

# RFID: Dynamic Surveillance Approach

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## Abstract

Most of the modern security and monitoring domain is based upon Camera based Surveillance Architecture. Prison cells, corporate offices, government buildings, stock market, supermarkets etc all the seats utilize this structure in core. Most CCTV systems are used for surveillance which can include security monitoring, spying or for safety monitoring purposes. Although this system has been quite popular being affordable and visually administrable, it is no exception to improvements and up gradation. Thus in this paper we have come up with efficient proposals to upgrade the approach for Camera based Surveillance Architecture for security and Administration.

This renewed approach is essentially based upon RFID technology where we are utilizing RFID tags and their readers as basic components. Unlike Camera-based surveillance, RFID-based approach can monitor and administer a quarter not only within some region of visibility but can efficiently do the same for locating the individuality (through Dynamic Surveillance as explained further). This approach emphasizes not only on overcoming the demerits of observation-based supervision, but it presents easier and effective monitoring methodologies using radio waves and their usable features in security and administration for areas with consumer pour out.

**Keywords:** *Surveillance, Static Surveillance, Dynamic Surveillance, RFID, Tomography.*

## 1. Introduction

Security provides safety, prevent failures and guarantees obligation to be met; for the same reason, in almost all enterprises, industries, governmental non-governmental sectors, domestic non-domestic strata, everywhere a system of security and administration is a mandatory requisite. Any Security/ Administration System's efficiency is measured based on following parameters:

- 1) Automation: To what degree the system doesn't need manual interference for execution.
- 2) Time efficiency: It defines the time lag between the reporting and monitoring action to take place.
- 3) Ease in monitoring and administering in operations for a naïve hand.

- 4) Impenetrable: It ensures the safety from disturbance in the system by foreign invader or other elements or even hacking of security administration by unauthorized agents.
- 5) Efficient for Mobile and Immobile objects and regions: It ensures that the surveillance system not only monitors or administers the immobile regions but also locates and identifies mobile objects and beings.
- 6) Installation cost of System: It includes the cost of hardware and software equipments along with other peripherals.

Decades before, although this need for security and administration used to be met manually, but later men were replaced by automated short circuit surveillance cameras. Till today most of the sophisticated or lucid administrative demands are met by Camera based Structure.

After vigilantly studying the Camera Based Surveillance Architecture, and judged on the basis of above parameters doesn't overall fulfill the demands due to technological limitations. So in this paper we have come up with RFID technology as a multiparty implantable scheme with Camera Based safety and administration System, to overcome the limitations of Camera Surveillance Mechanism.

The rest of the paper is organized as follows, section 2 discusses about Camera Based Surveillance Mechanism. Section 3 expresses the need of change. Section 4 discusses about RFID mechanism and Sections 5 and 6 confers about our proposed approach using RFID technology and its analysis followed by conclusion.

## 2. Camera Based Surveillance System

Nowadays, most of the surveillance mechanisms are majorly supported by CCTV technology. Within CCTV, foremost camera equipments to be used are IP Cameras [1]. IP cameras allow homeowners and businesses to view

their camera(s) through any internet connection available through a computer or a 3G phone [2]. Camera Surveillance Architecture Model is principally based upon

Video Streaming technology over internet or intranet, which so ever is applied.

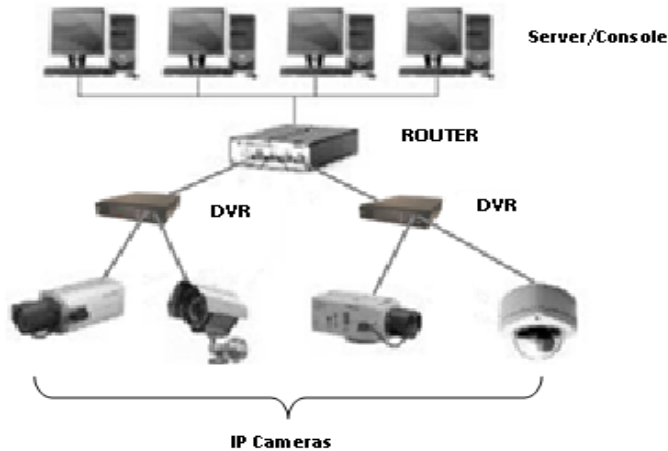


Fig.1. IP Camera Surveillance System[11]

All the IP camera devices may be connected to DVRs (Digital Video Recorder) which in turn are connected to a connector or router through LAN, which is finally connected to master console or server [3]. Over a pre-decided interval Video of the administered region within the range of lens focus is captured is saved in the Camera's EERAM memory module or DVR's memory module. Now the captured video is encoded by DVR at the terminal side and streamed to router in encoded format. The encoding of data ensures the safety and reliability of captured data. Encoded data consists of compressed video data with IP Camera's IP address (for unique identification).

