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Enhancing Steel Melting Shop Operations by Object Detection Using Template Matching Algorithm

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V. Srinivasan ; M. Parthasarathy ; M. Pavin Kumar ; S. Vaishnavi All Authors

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Abstract:
Ladle monitoring systems are essential for optimizing steel melting operations. They improve material and equipment flow, reduce wait times, increase overall production, enable quick problem response, and ensure steel quality. Traditional ladle tracking methods utilizing sensors require a wide frequency band for data transmission. However, sensor technology has limitations such as high cost, limited range, signal interference, poor integration, wear, and tear. Thus, an additional layer of security is needed. To address these issues, a proposed solution suggests implementing a machine vision system for ladle tracking and management in steel factories. This vision-based system uses a live video captured by a camera as input to de
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selected based on the results. The r
tracking positions can be accessed
ladles. The results demonstrate that
optimal outcomes with minimal harc

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Contents

A ladle is a cylindrical container made of heavy steel plates with a capacity of 100 to 200 tons and above; it has an internal refractory liner for conveying molten metal at a temperature between 1400°C and 1700°C. The outside temperature range of the steel ladle is between 300°C and 400°C. The management of ladles within the steel industry is a multifaceted challenge. Factors such as low circulation efficiency and idle time results in temperature loss, re heating, energy loss and less productivity. If the ladle position is tracked and updated, the time taken for ladle circulation can be reduced. In tum, this reduces the loss incurred. So, these crucibles are not merely carriers of molten metal; they are integral to maintaining the quality and consistency of the final product. The ladle tracking system collects the data, delivers it to the cloud, and analyzes it across several units. Identifying and tracking each ladle as it traverses the industrial landscape is not only a logistical necessity but also a safety imperative. Traditional methods of manual tracking and record-keeping are susceptible to human error, and they do not fully exploit the capabilities of modern computer vision and automation technologies. The ladles are tracked using sensors like Radio Frequency Identification (RFID) tags under the “contact” mode of tracking. RFID tracking exhibits disadvantages, such as RFID tags being damaged quickly, requiring frequent replacement of RFID tags, and the risk of installing a new tag in the working ladle being inapplicable. The RFID tracking system is shown in Fig. 1.

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