Artificial Intelligence Surveillance System

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Abstract- *This project aims to build a system that will analyze a particular site. The main purpose of this system is to improve the awareness of security personnel and decision makers by collecting real-time information automatically and sending alerts to the administrator through a user-friendly GUI. The GUI will hide the complex working of the system beneath it to provide an easy to operate application and a richer experience for the users. The major role of the application would be to collect the inputs provided by the IP Camera and feed them to the ML engine which is based on Darknet neural networks since they tend to provide better accuracy. The engine would do the processing task and send alerts in application for the administrator in case of emergency.*

Keywords- surveillance, cameras, detection, artificial intelligence

I. INTRODUCTION

The existing Surveillance System of our college is a traditional CCTV based monitoring system which requires an administrator to watch the footage if something goes wrong. It can help find the culprit in case of any unacceptable incidents but it does not provide any alert system. This is where Artificial Intelligence proves helpful. If the cameras are the eyes, A.I. provides a brain to the eyes to make it smarter. By incorporating Computer Vision and Artificial Intelligence, the existing surveillance cameras can be put into use in a lot of ways. The 24-hour surveillance system can notify the administrator and security if it detects movement in restricted areas after college hours. Cameras inside the classroom can also be used to keep track of the headcount throughout the day and notify concerned people in case of any discrepancy. A mobile application will be developed to view the camera feed as well as for receiving notifications.

II. SOLUTION

Going through hours of security footage is a boring task which causes fatigue. Computers, however, can do this job on their own easily. Our solution is to incorporate Artificial Intelligence to the existing CCTV based surveillance system of the college. If the cameras are the eyes, A.I. provides a brain to the eyes to make it smarter.

We have developed an application with a user-friendly interface which lets the user view the security footage feed of all the DVRs on campus. Administrators can log into the application using their credentials to add or remove cameras. This solves the problem of logging into different DVR's web consoles to view the feed.

Once the person detection feature is turned on in the app, frames are extracted from the live video feed and passed through an object detection algorithm. If a person is detected in a frame in a camera situated in a restricted area, an email alert is sent out to the concerned authorities. The notifications can also be viewed from the desktop app. Our solution streamlines the process of surveillance and eliminates the need for human intervention.

III. SYSTEM DESIGN

This project aims on developing a Desktop application in python for purposes of ease in development and updating any modules. The desktop application can be accessed from a compatible Windows or UNIX/LINUX system.

The application is expected to be used within the campus and hence it is deployed under the same network and requires an active internet connection and 24 hours surveillance of camera to avail all services.

A. PyQt5 Application

Features included in the application are:

- Camera Preview: Live feed from CCTV is streamed and displayed in 4X4 grid for each DVR respectively.
- Full Screen Mode: Displays full screen view of camera when clicked into the grid of the respective camera.
- Add DVR: Allows admin to add new DVR with different set of cameras into the application. A user just needs to add a streaming link provided by Hikvision in order to connect it with our application. Once added the state of application is saved.
- Inference Time: Admin also has an option to surveillance the cameras at particular times. Admin just needs to specify time, a start time and end time

B. Server

Features included in the server are:

- The server is written in Node Js and the main goal of the server is to extract images from the surveillance camera and send it to our inference model

C. Inference Algorithm

YOLO, short for You-Only-Look-Once has been undoubtedly one of the best object detectors trained on the COCO dataset. YOLOv4 being the latest iteration has a great accuracy-performance trade-off, establishing itself as one of the State-of-the-art object detectors.

OpenCV is used for image/video-stream input, pre-processing and post-processed visuals. OpenCV is now capable of running YOLOv4 natively with the DNN module using NVIDIA GPU.