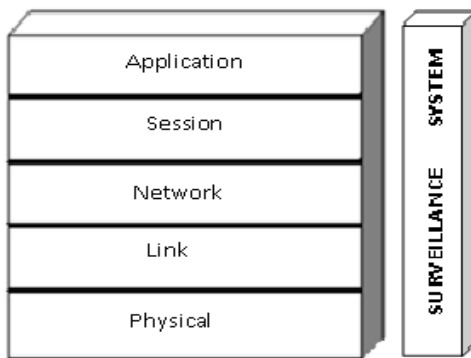


Fig.2. Layered Architecture of Camera Surveillance System

In turn the router sends acknowledgement to particular camera, after receiving which camera flushes its memory electrically and start video capturing and recording again. From the router encrypted video packet is directed to

console with particular camera IP. At server side, received video packet is decrypted and retrieved.

### 3. Need for Advancement in Present System

We have already seen the working flow of Camera Based Surveillance System. Although quite popular and extensively used, this approach of surveillance is not generic to many applications. An important flaw about Camera Based Surveillance is that it is static 'region of observation' oriented, not mobile object or entity oriented. It means in case of large scale security need, if requirement is to watch over a mobile object or entity or person, in that case Camera Based Surveillance will not be of much use. Examples can be sighted as follows: Prisoner in prison campus, employee in mall or professor in campus, etc.

For instance, I want to know where Mr. A is in the campus of a small acre locality (having 50 camera settings), I may have to go through all 50 instances of cameras. And after such an exhaustive work it is completely a matter of chance that the camera I am streaming has captured the video of Mr. A at that instant or not. Now in case of Prison, similar query becomes more crucial and time bound.

This outline of Camera based Security System reveals various features of the same.

Firstly, cost of hardware equipments like Camera, Routers, bulky Multimedia Console etc is quite high, which makes Security Model uneconomical to be so comprehensive to catch all nooks and corners of the area for a large firm, what to speak of a small time firm owner to implement.

Secondly, speed of streaming a 5 minute video of 10Mb through intranet is about 1.5 Mbps. Thus retrieving a Video record of 5 min takes around 10-11 min including decryption and video software upload time. Thus there is always a lag of 10-15 min in information retrieval. Consequently security action will always be 10-15 min late, even if alarms for burglars are put at the most strategic locations [4].

Thirdly, with respect to administration location of person has to be defined by security model. Whereas Camera based security structure presents safety model for location (the camera has been fixed at) and not any individual. Also Camera Based security system fails for administering the security of mobile objects (person, vehicle etc).

### 4. RFID Technology Outline

Radio Frequency Identification (RFID) is a generic term for non-contacting technologies that use radio waves to automatically identify people or objects. There are several methods of identification, but the most common is to store

a unique serial number that identifies a person or object on a microchip that is attached to an antenna. The combined antenna and microchip are called an "RFID transponder" or "RFID tag" and work in combination with an "RFID reader" (sometimes called an "RFID interrogator"). An RFID system consists of a reader and one or more tags. The reader's antenna is used to transmit radio frequency (RF) energy. Depending on the tag type, the energy is "harvested" by the tag's antenna and used to power up the internal circuitry of the tag. The tag will then modulate the electromagnetic waves generated by the reader in order to transmit its data back to the reader. The reader receives the modulated waves and converts them into digital data. In the case of the Parallax RFID Reader Module, correctly received digital data is sent serially through the SOUT pin [5].

