A Mini-Project Report on

Smart Society Security System

Submitted in fulfilment of Mini-Project (ITM605) of

Semester VI

in

Information Technology

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CERTIFICATE

This is to certify that

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has completed all the specified work for submission in Mini-Project (ITM605) of Semester VI, as laid down by University of Mumbai in satisfactory manner within the premises of Institute during the academic year 2018-19.

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Declaration

We declare that this written submission represents our ideas in our own words and where others' ideas or words have been included, we have adequately cited and referenced the original sources. We also declare that we have adhered to all principles of academic with honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in our submission. We understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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Abstract

Today every society face problem of intruders and illegal vehicle parking and many outsiders are entertained in the premises. This can be solved by developing a system that will dynamically detect vehicle and human and track their behaviour, and will provide essential data to solve the problem of society planning and road management. A security also needs to be mentioned at the boundaries of the building. This can be done using creating an imaginary line and detect all type of trespassing. Proper and enhanced records of the outsiders will be maintained In this system. Using this model, we will obtain Human, vehicle number in real-time. The detection speed of our model will be fast enough to process streaming video. Our proposed model will be on real-time footage, accurate human and vehicle detection, making it ideal for computer vision application and safer for society.

1. 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 system 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 Smart Society Security System is basically notifying the vehicle owners about the check-in and check-out of their respective vehicle into their apartment's. The project will work as a security system for a residential society. Proper Details of the outsiders will be maintained in the form of image which was stored in 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.

2. Literature Review

The paper referred to while developing the system are mentioned below.

1. REAL-TIME VEHICLE DETECTION AND TRACKING USING DEEP NEURAL NETWORKS.

Authors: Xiao-Feng Gu, Zi-Wei Chen, Ting-Song Ma, Fan Li, Long Yan

Method Used: This paper was published in the year 2016. Their architecture is composed of convolutional layer and max spooling layers. They have trained on PASCAL VOC 2007 and 2012 image dataset for enhancement of the network performance, they have labelled them by themselves and Tested on ImageNet dataset

Their system was implemented on a build which consist of an 8-core 4GHz Intel I7 6700K, a NVIDIA GTX1080 GPU and 8GB of RAM and they train this network for approximately 5 days. And after obtaining the knowledge through the analysis of the training set, they tested their network on ImageNet dataset. They have compared their detection speed with other detection systems. Which we can see in the Figure1.

Method	mAP
Our Method	80.5
R-CNN	64.4
Faster R-CNN	76.6
Fast R-CNN	72.0
DPM	47.4
UVA	63.5

Figure 1: Comparison of detection speed with other methods

They have illustrated their convolutional layers as , max-pooling layers, and inception layers used. The first part is a 7×7 convolution with 64 filters, which learn convolved features from the image pixels and result in a 224×224×64 output. Then a max-pooling layer with 2×2 filter size and stride 2 have the resolution of the grid. In order to reduce the features space from preceding layers, a 1×1 convolutional layer is exploited in the second part, then a 3×3 convolution with 192 filters learn convolved feature from the output of the last layer. The next part consists of inception modules and max-pooling layers result in a 14×14×512 output.

In their work, they have proposed a network architecture for vehicle detection and tracking in real-time. In general, their network includes 9 convolutional layers, 4 inception modules, one SPP layer and 2 fully connect layers.

2. A New Approach For Vehicle Number Plate Detection

Authors: Sarthak Babbar, Saommya Kesarwani, Navroz Dewan, Kartik Shangle, Sanjeev Patel
Method Used: This paper was published in the year 2018. There are number of steps that they are performing to achieve the vehicle number plate. These goes as: 1. Gray Scale Conversion - The main reason they are using it because working on colourful images directly is that RGB (colour) has a 3-dimensional property (24-bit size) and on greyscale it becomes much better and efficient. 2. Binarization - The Binarization Method converts the image into an image in which the pixel can only have 2 values – 0 or 1, i.e., a black and white image. 3. Number Plate Localization here ther are further more steps: A) Connected Component Analysis(CCA)- Plate localization is concerned about segregating the number plate area from the rest of the image. B) Ratio Analysis - To shortlist the falsely selected candidates for number plate. 4. Noise Reduction - Noise Reduction is done at this stage because the following techniques were hindering with the localization stage. Noise reduction is a process for eliminating unwanted identifiers(distortions) in the number plate. 5. Character Segmentation - It has helped them in separating the characters on the plate so they could be passed on to the next stage for recognition. 6. Optical Character Recognition - We first convert the images into a one-dimensional array containing all the pixels. Each of those pixels is used as a different feature for training the model. 7. Character Segmentation and Recognition - The result of character segmentation is achieved by using CCA and ratio analysis, they have compared the percentage of characters recognized out of the segmented characters.
Various OCR techniques such as LR+RF, SVC+KNN, Extra Trees, SVC (Linear, Poly, Rbf, Linear.svc) have been applied and compared, with SVC (Linear) giving the best accuracy of 97.1% segmented characters correctly recognized.

