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Border Surveillance System

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ABSTRACT: Accidental fire is a natural disaster which threatens the public safety in a huge manner. In the past few years, accidental fire has occurred very frequently in many places, including forests, shopping malls and industries, which in turn yields to the huge loss of human lives and capital. By paying attention to simple steps and being familiar with obvious dangers, one can help to lower the likelihood of accidental fires and hinder damage caused to the property or even worse, loss of property. It mainly reduces the risk of potential loss of lives. Possession of fire arms without a license is an offence and even if someone does have a license for it, bringing it to certain places is restricted. Though there is rigorous checking in the entrance of every place, there are possibilities of a mishap. Instead of looking at the whole network, the YOLO algorithm looks into the parts of the image which has high possibilities of containing the object. You Only Look Once (YOLO) is an object detection algorithm, and it is faster than other object detection algorithms.

Keywords— Fire detection, Gun detection, YOLO algorithm

I.INTRODUCTION

Object detection is a computer vision task that involves predicting the presence of one or more objects, along with their classes and bounding boxes. The object detection has attracted an increased amount of attention in recent years due to its wide range of applications. This mission is subject to extensive investigation both in academic domain and in real-world applications, such as security monitoring, autonomous driving, transportation monitoring, drone scene analysis, and robotic vision [1]. The main purpose of object detection is to indicate, classify and locate the location and type of object in images or videos [2]. There are other purpose of object detection is to detect all states of objects of a known class, such as cars, people, or faces in an image [3]. Fires and guns hit many people and cause damage to their properties in the whole world. Thus, to prevent such loses we need accurate systems to detect the fires and guns early in private and general places. Forest fires are occur always in different countries and cause tremendous damages. Crime rates caused by pistols and guns' fire are increasing as ones of the most common disasters that threaten the world at the present time [5]. The latest statistics reported by the United Nations Office on Drugs and Crime (UNODC) reveal that the number of crimes involving firearms per 100,000 inhabitants is very high in many countries, for example, 21.5 in Mexico, 4.7 in the United States and 1.6 in Belgium [6].

It is very imperative to reduce this type of violence through early detection of guns and pistols' fire. YOLO "You only look once" is one of the modern and most popular and preferred algorithms for artificial intelligence engineers as object detector that can perform realtime object detection with good accuracy [4]. It has always been the first preference for real-time object detection [7] as one of the finest family of reveal models with start of the art. YOLO algorithm splits images into a grid system. Each cell in the network is responsible for discovering things within itself. The series of YOLO was introduced in May 2016 by Joseph Redmon who released YOLOv1 [8], as one of the biggest advances in real-time object detection. In December 2017 joseph introduced second version which was known as YOLO 9000 [9]. After one year in April 2018 new version called YOLOv3 was released by Joseph and his partner, which was considered as the most popular and stable version [10]. Finally, in April 2020 Alexey Bochkovskiy introduced YOLOv4 [11] with additional amazing features. YOLOv4 outperforms YOLOv3 by a high margin and also has a great deal of average accuracy when compared to the EfficientDet family. After few days on 9 June 2020 Glenn Jocher released YOLOv5. There are a lot of disagreements about the choice of the name "YOLOv5" and other things. Glenn introduced a PyTorch-based version of YOLOv5 with exceptional improvements.

II. LITERATURE SURVEY

⌐ Image fire detection algorithms based on convolutional neural networks
Authors: Author: Pu Li, Wangda Zhao
Abstract: Fire hazards are becoming more frequent in recent years. Hence, reducing losses caused by fire is a dire necessity. Alarming users before in hand is one of the main things to do, to reduce risks. By spontaneously extracting image features, the comparison becomes easy. CNN algorithm-based fire detection reports that the accuracy of it is higher than all other algorithms. YOLO v3 gives 83.7% precision which is higher than all proposed algorithms. It also has a great detection performance and the detection speed is around 28 FPS. This enables real-time detection in an easier way.[2]

⌐ An Early Flame Detection Based on Image Block Threshold Selection Using Knowledge of Local and Global feature Analysis
Authors: Ting Hsu, Shreya Pare, Dong Lin Li.
Abstract: Fire is one among the uncontainable events that occur in our day-to-day life. Every year, it is responsible for innumerable human life, flora and fauna. Hence, many researchers have associated themselves with early warning systems to minimize the fire damage and the resulting consequences. In this paper, the occurrence of fire is classified into four periods, namely, inception, fire growth period, fully developed period and decay period. The flame detection is done by considering four categories, namely, shape, color, motion and texture. The system has 97% detection rate and about 3.5% false alarm rate. The processing time is 5 ms per frame. [3]

⌐ Batik Image Classification Using SIFT Feature
Extraction, Bag of Features and Support Vector Machine
Authors: Ryfial Azhar, Desmin T uwohingide, Dasrit Kamudi
Abstract: Batik is an Indonesian traditional fabric which is also its cultural heritage since 2009 [4]. Batik image sorting and grouping is required to protect the resources of traditional art of Indonesia. Hence, a feasible technique is important to extract the distinctive characteristics of batik image. Bag of Features (BOF) is used in the image classification along with Scale-Invariant Feature Transform (SIFT) and Support Vector Machine (SVM) classifier [5][6]. The observation results show that the mean accuracy of this reaches 97.67% for normal image, 95.47% for rotated image and 79% in scaled image. [7]

III. PROPOSED METHODOLOGY

A. Fire and gun detection
Fire and gun detection basically means detecting dangers before they occur. Tools are a great necessity to predict danger before it occurs. Currently, tools like fire alarms and smoke detectors are used by people to detect fire.

