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Kaksha Anushasan Nigraani Vyavastha

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Abstract*: In order to improve classroom security and student well-being, this project provides a comprehensive class surveillance system that makes use of cutting-edge technology, such as facial recognition and body activity detection. The Head of Department (HOD) or other pertinent staff members will receive timely alerts and notifications from the system, which is designed to monitor and identify anomalous actions in real-time. The implementation comprises camera-based monitoring that is scalable for deployment in different educational contexts, with an emphasis on high-quality pixel collection. An intuitive user interface is guaranteed by the user-centric design, facilitating prompt alert acknowledgment and report access. The system works flawlessly in a classroom setting, placing cameras in strategic locations to maximize coverage and integrating with the current infrastructure to facilitate efficient data flow and communication. At the nexus of technology and safety, the initiative helps create a safe and comfortable learning environment for educational establishments.*

Keywords: mobile phone usage, food consumption,YOLOv8 Algorithm, Unusual Activity Detection, Bounding Boxes, Adam Optimizer, Real- Time Detection

I. INTRODUCTION

Creating a productive learning environment in college classrooms requires competent behavior management from the students. Three frequent behaviors that can affect this atmosphere are using a cell phone while in class, laughing, and eating. Although these activities are not always bad, occasionally they might interfere with a lesson's flow and take away from the learning process as a whole. In order to maintain classroom concentration and an environment that supports learning, educators are becoming more and more interested in comprehending and dealing with these behaviors. The identification of food intake, laughter, and mobile phone usage in college lectures has drawn attention since it can offer important insights about the behavior and involvement of students. Through the examination of patterns associated with these activities, educators can enhance their comprehension of how kids engage with their surroundings and pinpoint areas that require development. Furthermore, by working with educators to create effective management measures for these behaviors, these detection systems can promote a classroom climate that is more orderly and polite. Recent technological developments have made it possible to create automated systems that can identify these activities in real time. These systems use complex algorithms and a variety of sensors, including microphones and cameras, to assess behavior in the classroom. Even while there are many exciting opportunities to improve classroom management with these technological solutions, it's important to think about the privacy issues and ethical ramifications of tracking student behavior.

II. LITERATURE REVIEW

Paper [1]: The authors describe a method for employing machine learning techniques to identify anomalous activity. The main goals are to locate and record distinct block movements, identify unique actions in real time, and calculate odd frames. The writers examine the features of the moving object to ascertain whether it is an individual. They build a technique for identifying odd activity in frames using a movement effect map. In order to examine interactions inside frames, such as movement direction and object interactions, this method creates a motion effect map. Unusual activity, computer vision, motion influence map (MIP), closed-circuit television (CCTV), and mixture of dynamic texture (MDT) are the keywords for this paper.

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Paper [2]: With an emphasis on facial biometrics, the paper offers a thorough review of biometric systems. It describes the basic objective of biometric systems, which is to measure and analyze each person's distinct physical or behavioral characteristics, differentiating between physiological characteristics such as fingerprints and behavioral attributes such as speech patterns. Because facial biometrics are non-intrusive and may be recorded without user cooperation, they are the focus of this discussion. This paper reviews the fundamental processing processes and historical advances in the field of facial biometrics and highlights the many approaches to gather and categorize facial biometric data, including image-based and video-based face recognition systems. It draws attention to the role deep learning-based techniques have played in the most recent developments and makes recommendations for future research paths to enhance facial biometric systems even more

Paper [3]: The goal of the proposed study is to create a system that uses video analytics to identify questionable behavior in a classroom setting during exams. Three components make up the system framework: hand contact detection, hand signal identification, and facial detection and monitoring. Grid formation is used to investigate hand contact detection, whereas Haar feature extraction is used for face detection. The convex hull algorithm detects hand signals, and the invigilator receives an alarm. With the OpenCV library and C/C++ architecture, the system achieves higher performance in real-time video frames. The integrity of the examinations is guaranteed by the algorithms employed in this system, which guarantee precise detection and analysis of suspicious activity.

