CHRISTIAN SERVICE UNIVERSITY COLLEGE,
KUMASI

DEPARTMENT OF COMPUTER SCIENCE

SURVEILLANCE SYSTEM FOR THE POLICE

CASE STUDY: GEORGE WALKER BUSH MOTORWAY (N1), ACCRA

BAYOR CEPHAS KANYIRI

TAYLOR ROBERT EBOW

A THESIS PRESENTED TO CHRISTIAN SERVICE UNIVERSITY COLLEGE IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF B. SC. COMPUTER SCIENCE

JUNE, 2014

STATEMENT OF AUTHENTICITY

We have read the university regulations relating to plagiarism and certify that this report is our own work and do not contain any unacknowledged work from any other source. We also declare that we have been under supervision for this report herein submitted.

NAME	**SIGNATURE**	**DATE**
BAYOR CEPHAS KANYIRI (10140954)	.....……	…….....
TAYLOR ROBERT EBOW (10140855)	.....	……

SUPERVISOR'S DECLARATION

I hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision laid down by Christian Service University College, Kumasi-Ghana.

Certified by

Dr. Thomas Yeboah (Mr.)	……	…….....
Supervisor	**Signature**	**Date**

Dr. Thomas Yeboah (Mr.)	……	…….....
Head of Department, Computer Science	**Signature**	**Date**

DECLARATION

We do hereby, declare that the dissertation entitled "**Surveillance System for the Police on the George Walker Bush Motorway, Accra**" is an authentic work developed by us BAYOR CEPHAS KANYIRI and TAYLOR ROBERT EBOW at Christian Service University College, under the guidance of Dr. Thomas Yeboah (Lecturer) and submitted as a partial fulfillment of the requirements for the award of a Degree.

We also declare that, any contents incorporated in this dissertation have not been submitted in any form for the award in any university or elsewhere. It is a genuine record of the task we set out to accomplish. All authorities quoted in this book have been duly acknowledged.

MEMBERS	**SIGNATURE**	**DATE**
BAYOR CEPHAS KANYIRI (10140954)	…….	……..
TAYLOR ROBERT EBOW (10140855)	…….	…….....

SUPERVISOR

DR. THOMAS YEBOAH (Mr.) SIGNATURE...…….....

DATE…….....

HEAD OF DEPARTMENT

DR. THOMAS YEBOAH (Mr.) SIGNATURE……..

DATE…….

ACKNOWLEDGEMENT

We are greatly indebted to the Almighty God for granting us good health, protection and all the needed help throughout this course.

Special appreciation goes to Dr, Thomas Yeboah for not withstanding his busy schedules made time to share his rich experience with us and in fact supervised and guided us throughout the process of this project work.

Our sincere gratitude goes to Miss Linda Amoako, a lecturer Computer Science Department at the Christian Service University College, a renowned scholar, and one of our mentors in the academia for accepting to guide us and also for her support and encouragement throughout this work.

We would also like to express sincere gratitude to our dear parents, Ms Jane-Frances Bayor and Mrs. Adelaide Taylor for their encouragement, love and prayers which sustained us throughout the course.

We are also grateful to Supt./Very Rev Jonas S. Aboagye, Police Chaplain, Very Rev. Kusi Appau, Mrs Sophia Bayor Yob, Mr. John Amoah and Very Rev. kwaku Acheampong for their immense contribution into our lives. May the Almighty God richly bless you all.

We owe a debt of gratitude to Ms Joyce Odei, Peter Nimoh, Felix Nimoah, Derrick Allotey Murphy, Miss Patra, Boateng Marfo, and Daniel Kwakwa all of Christian Service University College for their influence on our lives and contribution in the writing of this project

Finally to all those who in their various ways contributed to the success of this project, we say God richly bless you all.

DEDICATION

This project is proudly dedicated to God Almighty for the knowledge and strength given to us. It is also dedicated to our dear parents and all those who in diverse ways helped us in our education. Thanks to you all for your prayers, support and encouragement throughout our educational life. All we can say is God bless you abundantly.

ABSTRACT

The system was developed using the prototyping model as the methodology since it can address all the weaknesses of other model for developing a system. A Windows application was the main tool used for developing the system. These tools were carefully selected because they are the standards of building the system.

During the research, a detailed feasibility was carried out under economic, operational and technical. The system was therefore designed based on the requirement analysis carried out.

The proposed system will work under the principle of surveillance video system through CCTV cameras which will be mounted at vantage points watching over the public areas and will be linked to the computer database of pictures of vehicles, number plates and also connected to a central Network Video Recorder (NVR) to handle the recording, video and alarm management**.**

Since every system has some limitations, so the proposed system is also not untouchable in this regard. Although it includes many features but still it would not be sufficient as the user requirements are not always same. The change in the requirements will need some changes in the system to fulfill the requirements. The proposed system provides effective security by restricting the administrator to their authorized access to the parts of the system.

This is very much needed in database systems that are used to store a huge amount of information to ensure that the system is reliable and secured. Attached to the abstract is a feedback form from end users completed during each design stage of the system.

TABLE OF CONTENT

CHAPTER THREE: METHODOLOGY

CHAPTER FOUR: SYSTEM SPECIFICATION AND DESIGN

LIST OF FIGURES

CHAPTER ONE

1.0 INTRODUCTION

Government organizations are considering the implementation of surveillance technology with increasing frequency for the purposes of general law enforcement and public safety. In limited and defined circumstances, surveillance video cameras may be appropriate to protect public safety, maintain social control, recognize and monitor threats, detect and assist in the investigation of criminal activities.

The word surveillance is the French word (Surveiller) for "watching over"; "sur" means from above and below and "veilled" means "to watch". Surveillance system works in many forms which include: telephones, video cameras, social network, biometric surveillance, satellite imagery etc. My focus will be on the surveillance through video cameras. The word Surveillance may be applied to observation from a distance by means of electronic equipment such as Closed Circuit Television (CCTV) cameras. According to Allien M (1994) theory of surveillance which states that; Video Surveillance System refers to a electronic digital wireless video device that enables continuous or periodic video recording, observing or monitoring of personal information about individuals in open and close public areas (including streets, highways, parks). It also act as a force multiplier which monitor more areas at a particular time. Video surveillance system also includes an audio device, component associated with capturing the image of an individual and also monitor of the behaviors, activities usually of people for the purpose of protecting and observing.

According to the analysis work of Bentham J. (1748-1832) An Induction to the principle of morals and legislation, London, Louise published, U.K, pg. 1.1 and Foucault M (1926-1984) Discipline and punishment, London, Louise published, U.K, pg. 205, they both studied surveillance by CCTV cameras. Applying this principle to crime, we could say that one would not commit an offence likely to mean one suffered more pain for committing the act. Bentham

created an architectural device which is called the Panopticon, which is a Greek word for “all –seeing”. The idea was, to guard or overseer in the watch tower which would be able to monitor every movement on the motorway. The design ensures that the people watching cannot see their observers. They have no way to find out if they are being watched at any given time.

The cameras have a “pan-tilt-zoom that rotate its axis” for capturing images of individuals and vehicles. The cameras have a “facial recognition” meaning a computer can automatically search for a particular person’s face and vehicles number plate. The cameras have an “automatic tracking device” which means a computer can automatically track a person or vehicle moving along the motorway, jumping from one camera to the next one and also record voices. All three of these technologies far exceed the powers of ordinary human observation, and dramatically increasing the power of the government to watch the public.

1.1 EXISTING SYSTEM

The administration of the police service is currently using the manual way system. The police have to go to the place where the accident or incident happened and take a report to the authorities. Also not adequate evidence will be observed at the scene of the crime or accident at the same time.

1.2 PROBLEM STATEMENT

Over the years, there have been many series of accidents occurring on George walker Bush motorway also known as N1 highway. Some of the problems which are facing the highway include:

i. Difficulty in tracing and tracking of drivers and vehicles.

ii. Difficulty in arresting criminals.

iii. Difficulty in identifying and reporting the crime scene.

iv. Pedestrians been knocked down when crossing.

1.3 PROPOSED SYSTEM

The proposed system will work under the principle of surveillance video system through CCTV cameras which will be mounted at vantage points watching over the public areas and will be linked to the computer database of pictures of vehicles, number plates and also connected to a central Network Video Recorder (NVR) to handle the recording, video and alarm management.

1.4 OBJECTIVES OF THE STUDY

i. To be able to monitor all the activities on the road such as non-functioning traffic and street lights, break down vehicles will be identified, capturing dangerous driving etc.

ii. To be able to obtain detailed information and keep them in one database to make information retrieval easy.

iii. To provide reliable data for timely decision making.

