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A Design of a Management System for Videos of Surveillance Cameras

تصميم نظام إدارة لأفلام كاميرات المراقبة

Thesis submitted in partial fulfillment of the academic requirements for the degree of Master in Information Technology

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الآيـــــــة

قال تعالى: {اقْرَأْ بِاسْمِ رَبِّكَ الَّذِي خَلَقَ * خَلَقَ الإِنْسَانَ مِنْ عَلَقٍ * اقْرَأْ وَرَبُّكَ الأَكْرَمُ * الَّذِي عَلَّمَ بِالْقَلَمِ *عَلَّمَ الإِنْسَانَ مَا لَمْ يَعْلَمْ}

صدق الله العظيم

العلق:[1-5]

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Abstract

Surveillance plays a huge part in today's society, and with cameras lives are experiencing higher levels of security each day.

Closed-circuit television (CCTV) which is also called video surveillance is an electronic system for the capture of images, and their transmission to another location for viewing and recording. CCTV cameras or surveillance cameras are video cameras used for the purpose of observing an area that may need monitoring such as banks, stores, and other areas where security is needed. There is a variety of different types of CCTV camera, a more advanced form of CCTV utilize digital video recorders (DVRs). Digital video recorder (DVR) which is an electronic device designed for recording video in a digital format within a mass storage device such as hard disk drive or any other storage device, but the storage capacity of the hard disk drive (HDD) is limited, when this capacity is full the oldest video files will be overwritten automatically. So videos of each camera are stored separately for a relatively short period of time. A Centralized storage is required, so as to obtain information scattered on more than one video and avail the videos for future investigation and research.

This research is aimed to transfer videos, which are captured using closed circuit television (CCTV) cameras, existing in digital video recorders (DVRs) devices and store it in a central database, then design a management system for managing, organizing and retrieving of videos. Data collection is based mainly on samples of video taken from Albaraka Sudanese bank. The results shows that designing a management system facilitate retrieval of videos after a long period of time to detect and identifying any abnormal behavior or activity in the enterprise.

المستخلص

تلعب المراقبة دورًا كبيرًا في مجتمع اليوم ، ومع وجود كاميرات تشهد حياتنا اليومية مستويات أعلى من الأمان كل يوم.

نظام المراقبة بالفيديو هو نظام إلكتروني لإلتقاط الصور ونقلها إلى موقع آخر ل لعرض والتسجيل. كاميرات المراقبة هي كاميرات فيديو تستخدم لغرض مراقبة منطقة قد تحتاج إلى مراقبة مثل البنوك ، والمخازن ، والمناطق الأخرى التي تحتاج إلى الحماية. هناك مجموعة متنوعة من أنواع مختلفة من كاميرات المراقبة ، وهنالك شكل أكثر تقدم اً وذلك باستخدام مسجلات الفيديو الرقمية . مسجل الفيديو الرقمي هو جهاز إلكتروني مصمم لتسجيل الفيديو في تنسيق رقمي داخل جهاز تخزين كبير مثل محرك الأقراص الصلب أو أي جهاز تخزين آخر ، ولكن سعة التخزين لمحرك الأقراص الصلب محدودة ، وعندما تكون هذه السعة ممتلئة ، سيتم إستبدال ملفات الفيديو الأقدم تلقائيًا .لذلك يتم تخزين مقاطع الفيديو لكل كاميرا على حدة لفترة زمنية قصيرة نسبيًا ، المطلوب تخزين مركزي ، وذلك للحصول على معلومات منتشرة على أكثر من فيديو واحد والحصول على الفيديو للتحقيق والبحث في المستقبل.

يهدف هذا البحث إلى نقل مقاطع الفيديو ، ال تي تم التقاطها باستخدام كاميرات المراقبة ، والموجودة في أجهزة تسجيل الفيديو الرقمي وتخزينها في قاعدة بيانات مركزية ، ثم تصميم نظام إدارة لإدارة وتنظيم وإسترجاع مقاطع الفيديو . ويستند جمع البيانات بشكل رئيسي على عينات الفيديو المأخوذة من بنك البركة السوداني. تظهر النتائج أن تصميم نظام إدارة لأفلام كاميرات المراقبة يسهل عملية إستعا دة الفيديو بعد وقت طويل لإكتشاف وتحديد أي سلوك أو نشاط غير طبيعي في المؤسسة.

