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Cloud Controlled Intrusion Detection and Burglary Prevention Stratagems in Home Automation Systems

Sindhulakshmi.K¹, Soundarya.J², Sowmya.U³

Abstract— we have proposed to remotely monitor security surveillance system through cloud computing using any Internet enabled device. As soon as an intrusion is detected, an SMS alert is given to the user and the user can view the video of the intruded room and secure his house by giving an alert to the neighborhood. The user can monitor the intrusion from anywhere, on any internet enabled device by accessing the cloud's web interface. If the intrusion is genuine, the user is provided with the options to stealthily alert neighbours, play alarm sounds and report to the police. Thus, theft can be prevented. Thresholding algorithm along with OpenCV is used to split an image into smaller segments, or junks, using at least one color or gray scale value to define their boundary.

Index Terms—Cloud computing, OpenCV, Security surveillance system, Thresholding algorithm.

I. INTRODUCTION

Home automation offers comfort and security. Home surveillance systems are being used for more than three decades. Many improvements have been made in the system and now it is yet to be commercialized due to the High cost of server usage [1]. This study combines the use of Cloud computing and image processing. The standard cloud computing model is in which we make our services available to the general public over the Internet as long as they use our web interface [2]. It emphasizes in enhancing home security using cloud computing technology. Cloud computing offers remote services with a user's data, software and computation. End users access cloud-based applications through a web browser or a light-weight desktop or mobile app while the business software and user's data are stored on servers at a remote location [3]. Its usage is very much needed for safety and security. This technology is used to detect an intruder at home when nobody is present. As soon as the intruder is in, the controller captures the video and sends it to the user and in turn he/she receives an SMS alert and is ready to watch the video of the intruded room through any remote device.

II. RELATED WORK

Digital video recorder (DVR) captures videos continuously but it requires some human resource to monitor it which is applicable only in organizations and business areas whereas this will not be suitable for a home environment. If any motion is detected by the camera, it will be sent to the controller. Controller analyses the signal and processes it by using thresholding algorithm [4]. By using LAN connection in the room, it can be transferred to the cloud server and stored in it. To inform the status of the room, the user will be receiving the SMS alert in his/her mobile. So, user can view the video of the intruder by entering the URL of the server using internet connection anywhere from the world. If an alert is to be given, the alert button on the page can be clicked so that the alarm rings. Alert is also sent to the nearby police station to protect the house.

Cloud computing (or simply cloud) refers to the online services provided over the Internet together with the hardware and software resources of the server that offer those services. A SMS modem connected to the cloud server is used to notify the users, in case of intrusion events [5]. A schematic diagram of how a user is notified and how he/she controls and monitors the security surveillance system via the cloud services is illustrated in the diagram. The figure 1 portrays a direct connection of all boards (nodes) to the cloud over Internet which may or may not be through thread-hoc wireless network gateway, depending on configuration.

