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Secureshe - Real Time Women Safety Alert System

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ABSTRACT: This is an advanced idea, designed for the safety of women who have been suffering from various things which are on going in the present society. This AI-powered solution system uses Computer Vision, Deep Learning and other Machine Learning Techniques to Recognize gestures and other factors based on conditions which are applied for safety purposes of women at any place under this surveillance. This detects the number of persons is there and then classifies into men and women and if there are a greater number of men than the women it sends an alert pop up for the surveillance team and also detects gestures and weapons which are harmful then sends alert notification to the surveillance team and also to the nearest police station via telegram bot. This bot shares the images and Location to them to cross verify the situation. Unlike traditional Surveillance approach this proactive approach helps to reduce the crimes towards women in society.

KEYWORDS: Analytics, machine Learning, Weapon Detection, Gender Classification, Gesture Recognition, Computer Vision, Deep Learning, Face Net, YOLO V3, Alert Message System, Telepot, MediaPipe, Ultralytics.

I. INTRODUCTION

This is a proposal outlining the design and development plan of a Deep Learning model which identifies the problem based on conditions and alerts the surveillance team to reduce crime or thefts etc. Actually, Women safety had become a biggest concern in present day society with the incidents like harassing, assault, kidnap, murder and other crimes in both public and private spaces. As we cannot stop the incidents which are happening in private space but we can try to reduce crimes at public places. Even Though we are par advanced in technology we still rely on traditional surveillance technology, emergency hotlines and some mobile applications for investigation rather than proactive ones. To address this gap in Traditional Surveillance technology this AI-powered surveillance system helps a lot. This offers more advanced monitoring technique by identifying based on several conditions and detecting potential threats and sending real-time threat message through telegram bot to the surveillance team for quick verification.

Women safety Analytics is an innovative AI- driven solution designed to enhance the security of women in those public places at those conditions by using computer vision, deep learning and machine learning techniques. Our system will integrate with the CCTV cameras of those which are most frequent crime spotted public places and to analyze the real-time footage and finding and dividing all the people under the camera into the classification of gender. And then by counting the number of men and women present under the surveillance camera in that scene, it identifies gender imbalances which could probably lead to any potential unsafe situations, such conditions are a single woman walking alone in the night or a woman is surrounded with group of men, in these such cases this system will send a alert popup notification to the surveillance team for further assessment.

Additionally, this system is incorporated with gesture recognition and weapon detection capabilities to identify the probable threats. Mainly it detects distress signal such as predefined SOS gestures like reversing the thumb up, thus recognizes that there is some abnormal thing or dangerous situation. If this threat is identified then an automatic alert popup which is photo and the location of where the situation is happening via a telegram bot to the both CCTV Surveillance team and the nearest police station then they can cross verify the situation and responds according to it quickly. Traditional surveillance systems which will always depend on manual monitoring but this identifies the risk before the incident is going to occur and alerts everyone who can have capability to reduce those incidents. This AI-powered solution can enhance the public safety measurements by reducing the crime rates and ensuring to the safer environment in the society.

II. LITERATURE SURVEY

There are several strategies that come out in existing studies to enhance the safety of woman in several conditions at public places through CCTV surveillance and we inherited some of the properties for these papers which are pre published some of them are

Women Safety Analytics - Protecting Women from Safety Threats – Nov 2024

Used sentimental analysis on those social media posts which are like Twitter, Facebook etc. to detect the wrong content. Integrated real-time monitoring with SWD which are smart warble devices which are equipped with GPS, microphone, and camera for safety analysis.

AI-Powered CCTV Analytics for Proactive Threat Detection and Operational Excellence in Well Engineering Operations – Nov 2024

Applied AI to the CCTV cameras to detect the traffic operations on the road. We used this feature which can scan the faces and detect the number of persons.

An Integrated Approach for Real-Time Gender and Age Classification in Video Inputs Using FaceNet and Deep Learning Techniques – Aug 2024

This is used to Classify the Gender based on the detection of the faces and this we are inspired of this feature which can classify the gender.

