IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319 5940

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 5, Issue 3, March 2016

Automated Attendance by Face Recognition and SMS Sending to the Authorized Person

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Abstract: Face recognition is an integral part of biometrics. In biometrics basic traits of human is matched to the existing data and depending on result of matching identification of a human being is traced. Facial features are extracted and implemented through algorithms which are efficient and some modifications are done to improve the existing algorithm models. A face recognition system using the SIFT (Scale invariant feature transformation) algorithm was implemented. The algorithm is based on Image features approach which represents a SIFT method in which a small set of significant features are used to describe the variation between face images. Experimental results for different numbers of faces are shown to verify the viability of the proposed method. In this project an approach to the detection and identification of human faces is presented and then recognizes the person by comparing characteristics of the face to those of known individuals is described. And we introduced a new approach that give report by SMS to parents or authorized person using GSM modem.

Keywords: Face Recognition; SIFT; Local Feature Point; Real-time; Mobile Device.

I. INTRODUCTION

Facial recognition or face recognition as it is often referred to as, analyses characteristics of a person's face image input through a camera. It measures overall facial structure, distances between eyes, nose, mouth, and jaw edges. These measurements are retained in a database and used as a comparison when a user stands before the camera. One of the strongest positive aspects of facial recognition is that it is non-intrusive. Verification or identification can be accomplished from two feet away or more, without requiring the user to wait for long periods of time or do anything more than look at the camera.

Traditionally student's attendance is taken manually by using attendance sheet, given by the faculty member in class. The Current attendance marking methods are monotonous & time consuming. Manually recorded attendance can be easily manipulated. Moreover, it is very difficult to verify one by one student in a large classroom environment with distributed branches whether the authenticated students are actually responding or not. Hence the paper is proposed to tackle all these issues.

The proposed system consists of a high resolution digital camera to monitor the classroom or office room. It is embedded on a micro-controller based motor system which enables it to rotate in left & right directions. The data or images obtained by the camera are sent to a computer programmed system for further analysis.

The obtained images are then compared with a set of reference images of each of the employees or students & mark the corresponding attendance. The system also provides for continuous monitoring of the classroom by an operator if needed. The camera module can be a wireless or wired system.

II. SCALE INVARIENT FEATURE TRANSFORM

Image matching is a fundamental aspect of many problems in computer vision, including object or scene recognition, solving for 3D structure from multiple images, stereo correspondence, and motion tracking. This paper describes image features that have many properties that make them suitable for matching differing images of an object or scene. The features are invariant to image scaling and rotation, and partially invariant to change in illumination and 3D camera viewpoint. They are well localized in both the spatial and frequency domains, reducing the probability of disruption by occlusion, clutter, or noise. Large numbers of features can be extracted from typical images with efficient algorithms. In addition, the features are highly distinctive, which allows a single feature to be correctly matched with high probability against a large database of features, providing a basis for object and scene recognition.

The cost of extracting these features is minimized by taking a cascade filtering approach, in which the more expensive operations are applied only at locations that pass an initial test. Following are the major stages of computation used to generate the set of image features:

1. Scale-space extrema detection: The first stage of computation searches over all scales and image locations. It is implemented efficiently by using a difference-of Gaussian function to identify potential interest points that are invariant to scale and orientation.
2. Keypoint localization: At each candidate location, a detailed model is fit to determine location and scale. Keypoints are selected based on measures of their stability.
3. Orientation assignment: One or more orientations are assigned to each keypoint location based on local image

 DOI 10.17148/IJARCCE.2016.53134

IJARCCE

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gradient directions. All future operations are performed on image data that has been transformed relative to the assigned orientation, scale, and location for each feature, thereby providing invariance to these transformations. 4.Keypoint descriptor: The local image gradients are measured at the selected scale in the region around each keypoint. These are transformed into a representation that allows for significant levels of local shape distortion and change in illumination.