Paper[4]: The research describes a technique for identifying human actions using information from an RGB-D camera, namely the Microsoft Kinect. In order to recognize and classify the poses associated with different activities, the system uses three different machine learning techniques: K-means clustering, support vector machines, and hidden Markov models. It also estimates relevant joints of the human body using the Kinect. Every action is represented as the spatiotemporal development of well-known postures. Two datasets were used to test the method: the CAD-60 public dataset and the Kinect Activity Recognition Dataset, which is a novel dataset. The experimental results showed that, compared to four other related works using different methodologies, the proposed solution performed better. The obtained 77.3% and 76.7% precision and recall rates, along with the partial-time identification capabilities, point to a bright future in real-world applications. By utilizing RGB-D camera data and machine learning algorithms, this research advances the field of activity identification systems, which has potential applications in interactive systems and healthcare monitoring.

III. METHODOLOGY

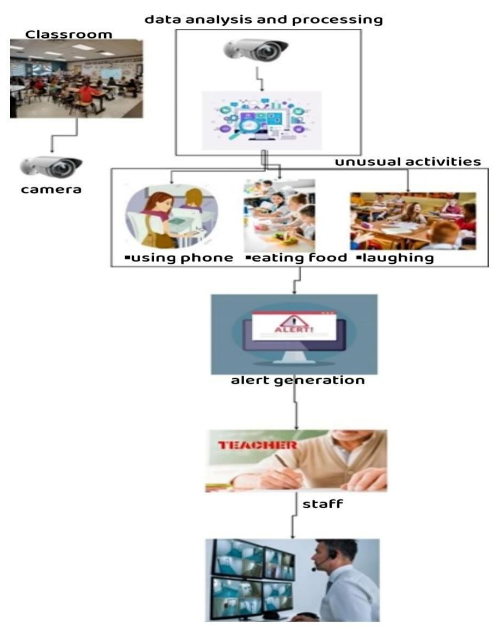

Fig. 3.1 Block Diagram

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Description of the Methodology

Data Sources: This block would include the classroom camera and other potential data sources related to staff and classroom activities.

Data Annotation: The nearly 1000 images are been annotated and trained has the Phone and Unusual activity.

Data Preprocessing: YOLOv8 Algorithm Breakdown

Dividing the Image:

The input image provided is divided into a grid of squares. Common grid sizes are 13x13 or 26x26.

Each grid cell is responsible for predicting objects within its designated area.

Bounding Boxes and Class Probabilities**:**

YOLOv8 predicts multiple bounding boxes for every cell.

Every bounding box forecast has confidence ratings in addition to coordinates (x, y, width, and height). The probability that an object will be inside the bounding box is indicated by the confidence ratings.

Additionally, YOLOv8 forecasts the class probabilities for every bounding box.

These odds show how likely it is that particular object classes will be found inside the bounding box.

Backbone Network:

YOLOv8 utilizes a CNN architecture called CSPNet (Cross Stage Partial Network) as its backbone. CSPNet is designed for efficiency and accuracy.

The network allows for faster processing while maintaining high detection capabilities.

The backbone network extracts features from the input image that are used for object detection.

Non-Maxima Suppression (NMS):

After making predictions, YOLOv8 applies Non-Maxima Suppression (NMS). NMS helps to filter out redundant and overlapping bounding boxes.

This technique selects the most likely bounding box for each detected object.

NMS ensures that only one bounding box is kept for each detected object, reducing false positives.

Training Procedure:

YOLOv8 incorporates a unique training procedure that combines supervised and unsupervised learning.

Labeled data is used to train the model in supervised learning.

The model is better able to generalize to new, unknown data when unsupervised learning is used. The model's capacity for generalization and detection accuracy are enhanced by this method.

Additional Technical Details

Algorithm Used: Gradient Descent

YOLOv8 uses gradient descent for optimizing the model during training.

Classifier: Deep Neural Network

YOLOv8 employs a deep neural network for classifying objects within the bounding boxes.