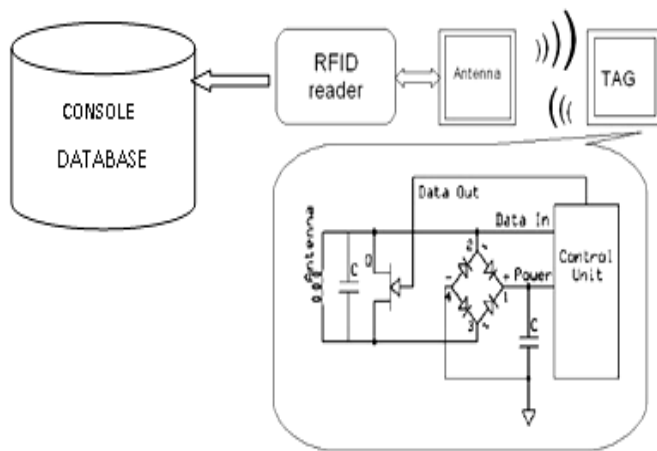


Fig.3. RFID mechanism

There are two major types of tag technologies. "Passive tags" are tags that do not contain their own power source or transmitter. When radio waves from the reader reach the chip's antenna, the energy is converted by the antenna into electricity that can power up the microchip in the tag (known as "parasitic power"). The tag is then able to send back any information stored on the tag by reflecting the electromagnetic waves as described above. "Active tags" have their own power source and transmitter.

Table1: Comparative study b/w Passive and Active Tags[7]

Parameter	Passive RFID	Active RFID
Primary Purpose	Identifying	Identifying/locating
Range	Short mm - 30ft	Long < 1200ft
Can use sensor?	No	Yes
Cost	Few sterling	Few dollar

The power source, usually a battery, is used to run the microchip's circuitry and to broadcast a signal to a reader. Due to the fact that passive tags do not have their own transmitter and must reflect their signal to the reader, the reading distance is much shorter than with active tags. However, active tags are typically larger, more expensive, and require occasional service. The RFID Reader Module is designed specifically for low-frequency (125 kHz) passive tags.

### 5. Proposed "Dynamic" Surveillance Model

In Section.3 we already discussed the flaws and limitation of Camera Surveillance Structure, in presenting a generic architecture for surveillance both static region and dynamic or mobile objects/entities. Surveillance for Static region exists in the form of Camera Based Surveillance Architecture. Thus, in this paper we will be presenting Dynamic Surveillance for mobile objects/entities in the form of RFID Based Surveillance Architecture [8]. Based on the RFID technology described in Section.4, Surveillance Architecture can be designed using RFID tags, RFID readers/interrogators and cheap simple console.

In this Surveillance model each object or entity (say prisoner/employee/student/vehicle etc) to be watched over within a particular domain or region of influence, is provided with cheap RFID tags (can be Active/Passive tags according to application) with unique identification code like EPC. The region of influence can be structured as 2D matrix (3D matrix only if very sensitive surveillance is required) and low cost RFID interrogators/readers (like Parallax RFID Reader module) can be installed at every distance of 1200ft. Now all the RFID interrogators are wirelessly connected to wireless router (if need be, with a suitable API embedded within it). This router is further connected to a wireless or wired LAN then to a Master Console. The whole system is power driven.

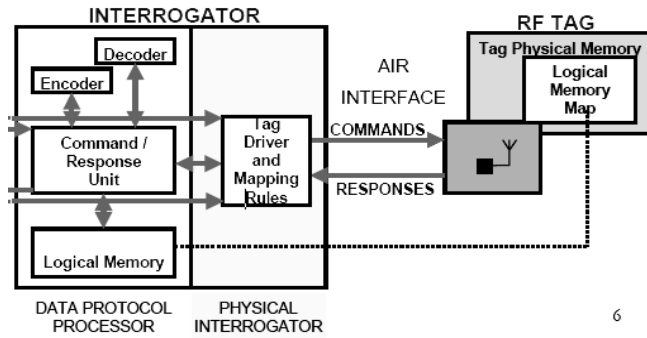


Fig.4. Communication b/w RFID Interrogator and RFID Tag[9]

The object tagged with RFID tag in the closest vicinity of RFID Interrogator continuously senses the unique code (thus identifies the object and its position w.r.to RFID reader) and carries it in a command – response format. This unique data from logical memory of RFID tag is stored in logical memory of RFID Interrogator. Further Interrogator encodes the Unique Identification code packaging it with its own identification code and sends the packet onto its corresponding router terminal, again in a command – response format. This interaction of RFID tag and RFID Interrogator/Reader follows a predefined mapping algorithm.

