Intelligent disassembly of lithium batteries

Overview

Retired electric-vehicle lithium-ion battery (EV-LIB) packs pose severe environmental hazards. Efficient recovery of these spent batteries is a significant way to achieve closed-loop lifecycle management and. Electric vehicle (EV) battery recovery is critical to circular economy and sustainability. Today, the g. 2.1. TaxonomyOne major purpose of this review is to clarify how AI/ML can be integrated into EV-LIB disassembly activities. Therefore, a taxonomy is prop. This section first presents the current states of disassembly automation. Then the challenges and requirements of EV-LIB automated disassembly are analyzed and discussed to expl. 4.1. Intelligent preprocessing of EV-LIBChecking, testing and sorting are critical preprocessing tasks in identifying the specification of the spent EV-LIBs and evaluating their c. 5.1. AI/ML's value and opportunitiesTo further identify the contributions and progress of AI/ML methods for EV-LIB disassembly, Table 6 summarizes the scientific problem.

Article Content

Structural Composition and Disassembly Techniques for Efficient ...

Concurrently, the high-value recycling and utilization of waste lithium-ion batteries (LIBs) has emerged as a prominent area of research. This review commences with an examination of the structural composition, operational methodology, and inherent challenges associated with the recycling process of lithium-ion batteries.

An Approach for Automated Disassembly of Lithium-Ion Battery ...

A large number of battery pack returns from electric vehicles (EV) is expected for the next years, which requires economically efficient disassembly capacities. This cannot be met through purely manual processing and, therefore, needs to be automated. The variance of different battery pack designs in terms of (non-) solvable fitting technology and superstructures ...

Towards reuse and recycling of lithium-ion batteries: tele-robotics ...

1 Introduction. As a result of the increasing demand for electric vehicles (EVs) (Rietmann et al., 2020), a large number of EV batteries are expected to reach end of life.Owing to a combination of contained high-value materials such as lithium, nickel and cobalt (Thies et al., 2018), and a limited lifespan of 10–15 years (Ai et al., 2019), there is an increasing research ...

Adaptive planning of human–robot collaborative disassembly for ...

Increasing numbers of lithium-ion batteries for new energy vehicles that have been retired pose a threat to the ecological environment, making their disassembly and recycling methods a research ...

Research on the Human& ndash;Robot Collaborative Disassembly ...

The disassembly of spent lithium batteries is a prerequisite for efficient product recycling, the first link in remanufacturing, and its operational form has gradually changed from traditional manual disassembly to robot-assisted human–robot cooperative disassembly. Robots exhibit robust load-bearing capacity and perform stable repetitive tasks, while humans possess ...

End-of-life electric vehicle battery disassembly enabled by intelligent ...

Semantic Scholar extracted view of "End-of-life electric vehicle battery disassembly enabled by intelligent and human-robot collaboration technologies: A review" by Weidong Li et al. ... Lithium-ion batteries are pervasive in contemporary life, providing power for a vast array of devices, including smartphones and electric vehicles. ...

Intelligent disassembly of electric-vehicle batteries: a forward ...

Retired electric-vehicle lithium-ion battery (EV-LIB) packs pose severe environmental hazards. Efficient recovery of these spent batteries is a significant way to achieve closed-loop lifecycle management and a green circular economy. It is crucial for carbon neutralization, and for coping with the environmental and resource challenges associated with the energy transition.

Research on the Human& ndash;Robot Collaborative ...

The disassembly of spent lithium batteries is a prerequisite for efficient product recycling, the first link in remanufacturing, and its operational form has gradually changed from traditional manual disassembly to robot ...

Current status and outlook of recycling spent lithium-ion batteries

Disassembly of electric vehicle batteries is a critical stage in recovery, recycling and re-use of high-value battery materials, but is complicated by limited standardisation, design complexity ...

Artificial Intelligence in Electric Vehicle Battery Disassembly: A ...

A significant focus is placed on estimating batteries'' state of health (SOH), which is crucial for determining the availability of retired EV batteries, and AI-driven methods for planning battery disassembly sequences are examined, revealing potential efficiency gains and cost reductions. The rapidly increasing adoption of electric vehicles (EVs) globally underscores the ...

Adaptive planning of human–robot collaborative disassembly for ...

Human–Robot Collaboration Disassembly (HRCD) mode maximizes the advantages of both humans and robots, progressively replacing single-person disassembly ...

A new heuristic algorithm based on multi-criteria resilience ...

Recycling spent lithium-ion batteries is a significant way to achieve life-cycle management and a green circular economy, helping to achieve carbon neutrality.The form of battery pack disassembly has gradually moved away from manual manipulation to a human–robot collaborative process.

Generation of human–robot collaboration disassembly sequences ...

Current research primarily focuses on the disassembly-specific model of lithium battery models, lacking reusability for disassembly sequences of different models. Therefore, a more intelligent knowledge representation method is needed, leveraging technologies such as data mining and machine learning to automatically develop knowledge bases from ...

