Open Robotics and Circularity

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According to the Circular Economy Institute (CEI) a circular economy is defined as an alternative to the current linear economy in which we take resources, produce, consume and generate waste. In a circular economy, systems and products are designed to eliminate the concept of waste by enabling the recovery and reuse of all materials at the highest value possible.

Circular Economy (CE) is noted by many corporations as a way to become socially responsible, economically viable, and environmentally friendly to sustain a healthy growth. The question that arises however, is how to best integrate the concept of circularity into the era of Industry 4.0, digitization, and IoT. What should be the strategies for robotics and automation solutions to adhere closer to the principles of circularity?

We should be able to find the answers by looking at the issue through the lens of CE. To accomplish this, we first need to understand the criteria pillars which constitute circularity and circularity assessment of an organization. The most relevant pillar to the purpose of this paper is Circular Design. CEI defines the circular design of a product or a service such that waste or negative externalities are not generated during or at the end of life of the product or service. To make it practical, the organization is encouraged to work on four areas:

1. **Dematerializing:** if one decides to build a product, the key would be minimizing the amount of materials that a product needs for its main functionality.
2. **Choosing safe material:** the materials chosen to go into the product should be safe to go back to the biosphere through biological cycles, or back to the marketplace via technical cycles (re-use, redistribute, refurbish, repurpose, remanufacture, recycle).
3. **Designing for durability:** rather than designing disposable products that end up in landfills, the product should be as durable as possible so that it can be used for longer and reused by different stakeholders.
4. **Designing for the smaller loop**: it is not enough to design a product so that it can be recycled once no longer needed (the biggest loop that needs the more energy and water to make the most of the product), it is important to design a product so that it can be maintained and reused (the smallest loop in terms of the resources needed to be utilized). An example is modular design which allows easier disassembly and reuse of parts.

Now that we understand the requirements for Circular design, we can explore the ways in which the principles of Circular Economy can be brought to Robotic Automation. To build our case, let us consider an example; and what would be a better example for employing automation and robotics than an application in waste management? Robotics and AI-image processing (AI-driven robotics) are certainly gaining traction in a variety of areas of recycling and de-manufacturing in the recent years. Aside from increasing efficiency, transparency, and security, automation and robotics will facilitate connection among different ecosystems such as OEMs, recyclers, and government agencies. In addition, the environmental health and safety concerns to directly work with electronic waste (e-waste) are dire. E-waste contains several toxic additives or hazardous substances detrimental to human health, such as

mercury, lead, brominated flame retardants (BFR), and chlorofluorocarbons (CFCs). Automation and robotics could be a remedy to these concerns.

Adapting to automation and robotics and economically growing with technology sounds promising and exciting but the main question is how do we make our system more circular? Open Robotics (OR) is an alternative to automation and robotics which meets the Circular Design pillar by its nature. OR offers an ultimate flexibility in custom designed hardware and software needed for any automation and robotics solutions. For instance, if one decides to implement a robotic sorting and packing system comprising several robotic arms, motion and conveyor controls, and yet doing so using a single controller, the choice is OR. One single PLC with loads of software can control up to 16 robotic arms eliminating many unnecessary controllers and networking devices. In addition of being very efficient in communication, OR eliminates considerable amount of unnecessary material and can meet the dematerializing point of Circular Design.

OR offers modularity, digitization, and scalability as one can add hardware and configure its controlling software with minimal effort. It is easy to add motor drives to expand the number of motion controls, whether it is adding another robotic arm or a piece of conveyor belt, and then configure software to control all new modules (conveyor tracking, program robots with multiple tools, communicate with a vision system to inspect or control the paths of the robots, and integration of users process know-hows). OR systems can be repurposed easily for new applications keeping the devices longer in use. Modularity of OR has many other advantages such as ease of maintenance and repair, upgrading to avoid obsolescence, sharing modules and components with the stakeholders within the organization. All of these attributes fall within the realm of circular design.

To learn more about Open Robotics please refer to the following whitepaper:

“Why is Open Robotics the best choice for scale-up manufacturing companies?”

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