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List of Abbreviations

Abbreviation	Meaning
CCTV	Closed Circuit Television
DVR	Digital Video Recorder
SD	Solid State
SSD	Solid-State Drive
HDD	Hard Disk Drive
USB	Universal Serial Bus
PC	Personal Computer
PTZ	pan-tilt-zoom camera
NTSC	National Television System Committee
fps	frames per second
PAL	Phase Alternating Line
UTP	Universally Twisted Pairs
NVR	Network Video Recorder
LAN	Local Area Network
SSMS	SQL Server Management Studio
GUI	Graphical User Interface
IDE	Integrated Development Environment
FCL	Framework Class Library
C#	C-Sharp Language
OOP	Object-Oriented Programming

CHAPTER ONE

INTRODUTION

CHAPTER ONE

INTRODUTION

1.1 Overview

This chapter introduces the research work with the background of the problem described first. After that, the problem statement, objective, importance of the study, scope of work, research methodology and research contents are described respectively.

1.2 Background

Closed Circuit Television (CCTV) is an electronic system for the capture of images, and their transmission to another location for viewing and recording [1].

In industrial plants, CCTV equipment may be used to observe parts of a process from a central control room, for example when the environment is not suitable for humans. CCTV systems may operate continuously or only as required to monitor a particular event. a more advanced form of CCTV, utilizing digital video recorders (DVRs), provides recording for possibly many years, with a variety of quality and performance options and extra features (such as motion detection and email alerts) [2].

A Digital video recorder (DVR) is an electronic device that records video in a digital format to a disk drive, Universal Serial Bus (USB) flash drive, solid state (SD) memory card, solid-state drive (SSD), other local or networked mass storage device [3].

Digital video recorders have played an important part in closed circuit television, because they can have the capacity of maximum storage, which is far greater than the video cassette recorders used in the past [4].

The digital video recorder (DVR) used to recording video streams up to 4 channels at the same time. It adopts a digital image compression technology to compress the input channel video streams, and uses hard disk drive (HDD) to record the compressed video stream [5].

1.3 Problem Statement

Digital Video Recorders (DVRs) use hard disk drive (HDD) to record video files which are captured using closed circuit television (CCTV) cameras, but the storage capacity of the hard disk drive (HDD) is limited, when this capacity is full the oldest video files will be overwritten automatically. So videos of each camera are stored separately for a relatively short period of time. A Centralized storage is required, so as to obtain information scattered on more than one video and avail the videos for future investigation and research.

1.4 Research Objective

The purpose of this research is transfer videos, which are captured using closed circuit television (CCTV) cameras, residing in digital video recorders (DVRs) devices periodically and store them in a central database to facilitate retrieval and viewing them after a long period of time.

1.5 Importance of the Research

Storing videos in database to facilitate retrieval for later viewing to detect theft cases, identifying any abnormal behavior or activity in the enterprise , identifying and tracking down the potential suspects, also to monitor and track workflow , monitor employee productivity, determine job performance areas where the employee needs improvement and insure that employees follow enterprise safety rules.

1.6 Scope of Work

1. CCTV Cameras network of Albaraka Sudanese bank is used.
2. The cameras hardware employ the current technologies.

1.7 Research Methodology

- Transfer videos from DVRs to PC using USB drive.
- Storing video files in the database using Microsoft SQL Server 2014.
- Design a management system for videos capture by (CCTV) cameras to facilitate retrieving and viewing them within the database using Microsoft Visual Studio2015 and C# programming language.

Devices used:

- Closed Circuit Television (CCTV) cameras used to capture and recorded videos.
- Digital video recorders (DVRs) devices to store videos temporarily.
- Personal Computer (PC) to transfer videos from (DVRs) and store them permanently.

