Surodh Dey, 2023, 11:6
ISSN (Online): 2348-4098
ISSN (Print): 2395-4752

International Journal of Science, Engineering and Technology

An Open Access Journal

Project "DRISHTI" to Enhance Site Safety by Integration of AI, VA and PA with CCTV VMS

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Abstract- Digitalization of safety round by integration of CCTV Video Management System, Video Analytics and Public Annunciation system which will proactively identify unsafe act as well as Unsafe condition. Implementation of Artificial Intelligence and Video Analytics in CCTV system for early detection of Safety hazards including unsafe conditions as Fire and Smoke, collapse of person, manpower in hazardous zone as well as unsafe Acts as Violation of Safety Helmet, Safety jacket or Safety Harness at height work. Mentioned hazards are very common reasons of major and minor accidents, early detection of these issues can save human, equipment & environment. Along with alarming the operator for any detected violation, public announcement speaker is installed at various areas throughout the plant, from which the operator can announce at the particular area or all areas as per requirement for necessary action.

Keywords- Digitalization, Artificial Intelligence, Video analytics, Public Annunciation system, Video Management System

I. INTRODUCTION

Maithon Power Limited (MPL) is an electricity generation plant. It is a joint venture of Tata Power & Damodar Valley Corporation. The venture implemented 1050 MW (2X525 MW units) in Nirsa District Dhanbad in the Indian state of Jharkhand. This project is India's first 525 MW unit thermal power plant using subcritical technology. It is a coal based thermal power plant and this project is India's first Public Private power project.

Safety is of paramount importance at Tata Power, as the company recognizes that the well-being of its employees and stakeholders is crucial for sustainable business operations. Emphasizing a proactive approach, Tata Power has implemented a range of initiatives to ensure a safe working environment across its operations. The company has invested in Cutting edge technology and state-of-the-art safety protocols to identify and mitigate potential risks. Training programs are regularly conducted to equip employees with the knowledge and skills necessary to handle various situations safely. Tata Power also fosters a culture of continuous improvement, encouraging employees to actively participate in safety initiatives and share best practices. By integrating safety into its core values and operations, Tata Power not only safeguards the health and wellbeing of its workforce but also enhances operational efficiency and reliability, ultimately contributing to the overall success and sustainability of the organization.

1. Digitalization in Safety

MPL has embraced the power of data analytics and digitalization to elevate its safety initiatives to new heights. Leveraging cutting-edge technologies, the company employs video analytics to identify potential safety hazards and predict emerging risks.

The approach allows to proactively address safety concerns before they escalate, significantly reducing the likelihood of accidents. Digitalization plays a pivotal role in real-time monitoring and communication, enabling the swift dissemination of critical safety information to all stakeholders. Additionally, the implementation of digital platforms facilitates interactive training modules, ensuring that employees are well-versed in safety protocols. The synergy between data analytics and digitalization not only fortifies Tata Power's commitment to a secure work environment but also exemplifies how innovation can be harnessed for the betterment of employee well-being and operational excellence.

II. TRIGGER FOR IMPROVEMENT

Heinrich's safety Pyramid suggested that 88 per cent of all accidents happen due to human decision to carry out an unsafe act. And numerous no. of unsafe act leads to near misses, Lost time injury and fatality. In case of person collapse, fire and Smoke, reduction of damage depends on time to identify and action taken. Unauthorized entry of uncertified person in hazardous and restricted area is major concern for person and equipment safety. Monitoring and tracking these unsafe act and conditions in real time to correct this habitual issue and unsafe conditions is a major challenge for us. A unique solution is required to monitor, track and immediate action to correct the same with minimum work force in real time for 24*7 along with data collection of mentioned incidents for further investigation and actions.

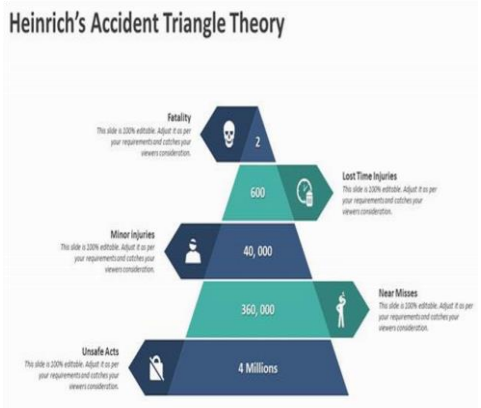

Figure 1: Heinrich's Accident Triangle Theory

III. DETAILED DESCRIPTION OF BEST PRACTICE

The implementation of AI and video analytics in site supervision through CCTV monitoring has revolutionized the field of safety and surveillance, enhancing efficiency and responsiveness. By integrating AI algorithms, the system can intelligently analyze video feeds in real-time, automatically detecting and alerting safety personnel. Video analytics can detect many unsafe act and condition, enabling a more focused and targeted approach to site supervision.

The VA software captures analytic conditions according to applied algorithm and data training of module and pushes a pop-up notification with voice alarm in operator room. The operator announces pre-recorded message to notify the personal in the particular area through the integrated system. Along with the pre-recorded message, the Public Annunciation System provides the operator additional feature to manually interrupt and announce through provided mic near operating station to area or all area by single click.

Additionally, AI-powered systems can learn and adapt over time, continually improving their ability to recognize patterns and anomalies. This not only enhances the overall safety of the monitored site but also offers a cost-effective and scalable solution for businesses and organizations looking to strengthen their surveillance capabilities. The combination of AI and video analytics in CCTV monitoring not only provides a force multiplier for security personnel but also sets a new standard for proactive and intelligent site supervision.

