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AI Based detection of shoe and ID Card using YOLO

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***Abstract*-- Organizations and industries can keep the level of discipline, security, and professionalism by ensuring that employees adhere to both workplace safety protocols and dress code policies. In many workplaces, employees must wear specific items such as safety shoes and identification (ID) badges. However, traditional methods for verifying compliance with these items usually take a long time to complete and are subject to human errors. As a result, frequent monitoring is very difficult for the organization. This project proposes an artificial intelligence (AI)-based detection system for confirming compliance with mandatory footwear and ID card regulations by using deep learning and computer vision techniques. The AI system will use the You Only Look Once (YOLOv8) object detection algorithm to identify mandatory items (footwear and ID cards) from live webcam feeds or uploaded pictures. A custom dataset will be created and annotated using LabelImg. This dataset will include pictures of mandatory footwear and ID cards captured at different times of day, angles, and backgrounds to help improve the robustness of the trained YOLOv8 model. This project will train a YOLOv8 model to process pictures in a single forward pass and will enable the model to quickly detect required objects in real time with little delay. The project will also build a web application using the Flask framework that will provide secure user authentication and role-based access controls for users. When the model detects that an employee is missing either a required item (footwear or ID cards) based on the picture captured by a webcam, an alert will be generated to the user.The webcam will take pictures of the items and the trained model will detect what is being seen from the webcam and generate an alert if there are missing items. The results of the detection and the compliance records will be stored in a MySQL database, allowing the administrator to easily monitor employee activity, analyze compliance trends, and generate reports.**

***Keywords*— Organizations and industries , Safety shoes and identification (ID), You Only Look Once (YOLOv8) , web application , webcam**

I. INTRODUCTION

Safe workplaces and organizational rules play vital roles in creating a secure, professional working environment - especially for industries/institutions/corporate offices when there are dress codes/rules for safety and operating as part of this environment demands these types of codes/rules. Many times, company employees need to wear identification badges to identify them as authorized personnel; safety shoes may be an example of appropriate footwear employees need to wear in order for them to be able to do their jobs safely without injuries occurring due to accidents on the job. Unfortunately, overseeing these requirements at an organization is difficult because they require ongoing supervision (continuously watching) from multiple people (employees) who use a lot of time/resources and the possibility exists that something could happen where there might be an error or omission made during the supervision process which would result in an employee being allowed/encouraged by a supervisor or security personnel to not comply with the codes/rules. There are numerous companies that have employed a visual-only means of verifying compliance versus employing some form of automated monitoring, which results in long delays (during peak periods when visual checks would occur) and can increase the likelihood that errors occur during the

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identification process for those who are non-compliant with the codes/rules. As organizations continue to grow both in size and number of employees within the workforce, the requirement for an automated solution that is both reliable and scalable becomes increasingly necessary to help control the costs of monitoring compliance. Therefore, incorporating intelligent technologies into workplace monitoring systems provides employers with significant operational efficiencies, improved safety compliance, and greater overall effectiveness when managing their workforces.

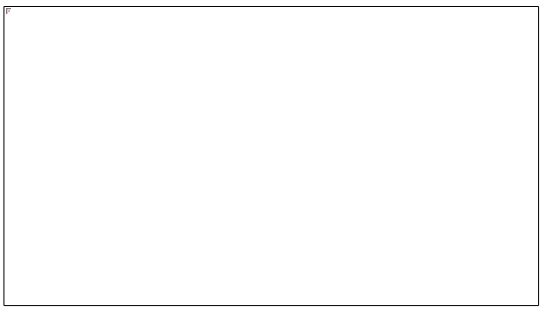

Figure 1 : Detection System Structure Based on Artificial Intelligence (AI) Using Shoes and ID Cards.

