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# Smoke Detection Captured from Image Features

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**ABSTRACT:** This paper explains an embedded system comprises of a sensor, camera, microcontroller and a GSM module for detection purpose. PIC16F877A is the microcontroller used. The sensor detect the smoke and camera detects the smoking person with the help of face detection through face recognition program from the database provided. The MQ-7 sensor detect the smoke and the face detection is done through the face recognition program developed in MATLAB. The fine for his illegal action in the public place(smoking) is send to his address and alerts him by sending a message to his mobile phone. This system have vast applications in public places like shopping malls, bus stops railway compartments etc.

**KEYWORDS:**Wavelet transform,Image recognition, Feature selection,Euclidian distance

## I.INTRODUCTION

Tobacco use remains the single largest preventable causeof death and disease in worldwide.According to the latest survey estimates, cigarette smoking kills morethan 440,000 Indians each year, either through cancer,heart disease, stroke, or lung diseases. It also increases thechances of other serious illnesses, such as diabetes. The numbers are more alarming worldwide,where tobacco use is increasing rapidly in low and middleincomecountries. In fact, it is estimated that there are abouta billion smokers worldwide, with more than 80% in the lowand middle income countries. Of these, about 6 million diethrough smoking related causes each year.

We argue that there is a dire need for a simple and reliablesmoking detector that has high sensitivity and specificity. Smoking is injurious to health.Millions of surveillance cameras are installed in the city area or inside buildings in recent years. These surveillancecameras are mainly used for the security purpose such as the criminal investigation and deterrent. However,these cameras are only connected to monitors, video recorders, and/or closed/open networks, and the probabilityof each camera working for the original purpose, say, crime investigation or deterrent could not be zero, but mustbe very small in general. To effectively use such a “bored” camera, “another function” of surveillance camerashas been proposed.In this work,a concept of detecting small smoke, in particular, cigarette smoke by capturedvideo has been established. This is quite necessary for providing amenities in public areas. In the framework, the technical goalis to detect the cigarette smoke by using only image sequences captured by a standard security camera under thefollowing conditions/restrictions: first, the image sequences are obtained by one camera; second, the detectionshould be done in real-time; and third, fine tuning of parameters should be avoided as much as possible. Themotivation and underlying idea behind the paper were quite novel and to our knowledge.

In this paper, The sensor detect the smoke and camera detects the smoking person with the help of face detection through face recognition program from the database provided.The MQ-7 sensor detect the smoke and the face detection is done through the face recognition program developed in MATLAB. The fine for his illegal activity in the public place (smoking) is send to his address and alerts him by sending a message to his mobile phone. This system have vast applications in public places like shopping malls, bus stops, railway compartments etc.

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## II.SYSTEM MODEL AND ASSUMPTIONS

