AI based Vehicle Monitoring Security System

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Abstract: Artificial intelligence based image processing systems are now quite common in use. The following report consists of the information about AI based Vehicle Monitoring system (A.I.V.M.S.S). Image processing and capturing are vital part of this project and then based on this two processing the vehicle data is collected. And record of how many times a car has entered exited the campus can be kept. The system also acts as a security system and captures images of all kind of vehicles that enter the campus. The system is based on the deep learning concepts of AI and machine vision. The neural networks are used for the programming and identification of the vehicles. Every time the vehicle enters or leaves the count changes of that particular car and to maintain that count record and capture a clear image of the number plate is the main aim of this system. The system is very identical to the traffic control system and number plate identification, but with addition of few more modifications.

Index Terms - Artificial intelligence (AI), AI based Vehicle Monitoring system (A.I.V.M.S.S), Artificial neural network (ANN), Convolutional neural network (CNN), Optical character recognition (OCR).

I. INTRODUCTION

Campus security has been a very huge concern for a while now, and the usage of a car recently has increased a lot as well. There is a need to make a system that can monitor the vehicles and keep the required record for security.

In recent years there has been many developments in the field of artificial intelligence and other deep learning intelligent programs which are intelligent in decision making and record keeping and monitoring. Computer vision is one of these software, it studies the given dataset and we can train it based on the dataset to identify and decide if the new image is of the desired object. The provided dataset is of the object we want to monitor and we train it based on various images to identify the new image captured. Artificial Intelligence Monitoring System (A.I.V.M.S.S) is a system that is responsible for capturing the image of car entering through the gate of campus and maintaining the count of the entries and exits of the car. The system will work on Machine vision and convolutional neural network (CNN) based Algorithm, And with the help of supplied data set it will compare the captured image and Update the data and give output of how many times the car enters and exits the campus premises. It will also keep data of, if the car is authorized and belongs to a faculty member or if it's a visitor car or a guest car and should maintain a separate data for it.

In addition to that the system would make sure no car should be staying inside of the campus after a certain time and if any car is still inside the campus it should send an alert to the respective owner of the car and notify them to leave the campus. Also not only would it keep a count of entries and exits of the cars it would also monitor that no car in entering after the closing time of campus. And if any car does enter the respective authorities would be immediately notified with the help of an alarm system that would be installed in it.

The system will mainly work on machine vision algorithm and software's. Machine vision is a software that studies the given data set and makes decision accordingly. It is a deep learning intelligent algorithm. Every time a new image Is provided to the system it will compare the image with the previous training data

that is already programmed inside of the system and conclude accordingly that if the image captured is of car or not.

And if it is a car then it would go to another dataset that is registered vehicle data set which would also be provided to the system and it would see if the car belongs to a faculty member in the campus or if it's a guest or visitor car.

The system will have all the required data already programmed inside to make necessary decisions. After identification of car it will make the changes in the count table of entries and exists of the car in that day.

The campus security is one of the main concerns for the system, it should perform the following tasks,

I. To capture a live image of a vehicle and then process it for feature extraction and remove the background and focus on number plate identification.

II. The processing will only be done for car images and other vehicle images should be saved as well even if they're not being processed.

III. To change the status of counting of entrys and exits of the cars.

IV. To keep the record in an excel file of the car and its owner and there exit and entry in the campus.

V. To capture and process image as fast as possible and not miss any other car entering and exiting while the process continues.

II. LITERATURE SURVEY

Machine visions based image identification and monitoring type of system are the one that captures and image and identifies it for the required output or the process.

It is an AI based algorithm that is very intelligent and identifies objects and learns through dataset that are provided. It can be used for campus monitoring through various processes.

The following are a few proposed methods of it.

The paper Campus vehicle monitoring through image processing (G jagdamba, shrinivaschrya purohit and G. chayashree) has proposed a method for campus vehicle monitoring in a research paper published at Springer Nature Singapore Pte Ltd. 2019.

The proposed system "Campus Vehicle Monitoring through Image Processing," consists of various hardware and software units in order to achieve desired result. The very first step is to detect motion to check if any object is entering. The sensing unit in the architecture does the task of motion sensing and PIR sensor is used for this purpose. Raspberry Pi is used as hardware controller. If the motion is detected, then images of the object are captured by image capturing unit using camera. [1]

Algorithm for vehicle detection using image processing proposed by C. Krishna Prasad1, Lavanya S2, Manikanta S Rao3, Nandu Rajeshwari K4, and A. Benjamin Joseph published Perspectives in Communication, Embedded-Systems and Signal-Processing (PICES) ISSN: 2566-932X, Vol. 2, Issue 1, April 2018.This paper presents a comprehensive view of an algorithm that is used for vehicle detection from video. The algorithm that is used is more effective, as it is adaptable to varying levels of brightness. The algorithm focuses on using the Components of the HSV model to distinguish between the vehicles and the road. The RGB component is first converted to the S-component and then the S-component is converted to a binary image based on the average Sales of the road and the vehicles [2].

