Original Research Article

Controlling surveillance systems and PTZ cameras from a mobile device

ABSTRACT:

A data center is a physical facility that organizations use to house their critical applications and data. An application delivery controller, router, switch, firewall, storage system, and server make up the design for the data center. Data security in the data center is critical due to these components' role in storing and managing critical business data and applications. An Android application has therefore been developed that can be used on smart phones to monitor and follow the performance of the data center camera monitoring system. Surveillance cameras in the data center allows the data center manager to monitor employees, machines, and all data center facilities from his office via his mobile phone, or even when he is out of the office, and to view a report of faults and maintenance to ensure the efficiency of the system. Using the application, the engineer can also control the cameras by panning and zooming in on the camera images in the data center, playback previous recordings of cameras, and review fault reports to find out the malfunctions of the monitoring system from anywhere with an Internet connection.

Key word: Data center, surveillance system, CCTV, PTZ cameras

INTRODUCTION

It is the role of the data center in the Information and Communication Technology (ICT) era, especially for businesses to be able to provide optimal services to support their success. The data center processes, transmits, and store a large amount of data and information that is necessary to run a business effectively. The success of an organization depends on the availability of information. Therefore, protecting information against a variety of security threats is an important requirement for success. For preventing security threats such as identity theft, computer-assisted fraud, vandalism, and computer hacking [1], CCTV plays a critical role in the overall security plan. Essentially, it serves as a means of monitoring assets by monitoring their locations and their activity. It is intended to detect unauthorized entry into a facility by monitoring the perimeter and following the individual through the building [2]. The common

objective of most CCTV systems has been to prevent crime and disorder by tracking and monitoring through the use of the location and orientation of cameras The advantage of CCTV is claimed to be that it provides public reassurance, which reduces the fear of crime. In addition, CCTV is claimed to assist in detection through its surveillance ability. The use of mobile phones has become one of the most fundamental parts of everyday life, especially when it comes to managing our sites, like monitoring traffic patterns or controlling crowds [3]. High-end video surveillance systems often utilize PTZ (Pan, Tilt, Zoom) cameras, which allow for greater flexibility. Since the number of subjects is usually greater than the number of video cameras, it is difficult to assign subjects to these cameras. In this paper, we investigate the problem of controlling the cameras in automatic video surveillance systems, which has been the subject of numerous studies [4]. In the absence of the manager or engineer, we develop a program to automate the pan, tilt, and zoom features so an engineer can control them remotely while they are away from the office. There are many factors which affect the control of cameras, such as the direction and location of the subject, the distance from the cameras, occlusion, the overall recognition probability, and the expected time when the subject will leave. The control is also influenced by the movements of cameras and their capabilities and limitations [5].

Typically, the purpose of CCTV systems has been to prevent crime and disorder through intelligence and monitoring. As a result, intelligent video surveillance technologies are needed to automatically monitor the scene for important events and behaviors. Intelligent video surveillance technologies are characterized by two particularly important characteristics: efficiency and robustness. As a result, mobile applications are increasingly being used to track CCTV systems [3]. There has been recent research on the use of PTZ cameras. The Distant Human Identification (DHID) system [6] provided an example of a master-slave configuration. A fixed camera is used to observe a scene and send visual information to a server, which then analyzes the scene and sends commands back to the PTZ camera, which then captures finer frames for targets.

Traditionally, closed-circuit television (CCTV) has been the primary method for video surveillance. Nowadays, Camera video surveillance has gained a lot of attention as a research area. Therefore, automated video surveillance systems include real-time and sophisticated artificial intelligence techniques. [7]. A major development in video surveillance in the last few years has been the transformation of analog video to IP video and the resulting improvements in

processing power and compression algorithms [8]. In order to design a video surveillance system, you should be aware of the basic options and understand the guiding principles behind deciding which options are available in the market [9]. As a result, developing a system necessitates improved remote access, a more noteworthy mix with other systems, improved picture quality, and flexibility with other systems [10, 11]. Murder and rape have been repeatedly committed against relatively vulnerable people such as women, children, and youth in recent years, which has resulted in the safety gap widening in modern cities as a result of the growing crime problem [12]. CCTV has been recognized as a powerful crime prevention tool all over the world, and CCTV systems are expanding in developed countries including the U.K., the U.S., and France[13]. There are many reasons for using Android devices, including the open-source nature of Google's platform, which has encouraged manufacturers to develop low-cost smart devices [14]. Android is an operating system where the entire system is open and accessible to developers, and Android applications are written using the programming language Java, which also facilitates access to Android's software development kits (SDK), which have resulted in an explosive development of Android applications. An Android application is useful for controlling surveillance cameras and reviewing all the recordings, allowing the engineer or director of a data center to know the status of surveillance cameras without going to the server room or data center. This paper makes an in-depth study of the design and feasibility of solutions, highlighting the need to develop an Android app for this purpose.

