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Webcam Based Intelligent Surveillance System

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Abstract -*. An intelligent monitoring sensor is an application which is developed from the security point of view. The objective of this project is to develop a system that monitors the area in which it is being implemented. An Intelligent Monitoring Sensor is applicable in the area where no one is permissible to enter, also where we need to detect if any motion has been done. For this a digital camera is used. By combining the software and camera we can use this system as an Intelligent Monitoring Sensor.The Camera is used to catch the live images of the area in which it is being implemented, if any object is moving. The captured images are stored in a particular folder. The stored images will be then useful to work on. As the software detects the motion, it sends the signal from a transmitter, which is connected to the PC. The transmitter will send the wireless signal to the receiver out somewhere else, in the form of radio frequency. In this way the system will provide the security against any misdeed.*

Keywords *– image capturing, motion detection, monitoring, receiver, security, transmitter.*

I. INTRODUCTION

Intelligent Monitoring Sensor is an application in which a digital camera is used as a powerful motion detector. Instead of using various ultra-sonic or other sensors, we are using camera as the sensor here. By combining the software and the camera we can use this system as a Intelligent monitoring Sensor.

An Intelligent Monitoring Sensor can be used for security in restricted areas, where no one is allowed to visit or enter the space during particular time. For this a digital camera is used. By combining the software and camera we can use this system as an Intelligent Monitoring Sensor.If any changes has been found the camera capture the images at the rate of **one image per 60msec** and stores them in the folder. The stored images will be then useful to work on. As the changes have been detected, the transmitter which is connected to the PC sends the wireless signal to the receiver at the other end.

There are three security levels in the software to control the monitoring.

[1] **High:** This level will focus on the particular object only and can sense within the range of 1meter only
[2] **Middle:** In this level the security will be less as compared to High Level .here it will sense the human as well as object.
[3] **Low:** It's the lowest level security. This mode is basically used for monitoring only.

The main modules of the project are:

[1] Login Form designing
[2] Camera Interfacing
[3] Image Capturing & Storage
[4] Hardware Interfacing
[5] Motion Detection

1.1. First Module :- Login Form designing.

The Login form is designed to provide authentication. If the login is successfully done, then it will switch to next form i.e. Option Form, where we have three options-

[1] Motion Detection Form
[2] Image List Form
[3] Exit

In Motion Detection Form, the motion caused ,if any, is analyzed and thus the indications are given to the authenticated person. In the second option, all the images can be viewed wherein we can see what all changes have been done and by whom. Whereas, the third option is the way to exit an application.

1.2. Second Module :- Camera Interfacing.

This form contains the list box where the list of all the camera devices connected to the software are displayed . By default the first camera is selected, but we can select any of the available devices from the listbox .After the device is selected, the camera is interfaced through coding part. Then there is a button 'Activate Motion Detection', through which we can select the mode of our working and the application is set on. Here we actually have three modes -

- High
- Middle
- Low

1.3. Third Module :- Image Capturing & storage.

Whenever any changes between the two corresponding images have been detected, the application starts capturing the images and they are stored into the folder using AVICAP32.dll class. At the same time , a wireless signal is transmitted to the receiver through .Wave file.

- AVICap routes video and audio stream data from a captured window to a file named CAPTURE.AVI in the root directory of the current drive. AVICap window class provides applications with a message-based interface to access video and waveform-audio acquisition hardware and to control the process of streaming video capture to disk. AVICap window is efficient enough to control the process of streaming video capture to disk.

1.4. Fourth Module :- Motion Detection.

The basic working of motion detection module is comparison between two images. The first image is the one when we activate the application and the second image is of the second instant of time. When the application recognizes any changes between two corresponding images, it calls the next module i.e Image Capturing, and if not, it keeps monitoring again.

1.5. Fifth Module :- Hardware Interfacing

When the software will detect any movement or changes in the image, it will send a signal (hex value) to LPT port. A transmitter will be connected to the LPT port of the PC. The transmitter will transmit the signal to the receiver and it will play the buzzer at the receiver's end. Then the further actions will be taken by user.

II. LITERATURE REVIEW

There are many existing devices in market such as CCTv Cameras, IP camera, Infrared Sensor, Laser Sensor etc.

CCTv : Implementation of CCTv cameras are very costly and has drawbacks since it require constant monitoring of every activity which is not as ease. Continuous manual visualization hampers the productivity and time. Criminals can penetrate into the CCTV system, thereby facilitating criminal acts.

