Process Documentation Report: Smart Reverse Logistics (Reuse & Recycle Workflow)

1 Purpose

The purpose of this documentation is to explain how returned IoT components are processed after collection. It describes the path from reception to inspection, testing, repair, reuse, refurbishment, or recycling. The process is designed to preserve the value of components wherever possible and to ensure that only suitable parts re-enter the inventory stream.

2. Introduction

This report establishes the technical workflow for an automated end-of-life (EOL) reverse logistics system designed around clear Reuse and Recycle paradigms. The workflow handles modular Internet of Things (IoT) hardware, optimizing material circularity by establishing distinct pathways for high-value electrical components, coloured device housings, and structural transport carriers. By isolating hazardous units early and relying on data-driven classification, the process ensures that maximum asset value is recovered for reuse, while non-recoverable materials are cleanly extracted for environmental recycling.

Overview of the Process

The working process starts when a returned product or component arrives at the facility. Each item is first identified and then inspected visually to determine whether there is visible damage. If the item appears intact, it is subjected to functional testing; if damage is present, the component is assessed for repairability. Based on these checks, the item is routed into one of three outcomes: reuse, refurbishment, or recycling.

Component Name	Component ID	Category	Targeted Workflow Pathway
IoT main PCB	PNo. 800	Hardware components	Reuse / Refurbish
IoT Gyroskop	PNo. 811	Hardware components	Reuse / Refurbish
IoT Weatherstation / Wetterstation	PNo. 812	Hardware components	Reuse / Refurbish
IoT analog PCB / 0-10V analog	PNo. 813	Hardware components	Reuse / Refurbish
IoT Display	PNo. 814	Hardware components	Reuse / Refurbish
IoT back black	PNo. 821	Component Housing	Reuse / Recycle
IoT front black	PNo. 831	Component Housing	Reuse / Recycle

Component Name	Component ID	Category	Targeted Workflow Pathway
IoT front blue	PNo. 832	Component Housing	Reuse / Recycle
IoT front red	PNo. 833	Component Housing	Reuse / Recycle
IoT front grey	PNo. 834	Component Housing	Reuse / Recycle
box	Mes 29	IoT Storage box	Immediate Reuse
Palette	Mes 25	Carriers	Immediate Reuse
Product Carrier	Mes 31	Carriers	Immediate Reuse

3. Step-by-Step Working Process s

Collection and registration. Returned IoT components are received and recorded in the system.

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Visual inspection. The item is checked for cracks, missing parts, burn marks, corrosion, or other physical defects.

Functional evaluation. If the component has no major damage, it is tested technically to verify whether it still works correctly.

Decision on condition. If the component passes, it is prepared for reuse; if it fails but can still be repaired, it is sent for refurbishment.

Repair and refurbishment. Minor faults are corrected, the part is cleaned or recalibrated, and the item is tested again.

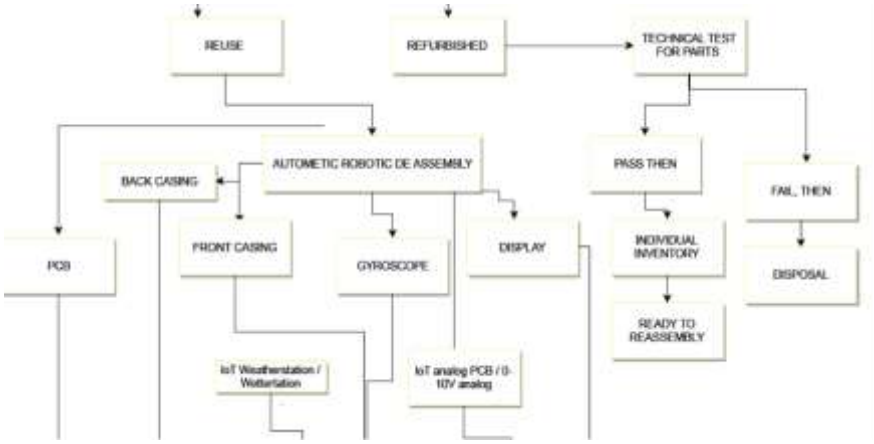
Quality inspection. The refurbished part is checked to ensure it meets the required standard before reuse.

Final routing. Parts that cannot be repaired safely are sent to recycling or disposal.

Inventory update. Approved reusable items are stored in inventory and marked as ready for future use.

4. Explanation of the Flowchart

The flowchart shows how a returned IoT component moves through a controlled decision process. It begins with the arrival of the component and then moves to visual inspection, which separates clearly damaged items from potentially usable ones. The next stage is functional testing, where the system verifies whether the part is still operational. If the component is repairable, it goes through a refurbishment loop and then returns to quality inspection before being accepted back into inventory. If the component cannot be repaired, leaves the recovery cycle and is sent to recycling or discard



5. Reuse Stream

The reuse stream is intended for components that remain fully functional and require no significant intervention. Examples include carriers, storage boxes, and housings that are still structurally intact, as well as electronic parts that pass inspection and testing. These items can be certified, returned to stock, and used directly in future assembly or logistics operations. This stream provides the highest value retention because it avoids unnecessary processing.

6.Refurbishment Stream

The refurbishment stream includes components that are functional but need cleaning, repair, calibration, or partial replacement before reuse. For example, an IoT display with minor defects or an analog PCB with calibration drift may be restored through controlled technical intervention. After refurbishment, the part must undergo retesting and quality approval before being reintegrated into inventory. This stage extends product life while maintaining technical reliability.

7. Recycling Stream

The recycling stream is used for items that are no longer technically suitable for reuse or refurbishment. In this project, damaged housings, broken PCB boards, and unsafe electronic units should be separated into material categories and sent for recycling. Recycling allows recovery of plastics, metals, and electronic materials while preventing wasteful disposal. This supports environmental responsibility and resource recovery.

8. Conclusion

This academic report shows that returned IoT components can be managed through a structured circular process rather than a linear disposal model. The flowchart logic supports a practical decision system in which each item is inspected, tested, repaired if possible, and then routed to reuse, refurbishment, or recycling. Applying this model to the listed IoT parts improves sustainability, reduces waste, and strengthens inventory efficiency. The result is a more resilient and resource-conscious manufacturing system.