1.5 RESEARCH QUESTION

i. How will the system help the police to achieve its purpose?

ii. How can the camera capture a scene?

iii. How will the system alert the police when there is an incident or accident occurs?

1.6 BACKGROUND

The George Walker Bush Highway is a six-lane, 14-kilometre (8.7 ml) highway in Accra the eastern part of Ghana. The construction of the highway was financed by the Millennium Challenge Account. The highway is also known as the N1 highway.

The highway was officially opened on Thursday 16 February 2012 jointly by the Late President John Evans Ata Mills and the former President John Agyekum Kuffour. In his speech at the ceremony, the late President Mills noted the Importance of the kilometer road, and encouraged the general public, motorists and all stakeholders to take good care of the road, among others, provided under the Millennium Challenge Account. But now what is happening now on the road does not show our appreciation for the president's admonition. It is sad and appealing that only a few years after the multi-million dollar road was commissioned, as many as uncountable number of deaths, through crashing of Vehicles recorded on the road every single day. The nation was thrown into mourning everyday of last year as a result of lorry accidents which claimed four lives daily.

Most of the accidents occurred because of human errors and the road Constructions, including disrespecting for the road regulations etc. Reports about the number of accidents recorded so far, since the start of this year are discouraging; they suggest that the situation will not be different from that of last year unless care is taken. The highway links the Tama Motorway from the Tetteh Quarshie interchange to the Mallam Junction, from the were the heavy-duty Vehicles from Tama Harbor and the other road users will exit to other parts of the Country.

1.7 SIGNIFICANCE OF THE STUDY

The Implementation of the software will solved the problems stated. The importance of this project is to reduce motor accidents occurring and knocking down of pedestrians on the road, since all the processes are going to be computerized to save time and energy.

1.8 LIMITATIONS AND DELIMTATIONS OF THE STUDY

LIMITATIONS:

i. It stores up legal aspects or cases. It explains that the new generation surveillance cameras system can also record audio, sound and voice. For example sexual harassment, robbing and other forms of veiled threats and any rough behaviors can be spotted and recorded.

ii. It prevents theft and illegal activities. The main purpose of installing the surveillances cameras is to act as deterrence to robbers, criminals and unscrupulous elements from indulging in theft, illicit and criminal activities.

iii. It reduces insurance premiums and taxes. Security cameras, video surveillance and allied system can be reduce insurance premiums over a long period depending on contracts drawn up with insurance companies and agents.

DELIMITATIONS:

i. The cost of purchasing the cameras and some of the equipment is expensive.

ii. Some system components such as cameras and the recorder are subjected to damage if they are not hidden from view.

iii. Cameras need to have sufficient resolution and be position correctly so that actions and suspects can be identified.

1.9 DEFINITIONS OF TERMS

SURVEILLANCE: it is act of carefully watching over someone or something in order to prevent or detect crime activities.

Closed Circuit Television (CCTV) cameras: It is a camera TV system in which signals are not publicly distributed but are monitored primarily for surveillance and security purposes.

NETWORK VIDEO RECORDER (NVR): It is a network camera which enables simultaneous recording, capture images and remote access to both live views and recorded images.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

The purpose of this literature review is to highlight materials related to issues of privacy and surveillance as they affect social behavior. The most common form of surveillance affecting social behavior is the use of cameras or closed-circuit television (CCTV) in public spaces such as car parks, public transit, housing projects, malls, streets, and city or town centre. Nowhere is the use of CCTV camera more prevalent than in the United Kingdom. Closed-circuit television has also begun to emerge in Australia, America, Canada and South Africa as a means of crime prevention.

Much of the literature dealing with surveillance of public space examines the effect that it has on crime and maintaining public order. Limited information is available on the effect that surveillance has on casual, non-criminal behavior. The few articles that deal with this topic state that people are made to feel self-conscious when in-front of a camera. Individuals will go out of their way to appear innocent even if they have nothing to hide. Moreover, surveillance might prompt people to avoid behavior that could be considered deviant by the person monitoring the camera footage. Some of the literature notes how CCTVs are used to exclude others from public space.

Overall, most studies indicate that CCTVs are not an effective means for reducing crime. CCTVs are effective at reducing incidents of burglary and property crime, but they are not effective against personal crime, violent crime or public disorder. A report released by NARCO (National Association for the Care and Resettlement of Offenders) states that CCTVs result in a 5% reduction in crime whereas better street lighting results in a 20% reduction in crime. These figures are fairly consistent throughout most CCTV studies. The effect that CCTVs appears to have on crime usually ranges anywhere from nil to between 3%

and 6%. In a few instances, the crime rate actually increased following the installation of cameras. This might be due to the natural oscillation that crime experiences. Crime levels will naturally oscillate and cameras might be installed at a time when levels are low and expected to increase. Many CCTV evaluations have surveys that compile data on public perceptions of crime, public use of town centers, and public views concerning the proposed installation of cameras.

Most people state that they would feel safer with the installation of cameras however; evidence indicates that people do not feel any safer once the CCTVs are fully operational.

Some people fear that police might prove a little over-zealous in their use of the cameras in order to justify installation. Furthermore, much of the public view the use of CCTVs as a means to "spy on people." Public support of CCTVs is based upon many misconceptions regarding their use to monitor public space. Some CCTV evaluations interview offenders regarding their attitudes towards the installation of CCTVs and the effect they have or may have on crime. As stated in several resources, offenders often come to realize that CCTVs do not greatly impact their risk of being caught. CCTVs simply make them more cautious when they commit their crimes.

2.2 THEORETICAL FRAMEWORK

Moderated surveillance is a feature of modern government because it relates to the development of the bureaucratic state and the camera watching the streets is limited by laws. Technology makes surveillance possible, but our social theory provides the framework that makes it meaningful and limits it. We will first analysis the work of Jeremy Bentham (1748-1832), then look at the analysis of Michel Foucault (1926-1984), in the light of this; we will discuss surveillance by closed circuit television (CCTV) cameras. Nature has placed mankind

under the governance of two sovereign masters, pain and pleasure. It is for them alone to point what we ought to do, as well as to determine what we should do.

Applying this principle to crime, we could say that one would not commit an offence likely to mean one suffered more pain for committing the act. As a part of his vision of rational social control, Bentham devised an architectural device which is called the Panopticon, which is a Greek word for “all –seeing”. The idea was that the guard or overseer in the watch tower would be able to monitor the every movement of the inhabitants of the cells, all of the time, hence the “all-seeing”. The design ensures that the people watched cannot see their observers. They have no way to find out if they are being watched at any given time, but they know that it is the constant possibility.

2.3 RELATED STUDIES AND LITERATURE REVIEW

In recent decades, researchers have been actively investigating numerous technologies, ranging from sensitive acoustic devices to pattern recognition algorithms, in an effort to improve upon existing traffic surveillance methods. Given that it is a relatively young technology with many potential uses, AVI continues to be one of these technologies researched in academia. In light of recent research efforts, AVI appears to show more promise as a more reliable and accurate method of predicting travel time information than other technologies, particularly loop detectors.

This work serves as an independent evaluation of the existing AVI system in San Antonio. Several issues addressed in this literature review will be discussed in more detail, including out-of-town influence of tag-equipped vehicles and tag read rates of antennas. The numerous references cited in this literature review also indicate that AVI technology likely possesses untapped potential in other ATIS applications, particularly incident detection. This field

study appears to be the first of its kind in evaluating an in-place, full-scale AVI system. It is hoped that this work will serve as a first step in quantifying the efficacy and reliability of such a system.

In recent years, researchers have also been looking to AVI to help improve incident detection on freeways and arterials. Historically, incident detection has been performed by algorithms which analyze loop detector data. Ivan and Chen compared several algorithms using both fixed and vehicle-based surveillance methods (1997). Their results indicated that a combination of the two types of surveillance methods yielded the best incident detection results. This reliability stemmed from the individual vehicle travel times gathered by the system. Lastly, Carlin gathered travel time data from Houston's AVI system in order to establish a suitable database from which to develop an automated incident detection algorithm (1996).

In addition to AVI's reported ability to provide reliable travel time information and potential to improve incident detection methods, AVI offers more flexibility in its potential uses in transportation management programs than traditional loop detection systems. Inherent to the use of AVI technology is its ability to track individual vehicles, a capability that loop detection does not possess. Turner mentions that, in addition to its ability to provide real time travel information, AVI is even more valuable because of its use in electronic toll collection and fleet management applications. In addition, travel-time information is fast becoming an integral part of real-time travel information systems used in such applications as in vehicle navigation.