B. YOLO Algorithm
You Only Look Once (YOLO) is an object detection algorithm, and it is faster than other object detection algorithms. In the initial detection systems, localizers or classifiers were used to perform detection. The algorithm applies a single neural network to the complete image. The algorithm looks into particular parts of the image and not the complete image. Hence, this algorithm is fast and more effective.

C. Prediction and forecasting
Predicting the cause of fire and possession of guns help in decreasing the loss of life and property. Prediction is based on the previous data and the features extracted from them.

The new data captured from the video is compared to the preexisting data. Later, the danger is predicted based on that. ire detection by using live camera feed, plays an important role in reducing losses caused by fire, as it alarms the user before in hand, and in turn reduces the risks caused by fire. Image based fire detection is established by analysis of the images algorithmically. The live video is passed through the algorithm and then the YOLO algorithm processes the input data. The system searches for the presence of gun or fire and then detects the same.

If fire or gun is present in the particular video, it will alert the supervisor through EMAIL. You Only Look Once (YOLO) algorithm is an object detection algorithm which helps to detect fire and gun more efficiently and also in a faster way.
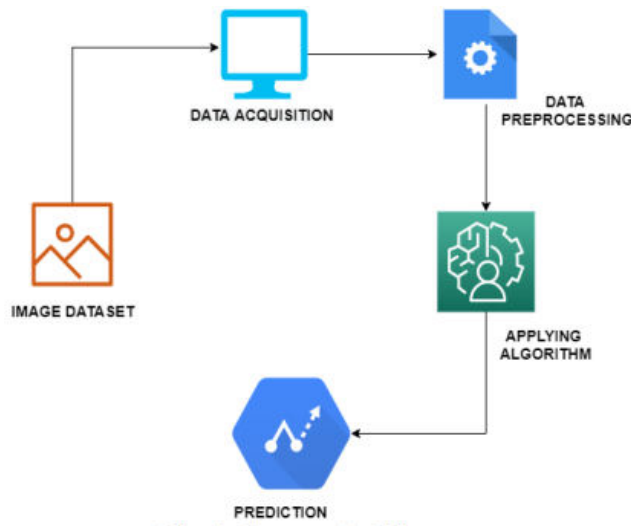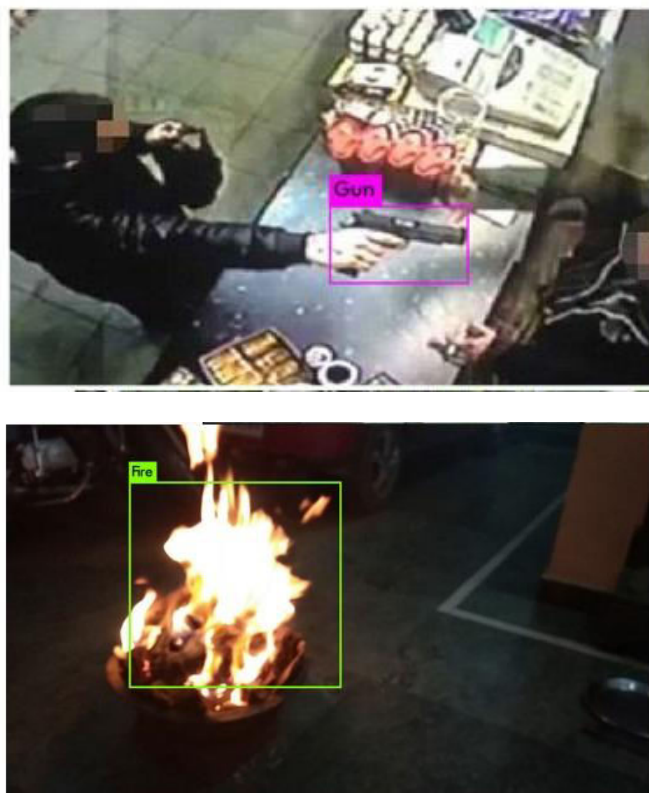

Fig 1. System Architecture

Fig 2. Detection of fire and gun

IV. CONCLUSIONS

Fire hazards are very common in our day-to-day life and the losses caused by them are quite high. Smoke detectors and fire alarms are some of the methods used to notify people of the disasters that are yet to occur. But, one drawback of these things is, they sense danger only after it has spread to some extent.

By paying attention to simple steps and being familiar with obvious dangers, one can help to lower the likelihood of accidental fires and hinder damage caused to the property or even worse, loss of property. It mainly reduces the risk of potential loss of life. Possession of fire arms is an offence and this method helps us to detect it by minimizing the consequences. Using this system will help us detect danger in the early stages, which in turn reduces the loss of lives and property

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