

Wolthers Coffee Quality Control System

Complete Technical Specification Document

Document Information

Project: Coffee Quality Control Web & iPad Application

Client: Wolthers Associates

Version: 1.0

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Database: Existing Supabase Infrastructure

1. Executive Summary

This document outlines the complete specification for developing a comprehensive coffee quality control system consisting of a web application and iPad application. The system will replace the failed 2017 implementation and serve Wolthers' global laboratory network, providing real-time quality assessment, client dashboards, and automated certification processes.

2. System Overview

2.1 Objectives

- Digitize and streamline coffee quality control processes across multiple laboratories
- Provide real-time collaboration tools for cupping sessions
- Automate quality assessment against client specifications
- Generate and distribute digital certificates
- Create comprehensive dashboards for all stakeholders

2.2 Scope

The system encompasses sample intake through certificate delivery, supporting multiple laboratories, clients, suppliers, and quality specifications across different coffee origins.

3. User Management & Access Control

3.1 User Categories

Laboratory Personnel

Santos HQ (Master Lab)

- Full system administrative access
- Global oversight of all laboratory operations
- Master data management capabilities
- Cross-lab analytics and reporting

Regional Labs:

- **Buenaventura Lab:** Colombia operations
- **Guatemala City Lab:** Guatemala, El Salvador, Honduras, Mexico, Nicaragua
- **Peru Lab:** Third-party service provider with independent account structure

Each regional lab has:

- Local sample management
- Quality assessment capabilities
- Regional reporting
- Limited administrative functions

External Stakeholders

Clients/Buyers

- Sample status monitoring
- Certificate download access
- Historical performance data
- Real-time approval notifications

Suppliers (Exporters, Producers, Cooperatives)

- Performance dashboards
- Quarterly comparative analysis
- Sample submission tracking
- Quality trend reports

Final Buyers (Dunkin', Floriana, etc.)

- Supply chain visibility
- Access to all lots in their pipeline
- Aggregate quality reporting

- Supplier performance metrics

3.2 Authentication Methods

- Primary: Email + Password with strong password requirements
- Secondary: Microsoft OAuth integration
- Multi-factor authentication available for administrative accounts
- Session management with automatic timeout

3.3 Authorization Matrix

Role-based permissions controlling access to:

- Sample data by laboratory/region
- Client information and specifications
- Quality assessment tools
- Administrative functions
- Reporting and analytics

4. Core System Architecture

4.1 Database Integration

- Utilize existing Supabase infrastructure
- Connect to trips.wolthers.com supplier database
- Implement quality control specific tables
- Maintain data relationships with existing systems

4.2 Application Structure

Web Application

- Modern responsive design for desktop and tablet
- Real-time updates using WebSocket connections
- Progressive Web App (PWA) capabilities
- Cross-browser compatibility

iPad Application

- Native iOS development for optimal performance

- Offline functionality with background synchronization
- Camera integration for OCR processing
- AirPrint integration for certificate printing

5. Sample Management Workflow

5.1 Sample Intake Process

Manual Entry

- Standard form with all required sample information
- Client selection from existing database
- Automatic quality specification assignment
- Sample tracking number generation

OCR-Enhanced Entry

- Camera capture of sample sleeve labels
- Optical Character Recognition processing
- Data validation and correction interface
- Fallback to manual entry for incomplete recognition

Required Sample Data

- Sample identification numbers
- Origin information (country, region, farm/cooperative)
- Exporter/supplier details
- Client/buyer information
- Lot size and packaging details
- Arrival date and condition notes

5.2 Client Detection & Assignment

- Automatic client matching based on sample data
- Manual client assignment interface
- New client creation workflow
- Quality specification auto-assignment

6. Quality Assessment Pipeline

6.1 Green Bean Analysis

Physical Inspection

- Defect Classification System**

- Primary defects: Full black, full sour, pod/cherry, stones/sticks, foreign material
- Secondary defects: Minor/major broca, partial black/sour, shells, broken beans, unripe/immature, husk, parchment
- Defect counting per 300-gram sample
- Automatic scoring calculation