This approach has been named the Scale Invariant Feature Transform (SIFT), as it transforms image data into scale-invariant coordinates relative to local features. An important aspect of this approach is that it generates large numbers of features that densely cover the image over the full range of scales and locations. A typical image of size 500x500 pixels will give rise to about 2000 stable features (although this number depends on both image content and choices for various parameters). Multi biometric system using Face Recognition by SIFT Algorithm and RFID with SMS reporting system.

The quantity of features is particularly important for object recognition, where the ability to detect small objects in cluttered backgrounds requires that at least 3 features be correctly matched from each object for reliable identification. For image matching and recognition, SIFT features are first extracted from a set of reference images and stored in a database. A new image is matched by individually comparing each feature from the new image to this previous database and finding candidate matching features based on Euclidean distance of their feature vectors.

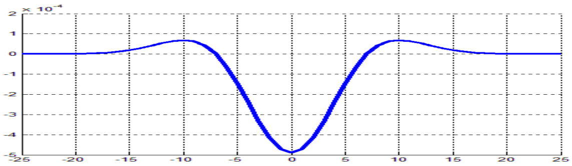
This paper will discuss fast nearest-neighbor algorithms that can perform this computation rapidly against large databases. The keypoint descriptors are highly distinctive, which allows a single feature to find its correct match with good probability in a large database of features. However, in a cluttered image, many features from the background will not have any correct match in the database, giving rise to many false matches in addition to the correct ones. The correct matches can be filtered from the full set of matches by identifying subsets of keypoints that agree on the object and its location, scale, and orientation in the new image.

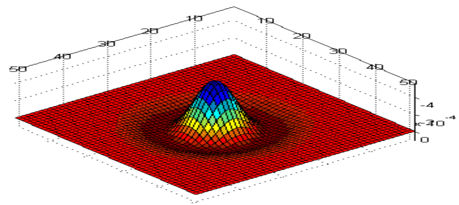
III.MATH

Lowe's Scale-space Interest Points:

- ■ Laplacian of Gaussian kernel
- ❑ Scale normalised (x by scale^2)
- ❑ Proposed by Lindeberg
- ■ Scale-space detection
- ❑ Find local maxima across scale/space
- ❑ A good "blob" detector

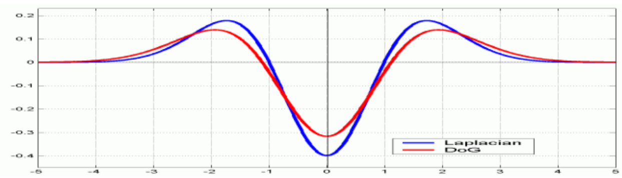
$$G(x,y,\sigma)=\frac{1}{\sqrt{2\pi}\sigma}e^{-\frac{1}{2}\frac{x^2+y^2}{\sigma^2}}$$





$$\nabla^2 G(x,y,\sigma)=\frac{\partial^2 G}{\partial x^2}+\frac{\partial^2 G}{\partial y^2}$$

Lowe's Scale-space Interest Points:
Difference of Gaussians



■ Gaussian is an ad hoc solution of heat diffusion equation

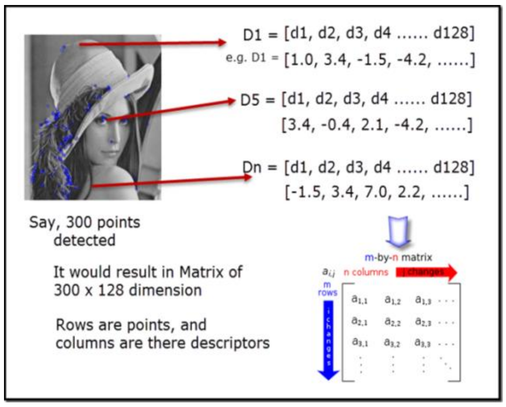
$$\frac{\partial G}{\partial \sigma}=\sigma\nabla^2 G.$$