Through the rapid advancement of Artificial Intelligence (AI), deep learning, and computer vision; the automation of monitoring processes that previously necessitated human involvement has been created. Object detection models built on top of deep learning algorithms allow us to monitor and assess visual information in real-time and have the ability to accurately detect and track particular items. In addition to these capabilities, many organizations are able to implement these technologies into systems to detect if their employees wear certain mandated items (shoes, ID cards, etc.) when they are entering or working within a secured area. Furthermore, with the ability to create web-based applications to perform real-time detection; this enhances how a user can utilize the system by providing live views, instant notification alerts and easily manage historical data associated with the detection system, all of which eliminate the manual processes and create a consistent manner of detection and monitoring over an extensive area.

The AI-based real-time monitoring system was developed for detecting personnel compliance with footwear and identification badges (ID's) using the YOLO Object Detection Framework through image capture by web cams or upload of images. The images will be processed through the trained YOLO model and the detections will determine if either footwear or ID's were detected or not. A web application (Flask based) was created to facilitate user authentication, real-time detection and sending alert notifications to users. All detection records are stored in a single database for administrators to manage/review compliance, analyze user behavior and create reports for management. The developed System is a smart, automated and scalable solution using Deep Learning, Computer Vision and Web Technology to create safer workplaces, greater efficiencies in monitoring and support discipline of the Organization in the Industrial and Institutional Environment.

II. RELATEDWORK

The use of automated dress code surveillance systems through computer vision and deep learning is becoming more common according to recent studies. Sudharshan et al. [1] propose the implementation of an automatic dress code compliance monitoring system using YOLO models to automatically identify students who are violating institutionally mandated dress codes in real time. Muley et al. [2] improved this model by developing a smart dress code compliance monitoring system utilizing transfer learning from YOLOv11, providing the system with greater adaptability to various styles of clothing and improved detection accuracy. Similarly, Aravinth et al. [3] developed an automatic student dress code compliance monitoring system based on machine learning using real time object detection techniques in order to recognize violations of uniformed dress codes at educational institutions. Abubakar et al. [4] designed an explainable deep learning-based illegal dress code detection and classification model that can provide transparency as to how the model made its predictions, increasing the level of confidence that people have in automatic surveillance systems. Zou et al. [5] created an

industrial-grade dress code compliance monitoring system using a modified YOLOv8n model with integrated DeepSORT tracking to enable the monitoring of worker safety compliance in real time.

Multiple investigations have studied using computer vision to improve clothing identification and to enhance security via CCTV. Shanmugapriya and SaravanaPerumaal [6] developed a clothing-based image retrieval system, which incorporated a CCTV system to increase its ability to identify and enhance monitoring capabilities of clothing attributes. Renugadevi et al. [15] created a real-time dress code surveillance system for the college environment that utilizes deep learning methodologies to automatically determine dress code violations and hence increase campus discipline. Ludwika and Rifai [16] studied the usage of deep learning methods to ascertain the average compliance with the use of personal protective equipment (PPE) in laboratories and illustrated that object detection models are applicable for the monitoring of safety compliance. All of these studies underline the capabilities of deep learning and object detection models to identify clothing attributes and monitor compliance in many different institutional and industry settings.

Numerous studies have investigated the use of identity verification, access control systems and dress code monitoring to improve security and accountability. Automated ID card detection/penalty systems were proposed by Sultana et al.[9] through use of YOLOv5 for object detection and facial recognition for verifying students' identities as well as identifying those without an ID card. An automated ID verification/violation penalization framework was proposed by Haritha and Anitha [10]. A college ID card recognition system was created in real-time based upon YOLO or other AI-based models by Vaigunth [11]. An earlier work by Kusuma et al.[12] used YOLOv3 and image rectification methods to detect ID cards, while Ryan and Hanafiah [13] examined using template matching-based methods to recognize ID card characters. Illuri [8] added to the body of research by proposing a face recognition-based system that could authenticate employees to help improve secure access control in organizations. These studies show how combining object detection technologies with biometric image processing technologies can help create robust identity-verification systems.