1. Dashboard & Monitoring

Main Dashboard

The unique Dashboard and other web pages have been designed along with vital information as per site requirement.

The Dashboard provides following features:

- Real-time video monitoring of selected Cameras in muti or single mode.
- Pop-up of captured Violation.

- Feature to view live streaming of respective area by single click on Pop-Up.
- List of last 10 captured alerts.
- Feature to view captured violation snaps and short video on single click.

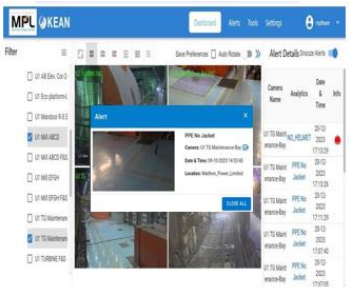

Figure 2: Main Dashboard with pop up

Alert Summary

Configuration and Designing of Alert Summary page is for ease of operator to analyze the data for investigation and action implementation. It consists following features:

- Data based on dates, type of violations or area can be analyzed, checked and reports can be printed with easy steps.
- Detailed description of violations can be analyzed.
- Reports in form of bar graph, pie chart and list can be analyzed and fetched from same.

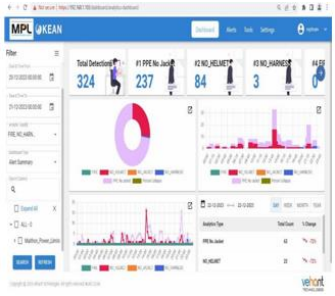

Figure 3: Alert Summary

Figure 4: Smoke Alert Detailed View

Type of Analytics

Different types of analytic algorithm deployed in different location strategically are follows:

- No of person inside confined space
- Violation of Safety Helmet
- Violation of Safety Harness
- Unauthorized Person in Restricted Zone
- Violation of Safety Jacket
- Person Collapse
- Smoke Detection
- Fire Detection

Detailed View

The Detailed view page of each analytics can be viewed by clicking on pop-up notification or from the list view.

It consists following features:

- It consists all the details of type of analytics, area of violation, time and date of the captured violation.
- It stores snap of violation with highlighting the main area of captured analytics.
- A short video clip is also shown and stored with it, which shows the overall incident for ease of operator to analyze.
- Live streaming of particular area can be enabled by single click.
- The Remarks box allows to save notes with each violation for future references.

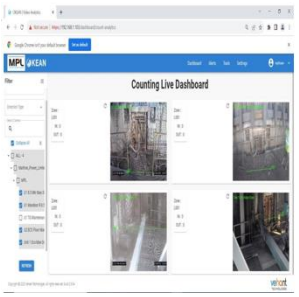

Figure 5: Count Live Dashboard

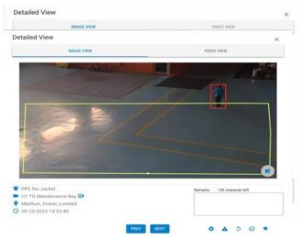

Figure 6: No Harness Violation

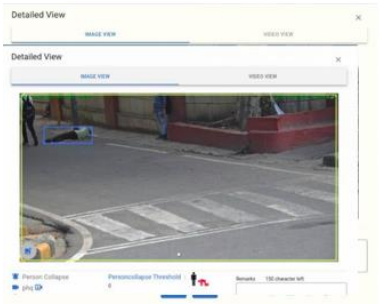

Figure 7 : Fire Alert

IV. CRITICAL SUCCESS FACTOR FOR THE IMPLEMENTATION AND SUSTENANCE OF BEST PRACTICE

This Unique solution of integrated Video Management System, Video analytics and auto annunciation. Use of specified product to utilize the same network for communication of all these mentioned systems. And integration of all the application for ease of operator to monitor and act according to captured violation. Provide comprehensive training for staff involved in CCTV monitoring and analytics.

Implement a change management plan to address any resistance and ensure smooth adoption.

V. BENEFITS & KPI IMPACT

1. In case of Smoke, Fire or collapse of person at site the time of response is key to safeguard man, machine and environment. Early detection of unsafe condition as Fire and Smoke will ensure fast action to mitigate the same in initial stage.

2. As per studies, 88% of incidents are due to unsafe act. Alarming, reporting and counselling through the applied technology in case of unsafe acts will ensure immediate mitigation of the hazards and continuity of this practice would help the person on workshop floor to follow safety rules by building habit.

3. Indication of incidents as person inside a confined space would immediately alarm the operator to take necessary action to safeguard the workmen. KPI Impact: Safety Index

Figure 8: Best Innovative Paper Award FY24

Figure 9: Safety Maestro for the month of Oct-2023

VI. CONCLUSION

In conclusion, the integration of AI and video analytics into CCTV monitoring for site supervision has brought about a transformative paradigm shift in safety and surveillance. The real-time analysis, automatic detection, and focused approach to site supervision, coupled with advanced features such as pop-up notifications and voice alarms, underscore the system's efficiency and responsiveness. The ability to adapt and learn over time not only enhances the overall safety of monitored sites but also presents a cost-effective and scalable solution for organizations. This amalgamation of AI and video analytics not only acts as a force multiplier for safety personnel but also establishes a groundbreaking standard for proactive and intelligent site supervision, ushering in a new era of heightened safety measures.

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