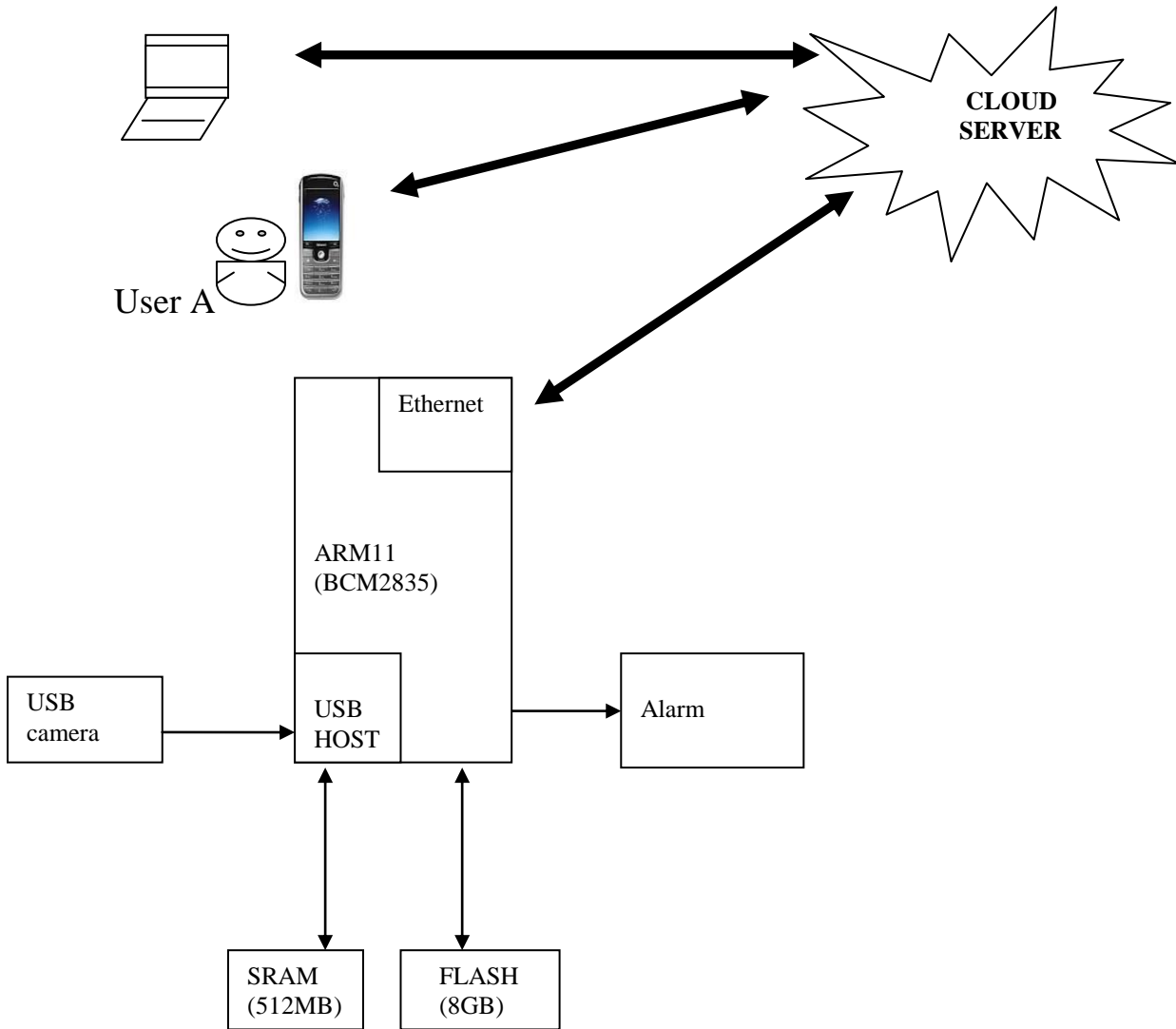


Fig 1. Structure of the cloud model

III. PROCESS INVOLVED

Home Automation and Security using Cloud computing is performed by capturing the image and then processing it accordingly. A Camera placed in a room records the image of that room and the captured image is named as the original image, I1 [6]. The resolution of the image is varied according to the specification of the camera. Resizing the image is performed and the resolution of the resized image must be 320*440. The reference image, I2 is the initial stage of the room and it is adjusted according to the specification. The original image I1 is compared with the reference image I2 and the condition $I2 - I1 > 0$ is evaluated. Only if the above mentioned condition is true intrusion is detected else there is no intrusion. The process in figure 2 confirms intrusion.

The intruded image is stored in the server page of the cloud systems. The Internet Protocol Address (IP Address) of the cloud server is 10.0.0.254 and the intruded image is stored here. The User receives a message stating that house is under intrusion and he/she receives it as "Person in Home". The User can view the video of the room and the intruded person by visiting the user's IP Address. The User's IP Address is 10.0.0.17. The User views the video of the intruded room and if it's a valid intrusion, an alarm bell rings to caution the neighbors' and a message is sent to the neighbor's and police immediately stating that "Intrusion Detected". Figure 3 shows the process 2.

