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ML Enabled Surveillance System for Societies

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***Abstract*— Today every society faces the problem of intruders and illegal vehicle parking and many outsiders are entertained in the premises, which can make harm to the public and can damage their property, even the register book can be easily manipulated by the intruders. The purpose of this study is to successfully develop a system that will detect the vehicle number plate, recognize the human faces of the residential members and as well as for the outsiders in real-time using a deep neural network. The walls of our societies are not that safe, our model detects any intruder penetrating the society walls and as detected an alarm is raised to stop the intruder and make aware to the residential members. The application provides interesting features that improve the overall security of the residential society.**

Keywords- Deep neural network, Face recognition, Vehicle detection, Surveillance system.

I. INTRODUCTION

Many residential societies in India face an impending problem of illegal vehicle parking inside their societies and theft of the vehicles. This issue is not bounded to just vehicles, but also adds to other security concerns inside the residential societies. Though there are solutions that exist in the market for monitoring through cameras and software systems but are expensive and the affordability comes into the question. In this regard, we would like to have an affordable and innovative solution that caters to the Indian market. Scope of ML Enabled Surveillance System for Societies is notifying the vehicle owners about the check-in and check-out of their respective vehicles into their apartments. Our project will work as a security system for a residential society. Proper Details of the outsiders will be maintained in the form of an image that will be stored in the database. If any intruder comes from the boundary wall of the society can be easily detected and the alarm will on to restrict the intruder.

II. OBJECTIVES

To provide effective security to the residential society using a deep learning algorithm. To detect residential and non-residential vehicle through a vehicle number plate. To send a message to the owner about his vehicle actions. Detect residential and non-residential members through face detection. Any intruder penetrating the boundary wall of the societies will be easily detected. The need for watchman in residential societies will be reduced.

III. LITERATURE REVIEW

In literature [1], paper was published in the year 2016. they have labeled vehicles by themselves and Tested on the ImageNet dataset. Their system was implemented on a build which consists of an 8-core 4GHz Intel I7 6700K, an NVIDIA GTX1080 GPU and 8GB of RAM and they train this network for approximately 5 days. Needs They need high processing power to run and get the output file. as well as they took a large amount of time just to train, detect and track vehicles. and they aren't getting the number plate information from those vehicles. and not even detecting pedestrians.

In literature [2], paper was published in the year 2018. There are several steps that they are performing to achieve the vehicle number plate. which are quite huge and less worthy as the output is considered. Those are 1. Gray Scale Conversion 2. Binarization 3. Number Plate Localization here there are furthermore steps: A) Connected Component Analysis(CCA) and B) Ratio Analysis then 4. Noise Reduction 5. Character Segmentation 6. Optical Character Recognition 7. Character Segmentation and Recognition. Their designed network is good for fetching information from an image of a single-vehicle but doesn't work well in the case of multiple vehicles. Here vehicle number plates are

only detected not along with their associated vehicle, this can cause conflict while several vehicles are entering at the same time. even they aren't detecting pedestrians.

In literature [3], paper was published in the year 2017. They have used CNN and re-trained on the ImageNet dataset. And able to recognized real-time traffic which including cars of all types. but excluding a part of detecting the number-plate from them. concluding the paper they only have detected the vehicles. they haven't provided a solution for storing the records of them otherwise their type. As well they aren't providing any feature to detect pedestrians.

In literature [4], paper was published in the year 2018. In this paper, they have used AlexNet for training the ImageNet along with OpenALRP for detecting number plates. they need a lot of GPU performance to run and then to output varies on funky vehicle number plates, and even they aren't detecting pedestrians.

In literature [5], paper was published in the year 2015. Their goal is to measure real-world accuracy and reliability to assess suitability for deployment in an ITS system with realistic challenges, including changing lighting conditions, but using MatLab for suck task makes it less affordable and the biggest problem occurs when the driver drives on either half lane. this model raises a difficulty in handling this, and they are just detecting the vehicles in a particular area, recognization of number plate needs to be cared about. and even they aren't detecting pedestrians.

IV. PROBLEM STATEMENT

In the current scenario, security is one of the major problems faced in societies. Boundaries of the society are also very less secure. An intruder can easily penetrate the boundary wall of the societies. Many outsiders/salesman enter without permission into society. IN and OUT of the residential vehicle needs to be managed. Many societies also face the problem of illegal vehicle parking, to overcome such scenario, we are providing an extra layer of security in the residential societies by detecting human faces and vehicle number plate using deep learning algorithm such as CNN (Convolutional Neural Network) having excellent performance compared to traditional algorithms.

V. EXISTING SYSTEM

In the existing system, the security was maintained by the watchman and by the cameras which were installed in the society premises. The Vehicle records (Enter and Exit) are maintained by the watchman in the registry, which was a time-consuming process for the watchman. The records of vehicles maintained in the registry may contain many mistakes (human errors) which can be done by the watchman, which leads to safety dilemmas for the residential societies and the residential society members.

