Advanced Embedded Security System With Image Capturing In SD Card

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Abstract:

An image capture system with embedded computing can extract information from images without need for an external processing unit, and interface devices used to make results available to other devices. The choosing of an Embedded platform is very unique and easy to implement. The paper proposed an image capturing technique in an embedded system based on Raspberry Pi board.

Considering the requirements of image capturing and recognition algorithm, Raspberry Pi processing module and its peripherals, implementing based on this platform, finally actualized Embedded Image Capturing using Raspberry Pi system (EICSRS). Experimental results show that the designed system is fast enough to run the image capturing, recognition algorithm, and the data stream can flow smoothly between the camera and the Raspberry Pi board.

Keywords:

Image capturing, Embedded system and Raspberry Pi board.

1. INTRODUCTION:

Traditional ways for personal identification depend onexternal things such as keys, passwords, etc. But suchthings may be lost or forgotten. One possible way to solvethese problems is through biometrics, for every personhas his special biometric features definitely. Biometrics identification has gained increasing attention from thewhole world [1]. Biometrics features that can be used foridentification include fingerprints, palm prints,handwriting, vein pattern, facial characteristics, face, andsome other methods such as voice pattern, etc [2].Compared with other biometric methods, the facerecognition has the following advantages:

The face imageacquisition requires no physical contact, so faceidentification system is non-invasivenessSince the face is created in a nearly randommorphogenetic process during the gestation, it has littleprobability to find two people in the world whose facetextures are identical. So face recognition is the mostaccurate method and has the lowest false recognition rate.The face recognition has more stability than otherbiometric identification methods because the face hasmuch more features than other biometrics and it won'tchange in people's life.

With the advantages of noninvasiveness,uniqueness, stability and low falserecognition rate, face recognition has been researchedwidely and has a broad usage, such as security,attendance, etc.Most of the recognition systems are based on PC.However, the portability of PC is limited by its weight,size and the high power consumption. Thus results in thatthe using of face recognition is confined in few fields, andit is inconvenient to use.

The way to get rid of the limit ofPC is using embedded system.The designed EICSRS platform acquires the images andstores them into the real time database , which in turnlater used for comparing the faces of the users to provideaccess to them or to deny the access to a place or tooperate a device. Recent technological advances areenabling a new generation of smart cameras thatrepresent a quantum leap in sophistication.

While today'sdigital cameras capture images, smart cameras capture high-level descriptions of the scene and analyze what theysee.These devices could support a wide variety of applicationsincluding human and animal detection, surveillance,motion analysis, and facial identification. Fortunately,Moore's law provides an increasing pool of availablecomputing power to apply to real-time analysis. Smartcameras leverage very large-scale integration (VLSI) toprovide such analysis in a low-cost, low-power systemwith substantial memory.

Moving well beyond pixelprocessing and compression, these systems run a widerange of algorithms to extract meaning from streamingvideo.Because they push the design space in so manydimensions, image capturing are a leading edgeapplication for embedded system research.Most of the capturing systems are based on PC. However,the portability of PC is limited by its weight, size and thehigh power consumption. Thus results in that the using of image capturing is confined in few fields, and it isinconvenient to use.

The way to get rid of the limit of PCis using embedded system. We analyzed the designmethod of the image capturing and recognition algorithm,Raspberry Pi board module and its peripherals,implementing based on this platform. The Raspberry Pihas a Broadcom BCM 2835 a System on Chip (SoC). Soc has ARM 1176JZF-S 700 MHz processor, Video Core IVGPU and was originally shipped with 256 megabytes ofRAM, later upgraded to 512 MB.

It does not include abuilt-in hard disk or solid-state drive, but uses an SD cardfor booting and persistent storage. The Foundationprovides Debian and Arch Linux ARM distributions fordownload.Tools are available for Python as the main programminglanguage with support for BBC BASIC (via the RISC OSimage or the Brandy Basic clone for Linux), C, Java andPerl.

2. SYSTEM HARDWARE DESIGN:

The whole system is composed by following parts: animage capturing camera, Raspberry Pi board to run imagerecognition programs on it. DVI compatible monitors alsoconnected with this system during initial stages topreview the captured images and give the user indication.
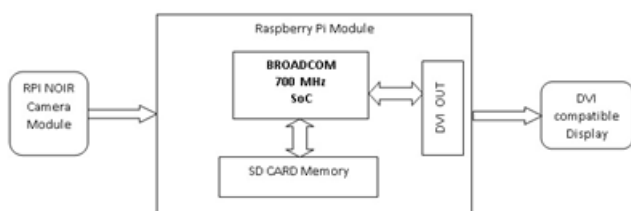
The system block diagram is shown in Figure 1.

Figure .5 System Block Diagram

2.1 RASPBERRY PI BOARD:

This board is the central module of the whole embeddedimage capturing and processing system as given in figure2. Its main parts include: main processing chip, memory,power supply HDMI Out, Ethernet port, USB ports andabundant global interfaces.

