TechKo – Whitepaper

Technology in harmony for the good life

HackCafé 2025 Submission

Project Technical Summary

TechKo is a dual-module simulation platform designed for small-scale coffee farmers in mountainous regions. It combines real-time environmental monitoring and composting automation into a single, visual interface allowing farmers to both understand their land and regenerate it sustainably.

This MVP was built entirely as a simulated but functional UI, offering a realistic vision of a future-ready, low-cost farming assistant. More than just a prototype, TechKo lays the foundation for an expandable agrotech ecosystem designed for low-connectivity and low-literacy contexts.

Inspired by the Guaraní word ***"teko"*** — the way of living in harmony — **TechKo** seeks to return balance to the coffee-growing process: soil, cycle, and farmer aligned.

System Architecture Overview

TechKo's architecture is based on two main functional modules:

1. Environmental Monitoring Module

Simulated sensors for:

- Soil moisture
- Ambient temperature
- Pest presence (manual entry or future AI)
- Data feeds into a dashboard with visual alerts and suggestions.

Farmers can make timely decisions about irrigation and pest management.

2. Composting Automation Module

Simulates the lifecycle of composting coffee residues (pulp, husks).

- Detects internal humidity and temperature levels.
- Triggers simulated motor mixing if thresholds are exceeded.
- Displays compost status: In Progress, Ready, Error.

These modules are unified via a web-based dashboard that runs on mock data but is logically structured to integrate with real hardware or APIs in future iterations.

Simulation vs. Real-World Implementation

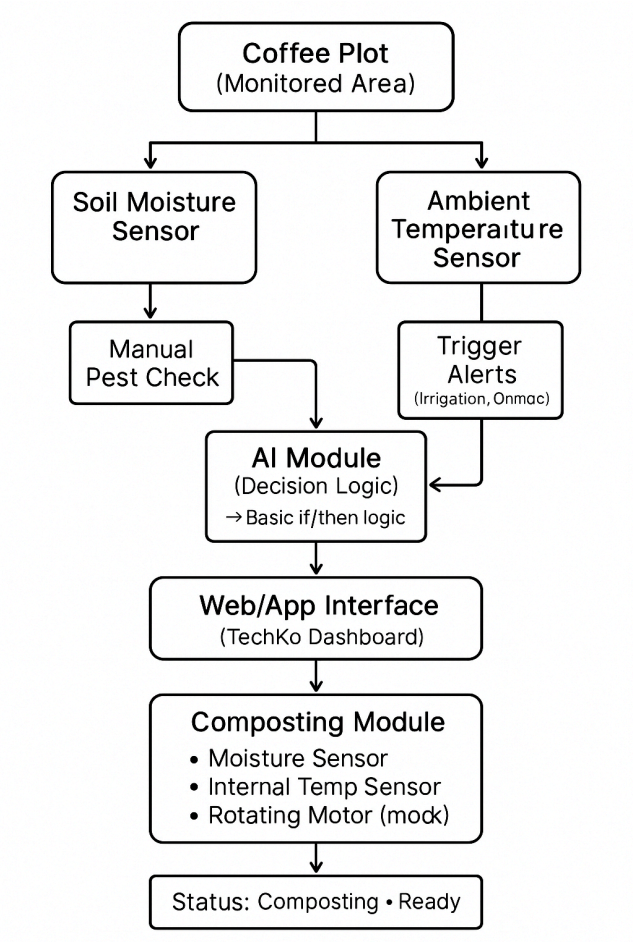
Aspect	Without TechKo	With TechKo (Simulated)
Monitoring	Manual, reactive	Visual alerts + early warnings
Post-harvest	Waste discarded	Waste turned into compost
Production	Unstable, vulnerable	More sustainable and consistent

The simulated logic maps 1:1 with realistic, low-cost components already widely available.

Data Flow Overview

```
[Mock Sensors / Input Data]
     |
     ▼
[Logic Engine: Rules for Moisture, Temp, Pests]
     |
     ├──→ [Alert System: Visual Flags + Recommendations]
     └──→ [Compost Engine: Temp/Humidity triggers motor rotation logic]
                |
                ▼
        [Compost Status Output: Dashboard Visuals]
```

In real use, this data flow would be driven by microcontrollers and sensor inputs routed to a local device or cooperative server.