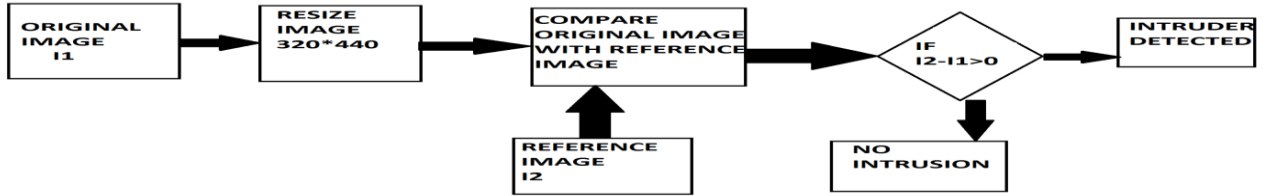


Fig 2.Process 1

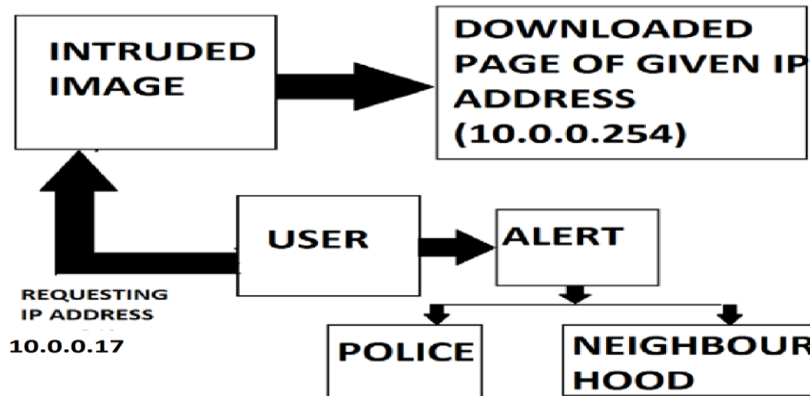


Fig 3.Process 2

IV.THRESHOLDING ALGORITHM

Thresholding algorithm is used for image segmentation. The gray scale image has a very low threshold value. It is also known as template matching algorithm. It is used in finding small parts of image to match the template image. Large number of sample points can be reduced by reducing the resolution of the search and template image. It uses a mask for specific feature of search image and it is performed by gray image or edge image. Typically, an object pixel is given a value of “1” while a background pixel is given a value of “0”. Finally a binary image is created by coloring each pixel white or black, depending on a pixel’s labels [7]. The gray and binary image are represented in figure 4 and 5. Figure 6 shows the view of capturing an intruder’s image.