Research on alternative biometric and behavioural identification methods has also been conducted. For example, Dong et al. [14] developed a new approach to person identification via structural vibrations caused by footsteps in order to distinguish between individuals wearing different shoes. Similarly, Holden [15] researched how digital microscopes can be used to analyse footwear patterns for forensic purposes and identified footwear analysis as an important component of identification methods. Naveen et al. [7] created a hybrid deep-learning based student engagement monitoring system that could be used while online examinations are being held, to promote discipline and uncover potential misconduct. All of these studies show that many intelligent monitoring systems using a combination of deep learning, computer vision and biometric technologies are increasingly being developed to enhance security, compliance monitoring and behaviours in educational, industrial and business settings. However, most currently available systems concentrate solely on one or more individual components (e.g., dress code enforcement, ID verification, or activity monitoring) without integrating them together. Thus, there is a need for an integrated intelligent monitoring system that provides all three functions (dress code enforcement, ID verification, and compliance monitoring) into one monitoring system to enhance overall monitoring effectiveness.

III. PROPOSEDMETHODOLOGY

An AI-based real-time monitoring framework for workplace compliance with mandatory safety shoes and mandatory identification card requirements through the use of deep learning and computer vision techniques has been proposed. This framework will consist of a detailed data collection, model development, the development of a real-time detection capability, and monitor compliance capability. The proposed system will use the YOLOv8 (You Only Look

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Once) object detection method to identify safety-related objects in real-time from either live camera feeds or uploaded images. A custom dataset containing labeled images of employees wearing and not wearing safety shoes or identification cards will be developed and annotated using the LabelImg annotation tool to ensure the creation of accurate bounding box annotations. Then the YOLOv8 model is to be trained using the created dataset to produce an optimized real-time detection model of compliance-related objects.

A Flask-based web application has been developed to provide users with the ability to authenticate and access their real-time monitoring status using a YOLO-based trained model for object detection. The system is capable of capturing live frames using a webcam and processing them using the trained YOLO object detection model. The outputted bounding box and confidence score from the object detection model for the detected shoe or ID card will be used to determine whether the safety item is present. If the YOLO object detection model detects a missing safety item, it will issue a visual alert and voice notification via a text-to-speech function. All detection information should also be stored in a MySQL database with time stamps and user information, which will assist administrators in tracking patterns of compliance and generating reports via a centralized dashboard. Overall, this will simplify the need for manual tracking and provide a continuous means of ensuring safety compliance in the workplace and/or educational institutions.

Fig 2 : Proposed System Architecture

A. Retrieval of Data and Preparation of a Dataset

The first step of the proposed methodology is collecting a quality image set, which will serve as the training dataset for object detection. The image set will consist of photos or images of employees wearing shoes and ID cards. These images will be retrieved from various sources including cameras, workplaces, and other online data sources. To increase the robustness of our model to different types of objects, we will capture images in a variety of lighting, on varied backgrounds, and from multiple perspectives (i.e., from varying distances away). After retrieval, we will annotate the images using the LabelImg annotation tool for bounding box creation (to outline the objects of interest) and will assign corresponding class labels to each image to guide the training of our model.

The dataset is separated into training, validation, and testing groups after annotation to evaluate how models are performing based on their ability to correctly predict the class of objects within their field of view. Data augmentation methods (flipping, rotating, scaling, and changing the brightness) are applied to create variability within the dataset, thus increasing its usefulness as a base from which to apply machine-learning algorithms. The prepared dataset's annotation information has been converted into the YOLO annotation format, which contains normalized bounding-box coordinates along with the class identifiers for each object in that bounding box. The dataset is now structured and is used as the basis for training the deep-learning model in real time to accurately classify objects that comply with specific requirements.