Number of Classes**:**

YOLOv8 is configured to detect two classes: "phone" and "unusual" (representing unusual activities).

Optimizer: Adam

The Adam optimizer is used for training the neural network.Adam combines the advantages of two other extensions of stochastic gradient descent: AdaGrad andRMSProp.

Network Architecture:

Total of 108 convolutional layers. Remaining layers are dense layers.

Activation function: ReLU (Rectified Linear Unit) for intermediate layers.

Output layer activation function: Sigmoid, used for class probability estimation.

Unusual Activity Detection: This block would analyze the data from the camera and other sources to detect any unusual activities, such as using a phone, eating food in the classroom.

Alert Generation: Once unusual activities are detected, this block would generate alerts to notify the appropriate personnel, in this case, the teacher.

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Teacher/Staff: The teacher or other staff members would receive the alerts and take appropriate action based on the unusual activities detected in the classroom.

IV. RESULTS

Fig 4.1: Unusual activity (Eating)

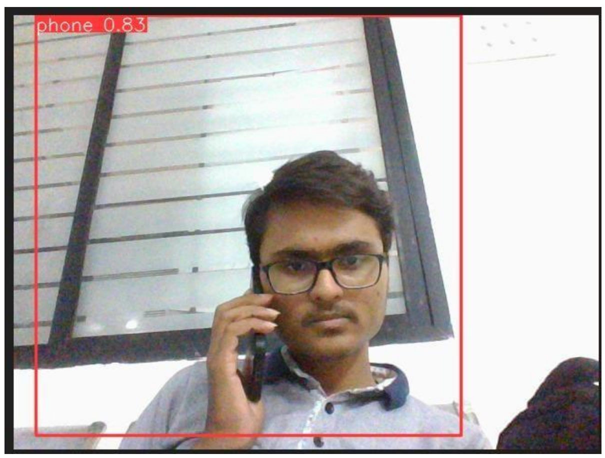

Fig 4.2:Phone Detected

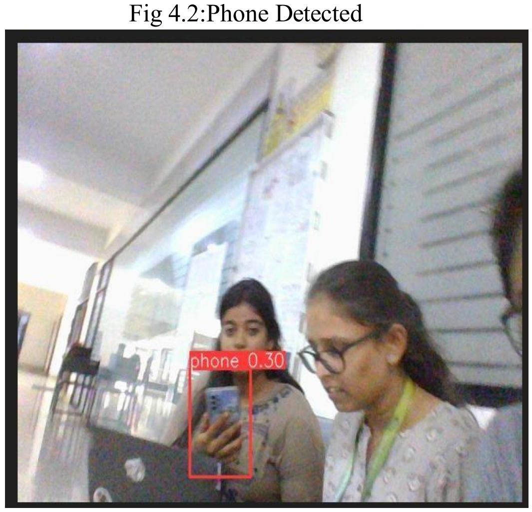

Fig 4.3: Phone Detected

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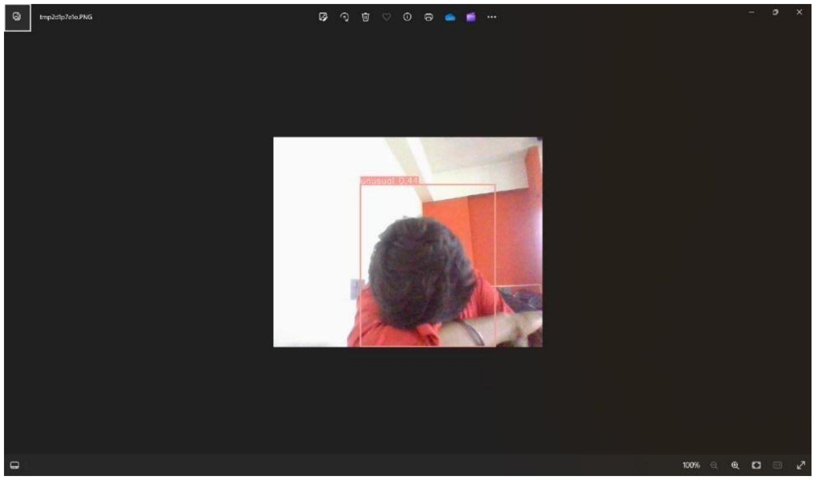