CHAPTER THREE

METHODOLOGY

3.0 INTRODUCTION

A software development methodology refers to the framework that is used to structure, plan, and control the process of developing an information system. A wide variety of such frameworks have evolved over the years, each with its own recognized strengths and weaknesses. One system development methodology is not necessarily suitable for use by all projects. Each of the available methodologies is best suited to specific kinds of projects, based on various technical, organizational, project and team considerations. The framework of a software development methodology consists of:

- A software development philosophy, with the approach or approaches of the software development process.
- Multiple tools, models and methods, to assist in the software development process.

These frameworks are often bound to some kind of organization, which further develops, supports the use, and promotes the methodology.

Every software development methodology has more or less its own approach to software development. There is a set of more general approaches, which are developed into several specific methodologies.

These approaches are:

- Prototyping.
- Spiral model
- Waterfall model.
- Agile model.
- Evolutionary model.

3. 1 METHODOLOGY WAS USED IS SOFTWARE PROTOTYPING

Software prototyping is the framework of activities during software development of creating prototypes, i.e. incomplete versions of the software program being developed. A prototype typically simulates only a few aspects of the features of the eventual program, and may be completely different from the final product.

The conventional purpose of a prototype is to allow users of the software to evaluate developers' proposals for the design of the eventual product by actually trying them out, rather than having to interpret and evaluate the design based on descriptions. Prototyping can also be used by end users to describe and prove requirements that developers have not considered, so "controlling the prototype" can be a key factor in the commercial relationship between solution providers and their client.

The process of prototyping involves the following steps:

1. **Identify basic requirements**

Determine basic requirements including the input and output information desired. Details, such as security, can typically be ignored.

2. **Develop Initial Prototype**

The initial prototype is developed that includes only user interfaces.

3. **Review**

The customers, including end-users, examine the prototype and provide feedback on additions or changes.

4. Revise and Enhance the Prototype.

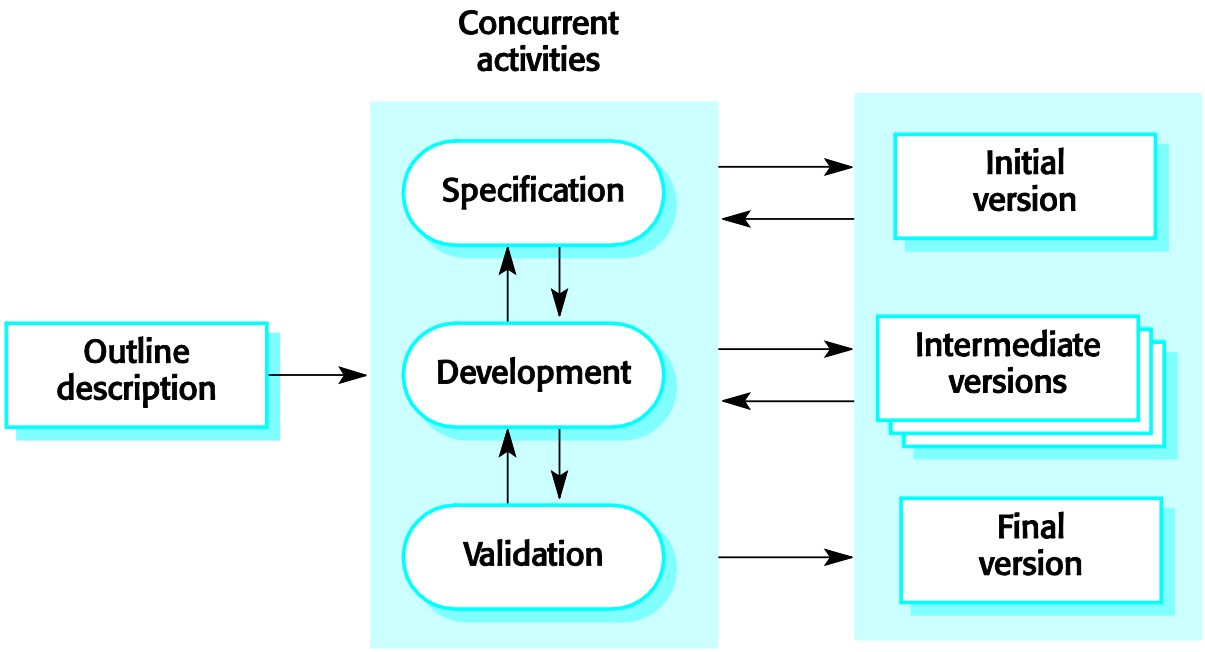


Fig. 3.1 Software Prototyping Process from Sommerville, Software Engineering, 7th Edition.

3.1.2 Types of Prototyping

Software prototyping has many variants. However, all the methods are in some way based on two major types of prototyping: Throwaway Prototyping and Evolutionary Prototyping, and the others are; Incremental and Extreme prototyping.

3.1.3 Throwaway prototyping

Also called close ended prototyping. Throwaway or Rapid Prototyping refers to the creation of a model that will eventually be discarded rather than becoming part of the final delivered software. After preliminary requirements gathering is accomplished, a simple working model of the system is constructed to visually show the users what their requirements may look like when they are implemented into a finished system. In this approach the prototype is

constructed with the idea that it will be discarded and the final system will be built from scratch.

The steps in this approach are:

1. Write preliminary requirements
2. Design the prototype
3. User experiences/uses the prototype, specifies new requirements
4. Repeat if necessary
5. Write the final requirements
6. Develop the real products

The most obvious reason for using Throwaway Prototyping is that it can be done quickly. If the users can get quick feedback on their requirements, they may be able to refine them early in the development of the software. Making changes early in the development lifecycle is extremely cost effective since there is nothing at that point to redo. If a project is changed after a considerable work has been done then small changes could require large efforts to implement since software systems have many dependencies. Speed is crucial in implementing a throwaway prototype, since with a limited budget of time and money little can be expended on a prototype that will be discarded.

Another strength of Throwaway Prototyping is its ability to construct interfaces that the users can test. The user interface is what the user sees as the system, and by seeing it in front of them, it is much easier to grasp how the system will work.

Prototypes can be classified according to the fidelity with which they resemble the actual product in terms of appearance, interaction and timing. One method of creating a low fidelity Throwaway Prototype is Paper Prototyping. The prototype is implemented using paper and pencil, and thus mimics the function of the actual product, but does not look at all like it.

3.1.4 Evolutionary prototyping

Evolutionary Prototyping (also known as breadboard prototyping) is quite different from Throwaway Prototyping. The main goal when using Evolutionary Prototyping is to build a very robust prototype in a structured manner and constantly refine it.

"The reason for this is that the Evolutionary prototype, when built, forms the heart of the new system, and the improvements and further requirements will be built. system, and the improvements and further requirements will be built.

When developing a system using Evolutionary Prototyping, the system is continually refined and rebuilt. This technique allows the development team to add features, or make changes that could not be conceived during the requirements and design phase.

Evolutionary Prototypes have an advantage over Throwaway Prototypes in that they are functional systems. Although they may not have all the features the users have planned, they may be used on an acting basis until the final system is delivered.

In Evolutionary Prototyping, developers can focus themselves to develop parts of the system that they understand instead of working on developing a whole system.

3.1.5 Incremental prototyping

The final product is built as separate prototypes. At the end the separate prototypes are merged in an overall design.

3.1.6 Extreme prototyping

Extreme Prototyping as a development process is used especially for developing web applications. Basically, it breaks down web development into three phases, each one based on the preceding one. The first phase is a static prototype that consists mainly of HTML pages. In the second phase, the screens are programmed and fully functional using a simulated

services layer. In the third phase the services are implemented. The process is called Extreme Prototyping to draw attention to the second phase of the process, where a fully-functional UI is developed with very little regard to the services other than their contract.

3.1.7 Advantages of prototyping

There are many advantages to using prototyping in software development – some tangible, some abstract.

- **Reduced time and costs**

  Prototyping can improve the quality of requirements and specifications provided to developers. Because changes cost exponentially more to implement as they are detected later in development, the early determination of what the user really wants can result in faster and less expensive software.

- **Improved and increased user involvement**

  Prototyping requires user involvement and allows them to see and interact with a prototype allowing them to provide better and more complete feedback and specifications. The presence of the prototype being examined by the user prevents many misunderstandings and miscommunications that

Occur when each side believe the other understands what they said. Since users know the problem domain better than anyone on the development team does, increased interaction can result in final product that has greater tangible and intangible quality. The final product is more likely to satisfy the users' desire for look, feel and performance.