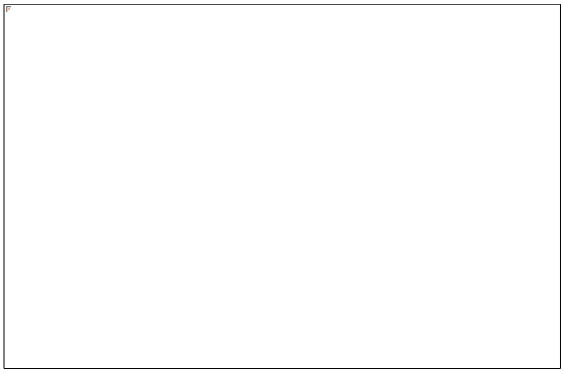

Fig 3 : Dataset Preparation Workflow

B. YOLO Based Object Detection Model

The YOLO model detection model and architecture will be trained with the annotated data set. The YOLOv8 object detection architecture is a form of deep learning that classifies and identifies object locations within a single neural network. To achieve this goal, the YOLOv8 model receives an image input from the image sensor and divides it into grids and predicts bounding boxes and confidence levels that relate to whether a specific object (IDs or shoes) appears within a bounding box.

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When training the object detection YOLOv8 model, there will be an annotated dataset created that will be utilized to find visual characteristics for the defined object shapes, textures and structures. The YOLOv8 object detection model will also be augmented with a trained model file or best.pt to optimize its weights and detect objects at real time speeds and with high detection rates.

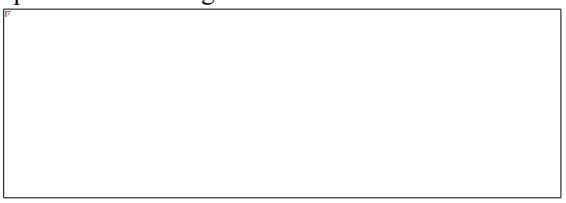

Fig 4 : YOLO Detection Model Architecture

C. Module for Real-Time Detection and Monitoring

Once the YOLO model has been trained successfully, it will then be implemented in a real-time monitoring environment that will process live video feeds via CCTV cameras, or still images taken from previously captured footage (e.g. photos). The interface for the webcam is accessed via either a web or mobile application. The webcam will then continuously capture frames, which will be sent to the YOLO model in real-time to detect evidence of shoes and/or ID cards by drawing bounding boxes around recognised objects.

The output data from the YOLO object detection algorithm will include labels for the detected objects (i.e. shoes and ID cards), relative confidence scores and the coordinates of where the object was detected. If both shoes and ID cards are found to be present, then the system will mark this as compliance. If either the shoes or ID card are found to be missing from the individual then the system will identify that there is an infraction and immediately issue an alert. With this capability of real-time detection, there is constant monitoring of compliant/non-compliant individuals; therefore, an organisation will be able to enforce health and safety as well as dress code requirements at work.

D. Module for Notification and Alerting of Compliance Issues and Violations

The compliance monitoring module will provide for the immediate reporting of violations. The compliance monitoring module will generate visual warnings on the system interface and provide auditory warnings through the use of the text-to-speech engine to notify employees of identified violations (i.e., not wearing shoes, not being in possession of their ID card, etc.) As soon as the violation is detected, an alert will be created immediately to allow for timely corrective action.

Each time a violation occurs, it is logged, including the date and time of the occurrence, the employee's information, and how the violation was detected. These logged incidents will enable organizations to track safety violations and enforce discipline within the organization. The alerting system will improve employees' safety awareness and encourage them to adhere to the dress code requirements of the organization.

Fig 6: Alert and Compliance Monitoring System

E. Data and Administration Dashboards

The Program/Software uses MySQL as its database for all employees' information (e.g., record, history, detection, filing, etc.), violations, and compliance. The initial info on an employee is submitted by them, including registration, credentials for login, history of detections, and any violations. All of that data is compiled into 1 central database where effective employee compliance monitoring can take place. In addition to being stored in the database for future reference, the database contains all of the Information that is displayed in the Admin Dashboard of the web app.

All of the compliance statistics, employee record summaries, and analytical reports can be visualized on the Admin Dashboard. The Admin Dashboard uses the records of daily monitoring logs, total number of violations, total compliance trends, etc. to help management identify reoccurring problems, employee discipline, and improvements to safety policies. This module will help management

manage their data effectively and support their decision-making process as related to organizational administrators.

