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# A Mobile Phone- Embedded Real-Time Remote Video Surveillance System With Network Camera Using Arm

**P.Vamsi Krishna**
M.Tech student
PKSK college
ECE.Dept

**K.Venkateswarlu Reddy**
ASSOC.prof
PKSK college
ECE.Dept

**Abstract:-**

**Monitoring facilities will be necessary and useful for our daily life, because it is very important for us to think about our security. This work developed an remote video surveillance system, which is organized with an integrated web server, network cameras, remote control devices and clients which connected to internet. Some kinds of devices can be used as our clients , for example, high-performance mobile phones, which are equipped with web-browsing facility or mobile phones with Wi-Fi connectivity. An specific server is located in the center of our surveillance system, which is called integrated server. It can obtain video from network cameras and then compress that video. They can accumulated as MPEG video temporally into the internal buffer of the server, and stored into a video database. It can also receive some types of requests from clients, analyze them and perform several kinds of services such as monitoring, controlling and so on. Almost all software of the surveillance system is written in C programming language. With enhanced facilities for mobile phone, our system has been available for many applications. These entire work had done on ARM11 processor with linux operating system ported on it.**

**Keywords;** remote monitoring, remote controlling, mobile phone, video database, camera platform homing

## Introduction:

Monitoring facilities will be necessary and useful for our daily life, because it is very important for us to think about our security. From elementary schools to several companies, some kinds of surveillance systems have introduced in order to keep their security, even in Japan. People have the inclination to need higher-performance surveillance system with lower cost.

Security cameras and sensors are widely employed in the several areas and public environments[3][4]. So almost all users want to utilize them and obtain a useful information including video for our efficient determination as well as our risk aversion. We have already developed a remote surveillance system to perform remote monitoring and remote controlling services for not only system reliability and maintenance but also security improvement[6]. The previous version of our surveillance system was realized by means of well-known technologies. With such technologies, our surveillance system had been easily developed and modified in a relatively short time and then it had achieved high cost performance as result. Now, we have been improving and reconstructing functionality of our system. With some kinds of facilities such as database handling, video processing and remote control function, the new version of our surveillance system will be powerful and useful for several kinds of clients. Generally speaking, mobile computing devices, for example,high-performance mobile phones, will be able to provide remote monitoring and controlling services[2] In this paper, we will introduce our newly revised surveillance system, explain its monitoring and controlling services in the next section, describe the performance and evaluation of our system in the third section and illustrate some applications of it in the fourth section. Finally I will conclude my paper.

## II. SYSTEM CONFIGURATION AND FACILITIES

The system configuration and facilities are explained in this section. Monitoring and controlling are basic facilities of our surveillance system.

### A.Monitoring Facilities

An specific server is located in the center of our surveillance system, which is called *Integrated Server*. It can periodically obtain videos from some network cameras through the private network. Such videos are transmitted from cameras to the server. They are accumulated as MPEG video temporally into

the internal buffer of the server, reduced into a fourth and a ninth resized video data and finally stored into video database. Compression of video must be done, because some mobile devices allow only restricted amount of packet size between the server and themselves..The *Integrated Server* requires network cameras to transmit video at a sampling rate, receives such video as monitoring view, and compress the video to MPEG then accumulates a series of them in the storage. The server also prepares an applet on its homepage th rough its Web service, begins to run the process of HTTP daemon, waits for client's access from global network, receive a request from a client and then delivers such an applet to the target client..

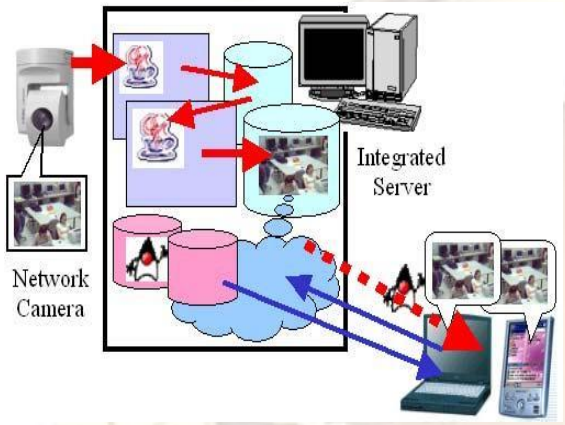



**Fig. 1**.Scheme of Remote Monitoring

Figure 1 shows a general scheme of remote monitoring provided by our surveillance system. At the side of client, the browser downloaded from the server provides a GUI service which communicate with the server to request transmitting MPEG video through HTTP connection and display received MPEG video file on the browser.