- Screen Size Analysis**

- Multiple screen size measurements (14, 15, 16, pan)
- Percentage distribution calculation
- Compliance checking against specifications
- Warning alerts for non-compliance

- Physical Properties**

- Moisture content measurement and recording
- Color uniformity assessment
- Bean density evaluation

Digital Recording Interface

- Touch-friendly input for defect counting
- Dropdown menus for defect types
- Automatic calculations and warnings
- Photo attachment capability for unusual defects

6.2 Roast Analysis

Roasting Process

- Roast sample preparation tracking
- Roast profile recording
- Cooling and grinding process notes
- Time and temperature logging

Olfactory Evaluation

- Structured aroma assessment
- Defect detection (taints/faults)
- Roast quality evaluation
- Digital scoring interface

Quaker Analysis

- Quaker counting per 200-gram roasted sample
- Percentage calculation
- Compliance verification against client specifications
- Photographic documentation

6.3 Cupping Process

Session Setup

- **Flexible Cup Configuration**
 - Range: 2-15 cups per client preference
 - Preset management for regular clients
 - Custom cup count for one-off assessments
 - Automatic cup preparation tracking

Multi-Cupper Coordination

- **Real-time Collaboration**
 - Minimum 2 cuppers required per session
 - Live score synchronization
 - Discrepancy detection and flagging
 - Discussion interface for score reconciliation

Cupping Evaluation Categories

Standard Scoring (1-7 scale, 0.25 increments)

- Fragrance/Aroma
- Body
- Acidity
- Sweetness

- Balance
- Finish
- Overall quality

SCA Arabica Cupping Form (Q-Grader)

- **Scoring Scale:** 6.00-10.00 with 0.25 increments
 - 6.00 = GOOD
 - 7.00 = VERY GOOD
 - 8.00 = EXCELLENT
 - 9.00 = OUTSTANDING
- **Evaluation Attributes:**
 - **Fragrance/Aroma** (6-10 scale): Dry fragrance and wet aroma (break) sub-scores
 - **Flavor** (6-10 scale): Overall flavor impression
 - **Aftertaste** (6-10 scale): Lingering taste after swallowing/spitting
 - **Acidity** (6-10 scale): With intensity markers (High/Low)
 - **Body** (6-10 scale): With level markers (Heavy/Thin)
 - **Uniformity** (0-10 scale): 5 cups evaluation (2 points per uniform cup)
 - **Balance** (6-10 scale): Harmony of flavor, aftertaste, acidity, and body
 - **Clean Cup** (0-10 scale): 5 cups evaluation (2 points per clean cup)
 - **Sweetness** (0-10 scale): 5 cups evaluation (2 points per sweet cup)
 - **Overall** (6-10 scale): Holistic evaluation of the sample
- **Defects System:**
 - **Taint:** -2 points per affected cup
 - **Fault:** -4 points per affected cup
 - **Calculation:** Number of cups × intensity = total deduction
- **Digital Form Features:**
 - Visual roast level indicators (light to dark)
 - Interactive scoring bubbles
 - Real-time final score calculation
 - Notes section for each sample
 - Multiple sample evaluation on single session
 - Cupper identification and timestamp

- Table number and session tracking

Interactive Sensory Wheel

- **Visual Interface:** Full coffee sensory wheel display
- **Selection Methods:**
 - Click to select individual attributes
 - Click and hold for multiple selections
 - Touch-friendly mobile/tablet interface
- **Attribute Categories:**
 - Fruity (citrus fruit, berry, dried fruit, other fruit)
 - Sour/Fermented (alcohol/fermented, sour aromatics, acetic acid, butyric acid, isovaleric acid, citric acid, malic acid)
 - Green/Vegetative (olive oil, raw, underripe, peapod, fresh, beany, green vegetative)
 - Other (papery/musty, chemical, medicinal, salty, bitter, petroleum, rubber, skunk)
 - Roasted (cereal, burnt, tobacco, pipe tobacco, ashy, acrid)
 - Spices (pungent, pepper, brown spice, anise, nutmeg, cinnamon, clove)
 - Nutty/Cocoa (nutty, cocoa, chocolate, dark chocolate, almond, hazelnut, peanuts)
 - Sweet (honey, caramelized, molasses, maple syrup, brown sugar, vanilla)
 - Floral (black tea, floral, chamomile, rose, jasmine)

