A Novel Technique to Secure Data using IOT and Raspberry Pi

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Abstract - Security has become an important issue everywhere. Nowadays IOT based security is necessary as the possibilities of intrusion are increasing day by day. This system is a low cost, flexible control and monitoring system using an embedded server with IP connectivity and remotely using an application or simulator. This system provides essential security to our home and other control applications. The system captures information and transmits the live video streams via Wi-Fi module to a Smart phone personal application by using web. This system operates and controls motion detectors, live video streams and records it for future use.

Keywords- IOT, Raspberry Pi, Wi-FI.

I.   Introduction

Information Technology is present everywhere and plays a very dynamic role in the progress and economic development of country. We are using applications in number like banking, tourism, e-commerce, agriculture etc. and the modern trend is combination of both hardware as well software. IOT is a new trend in which hardware is controlled by applications or apps across the word using the prime network commonly known as Internet. In this research paper I am focusing on how to implement Raspberry Pi based security system instead of traditional CCTV based security system. Monitoring facilities will be necessary and useful for our daily life, because it is very important for us to think about our security. Our developed system, which is organized with an integrated web server, highly secured cameras, Wi-Fi devices are connected to the internet. A specific server is located in the center of our system, which is called Integrated Server, which periodically obtains videos from some security cameras through the private network. Such videos are transmitted from the cameras to the server. The Integrated Server requires network cameras to transmit video at a sampling rate and compresses the video to MPEG then accumulates a series of them in the storage. The system captures information and transmits the live video streams via Wi-

Fi wireless transceiver for IoT module to a Smart phone personal application by using the web. Starting from small houses to huge industries, surveillance plays very vital role to fulfill our safety aspects as Burglary and theft have always been a problem. In big industries personal security means monitoring the people's changing information like activities, behavior for the purpose of protecting, managing and influencing confidential details.

II.   Enabling Technologies

Internet of Things has a strong backbone of various enabling technologies- Wireless Sensor Networks, Cloud Computing, Big Data, Embedded Systems, Security Protocols and Architectures, Protocols enabling communication, web services, Internet and Search Engines.

Wireless Sensor Network (WSN): It consists of various sensors/nodes which are integrated together to monitor various sorts of data.

Cloud Computing: Cloud Computing also known as on-demand computing is a type of Internet based computing which provides shared processing resources and data to computers and other devices on demand. It can be in various forms like IaaS, PaaS, SaaS, DaaS etc. Big Data Analytics: Big data analytics is the process of examining large data sets containing various forms of data types—i.e. Big Data – to uncover hidden patterns, unknown correlations, market trends, customer preferences and other useful business information.

Communication Protocols: They form the backbone of IOT systems to enable connectivity and coupling to applications and these protocols facilitate exchange of data over the network as these protocols enable data exchange formats, data encoding and addressing.

Embedded Systems: It is a sort of computer system which consists of both hardware and software to perform specific tasks. It includes microprocessor/microcontroller, RAM/ROM, networking components, I/O units and storage devices.

III.   The Raspberry Pi

Raspberry Pi is a computer, the size of a credit card, which was designed to promote the training on computer programming skills and the understanding of computer hard-ware in schools. Due to its size and accessibility in price, it was adopted by users for projects that required more than a primary microcontroller. Raspberry pi has computer capabilities. It plugs into a TV or a keyboard and is used in electronics projects and desktop PC for spreadsheets, browsing the internet, playing games, and word processing. Raspberry Pi comes with a free operating system called Raspbian which is a version of Debian and is optimized for the hardware components of the system.