### A.Control Facilities

Remote control service seems to be essential for supplementing remote monitoring service and enlarging it into wide applications. Various control mechanisms have been proposed until now. We have employed power-switching facility as re- mote control. It is based on the Open PLANET technology[5]that has been developed by Shikoku Electric Power Company Ltd. It has some excellent characteristics, one of which is to transmit digital information from node to node through electric power line. The Open PLANET control server is connected to the integrated server in the private network. It works as a sub-server in our surveillance system. It has a dedicated interface to connect serially with the Electric Power Line Router (EPLR). It is the special-purpose microcomputer-based device, which can translate digital information into analog signal and mix it along electric power line. With EPLR, digital information of Open PLANET server can be carried to another computer only by means of electric power line. So we need not to equip additional cable to transmit digital information between controller and the target node to be controlled. Power Control Adaptor (PCA) is the special- purpose power outlet based on Open PLANET technology, which can turn on or off electric power according to analog control signal from remote controller via electric power line.

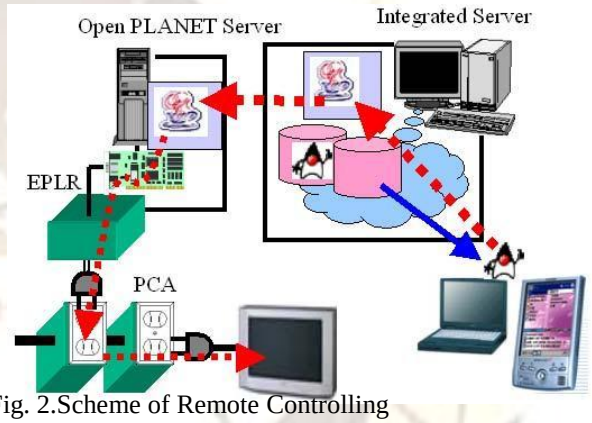



Fig. 2.Scheme of Remote Controlling

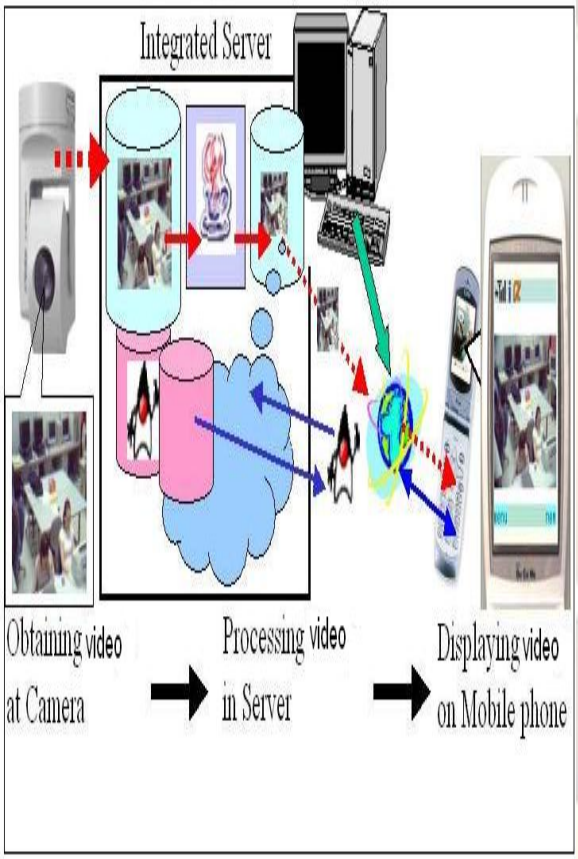
The Open PLANET server provides remote control facilities to perform electric power switching by means of transmitting control signal for digital information into PCA with EPLR. Our integrated server has a connection with the Open PLANET server, sends and receives socket based messages to/from such a server, and performs remote control service for electric power switching through private networking. Communication between our server and the Open PLANET server is carried out based on TCP/IP protocol. The Transmission Control Protocol/Internet Protocol (TCP/IP) suite has become the industry-standard method of interconnecting hosts, networks, and the Internet. As such, it is seen as the engine behind the Internet and networks worldwide. Although TCP/IP supports a host of applications, both standard and nonstandard, these applications could not exist without the foundation of a set of core protocols. The TCP/IP protocol suite is so named for two of its most important protocols: Transmission Control Protocol (TCP) and Internet Protocol (IP).

