

## Review Paper on Smart Security System

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**Abstract**—These days, CCTV cameras are a boon to many agencies in order to keep them safe and keep an eye on any sort of malpractices. But they largely require manpower in cases of live streaming. Hence, to reduce manpower and to assure efficiency a smarter system with the camera is required. A smart security system has a lot of uses these days in order to detect any sort of malfunctioning in the companies, detecting hazards in work places, homes etc. or to control any sorts of misconducts. This review paper contains the reviews of existing applications of such cameras for detecting an intruder in the house and smoke in case of fire. The other applications involve using such system in order to detect vehicles and count them to see if they reach the traffic congestion rate. They have also been used for indoor parking purposes using an MAV (Micro Air Vehicle) to detect if a parking spot is available for a car and also find the car for a driver in case he forgets where he has parked it. The paper has also laid a proposal of such system using Raspberry Pi as to show how various conditions can be programmed into that camera in order to deal with the malpractices and misconducts happening in various workplaces and organizations today and why it will be more useful to do so.

**Keywords**—Camera, Security, Image processing, Raspberry Pi.

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### I. INTRODUCTION

In today's world, CCTV cameras are integral to most of the companies and their offices in order to keep them safe and keep an eye on any sort of derelictions. But they largely require manpower in cases of live streaming. It means that they have to have a separate room in order to keep a track of all the cameras and its recordings. If in case any misconduct has happened, one needs to keep that recording safe enough for future purposes. Moreover, if in any case, the person is not present in front of the monitor screen, is sleeping or is engrossed in some other activity, and any malpractices take place, no action can be taken against it. Even if it is by having a look at the previous recordings, it might be too late. The procedure involving having to look up a minute part of a 24 hour long recording is a difficult and time consuming task. In order to overcome this problem, the paper proposes a system which involves use of intelligent cameras interfaced with Raspberry-pi which will keep a track of and sense any suspicious activities taking place and can raise an alarm if any misconduct happens.

### II. EXISTING SYSTEMS

#### A. Night vision camera to detect smoke and an intruder

This system implements the use of a night vision camera interfaced with Raspberry Pi in order to avoid burglary and to detect smoke. The system has implemented a night vision camera by removing the IR layer of a normal camera and thus,

the limitations of this system is that it works only in night and not day<sup>[1]</sup>. The goals achieved by this system are as follows:

- Detecting an odd shape. If it seems to be an intruder, click a picture by subtracting the background previously recorded as ideal one<sup>[2]</sup><sup>[3]</sup>.
- Detecting smoke by matching with the previously loaded images of smoke and click a picture.
- Raise an alarm by sending those pictures to the user via e-mail.

#### B. Vehicle Detection and Traffic Management

This system uses the Raspberry Pi camera in order to detect the number of vehicles on the street to check the amount of traffic. Much of the proposed methods used to extract traffic condition information are based on vehicle detection and tracking techniques<sup>[4]</sup><sup>[5]</sup><sup>[6]</sup><sup>[7]</sup>. Along with the Raspberry Pi and camera, the system also uses Intel OpenCV software in order to process the images of all the vehicles and make the counting easy. But, in this system, the camera itself is not given the condition to recognize only cars or vehicles. It is done while image processing using the OpenCV software.



Fig. 1: Original video frame

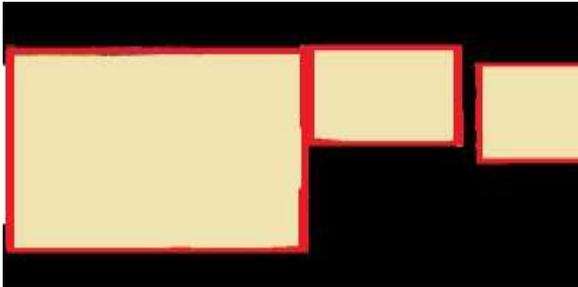


Fig. 2: Results of background subtraction.

The main objectives of this Vehicle detection and traffic management system are as follows:

1. Capturing images of the vehicles on the road by the camera installed for surveillance purposes, and eliminating the background in the image in order to ease the further processing of the image.<sup>[8]</sup>
2. Further processing the images in order to identify the shapes of only cars using the OpenCV software in order to count the vehicles for traffic congestion, easily.