3.1.8 Disadvantages of prototyping

Using, or perhaps misusing, prototyping can also have disadvantages.

- **Insufficient analysis**

  The focus on a limited prototype can distract developers from properly analyzing the complete project. This can lead to overlooking better solutions, preparation of incomplete specifications or the conversion of limited prototypes into poorly engineered final projects that are hard to maintain. Further, since a prototype is limited in functionality it may not scale well if the prototype is used as the basis of a final deliverable, which may not be noticed if developers are too focused on building a prototype as a model.

- **User confusion of prototype and finished system**

  Users can begin to think that a prototype, intended to be thrown away, is actually a final system that merely needs to be finished or polished. (They are, for example, often unaware of the effort needed to add error-checking and security features which a prototype may not have.) This can lead them to expect the prototype to accurately model the performance of the final system when this is not the intent of the developers. Users can also become attached to features that were included in a prototype for consideration and then removed from the specification for a final system. If users are able to require all proposed features be included in the final system this can lead to conflict.

- **Developer misunderstanding of user objectives**

  Developers may assume that users share their objectives (e.g. to deliver core functionality on time and within budget), without understanding wider commercial issues. For example, user representatives attending Enterprise software (e.g. PeopleSoft) events may have seen demonstrations of "transaction auditing" (where changes are logged and displayed in a difference grid view) without being told that this feature demands additional coding and often requires more hardware to handle extra database accesses. Users might believe they

can demand auditing on every field, whereas developers might think this is feature creep because they have made assumptions about the extent of user requirements.

If the solution provider has committed delivery before the user requirements were reviewed, developers are between a rock and a hard place, particularly if user management derives some advantage from their failure to implement requirements.

- **Developer attachment to prototype**

  Developers can also become attached to prototypes they have spent a great deal of effort producing; this can lead to problems like attempting to convert a limited prototype into a final system when it does not have an appropriate underlying architecture. (This may suggest that throwaway prototyping, rather than evolutionary prototyping, should be used.)

- **Excessive development time of the prototype**

  A key property to prototyping is the fact that it is supposed to be done quickly. If the developers lose sight of this fact, they very well may try to develop a prototype that is too complex. When the prototype is thrown away the precisely developed requirements that it provides may not yield a sufficient increase in productivity to make up for the time spent developing the prototype. Users can become stuck in debates over details of the prototype, holding up the development team and delaying the final product.

- **Expense of implementing prototyping**

  The start-up costs for building a development team focused on prototyping may be high. Many companies have development methodologies in place, and changing them can mean retraining, retooling, or both. Many companies tend to just jump into the prototyping without bothering to retrain their workers as much as they should.

3.1.9 Basic principles

Basic principles of prototyping are:

- Not a standalone, complete development methodology, but rather an approach to handling selected portions of a larger, more traditional development methodology (i.e. Incremental, Spiral, or Rapid Application Development (RAD).
- Attempts to reduce inherent project risk by breaking a project into smaller segments and providing more ease-of-change during the development process.
- User is involved throughout the process, which increases the likelihood of user acceptance of the final implementation.
- Small-scale mock-ups of the system are developed following an iterative modification process until the prototype evolves to meet the users' requirements.
- While most prototypes are developed with the expectation that they will be discarded, it is possible in some cases to evolve from prototype to working system.
- A basic understanding of the fundamental business problem is necessary to avoid solving the wrong problem.

From all these types of prototyping, we have decided to use the evolutionary type of prototypes because of its advantages over the others which is, evolutionary types are functional systems.

Although they may not have all the features the users have planned, they may be used on an acting basis until the final system is delivered.

CHAPTER FOUR

SYSTEM SPECIFICATION AND DESIGN

4.0 INTRODUCTION

Surveillance video system cameras that utilize an Internet Protocol-based IP network such as the Internet or a Local Area Network LAN in order to allow users to observe scenes or record audio and video are IP-Surveillance systems. Simple IP-Surveillance systems consist of network cameras (or analog cameras that have a video encoder), a network switch, and a computer equipped with software for video management. IP-Surveillance systems use IP networks to transmit information, unlike analog video systems' point-to-point cabling from the camera's physical location to the monitoring station. Video monitoring and recording is possible from anywhere in the world provided that the location is enabled with a wired or wireless IP network.

Network video systems allow signals to be sent and received simultaneously; they are bi-directional. As a result, network video systems can be easily integrated into larger systems. Analog systems, however, are unidirectional: only one signal can be transmitted at a time. For example, a network camera is capable of both sending data (audio, video, SMS) to a user and receiving information (instructions, audio) from the same user. This type of activity can be used to perform multiple functions, like activating alarms or doors.

Network video systems are also more flexible than audio in that they can multitask and connect with multiple applications at once. IP-Surveillance offers many benefits and advanced capabilities. Via IP-Surveillance, you have superior control over recorded video, live video, and alarm events, which makes a network video system a natural choice for surveillance applications.

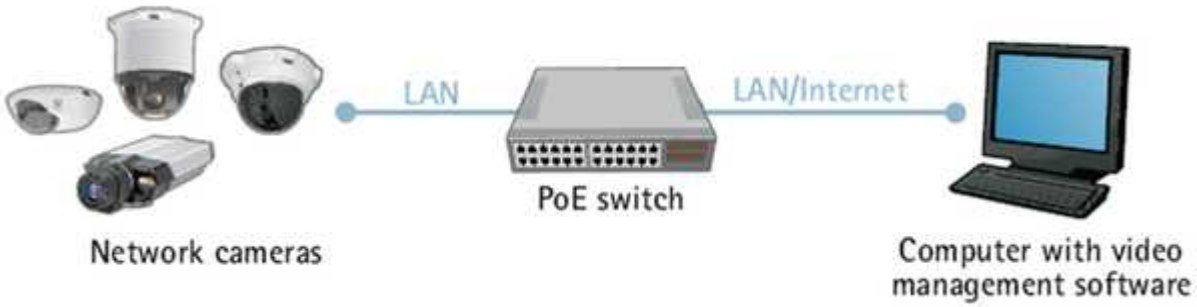


Figure 4.1: IP surveillance video system

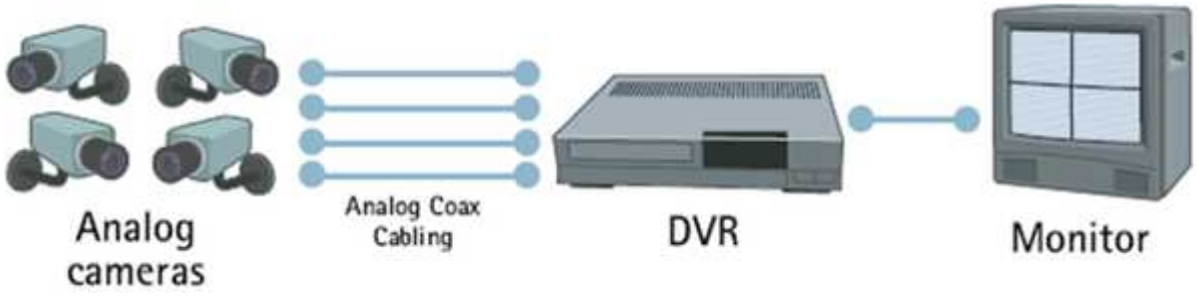


Figure 4.2: Analog surveillance video system

Some of the benefits are:

1. **Remote Accessibility:** Authorized users from around the world can view video footage at any time of day. If your company would like to contract out its security needs to a third party, remote accessibility is a huge advantage. Remote accessibility through an analog system would only be possible with the purchasing of extra equipment like network Digital Video Recorders DVRs and video encoders.

2. **Superior Image Quality:** In order to identify subjects in a video scene, the image must be clear. Network video systems' images are consistently sharp because no inessential conversions are performed and distance between the scene and the remote monitor is not a factor. However, every time a video is converted in an analog system,

its quality is degraded. Also, video signals become weaker with distance in an analog system.

4.1 HARDWARE SPECIFICATION

This talks about the hardware requirements of the system that would be developed. Since the proposed system is new and for that matter not an improvement on any already existing one, it would be suitable to first run it on a computer with minimum specifications. There would be some major hardware specification to enable the application run very effectively and efficiently since it is a computer base. Below are the standard hardware requirements for the Surveillance video system.