## III. SYSTEM PERFORMANCE AND EVALUATION

The performance and evaluation are described in this section. A new performance of the system includes GUI services for mobile phones and video processing for camera homing.

**A.GUI Service for Mobile Phones**

The clients can browse video obtained from network camera on their browser of PC through the integrated server. But it has seemed to be more effective and convenient for clients to browse such videos with their mobile phones because, for example, almost all people of Japan always carry their mobile phones together with them . It can be downloaded from a certain Web server and perform a mobile communication based on HTTP connection between




the server and mobile phones[1].

Fig. 3.Scheme of Monitoring video on a Mobile Phone

Figure 3 shows a sample view of monitoring video on a mobile phone, which is delivered from the integrated server. As there are some constraints on the video data size, which mobile phones can accept at the one time, for both of transmission and display of it, then our server must compress video from network camera into a suitable size for mobile phones and accumulate these videos in its storage for request of video delivery from mobile phones.

Enhancing The Functionality:

For enhance the functionality we are using GSM technology .At the remote Area we are using a motion sensor which sense Dynamic changes and inform Using GSM.. The information of such a situation for clients are sent with a warning message, so that they can enjoy personalized (or privacy-based) remote monitoring, especially, by means of the location-independent way in a case of mobile phone. Enhancement of our surveillance system can be realized and supported with the above structure and method.

2) Current State of Our surveillance system :At the present of our prototype system, the following services are available in our surveillance system.

1) video Transmission Service: A series of MPEG video file can be periodically taken by network cameras, trans-mitted into the integrated server, and accumulated with simple video resizing procedure in the storage of the server. Request to obtain the buffered video in the server causes transmission of such video into the browser of client PC, process videos and display videos on the browser .

2) Remote Control Service: The Open PLANET server can perform remote control for electrical device through electric power supply line. Our surveillance system has incorporated this server into the lower layer of the integrated server in the private network, which means that system permit no direct access into the Open PLANET server from global network. The integrated server communicates to the Open PLANET server and send request to control several kinds of electric device and appliance.

3) Display video on LCD of Mobile Phone: This facility is only available in the mobile phone (”keitai” of Japan) from the specific carrier, namely NTT DoCoMo. Although NTT DoCoMo is one of the major carrier of Japan, we must do best efforts for our system to be more applicable in order to utilize other types of mobile phone from other carriers. Current LCD size of mobile phone seems to be not suitable to display the video for remote monitoring.

## IV. APPLICATION OF OUR SYSTEM

Two Application examples are introduced in this section. One example is a remote monitoring service with our surveillance system. Another is a remote reservation service through mobile devices. These applications need the same monitoring function by means of mobile computing devices.

A Remote Monitoring of School for Distant Parents

All parents, who are working outside of home, are always interesting in and thinking of their children not only in their home but also in their school. Of course, grandparents look forward to seeing their grandchildren even if they are living in the house or they go to school. A monitoring service is available for a special request from the parents or grandparents who want to know their children or grandchildren at the special days when they make an agreement with school. A manager of the school can equip some kinds of monitoring service and then provide it to the parents or grandparents who want to utilize monitoring service. Several monitoring services are available in such a case. But, our surveillance system is suitable for the clients who want to take an advantage of monitoring service through mobile phone just like monitoring service scheme shown in Figure 6. Such monitoring services are expected and very useful for the following cases:

•Relevant children are sick or handicapped. Their parents and/or grandparents always want to know whether they are good or not even in their school.