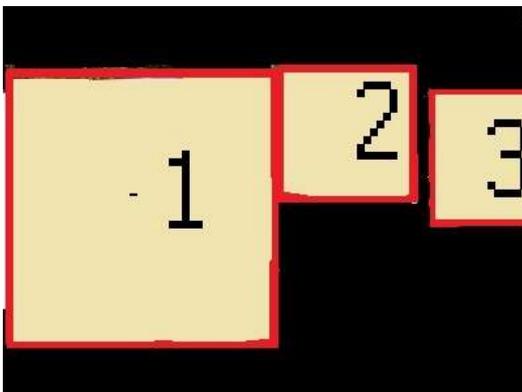


Fig. 3: Result of module counting vehicle.

### C. Intelligent Parking Lot System

This system uses an MAV (Micro Air Vehicle), instead of a set of fixed cameras in the Parking Lot to determine if a vehicle is parked in some place or not by monitoring the parking area. The MAV monitors for unused parking space and informs the driver if any space is available<sup>[9]</sup>. In case, the driver forgets the location of his parked vehicle, it also helps the driver to find the location where the vehicle is parked. The objective of the

system is to monitor the parking area from both driver's and security guard's view.



Fig 4: Example of MAV application<sup>[10]</sup>

### III. PROPOSED SYSTEM

The proposed system involves using a Camera for security purposes interfaced with Raspberry Pi to monitor the premises of an organization, sector etc. and report the admin via an email if any sorts of malpractices happen. It will further click an image of the said misconduct and save it for future references.

Raspberry pi is a small credit card sized computer. It is provided with 4 USB ports, full HDMI support, camera and display interface, micro SD card slot etc., all mounted on a small chip. It has 900MHz quad-core ARM Cortex-A7 CPU and 1GB memory.

#### A. Structure of the proposed system

The raspberry pi camera is connected to the raspberry pi. This camera will capture the live streaming and this will be stored on raspberry pi for some time. As the raspberry pi has less memory, the videos cannot be stored on it for too long, and therefore, will be transferred to some storage device or server connected via network.

1. In order to make camera act smart, and detect any sorts of malpractices, it needs to have some point of reference in forms of videos, images, gifs etc. With the help of image processing, and the given points of reference, the camera would be able to detect any delinquency being done by operator or an intruder. It would save the manpower required, and also overcome all its limitations. It would also save the time to glance through the entire footage in order to gain evidence because the system would be programmed to click an image and send it immediately as well as storing it.
2. The videos can be viewed from any computer that will be connected in the network to the server. The web pages can be designed for some categorized output.

### B. Image processing technique

Image processing technique involved in the system is as follows:

1. Camera recording is the input to the system.
2. Convert video into frames as per the needs of the organization. The frequency of frames i.e. the time gap between the frames can be adjusted or programmed.
3. Eliminate the background from the frames extracted from the video. This will reduce the processing of same background in each frame extracted from the video repeatedly.
4. Image after the background elimination is then compared with another set of images. These are the previously stored images in the system that demonstrate the malpractice.
5. After completion of the comparison, if more than 60% of the input image matches with any of the reference image in the set, then alert the administrator about the misconduct.
6. Upon the confirmation of the administrator that it was an act of the malpractice, update the set of stored images of malpractice by inserting this new image in the set.