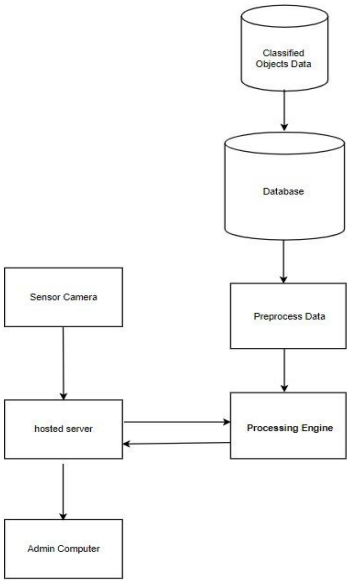

Figure 1: Block Diagram

Above is the block diagram of the app, as seen in the block diagram the surveillance footage from the ip camera is sent to the hosted remote server; this hosted server in turn sends images to the processing engine.

The processing engine consists of the yolo algorithm which detects the person and once the image is inferred it is sent back to the hosted server. The hosted server takes the inferred image and transfers it to the pyQt5 desktop app and also sends a notification email to the respective authorities.

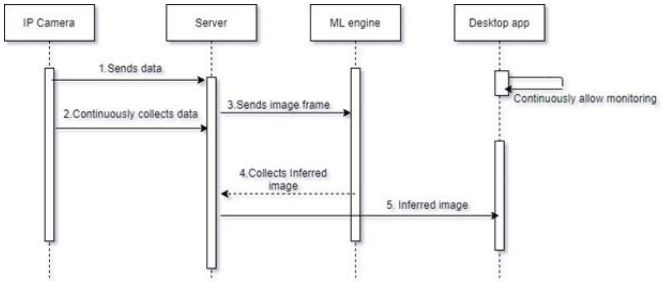

Figure 2: Sequence Diagram

The above diagram is of sequence diagram, with the help of the sequence diagram we can see the flow of our app. As it observed that the image received from IP camera is transferred to server and then from server to ML engine and from ML engine back again to server and then to desktop app

IV. IMPLEMENTATION DETAILS

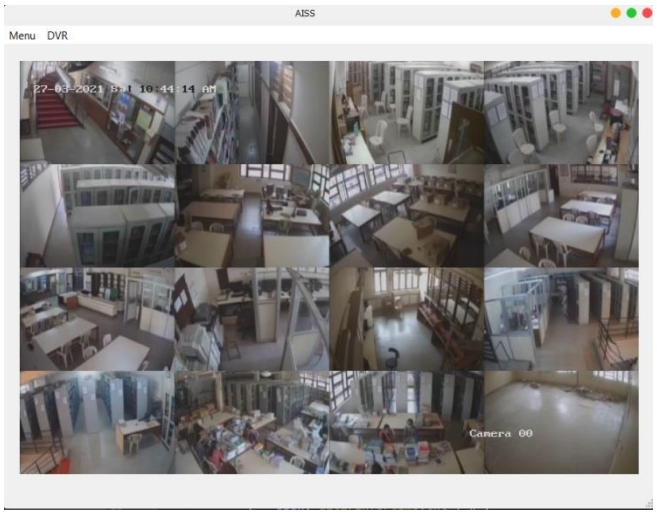

Figure 3: Main Screen of PyQt5 Application

Main Screen that shows feed from a single DVR as each DVR stores surveillance feed from 16 different cameras the feed is collected and displayed in a single screen with the help of real time streaming protocol. The feed received is continuous with 30 frames per second. The feed also contains current time and the location of the camera situated.