Hardware		**Specification**
Processor	:	2.0GHz and Above
Main Memory	:	512 MB.
Hard Disk	:	60 GB and Above
Keyboard	:	ANY
Mouse	:	ANY
Monitor	:	ANY
ROM Drive	:	DVD / CD ROM

4.2 SOFTWARE SPECIFICATION

Software		**Specification**
Operating System	:	Windows
Software	:	Windows Application

4.3 SYSTEM ARCHITECTURE

The system we have developed can run both laptop and desktop application. The two-tier architecture is followed in the development of the system. The two-tier architecture has two separate components: an application interface and a database stored in the Network Video Recorder (NVR) to handle the recording, video and alarm management. A great advantage of CCTV / IP camera surveillance is the feeling of safety and security in your home and public place.

CCTV / IP systems can also be connected to the internet for remote online access which means you can be anywhere in the world and you will still be able to watch CCTV footage back at home or work. A CCTV/ IP system is a DVR that connect to a specifically designed CCTV / IP camera which records all the time, on a scheduled basis or only when motion is detected(this setting is optional) The system transmit live signals to the television monitors at the police stations. The camera has some categories which include; monitor, detect, recognize and identify. The main purpose of installing these cameras is used to prevent / reduce crimes and behavior in the home and public areas.

A DVR accepts video and audio recordings from the connected CCTV /IP cameras and saves this data onto a hard disk that is built into the DVR. DVR's usually range between 4. 8, 16 and 32 channels. A DVR with 4 channels can take up to 4 cameras and so on. The best type of DVR to use for your home or public area would be full D1 DVR which records at the highest quality available and at 25 frames per second is referred to as Full D1 Realtime Recording as it records just the way we see on TV or in real-life, there is no skipping between frames.

4.4 OVERLAYING VIDEO IMAGE WITH A TIMESTAMP

Most IP cameras can include the current time from the internal clock of the IP camera as an overlay to the video image. Because the NTP configuration discussed in this section provides an accurate time source to the IP cameras, this video overlay can serve as a reference to the time stamps associated with the video feed by the Media Server. The IP camera is directed to adjust the local time for Daylight Savings Time when the offset is adjusted forward or back. The appropriate time zone is selected to specify the offset from UTC/GMT and the name of the time zone. Time is based off UTC, and each device on the network must be configured to adjust the clock by the offset for their locality.

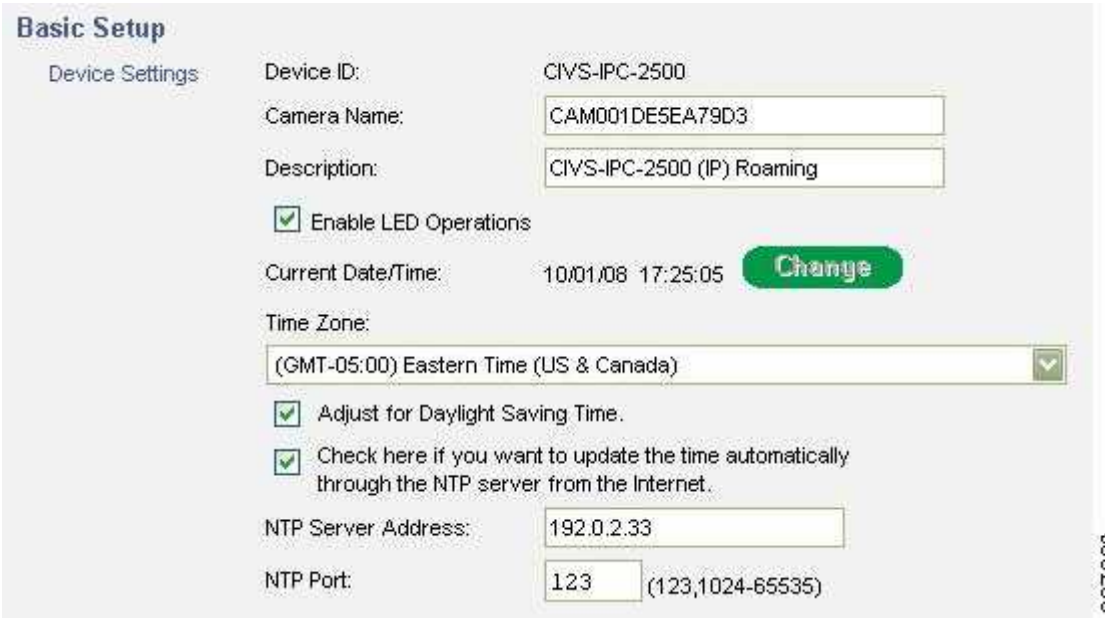


Figure: 4.4.1 NTP Configuration for Cisco 2500 series IP Camera.

4.5 SERVER AND WORKSTATION CONFIGURATION

The Cisco Physical Security Multiservice platform or standalone servers running Cisco Video Surveillance Media Server (Media Servers), Video Surveillance Operations Manager (VSOM), Video Surveillance Virtual Matrix (VSVM) as well as client viewing stations, iSCSI appliances or other networked DVR servers would be similarly configured as the IP camera in this section.

These devices all use the default router IP address as the NTP server IP address. An accurate and consistent clock is important to provide for the synchronization of images archived from a variety of camera feeds. An accurate time source is vitally important for forensic uses of video surveillance data to equate a time with a point in time. By implementing NTP in an hierarchical design, accurate time service can be provided to a very large scale enterprise network and have excellent reliability and availability.

Figure 4.5 Timestamp Overlay

4.6 HOW IP CAMERA SURVEILLANCE CISCO VIDEO SYSTEM WORKS

The Cisco Video Surveillance Solution relies on an IP network infrastructure to link all components. The designs of a highly available hierarchical network have been proven and tested for many years and allow applications to converge on an intelligent and resilient infrastructure.

Cisco offers a unique approach to moving different proprietary systems to a common IP backbone. This approach leverages other Cisco technologies, such as network security, routing, switching, network management and wireless.

Video from IP cameras can now be truly converged into a robust network environment with the intelligence and flexibility provided by the Cisco infrastructure.

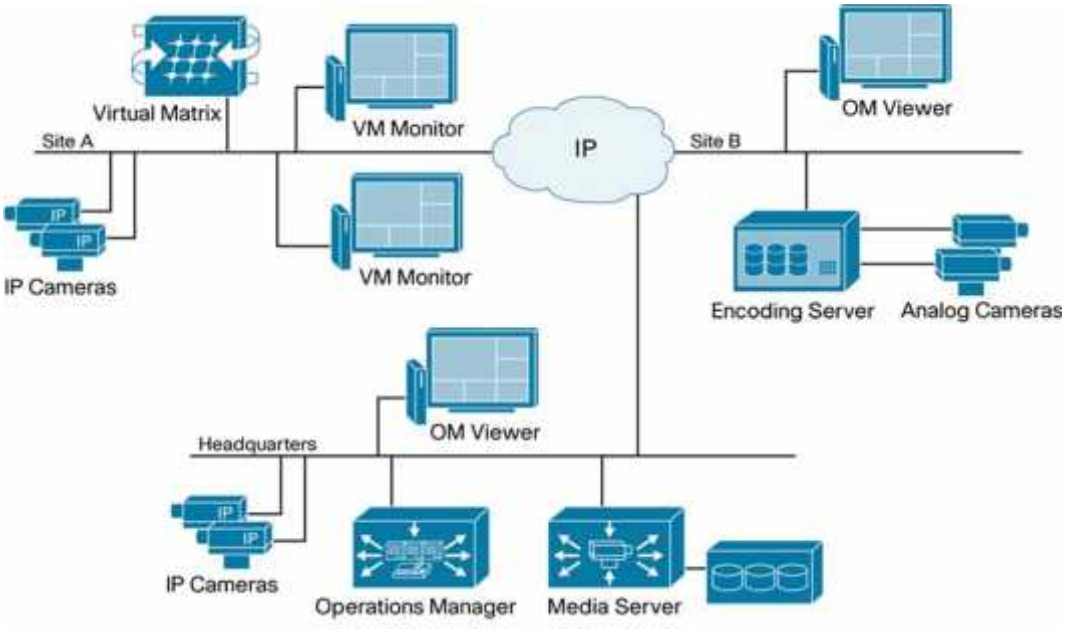


Fig 4.6 Cisco 25urveillance Video System.

The following components make up the Cisco Video Surveillance system:

- **Cisco Video Surveillance Media Server:** The core component of the network-centric VSM. Software manages, stores, and delivers video for the network-centric video surveillance product portfolio.
- **Cisco Video Surveillance Operations Manager:** The Operations Manager authenticates and manages access to video feeds. It is a centralized administration tool for management of Media Servers, Virtual Matrixes, cameras, encoders, and viewers and for viewing network-based video.
- **Cisco Video Surveillance Virtual Matrix:** The Virtual Matrix monitors video feeds in command center and other 24-hour monitoring environments. It allows operators to control the video being displayed on multiple local and remote monitors.