A Virtual Robotic Disassembly System for Retired Power Battery ...

Taking the intelligent disassembly of retired power battery pack as the research object, a virtual robotic disassembly system is constructed. The system consists of a multi-robot collaborative disassembly workstation built based on ABB''s virtual simulation platform-RobotStudio and external programs connected through its secondary development interface.

Safe, Flexible and Productive Human-Robot-Collaboration for Disassembly ...

This chapter presents the implementation of human robot collaboration for disassembly of lithium-ion Batteries and shows how an intuitive programming environment, which does not require experience in robot programming, is combined with cost efficient tooling and additional 3D safety sensors to realize a safe, productive and ergonomic workspace. The rising number of electric …

Semi-Autonomous Robotic System for Efficient Recycling of Lithium …

The increasing popularity of electric vehicles is leading to a massive increase in the use of lithium-ion batteries ... and a disassembly mechanism. The proposed system leverages human skills in removing fragile and deformable battery casing, intelligent grasping capabilities of a robotic manipulator in retrieving individual cells from the ...

End-of-life electric vehicle battery disassembly enabled by …

State-of-the-art deep learning and RL technologies can be explored and applied when planning the disassembly process to provide a fast, model-free, intelligent disassembly …

Automated Disassembly of Lithium Batteries; Methods, …

If correctly sorted and identified before material recovery, the process becomes easier to control, and more affordable to perform separation. 3.2 Disassembly Battery disassembly is required for large scale batteries to remove durable casings and fixtures adjoined to the exterior to collect materials unable to be recycled using other processes.

A novel disassembly process of end-of-life lithium-ion batteries ...

Introduction. The booming market of LIBs led to a three-fold increase in the price of lithium and a four-fold increase in that of cobalt between 2016 and 2018 (Pagliaro & Meneguzzo, 2019).Meanwhile, it will also bring huge amount of hazardous waste due to the end-of-life disposal of LIBs and create concerns over the long-term sustainability of critical elements for producing …

Safe, Flexible and Productive Human-Robot-Collaboration for Disassembly ...

This chapter presents the implementation of human robot collaboration for disassembly of lithium-ion Batteries. While the human operator performs the more complex tasks, the robot performs simple, repetitive tasks such as removing screws and bolts. ... International Conference on Intelligent Robots and Systems, Hamburg.

Intelligent disassembly of electric-vehicle batteries: a forward ...

This study aims to provide a systematic review and forward-looking perspective on how AI/ML methodology can significantly boost EV-LIB intelligent disassembly for achieving ...

Robotic Disassembly Platform for Disassembly of a Plug-In ...

Efficient processing of end-of-life lithium-ion batteries in electric vehicles is an important and pressing challenge in a circular economy. Regardless of whether the processing strategy is recycling, repurposing, or remanufacturing, the first processing step will usually involve disassembly. As battery disassembly is a dangerous task, efforts have been made to robotise ...

Artificial Intelligence in Electric Vehicle Battery ...

This paper reviews the application of AI techniques in various stages of retired battery disassembly. A significant focus is placed on estimating batteries'' state of health (SOH), which is crucial for determining the availability ...

Knowledge Graph Construction of End-of-Life Electric Vehicle Batteries ...

End-of-life (EoL) electric vehicle (EV) batteries are one of the main fountainheads for recycling rare metal elements like cobalt and lithium. Disassembly is the first step in carrying out a higher level of recycling and processing of EV batteries. This paper presents a knowledge graph of electric vehicle batteries for robotic disassembly. The information ...

A novel disassembly process of end-of-life lithium-ion batteries ...

It is imperative to develop automatic disassembly solution to effectively disassemble the LIBs while safeguarding human workers against the hazards environment. In ...

Research On Task Allocation Of Power Battery Disassembly ...

Research On Task Allocation Of Power Battery Disassembly Based On Intelligent Optimization Algorithm. Authors: Zheng Zhou, Xiao ... K., Liu, W., and Li, R. (January 30, 2023). "Retired Lithium-Ion Battery Pack Disassembly Line Balancing Based on Precedence Graph Using a Hybrid Genetic-Firework Algorithm for Remanufacturing." ASME. J. Manuf. Sci ...

Artificial Intelligence in Electric Vehicle Battery Disassembly: A ...

The review concludes with insights into the future integration of electric vehicle battery (EVB) recycling and disassembly, emphasizing the possibility of battery swapping, design for disassembly ...

Recycling of spent lithium-ion batteries in view of graphite ...

Nowadays, EVs have emerged as powerful platforms for advanced battery technologies .Lithium-ion batteries are the predominant energy supply system for these vehicles owing to their high specific capacity, high energy density, good cycle stability, and absence of memory effects .A typical lithium-ion battery consists of three essential ...

Intelligent disassembly of electric-vehicle batteries: a forward ...

This paper provides the practical map to direct how to implement EV-LIB intelligent disassembly as well as forward-looking perspectives for addressing these challenges. AB - Retired electric ...