IP camera : Implementation of IP cameras are also very costly and not feasible. This system cause major problems as it becomes open to hackers via internet(false bomb threats, called in hoaxers while watching the cameras.) .

Infrared Sensor and Laser Sensor: These devices are quite economic in comparison to above devices however they have some drawbacks too. These devices are difficult to install and rarely available. One of the major disadvantages of infrared sensors is the size required to provide good resolution to the the signal.

III. INDENTATIONS AND EQUATIONS

3.1 Moving-Object Detection

The detection of moving objects is the first stage of a typical surveillance system. Motion detection aims at segmenting the regions pertaining to moving objects from the rest of the image. Subsequent processes such as tracking and behavior analysis are greatly dependent on the performance of this stage. Many algorithms have been suggested to solve the problem of motion detection, where the moving pixels are identified by thresholding the temporal difference between the frames; background subtraction where detection occurs by comparing the incoming frame with a background model of the scene that is built by modeling the pixel intensity either by a single Gaussian distribution , a mixture of Gaussians , or using the maximum, minimum and maximum intensity difference as in ; and optical flow approaches that use characteristics of flow vectors of moving objects over time to detect moving regions in image sequences.

3.2 Temporal Variance Based Motion Detection:

In our system, we use the temporal variance as a parameter to detect moving areas in a stationary scenes. The mean and variance of the intensity value at each pixel is calculated over a window of several previous frames and updated recursively for every new frame. This value of the variance is used directly afterward for the detection of moving area. The use of temporal variance for motion detection has some nice properties:

[1] The variance of intensity at a certain pixel depends on both the amplitude of changes and the duration of this
change so it is more robust to transient noises incurred by moving texture.

[2] There is no need for background training period as this method can build the model with the existence of moving objects on the scene.

The mean and variance for the intensity at each pixel (i, j) are recursively updated using a simple exponentially decaying adaptive filter as follows:

$$m(i, j, t) = \alpha m(i, j, t-1) + (1-\alpha)x(i, j, t)$$
$$m2(i, j, t) = \alpha m2(i, j, t-1) + (1-\alpha)x2(i, j, t)$$
$$\sigma 2(i, j, t) = m2(i, j, t) - m2(i, j, t) \quad \ldots..(1)$$

where: $x(i, j, t)$ is the intensity, $m(i, j, t)$ is the first moment, $m2(i, j, t)$ is the second moment and $\sigma 2(i, j, t)$ is the variance at pixel (i, j) at time t, α is the decay rate, that can be rewritten with respect to the filter window size N as:

$$\alpha = (N-1)/N$$
$$N = 1/(1-\alpha) \quad \ldots.(2)$$

3.3 Background Modeling:

In order to remove the trail effect, a background model is built by recursively updating another set of mean and variance as follows:

$$mbg(i, j, t) = \alpha bg\, mbg(i, j, t-1) + (1-\alpha bg)x(i, j, t)$$
$$m2bg(i, j, t) = \alpha bg\, m2bg(i, j, t-1) + (1-\alpha bg)x2(i, j, t)$$
$$\sigma 2$$
$$bg(i, j, t) = m2bg(i, j, t) - m2$$
$$bg(i, j, t)$$

where:

$mbg(i, j, t)$ is the background first moment,

$m2bg(i, j, t)$ is the background second moment, and

$\sigma bg(i, j, t)2$ is the background variance for the background at pixel (i, j) at time t. αbg is the background model decay rate that can also be written with respect to the background
filter window size Nbg

The background model is used to obtain a confidence weight representing the confidence of this pixel being a part of the foreground. This confidence weight is obtained as a function of the distance between the pixel intensity and the background model

C(i, j, t) = f _|x(i, j, t) − mbg(i, j, t)|_σbg(i, j, t)
where C(i, j, t) is the confidence weight that the pixel (i, j) is part of the foreground and f is a nonlinear-mapping function– such as sigmoid– to map the distance to range of [0,1] and to emphasize the large distance points. The final binary detection map L(i, j, t) is obtained as follows:
L(i, j, t) = _ 1 if C(i, j, t)σ(i, j, t) ≥ Threshold 0 if C(i, j, t)σ(i, j, t) < Threshold
where the value of Threshold can be obtained either empirically or by multiplying the average background variance by a factor.

