

Enhancing Shop Floor Safety through Industry 4.0 Technologies

Abstract:

This paper details a case study on how ITC Limited Paperboards and Specialty Papers division (ITC PSPD) explored application of various Industry 4.0 technologies for shop floor safety improvement along with enhancing the safety awareness and knowledge on safety guidelines, safe work practices among various levels of workforce in the organization.

Key words : Shop floor safety, IoT, Object detection, Video Analytics, digitization of safety activities, safety dashboard, Generative AI.

Introduction

ITC PSPD is one of largest producer of Paper Board, Paper and Specialty Papers in India with a production capacity of over 0.8 MTPA. Through implementation of philosophies like TPM, 6-sigma, the Business had become a leading player in India and a top quartile player globally. Shopfloor safety is of utmost importance in ITC PSPD as it ensures the well-being of employees and prevents accidents and injuries. The Pulp & Paper manufacturing involves the use of heavy machinery, equipment, and tools, which can be dangerous if not handled properly. Accidents can result in serious injuries, loss of productivity, and damage to equipment, which can be costly for the company. Implementation of safety measures and adherence to safety during work is of paramount importance. This not only protects employees but also helps to maintain a safe and productive work environment. In addition to protecting employees, shopfloor safety also helps the company to comply with regulations and standards set by government agencies. Overall, shopfloor safety is essential for the well-being of employees, the productivity of the company, and compliance with regulations.

Industry 4.0 technologies implementation @ ITC PSPD for Shopfloor safety improvement

The journey of Industry 4.0 implementation started in FY 18 with PoCs in multiple business functions with specific use cases such as Clonal production in plantations, Chemical's optimization in Pulp mills, Quality improvement in Paper machines, energy optimization in paper machines, wood quality prediction through image analytics, and golden batches identification in paper machines. The PoCs were implemented with different partners to find out the best fit technology as well as the technology partner for business. Post successful implementation of the pilots, business felt the need for scaling up the implementation of various Industry 4.0 technologies with identified business cases. While leveraging the Industry 4.0 technologies for improvement of operational performances, business explored several possibilities of utilization of these Niche technologies for shopfloor safety adherence improvement and safety awareness improvement.

+ Image analytics for PPE detection:

Video footage from the existing CCTV Camera is processed and converted to snapshots, the desired object (Helmet) is identified in each snapshot and annotated. Such annotated clips are processed through Video analytics model and to identify the desired object with High accuracy. Shift wise report gets generated and a mail will be sent to the concerned area in charges with percentage of workforce in the shop floor wearing Helmet. This is an inhouse development made by the digital talent pool within the organization and scaled up to multiple paper machines floor.

+ Safe and Unsafe Act Identification Through CCTV footage

This solution focuses on early detection of Smoke, fire and Oil leaks inside the factory premises;



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Identification of unsafe behavior (PPE non adherence, walking close to moving vehicles, running, person fall, etc) in vehicle movement areas and gives real-time alerts in the form of Dashboards, Email and SMS alerts.

22 unique unsafe practices detections from the available CCTV Cameras is implemented in one of the manufacturing units in partnership with startups and scale up is in progress in remaining 3 manufacturing units.



✦ Artificial Intelligence and IoT for enhanced safety with Material Handling Equipment

Intelligent camera fixed on the forklift to cover objects falling in path of the forklift and alert the forklift driver and the person nearby the moving vehicle on the possibility of collision by providing Distance based alerts in the shop floor.

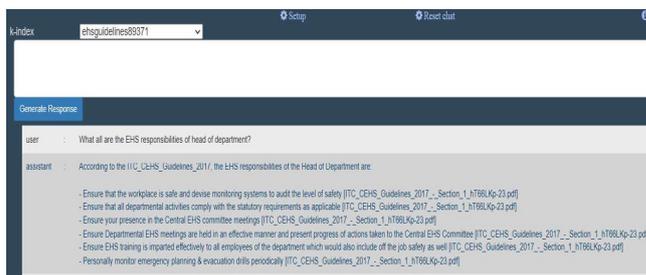
IoT devices are placed on the forklift and the workmen moving in the forklift moving areas will need to wear the safety gadget to his/her hand. As and when the forklift comes closer to the person wearing the safety IoT device, the vehicle speed automatically gets controlled based on the closeness in case of electric forklift, apart from the speed control the solution also provides distance-based alarm to alert the driver and the workmen on floor.

The solution has been implemented in over 70% of the Material handling equipment across the manufacturing units.



✦ Generative AI based Chatbot for EHS Guidelines learning

Creation of a chatbot to extract key information from EHS documents to help concerned managers to understand the safety guidelines faster, given the massive size of the safety audit standards and safety procedures guidelines document, it will be practically very time taking for managers or operators to read and understand the guidelines. This inhouse developed Chat GPT based Bot helps the shopfloor personnel for quick references to the guidelines and improved adherence



RESPONSIBILITY FOR ENVIRONMENT, HEALTH & SAFETY

This is to confirm that you will be responsible for Environment, Health & Safety (EHS) of theDepartment

Your responsibility would be to:

- ✓ Ensure that the workplace is safe and devise monitoring systems to audit the level of safety
- ✓ Ensure that all departmental activities complies with the statutory requirements as applicable
- ✓ Ensure your presence in the Central EHS committee meetings
- ✓ Ensure Departmental EHS meetings are held in an effective manner and present progress of actions taken to the Central EHS Committee
- ✓ Ensure EHS training is imparted effectively to all employees of the department which would also include off the job safety as well
- ✓ Personally monitor emergency planning & evacuation drills periodically

✦ Digitization of Safety activities on the shop floor through “Gensuite”

Comprehensive and integrated digital EHS platform has been deployed across the manufacturing units by including continuously evolving best-practice EHS workflows. Streamlined Incident Management for flexible Safety, Health & Environmental reporting, Safety trainings, AI-enabled follow-up and compliance reporting. Integrated Corrective and Preventative Action Tracking and Regulatory Compliance Obligation Task management, including Digital Inspection program with Pre-built Insights, Reports and Dashboards to operationalize the EHS program.

Conclusions & Results:

With the aim to be one of the most sustainable & safest pulp and paper plant in the world with leading performance on key sustainability and safety KPIs, ITC PSPD has implemented several technologies like IoT, Image Processing, Video Analytics, Safety digital platform, Artificial intelligence based Cameras for man machine intersection avoidance, Chatbots and e Learning modules for safety training and achieved a sustained improvement in safety performance by over 20% in the areas of incident reporting and loss time accidents, compared to the periods before use of the above mentioned technologies.