Their system is also successful for detection number plates from skewed angles. their aim is to make registration of vehicles in Jaypee Institute of Information Technology. There is a need to expand the types of vehicles that can be detected: trucks, buses, scooters, bikes.
The design should also provide help in toll plaza, parking lots, theft of vehicles and in accidents. This technology can be further improved to detect the crashed vehicle's number plate in an accident and alert the closest hospital and police station about the accident, thus saving lives. India being the 4th largest auto market that requires Number plate detection to assist traffic authorities and curb criminal activities.

3. Forward Vehicle Detection Based on Incremental Learning and Fast R-CNN

Authors: KaijingShi, Nan Ma, Hong Bao
Method Used: This paper was published in the year 2017. They have used CNN and re-trained on ImageNet dataset. And able to recognized real-time traffic which including cars of all type. Their network model was divided into two phases, training and testing phase.
At training phase, the convolution neural network of initial parameters after pre-training on ImageNet is re-trained to obtain the vehicle detection model. At test phase, the test samples are input into detection model to obtain the test result.
They choose the KITTI public data set of cars derived from the KITTI Vision Benchmark Suite and BUU - T2Y data set.
Use a trained model to test. Firstly, randomly selecting 20% KITTI data as a test set to test the model, adjust the parameters and get the best test results. Then, apply the
trained model to the BUU-T2Y dataset to test.
Finally, the BUU-T2Y data set and the KITTI data set are randomly combined with incremental testing.
The forward vehicle detection includes: small passenger cars, cars, sport utility vehicles, light trucks, large passenger cars, heavy trucks and other common models.
Most of the deep learning methods of data sets are processed by generating a set of training sets, validation sets, and test sets at a certain scale. In their experiment, the KITTI dataset was randomly

generated with a training validation set and test sets at a ratio of 8: 2. In training validation set, 80% was used as the training data set and the remaining 20% was used as the validation data set. So as the BUU-T2Y dataset. The whole experiment were based on the deep learning framework Caffe, and the results were obtained by several experiments.

Their experimental results showed that if the KITTI data set was used to train the model, and then the BUU-T2Y dataset was used to adjust to the optimization model. Finally, the BUU-T2Y data set was added to the KITTI dataset to form a new data set for incremental learning. The experimental result can reach 86.2%. The optimal result were selected from several times experiments. It showed the proposed method is effective. To a large extent This method solved the problem of missed detection in the traditional vehicle target detection model. However, compared to other models, it was not the end-to-end network structure. And it was not real time and spent much time. Under the effective vehicle detection accuracy, to solve the above problems is the key issues in the future.

4. Video Based License Plate Recognition of Moving Vehicles Using Convolutional Neural Network

Authors: Sanghyeop Lee, Keum-Young Son, Byung-Woo Yoon, Jangsik Park

Method Used: This 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. The license plate recognition based on CNN is carried out with AlexNet using license plate DB, the plates images are recorded in input video clip are recognized with a trained AlexNet. The flow can be explained from the Figure 2.

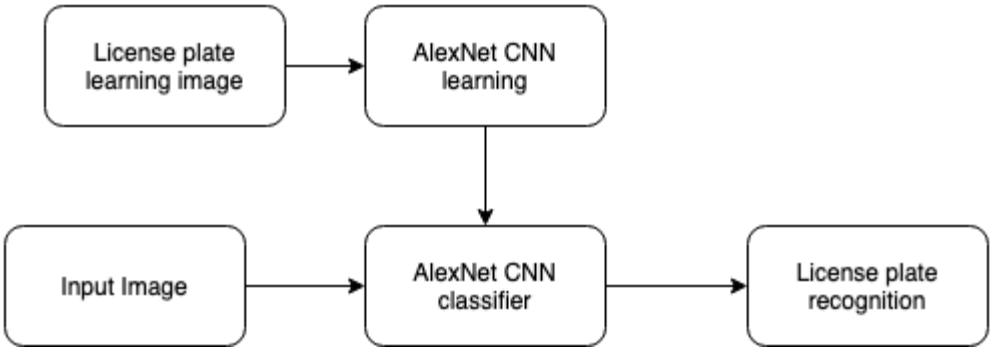

Figure 2: Working of Their Model

The size of the input image is 1392 x 1040, and the image is removed by 20% of the horizontal and vertical planes and the remainder is treated as an area of interest. For learning, they are using openALRP, and the data were used 500 plates. The recognition rate was calculated with respect to the AlexNet of 100 input images.