At the router terminal the packet is checked for authenticity and thus forwarded to respective console port. At Master Console, the packet is checked for error, further it is decoded and analyzed using suitable API. The unique identification of RFID tag and interrogator is extracted from packet format.

Now most importantly this information is mapped continuously onto sectional tomograph which identifies the exact location of RFID tag w.r.t. the interrogator sensing it [10]. Over the monitoring board on the Console screen each router data is sensed sectionally and mapped onto sectional tomograph. This can be obtained by stationing a particular number of Interrogators fixed at proposed strategic locations. This helps the Interrogators to map a matrix on the console screen. Thus, when operated in this way, certain fixed patterns of tomograph define the motional position of object/entity. [10]

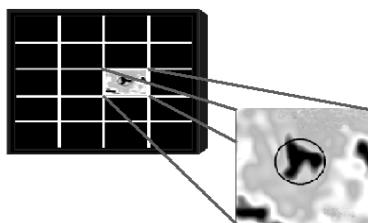


Fig.5. Tomographic presentation w.r.t. data sensed by to interrogator at particular router

## 6. Analysis Of Proposed Architecture For Dynamic Surveillance

As far as the security and administration is concerned promptness of the system weighs a lot. Especially in case of Dynamic Surveillance for mobile objects/entities fast and continuous flow of data and results is expected. Thus, to decide the efficacy of any surveillance architecture we again consider deciding parameters mentioned in Section.1.

Camera Based Surveillance Architecture establishes merit in terms of its Automation, Ease in monitoring and impenetrable transaction, whereas with respect to initial cost, time efficiency etc its demerits have been already discussed in section.3. Moreover in case of Dynamic Surveillance its failure and ‘chance’ mechanism has been mentioned in section.3 again. This over all establishes that Camera Based Surveillance architecture is good enough only for Static or Region bounded Surveillance.

Now to deal with Dynamic Surveillance, proposed RFID Surveillance Architecture establishes merit over all following six factors to be focused while analyzing any Surveillance Structure.

- 1) Automation: RFID Surveillance needs no manual interference as far as execution part is concerned.
- 2) Time efficiency: The proposed Architecture do not process bulky data like captured video clip or audio, it simply processes a unique variable, thus processing and execution of system is faster and unremitting.
- 3) Ease in monitoring and administering: Sectional tomograph is enough to provide all information like location of object, identification of object, identification of interrogator, motion of object, etc.
- 4) Impenetrable: Since the data packet is wirelessly communicated, thus there may be a possibility of loss of data, but it can been arranged for by not flushing the data from logical memory of Interrogator until console completely receives acknowledgement from router. In case of loss of packet interrogator may wait for acknowledgement which if not received, interrogator can resend the packet. Encoding of data also prevents any hacking possibility to a good extent.
- 5) Efficient for Mobile and Immobile objects and regions: Although it does not provide Visual information like Camera Surveillance System but it provides enough of Surveillance report about motion, location and identification. As stated earlier, if observation based system is used in parallel it can help to a certain extent.
- 6) Establishment cost of System: Most of the h/w equipments like RFID tag, RFID interrogator, console etc. are much cost effective.

## 7. Conclusion

It is acceptable that in case of need for visual information for Surveillance, Camera based Surveillance secures merit. But most of Surveillance agencies like National Association for the Criminal Rehabilitation of Offenders (NACRO), Home Office USA etc [10] accept the failure of Camera Surveillance due to technical, manual or any other discrepancies in the system. Thus there arises a need for better technology for Surveillance. RFID provides a Surveillance Technique which can't be mistuned technically, manually or by any other means. Also there exists a better scope, where both RFID based Surveillance and Camera Surveillance can be embedded together to serve the purpose for both Dynamic Surveillance which focuses over "MOTION, LOCATION and IDENTIFICATION" and Static Visual Data based Surveillance giving "VISUAL" support to the system when need be.

technical presentations. Currently he is also assisting Prof. Karthik Subramanyam in research over "solutions to NAT-IPSEC conflict using Wireless Sensor Network Technology."

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