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Raspberry Image Security for Society

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Abstract- **Century has evolved, new technology has been adopted, but crime rates still hit their peak in the graph. So we have a 21st century technology raspberry pi as security system with image processing. Raspberry–pi is a mini CPU which is cable of high performance. Image processing is a completely 21st century concept and is widely used in defence sector. These two technologies even being in the society but are working at two extreme ends. Knowing or unknowing we use these technology at day to day life. Our idea is to merge these two concepts to a single circuit board and bring up a security model. Here we mainly concentrate on security at society level and also monitoring crime rate.**

I.INTRODUCTION

A.Problem Statement

We always address engineers as change makers in the society and so are they .Crime may be defined as activity which is performed by a subject on a subject or an object knowingly or unknowingly.

From CCTV to sensors, from bomb detecting machines to high quality forensic labs everything has been improved, innovated and modernized, but still we see a small dip in crime rate graph.

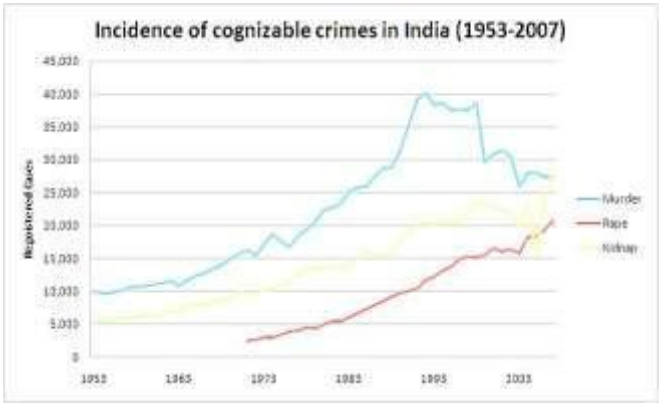

Fig. 1 Graph of the crime rates in India

Just for the study purpose we looked on the graph, through which we can see a constant dips in the crime rates, which is due to introduction of technologies. But we do agree that technologies have to be updated to have constant decrease in crime rates.

This is a challenge in this present constant evolving world. So questions and challenges in our mind would be.....

- Can these technologies be improved in such a way that crime rates can be decreased?
- How do we engineers respond to this?
- Can we still go beyond cc TV and sensors?
- Can we bring in 21st century Hollywood movie's security systems to reality?

For all these questions our answer would be **YES**, through our idea on Raspberry image security for society.

II.IMAGE PROCESSING FOR SOCIETY

Image processing is an imaging science which is a form of signal processing for which the input is an image, such as photograph or video processing etc. The output of image processing may be either an image or a set of characteristics or parametersrelated to the image. Most image-processing techniques involve treating the image as a dimensional signal and applying standard signal-processing techniques to it. Before processing an image, it is converted into a digital form. Digitization includes sampling of image and quantization of sampled values. After converting the image into bit information, processing is performed. This processing technique may be Image enhancement, Image reconstruction, and Image compression.

In this vast technology of image processing we focus mainly on feature extraction. Transforming the input data into the set of features is called **feature extraction**.

A.*Feature Extraction*

If the features extracted are carefully chosen it is expected that the features set will extract the relevant information from the input data in order to perform the desired task using this reduced representation instead of the full size input.

Feature extraction involves simplifying the amount of resources required to describe a large set of data accurately. When performing analysis of complex data one of the major problems stems from the number of variables involved. Feature extraction is a general term for methods of constructing combinations of the variables to get around these problems while still describing the data with sufficient accuracy [1].

Fig: 2 Original Image

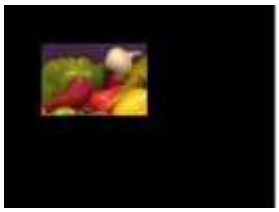

Fig: 3 Feature Extraction

*Image processing in forensic science:*Dead bodies are not new subjects in forensics field. Forensic science mainly learns from it and deals with it. By using the current technology they can predict time of death, cause of death and many more parameters [3].

What can image processing do in this field?

For example, consider a dead body with an open eye. Image processing technician takes a pic of the retina and then takes it to the mat lab. **MATLAB** (**mat**rix **lab**oratory) is numerical environment and language. Just with the picture of retina we are able to reconstruct last image seen by an eye and we able to calculate the distance from which the man was shot. And also other parameters can be roughly calculated. This image might be blurring, might not be of good quality but it can certainly be enriched by image enhancement. This is also a technique of image processing.

