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Automated Storage Rack Decommissioning and Commissioning in a Datacenter

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ABSTRACT

This disclosure describes automation of commissioning/decommissioning of data storage racks and HDDs in data centers. During commissioning, a multi-robot workcell is utilized to populate a data storage rack with HDD storage devices from a HDD storage container. During decommissioning, the operation is performed in reverse, and the multi-robot workcell is utilized to remove HDD devices from the data storage rack and store them in a HDD storage container. The robots can be equipped with one or more high speed robotic arms, machine vision capabilities, and a human-machine interface for control and access. Identifiers such as bar codes associated with each individual HDD and data storage rack are obtained and recorded at selected points in the workflow.

KEYWORDS

- Datacenter automation
- Server rack
- Storage rack
- Hard disk removal
- Robotic arm
- Multi-robot workcell

BACKGROUND

Data center facilities typically house multiple storage racks that are connected to utilities such as power, network, etc. and can each include storage devices such as hard disk drives (HDD) for storage and retrieval of data. Handling of data storage racks and HDDs can be labor intensive and can pose challenges during bursty operations such as commissioning and decommissioning of data center equipment.

DESCRIPTION

This disclosure describes automation of data storage racks and hard disk drives (HDDs) during decommissioning and/or commissioning of data center equipment. A multi-robot workcell is utilized wherein specialized containers are utilized in conjunction with robots for the handling of the data storage racks and HDDs. During commissioning, the workcell is utilized to populate a data storage rack (rack) with HDDs from a HDD storage container (container). During decommissioning, the operation is performed in reverse where the workcell is utilized to remove (depopulate) HDDs from the rack and store them in a container. Multiple racks or containers can be placed on a pallet that can then be safely transported, as needed.