As the Internet network has grown, network-based CCTV has become more and more common in the world. CCTV is particularly useful in the prevention of crime, but its scope is becoming ever broader. As a CCTV system consists of various components, such as a surveillance camera, image monitoring control server, authentication and access control server, desktop computers, screens, and laptops, image data is transmitted and received via a wired or wireless communication channel. The surveillance camera, the image monitoring and control server communicate over a wired or wireless network. Several steps are involved in the process of sending and receiving image information between surveillance cameras and image monitoring control servers. Images are taken by the surveillance camera and encrypted before being sent to the image monitoring control server. During these steps, the encrypted image data is sent, the received image data is decrypted, the facial area is detected, an image is created with privacy

protection, and the image is saved. CCTV cameras and image monitoring control servers should be able to transmit images securely.

2. EXISTING SYSTEM

An attempt has been made to detect and track certain objects from image sequences, as well as to understand their behavior. The aim is to replace traditional video surveillance with intelligent visual surveillance. Cameras are not only used to replace human eyes, but also to automate surveillance tasks such as controlling PTZ cameras, retrieving previous cameras records, monitoring cameras and displaying fault and maintenance reports through mobile devices. It is possible to use visual surveillance in dynamic scenes for a wide variety of purposes, including providing security for important buildings and communities, monitoring traffic in cities and expressways, detecting military targets, etc. The focus of this paper is on surveillance applications involving people or vehicles in buildings, since they are typical of surveillance applications and encompass all surveillance methods and control. People and vehicle surveillance applications include:

A) Person-specific identification in certain scenes.

Using a smart surveillance system guards can identify intruders and thieves from afar. The system automatically detects whether the person in view is an intruder or a thief. If yes, an alarm is immediately sent. The reliability of such systems with face recognition is below what police need, but it has been tested at public sites [15].

b) Anomaly detection and alarming.

In order to identify abnormal behavior, it is sometimes necessary to analyze a person's or a vehicle's behavior. For example, surveillance cameras in parking lots and supermarkets could observe abnormal behavior that indicates theft. An alarm can normally be given in different ways, one of which is to automatically make an announcement whenever any abnormal behavior is detected, and another of which is to automatically contact the police [16][17][18].

C) access control in special areas.

Only those with special identification are legally allowed into some security-sensitive areas, such as military bases and important government facilities. Using biometrics, a database of biometric features is created in advance that includes VIP visitors. A system could identify the visitor's features, such as height, face and eye appearance, walking gait, and walking style, based on images taken in real-time, and then determine whether the visitor can enter the facility [19].

D) Crowd flux statistics and congestion analysis.

Through approaches for detecting humans, visual surveillance systems can calculate how many people are at public areas such as stores and travel sites and provide congestion analysis to assist in their management. Likewise, visual surveillance systems are useful in monitoring expressways, analyzing traffic flow and monitoring road congestion, both of which are highly important to traffic management [20].

E) Interactive surveillance using multiple cameras.

Social security could be enhanced by cooperative surveillance using multiple cameras by tracking suspects over a wide area, for example, in order to ensure the safety of the entire community. Traffic police can identify, track, and arrest vehicles involved in traffic crimes through interactive surveillance using multiple cameras [20].

3. PROPOSE SYSTEM

Almost every government is faced with the issue of crime. Using CCTV to control PTZ cameras at a distance can help guards identify intruders and thieves, and place visual surveillance systems at locations where intruders usually congregate, such as corridors, near server rooms, etc. Visual surveillance is a research topic in tracking systems for identifying and determining whether the people in view are intruders. It has been using to detect, recognize and track certain objects from image sequences, and more generally to understand object behaviors. In order to automate as many surveillance processes as possible, we plan to use smart phones, including controlling cameras, monitoring cameras, retrieving historical records, and receiving fault and maintenance reports.. Today, CCTV systems employ a variety of well-established methods for detecting humans.

A. Mobile Application controls surveillance cameras monitoring

Control and playback of videos from monitoring cameras can be controlled by mobile applications, and previous recordings can be retrieved from the storage server.

