Product Selection**: Guides customers through available products
3. **Detail Collection**: Gathers necessary customer information for new users
4. **Order Summary**: Presents complete order details with pricing
5. **Confirmation**: Secures customer approval before processing
6. **Notification**: Alerts both customer and business owner

## Session Management

- **Automatic Session Reset**: Sessions reset after specified quota hours
- **State Persistence**: Maintains conversation context across interactions
- **Returning Customer Recognition**: Provides order updates for returning customers
- **Chat Logging**: Comprehensive conversation logging for audit trails

## Business Intelligence

- **Visit Analytics**: Tracks customer engagement patterns
- **Order History**: Maintains comprehensive transaction records
- **Customer Profiling**: Builds detailed customer profiles over time
- **Business Performance**: Supports business analytics through data collection

# Security and Compliance

## Data Protection

- Customer data encrypted and securely stored
- Session-based authentication
- Access control based on business and customer IDs

## Business Logic Security

- Prevents self-ordering by business owners
- Validates minimum selling prices during negotiations
- Maintains audit trails for all transactions

## Error Handling

- Comprehensive exception handling for database operations

- Graceful degradation for network issues
- User-friendly error messages

## Integration Points

### Database Integration

- Direct SQL database connectivity
- Transaction-safe operations
- Data validation and sanitization

### Telegram Integration

- Asynchronous message handling
- Rich message formatting
- Command-based interactions

### Business System Integration

- Real-time notifications to business owners
- Integration with business management systems
- Automated reporting capabilities

## Configuration

### Environment Variables

- `COMMS`: Communication channel identifier
- `RESET_QUOTA`: Session reset time in hours
- `LOGS_FOLDER_PATH`: Path for conversation logs

### Database Configuration

- Supports MySQL/PostgreSQL databases
- Connection pooling for performance
- Transaction management for data consistency

## Usage Patterns

### Customer Interactions

1. **Initial Contact**: `/start` or `/hello` commands

2. **Business Inquiry**: Ask about products, services, or business information

3. **Order Placement**: Select products, provide details, confirm orders

4. **Order Tracking**: Check status of existing orders

5. **History Review**: View past purchases and interactions

## Business Administration

- Receive order notifications

- Monitor customer interactions

- Access customer analytics

- Manage product information

This customer service agent provides a comprehensive solution for SME customer management, combining AI-powered conversation capabilities with robust order management and customer relationship tools.

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# BizMate Agent Documentation

## Agent Overview

### Name

**BizMate** (`bizmate`)

### Description

An intelligent business management assistant designed specifically for Small to Medium Enterprise (SME) business owners. BizMate serves as a comprehensive Personal Assistant (PA) that manages inventory, suppliers, customer orders, and business analytics through Telegram integration.

### Technology Stack

- **AI Framework**: Google ADK (Application Development Kit) Agents

- **Language Model**: Gemini 2.0 Flash

- **Database**: SQLAlchemy with MySQL/PostgreSQL

- **Messaging Platform**: Telegram Bot API (AsyncTeleBot)

- **Programming Language**: Python

- **Session Management**: Custom session utilities with 30-minute timeout

- **Environment Management**: python-doteny

- **Analytics**: Integrated data analysis tools
- **File Management**: Automated visual content handling

## Core Capabilities

### 1. Personal Assistant Services

- **Business Owner Verification**: Validates registered business owners through database lookup
- **Welcome Back Intelligence**: Provides personalized greetings with business performance summaries
- **Business Information Management**: Delivers factual business data from knowledge base
- **Session Continuity**: Maintains context across conversations with automatic session management
- **Login Tracking**: Records and analyzes business owner login patterns

### 2. Business Management Orchestration

- **Inventory Management**: Delegates inventory tasks to specialized database manager
- **Supplier Management**: Handles supplier information and relationships
- **Order Fulfillment**: Coordinates customer order processing and fulfillment
- **Task Delegation**: Intelligently routes complex tasks to appropriate subagents
- **Real-time Notifications**: Processes and forwards sales notifications

### 3. Analytics and Reporting

- **Business Performance Analysis**: Delegates analytical tasks to specialized analyst agent
- **Sales Metrics**: Tracks and reports on business performance indicators
- **Customer Analytics**: Provides insights on customer behavior and trends
- **Visual Reports**: Generates and delivers visual analytics through images

### 4. Sales Notification System

- **Order Processing**: Extracts and processes order details from notifications
- **Automated Messaging**: Generates structured messages for business owners
- **JSON Response Format**: Provides structured data for system integration
- **Real-time Alerts**: Immediate notification of new sales and orders

## Subagents

### 1. Database Orchestrator (`orchestrator`)

- **Purpose**: Handles complex database operations and management tasks
- **Delegation Trigger**: Inventory management, supplier updates, order fulfillment
- **Data Handling**: Business registration, product management, relationship management

## 2. Data Analyst (`analyst_agent`)

- **Purpose**: Provides business intelligence and analytics services
- **Delegation Trigger**: Performance analysis requests, business insights, trend analysis
- **Output**: Visual reports, performance metrics, business recommendations