Automatic Number Plate Recognition Using Machine Learning proposed by A. M. Pujar(B) and Poornima B. Kulkarni published by S. Tamane et al. (Eds.): ICAMIDA 2022, ACSR 105, pp. 149–156, (2023).Real Time Automatic Number Plate Recognition is a process where vehicles are detected or recognized using their number plate [9]. The proposed system uses image pre-processing methodologies to convert digital images and vehicle number plate is extracted. A camera is used to capture vehicle number plate images. This pixel-format images are converted into readable characters by character recognition tools.

R-CNN and OCR methods are used for character segmentation and character recognition purpose. R-CNN is trained to detect number plates from images and classifies them as numerical and alphabetical characteristics. This process is called as character Segmentation. Through this system and collected data, it is easy to detect the vehicle and its owner who is disobeying the traffic rules which can be forwarded to the traffic police department for respective action to be taken on them [3].

IET Signal Processing published by John Wiley & Sons Ltd on behalf of The Institution of Engineering and Technology in (2022). The proposed method is validated on the Karlsruhe Institute of Technology and Toyota   Technological Institute public dataset. It is demonstrated

that the proposed model is better at predicting the details of outdoor scenes, such as cars, road signs, pedestrians, and other objects. In addition, the presented model has full potential for application in the field of automotive autonomous driving and the design of blind navigation devices similar to human vision. Method can well capture the local information of the image. The authors introduced the block partition method to comprehensively utilize the depth details and the global distribution of depth. Additionally, the authors proposed a loss function based on Mean Structural Similarity Index from literature to compensate for the difference between left and right views and realize unsupervised monocular image depth prediction model training [4].
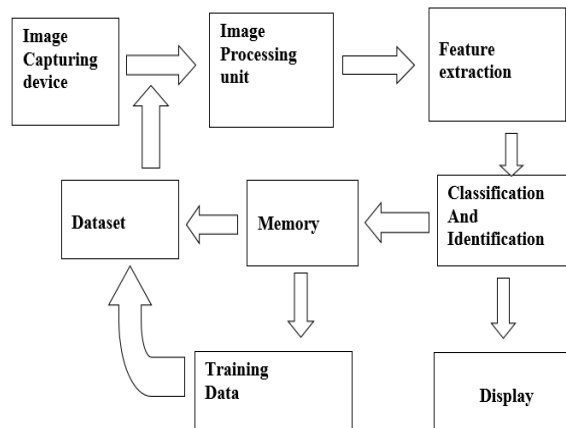
III. BLOCK DIAGRAM/ DESIGN ASPECT

Fig. 3.1 Block diagram of A.I.V.M.S.S

3.1 PROPOSED METHODOLOGY

The proposed system consists of various components both hardware and software, such as camera and processing unit, dataset, algorithm for image recognition and Detection.

The system should detect the image and verify if it is a vehicle and then process it in addition to that it should also save all the vehicle images as an optional data, but only process car images by identifying them after comparing with saved training data. The detected car image is then processes, and then number plate detection will happen in the same way with the help of saved data; For number plate detection we use Optical character recognition (OCR).

The OCR will convert the number plate in image into text form and will compare it with the saved number plate information of campus faculty cars.

If the information of number plate matches then the entry and exit count is changed but if not then the entry and exit is made as guest (n) or Visitor (n). With this the system will also save the car image in the memory and training data, which means the training data of the system will keep changing, i.e. increasing every time a new image of a car is captured and the data is recorded. If the car is of campus faculty member then the Excel sheet will show a change in entry/ exit count and also show the image of entry/exit.

IV. CONCLUSION

The expected output for any image capture security system can vary widely depending on the context and the specific technology or device being used. In general, for A.I.V.M.S.S when you capture an image using a camera or imaging device, the output is to show the image in excel sheet along with the time and details of the person entering and exiting the campus. It should also keep track of how long a vehicle (unknown vehicle) stays inside the campus , and make sure no vehicle stays inside the college campus after the closing time, if a car is still inside then it should notify the Authorized person along with the owner of the car , considering the car is of faculty member..

Mainly the system should capture an image, and maintain the record.

After the processing the system should give the outcome of entry or exit of the car and go for the next image processing.

This complete process should be done in a few seconds so as to not miss the next coming car. In addition to this there should be a clear image of the car number plate that should be stored in the memory as well as training data.

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