B. Server Application for Monitoring and Controlling

An engineer can control PTZ cameras (pan and tilt), retrieve video records, and generate maintenance reports using this proposed application, when he is in or out side data center. CCTV cameras can focus on given parameters. When an engineer is outside a data center, this application might be most useful. When that happens, engineer will activate application that will control PTZ camera in all the directions he desires. Using these parameters, commands will be given to CCTV cameras for panning, tilting and focusing the cameras at a specific location. This makes it easier to identify people since they can be seen on the video.

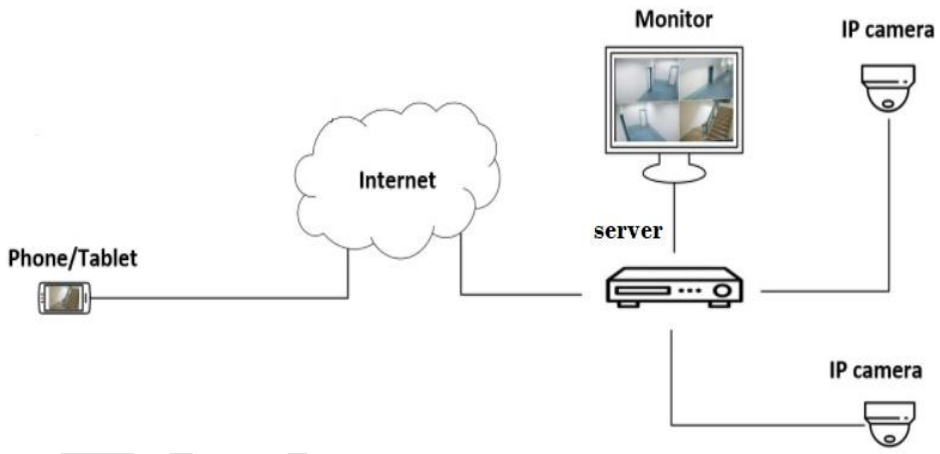

Figure 1. Propose System Architecture.

C. Mobile phone

Through J2ME, mobile phones can take control of and view surveillance videos remotely. For example, via NXT Service, mobile phones can remotely control the movement of a mobile camera, as well as retrieve the surveillance videos recorded by a remote camera through the Cam Service. In wireless environments, security and privacy are key concerns. From a system perspective, in addition to the username and password check on the system, the surveillance user can activate the firewall function to prevent any malicious networks from accessing the system and enable an end-to-end Secure Socket Layer connection (SSL) mechanism to protect the data transmitted via Internet. Modern Wi-Fi access points support (AES) mechanisms for encrypting data transmitted over Wi-Fi networks, whereas data can be encrypted over HSDPA networks using SIM-based encryption. Additionally, WiMAX is capable of encrypting data using modern cryptographic algorithms including AES with a 1024-bit key [21].

D. Control data transmission

Some of the earliest remote control CCTV systems relied on a hard-wired link between the control console and the PTZ head. However, these systems required a lot of multicore cabling between the control room and each individual camera site and, in some cases, were prone to the effects of voltage drops along the cables.

A much more effective alternative to this method of control was to send digitally encoded PTZ commands along a twisted pair cable in the form of RS 422 or RS 485. The principle is illustrated in Figure (2). The commands are encoded into a data format and sent to the receiver through a two-wire connection. A decoder chip in the receiver (the site driver) translates the commands and controls the relay(s) as directed by the site driver [22].

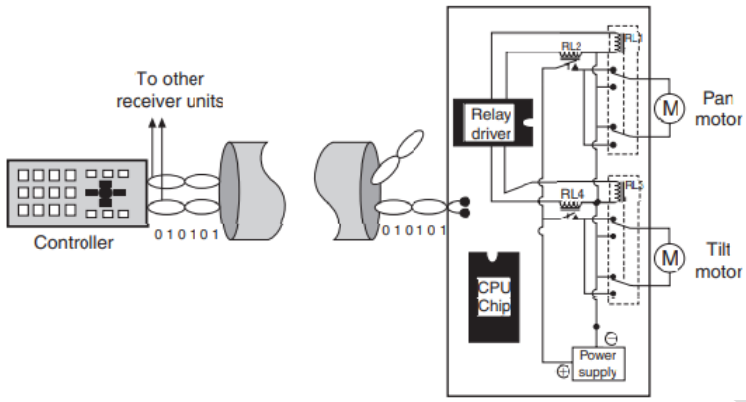

Figure 2. Control of motors using a separate data link such as RS 485 over a twisted pair.

