IJIREEICE

ISSN (Online) 2321 – 2004
ISSN (Print) 2321 – 5526

International Journal of Innovative Research in
Electrical, Electronics, Instrumentation and Control Engineering
ISO 3297:2007 Certified
Vol. 4, Issue 11, November 2016

Design & Implementation of Secure Provenance Transmission for Streaming Data

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Abstract: In this paper, a solution about secure provenance transmission for streaming data which is introduced based on Raspberry Pi processor, is presented. The embedded system, video capture, and video monitor are introduced. Video 4 Linux is used to get the camera video data, which is transferred to the Web Server, and the data is displayed on the client browser. The main aim of this paper is to design a system that has a USB camera, which continuously captures videos of the people then processes the captured videos via USB host to the Raspberry Pi to display it on the display device unit, and the parallel connection of Ethernet module, web page is created on the remote PC using HTTP protocol because HTTP protocol provides secure data transmission. And for more security we are creating some IP address to view the live streaming data on remote PC and when the person appears in front of camera the processor collects the information and stores temporarily in the database to check or recognize, is this person the right person to use or not. Compared with video capture system based on digital signal processor(DSP), this system has the advantage of fewer modules, lower cost, higher intelligence, higher system stability, and higher security. The design of system presented in this paper will integrate ARM11, USB cam, Remote PC, Display Monitoring unit, and Ethernet. The entire process proves continuous, and a surveillance secured system.

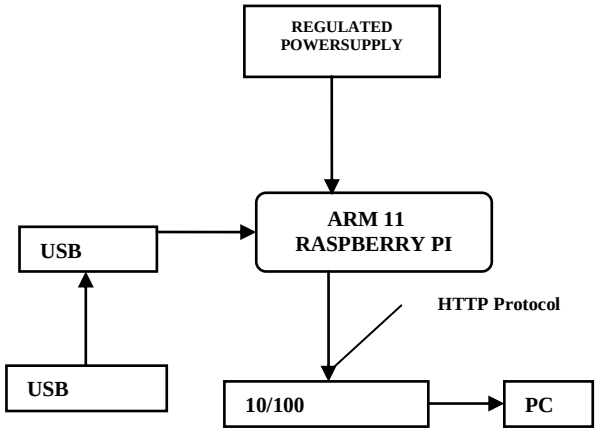
Keywords: Security, Raspberry Pi (ARM11), Ethernet, HTTP.

I. INTRODUCTION

The word provenance is used synonymously with the word lineage in the database community. It is also sometimes referred to as source attribution or source tagging. Provenance means origin or source. The rapid growth of the Internet, embedded systems and sensor networks technology has greatly contributed to the wide development of streaming applications. Examples include real-time financial analysis, location-based services, control of automated systems, stock market. This diversity of data sources accelerates the importance of data provenance to ensure secure and predictable operation of the streaming applications. Data provenance is considered as an effective tool for evaluating data trustworthiness, since it summarizes the history of the ownership and the actions performed on this data. As an example considered, a battlefield surveillance system gathers enemy locations from various sensors deployed in vehicles, air-crafts, satellites etc., and manages queries over these data. Now a days research peoples mostly prefer data mining applications that are used in so many areas such as web service, communication and security in surveillance systems. In this paper, we use high performance Raspberry Pi processor. Video data is captured from a USB camera, the captured data is sent to Raspberry Pi board via USB cable which consists of ARM processor and transferred over Internet through Ethernet and then the monitor client will receive the compressed data frame to restructure, and recompose video images by using HTTP protocol.

II. PROPOSED METHOD

The proposed method is used to overcome the drawback present in existing method. The design for the video encoding system involves various aspects such as the selection of the hardware platform and the embedded operating system (Raspbian). The development board with ARM architecture is selected as the hardware platform. Start-up codes, OS kernel and user's application programs are together stored in a NAND FLASH (a Memory Card). Application programs run in 64MB SDRAM, which can also be used as the room of various data and the stack. A CMOS camera capturing videos is connected to a USB interface in the board.



DOI 10.17148/IJIREEICE.2016.4116

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This system is used to design capturing &continuous streaming of videos like live cricket matches etc. capturing these live data and videos are stored inside internet by using HTTP protocol.

III. HARDWARE DESIGN OF PORTABLE DEVICE

1. USBCAMERA:
A webcam or USB camera is a video camera that feeds its image in real time to a computer or computer network. Unlike an IP camera which uses a direct communication using Ethernet or Wi-Fi, a USB camera is generally connected by USB cable, FireWire cable, or similar cable.