They use DIGTIS to recognize numbers and letters first, then increase each recognized area by 40% to find objects around them. These discovered objects are identified by four consecutive numbers and two consecutive numbers, which are identified as the number plates.

In their project, a built-in system was implemented with a GPU in order to recognize the license plate number without detection line. The deep-learning network to recognize the license plate number of the vehicle uses relatively simple yet fast AlexNet. Tests confirm that the vehicle license plate can be effectively recognized using CNN. The problem is that the green license plate does not become a recognition rate, which will be secured through future research.

5. A Hidden Markov Model for Vehicle Detection and Counting

Authors: Nicholas Miller, Mohan A. Thomas, Justin A. Eichel, Akshaya Mishra

Method Used: This paper was published in the year 2015. IN this paper they have used tracking and counting number of vehicles. And used matlab for hidden line. Their method implemented represents a specified small region of the roadway as 1. empty, 2. vehicle entering, 3. vehicle inside, and 4. vehicle exiting, and after that applies an altered Viterbi calculation to the HMM consecutive estimation structure to introduce and follow vehicles.

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, partial occlusions, low bitrate (~ 100 kbps), and low resolution (~ 320 ~ 240) video from uncalibrated cameras with a variety of perspectives and road geometries.

Moving vehicles are detected and segmented from the background using a mixture of Gaussians background model, background subtraction, open and close morphology operations and connected components blob identification. The multiple target tracking uses Kalman filters with a linear motion model and constant width and height blob properties. The Munkres algorithm and gating provides data association and thresholding rules on associations, and missing detections are used to initialize and delete vehicle tracks. The resulting tracks provide vehicle counts. This method is not overly sensitive to threshold parameters so the default parameters were sufficient.

In this paper they have a state tracking method to take advantage of constrained vehicle motion to detect and count vehicles using a hidden Markov model. Observations for the model are provided by a trained Haar feature vehicle detector. These detections are robust in stop and go traffic and changes in lighting and camera motion, which would normally interfere with motion-based vehicle detection and counting.

Their method has been shown to give significantly better vehicle volume counts than both multiple target moving object tracking and VDL on a dataset of over 88 hours of video. On this testing set, the proposed method achieved a median 5-minute-bin error of 0.0686 for this counting task while the multiple target motion tracking and VDL implementations had median errors of 0.0957 and 0.2290 respectively. Their proposed method was also more reliable having fewer and less severe occurrences of 5- minute-bin errors throughout the testing set.