Raspberry pi board contains Random Access Memory (RAM), Central Processing Unit (CPU)/ Graphics Processing Unit (GPU). Additionally, it includes a port for Ethernet connection, XBee socket, UART, GPIO pins and a connector to the power source. The critical hardware specifications for raspberry pi include keyboard, monitor, SD card containing Linux Operating Systems, video cable and power supply. Other hardware devices that may be used include internet connection, USB mouse, case, and powered USB hub. Raspberry Pi comes in various models, i.e. Raspberry Pi 3, Raspberry Pi 2, Raspberry Pi Zero and Raspberry Pi 1. Model B Raspberry Pi hardware is represented in the following figure.
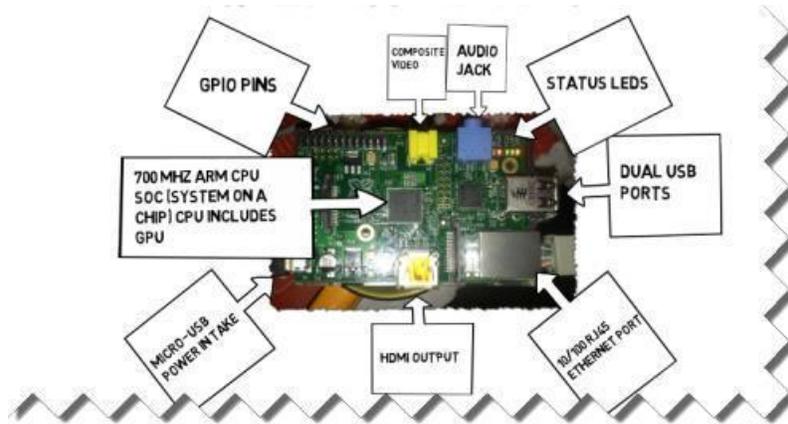
Model B hardware of Raspberry Pi

IV. Our Model

The aim is to make a smart security system which can be monitored by owner remotely through a simulator based application. As it is connected with the system with IOT, system will send the push notification to device when an intrusion is detected. It is required to develop and implement and affordable low cost web-camera based surveillance system for remote security monitoring. Authorized user can access to their monitoring system remotely via internet with the use a mobile phone and monitor the situation on application. This entire work is done on raspberry pi with Raspbian operating system ported on it. Surveillance System consists of mainly two parts:

1. **Hard-wired surveillance systems:** These systems use wires to connect the cameras, motion detectors, power supply and LAN cable with the pi.

2. **Remote Access Systems:** These systems have the capability to monitor and control a security system from a location away from the surveillance area through android device.

3. **USB Camera:** USB Camera captures the image and sends it to the USB port of the Raspberry Pi board. The camera model used here is USB Camera model 2.0.

4. **Raspberry Pi:** Raspberry pi is a small credit card sized computer capable of performing various functionalities such as in surveillance systems, military applications, etc.

5. **Android device:** To view the captured images remotely and also receive the notification message.

6. **PIR sensor:** Detect the motion in surveillance area.

7. Pushetta Simulator: Sending notification with embedded system was a problem with few solutions, widespread was SMS but other side there are some issues of extra payment, limited number of data, etc. Pushetta provide push notification from cloud after getting registered on Pushetta website. After registering it requires System requires 650 mA@5v power supply and internet. System works on Raspbian Os and image is captured through Opencv and programming is done in python scripting language. So for capturing images and interfacing, lots of packages need to be installed on Raspbian. Whenever PIR sensor detects any intrusion it will send positive signal to the raspberry pi GPIO pin. Pi senses the signal and send the output signal to USB camera for capturing image. Temporarily image is stored in raspberry SD card along with that it will send one notification message to user's device through internet.