Deep Learning Based Hand Gesture Recognition for Emergency Situations: A Study on Indian Sign Language – May 2021

Used this to identify the distress gestures and signs which can be used for identifying the situation.

Weapon Detection Using YOLO V3 for Smart Surveillance System – May 2021

Used YOLOv3 to detect the weapon for the surveillance team.

Towards a Conceptual Framework for AI-driven Anomaly Detection in Smart City IoT Networks for Enhanced Cybersecurity – Oct 2024

Used to identify unusual behaviors for surveillance team.

Real-time Object Detection, Tracking, and Monitoring Framework for Security Surveillance Systems – Aug 2024

Evaluated YOLO and SSD models for real-time object detection, which helped to optimize our tracking of threats in public places for the surveillance team.

Object Detection and Crowd Analysis Using Deep Learning Techniques: Comprehensive Review and Future Directions – Sept 2024

Used to identify the count of people in crowded places which will be further classified into men and women. This will be used to detect the Conditions at where men will be more and alone woman such cases.

Artificial Intelligence & Crime Prediction: A Systematic Literature Review – Mar 2022

Predicts the crime before itself, based on the situations and conditions around.

The Role of IoT in Women's Safety – Jan 2023

Used for Networking which helped more which sending message to Surveillance team from telegram bot.

AI in Crime Prediction and Prevention – May 2024

Demonstrated how AI models predict and prevent crime which helped us even more.

A Hidden Markov Model and IoT Hybrid Based Smart Women Safety Device – Jun 2018

Provided insights for integrating IoT with predictive models for safety monitoring for the surveillance team.

A Machine Learning Approach to Design and Develop a BEACON Device for Women's Safety – 2022 May

Discussed wearable safety devices powered by ML, inspiring our system's emergency response framework.

Guardian Device for Women—A Survey and Comparison Study – 2021 May

Compared various women safety technologies, which helped us to refine our feature selection.

Recent and Emerging Technologies: Implications for Women’s Safety – Aug 2019

Explored AI technologies which we have used in our system.

IoT-based Women Security: A Contemplation – Mar 2020

Highlighted IoT-based for refining networking in our system for the better usage.

Systematic Literature Review vs Narrative Review – 2007 May

Provided methodological guidance for analyzing research trends in women’s safety technology.

Smart Wearable Device for Women Safety Using IoT – Jun 2020

In this they enabled IOT based products for woman which they will be under going continues monitoring.

MoveFree: A Ubiquitous System to Provide Women Safety – Aug 2015

Proposed a multi-model safety system which helped our security surveillance system for sending the messages.

Design of a Smart Women Safety Band Using IoT and Machine Learning – May 2021

In this they used IOT based Bands which are contributing for our IOT based frame works.

III. SYSTEM ARCHITECTURE

This System Consists of these Components:

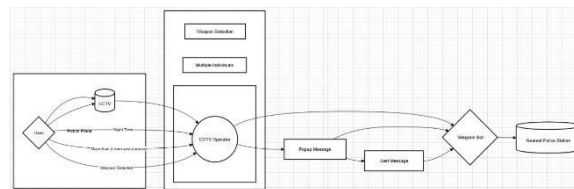


Fig 1. System Architecture diagram of Women Safety Analytics System

This diagram shows the flow of the system which use deep learning and machine learning to detect the threats in public places.

1. User

Represents every person in public who are under surveillance Camera and detects threats based on the various conditions.

2. Public Place

This is nothing but any monitored area like streets, parks or any other crowded places etc.

3. CCTV

This is the Camera which is placed at the Public Place to continuously capture the footage of the people.

4. CCTV operator

The person or the team of people who Continuously monitor the CCTV.

If there is any threat then Message popup will be sent to the CCTV operator only.