2. RASPBERRY PI:
The Raspberry Pi is a low cost, credit-card sized computer that plugs into a computer monitor or TV, and uses a standard keyboard and mouse. It is a capable little device that enables people of all ages to explore computing, and to learn how to program in languages like Scratch and Python. It's capable of doing everything you'd expect a desktop computer to do, from browsing the internet and playing high-definition video, to making spreadsheets, word-processing, and playing games.
In the proposed system, secure provenance transmission for streaming data system we, used the Raspberry Pi. It is a credit-card sized single board computer developed in the UK by the Raspberry Pi foundation. The Raspberry Pi has Broadcom BCM2835 system on chip (SoC), which includes an ARM1176JZF-S 700 MHz processor. Video Core IV GPU, and was originally with 256 megabytes of RAM, later upgraded to 512 MB. It does not include a built in hard disk or solid state drive, but uses an SD Card for booting and long term storage.

The Raspberry Pi has the ability to interact with the outside world, and has been used in a wide array of digital maker projects, from music machines and parent detectors to weather stations and tweeting birdhouses with infra-red cameras. We want to see the Raspberry Pi being used by kids all over the world to learn to program and understand how computers work.

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3. Processor / SoC (System on Chip):
The Raspberry Pi has a Broadcom BCM2835 System on Chip module. It has an ARM1176JZF-S processor.
The Broadcom SoC used in the Raspberry Pi is equivalent to a chip used in an old smartphone (Android or iPhone).While operating at 700 MHz by default, the Raspberry Pi provides a real world performance roughly equivalent to the 0.041 GFLOPS. On the CPU level the performance is similar to a 300 MHz Pentium II of 1997-1999, but the GPU, however, provides 1 GPixels/s, 1.5 GTexel/s or 24 GFLOPS of general purpose compute and the graphics capabilities of the Raspberry Pi are roughly equivalent to the level of performance of the Xbox of 2001. The Raspberry Pi chip operating at 700 MHz by default, will not become hot enough to need a heat-sink or special cooling.

4. Power source:
The Raspberry Pi is a device which consumes 700mA or 3W of power. It is powered by a MicroUSB charger or the GPIO header. Any good smartphone charger will do the work of powering the Pi.

5. SD Card:
The Raspberry Pi does not have any onboard storage available. The operating system is loaded on a SD card which is inserted on the SD card slot on the Raspberry Pi. The operating system can be loaded on the card using a card reader on any computer.

6. GPIO:
GPIO – General Purpose Input Output
General-purpose input/output (GPIO) is a generic pin on an integrated circuit whose behaviour, including whether it is an input or output pin, can be controlled by the user at run time.
GPIO pins have no special purpose defined, and go unused by default. The idea is that sometimes the system designer building a full system that uses the chip might find it useful to have a handful of additional digital control lines, and having these available from the chip can save the hassle of having to arrange additional circuitry to provide them.

GPIO capabilities may include:
• GPIO pins can be configured to be input or output
• GPIO pins can be enabled/disabled
•Input values are readable (typically high=1, low=0)
•Output values are writable/readable
•Input values can often be used as IRQs (typically for wakeup events)

The production Raspberry Pi board has a 26-pin 2.54 mm (100 mills) expansion header, marked as P1, arranged in a 2x13 strip. They provide 8 GPIO pins plus access to I²C, SPI, UART, as well as +3.3 V, +5 V and GND supply lines. Pin one is the pin in the first column and on the bottom row.

7. DSI Connector:
The Display Serial Interface (DSI) is a specification by the Mobile Industry Processor Interface (MIPI) Alliance aimed at reducing the cost of display controllers in a mobile device. It is commonly targeted at LCD and similar display technologies. It defines a serial bus and a communication protocol between the host (source of the image data) and the device (destination of the image data).

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A DSI compatible LCD screen can be connected through the DSI connector, although it may require additional drivers to drive the display.

8. RCA Video:
RCA Video outputs (PAL and NTSC) are available on all models of Raspberry Pi. Any television or screen with a RCA jack can be connected with the Raspberry Pi.

9. Audio Jack:
A standard 3.5 mm TRS connector is available on the Raspberry Pi for stereo audio output. Any headphone or 3.5mm audio cable can be connected directly. Although this jack cannot be used for taking audio input, USB mics or USB sound cards can be used.

10. Status LEDs:
There are 5 status LEDs on the Raspberry Pi that show the status of various activities as follows:
"OK" - SD Card Access (via GPIO16) - labelled as "OK" on Model B Rev1.0 boards and "ACT" on Model B Rev2.0 and Model A boards
"POWER" - 3.3 V Power - labelled as "PWR" on all boards
"FDX" - Full Duplex (LAN) (Model B) - labelled as "FDX" on all boards
"LNK" - Link/Activity (LAN) (Model B) - labelled as "LNK" on all boards
"10M/100" - 10/100Mbit (LAN) (Model B) - labelled (incorrectly) as "10M" on Model B Rev1.0 boards and "100" on Model B Rev2.0 and Model A boards

11. USB 2.0 Port:
USB 2.0 ports are the means to connect accessories such as mouse or keyboard to the Raspberry Pi. There is 1 port on Model A, 2 on Model B and 4 on Model B+. The number of ports can be increased by using an external powered USB hub which is available as a standard Pi accessory.