V.   Methodology

Hardware Synchronization

Camera Attachment

In this step camera is fixed on Raspberry Pi as shown below:
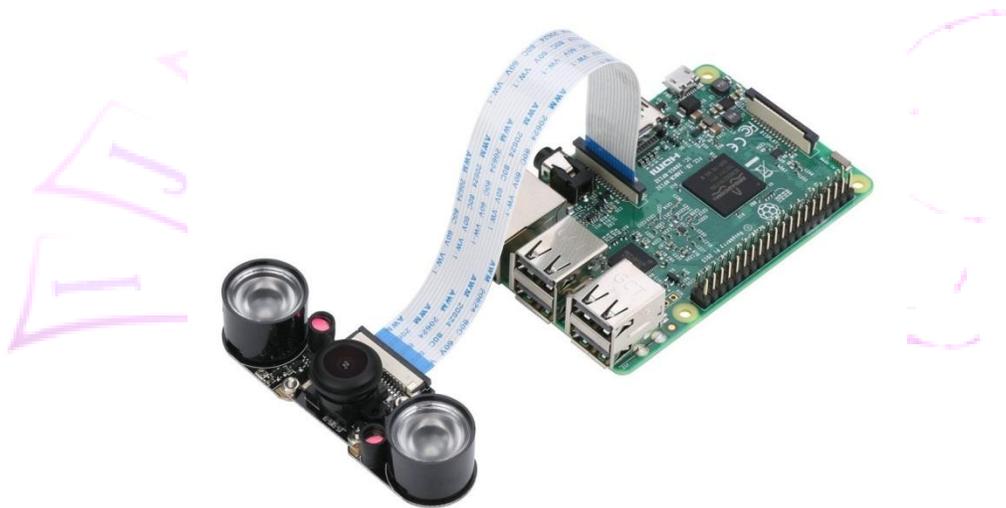

Raspberry pi and camera

Image Capture

Upon confirmation of intrusion of a human in the field of view of the sensor, the Passive Infrared sensor triggers the pi camera through the Raspberry pi. RPI directs instructions to the pi camera to click the picture and consequently save it. While capturing the image, the pi camera records video of the occurrence and keeps it with a name containing the date and time of entry. Below in figure is a captured image by the surveillance

Raspberry Pi Configuration

This step involves configuration of Raspberry Pi as shown below:
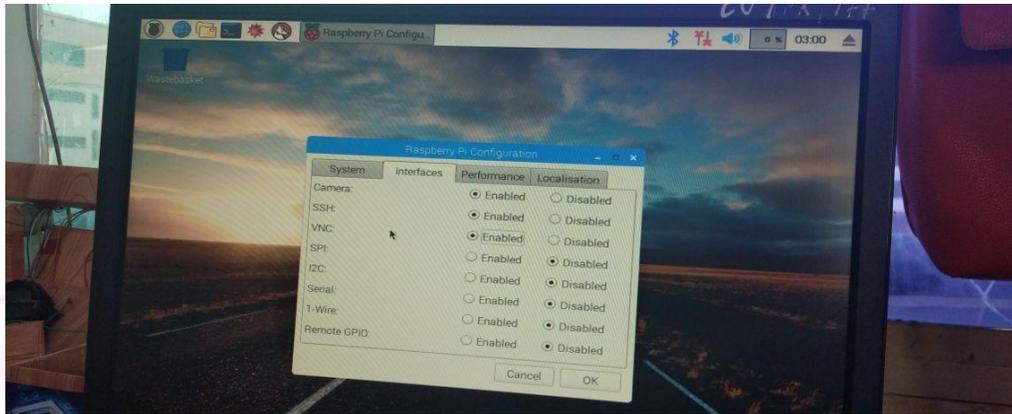
Raspberry pi Configuration

Displaying image:

In this step the screen is configured with another Raspberry Pi which displays the clone of captured image in an encrypted format as shown below:

VI.   Conclusion

The proposed system is highly customizable and very useful tool for present times. The development of this concept is done on the Raspberry pi as it offers customizable GPIO ports which help in an easy interface. The smart security system is capable of recording/capturing video/image and transmitting to a smart phone. It is advantageous as it offers reliability and privacy on transmitter and receiver sides. It is authenticated and encrypted on the receiver side; hence it offers only the concerned person to view the details .Necessary action can be taken in a short span of time in the case of emergency conditions such as an elderly person falling sick, military areas, smart homes, offices, industries, etc.

VII.   References

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