Relevant children are living at school in a suitable condition, but they must stay there, even after school, until their parents go to pick them up. Of course, teachers have duties to nurse and/or take care of their pupils who are staying at school. But almost always teachers are busy and have little time to do together with such relevant children. Remote monitoring service is reasonable for both school managers and parents. And it is natural and not nervous for those children. Recently in Japan, it has become not so safe for pupils or little children to study and stay in some education places, for example, even schools. There happen more number of criminals in the education places than the past case. So it is much expected that some suitable security services with useful surveillance system will be provided even within the school area. Such a surveillance system is available in the school so that the parents are willing to take advantages of utilizing remote monitoring facilities in order to investigate whether their children are good or not at their convenient time, place and/or occasion. Because of usefulness of mobile devices, these services are more efficient and effective than other no-mobile-device-based surveillance system. With our surveillance system, the remote monitoring facility is available in the school as follows: parents take a look at their children, teachers have a time enough to do other important duties, and security service providers provide an advanced service scheme for clients.

**A Remote Reservation of Stores for Daily Customers**

The second case of our applications is a remote reservation service of stores and/or other business meeting places. In the case of restaurant, daily customers want to know a menu of that day (or today's recommendation) and current state of that store, namely how many people are waiting for a service in front of the store. Without such a reservation service, all the customers must come to the store, wait for the services and obey the sequence of waiting queue. No ones like to waiting at the last end of long queue, because it is lazy and time consuming task .In order to improve such a state of poor services from the store, some smart announcement mechanisms must be available to inform the customers whether the store is busy or not at that time and/or what are special recommendations of the store at that day. It is a very good idea to utilize mobile device as an information receiver from the store and simple reservation terminal for several announcements. It is necessary for clients to have suitable information for the relevant store whenever they make appropriate reservations. So a procedure "Look and Reserve" is definitely important to provide satisfactory services for all the customers whether consequently they do make reservations or not. In almost famous and favorite restaurants, for example, it is very busy and crowded at the lunchtime and weekend evening. So it is very useful for both owners/chefs of restaurants and their customers to utilize smart reservation mechanism without lazy and time-consuming waiting in front of the store. With our surveillance system, for example remote reservation procedures are carried out in the following steps:

An owner of the restaurant has equipped the network camera which obtains video of waiting queue of customers in front of the restaurant, looks around the room of the restaurant, get outline view of customers who are eating, and/or watch the inside of the kitchen.

The owner also prepares information about today's recommendation on the Web site, which is located in the Integrated Server of the surveillance system. Such information is to be transferred into mobile devices of clients when they access to the above Web site.

**Fig. 4.** Service Scheme of the Remote Monitoring Facility of School for Distant Parents

3) Clients are candidates of today's customers who visit the restaurant and have lunches/diners. They get information of the special menu from the Web site of the surveillance system.

4) A suitable application can be downloaded from the Web site into the mobile devices such as mobile phones, PDA and so on. With such an application, those devices of clients will be smart terminals for remote reservation services.

5) Monitoring services are also available for clients to get some real videos about the current situation of the restaurant from the surveillance system. Clients get information and facilities to make reservation.

6) When clients refer to several videos from the surveillance system, they can decide that they should make reservation or not. And request of reservation can be transmitted into the owner of the restaurant through the communication facilities of the system just like the request for controlling is done from the client to the target appliance. Of course, security services are still very important to be resolved also in our surveillance system. We dare not to mention about security services because some possible trials are going to be investigated for practical applications with business partners. It is an experimental approach to utilize the personal identification based on the mobile phone, since carrier companies of mobile phone use machine identification and number of telephone for user identification. That will be one of our future problems to be resolved with our partners.

## V. CONCLUSION

A remote surveillance system has been introduced in this paper. It provides remote monitoring facilities as well as remote controlling ones. Some characteristic properties are illustrated to be useful in the applications. And its performance has been explained in relation to the response speed for remote monitoring and remote controlling between a mobile phone of client and monitoring camera / appliance to be controlled. In the second part of this paper, some applications of our remote surveillance system are demonstrated by means of two examples of practical service schemes. One of those schemes is based on a remote monitoring facility and then another is for a remote reservation function. Both of them will be performed with mobile devices such as mobile phones. With our surveillance system, not only remote monitoring but also remote controlling is efficient and useful for some applications based on mobile computing mechanism. It will be expected that such a seed can provide some practical schemes for mobile business which is our most interesting field in the future business.

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