■ Hence

$$G(x,y,k\sigma)-G(x,y,\sigma)\approx(k-1)\sigma^2\nabla^2 G.$$

■ k is not necessarily very small in practice

IV.EQUATIONS



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Eliminating the Edge Response

- Reject flats:

$$|D(\hat{\mathbf{x}})| < 0.03$$

- Reject edges:

$$\mathbf{H} = \begin{bmatrix} D_{xx} & D_{xy} \\ D_{xy} & D_{yy} \end{bmatrix}$$

Let α be the eigen value with larger magnitude and β the smaller

$$\mathrm{Tr}(\mathbf{H}) = D_{xx} + D_{yy} = \alpha + \beta,$$
$$\mathrm{Det}(\mathbf{H}) = D_{xx}D_{yy} - (D_{xy})^2 = \alpha\beta.$$

Let r = α/β.
So α = rβ

$$\frac{\mathrm{Tr}(\mathbf{H})^2}{\mathrm{Det}(\mathbf{H})} = \frac{(\alpha+\beta)^2}{\alpha\beta} = \frac{(r\beta+\beta)^2}{r\beta^2} = \frac{(r+1)^2}{r},$$

$(r+1)^2/r$ is at a min when the 2 eigen values are equal.

- r < 10

V. .RESULTS AND DISCUSSIONS

- Block diagram of Automatic attendance system is shown below.
- In this, Camera is used for capturing the current images.
- In PC MATLAB, GUI tool is implement.
- MATLAB has an feature as external interface we connect MATLAB to any external electronic IC or communicate with any embedded system application.Using RS232 we will give the instructions to AT89S52 controller , then controller operate the motors and sensors according the MATLAB instrictions.
- Max232 IC is a specialized circuit which makes standard voltages as required by RS232 standards.
- This IC provides best noise rejection and very reliable against discharges and short circuits.
- MAX232 IC chips are commonly referred to as line drivers.
- Radio-frequency identification (RFID) is the use of a wireless non-contact system that uses radio-frequency electromagnetic fields to transfer data from a tag attached to an object, for the purposes of automatic identification and tracking.
- Some tags require no battery and are powered by the electromagnetic fields used to read them.
- Others use a local power source and emit radio waves (electromagnetic radiation at radio frequencies).
- The tag contains electronically stored information which can be read from up to several metres (yards) away.
- Unlike a bar code, the tag does not need to be within line of sight of the reader and may be embedded in the tracked object.
- Image matching is a fundamental aspect of many problems in computer vision, including object or scene recognition, solving for 3D structure from multiple images, stereo correspondence, and motion tracking.
- The cost of extracting these features is minimized by taking a cascade filtering approach, in which the more expensive operations are applied only at locations that pass an initial test.
- Following are the major stages of computation used to generate the set of image features:

A. Scale-space extrema detection: The first stage of computation searches over all scales and image locations. It is implemented efficiently by using a difference-of-Gaussian function to identify potential interest points that are invariant to scale and orientation.

B. Keypoint localization: At each candidate location, a detailed model is fit to determine location and scale. Keypoints are selected based on measures of their stability.

C. Orientation assignment: One or more orientations are assigned to each keypoint location based on local image gradient directions. All future operations are performed on image data that has been transformed relative to the assigned orientation, scale, and location for each feature, thereby providing invariance to these transformations.

D. Keypoint descriptor: The local image gradients are measured at the selected scale in the region around each keypoint. These are transformed into a representation that allows for significant levels of local shape distortion and change in illumination.

- This approach has been named the Scale Invariant Feature Transform (SIFT), as it transforms image data into scale-invariant coordinates relative to local features. An important aspect of this approach is that it generates large numbers of features that densely cover the image over the full range of scales and locations. A typical image of size 500x500 pixels will give rise to about 2000 stable features (although this number depends on both image content and choices for various parameters).
- Global System for Mobile (GSM) is a second generation cellular standard developed to cater voice services and data delivery using digital modulation.