1.8 Thesis Organisation

The research contains five chapters:

- Next chapter contains the concept of video surveillance, surveillance camera, recorders devices and their types, It is also provides a related works.
- Chapter three includes tools and methodology used to achieve the purpose of this research.
- Chapter four has described the proposed system, and the results of the system.
- Final chapter has set for conclusion and recommendations for future work.
- A list of references follows at the end.

CHAPTER TWO

LITERATURE REVIEW

CHAPTER TWO

LITERATURE REVIEW

2.1 Overview

This chapter describes the preliminary concepts and presents current approaches for surveillance systems. The chapter begins with the definition and some background of video surveillance and taxonomy of video surveillance cameras; next, it presents the related works to the research topic.

2.2 Introduction

Fast development in the technology has increased the risk of intrusion. Using surveillance cameras allows a person to monitor his property. The majority of organization and administrations are making use of such security cameras with the intention to save their business as well as property from terrorists and illegal entry. Nowadays, the surveillance cameras have become much more advanced, reasonable, and smaller and straight forward [6].

2.3 Surveillance

Surveillance is the monitoring of behavior, activities, or other changing information for the purpose of influencing, managing, directing, or protecting people. Surveillance is used by organizations for intelligence gathering, prevention of crime, the protection of a process, person, group or object, or the investigation of crime [7].

2.4 Video Surveillance

Also known as Closed-Circuit Television (CCTV) is an electronic system for the capture of images, and their transmission to another location for viewing and/or recording[2].

Almost all video cameras often applied to use for surveillance in areas that may need monitoring such as banks, stores, and other areas where security is needed.

In industrial plants, CCTV equipment may be used to observe parts of a process from a central control room, for example when the environment is not suitable for

humans. CCTV systems may operate continuously or only as required to monitor a particular event.

The earliest video surveillance systems involved constant monitoring because there was no way to record and store information. The development of media enabled the recording of surveillance footage. These systems required magnetic tapes to be changed manually, which were a time consuming, expensive and unreliable process, due to these shortcomings, video surveillance was not widespread. Videocassette recorder (VCR) technology became available in the 1970s, making it easier to record and erase information, and use of video surveillance became more common.

A more advanced form of CCTV, utilizing digital video recorders (DVRs), provides recording for possibly many years, with a variety of quality and performance options and extra features such as motion detection and email alerts [2].

2.4.1 Advantages and disadvantages of Video Surveillance

2.4.1.1 Advantages

1. Availability- Now-a-days, surveillance cameras almost at any place you visit, from a small store to homes and holy places. As a result, they guarantee greater public security at a fraction of the cost.
2. Real-time monitoring-In the past, the events captured on video was used to expose important information and work as proof after the event happened. But, modern technologies let users to check and reply to alarms immediately [8,pp.353].

2.4.1.2 Disadvantages

- It can cause the violation of privacy of people if it is not used professionally.
- It makes people feel that they are always watched. This makes the world like a jail.

2.4.2 Applications for CCTV

A CCTV system can be put to many uses, but listed below are some security related applications:

- Checking identity of persons seeking entry.
- Monitoring access to car parks or private roads.

- Monitoring traffic on a bridge.
- Monitoring Safety :
    - In public areas.
    - Of staff working in vulnerable occupations or locations.
    - Of customers .
- Controlling Theft and Vandalism by monitoring :
    - Cash handling positions.
    - Bank vaults or similar high security areas
    - Activities of employees[1].

2.4.3 Components of a CCTV system

- Basic Components:

  Are the components that must be all available in order to run the system, these components are:
    - Cameras: The starting point for any CCTV system must be the camera.
    - Recorders: The devices that connect the cameras to each other, such as a digital video recorder (DVR).
    - Cables: The cables connect the surveillance cameras to a recording device, CCTV systems rely on a system of coaxial cables to transmit video footage from the analog cameras.
    - Power: Electricity that connects to cameras.

Figure (2. 1): Basic Components of CCTV System[9]

- Sub-Components :

  If they do not exist, will never affect the functioning of the system, these components are:

  - Internet: The DVR can be connected to the Internet, because many customers demand a camera system that they can watch on the Internet.
  - Monitors: To view video captured by the cameras, CCTV systems typically use monitors placed at a central location. Monitors can be dedicated to review video from a single camera, or they can be configured to access multiple cameras at one time.
  - Hard disk drive (HDD): It is not a basic component of the system because can watch the cameras via the display screen or via the Internet without recording [10].

