International Journal of Engineering Applied Sciences and Technology, 2016
Vol. 1, Issue 6, ISSN No. 2455-2143, Pages 63-66
Published Online April - May 2016 in IJEAST (http://www.ijeast.com)

POWER SAVING IN ELECTRICAL DEVICES USING IMAGE PROCESSING

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Abstract: **The demand of electricity is increasing day by day. The awareness of "smart energy usage" is actually needed but, awareness alone cannot fix problem of misuse and ignorance towards energy management. There are many ways to save electricity like using electronic gadgets when needed otherwise switch off electricity while not in use. But there are many large places like auditoriums, large classrooms where it is very difficult to manage electricity every time. This causes considerable amount of electricity wastage. There are many ways to prevent electricity wastage like installing sensors etc. They may be helpful in some cases, but these methods are costlier and complex for large areas. So, here we proposed a solution through image processing which detects that is there any person present in class if not present then power supply should be switched off. This method is helpful in managing electricity at large places.**

Keywords—*Image Processing, Edge Detection, video Streaming, Relay*

I. INTRODUCTION

The core infrastructure of smart city is about assured electricity supply. Electricity is needed for functioning of everyday activities in household's factories and organizations. Lack of electricity supply is hindrance in work which affects performance of activities, this will overall affect productivity and profit by different means.

A recent report by ICRA (Investment Information & Credit Rating Agency) shows that India's transmission and distribution (T&D) losses as a proportion of electricity output are among the highest in the world. The average all-India loss levels in FY13 (Fiscal Year 2013) were in the range of 27 per cent. The reasons for high Transmission & Distribution (T&D) losses include electricity theft, meter tampering, faulty meters and inadequate investments in transmission equipment hampering the financial status of utility companies. Unless these issues are cured, reliable power supply will not be possible in the country.

Different steps and moves have been implemented by government to lower the energy crises. They have been suffering from improper implementation of electricity in rural and township areas. Proper energy distribution is demand of today's heavy use of electricity. The concept of smart city is based on reliable electricity management. We often came across the scenarios like big hall or auditorium where lights and fans are on even when there is no person. Many a time's manually switching off lights is very uncomfortable task. But this causes considerable wastage of power. Hence a system which automatically turns off lights and fans are in demand. There are many methods to prevent electricity wastage like, installing sound sensors, optical sensor, RFID [3] etc. to detect people. They may be helpful in some cases, but these methods are costlier and complex for large areas. Hence, this paper proposed a method of controlling the power supply of organizations using image Processing [4], face detection to be precise.

II. METHODOLOGY

The general framework [1] is shown in fig. 1:

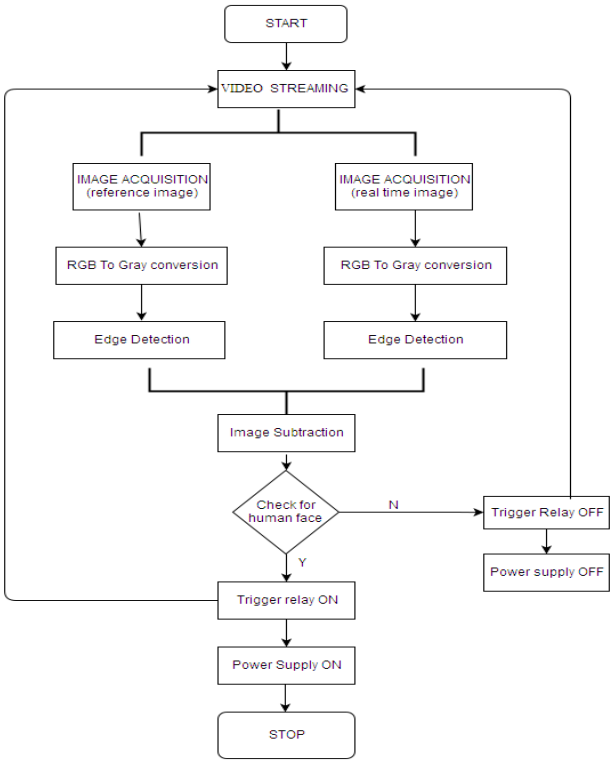

Fig 1: General framework

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In this paper we have experimented with images of classroom instead of auditorium**.**

STEP I: Image Acquisition:

First stage of image processing is image acquisition. After the image has been obtained, various methodologies like processing, compressing, storing, printing, displaying are applied to an image. The most common method is digital photography but, other methods like image sensors etc can also be used. In this paper digital camera are used. Camera should be installed at proper place so that it will cover whole classroom.

Video Streaming:

Streaming video is extracting crucial frames from video so that we can apply further processing. In this paper we have used video streaming to capture images within 10 seconds and can apply further processing to those images.

STEP II: RGB to Gray Conversion:

Due to compatibility issue the captured real time images are converted into gray scale images. Gray scale image are digital image in which value of each pixel is considered as single sample (contains single intensity) [6].These type of images are also known as black and white images. Gray scale image contains image components having 256 intensity level varies from 0 to 255.We have converted referenced and real time image into gray scale image for better analysis and made some changes accordingly as shown below.

```
GIm=uint8(zeros(size(Im,1),size(Im,2)));
for  i=1:size(Im,1)
for j=1:size(Im,2)
GIm(i,j)=0.2989*Im(i,j,1)+0.5870*Im(i,j,2)+0.1
140*Im(i,j,3);
end
end
```

STEP III: Edge Detection:

In image processing, edge detection is a technique of finding boundaries of a given object. Edge is detected by any small change in intensity of an image. The purpose of detecting sharp changed in image is to capture significant event and changes in properties of an image. There are lots of edge detectors like sobel, canny, prewitt etc. Here canny edge detector. The Canny edge detection as shown in fig. 2 is the first derivative of a Gaussian and closely approximates the operator that optimizes the product of signal-to-noise ratio and localization.