VI. PROPOSED SYSTEM

Initially one needs to set up a camera on a specific height that can properly capture the pedestrians & vehicles. The admin, will make an entry of the member's vehicle numbers and their facial data in the form of images and mark the boundary walls. Considering all these things which can cost a budget of approx. 20,000 INR. After setting all things up, the rest of the work is done by our ML model. Which recognizes a residential vehicle entering society and makes a log of check-in and checkout time of vehicle and store in the Database. And for the recognition of residential members face data is compared with the stored data in the database and if matches he is marked in log as a residential member. And if the person is a non-residential then his face data with the current timestamp is stored in database.

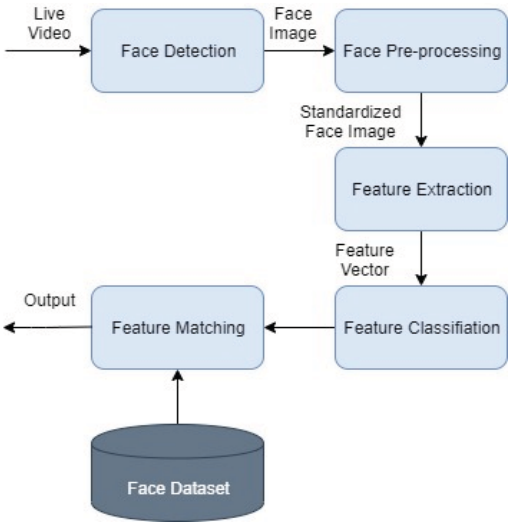

Figure No 1.1-Block diagram of Face Recognition module

In the above figure 1.1, consists of various dependent modules starting from capturing of real-time footage and detection of faces to pre-processing of images and extracting the important features. Then matching those features from the stored face dataset and classifying them based on residential and non-residential member of society.

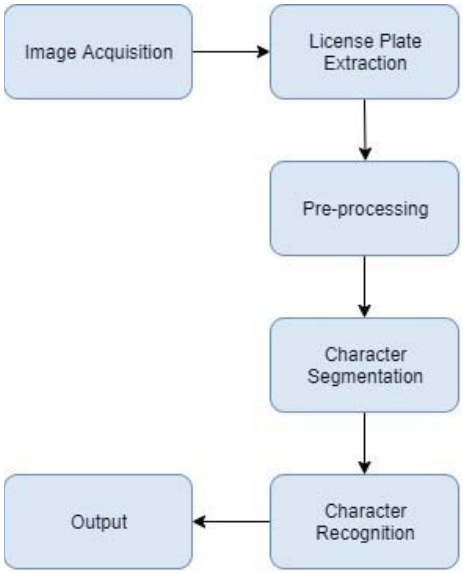

Figure No 1.2- Block diagram of Vehicle Number Plate Detection module

In the above figure 1.2, we are capturing real-time footage from the society gate. And we are detecting the cars and then segmenting the number plate from the car. After then we filter out the noise from the number plate. Then we segment the characters and apply the OCR using the tesseract library of python for character recognition, the extracted number plate is then compared with the one stored in the database and based on the vehicle owner we store the log of vehicle in database.

Figure No 2.1- The output for the face recognition Module

In the above figure 2.1, we have used OpenCV to perform face recognition. To build our face recognition module, we have first performed face detection, extract face embeddings from each face using deep learning, train a face recognition model on the embeddings, and then finally recognize faces in both images and video streams with OpenCV. For illustration purposes, we have shown bounding boxes along with the class/category to which a human face belongs. For reaching the accuracy level of 80% from 20% it took us one week.

Figure No 2.2- The output for the vehicle number plate recognition Module

In the above figure 2.2, we have used OpenALPR is an open-source Automatic License Plate Recognition library to perform vehicle number plate recognition. The library analyzes images and video streams to identify license plates. The output is the text representation of any license plate characters recognized in the processed image. For proper recognition character from the number plate, it took us three weeks.

Figure No 2.3- The output for human and object detection module

In the above figure 2.3, we have used YOLOv3 model for object detection and human detection. Object detection is a computer vision task that involves both localizing one or more objects within an image and classifies each object in the image. For this module, it takes two weeks to recognize all the required objects.

VII. TECHNOLOGY STACK

We are using all the open-source software, so the system cost related to the software part is zero, which includes python 3.7, TensorFlow, spline curve, OPEN CV2, mtcnn and face_recognization. Our aim is to have an affordable and innovative solution that caters to the Indian market. And the system cost related to hardware components is approximately 20,000 INR, which will be a one-time investment with very low maintenance.

Operating System	Ubuntu
IDE	Python 3.7
Hard disk	Minimum of 250 GB 250GB
Processor (CPU)	2 GHz frequency or above
Database	Mysql
RAM	Minimum 4 GB of RAM
Camera	2mp with 720p

VIII. RESULTS

The Object Detection Module can detect common objects like chair, mug, person, etc with an accuracy of 82% after being trained on a set of only 60 images of each object. The face recognition module can detect faces by using embedding's of faces such as nose, eyes, ears, and eyebrows with an accuracy of 80% after being trained on a single image.

IX. CONCLUSION AND FUTURE WORKS

In our work, we propose a system for vehicle detection and tracking in real-time. Our system is also used to detect the human face in real-time. This proposed system can be applied in the fields of the society security system and also in the smart vehicle parking system. However, there are limitations in our system. Our system struggles to detect human faces covered with any object such as cloth or any type of mask. Future works will contain the improvement of that.

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