This unit consists of two motors that are connected by gears that convert motor speed to torque. The motors may be 24 VD.C., 24 VA.C. While an AC motor is generally more efficient and often produces more torque than its equivalent-size DC motor, the control of an AC motor is somewhat more complex than that of a D.C motor. When high winds are exerting a heavy load upon the camera assembly, motors are ideal, as a high torque drive mechanism is required to overcome this. D.C. P/T units, on the other hand, will offer multi-speed (speed changes progressively) or variable-speed control where dynamic joystick control is to be implemented in the system or controlled by a phone device [22].

E. Significance of the proposed system

- The importance of proposed system to development an Android application to control PTZ cameras and retrieve previous recorded videos from server.
- Producing a comprehensive faults report.
- Get information about cameras that an engineer need.
- Knowledge of the state of the system in terms of stability from anytime and anywhere.

The proposed system facilitates the process of accessing the cameras and moving them in all directions with the ability to view all the cameras on the site, in addition to retrieving previous video recordings according to time and date and displaying the fault report and dealing with cameras of different sources such as cameras (Sony, ZTE and Hikvision) compared to other applications that deal with only one type of camera.

The proposed system contributes to saving time, effort and money for the services it provides and for knowing the events when they occur, from anywhere and at any time. Without going to the control room in the data center to find out what is happening.

F. Proposed System efficiency

The efficiency of the proposed system is primarily determined by the CPU architecture, RAM, storage capacity, and internet signal performance factors. To investigate and verify this reliance, as well as the system's assumptions and requirements. The cell phone had been chosen for its outstanding performance and specifications. and give internet to mobile devices via Wi-Fi and a SIM card.

G. proposed system design

We use UML diagram to represent system as following

- Use case diagram
  Use cases describe a set of activities that result in a certain output.