IV FIGURES AND TABLES

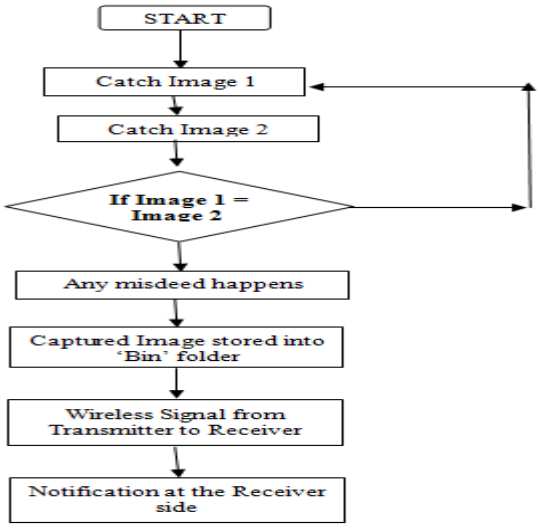

fig:flowchart

V. TRANSMITTER AND RECEIVER KIT

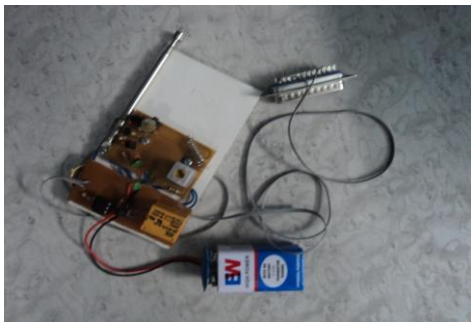

Fig: Transmitter kit

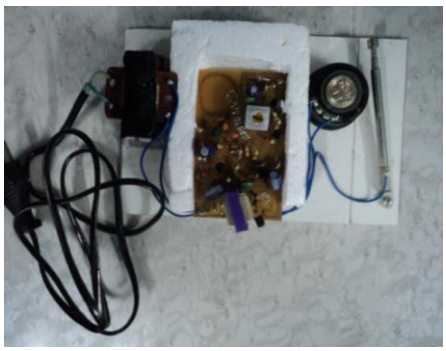

Fig: Receiver kit

WORKING OF TRANSMITTER KIT:

[1] When the power is supplied to the circuit, the frequency is generated
[2] This frequency is traveled through gang condenser where it is tuned to 3.587MHz
[3] Then the frequency is converted into voltage. This voltage is amplified using the transistor T1
[4] During this process the noise is generated which is filtered using capacitive-resistive filter
[5] Now this voltage is travelled through capacitor c3 where the capacitor gets charged
[6] To transmit the signal this voltage is again converted into frequency using induction coil and thus it generates emf.
[7] Due to this induced emf, the frequency is generated, which is then transmitted by antenna and gives wireless signal at the receiver end.

WORKING OF RECEIVER KIT:

[1] Antena receives signal through transmitter, the capacitor c3 gets charged and it converts frequency to volatge at 9volt and the noise is generated.
[2] Then the current is forwarded through the transformer through the inductively coupled conductors in the transformer.
[3] Then the capacitive-resistive coil filters the noise generated in the received signal.
[4] The silicon diode is one way conductor and provides no backing of voltage and amplifies the signal.
[5] Inductor converts voltage to frequency.
[6] Also there is a filtering circuit which filters 2-3 times to drop the weak signals.
[7] Further the NPN transistor amplifies the current which acts as a switch.
[8] The capacitor c6,c9 and c10 gets charged which holds the energy for a while and notification is given to the receiver through buzzer.

VI. CONCLUSION

Webcam Surveillance Standard is advanced video surveillance software. Users can effortlessly monitor home, office, cradle, parking area, storehouse, UFO or any other premises 24-hours a day. Timestamped image capturing let users capture details of events precisely when they happen. Simply connect a USB or FireWire Camera to your PC. Different environments have different surveillance requirements. A large facility like a parking lot, store, residence, or hall cannot be monitored efficiently by a single camera. Advances in PC based surveillance software now allow anyone with a webcam to setup a robust, effective and inexpensive surveillance system. Today, all you need for securing your assets is a PC, a couple of webcams and software like

Webcam Based Intelligent Surveillance System.

Traditionally, CCTV (Closed Circuit TV) based Surveillance Systems were used for multi camera monitoring. This solution was expensive due to the huge hardware costs.

Applications :

[1] Office Security
[2] Army Surveillance
[3] Museum
[4] Bank Security
[5] Space Research
[6] Home Security

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Books:

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[2] Book: Visual Basic Bible by Douglas Herger