2.1.1 MAIN PROCESSING CHIP:

The main signal processing chip used in our system is aBroadcom 700MHz Chip in which CPU core is a 32 bitARM1176JZF-S RISC processor designed by AdvancedRISC Machines, Ltd. It has very rich peripheral. Thismain processing chip connects a camera and displayunits.
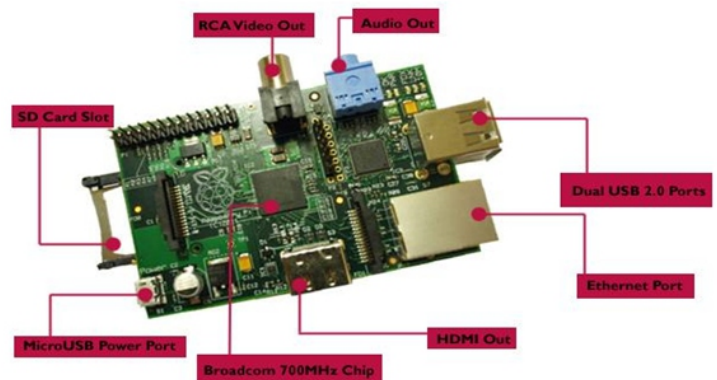
2.1.2 MEMORY:

The design does not include a built in hard disk or solidstate drive, instead relying on an SD card for booting andlong term storage. This board is intended to run Linuxkernel based operating systems. This Raspberry Pimodule has a Samsung class 4 micro SD card preloadedwith the official Raspberry Pi NOOBS (New Out of BoxSoftware) package, and a beautifully screen printed MicroSD card adaptor.

2.1.3 INTERFACES:

Plenty of interfaces are contained on the Raspberry Piboard, including 2 USB ports through which a Keyboardand mouse can be connected, a HDMI out for connectingHD TVs and monitors with HDMI input or HDMI to DVIlead for monitors with DVI input. Other peripherals likeA standard RCA composite video lead to connect toanalogue display if HDMI output is not used.

Ethernetport is used for networking even though it is optional,although it makes updating and getting new software forRaspberry Pi board much easier. An Audio lead is alsoprovided for getting the stereo audio if HDMI is not used,otherwise HDMI will get digital audio with it.

CAMERA INTERFACE:

The camera module used in this project is RPI NOIR-CAMERA BOARD i.e. Raspberry Pi No IR camera boardas shown in the Figure 3. The camera plugs directly intothe CSI connector on the Raspberry Pi. It's able to deliverclear 5MP resolution image, or 1080p HD video-recording at 30fps. The module attaches to Raspberry Pi,by way of a 15 pin Ribbon Cable, to the dedicated 15 pinMIPI Camera Serial Interface (CSI), which was designedespecially for interfacing to cameras.

The CSI bus iscapable of extremely high data rates, and it exclusivelycarries pixel data to the BCM2835 processor.This camera board which has no infrared filter making it perfect for taking infrared photographs or photographingobjects in low light (twilight) conditions. Other featuresof this camera board areAutomatic image control functions ,Programmablecontrols for frame rate 32 bytes of embedded one timeprogrammable (OTP) memory and Digital video port(DVP) parallel output interface Excellent.
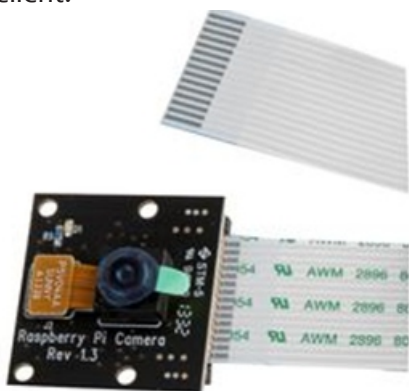

Figure 3 Raspberry Pi NoIR camera board

4. METHODOLOGY OF WORK:

The system designed system can be operated in twodifferent sessions, ie one for capturing and creating a database and the other session is to capture the image andwhich can be used for identifying or comparing theimages in the database.

Here in the second session we use Eigen faces methodology of face recognition for findingthe matches.

5. FUTURE APPLICATIONS:

To date, exploitation of smart camera technology hasbeen mainly for industrial vision systems, but a cross-overis just starting to take place. Camera technology willbegin to enter new plications, for example, in thesecurity and access control markets, in the automotiveindustry, for collision avoidance, and even – one day – forthe toy industry.Even our automobiles may soon be outfitted withminiature eyes.

Built into a cruise control system, forinstance, such a camera would suddenly alert the driver ifit noted a rapidly decelerating vehicle. The cameras couldalso take the place of the rear view and side-view mirrors,thereby eliminating dangerous blind spots and - in theevent of an accident – recording the seconds prior to acollision.

Another example would be with intelligent lifts. An officeblock, with many lifts and floors, may see a lot of peopletravelling up and down between floors, particularly athigh traffic times such as early morning or end of theworking day. At the moment, lifts are called by somebodypressing a Button and putting in a request for the lift tostop at a particular floor.

Connected with smart cameratechnology, lifts could be routed on demand, workingintelligently, stopping only when there was a pre-setnumber of passengers waiting at a floor – and missing outa floor if too many people were waiting to meet themaximum capacity of the lift.

6. CONCLUSION:

It's a progress of realizing embedded imagecapturing-system. We describe our design method in this paper. Based on these methods, we design the experimentalprototype of the embedded image capturing system withRaspberry Pi system. This system is smaller, lighter andwith lower power consumption, so it is more convenientthan the PC-based face recognition system. ecause of theopen source code, it is freer to do software developmenton Linux. Experimental results show that it's an effectivemethod of using Raspberry Pi board to actualizeembedded image capturing system.
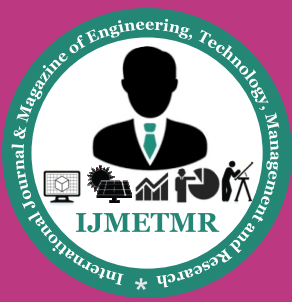
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