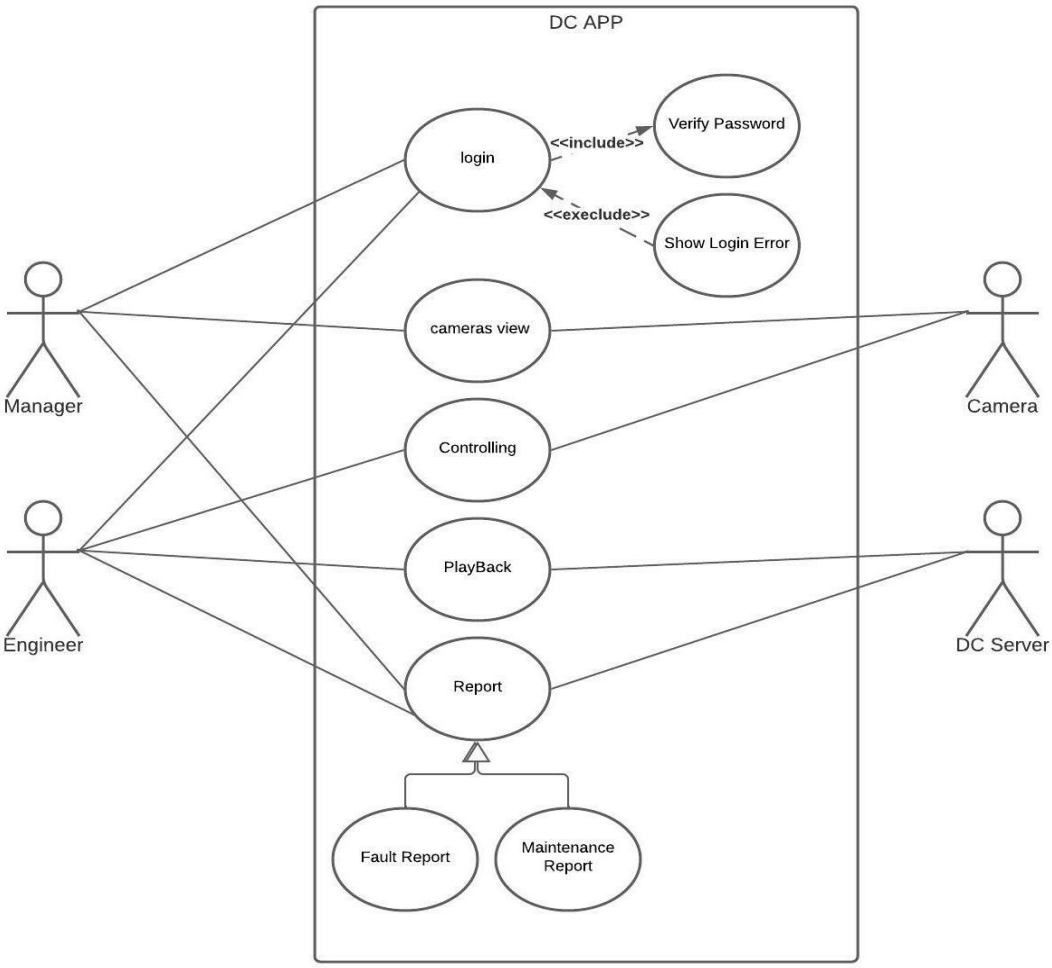

Figure 3. use case diagram

- **Sequence diagram**

  It is a diagram of the time sequence of the objects participating in the interaction, and it consists of the vertical dimension of time and the horizontal dimension of the objects Different numbers are used to show the sequence of messages between objects and time [23].