Fig 4.4: Unusual activity (sleeping) detected

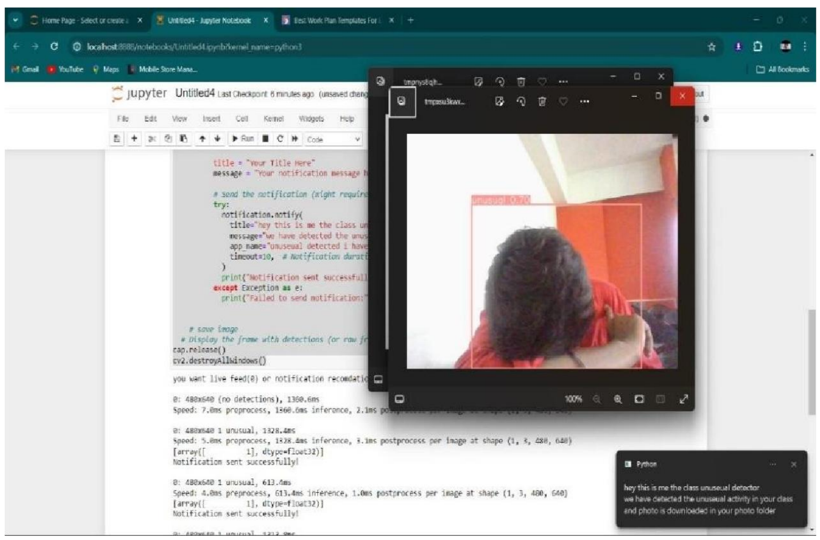

Fig 4.5: Unusual activity (Sleeping) detected with notification

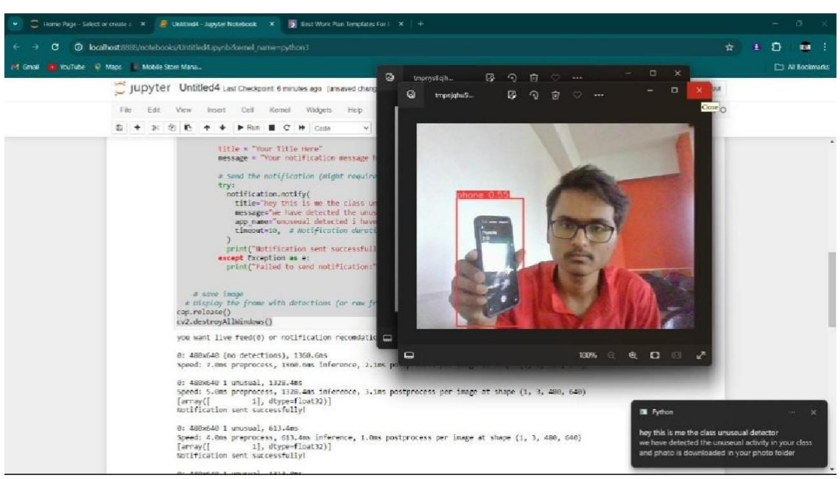

Fig 4.6: Phone detected with notification

V. CONCLUSION

To sum up, the project's goal is to create an advanced classroom surveillance system that makes use of facial recognition, body activity detection, and high-resolution cameras. Through the use of these cutting-edge technologies, the system will be able to recognize and instantly notify teachers about anomalous behaviors like using a cell phone, laughing, or eating. The project's potential to boost student engagement, maintain a conducive learning environment, and improve classroom management makes it significant Offering a vital tool for educational institutions globally, the project has the potential to be applied outside classrooms due to its focus on privacy compliance, ethical issues, and scalability. With this project, we hope to develop a system that not only meets the needs of the classroom right away but also establishes a standard for the successful use of technology in teaching.

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