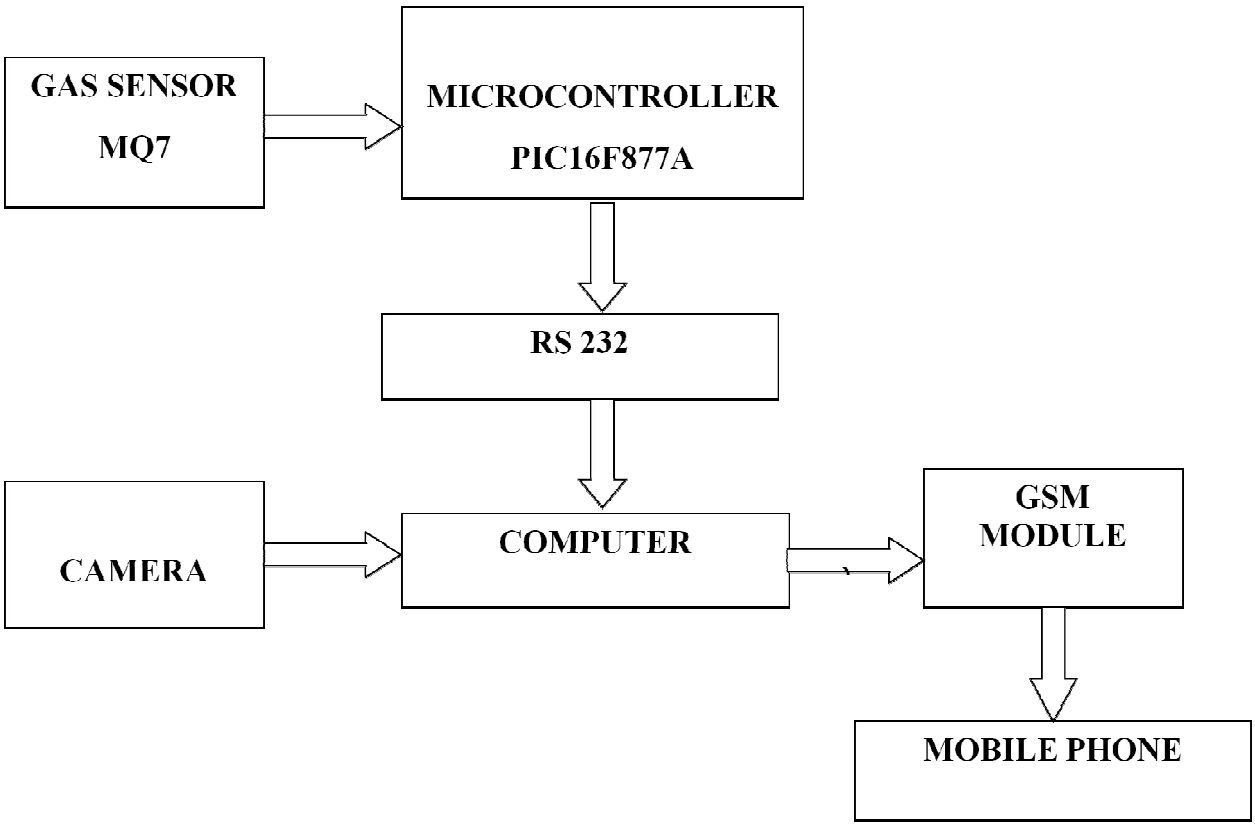


**Fig.1.**Block diagram of smoke detection captured from image features

This paper comprising of a sensor, camera, microcontroller and a GSM module. PIC16F877A is the microcontroller used. The sensor detect the smoke and camera detects the smoking person with the help of face detection through face recognition program from the database provided. The MQ-7 sensor detect the smoke and the face detection is done through the face recognition program developed in MATLAB. The fine for smoking is send to his address and alerts him by sending a message to his mobile phone. This system have vast applications in public places like shopping malls, bus stops, railway compartments etc.

## III.SMOKE DETECTION

The first stage we describe a method for judging the existence of cigarette smoke in public place. Cigarette smoke contains much higher concentrations of carbon monoxide (0.5-5% v/v) than the auto exhaust from a well maintained vehicle. Here we provide a carbon monoxide sensitive sensor MQ-7 for detecting the cigarette smoke. The MQ-7 is calibrated in such a way that it only detects the carbon monoxide gas from the cigarette rather than other sources.The detecting range of the sensor from 20ppm-2000ppm. The following graph shows the affinity of MQ-7 sensor to other gases.