Framework for Technical Implementation

The suggested system will consist of a full-stack web application that uses deep learning, computer vision, and web technologies for real time oversight and operation.

Front-end:

The front-end of the monitoring system will provide an interface developed using HTML5 CSS3 and javascript, which creates a responsive and user-friendly web interface that allows employees to register, log into, and have access to the monitoring system. A display for the detection results and alerts, will operate in real-time.

Back-end:

The back-end of the monitoring system will be implemented using Python with Flask as the framework managing the server-side logic of the application. Flask will authenticate users, provide communication between the web interface and the YOLO detection model, and process image frames captured from the camera of the web.

Database:

A MySQL database will be utilized to store employee profiles, detection logs, timestamps, and records of compliance and will help to provide a structured database from which information can be retrieved and analyzed for the purposes of administrating the monitoring systems.

Authentication and security:

Secure login methods and roles will provide a mechanism whereby authorized users, as well as their administrators, will have access to the monitoring system. All passwords will be encrypted and all sessions will be tracked to help protect against any unauthorized use of the monitoring system.

Deployment:

To help implement the application locally, or on a cloud platform, users will be able to integrate the monitoring function of this proposed system into their organizational surveillance systems.

IV. RESULTANDDISCUSSION

The implementation of an AI-based monitoring system for shoe and ID card detection as a web-based monitoring application that utilizes deep learning, real-time object detection (object recognition), and database management has been accomplished. The proposed system combines YOLO-based object detection, automated alerts for employee safety through administrative monitoring of employees' compliance with workplace safety regulations, and the development of artificial intelligence modules to provide a viable alternative to manual supervision, as well as increase the accuracy of monitoring employee safety. The subsequent areas will present the user interface of the proposed system and evaluate the performance of the system in the real-world environment.

A. User Registration

Employee-specific info like employee name(s), employee ID#, employee department(s), and employee log in credentials are entered into a user registration interface to gain access to the employee monitoring system by way of the Employees tab as a user completes the required fields in this portion of the system to establish authentication for use in the future. As a result of established employee registration functions and maintaining employee records on file in the monitoring database, an Administrator can track the results of each employee with respect to meeting guidelines established by the company for compliance purposes. The employee records have a very important role in creating a chance for effective management of users and security access to employee monitoring systems.

Fig 8 : Registration Interface

B. User Login

Secure access to the system is provided by means of verifying that a user has provided his/her username and password. When you verify that the user has entered valid credentials, you will redirect employees to the monitoring screen where they are able to start the detection process by clicking on the appropriate link.

This module will prevent any unauthorised users from accessing the system and/or changing monitoring records. Data Privacy will be maintained through Authentication Mechanisms and the results of the detection will be interlinked with the Proper Employee Profile.

Fig 9 : Login Interface

C. Detecting in Real-time

The core functionality of this new system will occur in the real-time detection module. The real-time detection module activates the webcam when a user logs into the system and captures frames in real-time (i.e., as the user is logging into the system). Then, when a picture of an employee has been captured by the webcam, it will be sent to a trained YOLO-based detection model for processing to see if an employee is wearing mandatory shoes and has their ID card displayed on their body.

The YOLO model will produce a separate bounding box for each of the detected objects and will provide a corresponding confidence score for each. Thus, if both objects are detected, then the employee will be marked as being compliant. If either of the two objects is not detected, the automated system will immediately identify that the employee has violated policy. This enables automated detection to occur 24/7 without human supervision.

Fig 10 : Real-Time Detection Interface

D. Result Visualization for Object Detection

The system provides a visual output of detected objects by drawing boxes around each detected shoe and ID card along with labels. Along with these boxes are confidence values for each detected object that indicate how accurately the model was able to predict each object.

By displaying results visually, users can see if the system was able to detect the desired object. Visualizing detection results also provides an increase in transparency for administrators to check detections visually. By providing a graphical view of detection results, it is easier for users to interpret results and monitor the system.