It is the finest, accurate and latest technology which can also be adopted in secular Indian society?

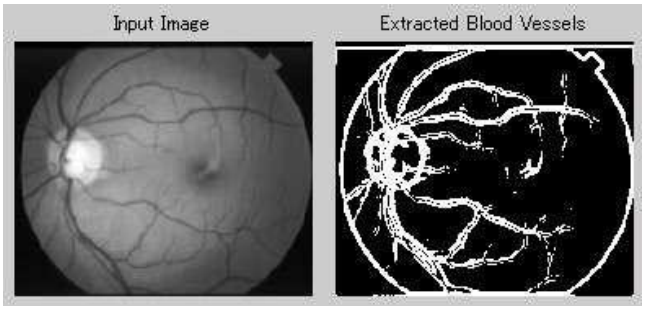

Fig . 4 Ex: For detection of blood vessels from retina

B.Recognition methods in image processing

Image recognition is the process of identifying and detecting an object or a feature in a digital image or video. This concept is used in many applications like systems for factory automation, toll booth monitoring, and security surveillance [2]. Typical image recognition includes:

- Optical character recognition
- Pattern and gradient matching
- Face recognition
- License plate matching
- Scene change detection

We are using CCTV and other video equipment for tracking the movement of people through which we can recognize crime if it's happening.

Object detection and tracking are important in many computer vision applications including activity recognition, automotive safety, and surveillance. In this example, you will develop a simple face tracking system by dividing the tracking problem into three separate problems:

- Detect a face to track
- Identify facial features to track
- Track the face

1) Detect a Face to Track: Before you begin tracking a face, you need to first detect it. By default, the detector is configured to detect faces, but it can be configured for other object types. You can use the cascade object detector to track a face across successive video frames. However, when the face tilts or the person turns their head, you may lose tracking. To avoid this issue, and because performing face detection for every video frame is computationally

intensive, this example uses a simple facial feature for tracking

2) Identify Facial Features to Track: Choose a feature that is unique to the object and remains invariant even when the object moves. In this example, we use skin tone as the feature to track. The skin tone provides a good deal of contrast between the face and the background and does not change as the face rotates or moves.

*3) Track the Face:*In this example, the channel pixels are extracted from the nose region of the detected face. These pixels are used to initialize the histogram for the tracker. The example tracks the object over successive video frames using this histogram.

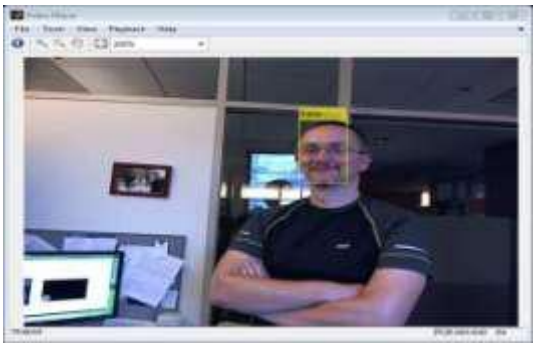

Fig . 5 Face recognition

C. Object Recognition

Yet another interesting feature of image processing device is that it has the ability to detect objects such as guns, knives and many such weapons.

Using the predefined images of the weapons that have been already stored, our device is able to detect such weapons from the captured images.

Fig. 6 Detection of the weapon

Fig . 7 No object detected

D. Speech Recognition

Initially, the graph of the speech signal is generated, after a specific delay, another graph of the signal is produced. This graph is then compared with previous one.

If the graphs surpasses the threshold level and drastic changes are found among them, then scream is detected.

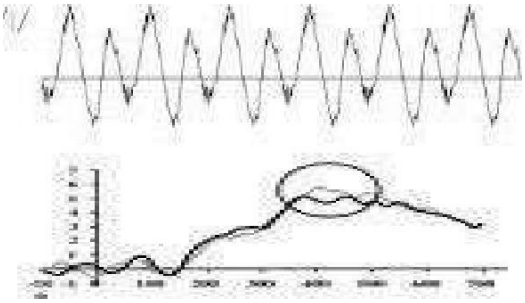

Fig . 8Graphs showing the speech recognition

E. Motion Detection

At first we capture an image and after a specified delay, we generate yet another image. Later these images are compared with respect to the movement of the people and if tremendous changes are found, each change is detected individually.