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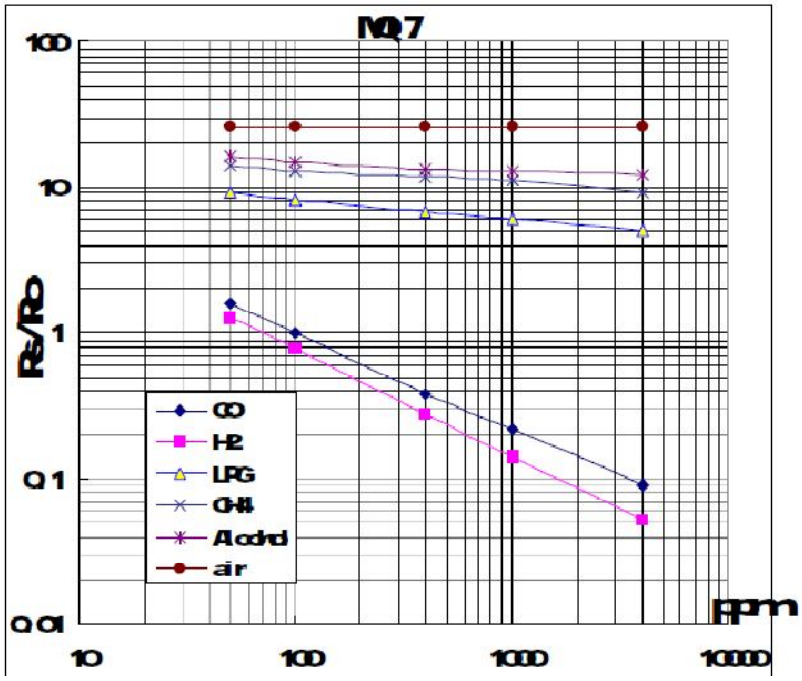


Fig.2Typicalsensitivity characteristics ofthe MQ-7 for several gases.

## IV.FACE RECOGNITION

Over the past several years, the wavelet transform has gained widespread acceptance in signal processing in general and in image compression research in particular. In applications such as still image compression, discrete wavelets transform (DWT) based schemes have outperformed other coding schemes like the ones based on DCT. Since there is no need to divide the input image into non-overlapping 2-D blocks and its basis functions have variable length, wavelet-coding schemes at higher compression ratios avoid blocking artifacts. Because of their inherent multi - resolution nature, wavelet-coding schemes are especially suitable for applications where scalability and tolerable degradation are important. Recently the JPEG committee has released its new image coding standard, JPEG-2000, which has been based upon DWT.

The wavelet transform involves projecting a signal onto a complete set of translated and dilated versions of a mother wavelet $\Psi(t)$. The strict definition of a mother wavelet will be dealt with later so that the form of the wavelet transform can be examined first. For now, assume the loose requirement that $\Psi(t)$ has compact temporal and spectral support (limited by the uncertainty principle of course), upon which set of basis functions can be defined.

The basis set of wavelets is generated from the mother or basic wavelet is defined as:

$$\Psi_{a,b}(t) = \frac{1}{\sqrt{a}}\psi\left(\frac{t-b}{a}\right) \quad ; a, b \in \Re \text{ and } a>0$$

The variable ‘a’ (inverse of frequency) reflects the scale (width) of a particular basis function such that its large value gives low frequencies and small valuegives high frequencies. The variable ‘b’ specifies its translation along x-axis in time. The term $1/\sqrt{a}$ is used for normalization.

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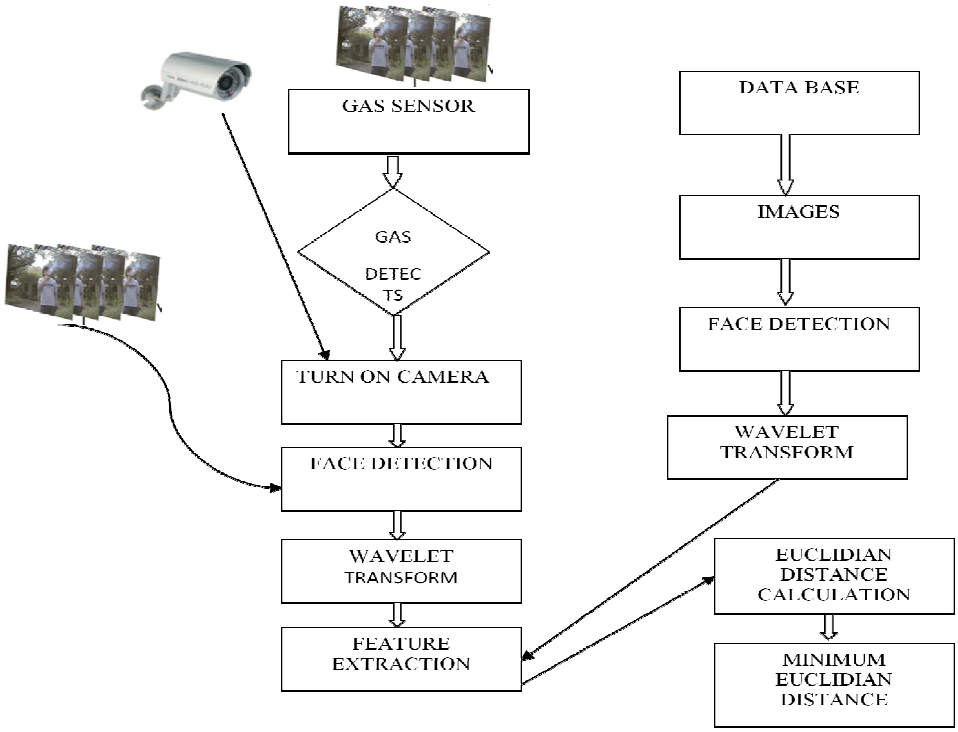