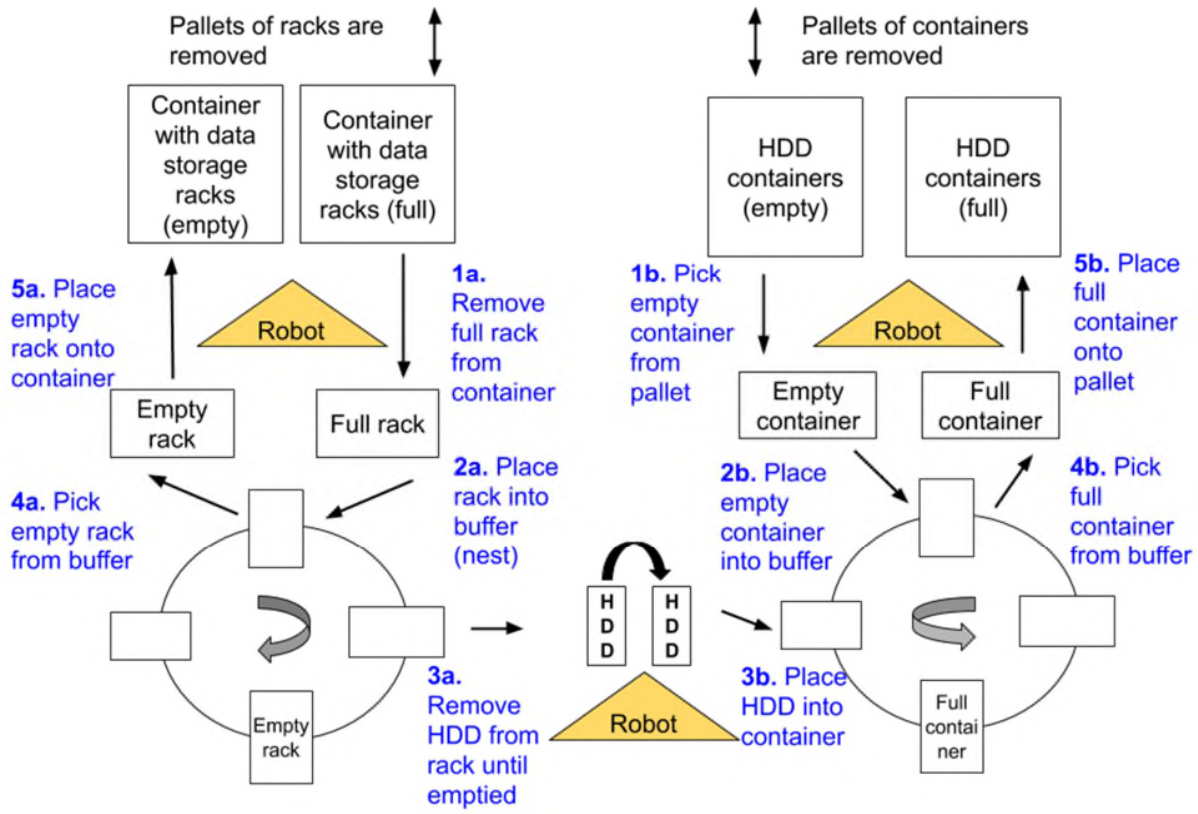

Fig. 1: Example workflow for decommissioning of data storage racks

Fig. 1 depicts an example workflow for a workcell for decommissioning of data storage racks, per techniques of this disclosure. The workcell can be utilized to safely remove HDDs from multiple data storage racks.

In an example workcell, multiple robots are utilized, each of the robots equipped with one or more high speed robotic arms, machine vision capabilities, and a human-machine interface for control and access. A first robot is utilized to remove full data storage racks from a container (**1a**) and to place it in a rack station nest (**2a**). An identifier such as a bar code associated with each full data storage rack is obtained and recorded for tracking progress and for tracing.

A second robot is utilized to prepare the storage rack for HDD removal and to remove the individual HDDs from the data storage rack (**3a**) to be placed in a HDD container (**3b**). Identifiers such as bar codes associated with each individual HDD are obtained and recorded. The HDD container is specially designed to match the dimensions of the HDD and provided with sufficient cushioning for safe transport.

When the data storage rack is emptied of HDDs, the first robot is utilized to pick the empty data storage rack (**4a**) and to be placed (**5a**) on a container used for storing and subsequent transport of empty data storage racks. Once the data storage rack is emptied, the process continues with the next data storage rack in the buffer, until completion or based on other control instructions.

Empty HDD containers are picked from a pallet that contains multiple empty HDD containers that are moved to the workcell site. A third robot is utilized to pick an empty HDD container from the pallet (**1b**) which is placed (**2b**) in a HDD container nest. HDDs that have been removed from a storage rack (e.g., at **3a**) are picked and placed (**3b**) in a HDD container.

Identifiers such as bar codes associated with each individual HDD are obtained and recorded as they are placed in the HDD container. This process continues until the HDD container is full.

When the HDD container is full, the third robot is utilized to pick the HDD container from the buffer (**4b**) and place the full HDD container onto a pallet (**5b**). An operator is provided with an alert when the pallet is filled to its capacity with HDD containers to enable replacement of the full pallet with an empty pallet.

The described workcell workflow can enable completely automated decommissioning of a datacenter with multiple data storage racks. Performance of the described workflow in reverse order can be utilized for commissioning of a datacenter, which starts with full HDD containers and empty data storage racks that are to be populated with HDDs.

While the foregoing description refers to the use of three different robots, each for a specific purpose, more or less robots can be used, based on the configuration and functional requirements. For example, multiple robots that perform the same tasks can be utilized. For the pick and place tasks as described herein, the robots can be high speed automatic robotic arms with multi-axis motion capabilities, configured to pick and place the specific components. The automation techniques as described herein can lower costs and improve security by reduced manual intervention.

CONCLUSION

This disclosure describes automation of commissioning/decommissioning of data storage racks and HDDs in data centers. During commissioning, a multi-robot workcell is utilized to populate a data storage rack with HDD storage devices from a HDD storage container. During decommissioning, the operation is performed in reverse, and the multi-robot workcell is utilized to remove HDD devices from the data storage rack and store them in a HDD storage container.

The robots can be equipped with one or more high speed robotic arms, machine vision capabilities, and a human-machine interface for control and access. Identifiers such as bar codes associated with each individual HDD and data storage rack are obtained and recorded at selected points in the workflow.