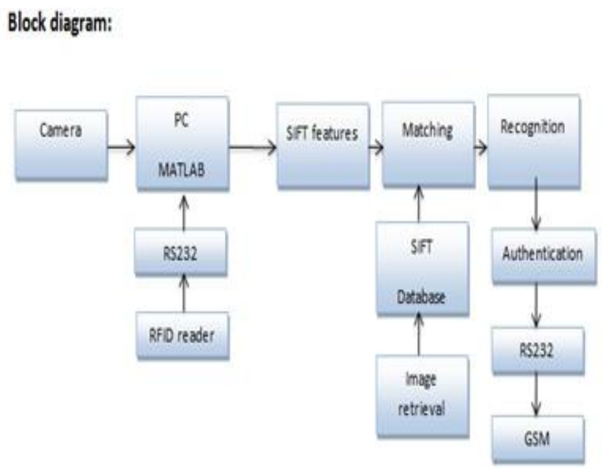

Fig: 1. Block diagram of Automatic attendance system

IDEA OF SIFT:

Image content is transformed into local feature coordinates that are invariant to translation, rotation, scale, and other imaging parameters

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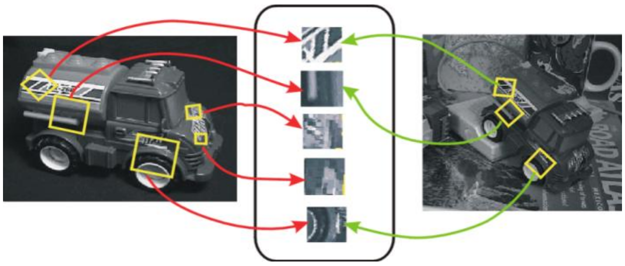

Fig: 2 Idea of SIFT in image file

Lowe's Key point Descriptor (shown with 2 X 2 descriptors over 8 X 8):
Gradient magnitude and orientation histograms: sum of gradient magnitude orientation at each point at each direction weighted by a Gaussian

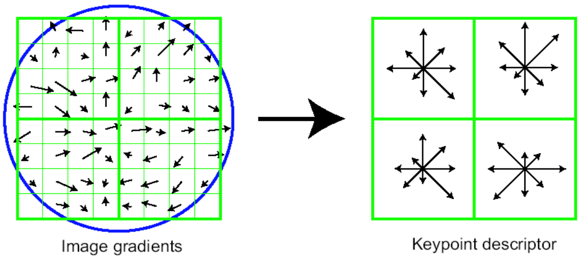

Fig: 3 Lowe's Key point Descriptor

In experiments, 4x4 arrays of 8 bin histogram is used, a total of 128 features for one keypoint.

FACE DATABASE:

- Two benchmark databases are employed for comparison purposes. The first AT &T face different orientations and facial expressions for each subject. The image size is 112*92pixels. There is an average of 70 SIFT features extracted from each image. Figure I shows a sample of images for one subject.
- The second database is Yale face database [1]. It contains 165 images for 15 subjects, with 11 images/person. The images contain different facial expressions and illumination conditions for each subject. The image size is 243*320pixels, and an average of 230 SIFT features are extracted for each image. Figure(b) shows a sample of images from this database.

- The raw faces were used without any kind of pre processing (cropping, normalization, histogram equalization, etc.) to access the robustness of the algorithms in the comparison.

REGULATED POWER SUPPLY:

- This project uses regulated 5V, 500mA power supply.
- 7805 three terminal voltage regulator is used for voltage regulation.
- Bridge type full wave rectifier is used to rectify the ac output of secondary of 230/12V step down transformer.

