

**PREDICTIVE MAINTENANCE OF QUARTZ PROCESSING EQUIPMENT  
USING MACHINE LEARNING**

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Sri Lanka's quartz industry plays a vital role in the country's mineral processing industry, accounting for US\$ 8.38 million in export earnings in 2023. However, the inefficiencies and machine downtime of the heavy-duty machinery challenge the overall performance of the industry. To address these issues, this feasibility study aimed to apply Machine learning (ML) to implement predictive maintenance in quartz processing machinery, particularly for crushers, mills, and classifiers. The study was structured into two principal phases: digital model development and model implementation. A synthetic dataset was created to simulate sensor readings, including temperature, vibration levels, and running hours, enabling the training of a Random Forest Classifier. Initial results revealed that running hours and temperature were the most significant predictors of machine failure. Since the damping mechanisms in heavy-duty machines absorb vibration, it has a lesser impact. The confusion matrix revealed that the model is more effective in predicting where no maintenance is needed. Further cross-validation with real-world data will be essential to strengthen the model's strength, assessing potential cost savings from downtime reduction and maintenance optimization. By deploying this ML-based model in the real world, the potential operational efficiency in Sri Lanka's quartz industry will be enhanced. This approach could integrate automation into the mineral processing industry, aligning with global trends to improve productivity and reduce maintenance costs of heavy-duty machinery.

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