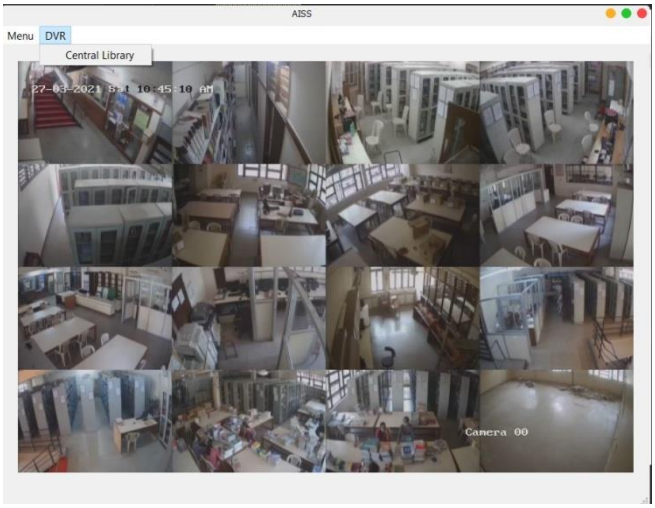

Figure 4: DVR tab to select required DVR

DVR tab where the user can select the DVR from which the user wants to see the surveillance feed. User can also add new DVR with the help of add new DVR form.

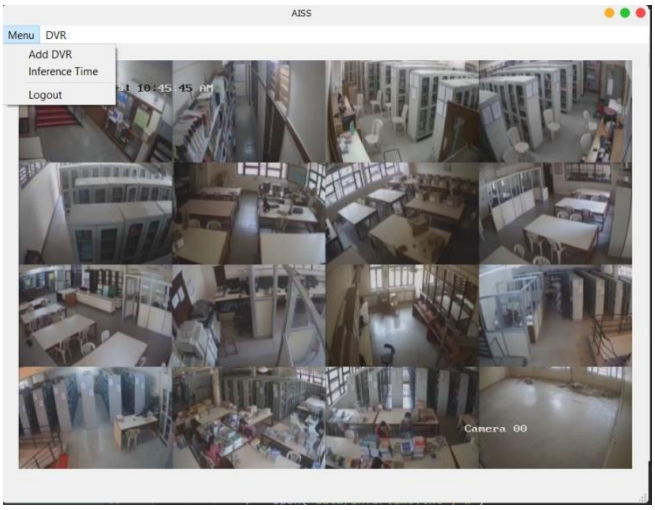

Figure 5: Menu tab to select shown options

Menu tab where users have following options, to add DVR, to change inference time and to logout.

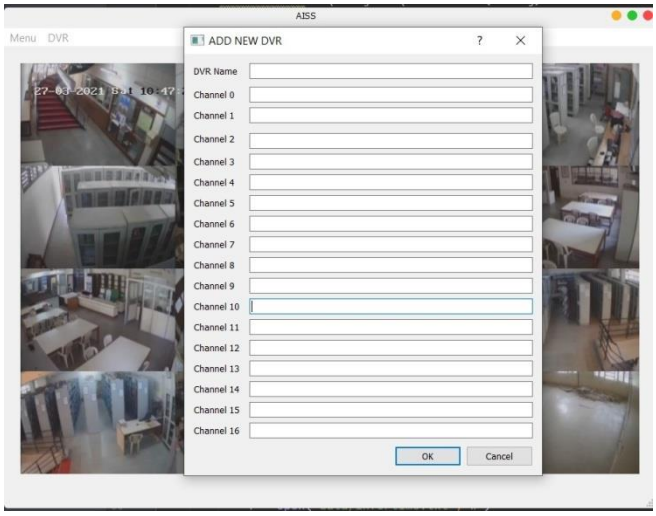

Figure 6: Add new DVR form

Above image shows a DVR form where users can copy/paste links of different channels and a DVR connection.

V. SCOPE

The goal of this project is to integrate Artificial Intelligence to the surveillance cameras which would make the task of identifying a possible security incident easier. This project aims to achieve the same through a desktop application running on a administrators personal computer through which he/she could receive the inferred data from the machine learning model running in a hosted environment. The application would be able to detect the objects present in the video frame and would draw a bounding box around them thus making the process of identification easier.

VI. CONCLUSION

The primary motive to develop this project was to create a seamless process of surveillance with minimal human interaction. We could achieve this by means of a desktop application and the object detection model. Although the current version of the application only identifies people in restricted areas and sends out an alert, there are many more use cases of AI surveillance. Identifying them accordingly and implementing the same would add more significant value to the application.

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