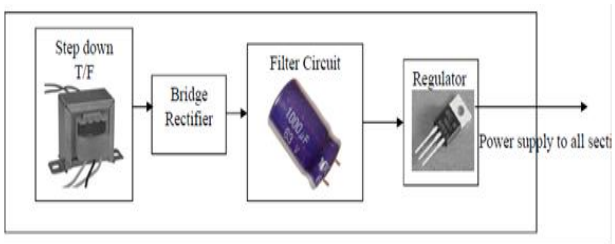

Fig: Regulated Power supply

MICROCONTROLLER:

- A microcontroller is a small computer on a single integrated circuit consisting of a relatively simple CPU combined with support functions such as a crystal oscillator, timers, watch dog timer, serial and analog I/O etc.
- Microcontrollers are also used in scientific, high technology, and aerospace projects.
- Microcontrollers are designed for small or dedicated applications.
- Block diagram and pin diagram of microcontroller is given below.
- 8052 is an 8-bit processor, meaning that the CPU can work on only 8 bits of data at a time.
- Data larger than 8 bits has to be broken into 8-bit pieces to be processed by the CPU.
- 8052 is available in different memory types such as UV-EPROM, Flash and NV-RAM.

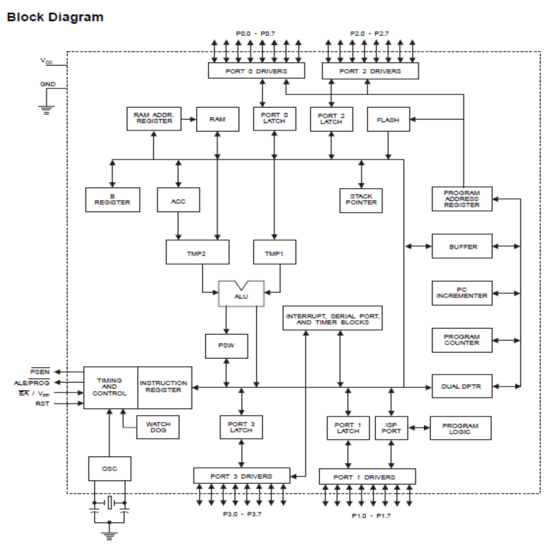

Fig: Block diagram of microcontroller

Pin diagram of microcontroller:

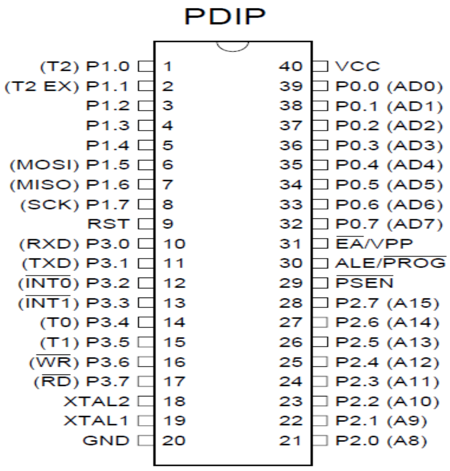

Fig: Pin diagram of microcontroller

ACKNOWLEDGMENT

With profound feeling of immense gratitude and affection, we express our whole hearted thanks to our guide **Prof. Hina Malik** of Smt. Rajshree Mulak College of Engineering for Women, Nagpur who has given us timely and affectionate guidance through the various pitfalls and obstacles encountered during the project. We would also like to acknowledge, the help and co-operation received from **Prof. S. A. Bagal**, **Head,** Department of Electronics and Telecommunication of Engineering**.** We express our sincere thanks to, **Prof. Sudha Shrikant**, Vice Principal, Smt. Rajshree Mulak College of Engineering for Women, Nagpur for her time to time encouragement towards fulfilment of this project. Our sincere thanks are also extended to **Dr. P. Devnani**, Principal, Smt. Rajshree Mulak College of Engineering for Women, Nagpur for her words of encouragement while completing this project.

Although we sincerely hope the work is free from any inaccurate statement. For any short comings we offer our sincere apology.

PROJECTEES:
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