

Precision Livestock Farming

Precision Livestock Farming (PLF) – Quick Reference Notes

1. What is Precision Livestock Farming?

Aspect	Description
Definition	Application of sensor-based monitoring, data analytics, and automation to manage individual animals and groups more efficiently, healthily, and sustainably.
Goal	Optimize animal welfare, productivity, and resource use while reducing environmental impact and labor costs.
Core Idea	“Know your herd” – continuous, real-time information replaces periodic, manual observations.

2. Key Technologies

Technology	Function	Typical Sensors / Devices	Data Collected	Example Use
Automated Identification	Individual animal tracking	RFID ear tags, electronic nose bands, optical readers	ID, movement timestamps	Traceability, feed allocation
Wearable Sensors	Physiological & activity monitoring	Accelerometers, gyroscopes, temperature patches, heart rate monitors	Steps, lying/standing time, body temperature, heart rate variability	Early disease detection, estrus detection
Vision & Imaging	Visual assessment of body condition, lameness, behavior	2D/3D cameras, infrared thermography, hyperspectral imaging	Posture, gait, skin temperature, body shape	Body condition scoring, heat stress monitoring
Environmental Sensors	Habitat monitoring	CO ₂ , NH ₃ , temperature, humidity, dust, light sensors	Air quality, microclimate	Ventilation control, welfare scoring

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Technology	Function	Typical Sensors / Devices	Data Collected	Example Use
Feed & Water Intake Sensors	Precise measurement of consumption	Load cells on feeders/drinkers, RFID linked dispensers	Amount, frequency, time of intake	Nutrient balance, feed efficiency
Acoustic Sensors	Sound pattern analysis	Microphones, ultrasonic detectors	Cough, vocalizations, rumination clicks	Respiratory disease, stress detection
Robotics & Automation	Physical interaction with animals	Milking robots, automatic feeders, cleaning robots	Operational logs, milk yield, feed dispensed	Labor reduction, consistent milking
Data Infrastructure	Storage, processing, visualization	Cloud platforms, edge computing, dashboards, mobile apps	All sensor streams	Decision support, alerts, reporting

3. Data Flow & Analytics Pipeline

1. **Acquisition** – Sensors → edge device (local gateway).
2. **Preprocessing** – Noise filtering, time stamping, unit conversion.
3. **Transmission** – Wired (Ethernet) or wireless (Wi-Fi, LoRa, NB-IoT, 5G).
4. **Storage** – Time-series databases (InfluxDB, Timescale), data lake (AWS S3, Azure Blob).
5. **Analytics**
 - **Descriptive**: dashboards, trend plots.
 - **Diagnostic**: anomaly detection (e.g., sudden drop in activity).
 - **Predictive**: machine learning models (e.g., disease risk, feed conversion).
 - **Prescriptive**: automated actions (adjust feed, open ventilation).
6. **Visualization & Decision Support** – Web/mobile UI, alerts (SMS, email, push).
7. **Feedback Loop** – Action outcomes fed back to model for continuous improvement.

4. Main Applications

Application	Sensors Involved	Primary Indicators	Benefits
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Health & Disease Monitoring

Wearables, acoustic, Body temperature, heart
thermography rate, cough frequency, gait

Early detection ? lower
mortality, reduced
medication

Reproductive Management