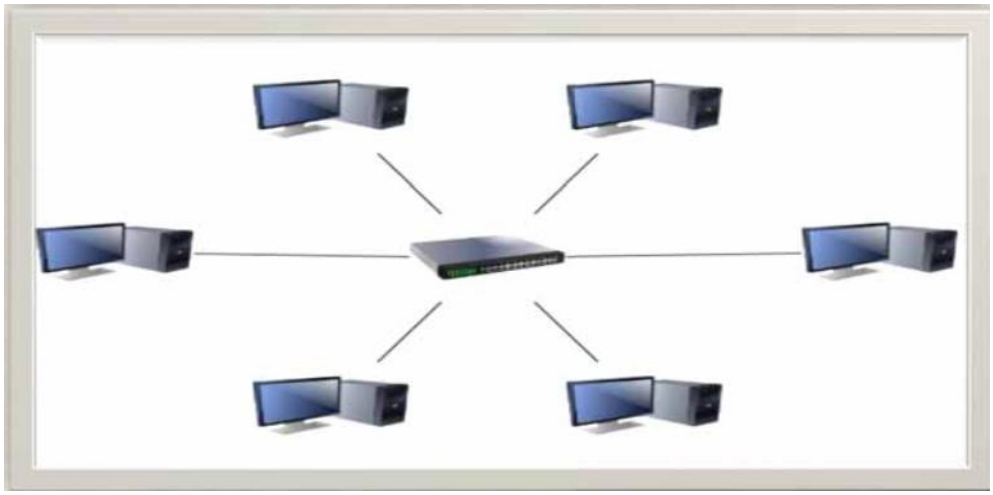


Figure (2. 2): Sub- Components of CCTV System [9]

2.5 Surveillance Cameras

Surveillance cameras are video cameras used for the purpose of observing an area. They are often connected to a recording device or IP network, and may be watched by a security guard or law enforcement officer. Cameras and recording equipment required human personnel to monitor camera footage; the amount of footage is also drastically reduced by motion sensors which only record when motion is detected [7].

2.5.1 Type of CCTV Cameras

CCTV cameras come in different shapes and types:

- By using video signal types; CCTV cameras classify into two main categories.
  - Analogue
  - Digital

- Analogue CCTV camera:
  - Cameras that transmit video signals in the form of analogue signals.
  - Analogue cameras use either NTSC (National Television System Committee) (30 frames per second (fps) or PAL (Phase Alternating Line) (25 fps).
  - Analogue cameras can use coaxial or UTP (Universally Twisted Pairs) to transmit video signals.

- Analogue cameras transmit signals to a recorder and the recorder encodes the signals.

- Digital or IP camera:
  - Digital cameras are also known as IP cameras.
  - IP cameras are capable of transmitting video in the form of data.
  - IP cameras are normally connected to a NVR (Network video recorder)
  - Some IP cameras have inbuilt storage, video footage can be stored using an SD card.
  - IP cameras encode the signals before transmission.

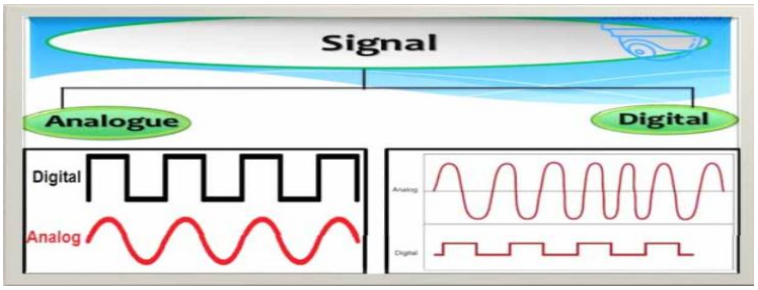


Figure (2. 3): Analogue and Digital Signal [9]

Figure (2. 4): Analogue CCTV Camera [9]

Figure (2. 5): Digital or IP Camera [9]

- By using Design; CCTV cameras classify also into two main categories:
    1. Indoor Camera: is a camera installed inside your home or business premises.
    2. Outdoor Camera: is a camera installed outside your home or business premises intending to secure the perimeter.