# Agent Tools

## Business Management Tools

- `get_business_details(username)`: Retrieves comprehensive business information using Telegram username
- `log(id)`: Records business owner login sessions with timestamps
- `get_recent_orders(id)`: Fetches recent orders within 30-minute window since last login

## Inherited Tools (from Database Manager)

- Complete suite of database management tools for inventory and supplier management
- Product lifecycle management tools
- Customer relationship management utilities
- Order processing and fulfillment tools

# Key Features

## Intelligent Business Registration

- **Automatic Detection**: Identifies unregistered business owners
- **Seamless Onboarding**: Delegates registration to database orchestrator
- **Verification Process**: Confirms business existence before providing services
- **Username Management**: Handles missing usernames through registration process

## Advanced Session Management

- **30-Minute Reset Quota**: Automatic session refresh for security
- **Returning User Intelligence**: Provides business updates since last login
- **Context Preservation**: Maintains conversation context across sessions

- **Multi-User Support**: Handles multiple business owners simultaneously

## Sales Notification Processing

1. **Order Detail Extraction**: Parses incoming sales notifications
2. **Message Generation**: Creates formatted messages for business owners
3. **System Integration**: Provides JSON-formatted responses for automation
4. **Fulfillment Prompts**: Asks owners about order fulfillment decisions

## Visual Content Management

- **Automatic Image Handling**: Processes and delivers visual analytics
- **Dynamic Folder Creation**: Creates user-specific directories for visual content
- **Cleanup Management**: Automatically removes sent images to manage storage
- **Multi-format Support**: Handles various image formats for reporting

# Security and Business Logic

## Business Owner Authentication

- **Username Validation**: Verifies business owner identity through Telegram username
- **Database Verification**: Cross-references against registered business database
- **Session Security**: Implements secure session management with timeouts
- **Access Control**: Restricts access to authorized business owners only

## Task Delegation Security

- **Controlled Delegation**: Only delegates to verified subagents
- **Context Preservation**: Maintains business context during task delegation
- **Error Handling**: Graceful failure handling for delegation errors
- **Audit Trail**: Logs all delegated tasks for accountability

## Communication Security

- **Encrypted Messaging**: Secure Telegram communication
- **Structured Responses**: JSON-formatted responses for system integration
- **Alert Management**: Secure handling of sales notifications and alerts
- **Privacy Protection**: Protects sensitive business information

# Integration Architecture

## Multi-Agent Coordination

- **Orchestrator Integration**: Seamless handoff for database operations

- **Analyst Integration**: Automated delegation for analytics requests

- **Customer Service Integration**: Receives sales notifications from customer service agent

- **Business System Integration**: Connects with broader business management ecosystem

## Database Integration

- **Business Registration**: Manages business owner profiles and credentials

- **Login History**: Tracks business owner engagement patterns

- **Order Management**: Interfaces with customer order systems

- **Reporting Database**: Stores analytics and performance data

## Telegram Bot Integration

- **Asynchronous Processing**: Handles multiple conversations simultaneously

- **Rich Message Support**: Supports text, images, and formatted content

- **Command Processing**: Handles standard Telegram commands and interactions

- **Error Recovery**: Robust error handling for network issues

# Configuration and Environment

## Environment Variables

- `BIZ_TOK`: Telegram bot token for business owner communications

- `COMMS`: Communication channel identifier for system messages

- `RESET_QUOTA`: Session reset time (configurable timeout)

- `LOGS_FOLDER_PATH`: Directory for conversation logging

## Session Configuration

- **Application Name**: `bizmate_app` for session management

- **Session ID Format**: `ENT{user_id}_session` for business entrepreneurs

- **State Management**: Maintains chat ID and business context

- **Timeout Management**: Configurable session expiration

## Usage Patterns

### Business Owner Workflow

1. **Initial Contact**: `/start` or `/hello` commands for onboarding

2. **Business Verification**: Automatic verification against business database

3. **Performance Summary**: Receive updates on recent business activity

4. **Management Tasks**: Request inventory, supplier, or order management

5. **Analytics Requests**: Ask for business performance analysis

6. **Sales Notifications**: Receive and respond to new order alerts

### Administrative Features

- **Business Registration**: Automated registration for new business owners

- **Performance Monitoring**: Track business metrics and KPIs

- **Order Management**: Oversee customer order processing

- **Supplier Coordination**: Manage supplier relationships and inventory

## Advanced Features

### Intelligent Task Routing

- **Automatic Classification**: Categorizes requests for appropriate handling

- **Subagent Selection**: Routes tasks to most suitable subagent

- **Context Preservation**: Maintains business context across delegations

- **Response Aggregation**: Combines responses from multiple subagents

### Business Intelligence Integration

- **Real-time Analytics**: Provides immediate business insights

- **Visual Reporting**: Generates charts and graphs for business metrics

- **Trend Analysis**: Identifies patterns in business performance

- **Predictive Insights**: Offers recommendations based on data analysis

This BizMate agent serves as the central hub for SME business management, coordinating multiple specialized agents to provide comprehensive business support through an intuitive Telegram interface.