(PDF) Intelligent Robotics for Battery Recycling 2030

If the waste lithium batteries are not processed and recycled systematically, it will seriously waste resources, pollute the environment and endanger human health. It can be seen that the recycling and reuse of waste batteries has a broad market. ... Fig. 11 shows the battery pack disassembly operation using an intelligent robot. The process is ...

Intelligent disassembly of electric-vehicle batteries: a forward ...

This study aims to enhance intelligent disassembly of retired electric-vehicle lithium-ion battery (EV-LIB) packs through the use of artificial intelligence and machine learning. The research ...

A Systematic Review on Lithium-Ion Battery Disassembly ...

Recycling plays a crucial role in achieving a sustainable production chain for lithium-ion batteries (LIBs), as it reduces the demand for primary mineral resources and mitigates environmental pollution caused by improper disposal. Disassembly of the LIBs is typically the preliminary step preceding chemical recovery operations, facilitating early separation of ...

Recent Advancements in Artificial Intelligence in Battery ...

These studies indicate that while intelligent robotics have made significant strides in battery disassembly, achieving the optimal balance between human and robot collaboration still requires further refinement. ... Wu, S.; Kaden, N.; Dröder, K. A Systematic Review on Lithium-Ion Battery Disassembly Processes for Efficient Recycling. Batteries ...

Multi-Robot Task Planning for Efficient Battery Disassembly in

With the surging interest in electric vehicles (EVs), there is a need for advancements in the development and dismantling of lithium-ion batteries (LIBs), which are highly important for the circular economy. This paper introduces an intelligent hybrid task planner designed for multi-robot disassembly and demonstrates its application to an EV lithium-ion ...

Integrated Risk-Aware Smart Disassembly Planning for Scrap

With the increase in the production of electric vehicles (EVs) globally, a significant volume of waste power battery modules (WPBM) will be generated accordingly, posing challenges for their disposal. An intelligent scrap power battery disassembly sequence planning method, integrated with operational risk perception, is proposed to automate the planning ...

Review Robotised disassembly of electric vehicle batteries: A ...

Diekmann et al. categorised the dangers associated with Lithium-ion batteries (LiBs) into the following primary groups: electrical, fire, explosion, and chemical risks. Electrical risks stem from the batteries'' stored charge and high voltage. Fire and explosion risks arise from the flammable materials in electrolytes or as by-products of ...

Enhancing Disassembly Practices for Electric Vehicle Battery

In the context of current societal challenges, such as climate neutrality, industry digitization, and circular economy, this paper addresses the importance of improving recycling practices for electric vehicle (EV) battery packs, with a specific focus on lithium–ion batteries (LIBs). To achieve this, the paper conducts a systematic review (using Google Scholar, ...

End-of-Life Electric Vehicle Battery Disassembly Enabled by ...

disassembly is used to dismantle high-value parts from LIBs to facilitate downstream recycling activities. Disassembly of parts of interest at the LIB pack-, module-, and cell-level can...

Human-robot collaboration disassembly planning for end-of-life ...

Furthermore, a growing number of researchers are realizing that industrial robots can be utilized for the intelligent disassembly of huge batteries due to the dramatically increased used PBs and the development of intelligence . 2.2. Robotic disassembly.

Recycling Li-Ion Batteries: Robotic Disassembly of Electric Vehicle ...

Abstract. This paper presents the application of robotics for the disassembly of electric vehicle lithium-ion battery (LIB) packs for the purpose of recycling. Electric vehicle battery systems can be expensive and dangerous to disassemble, therefore making it cost inefficient to recycle them currently. Dangers associated with high voltage and thermal runaway make a ...

Revolutionizing Battery Disassembly: The Design and ...

In this paper, we propose a Battery Disassembly AMMR(BEAM-1) system based on NeuralSymbolic AI. It detects the environmental state by leveraging a combination of multi ...

Intelligent disassembly of electric-vehicle batteries: a forward ...

This study aims to enhance intelligent disassembly of retired electric-vehicle lithium-ion battery (EV-LIB) packs through the use of artificial intelligence and machine learning. The research shows that AI can effectively address uncertainties and safety concerns in the disassembly process, and identifies future research opportunities.

End-of-life electric vehicle battery disassembly enabled by intelligent ...

There are four primary types of batteries used in EVs, namely, lead acid, nickel metal hydride, lithium-ion, and sodium nickel chloride . amongst them, lithium-ion batteries (LIBs), which were first introduced by Sony in its digital video cameras in 1991, have been recognised as the most promising energy solution for powering EVs.

Adaptive planning of human–robot collaborative disassembly for ...

Increasing numbers of lithium-ion batteries for new energy vehicles that have been retired pose a threat to the ecological environment, making their disassembly and recycling methods a research priority. Due to the variation in models and service procedures, numerous lithium-ion battery brands, models, and retirement states exist.

Contact Us

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