Fig. 9 Motion detection

III.A FRUIT BERRY TO A CIRCUIT BOARD BERRY

The Raspberry Pi is a credit-card-sized single-board computer developed in the UK by the Raspberry Pi Foundation with the intention of promoting the teaching of basic computer science in schools.

A single-board computer (SBC) is a complete computer built on a single circuit board, with microprocessor(s), memory, input/output (I/O) and other features required of a functional computer.

Additionally, the low power requirement facilitates battery powered usage in robots, while the video capabilities have led to interest in use as a home media center [4]. A Home Theatre PC (HTPC) or Media Centre computer is a convergence device that combines some or all the capabilities of a personal computer with a software application that supports video, photo, audio playback, and sometimes video recording functionality.

Feature	Specification
CPU	700MHz ARM1176-JZFS
GPU	Broadcom VideoCore IV
Memory	256MB LPDDR2-800
Video	HDMI, composite
Audio	HDMI, stereo analog
USB	2 x USB2.0 (model B)
Storage	SD card
Networking	10/100 Ethernet
Power	5V micro USB

Fig . 10 Feature and specification of Raspberry pi

The Raspberry Pi uses Linux kernel-based operating systems. Raspbian, a Debian-based free operating system optimized for the Raspberry Pi hardware, is the current recommended system.

A. *Tiny Wi-Fi adapter for raspberry pi*

Fig. 11 Wi-Fi adaptor

Wi-Fi is not really necessary for the Raspberry Pi. It already comes with an Ethernet port, provides RS-232 connectivity, and has two USB ports. However, in case you wanted to add Wi-Fi to the Raspi, this little adapter seems to be as good as any.

Adjust transmission output by distance and CPU offload, to reduce power consumption when wire and it is currently the same wireless adapter.

B. *Applications of raspberry pi*

1) Media streamer: The software can stream music and video stored online or locally, and can be configured to work with TV catch-up services like BBC player, as well as being completely controllable using a remote control. These Videos and images can be processed and also sent to mail addresses.

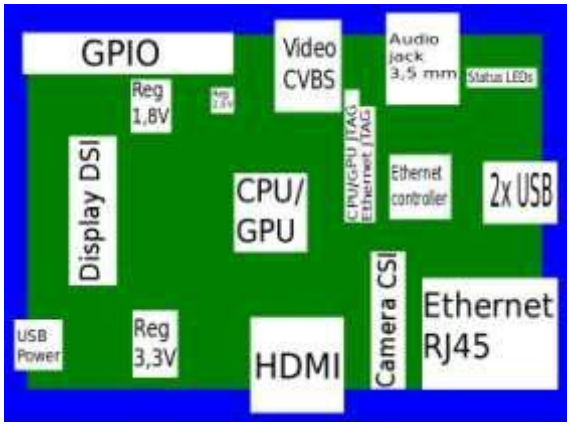

Fig . 12 Different ports of Raspberry pi

"The Raspberry Pi is great fun and it is amazing that I can hold it in my hand and write computer programs or play games on it".

2) Home automation: Lazy to press a light switch? Can't be bothered to open the curtains in the morning? Want to auto ring the alarm? Then these are the exact applications why raspberry is can be used.

3) Cosmic computer: You can use the camera module to turn a $35 Raspberry Pi into a security camera, video conferencing device, or just a little low power computer that can occasionally snap photos when the need arises.

IV. BLOCK DIAGRAM OF MERGING TWO TECHNOLOGIES:

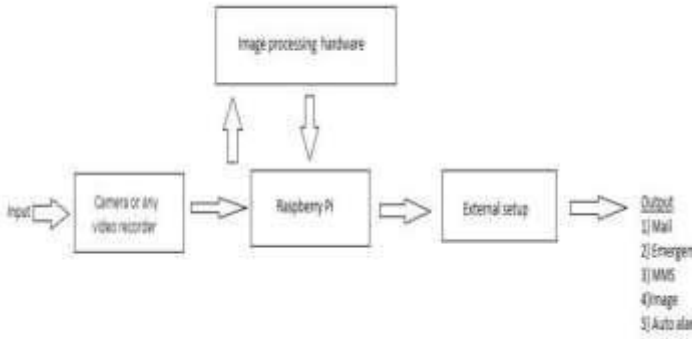

Fig . 13 Block diagram of Raspberry image security system

A. *Input*

Our main inputs will be the movements of population where camera has been installed.