A. Engineer sequence diagram

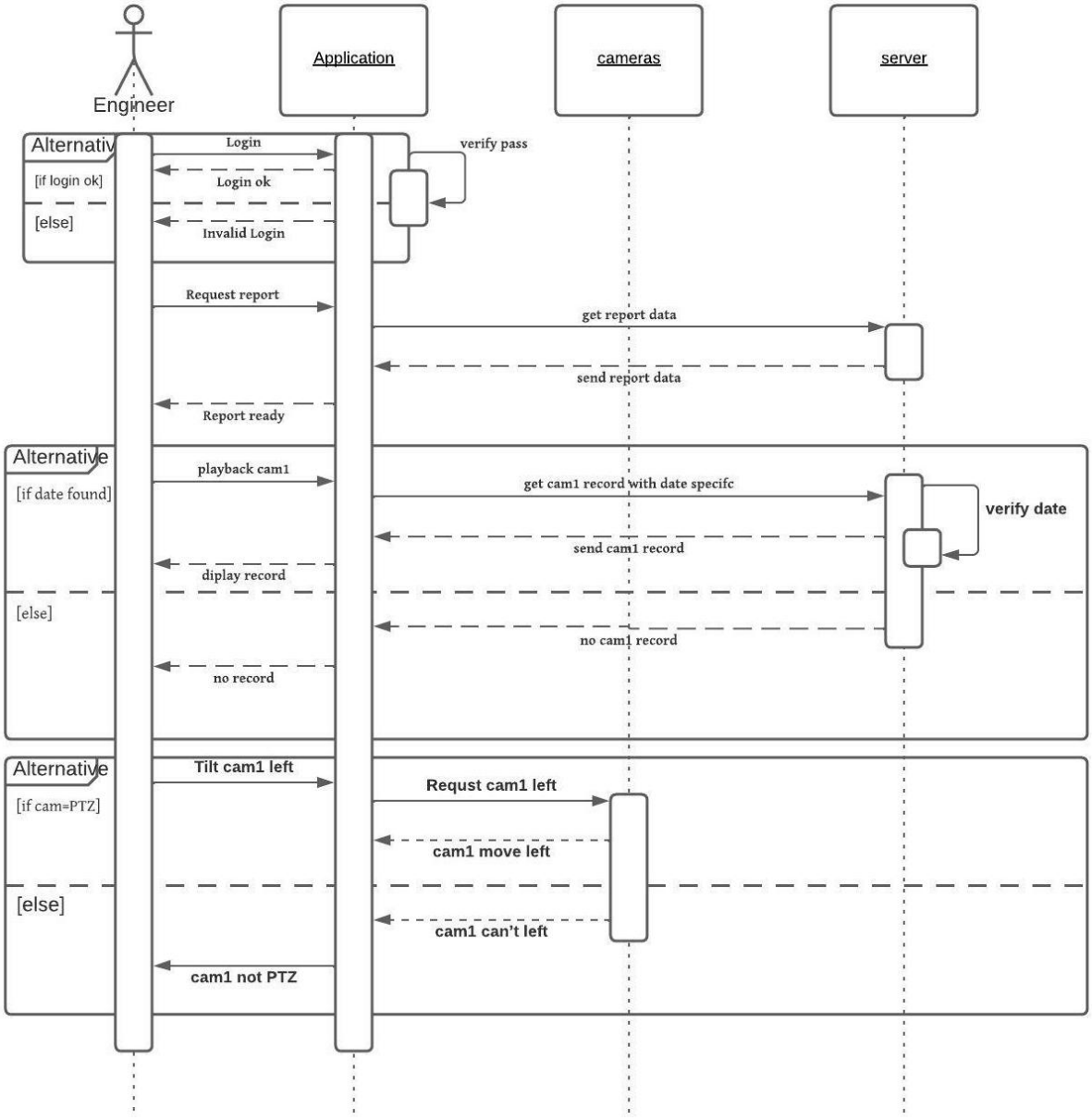

Figure 4. Engineer's Sequence diagram

B. Manager sequence diagram

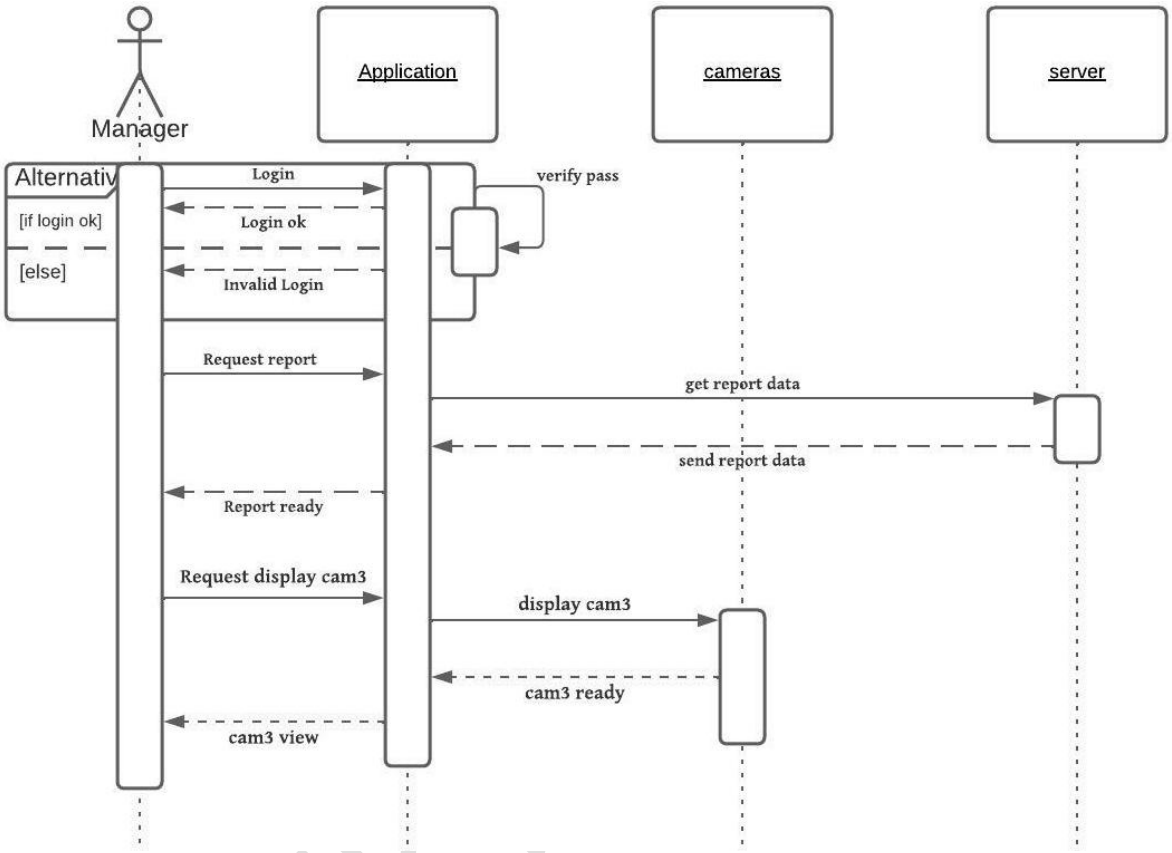

Figure 5. Manager's Sequence diagram.

- **State diagram**

  State diagrams show a behavioral model containing of states, state transitions and actions.