3. Existing System

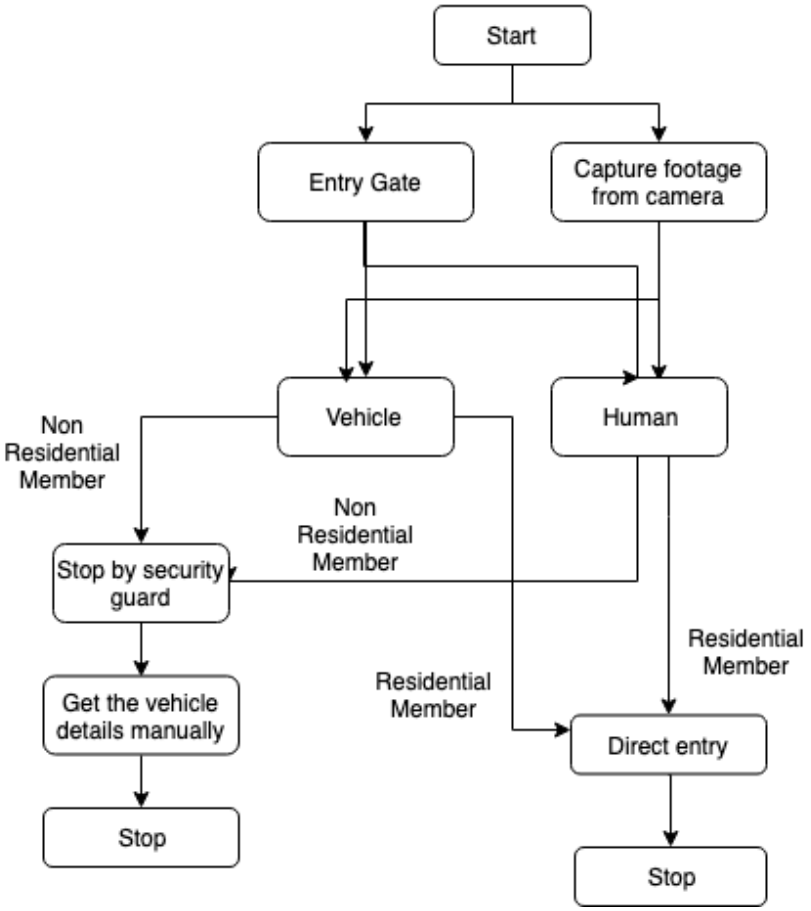

Figure 3: Existing Security System

4. Problem Definition

• Security is one off the major problem faced in societies

• Boundaries of the society are less secure.

• Many outsider/salesman enter without permission.

• IN and OUT of the residential vehicle needs to be managed.

• No more information of the outsider is available.

• Many society face problem of illegal vehicle parking.

• Current technologies that have the similar functionality are costlier and not that capable.

5. Objectives

• Detect residential and non-residential vehicle through vehicle number plate.

• Send a message to owner about his vehicle actions.

• Detect residential and non-residential member through face detection.

• Any intruder penetrating the boundary wall of the societies will be captured be captured by the camera.

• Need of watchman will be reduced.