Fig 11 : Detection Result Visualization

E. Compliance Alert System

The compliance alert module allows for immediate response to the dress code. If the employee is not wearing shoes or is not carrying their ID card at the time of the event, an alert will be provided in both visual form and as an audible alert. The alerts will be initiated through use of an internal text-to-speech engine that automatically notifies the employee of the violation. The automated notification system provides for the immediate corrective action to occur, thus reducing the need for manual supervision by the security staff.

Fig 12 : Compliance Alert Notification

F. Management of Detection Log & Database

All detection results (i.e. Employee Information, Detection Outcome, Date& Time of Detection, Compliance or Non-Compliance) are stored in an MySQL database. This allows administrators to review historical monitoring records and analyze how compliant an employee is.

The database provides a consistent method for record keeping and facilitates longitudinal analysis of disciplinary patterns within the workplace. The storage of detection logs allows for continued monitoring and assessment of safety policy implementation.

Fig 13 : Detection Log Database Interface

G. Admin. Monitor. Dashboard

An Administrator's Dash Board is a centralised control center for managing all systems and monitoring them for compliance issues. The Administrator can see information about the employees, including their ID info, when violations occur through their violation logs (detective log) and also information about the employee overall in the form of overall compliance statistics of the organisation, as well as, each respective state, area location.

The Administrative Monitoring Dashboard presents the administrator with this information in a clear, organized manner allowing them to identify those employees who are violating dress code policy most frequently, to assist in making decisions on the enforcement of Safety policies and to assist in improving the overall strategy for enforcement of Safety.

Fig 14 : Administrative Dashboard

H: Evaluating the Effectiveness of the YOLO Model for Detection Performance

The YOLO detection model was trained to detect various objects such as shoes and ID cards in a variety of lighting conditions and angles, and it performed well in terms of accuracy, real-time operations, and detecting objects across multiple still images from different sources (e.g., digital images taken by employees or from the camera attached to a cell phone). In addition to being able to identify objects with high accuracy, the model was also determined to have a very fast speed in providing inference (e.g., Inferring Whether an Item is an Object that can be Handled). Additionally, the accuracy of detecting employees when moving within the camera footage of the model was great enough to support the conclusion that the model is a dependable technology for applications requiring continuous monitoring of employees working.

Fig 15 : Detection Performance Results

I. Analysis of System Performance

The findings indicate that the proposed system adequately streams the monitoring of compliance with workplace environments. Due to the addition of deep-learning detection with web technologies, an organization can monitor while continuously monitoring employee compliance with safety regulations. In contrast, the manual inspection methods described above require human effort and permit inaccurate measurements while delivering quicker detection of violations. The combination of real-time alerts, database logging, and administrative analytics constitutes a comprehensive compliance monitoring solution. The developed platform demonstrates that A-I powered surveillance systems will greatly increase current workplace safety and efficiency through operational efficiencies resulting in improved productivity in today's organizations.

V. CONCLUSIONANDFUTURE SCOPE

The proposed AI-based shoe and ID card detection system demonstrates an effective approach for automating workplace compliance monitoring using deep learning and computer vision techniques. By utilizing the YOLO object detection model, the system is capable of identifying the presence of shoes and ID cards from real-time webcam input with high speed and accuracy. The integration of a Flask-based web application, database management, and automated alert mechanisms enables efficient monitoring and record maintenance. This automated approach reduces manual supervision, minimizes human error, and ensures that workplace safety regulations are followed consistently. The developed system proves that artificial intelligence can significantly improve operational efficiency and discipline in organizational environments.

In the future, the system can be enhanced by expanding detection capabilities to include additional safety equipment such as helmets, safety jackets, gloves, and masks. Integration with facial recognition and attendance management systems can also help automatically identify employees and link compliance results with attendance records. The implementation of cloud-based storage and IoT camera integration can allow large-scale monitoring across multiple locations within an organization. Further improvements in dataset size, model optimization, and mobile application support can enhance detection accuracy and enable administrators to monitor compliance remotely through real-time notifications and analytical dashboards.

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