The primary distinction between indoor and outdoor security cameras is the types of external factors each camera has to be able to withstand.

Outdoor cameras are also more vulnerable to being tampered with, so they are typically made of more durable materials, like metal [11].

Figure (2. 6): Indoor and Outdoor Cameras [9]

❖ By using Shape, there are several types :

1. Box Style Security Camera:

A Box Style camera is a standalone camera. The name is derived from the shape of the Camera. Most box security cameras do not come with a lens, but you do have the ability to choose from a wide variety of security camera lenses. These cameras are typically used in indoor environments, but can be turned into a weatherproof camera by placing it in an outdoor camera housing to protect it from the elements [12].

Figure (2. 7): Box Camera [12]

2. Pan-Tilt-Zoom(PTZ) Security Camera:

A PTZ camera or pan-tilt-zoom contains mechanical controls that allow the operator to remotely pan, tilt, and zoom the camera. There are variations of these cameras that are programmable and are manually controllable. This allows viewers to have more freedom and control on viewing things. Control movement via joystick or software [12].

Figure (2. 8): PTZ Camera [12]

1. Day/Night Security Camera:

A day/night camera is used for 24/7 installation, these cameras compensate light conditions with wide dynamic range to function in glare, direct sunlight, reflections and strong backlight. It used indoor and outdoor [13].

Figure (2.9): Day/Night Camera [12]

2. Wireless IP Camera:

Wireless IP Camera is camera that may or may not be connected to the internet. These cameras use signaling devices to transmit images from camera to viewing area. Wireless IP security camera offer ease of installation and

eliminate the cost of network cabling when adding this camera to video surveillance system [12].

Figure (2.1): Wireless IP Camera [12]

2.6 Recorders

The devices that connect the cameras to each other, recorders are mainly two types:

2.6.1 A Digital video recorder (DVR)

DVR is an electronics device that records video in a digital format to a hard disk drive. The DVR enables video capture and playback to and from the hard disk. The DVR come in 4 camera, 8 camera and 16 camera options, with varying sized hard drive depending on the amount of camera's being recorded, and the time the DVR is required to record. Archiving of footage would then be extracted to a USB drive, or to a CD drive. The DVR can also be connected to a Local Area Network (LAN) for remote viewing via a pc locally, or remote viewing off site [14].

Figure (2.2): 4 Channels DVR [14]

2.6.2 A Network Video Recorder (NVR)

NVR is responsible for video monitoring and storage. NVR capture video streams from remote IP cameras and store the footage on a hard disk, As long as the NVR is connected to the same local area network (LAN) as the IP cameras, install this device virtually anywhere and still capture video streams and images, store the footages on a hard disk, or transmit the images to a remote personal computer (PC) or Smartphone for viewing. Footage can also be accessed remotely over the Internet, offering more flexibility for monitoring. The network video recorder is a software program that has no dedicated video captures hardware. It receives video streams from an IP cameras for storage in a disk drive, SD memory card, or other mass storage devices [15].

Figure (2.12) : NVR with 4 Channels[15]

2.7 Related Work

This section presents briefly some of techniques which are used in many researches:

2.7.1 Smart Video Security Surveillance with Mobile Remote Control

This paper describes mobile based remote control and surveillance architecture. The project idea is to set up a computer terminal equipped with a global system for mobile communication (GSM) Modem, which can be used to transmit/receive video/photos and/or commands to and from the administrator/owner. This project use Open Source Computer Vision (Opencv) library to capture camera images and detect intrusion using image comparison technique (Euclidean Distance Method). Once the comparison is done and an intrusion is found, it sends the streamed video from server to remote administrator over android phone. Admin can then take appropriate action and alert local security. It is very suitable for remote bank monitoring [8].