- **Cisco Video Surveillance Encoding Server:** This single-box solution encodes, distributes, manages, and archives digital video feeds. Each server encodes up to 64 channels and provides up to 12 TB of storage.
- **Cisco Video Surveillance Storage System:** This complementary component allows the Media Server's internal storage to be combined with direct attached storage (DAS) and storage area networks (SANs).

4.6.1 IP Video Surveillance

A video surveillance system that runs over an IP network infrastructure enables the video to be distributed to any number of sites, within the constraints of available bandwidth. The convergence of video surveillance into an existing IP network offers several benefits, including:

- Network-wide management. Devices are monitored over a single network for alarms or failures.
- Transfer of control and monitoring to any other point in the network in an emergency situation.
- Increased availability. IP networks offer a high level of redundancy that can extend to different physical locations.
- A system that can easily expand as business needs change.

Cisco's solution offers software and hardware to support video transmission, monitoring, recording, and management. Cisco video surveillance solutions work in unison with the advanced features and functions of the IP network infrastructure—switches, routers, and other network security devices—to enable secure, policy-based access to live or recorded video.

Cisco video surveillance products are deployed within the Cisco Intelligent Converged Environment architecture. Through this architecture, video can be accessed at any time from any place, enabling real-time incident response, investigation, and resolution. As an extension of the Cisco Self- Defending Network, the Cisco Intelligent Converged Environment enables customers to use existing investments in video surveillance and physical security while enhancing the safety of people and protection of assets.

The open, standards-based Cisco infrastructure enables the deployment and control of new security applications and maximizes the value of live and recorded video, interacting with multiple third-party video surveillance cameras, encoders and applications. Unlike many other video surveillance offerings that use proprietary hardware, Cisco Video Surveillance software runs on Linux-based servers to allow for easy upgrades that support new features and support an evolving range of deployment scenarios

The main components of the Cisco Video Surveillance Manager

Fig 4.6.1 Cisco Video Surveillance Manager

4.6.2 Cisco Video Surveillance Media Server

The Cisco Video Surveillance Media Server is the core component in the Cisco Video Surveillance Manager and performs the following networked video surveillance system functions:

- Collection and routing of video from a wide range of third-party cameras and video encoders over an IP network
- Event-tagging and recording of video for review and archival purposes
- Secure local, remote, and redundant video archive capabilities

In Figure 4.6.2 the Media Server is responsible for receiving video streams from different IP cameras and encoders and replicating them as necessary to different viewers.

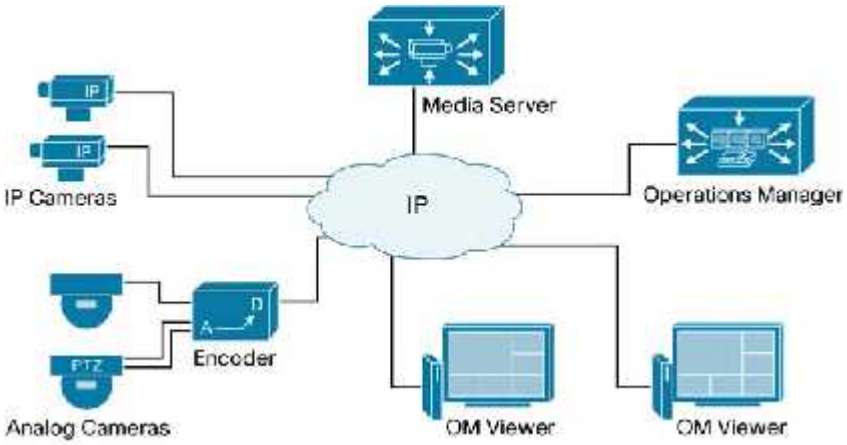


Fig 4.6.2 Video Surveillance Media Server

By using the power and advanced capabilities of today's IP networks, the Media Server software allows new third-party applications, additional users, cameras, and storage to be added over time. This system flexibility and scalability supports:

- Hundreds of simultaneous users viewing live or recorded video
- Standard video compression algorithms such as MJPEG, MPEG-2, and MPEG-4 simultaneously via a single Media Server or system
- Conservation of storage using events and loop-based archival options
- Integration with other security applications

4.6.3 Cisco Video Surveillance Operations Manager

Working in conjunction with the Cisco Video Surveillance Media Server, the Cisco Video Surveillance Operations Manager enables organizations to quickly and effectively configure, manage and view video streams throughout the enterprise. Figure 4 shows the Operations Manager main screen, which is accessed via a web browser.

Fig 4.6.3 Video Surveillance Operations Manager

The Operations Manager meets the diverse needs of administrators, systems integrators, and operators by providing:

- Multiple Web-based consoles to configure, manage, display, and control video throughout a customer's IP network
- The ability to manage a large number of Cisco Video Surveillance Media Servers, Cisco Video Surveillance Virtual Matrixes, cameras and users
- Customizable interface, ideal for branded application delivery

- Management of multiple Cisco Video Surveillance Media Servers
- Encoder and camera administration
- Scheduled and event-based video recording
- User and role management
- Secure login
- Event setup and event notifications
- Record Now" feature while viewing live video

4.6.4 Cisco Video Surveillance Virtual Matrix

The Cisco Video Surveillance Virtual Matrix software allows authorized security managers and operators to select and control video displayed on any number of digital monitors on a local and remote basis.

The software also permits integrated security applications to control digital video displayed on any number of digital monitors on a local or remote basis. The Virtual Matrix software uses the IP network to provide aggregation and transmission of video from cameras and recording platforms much like the function of a classic analog video matrix switch, offering capabilities that analog switches cannot deliver.

The Virtual Matrix brings complete flexibility to the delivery of live and recorded video to demanding command centers, providing high availability access to network video for 24x7 monitoring applications.

Figure 4.6.4 demonstrates how operators can choose from any number of available cameras to be displayed on any system monitors within any custom video display patterns. The VM Monitors display the video streams defined on the Operations Manager on a single display or video wall displays. The Virtual Matrix also integrates with other systems to automatically

display video in response to user-defined event triggers. These triggers can include access control and fire systems in buildings, outdoor motion sensors, or even radar systems for military applications.

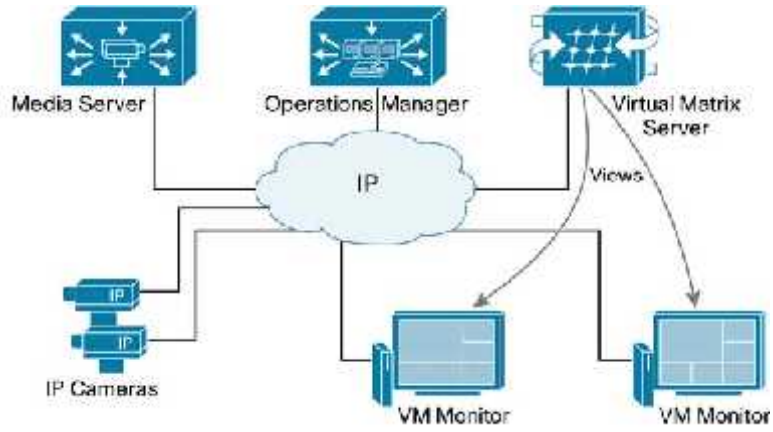


Fig 4.6.4 Virtual Matrix Switch

The Virtual Matrix software provides:

- Ability to access and display video in remote command centers
- Easy integration with other intelligent systems
- Flexible delivery of both live and archived video
- Ability to control multiple video displays from a single station
- Ability to control multiple video displays from a single station

4.6.5 Cisco Video Surveillance Encoding Server

The Cisco Video Surveillance Encoding Server is an all-in-one appliance that encodes, distributes, manages, and archives digital video feeds. Each server encodes up to 64 channels and provides up to 12 TB of storage. The Encoding Server can combine multiple video codecs in a single Encoding Server, including MJPEG and MPEG-4. With the addition of the Cisco Video Surveillance Operations Manager, the Encoding Server also provides administrators

and operators with multiple Web-based consoles to configure, manage, display, and control video.

Figure 4.6.5 shows an Encoding Server receiving video streams directly from IP and analog cameras. The analog video streams are encoded into a video stream that can be archived and distributed to the different viewers. The Encoding Server acts as the Media Server and Encoding Server simultaneously.