A. Engineer state diagram

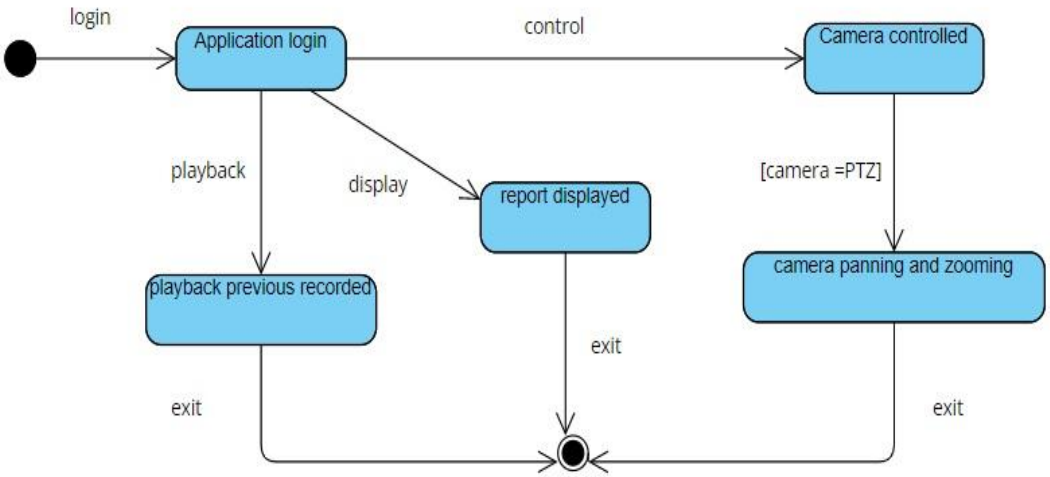

Figure 6. Engineer's State diagram.

B. Manager state diagram

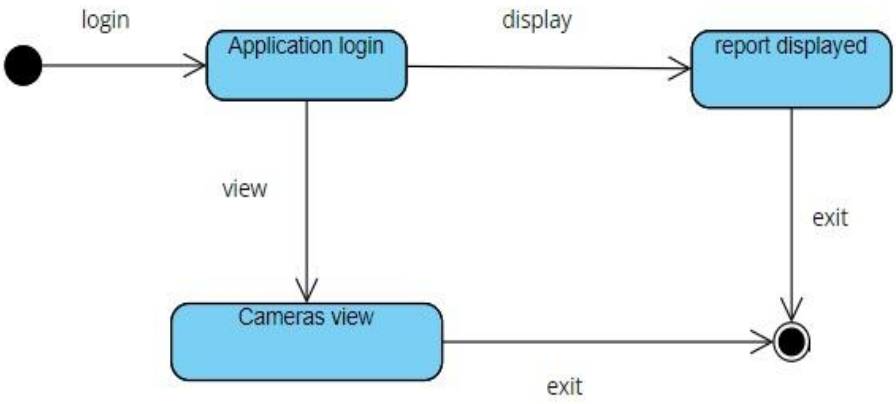

Figure 7. Manager's State diagram.

- **Deployment diagram**

  A deployment diagram is a diagram that shows the physical hardware that the software system will run on. It also dictates how the program is installed on the hardware.

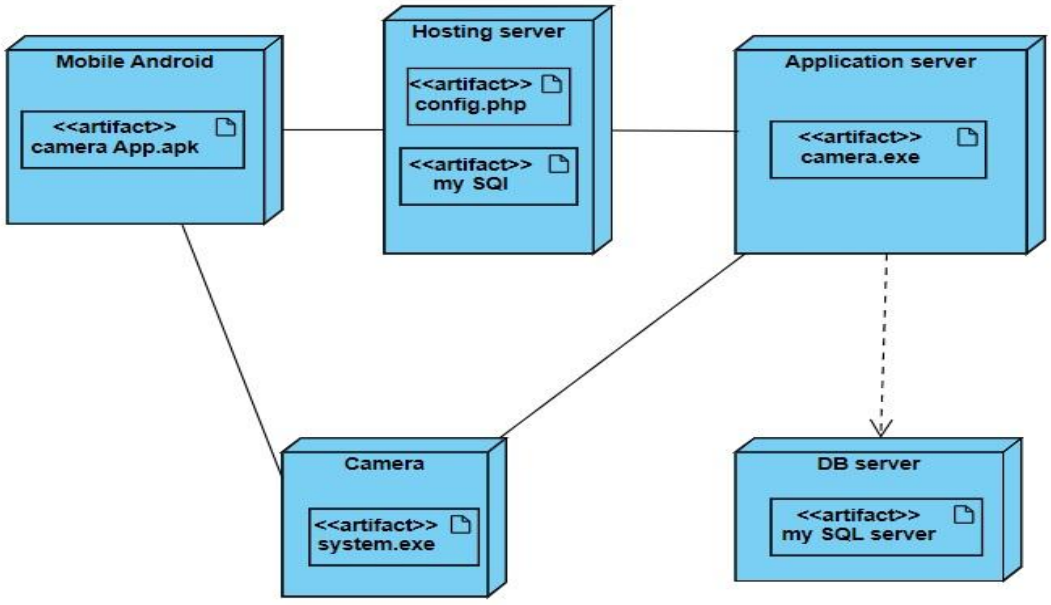

Figure 8. Deployment diagram.