Fig 4.Gray image



Fig 5.Binary image



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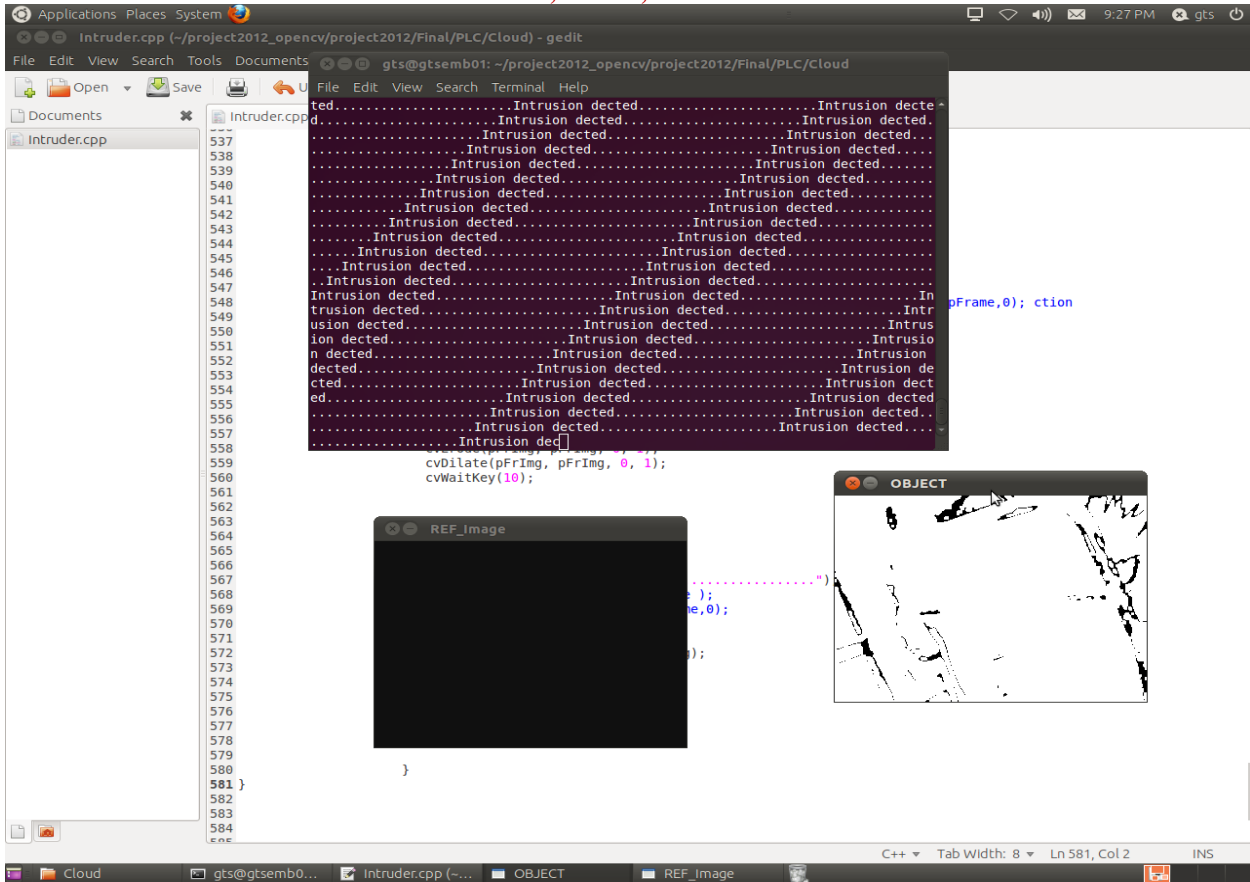


Fig 6. Reference image and an intruder's image

V. HARDWARE AND SOFTWARE DESCRIPTION

A. Arm processor

Embedded systems contain processing cores that are either microcontrollers or digital signal processors. ARM 11 Processor includes media instructions, multiprocessor support and new cache architecture. Micro architecture improvements in ARM11 cores include SIMD instructions which can double MPEG-4 and audio digital signal processing algorithm speed. Cache is physically addressed, solving many cache aliasing problems and reducing context switch overhead, Unaligned and mixed-endian data access is supported, Reduced heat production and lower overheating risk, Redesigned pipeline, supporting faster clock speeds (target up to 1 GHz), Dynamic branch prediction/folding, Cache misses don't block execution of non-dependent instructions, Load/store parallelism, ALU parallelism, 64-bit data paths. The camera has 1.3 mega pixels and captures 30 frames per second and has a resolution of 640*480. The image from the camera undergoes VGA scanning.

B. IC LAN 9512

The LAN9512 is a high performance Hi-Speed USB 2.0 hub with a 10/100 Ethernet controller. It is a low cost USB/Ethernet and has a USB/USB connectivity solution. It implements Reduced Power Operating Modes and, uses single 25 MHz crystal and built-in Power-On-Reset (POR) circuit with Universal Serial Bus Specification.



