Rita Chattopadhyay et al., Adv Robot Autom 2017, 6:2 (Suppl)
DOI: 10.4172/2168-9695-C1-008

Real time monitoring and automatic fault detection in robots in semiconductor fabrication industry

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Losses of wafers and expensive repairs of process equipment are often caused due to uncontrolled and unmonitored failures of components during semiconductor process. High volume manufacturing (HVM) of semiconductor chips employs large number of robots. Any malfunctioning of these robots causes particle contamination, wafer tip-over, or crash of wafers, resulting in production yield loss, equipment down time and economic loss. Presently, wafer handling monitoring instruments diagnose vibrations of a robot at end-effector. Detection of anomaly in these vibrations is performed manually during scheduled maintenance and is highly dependent on the experience of the maintenance personnel. This not only is prone to human error, but also limits large scale deployment in semiconductor fabrications; having thousands of robots in the assembly line. The proposed solution automates this process by monitoring the vibration signal patterns, continuously at real time, to proactively identify robots that are at the greatest risk of failure. The vibration signals are captured from triaxial accelerometers placed near the bearings in the arms of the robots. The proposed method analyzes specific parameters of the vibration signal and generates alerts for maintenance, before the uncontrolled vibrations affect production yield. Identification of parameters, which are indicative of failure, is a great challenge. This work presents four such indicative parameters, determined based on exhaustive time and frequency domain analysis of the vibration data collected from good and faulty robots. The proposed method based on outlier detection methods has been successfully deployed in a semiconductor fabrications using Edge/Cloud architecture for remote monitoring and alerting.

Biography

Rita Chattopadhyay is currently working as a Data Scientist at Intel Corporation, USA. She has completed her PhD in Computer Science from Arizona State University and also won an Outstanding PhD Student Award for her basic research in the areas of machine learning and data mining. She has more than 20 publications in renowned IEEE and ACM conferences and journals and more than 10 patents filed in the areas of signal processing and machine learning based classification and predictive model development. She is also a GE certified Master Black Belt in Six Sigma

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