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Crafted Scrap: Scrap Yard Automation and Advanced Sensors

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Steel circularity represents a sustainable strategy aimed at maximizing reuse of steel material, significantly contributing to the decarbonization of steel production. This approach encompasses the sustainable design of steel end products, resource-efficient steelmaking, and the recycling of steel products. Resource-efficient steelmaking is achieved through electric arc furnaces or converters prioritizing the use of recycled charging materials like steel scrap while minimizing the use of virgin materials such as pig iron or hot briquetted iron. Optimizing energy use and carbon footprint in these processes necessitates a thorough understanding of the composition of scrap portions charged into the melting unit to adjust process parameters accordingly. The recycling process involves collecting and pre-processing scrap through cutting, shredding, or cleaning. Efficient sorting, supported by chemical and/or optical analysis, is crucial for providing scrap of defined composition , which is essential for producing high quality steel grades with strict requirements. A scrap composition with defined quality and well-known properties is termed crafted scrap.
This paper presents a system of advanced sensor-based applications designed to determine the quantity and quality of scrap and track individual scrap portions throughout their lifecycle at a steel plant. It details how scrap quality is assessed using artificial intelligence-based camera image analysis for scrap type classification and detection of undesired objects, with the result applied to scrap pre-processing and sorting as well as inspection of incoming deliveries. Additionally, it demonstrates how scrap quantity is estimated by creating volumetric maps of scrap yards and containers using LIDAR sensor data. A comprehensive scrap tracking approach is also outlined, covering delivery by train or truck, material handling, scrap processing, manipulation into scrap baskets or chutes, and finally charging into melting units, facilitating real-time inventory management. Practical implementations at an electric steelmaking plant confirm the effectiveness of these approaches.

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