



ielivate[®]

Ielivate — How It Works

SWCF-B1 Smart Box • AI-powered irrigation & pest management

This report explains the device's end-to-end workflow, from sensing and edge-AI analysis to automated irrigation control, solar power management and mobile/cloud integration. It also outlines the electrical path used in the WaterBox add-ons (panel → charger → battery → dual boost rails).

1) What the System Does

The Smart Box is an intelligent hub that learns and adapts. It uses real-time soil, weather and crop data to autonomously control water distribution and pest prevention. A mobile dashboard gives farmers clear insights, while solar power keeps the device operating in remote areas.

2) Signal & Control Flow

Sensing: flow and pressure sensors feed pulses/voltages to the controller (GPIO/ADC).

Edge AI & rules: TensorFlow Lite models score pest activity and combine with moisture/pressure/flow rules.

Actuation: the controller drives a 12-V solenoid through a MOSFET; duty/time windows regulate irrigation.

Feedback: closed-loop checks compare target vs. actual flow/pressure; anomalies trigger alerts/fallbacks.

Connectivity: Wi-Fi, LoRaWAN or GSM forwards telemetry and receives remote commands from the app.

3) Power Path (Solar → Charger → Battery → Boost Rails)

5–6 V, ≈2 W solar panel feeds a Li-ion solar charger (e.g., CN3065/CN3722).

Charger connects to 18650 cell with protection/BMS; battery sense divider reports state to the MCU.

Battery feeds two boost converters: 5 V rail (controller, comms) and 12 V rail (solenoid valve).

MOSFET (logic-level N-ch) or relay switches the valve; the controller GPIO drives the gate via a resistor.

Wiring highlights: panel VIN+, GND; BAT+/BAT– to BMS; fused battery + to boost VIN; valve – returns to GND.

4) Mobile App & Cloud

A lightweight device API enables the mobile app and cloud to read sensors, visualize trends and send commands for schedules, thresholds and seasonal programs.

Offline, the box maintains local logic and queues telemetry for later sync.

5) Safety, Reliability & Maintenance

Failsafe water budget and maximum-run caps to avoid over-irrigation if comms fail.

Overcurrent/overtemp limits for the valve output; fused battery line; reverse-polarity protection.

Watchdog restart and brown-out recovery; safe-state rules on power loss/return.

Periodic nozzle/line check recommendations based on flow-variance trends; guided leak detection.

6) Installation (Quick Guide)

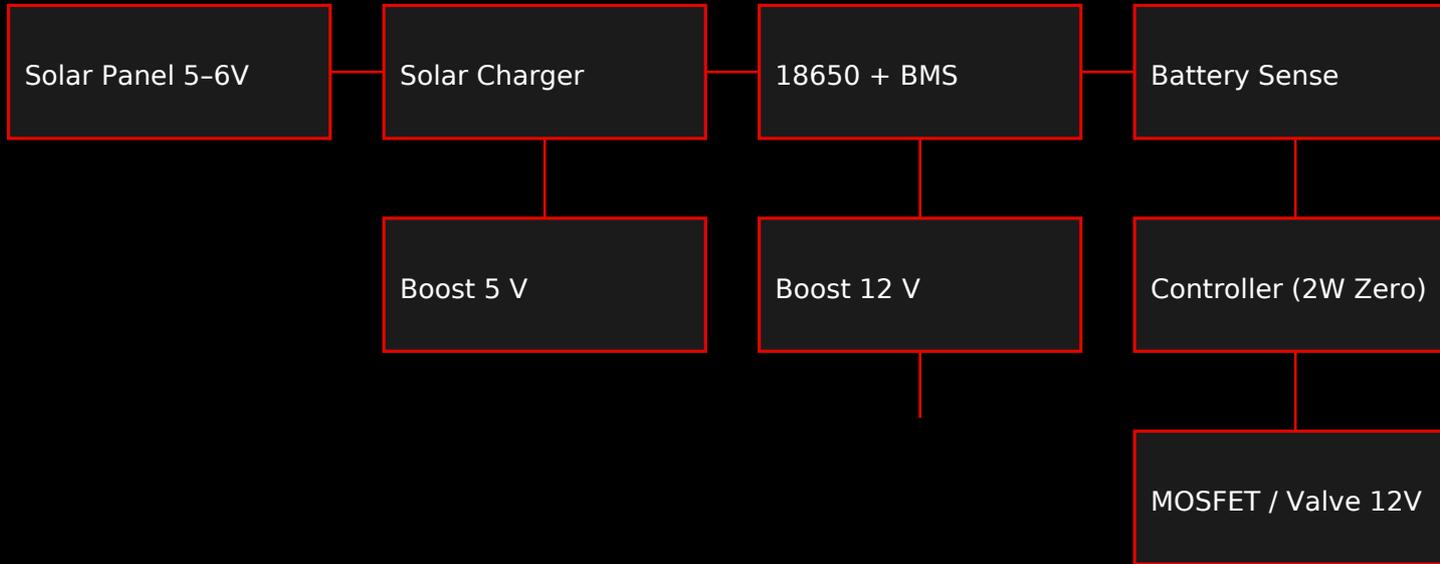
Mount solar panel in full sun; route leads through strain-reliefs to charger.

Fix Smart Box near the manifold; connect flow sensor inline and pressure sensor at a convenient tap.

Connect the 12-V valve to the switched output; verify polarity; set regional valve timing profile.

Run app pairing (Wi-Fi/LoRa/GSM); calibrate flow baseline and pressure thresholds; start a short test program.

Appendix — Electrical Topology



The diagram shows the solar-to-battery path and dual boosts. The controller reads sensor signals and drives the valve through a MOSFET, forming a closed loop with flow/pressure feedback.

Note: This document summarizes the operational design for field teams and partners. Always observe electrical safety and local irrigation codes when installing and servicing the system.