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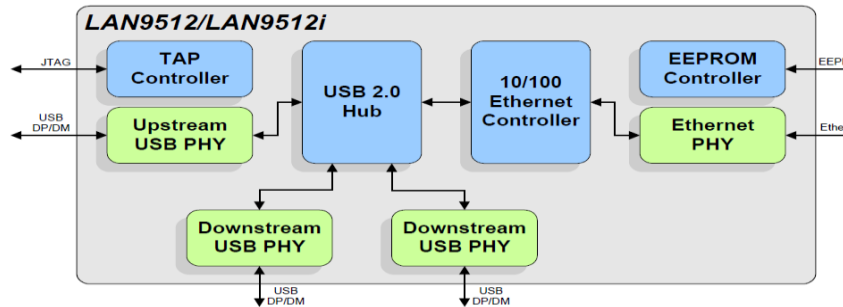


Fig 7.High performance LAN

The hub supports Low-Speed, Full-Speed and High-Speed (if operating as a High-Speed hub) downstream devices on all of the enabled downstream ports. A dedicated Transaction Translator (TT) is available for each downstream facing port. This architecture ensures maximum USB throughput for each connected device when operating with mixed-speed peripherals. All required resistors on the USB ports are integrated into the hub. This includes all series termination resistors on D+ and D- pins and all required pull-down and pull-up resistors on D+ and D- pins.

C. Apache tomcat

Apache Tomcat is an open source web server and servlet container developed by the Apache Software Foundation (ASF)[8].Tomcat implements the Java Servlet and the Java Server Pages (JSP) specifications from Sun Microsystems, and provides a "pure Java" HTTP web server environment for Java code to run. The components of apache tomcat are Catalina (servlet container), Coyote (an HTTP connector) and Jasper (a JSP engine).Apache Tomcat Server mainly runs only on a Java platform [9].

D. Embedded Linux

Embedded Linux typically refers to a complete system, or in the context of an embedded Linux vendor, to a distribution targeted at embedded devices. Although the term "embedded" is often also used in kernel discussions there is no special form of the Linux kernel targeted at embedded applications. [10] Instead, the same Linux kernel source code is intended to be built for the widest range of devices, workstations, and servers imaginable, although obviously it is possible to configure a variety of optional features according to the intended use of the kernel. For example, your embedded device will feature 128 processors and terabytes of memory, and so it is possible to configure out support for certain features typically found only on larger Linux system [11].

E. OpenCV

OpenCV is released under a BSD license and hence it's free for both academic and commercial use. It has C++, C, Python and Java interfaces and supports Windows, Linux, Android and Mac OS. OpenCV was designed for computational efficiency and with a strong focus on real-time applications. Written in optimized C/C++, the library can take advantage of multicore processing. Adopted all around the world, OpenCV has more than 47 thousand people of user community and estimated number of downloads exceeding 5 million. Usage ranges from interactive art, to mines inspection, stitching maps on the web or through advanced robotics. 2D and 3D feature toolkits, Facial recognition system, Gesture recognition, Human-computer interaction (HCI), and Mobile robotics.

VI. CONCLUSION

The use of cloud services in home automation devices has many benefits extending from cost reduction to value added services. Cloud services can also be implemented for few more services like cloud based power scheduling system, a cloud based music player and many more. By using cloud services in home automation and security, we can reduce the cost of surveillance systems, can easily detect any intrusion in house, easily informs to the neighborhood and alerts police. Audio can be implemented. Alert system can be made more effective by sending it to a group of people.

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AUTHOR BIOGRAPHY

1. **Miss.K.Sindhulakshmi** currently pursuing Masters in Embedded systems and technologies in Easwari Engineering College, Chennai, Tamil Nadu, India.
2. **Miss.J.Soundarya** currently pursuing her Masters in VLSI in Sri Shakthi Institute of engineering and Technology, Coimbatore, Tamil Nadu, India.
3. **Miss.U.Sowmya** currently pursuing her Executive postgraduate programme in financial services and it assurance in Loyola Institute of Business Administration, Chennai, Tamil Nadu, India.