Fig.3 Block diagram of face detection

WAVELET COMPUTATION

In order to obtain an efficient wavelet computation,it is important to eliminate as many unnecessary computations as possible. A careful examination of the forward and reverse transforms shows that about half the operations either lead to data which are destroyed or are null operations (as in multiplication by 0).

The one-dimensional wavelet transform is computed by separately applying two analysis filters at alternating even and odd locations. The inverse process first doubles the length of each signal by inserting zeros in every other position, then applies the appropriate synthesis filter to each signal and adds the filtered signals to get the final reverse transform.

Decomposition Flow

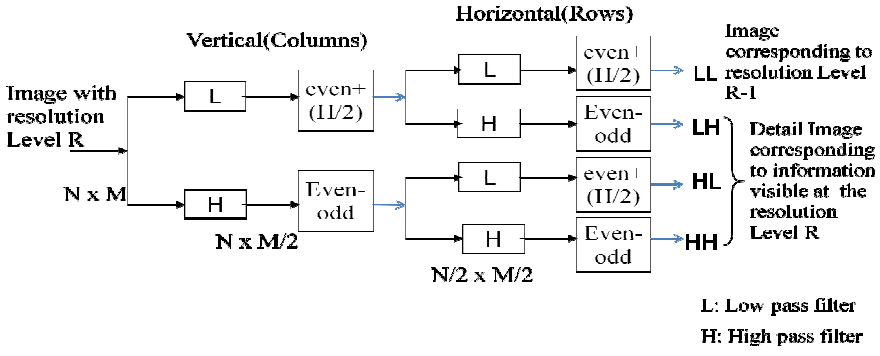


Fig. 4 Flow chart of decomposition flow

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## V. RESULT AND DISCUSSION

To investigate the effectiveness of the proposed method for smoke detection based on captured image sequence model and support the smoking personidetification using wavelet transform from the database provided.We used matlab software and some reputed image used for experimental task.

In this proposed method only one image and details of a person is provided in the database. If a person smokes in a public the MQ-7 sensor senses the smoke and alerts the camera through the microcontroller. The camera captures the image of the person and identifies him from the database provided. The database comprises of his personal details like address, phone number etc. The fine for his behaving in the public place (smoking) is send to his address and alerts him by sending a message to his mobile phone.