Key Components

Component	Description
Sensor Simulation Layer	Mocks real-time data from environment
Rule-Based Logic Engine	Interprets data to trigger alerts or compost actions
Dashboard UI	Displays system state clearly for non-technical users
Compost State Visualizer	Updates compost lifecycle status in response to data
Alert System	Guides farmer actions using simple messages (e.g., "Irrigation needed")

Use Cases (Based on Real-Life Scenarios)

Case: Don Elias – a farmer in Minas Gerais, Brazil

Don Elias has a 1.5-hectare coffee farm on a steep hillside. Without access to high-tech machinery, he relies on traditional practices and intuition but often over-irrigates, wasting water and causing fungal outbreaks.

With TechKo:

- He sees a low soil moisture alert and decides to delay irrigation for 12 hours.
- His compost bin status turns to “Ready”, so he spreads it across newly planted rows, saving on chemical fertilizer.
- Over a month, his yield improves, and he learns to read his land like a living system — not guesswork.

Roadmap

1. Simulated MVP completed
2. Build functional prototype with Arduino and recycled materials
3. Train localized AI assistant with rural expressions
4. Develop offline-first mobile app for low-connectivity zones
5. Deploy as open-source, community-owned toolkit for cooperatives

Minimum System Requirements

System Component	Minimum Requirement
Dashboard Access	Basic Android device or low-end PC
Power	For future hardware: 5V–12V battery or solar panel
Connectivity	MVP works with preloaded data; future SMS/mesh support
Literacy	Visual-based UI requires minimal reading skills

Notes on Rural Accessibility

TechKo was built with empathy for real-world constraints:

- Uses icons and color-coded indicators for easy decision-making
- Designed for offline-first usage in roadmap
- Future support for voice-based guidance and local language packs
- Logic is transparent, so it can be taught, explained, and repaired locally

This is not just a tool — it's a system designed to empower smallholder knowledge and resilience.

Modular Business Model

TechKo combines regenerative technology, freemium access, and responsible funding to scale sustainable solutions in mountain coffee farms — without losing control, quality, or purpose.

Three Complementary Revenue Streams:

1. B2B2C Model – Coffee brands funding regeneration

Coffee brands sponsor the use of TechKo across their allied farms as part of their sustainability, traceability, and regeneration commitments.

In return, they receive:

- “Powered by TechKo” visual certification
- Access to traceable environmental impact data
- Real farm stories for purpose-driven brand storytelling

What’s included: platform + physical kit + regenerative monitoring system

2. Sales of Low-Cost TechKo Kits

What’s included: sensors + composting unit + app access

Estimated price: to be confirmed after Phase 2 of the roadmap

The feasibility of self-assembled kits with recycled parts will be evaluated through local partnerships, provided minimum operational standards are met.

3. Licensing / Subscription for Cooperatives

Access to a community dashboard with:

- Group-level data visualization
- Cross-farm benchmarking
- Technical support & assistance with regenerative practices

Model: Monthly subscription scaled by number of farms

Freemium Access for Individual Farmers

- Free access to basic environmental visualization
- Digital composting guide

Revenue Activation Roadmap

Phase	Action	Goal
Phase 2	Technical kit validation + pilot test	Confirm cost, usability, and scalability
Phase 3	B2B2C model testing with a coffee brand	Validate business potential through impact
Phase 4	Subscription rollout for cooperatives	Scale regional adoption + generate revenue
Phase 5	Product optimization + rural expansion	Expand with quality control and consistency

License & Community Use

TechKo is released under a Creative license.

This means:

- Anyone can remix, adapt, and reuse TechKo for local contexts
- TechKo cannot be sold for commercial gain without permission
- Any improvements must be shared under the same license

We believe in simple & easy tools for regenerative futures.

This documentation and dashboard are intended as a blueprint for cooperatives, educators, and rural innovation labs across the coffee-producing world.

🌱TechKo is more than a dashboard. It's a return to listening to the land and giving it the tools to respond☕