Certificate Integration

- Selected attributes highlighted on sensory wheel
- Non-selected attributes greyed out
- Visual sensory profile included in PDF certificates
- Attribute intensity ratings (light/medium/strong)
- Comparative sensory profiles across cupping sessions

Scoring Interface

- Touch-optimized score entry for both standard and Q-Grade evaluations
- Interactive sensory wheel with real-time selection
- Visual scale representations
- Comment fields for qualitative notes

- Auto-save functionality
- Score comparison displays
- Q-Grade specific validation and compliance checking

7. Quality Specifications Management

7.1 Specification Entry Methods

PDF Upload & Auto-parsing

- Upload client quality specification documents
- OCR processing of PDF content
- Structured data extraction
- Manual verification and correction interface
- Template recognition for common formats

Manual Entry System

- Form-based specification creation
- Copy from existing specifications
- Multi-origin support for single clients
- Version control and change tracking

7.2 Specification Components

- **Origin-specific parameters**
- **Physical requirements** (screen size, moisture, defects)
- **Cupping score minimums**
- **Defect tolerance levels**
- **Special requirements** (organic, fair trade, etc.)

7.3 Auto-compliance Checking

- Real-time pass/fail determination during assessment
- Detailed compliance reporting
- Exception handling for borderline cases
- Override capabilities with justification requirements

8. Calibration System

8.1 Calibration Session Management

- **Session Setup**
 - Multi-participant invitation system
 - Sample allocation and preparation
 - Blind evaluation configuration
 - Timeline and scheduling management
- **Participant Management**
 - Internal participant registration
 - External participant invitations
 - Skill level tracking
 - Historical performance data

8.2 Calibration Process

- **Blind Evaluation Phase**
 - Anonymous participant identification
 - Independent score submission
 - Real-time progress tracking
 - Score collection without visibility
- **Results Analysis**
 - Statistical variance analysis
 - Individual performance comparison
 - Consensus scoring identification
 - Outlier detection and flagging

8.3 Calibration Dashboard

- **Results Presentation**
 - Score distribution visualizations
 - Individual vs. consensus comparisons
 - Discussion facilitation tools
 - Performance improvement recommendations
- **Long-term Tracking**
 - Cupper consistency monitoring

- Calibration history
- Skill development tracking
- Training need identification

9. Dashboard Systems

9.1 Client Dashboard

Real-time Sample Tracking

- **Sample Status Pipeline**
 - Received → In Progress → Under Review → Approved/Rejected
 - Expected completion dates
 - Processing bottleneck identification
 - Priority flagging system

Certificate Management

- **Digital Certificate Access**
 - PDF download functionality
 - Email delivery options
 - Certificate authenticity verification
 - Historical certificate archive

Performance Analytics

- **Approval Rate Tracking**
 - Monthly/quarterly approval percentages
 - Trend analysis and forecasting
 - Supplier performance breakdowns
 - Origin-specific quality patterns

9.2 Supplier Dashboard

Performance Metrics

- **Quality Scoring**
 - Average cupping scores
 - Defect rate trends

- Compliance percentage
- Improvement recommendations

Competitive Analysis

- **Anonymous Benchmarking**
 - Quarterly ranking system (A, B, C format)
 - Performance percentiles
 - Market positioning insights
 - Best practice recommendations

9.3 Laboratory Dashboard

Workflow Management

- **Work Queue Prioritization**
 - Urgent samples identification
 - Processing time estimates
 - Resource allocation optimization
 - Bottleneck analysis

Productivity Metrics

- **Efficiency Tracking**
 - Samples processed per day/week
 - Average processing times
 - Quality consistency measures
 - Error rate monitoring

9.4 Administrative Dashboard

System Overview

- **Multi-lab Coordination**
 - Cross-lab sample distribution
 - Capacity utilization monitoring
 - Quality standardization tracking
 - Performance benchmarking