B. *Video recorder/Camera*

Input is recorded and transferred to raspberry and image processing hardware.

C. *Image processing hardware*

This is the brain of our system. Now considering a crime happening in front of a camera, for example let us consider loud noise of bomb blast or sudden break of fire and blood spattered all round. Our camera sends this image to our image processing hardware where this image is compared with our standard installed predefined data. These data contain all the images of the crime aspects and our onscreen crime image is compared to it. Our image processor now compares audio, video and motion with the standard pre-defined data base. For example sudden screaming or running of a person and blood spattering etc. Thus these data's are processed in the image processing hardware and decision is forwarded to raspberry pi.

D. *Raspberry pi*

This is the heart of our system. It's a mini computer which is capable of handling all the 3 components connected to it simultaneously. As it is well connected with the internet it is capable of sending image, video, audio, mms etc. After the decision is given to the raspberry, it then sends the captured mms and images to the mail ids[8]. Also auto alarm and telephone call to the crime authorities can be sent on spot so that required action can be taken by them[9].

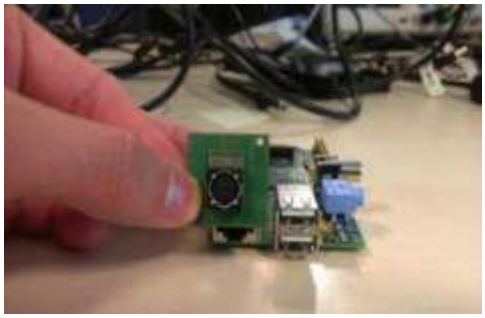

Fig . 14 Raspberry pi with camera

E. *External setup*

After the crime scene, details can be taken from backup data of our system. We also provide external hard disk for the storage.

This whole block diagram can be made into hardware setup which can be easily installed easily. Thus by installing these we can monitor the places sitting in a room.

F. *Output*

The outputs can be images, mms and alarm which can be sent to nearby police station. As the proof of action from our system the senior most official will also be sent a mail or mms.

V. CONCLUSIONS

Thus we here use the high end technology to detect and to bring down the crime rate.

Although these two technologies might be the two ends of the world, still we can put them together on the same board. Our system can be installed in traffic junctions, lonely roads, railway stations and in any public places where the crime monitoring has to be done.

TABLE I

CURRENT CRIME SURVEY RESULTS WITH EXPECTED CHANGE AFTER ADOPTING TECHNOLOGY

Year	Total cog. crimes under IPC	Murder	Kidnapping	Robbery
1953	6,01,964	9,802	5,261	8,497
2005	18,78,293	32,481	23,991	18,455
Expected change after implementation	12,00,000	25,000	10,000	5000

SOURCE: National Crime Records Bureau

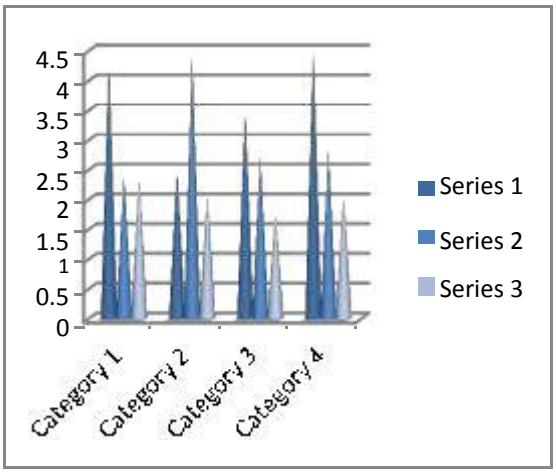

Fig . 15 Expected change in the graph

"Nothing is impossible, neither walking on the moon nor flying in the sky was possible quite a time ago but now we see the **change**. This quote applies to our technologyalso, we agree it's complex and hard to built, but as we have said above…..

"**NOTHING IS IMPOSSIBLE**"

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