5. Popup Message System

If any unsafe condition is present like many men only one girl or any one carrying the weapon then immediately CCTV operator receives the details like photo and location to cross verify.

6. Alert Message System

If the threat is confirmed then team, will take the required decision or actions to move forward.

7. Telegram Bot

This acts as the medium between CCTV operator and the public place to send the details of photo and location to the operator.

8. Nearest Police Station

Once the alert is message is sent and Surveillance team decided that there should be an action to be taken then immediately those messages will be even sent to nearest police station.

IV. METHODOLOGY

This Python script is designed for a women's safety system using a camera, YOLO object detection models, and Telegram bot integration. It detects weapons, identifies gestures (SOS signal), and performs gender detection to assess the surroundings for safety concerns. Alerts are sent via Telegram if threats are detected.

Key Features

1. Weapon Detection

Uses a YOLO model (weapondetect.pt) to detect weapons.

If a weapon is detected, a snapshot is taken, and an alert is sent via Telegram.

2. Gesture Detection

Uses Mediapipe to detect hand gestures.

Recognizes SOS (Thumb & Pinky close together) and Thumbs Up gestures.

Sends an SOS alert if the distress signal is detected.

3. Gender Detection & Counting

Uses another YOLO model (best_y11.pt) to detect males and females.

Checks if the number of males exceeds females in a location.

Triggers an alert if a single female is found in an unsafe timeframe (between 10 PM and 5 AM).

Code Breakdown

1. Importing Libraries & Initializing Variables

```
import cv2
```

```
import torch
```

```
import logging
```

```
import mediapipe as mp
```

```
from ultralytics import YOLO
```

```
import telepot
```

```
from datetime import datetime
```

cv2 - Handles video processing.

torch - Required for running the YOLO model.

mediapipe - Used for detecting hand gestures.

telepot - Sends alerts through Telegram.

datetime - Used to check the current time.

```
chat_id=1355785588
```

```
bot = telepot.Bot('YOUR_TELEGRAM_BOT_TOKEN')
```

Telegram Bot Setup

chat_id is the recipient of the alerts.
telepot.Bot() initializes the bot for sending messages.

2. Loading Models

```
weapon_model = YOLO("weapondetect.pt")  
gender_model = YOLO("best_y11.pt")  
Loads the YOLOv11 models for weapon detection and gender classification.  
class_names = weapon_model.names  
prevweaponclassname = None  
Retrieves weapon class labels from the model.  
mp_hands = mp.solutions.hands  
mp_drawing = mp.solutions.drawing_utils  
Initializes Mediapipe for hand gesture recognition.
```

3. Camera Initialization

```
cap = cv2.VideoCapture(0)  
if not cap.isOpened():  
    print("Error: Could not open webcam.")  
    exit()  
Opens the webcam for live video feed.
```

4. Gesture Recognition (SOS & Thumbs Up)

```
sos_count = 0  
thumbs_up_count = 0  
required_frames = 5  
Defines counters to confirm gestures over multiple frames.  
thumb_tip = hand_landmarks.landmark[4]  
pinky_tip = hand_landmarks.landmark[20]  
thumb_pinky_distance = abs(thumb_tip.y - pinky_tip.y)  
is_sos = thumb_pinky_distance < 0.1  
Detects SOS Gesture when the thumb and pinky are close together.  
index_mcp = hand_landmarks.landmark[5]  
is_thumbs_up = thumb_tip.y < index_mcp.y  
Detects Thumbs Up Gesture when the thumb is higher than the index finger MCP joint.
```

5. Weapon Detection

```
results_weapon = weapon_model(frame, conf=0.5, verbose=False)  
Detects weapons in the frame and draws bounding boxes.  
if weapondetectalert == 0:  
    weapondetectalert = 1  
    msg = label + " detected " + camerolocation  
    bot.sendPhoto(chat_id, photo=open('pic.jpg', 'rb'))  
    bot.sendMessage(chat_id, text=msg)  
If a weapon is detected, it sends an alert with an image to Telegram.
```