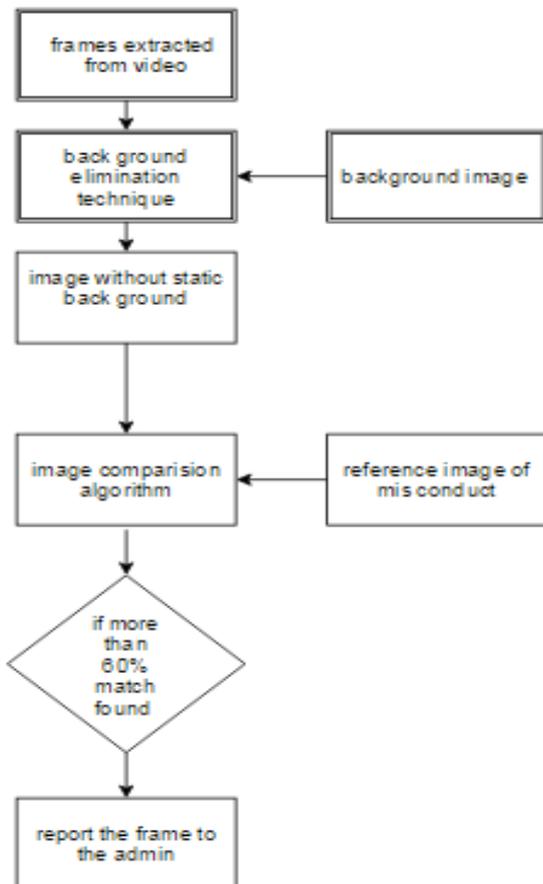


Fig. 5: Flow of image processing.



Fig 6: Reference image of static back ground



Fig 7: Image fed as input to the system



Fig 8: Image after the background elimination

Frames extracted from the video will be the main input to the system. As the camera is static, the background will be same for every frame which can be eliminated to reduce the work of processing ahead using back ground elimination technique.

The basic background subtraction technique which compares the two pictures to find the similarities in between them will be the best one as it has low computational requirements<sup>[2][4]</sup>. Theft or malpractice detection part fully depends on the program of background subtraction. If there is no motion detected, no further processing of raising an alarm will be done. The program will then update the background. On the other hand, if motion is detected, that particular frame will be the input frame for the image comparison process. The program will immediately convert the captured image to gray scale, improve the contrast of the image and store it in the memory (this is necessary in order to improve the processing speed of the program). The converted image will be matched with reference image and matching percentage will be calculated. If it turns out to be greater than 60%, then the alarm will be raised and the administrator will be notified.

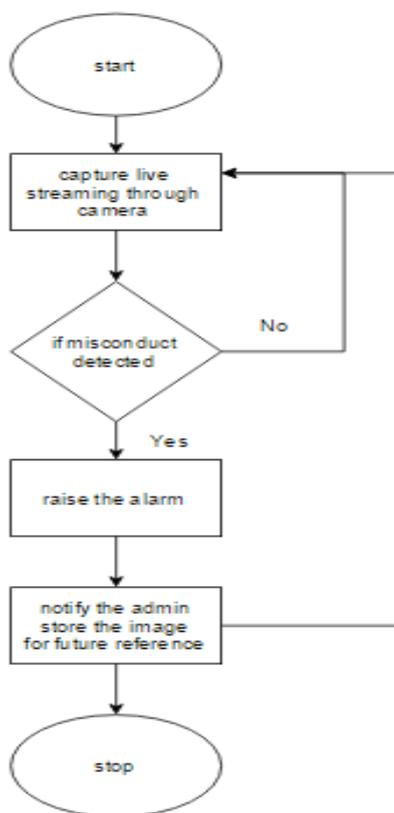


Fig. 9: Flow of the system operation.

#### D. Applications of the proposed system

The proposed system will have applications in several fields:

- In case of a petrol pump, it will be able to detect if the operator at the petrol pump is stealing petrol, or is not resetting the nozzle.
- In case of a bank, the system can be programmed to recognize a masked individual, or one carrying weapons who might be planning to rob the bank and consequently, raise an alarm as well as sending the information to the nearest police station.

- It can also be used in crowded places such as railway stations, airports etc. in order to recognize individuals with weapons or objects that have been stranded for more than 15 minutes and raise an alarm.
- In case of individual housing areas, it can be used to recognize intruders, detect fire, flood etc.

#### SUMMARY

This review paper covers reviews of various systems involving Raspberry Pi interfaced with camera for smart working in order to detect number of vehicles for traffic congestion, for detecting intruders and smoke in a house, for parking purposes in a closed environment with the help of an MAV.

The paper also proposed a system using a camera and making it smart enough to detect any sorts of malpractices happening in various workplaces and organizations to reduce the load off manpower and overcoming their limitations.

#### ACKNOWLEDGMENT

The project team would love to thank wholeheartedly, the project guide, Prof. Nisha Vanjari for her valuable inputs and suggestions pertaining to this project. Also, the team would like to thank the HOD and staff of the Department of Computer Engineering, K.J. Somaiya Institute of Engineering and IT for their support and cooperation into nurturing of this idea. The team would also like to express gratitude to all the well wishers and experts who have guided us during the formulation of this proposal.

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