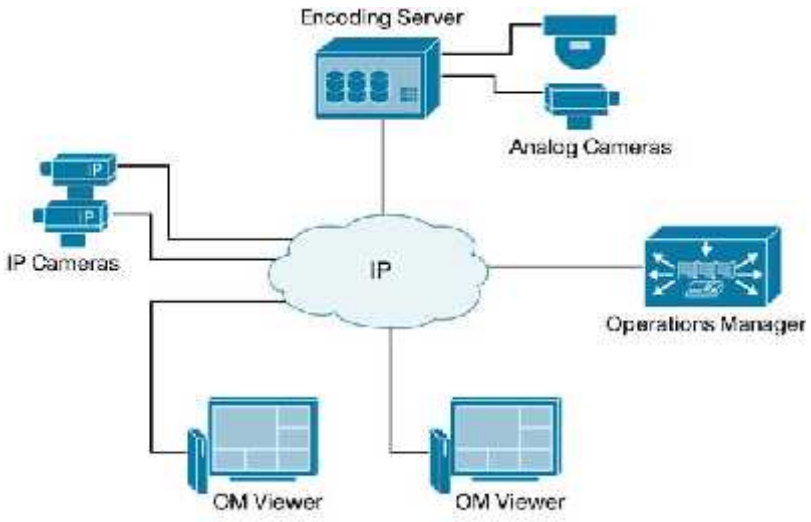


Fig 4.6.5 Video Encoding Server

The Video Surveillance Encoding Server provides:

- Flexibility to use a broad array of analog cameras and IP cameras
- Simultaneous MJPEG and MPEG-4 encoding
- Motion detection
- Scalable deployment with multiple sites, cameras, users, and storage
- Ability to connect to external storage up to: 64 CIF Channels, 32 2CIF or 4.4CIF channels.

4.6.6 Cisco Video Surveillance Storage System

As an integral component of the Cisco Video Surveillance Manager solution, the Cisco Video Surveillance Storage System provides flexible options for storing video and audio using cost-effective, IT-caliber storage devices. The Storage System allows the Cisco Video Surveillance Media Server's internal storage to be combined with direct attached storage (DAS) and storage area networks (SANs). As a result, video can be efficiently secured and accessed wherever it is needed, locally or remotely.

Figure 4.6.6 shows a single server providing the functions of a Media Server, Operations Manager and Virtual Matrix that is also connected to an external storage system.

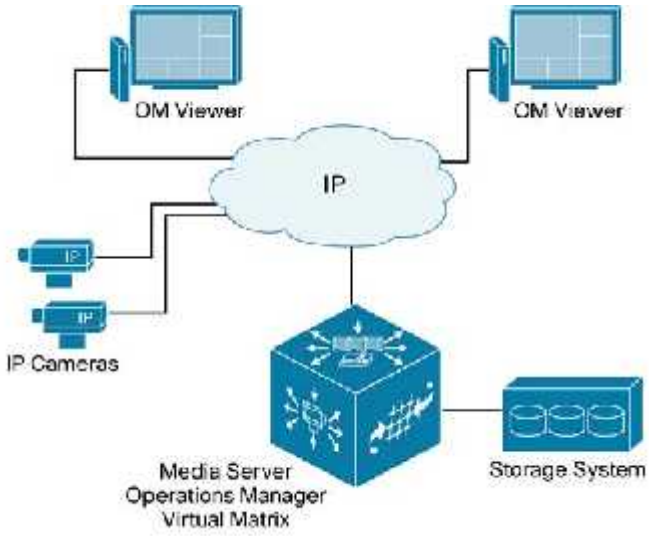


Figure 4.6.6 Storage System

The Storage System enables operations managers to institute video lifecycle management rules to ensure availability of the data. Video can be stored in redundant systems or in remote long-term archives to ensure the video is available when required.

Some of the Storage System features are:

- Media Server maintains internal storage up to 24 TB
- DAS arrays support up to 42 TB per array, 420 TB per rack
- Support for 3rd party SANS
- RAID 5 configurations available.

4.7 SYSTEM ANALYSIS

System analysis is the process of gathering and interpreting facts, diagnosing problems and using the information to recommend improvement to the analysis. It specifies what the system should do at a particular time. Design states the process involved in how to accomplish the objectives. It is also an activity that encompasses the tasks. In terms of this project, it will be the system development life cycle. The process of system analysis is conducted with the following objectives in mind:

- Identify the need of computerization of the database of the system.
- Evaluate the system concept for feasibility
- Reform economical and technical analysis.
- Allocate function of hardware, software, database and other system elements.

4.7.1 Database

The function of the Database is to store all information concerning pictures of vehicles, number plate and also connected to a central Network Video Recorder (NVR) to handle the recording, video and alarm management. It is not advisable for a user to get access to the Database. Therefore, the database has a very high security. The system administrator and the software developer are the only people who can access the database.

4.8 SYSTEM TESTING

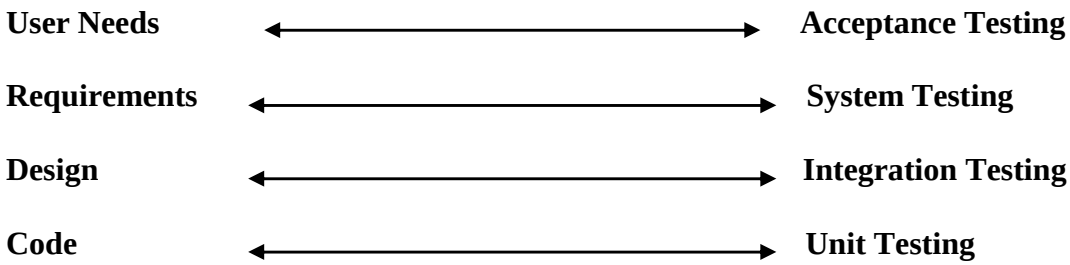
The aim of testing process is to identify all defects in a software product. Testing is any activity aimed at evaluating the software for quality results it produces and the quality of results it can handle. Testing is an operation to detect the differences between the expected (required) result and the actual result.

Testing a program consists of subjecting the program to a test inputs or test cases and observing if the program behaves as expected. If the program fails to behave as expected, then the condition under which failures occurs are noted for later debugging and correction. There are many stages of testing depending on the complexity of the software.

The basic levels of testing are:

i. Unit Testing.
ii. Integration Testing.
iii. System Testing
iv. Acceptance Testing.

The levels of resting attempt to detect different types of faults. The relation of faults introduces in different phases and the different levels of testing are shown.



4.8.1 Integration testing

Once a program or module has been unit tested, the programmer can then work with integration it with other programs. The primary objective of integration testing is to test the module interfaces in order to ensure that there are no errors in the parameter passing, when one module involves another modules.

During integration testing, different modules of the system are integrated in a planned manner i.e. the order in which they are combined to realize the full system.

The various approaches of integration testing are:

- Big Bang Approach.
- Top-Down Approach.
- Mixed Approach.
- Bottom-Up Approach.

Out of the above four approaches Mixed Approach has been used for the proposed system. A mixed approach integration testing follows a combination of top down and bottom up testing approach. In the top-down approach, testing can start only after the top level modules have been coded and unit tested. Similarly, bottom up approach can start only after the bottom level modules are ready. The mixed approach overcomes these shortcomings of the top-down and bottom-up approaches. In the mixed testing approach, testing can start as a when modules become available.

4.8.2 System testing

System testing is actually a series of different tests whose primary purpose is to exercise the computer based system, all work to verify that system elements have been properly integrated and performed allocated function. Its focus is to prove that the completed system does what it should. This test is conducted in a formal manner. System testing activities are intended to prove that the system meets its objectives. Testing proves that the system meets its requirements.

This is not entirely true unless one considers acceptance testing as a type of a system testing because the purpose of acceptance testing is to demonstrate that the system meets the user requirement.

4.8.3 Acceptance of testing

Acceptance testing is validation process. Acceptance testing in the strictest sense is a verification process. Regardless of whether it represents verification or validation, acceptance testing represents an external view of the system.

As students' project work, the system we have developed was tested with our project supervisor Dr. Thomas Yeboah. Since system testing requires that the whole system which has been developed meets the requirements that it was intended for. The main targets for this system were a database to store and records the pictures of vehicles generated. Therefore, we have been able to achieve our aims for developing the system.

Advantages of the acceptance testing

1. The acceptance testing was done in the shortest possible time.
2. Our aims for the project were successfully achieved.

Disadvantages of the acceptance testing

Since the acceptance testing was not done in our main scope but rather the supervisor, there might certain information the database might have added or removed from the completed system.