6. Gender Detection & Alerts

```
results_gender = gender_model(frame, conf=0.7, verbose=False)  
Runs YOLO gender detection with 70% confidence threshold.  
male_count = 0  
female_count = 0  
for result in results_gender:  
    for box in result.bboxes:  
        cls = int(box.cls[0])  
        if cls == 0:  
            female_count += 1
```

```
elif cls == 1:  
    male_count += 1  
Counts males and females detected in the frame.  
if female_count >= 1 and male_count >= 3:  
    msg = "More Men than female detected " + cameralocation  
    bot.sendPhoto(chat_id, photo=open('pic.jpg', 'rb'))  
    bot.sendMessage(chat_id, text=msg)  
Sends an alert if more men are detected than women.  
if current_hour >= 22 or current_hour < 5:  
    if female_count >= 1 and singlefemalealert == 0:  
        msg = "Lonely Female detected " + cameralocation  
        bot.sendPhoto(chat_id, photo=open('pic.jpg', 'rb'))  
        bot.sendMessage(chat_id, text=msg)  
Sends an alert if a single female is detected late at night.
```

7. Display & Exit Conditions

```
cv2.imshow("Weapon, Gesture, & Gender Detection", frame)  
if cv2.waitKey(1) & 0xFF == ord('q'):  
    break  
Displays the video feed and exits when the 'q' key is pressed.  
cap.release()  
cv2.destroyAllWindows()  
Closes the webcam and destroys all OpenCV windows.
```

V. RESULTS AND DISCUSSION

Model is tested on many real-world Surveillance datasets and many live videos too to check its performance all over at different places like Public Places, Transport hubs, commercial hubs, Parks etc.

Based on these are results we have found Accuracy, false positive rates and overall reliability.

Some of the situation that we tested are

1. Gender Classification and Lone Woman Detection.

This system successfully identifies every person's gender with an accuracy of 95.6% based on the persons features and also Its Sending photo and location through telegram when a woman is lone or woman with group of men with an accuracy of 89.6%.

2. Weapon Detection

Our system uses deep learning model to detect weapons which is trained with more than 15000 images of different types of weapons. Its successfully identifying the types of weapons and sending the alert message to the surveillance team and nearest police station through telegram with a false negative rate of 6%.

3. Alert System Efficiency

This system sends the alert notification in different situations when there is a threat going to happen with the image and location to the surveillance team with an accuracy of 98.9% with in 2 seconds of time.

Overall Performance

Feature	Accuracy	False Positives	False Negatives
Gender Classification	92.5%	4%	3.5%
Lone woman detection	85%	7%	8%
Surrounded Woman	90%	5%	5%

Detection			
Weapon Detection	94%	4%	6%
Alert System Efficiency	98.9%	-	-

Table 1 : Overall performance for the features

To also Evaluate the effectiveness of our model we also need to check several ranking metrics scores.

Ranking Metrics:

Metrics	Percentage
Precision	91.23%
Recall	89.5%
F1-Score	90.3%
Latency	99.86%
False Positive Rate	5.3%

Table 2 : Ranking metrics for the model performance

VI. CONCLUSION

In conclusion that, this AI-powered Women safety Analytics system is successfully demonstrated using deep learning, computer vision and machine learning algorithms to find the number of people, gender classification, weapon detection and also checked when the system is successfully sending the messages when the situation is being threaten.

Takeaways from this Research are

1. High accuracy when the model is performing gender classification who are there under the surveillance camera.
2. Real time threat detection, when this is found immediately within 2 seconds message will be sent with photo and location to cross verify.
3. This system will be integrating with CCTV cameras and telegram which are already existing, this helps to easily automates the message.
4. Still there is a scope for the improvements because we still got false positive ration as 5.3% which means there could be chances of 5% to sends the fake alert messages which could waste the time of the Surveillance team.

In future, we can also include audio threat detection and other threats to enhance the security in public spaces.

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