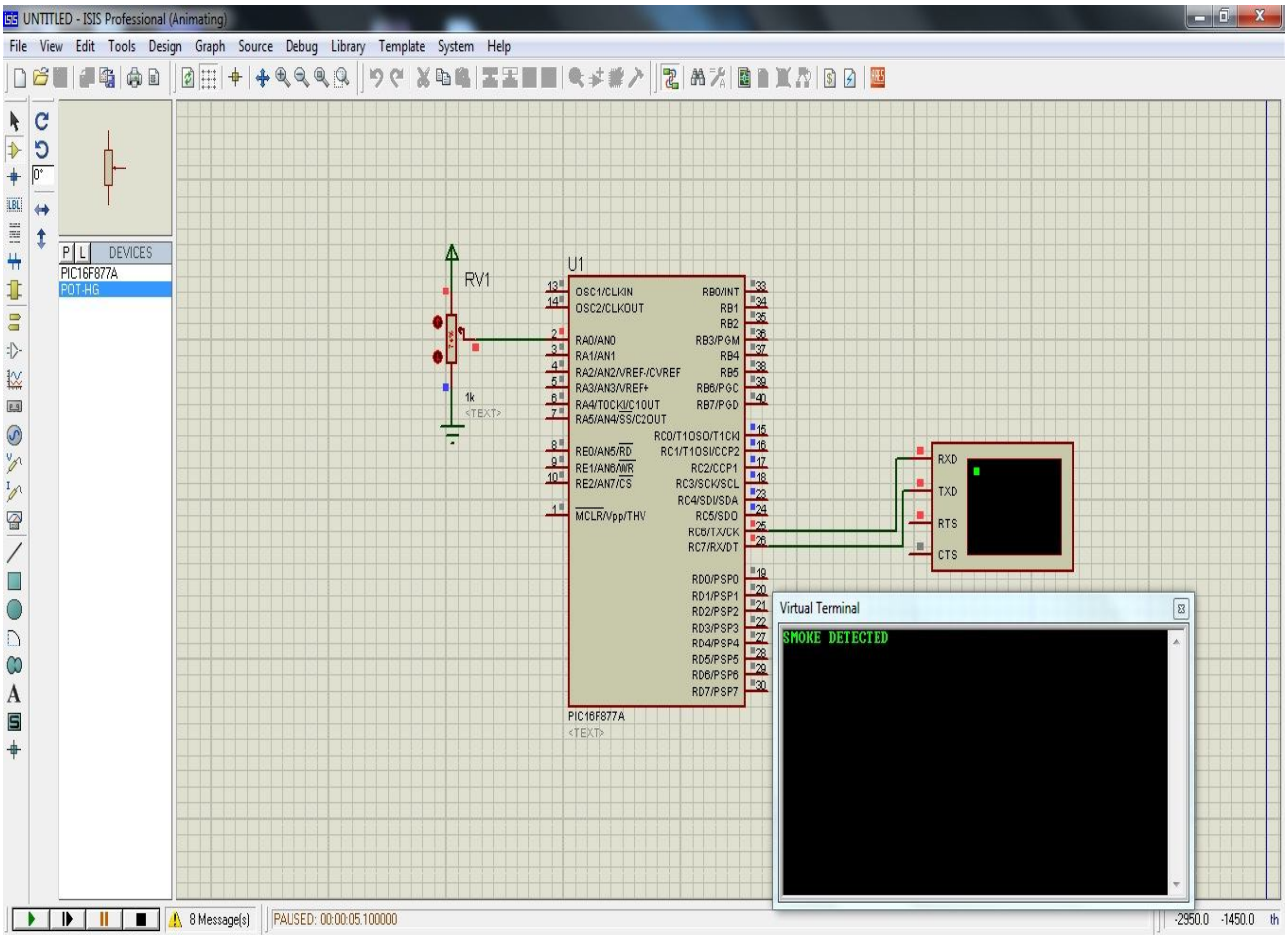


Fig.5 Simulation of smoke detection captured from image features in Proteus

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Fig.6 Face recognisation using wavelet transform in MATLAB

## VI.CONCLUSION

In this paper the cigarette smoke detectionfrom captured image sequences is proposed. The proposed model uses an MQ-7 sensor to detect the smoke and the face detection is done through the face recognition program developed in MATLAB. The fine for hi illegal activity in the public place(smoking) is send to his address and alerts him by sending a message to his mobile phone. The system can be further developed by increasing the database for making the system more efficient. This system have vast applications in public places like shopping malls, bus stops, railway compartments etc.

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