Product Requirements Definition (PRD)

Product Name (Working Title)

BovInsight™ – Scientific Cattle Management & Decision Support System

1. Purpose & Vision

BovInsight™ is a modern, science-driven cattle management system designed to help farmers, breeders, veterinarians, and agribusiness operators manage individual cattle with precision. The system combines **individual animal records**, **photo-based identification**, **reproductive tracking**, **herititage/genetics**, **analytics**, and **AI-assisted insights**, optimized for **Android mobile devices** and scalable to cloud and enterprise environments.

The vision is to move beyond traditional herd-level recordkeeping to **individual animal intelligence**, enabling better welfare, productivity, traceability, and profitability.

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2. Target Users & Personas

Primary Users

- Commercial cattle farmers (beef & dairy)
- Stud breeders and genetic programs
- Smallholder & emerging farmers

Secondary Users

- Veterinarians
- Animal health technicians
- Feedlot managers
- Agricultural researchers

User Environment

- Android smartphones (offline-first, rural connectivity)
- Tablet use in yards and crushes
- Optional desktop/web dashboards

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3. Core Design Principles

1. **Individual-Animal First** – Every cow and bull is a first-class entity
2. **Photo-Centric Identification** – Visual recognition complements ear tags and brands

3. **Offline-First** – Fully functional without signal, auto-sync when online
4. **Scientific Accuracy** – Dates, cycles, genetics, and metrics aligned with veterinary standards
5. **Low Friction Data Capture** – Camera, voice, and AI-assisted inputs
6. **Explainable AI** – Insights must be transparent, not black-box guesses

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4. System Platforms

Phase 1

- Android Mobile App (Primary)

Phase 2

- Web Dashboard (Analytics, Reporting)
- Cloud Sync & Multi-User Collaboration

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5. Core Functional Modules

5.1 Animal Identity & Records

Individual Animal Profile (Cow / Bull)

Each animal must have a complete scientific datasheet.

Mandatory Fields - Unique Animal ID (system-generated) - Ear Tag Number(s) - RFID (if applicable) - Name (optional) - Sex - Breed / Composite - Date of Birth (exact or estimated) - Farm / Location

Extended Fields - Coat color & markings - Horn status - Registration numbers (stud books) - Ownership history - Status (Active, Sold, Deceased, Culled)

5.2 Photo-Based Identification (Best Practice Feature)

Photo Capture

- Multiple photos per animal
- Left side
- Right side
- Face
- Rear
- Time-stamped and geo-tagged

AI Visual Recognition (Android-Native)

- On-device ML model using camera input
- Identify animals by:
- Coat patterns
- Facial features
- Scars / markings
- Confidence scoring (e.g. 92% match)

Best Practice

- Combine **visual ID + ear tag + RFID** for redundancy
- Allow farmer override when AI confidence is low

5.3 Heritage, Pedigree & Genetics

Pedigree Tracking

- Sire
- Dam
- Grandparents
- Unlimited ancestry depth

Genetic Attributes

- Breed composition (%)
- Known genetic markers (if tested)
- Inbreeding coefficient (calculated)
- Estimated Breeding Values (EBVs – optional/manual)

Visual Pedigree

- Interactive family tree
- Highlight genetic bottlenecks

5.4 Reproductive Management (Core Scientific Module)

Estrus & Breeding

- Heat observation logs
- AI-predicted estrus windows (based on cycle history)
- Natural mating / AI / Embryo Transfer
- Bull assignment tracking

Gestation Tracking

- Automatic gestation countdown (based on service date)
- Breed-adjusted gestation length
- Alerts:
- Pregnancy check due
- Calving window approaching

Calving Events

- Actual calving date & time
- Ease of calving score
- Assistance required (yes/no)
- Calf sex, weight, vitality

Best Practice

- Traffic-light system:
- Green: Normal
- Amber: Attention needed
- Red: Intervention required

5.5 Calf & Lifecycle Tracking

- Automatic calf record creation at calving
- Dam–calf linkage
- Weaning date & weight
- Growth curve tracking
- Sale or retention decision support

5.6 Health & Veterinary Records

Health Events

- Vaccinations
- Treatments & medications
- Withdrawal periods
- Diseases & diagnoses

AI Health Alerts (Suggested)

- Pattern detection for:
- Repeated treatments
- Poor weight gain
- Reproductive failure

Compliance

- Exportable treatment logs
- Audit-ready health history

5.7 Nutrition & Performance (Optional Phase)

- Body condition scoring (manual + photo-assisted)
- Feed regime notes
- Weight tracking
- Milk yield (dairy)

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6. AI & Advanced Features

6.1 AI Decision Support

- "Animals at Risk" list (fertility, health, productivity)
- Poor-performing cow detection
- Replacement vs cull recommendations

6.2 AI Speech & Voice Interaction

Android Speech Integration

- Voice note capture per animal
- Speech-to-text for:
- Treatments
- Observations
- Calving notes

Conversational AI (Future)

- "Which cows are due to calve in the next 14 days?"
- "Show me cows that missed two cycles"

6.3 Predictive Analytics

- Calving distribution forecasts
- Herd fertility trends
- Genetic improvement projections

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7. Alerts & Notifications

- Push notifications (Android-native)
- SMS fallback (optional)

Alert Types - Heat detection windows - Pregnancy check due - Calving imminent - Missed cycles - Overdue treatments

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8. Data & Analytics Dashboard

Herd-Level Views

- Pregnancy rate
- Calving interval
- Weaning percentage
- Mortality rates

Individual-Level Insights

- Lifetime productivity index
- Reproductive efficiency score

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9. Data Architecture (Conceptual)

- Individual Animal as core entity
- Event-based record system (breeding, health, calving)
- Local encrypted storage on device
- Secure cloud sync

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10. Security & Compliance

- User authentication (PIN / biometric)
- Encrypted local database
- Role-based access (farm staff, vet, manager)
- GDPR / POPIA aligned data handling

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11. Non-Functional Requirements

- Works fully offline
- Battery-efficient camera & AI usage
- Fast animal lookup (<1 second)

- Scalable from 20 to 20,000 animals

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12. Future Roadmap (Not in MVP)

- RFID reader integration
- Drone image integration
- Genomic lab API integration
- Market price intelligence
- Carbon & sustainability metrics

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13. Success Metrics

- Reduction in missed heats
- Improved calving interval
- Reduced data entry time
- User adoption & daily active use

Status: Requirements Defined – No Code Implemented