4.8.4 Performance testing

Performance testing was done to check whether the data structures have been designed successfully for extraordinary situation. The system application node responded to the request of another. The application identified end-users by some form of login procedure which requires that a user enters his or her username and password to have access to the system.

Software’s non-functional part was also tested on the system to evaluate the system's compatibility with the computing environment. After the compatibility testing the system was compatible with the hardware and software used.

4.9 SYSTEM IMPLEMENTATION

Once the system was tested, the implementation phase started. The term implementation has different meanings, ranging from the conversion of a basic application to a complete replacement of a computer system. Implementation is the process of converting a new or a revised system design into an operational one.

Implementation includes the activities that took place to convert the older system to the newer one.

The new system may be totally new or replacing an existing system. In either case, proper implementation is essential to provide a reliable system to meet organizational requirements. System implementation describes how the different parts of the system are interacting with each other to give us a realistic software solution.

CHAPTER FIVE

DISCUSSION

5.0 SUMMARY

Surveillance system has taken the next level towards the police in Ghana and now things are getting technology ways. The word surveillance is the French word for "watching over"; "sur" means "from above" and "veilled" means "to watch" The word Surveillance may be applied to observation from a distance by means of electronic equipment (such as CCTV/ IP cameras), or interception of electronically transmitted information (such as Internal traffic or phone calls).Surveillance is very useful to governments and law enforcement to maintain social control, recognize and monitor threats, and prevent or investigate criminal activities.

The word Surveillance may be applied to observation from a distance by means of electronic equipment such as Closed Circuit Television (CCTV) or Internet Protocol (IP) cameras. Video surveillance system also includes an audio device, component associated with capturing the image of an individual and also monitor of the behaviors, activities usually of people for the purpose of protecting and observing. The development of centralized networks of CCTV/ IP cameras watching public areas linked to the computer database of vehicles pictures and identity and to track vehicles movements throughout the N1 road. A database will also be created against the software for both the police and the Drivers and Vehicles Licenses Authority (DVLA) which will be link together to trace and track the hit and run away drivers and vehicles on the motorway. Since every vehicle is subjected to road tax and yearly renewals.

Our proposed system was work under the principle of surveillance video system through CCTV/ IP cameras which will be mounted at vantage points watching over the public areas and have be linked to the computer database of pictures of vehicles, number plates and also

Connected to a central Network Video Recorder (NVR) to handle the recording, video and alarm management.

5.1 DISCUSSION

IP surveillance video systems comes in some basic functions, the advantages of network video is customizing surveillance applications, and possible legal concerns. The most important step one can take before installing IP surveillance system is to define goals and requirements. Once these are determined, the video system can be set up.

The required goals to be determined are the following: definition of the video surveillance system needs (installation plan, area of coverage, camera positioning, illumination conditions determination, camera cabling, the recording server positioning), network camera and/or video encoder selection (image quality, lens selection, network camera selection, Power over Ethernet [POE], video motion detection, audio, accessories selection, testing), hardware (switches, additional light sources, power supplies, additional server for video management software, hard drives), software (software package selection, licenses, image quality and frame rate requirements, IP address range calculation, hard disk usage calculation, camera configuration, video motion detection settings, user access definition), and maintenance.

CHAPTER SIX

CONCLUSION AND RECOMMENDATION

5.2 CONCLUSION

Despite the fact that the system is hoped to be successful, the fact about future expansions should not be overlooked. It is our hope that we will continue from this point to develop a complete system that will make the surveillance video system as effective as possible. It will also be appreciated if other project teams will continue from where we have ended.

Hence this new system will help generate accurate and timely reports for management to make decisions that will enhance the successful operation CCTV/ IP cameras system

Also, the aim and objectives that were laid down before the start of the development of the system have been successfully achieved; that is

Aim:

Our main motive of this project on the N1 motorway was to trace and track vehicles, hit and run away drivers and also provide adequate evidence at the scene of crime for the authorities.

Objectives:

i. To be able to monitor all the activities on the road such as non-functioning traffic and street lights, break down vehicles will be identified, capturing dangerous driving etc.

ii. To be able to obtain detailed information and keep them in one database to make information retrieval easy.

iii. To provide reliable data for timely decision making.

Looking at the aim and objectives stated above, we were able to develop the system successfully and the other objectives have also been successfully achieved. The result of this project leads to the conclusion that if this software is introduced and implemented.

The result of this project leads to the conclusion that if this software is introduced and implemented, it would help both the Ghana police and Drivers and Vehicles Licenses Authority (DVLA) achieve the objectives above and also help get rid of manual work from the system.

5.3 RECOMMENDATION

Our first recommendation is that the DVLA Company and the Ghana Police should be willing to assist students to get some information pertaining to their work since project forms part of the students' academic work.

Also, we recommend that students should be able to complete their projects within the stipulated time to avoid any delays in supervision and defense.

We recommend that a backup of the database be created periodically to prevent data loss in the event of system breakdown.

We also recommend that username and password of the system should be kept secret from other staffs who are not allowed access to the system.

REFERENCES

Ainley R. (1998) Watching the detectors: control and the Panopticon

Albrechtslund, Anders (March 3, 2008). "Online Social Networking as Participatory Surveillance" First Monday **13**. Retrieved March 14, 2009.

Allen, M. (1994) 'See You in the City!' Perth's Citi- place and the space of surveillance.

Bannister, J., N.R. Fyfe and A. Kearns (1998) Closed circuit television and the city.

Bannister, J., N.R. Fyfe and A. Kearns (1998) Closed circuit television and the city. In C. Norris J. Moran and G. Armstrong (eds.) Surveillance, Closed Circuit Television and Social Control.

Bentham J. (1789) An Introduction to the principle of morals and Legislation.

Birch, Dave (July 14, 2005). "The age of surveillance". The Guardian (London). Retrieved August 6, 2007.

Butler, Don (February 24, 2009). "Surveillance in society". The Star Phoenix

Butler, Don (February 24, 2009). "Surveillance in society". The Star Phoenix (CanWest). Retrieved March 17, 2009

C. Norris J. Moran and G. Armstrong (eds.) Surveillance, Closed Circuit Television And Social Control.

Campbell, Monica (August 4, 2004). "Law enforcement in Mexico goes a bit bionic". Christian Science Monitor. Retrieved March 17, 2009.

Fopp, R. (2002) Increasing the potential for gaze, surveillance and normalization: the transformation of an Australian policy for people who are homeless. Surveillance and Society,1: 48-65 At:

http://www.surveillance-and-society.org/articles1/homeless.pdf.

Foucault M (1977) Discipline and punish.

Foucault, Michel (1995). Discipline and Punish. New York: Random House. pp. 200– 203.

Gilliom, John. 2001. Overseers of the Poor: Surveillance, Resistance, and the Limits of Privacy. Chicago: University of Chicago Press.

Gorman, Siobhan (October 1, 2008). "Satellite-Surveillance Program to Begin Despite Privacy Concerns". The Wall Street Journal. Retrieved March 16, 2009.

Graham, Steven, and David Wood. 2003. Digitizing surveillance: categorization, space, inequality. Critical Social Policy 23.

http://www.cisco.com/go/physicalsecurity

http://www.cisco.com/go/vsm

Jensen, Derrick (2004). , Welcome to the Machine: Science, Surveillance and the Culture of Control. Vermont: Chelsea Green Publishing. pp. 112–124.

Lyon, David (2001). Surveillance Society: Monitoring in Everyday Life. Philadelphia: Open University Press.

Lyon, David (2007) Surveillance Studies: An Overview. Cambridge: Polity Press.

Lyon, David. 2007. Surveillance Studies: An Overview. Cambridge: Polity Press.

Mail Online. 2008. Graffiti artist Banksy pulls off most audacious stunt to date - despite being watched by CCTV, Available from http://www.dailymail.co.uk/news /despite-watched- CCTV.html

Mann, Steve, Jason Nolan, and Barry Wellman. 2003. Surveillance: Inventing and using wearable computing devices for data collection in surveillance environments, Surveillance and Society.

Marx, G. T., & Muschert, G. W. (2007). Personal information, borders, and the new surveillance studies. Annual Review of Law and Social Science, 3, 375-395.

Spielman, Fran (February 19, 2009). "Surveillance cams help fight crime, city says". Chicago Sun Times. Retrieved March 13, 2009.

Vlahos, James (January 2008). "Surveillance Society: New High-Tech Cameras Are Watching You". Popular Mechanics. Retrieved March 14, 2009.

www.wikipedia.com