4. RESULTS AND EXPECTED OUTPUTS

Android application outputs lead to achieve goals are following:

1- In order to ensure that the cameras work normally and that they are adjusted to high importance places without going to the site, the engineer controls the cameras which have a movement motor (PTZ camera) and moves them.

2- The engineer can add cameras from different manufacturers, and not be limited to one (e.g., ZTE cameras, Sony and Hikvision cameras) in the application, and he can delete or replace cameras within the application without going to the site.

3- Detecting the presence of persons in a restricted area (server room) by locating a motion detector in that area, connecting it to the camera operating device, changing camera settings for that area, and sending a warning message within control camera room.

4- Using the application, the engineer can review the previous recordings and know the recording size of each camera to determine where there is a lot of movement to compare between cameras with high and medium storage levels in order to add large storage in the future.

This paper provides screen shots demonstrating the expected results of controlling the camera, streaming video, and retrieving past video records from the server.

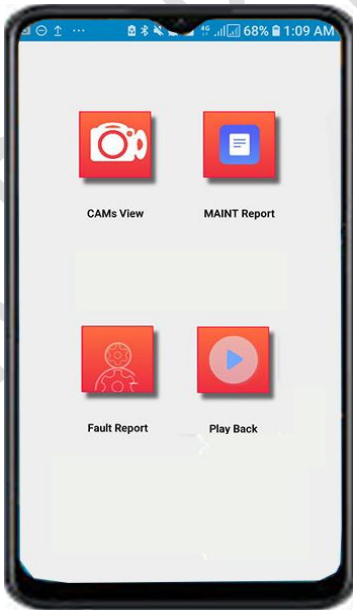

Figure 9. Screenshot of Mobile Application Engineer's Main Menu.

Figure 9 showing android mobile application screenshot for controlling surveillance system. This application controlling PTZ camera, retrieve previous video record, Fault and maintenance reports from server.

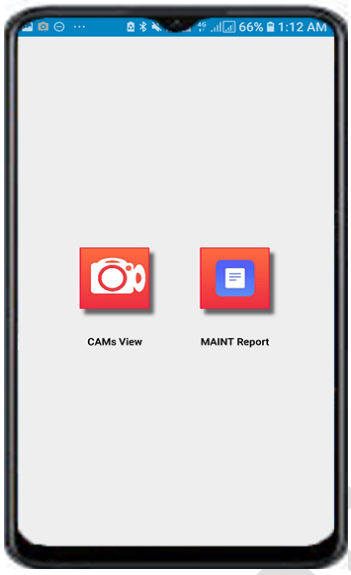

Figure 10. Screenshot of Mobile Application Manager's Main Menu.

Figure 10 showing android mobile application screenshot for display cameras and show maintenance report.

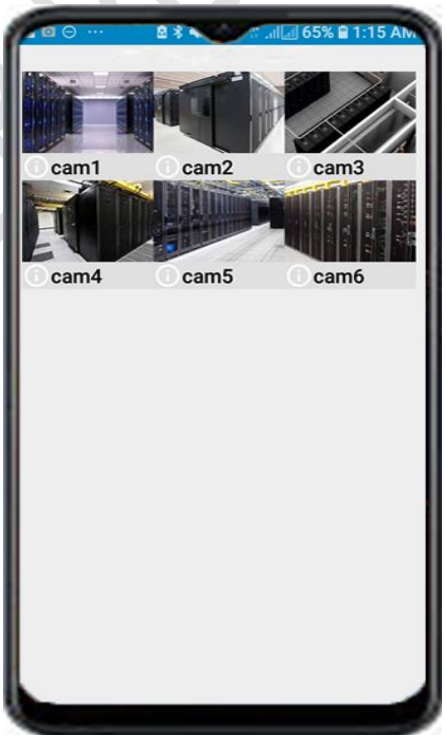

Figure 11. control cameras and view.

Figure 11 showing android mobile application screenshot for controlling surveillance system.

This application controlling PTZ camera and displaying cameras from the storage server.

5. CONCLUSION

It is customary to send information or data to servers via data networks but combining these two surveillance and data transfer procedures is a difficult task. Governments and large corporations are the primary implementers and managers of CCTV surveillance systems; nevertheless, this proposed technology can be employed on a large scale to control surveillance systems from the outside. In the future, we will improve the proposed system tracking algorithm to take into account numerous sensing data from a mobile user in a networked CCTV environment.

COMPETING INTERESTS DISCLAIMER:

Authors have declared that no competing interests exist. The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

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