Business Intelligence

- **Analytics and Reporting**

- Revenue tracking by client/origin
- Market trend analysis
- Operational efficiency metrics
- Growth opportunity identification

10. Certificate Generation & Distribution

10.1 Certificate Content

- **Sample Identification**

- Complete traceability information
- Batch and lot numbers
- Chain of custody documentation
- Authentication codes

- **Analysis Results**

- Complete green bean analysis
- Roast quality assessment
- Detailed cupping scores (standard and Q-Grade)
- Interactive sensory wheel visualization with selected attributes highlighted
- Pass/fail determination with reasoning
- Q-Grade final score and certification compliance status

- **Quality Assurance**

- Cupper identification and signatures
- Analysis date and location
- Equipment calibration status
- Quality control stamps

10.2 Distribution Methods

- **Automated Email Delivery**

- Stakeholder notification upon completion
- Customizable recipient lists
- Delivery confirmation tracking

- Failed delivery retry logic
- **Dashboard Download**
 - Self-service client access
 - Multiple format options (PDF, Excel)
 - Bulk download capabilities
 - Download audit logging
- **API Integration**
 - Direct system-to-system delivery
 - Real-time status updates
 - Bulk data transfer capabilities
 - Custom integration support

11. Technical Requirements

11.1 Web Application Specifications

- **Frontend Framework:** Modern JavaScript framework (React/Next.js preferred)
- **Real-time Features:** WebSocket implementation for live collaboration
- **Responsive Design:** Mobile-first approach with tablet optimization
- **Performance:** Sub-3 second page load times, optimized for laboratory WiFi
- **Browser Support:** Chrome, Firefox, Safari, Edge (current and previous versions)

11.2 iPad Application Specifications

- **Platform:** Native iOS using Swift/SwiftUI
- **iOS Compatibility:** iOS 14 and above
- **Offline Functionality:** Complete workflow available without internet connection
- **Synchronization:** Background sync when connectivity restored
- **Camera Integration:** High-quality image capture with OCR processing
- **Printing:** AirPrint integration for immediate certificate printing

11.3 Database Architecture

- **Primary Database:** Existing Supabase infrastructure
- **Data Relationships:** Integration with trips.wolthers.com data
- **Real-time Sync:** Live updates across all connected devices

- **Backup Strategy:** Automated daily backups with point-in-time recovery
- **Security:** Row-level security implementation, encrypted data at rest

11.4 Integration Requirements

- **OCR Service:** Cloud-based OCR with 95%+ accuracy target
- **Email Service:** Transactional email with delivery tracking
- **File Storage:** Secure cloud storage for images and documents
- **Analytics:** User behavior tracking and system performance monitoring
- **Sensory Wheel Implementation:**
 - SVG-based interactive wheel with touch/mouse support
 - Multi-selection capability with visual feedback
 - Hierarchical attribute selection (category → subcategory)
 - Real-time preview of selections
 - Export functionality for certificate integration
 - Responsive design for desktop and tablet interfaces

12. Security & Compliance

12.1 Data Security

- **Encryption:** AES-256 encryption for data at rest, TLS 1.3 for data in transit
- **Access Control:** Role-based permissions with principle of least privilege
- **Authentication:** Multi-factor authentication for administrative accounts
- **Session Management:** Secure session handling with automatic timeout

12.2 Audit & Compliance

- **Activity Logging:** Complete audit trail for all system actions
- **Data Retention:** Configurable retention policies per client requirements
- **GDPR Compliance:** Data privacy controls and right to deletion
- **Industry Standards:** Food safety and quality assurance compliance

12.3 Business Continuity

- **Backup & Recovery:** Daily automated backups with 4-hour recovery time objective
- **Disaster Recovery:** Multi-region deployment for high availability
- **System Monitoring:** 24/7 monitoring with automated alert systems

- **Maintenance Windows:** Scheduled maintenance with minimal downtime

13. Implementation Strategy

13.1 Development Phases

Phase 1: Foundation (Months 1-3)

- User management and authentication system
- Basic sample intake and management
- Simple quality assessment workflows
- Certificate generation (basic format)

Phase 2: Core Features (Months 4-6)