12. Ethernet:
Ethernet port is available on Model B and B+. It can be connected to a network or internet using a standard LAN cable on the Ethernet port. The Ethernet ports are controlled by Microchip LAN9512 LAN controller chip.

13. CSI connector:
CSI – Camera Serial Interface is a serial interface designed by MIPI alliance aimed at interfacing digital cameras with a mobile processor.
The Raspberry Pi foundation provides a camera specially made for the Pi which can be connected with the Pi using the CSI connector.

14. JTAG headers:
JTAG is an acronym for 'Joint Test Action Group', an organization that started back in the mid 1980's to address test point access issues on PCB with surface mount devices. The organization devised a method of access to device pins via a serial port that became known as the TAP (Test Access Port). In 1990 the method became a recognized international standard (IEEE Standard 1149.1). Many thousands of devices now include this standardized port as a feature to allow test and design engineers to access pins.

15. HDMI:
HDMI – High Definition Multimedia Interface.
HDMI 1.3 a type A port is provided on the Raspberry Pi to connect with HDMI screens.

IV. SOFTWARE DESIGN

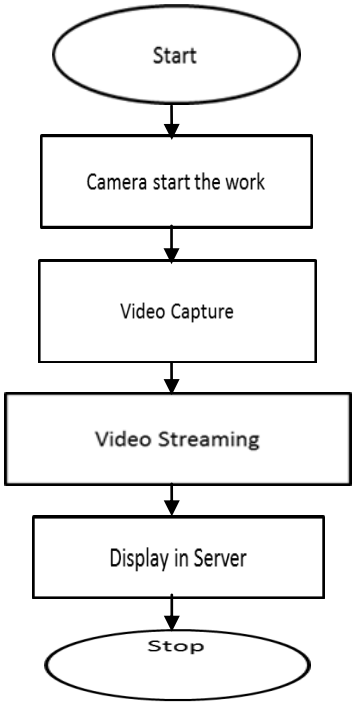

Fig 2: Flow Chart of Software System

V. EXPERIMENTAL RESULTS

Secure provenance transmission for streaming data using Raspberry Pi ARM1176JJZF-S 700 MHz processor was implemented successfully. We can see the results of the project as shown in figures. Figure 3 shows snap shot of the overall project secure provenance transmission for streaming data.

Fig 3: Snapshot of hardware kit

After switch on the power supply, USB camera continuously capturing the video and it is stored in

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Raspberry Pi and the raspberry pi acts as a server and the video displayed in remote PC by using HTTP protocol. The processed stream data packets are uploaded into server using HTTP protocol and transmitted through Ethernet cable, so that user inputs the corresponding IP address http://192.168.1.105/.html which is specific to router and then webpage is opened and the login page created with user name and password. If you entered correct login details it will open and video displayed. Otherwise incorrect login details message displayed.

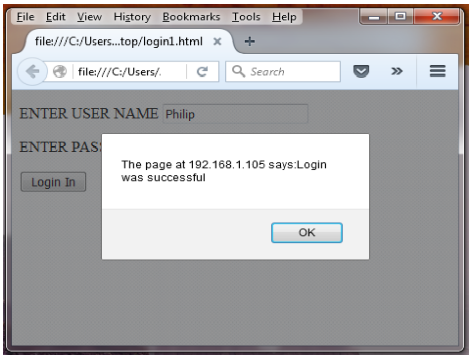

Fig 4: Login details on the webpage

After entering login details correctly then the webpage is opened and the output of video is streaming as shown in below figure 5.

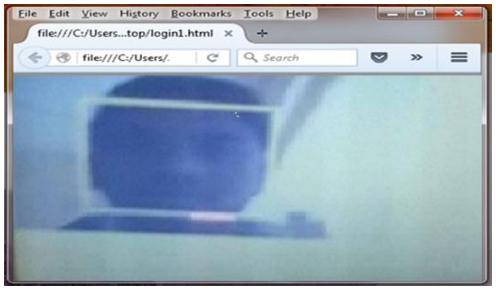

Fig 5: The output video streaming

VI. CONCLUSION

The system "Secure provenance transmission for streaming data system" has been successfully designed, developed and tested. It has been developed by integrating features of all the hardware components and software used. Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit. Secondly, using highly advanced ARM board and with the help of growing technology, the system has been successfully implemented.

ACKNOWLEDGMENT

We express our sincere gratitude to **Prof. Mohd. Muzaffar Ahmad**, Electronics & Communication Engineering Department, Nawab Shah Alam Khan College of Engineering& Technology, Hyderabad, for extending his valuable insight for completion this work.

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BIOGRAPHIES

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