6. Proposed System

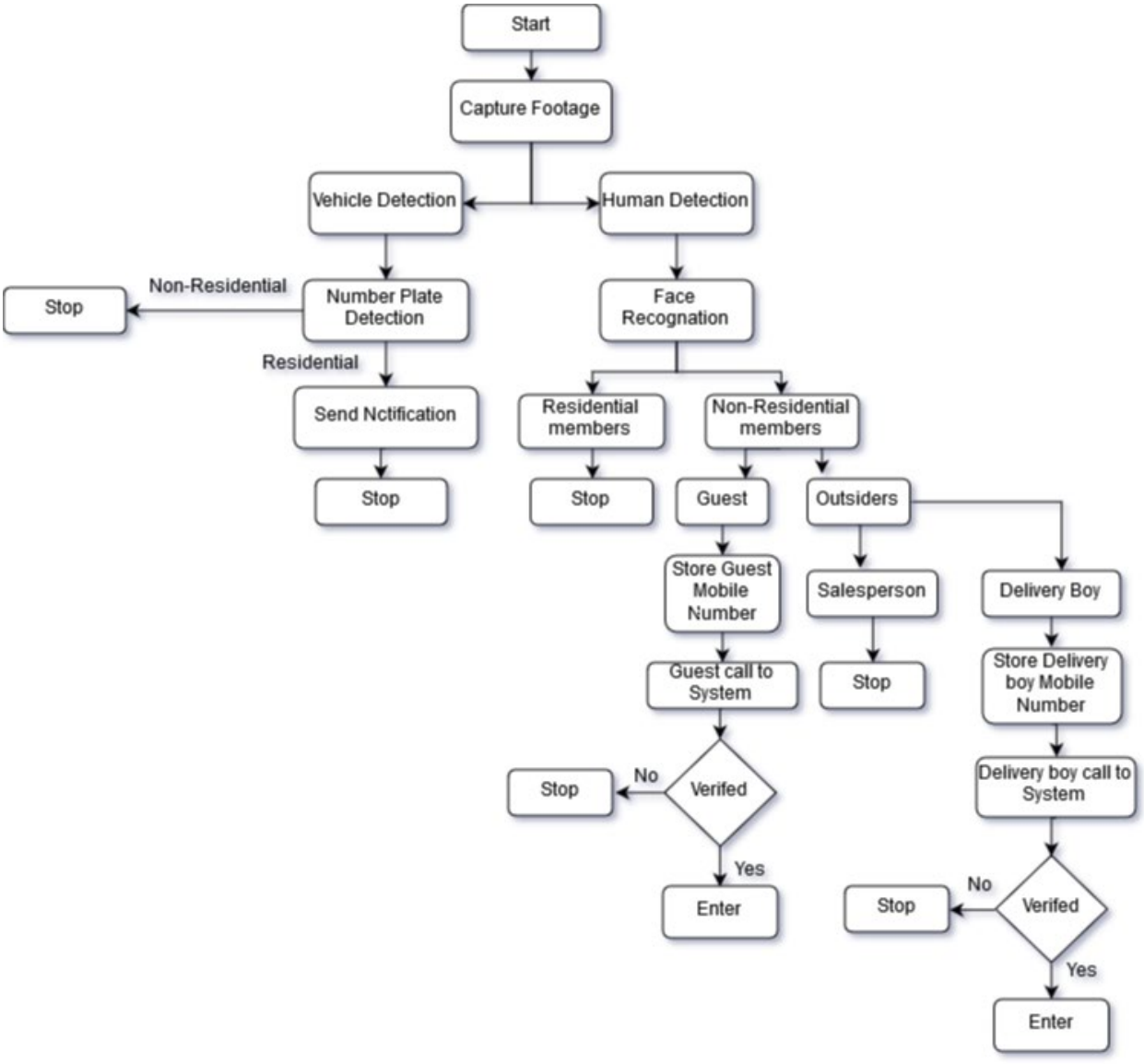

Figure 4: Proposed Security System

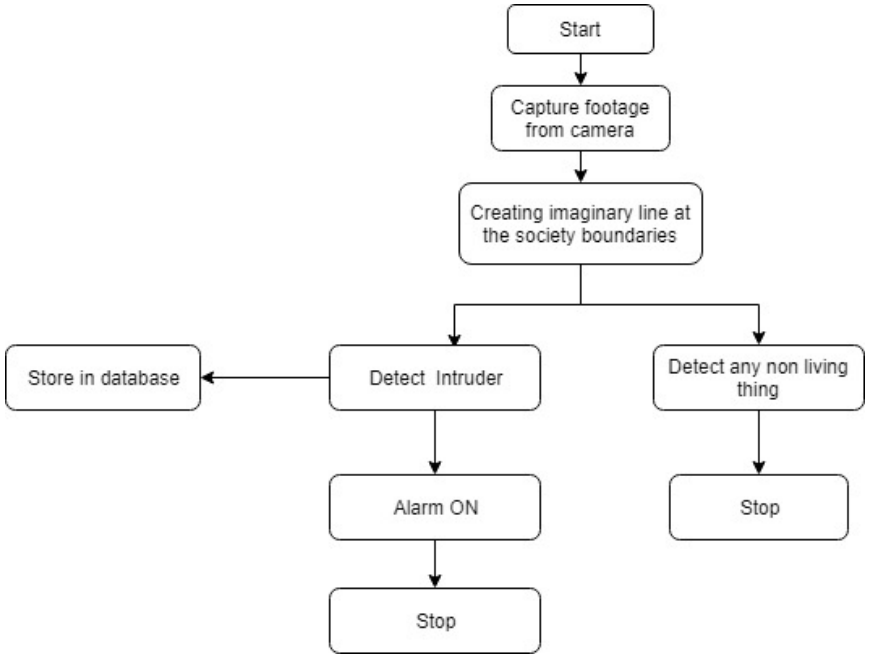

Figure 5: Imaginary Line

7. Technology Stack

Hardware Requirements

• Laptop or PC with minimum 4GB of RAM.

Software Requirements

• Machine Learning(Python)

• Neural Networks(RCNN)

8. References

[1] Gu, Xiao-Feng, et al. "Real-Time vehicle detection and tracking using deep neural networks." 2016 13th International Computer Conference on Wavelet Active Media Technology and Information Processing (ICCWAMTIP). IEEE, 2016.

[2] Babbar, Sarthak, et al. "A New Approach for Vehicle Number Plate Detection." 2018 Eleventh International Conference on Contemporary Computing (IC3). IEEE, 2018.

[3] Shi, Kaijing, Hong Bao, and Nan Ma. "Forward vehicle detection based on incremental learning and fast r-cnn." 2017 13th International Conference on Computational Intelligence and Security (CIS). IEEE, 2017.

[4] Lee, Sanghyeop, et al. "Video Based License Plate Recognition of Moving Vehicles Using Convolutional Neural Network." 2018 18th International Conference on Control, Automation and Systems (ICCAS). IEEE, 2018.

[5] Miller, Nicholas, Mohan A. Thomas, Justin A. Eichel, and Akshaya Mishra. "A hidden markov model for vehicle detection and counting." In 2015 12th Conference on Computer and Robot Vision, pp. 269-276. IEEE, 2015.