- Advanced quality assessment tools
- Real-time cupping collaboration
- Client specification management
- Dashboard implementations

Phase 3: Advanced Features (Months 7-9)

- OCR integration and optimization
- Calibration session management
- Advanced analytics and reporting
- iPad application development

Phase 4: Optimization (Months 10-12)

- Performance optimization
- Advanced integrations
- Mobile application refinements
- System scaling and enhancement

13.2 Testing Strategy

- **Unit Testing:** Comprehensive test coverage for all functions
- **Integration Testing:** Cross-system compatibility verification
- **User Acceptance Testing:** Real-world testing with laboratory staff

- **Load Testing:** Performance validation under peak usage
- **Security Testing:** Penetration testing and vulnerability assessment

13.3 Training & Deployment

- **User Training Programs:** Role-specific training modules
- **Documentation:** Comprehensive user manuals and video tutorials
- **Phased Rollout:** Start with Santos HQ, expand to regional labs
- **Support System:** Help desk and technical support infrastructure

14. Success Metrics

14.1 Operational Metrics

- **Processing Efficiency:** 40% reduction in sample processing time
- **Data Accuracy:** 95% OCR accuracy for sample sleeve recognition
- **User Adoption:** 90% of users active within 30 days of deployment
- **System Reliability:** 99.5% uptime with sub-5 second response times

14.2 Quality Metrics

- **Consistency:** 90% agreement between cuppers in calibration sessions
- **Compliance:** 100% accuracy in automated pass/fail determinations
- **Customer Satisfaction:** 95% satisfaction rating from client surveys
- **Error Reduction:** 80% reduction in manual data entry errors

14.3 Business Metrics

- **Client Retention:** Maintain 98% client retention rate
- **Process Automation:** 70% of routine tasks automated
- **Scalability:** Support for 50% increase in sample volume without additional staff
- **ROI:** System pays for itself within 18 months through efficiency gains

15. Risk Management

15.1 Technical Risks

- **Integration Complexity:** Comprehensive testing with existing Supabase system
- **OCR Accuracy:** Fallback procedures for low-confidence recognition
- **Real-time Synchronization:** Robust conflict resolution mechanisms

- **Offline Functionality:** Complete local data storage and sync capabilities

15.2 Operational Risks

- **User Adoption:** Extensive training programs and change management
- **Data Migration:** Careful planning and testing of existing data transfer
- **System Downtime:** Redundant systems and rapid recovery procedures
- **Scalability:** Cloud-based architecture designed for growth

15.3 Business Risks

- **Project Timeline:** Agile development with regular milestone reviews
- **Budget Management:** Fixed-price phases with scope control
- **Quality Assurance:** Continuous testing and user feedback integration
- **Vendor Dependencies:** Multi-vendor strategy to avoid single points of failure

16. Maintenance & Support

16.1 Ongoing Maintenance

- **Regular Updates:** Monthly feature updates and quarterly major releases
- **Security Patches:** Immediate deployment of critical security updates
- **Performance Monitoring:** Continuous system health monitoring
- **Database Optimization:** Regular query optimization and index maintenance

16.2 User Support

- **Help Desk:** Business hours support with emergency after-hours coverage
- **Documentation:** Continuously updated user guides and FAQ
- **Training Materials:** Video tutorials and webinar sessions
- **User Feedback:** Regular surveys and feature request management

16.3 System Evolution

- **Feature Roadmap:** Quarterly planning sessions with stakeholder input
 - **Technology Updates:** Annual technology stack review and updates
 - **Scalability Planning:** Continuous capacity monitoring and expansion planning
 - **Integration Opportunities:** Regular assessment of new integration possibilities
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Conclusion

This specification provides a comprehensive framework for developing a world-class coffee quality control system that addresses the limitations of previous attempts while incorporating modern technology and user experience best practices. The phased approach ensures manageable development complexity while delivering value early in the process.

The system's success will depend on close collaboration between development teams, laboratory personnel, and client stakeholders throughout the implementation process. Regular feedback loops and iterative improvement cycles will ensure the final product meets the exacting standards required for professional coffee quality assessment.

Next Steps: Technical architecture design, database schema planning, and development team assembly.