This algorithm is summarized by the following expression. Let I [i, j] denote the image. The result from convolving the image with a Gaussian smoothing filter using separable filtering is an array of smoothed data,

$$S[i, j] = G[i, j; a]* I[i, j]$$

where a is the spread of the Gaussian and controls the degree of smoothing.

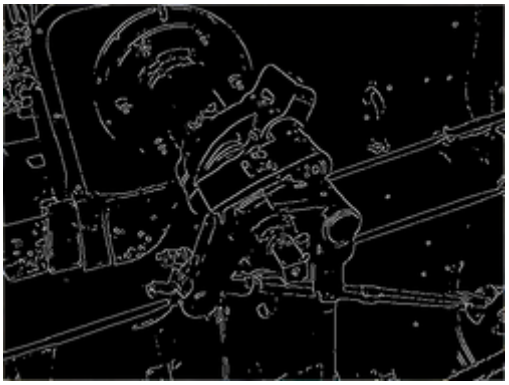

Fig 2: Canny Edge detection

STEP IV: Image Comparison (Subtraction)

In this step two images are compared and its intensity value is subtracted [5] Image is compared by subtracting real time image from reference image. We have applied this so as to find out any person in an image and its boundary can be detected

STEP V: Generate Control signals

Now all the analysis on an image has been done. So, now control signal has been generated according to output fed into the system. When empty class is detected then 1 output signal (control) is been generated and when there is any person sitting then 0 control signal is generated. Controlling is done through a circuitry interfaced microcontroller [2] then controller will send output to relay circuit. ATMEGA 16 microcontroller is used as shown in fig. 3

Fig 3: microcontroller (ATMEGA 16)

Relays as show in fig. 4 electromechanical devices which operate a pair of movable contacts from an open position to a closed position using a electromagnet. The advantage of relays is that it takes a relatively small amount of power to operate the relay coil, but the relay itself can be used to control motors, heaters, lamps or AC circuits which themselves can draw a lot more electrical power.

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Fig 4: An Electrical Relay

III. EXPERIMENTAL SETUP

STEP I: Image Acquisition:
First of all reference image as shown in fig. 5 and a real time image as shown in fig. 6 are taken. In reference image we have taken image of an empty classroom and in real time image we have taken image in which some students are sitting. We have read both the images as shown below:

```
Img_ref = imread ('ref,jpg');
Img_real = imread ('real,jpg');
```

Fig 5: Reference image

Fig 6: Real Time Image

STEP II: RGB to Gray Conversion:
Reference image and Real time image are then converted into Gray scale as shown in fig. 7 and fig. 8 due to compatibility issues. Both images are converted into grayscale image as shown:

```
Img_ref_gray=rgb2gray (Img_ref);
Img_real_gray=rgb2gray (Img_real);
```

Fig 7: Gray scale Reference image

Fig 8: Gray scale Real Time Image

STEP III: Edge Detection:
Canny edge detector is used for edge detection. Edge detection in both reference images and real time images are done as shown below:

```
Img_ref_edge = edge (Img_ref_gray,'canny');
Img_real_edge= edge (Img_real_gray,'canny');
```

Canny edge detection of reference gray scale image is shown in fig. 9 and real time gray scale image is shown in fig. 10.

Fig 9: Edge Detection of Reference image

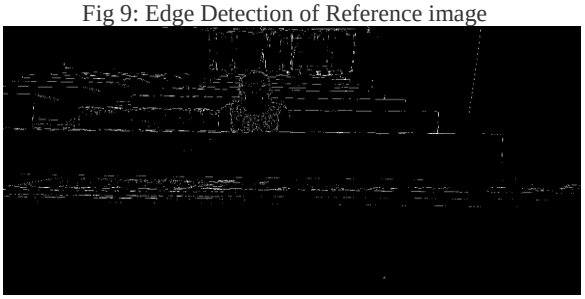

Fig 10: Edge Detection of Real Time Image

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STEP IV: Image Comparison (Subtraction)
In this step real time images are subtracted from referenced image as shown in fig.10 so as to find out person in an image and its boundary can be detected as shown below.

```
Img_sub=imsubtract (Img_ref_gray, Img_real_gray);
```

Fig 11: Image subtraction

STEP V: Generate Control signals
Now control signal are generated which is fed into microcontroller (ATMEGA 16) then microcontroller will pass output to relay (4 relay), then output of relay is passed to device as an input to switch on or off lights and fans.

IV. RESULTS

All the above steps has been done now, various results are compared with test cases. Students can be at corners or they can be at in front in a group etc. Test case I as shown in fig.12 display two students are sitting and their subtracted image is shown in fig. 14. Test case II as shown in fig.13 display two students are sitting and their subtracted image is shown in fig. 15.

Fig 12: Test case I

Fig 13: Test case II

Fig 14: Output of Test case

Fig 15: Output of Test case II

V. CONCLUSION

The study shows that this method is helpful in saving electricity. This method is very cheap, efficient and can reduce wastage of power. This will consistently detect that is there any person in a classroom and auditorium and hence saves electricity.

VI. REFERNCES

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