2.7.2 ARM Based Mobile Phone-Embedded Real-Time Remote Video Surveillance System with Network Camera

This paper deals with the integrated server and MPEG video. The integrated server means that a specific server is located in the centre of the surveillance system this can get the video information from the network camera and then compress that video and can also store that video into a video database for future reference. It can also receive request from the clients like monitoring, controlling etc. The method used in this paper is the open PLANET technology that has been developed by Shikoku Electric Power Company Ltd it has some excellent characteristics, one of which is to transmit digital information from node to node through electric power line. Its advantages include low maintenance, cost effective and mobile operation i.e. it can operated from anywhere and also on the mobile phones or on the desktop as per the user convenience [16].

2.7.3 A survey on behavior analysis in video surveillance for homeland security applications

This paper looks into how hardware and software can be put together to solve surveillance problems. In general, the framework of a video surveillance system includes the following stages: modeling of environments, detection of motion, classification of moving objects, tracking, behavior understanding and description, and fusion of information from multiple cameras. The paper reviews developments and general strategies of stages involved in video surveillance, and analyze the feasibility and challenges for combining motion analysis, behavior analysis, and standoff biometrics for identification of known suspects, anomaly detection, and behavior understanding [17].

2.7.4 World Heritage City Surveillance System by a Smart CCTV System

This paper propose a system that detects the movement around the monitoring area and then counts the number of tourists who enter and exit the word heritage city using smart closed circuit television (CCTV). The system has been developed to restricted area through the CCTV camera in detecting the trespassers, when the world heritage city is closed. This data can be used not only for the surveillance purpose but also for the commercial strategic planning and the security community as well for example; the number of participants, audience, or visitors who attend the event can be used to plan the upcoming event. In developing the world heritage city surveillance system using Smart CCTV, the developers adapted the knowledge about image processing to detect and count the number of people-in and people-out from video data and to security for the system [18].

2.7.5 Online Surveillance Video Archive System

This paper, propose a video data model and querying algorithms and developed a web-based query tool to address the surveillance video archives' requirements. The surveillance video modeling and querying system is called SURVIM which Models the metadata information, the moving objects, events, and spatial positions of the objects. These entities are extracted automatically by using a software tool. SURVIM architecture

consists of surveillance cameras, video storage server, data Extractor, video database model, query processor and user interfaces. Raw video files are captured from real time surveillance cameras, after that they are compressed and stored in the video storage server according to their location Information. Captured video file is also sent to the data extractor part, which composes of metadata extractor, moving object extractor, and stationary object extractor subparts. Data extractor gives following attributes of the video file: location, description, date, time, moving objects, stationary objects, events, and spatial positions of the objects. All of the extracted attributes are indexed in a database by using video data model. In the query processor part, there are number of query algorithms which process query specifications over the model. The query specifications are entered into system via query user interfaces and sent to query processor part. After processing the given query conditions, the query processor sends query results to the user interfaces. If Users want to play the retrieved video clips, then clips are streamed into the user's Computer [19].

2.7.6 Distributed hierarchical storage manager for a video-on-demand system

This paper describes the design of a distributed video-on-demand system that is suitable for large video libraries. The system is designed to store 1000s of hours of video material on tertiary storage devices. A video that a user wants to view is loaded onto a video file server close to the users desktop from where it can be played. The system manages the distributed cache of videos on the file servers and schedules load requests to the tertiary storage devices. The system also includes a metadata database that the user can query to locate video material of interest [20].

2.8 Conclusion

The above mentioned papers give a good background for this research. However, they do not address the problem of a centralized storage for the videos produced by the cameras.

This research is an exercise in manipulation of videos and integrating them in a management system to make them easily accessible by the users.

CHAPTER THREE

RESEARCH METHODOLOGY

CHAPTER THREE

RESEARCH METHODOLOG

3.1 Introduction

This chapter is devoted to the presentation and discussion of the research method used to achieve the purpose of this research. It explains in detail main steps that are used to conduct a management system for managing, organizing and retrieving of videos which were captured form multiple DVRs. these steps involve collection of data, Insertion of data, design of database, and managing and retrieving of data. As shown in the figure below:

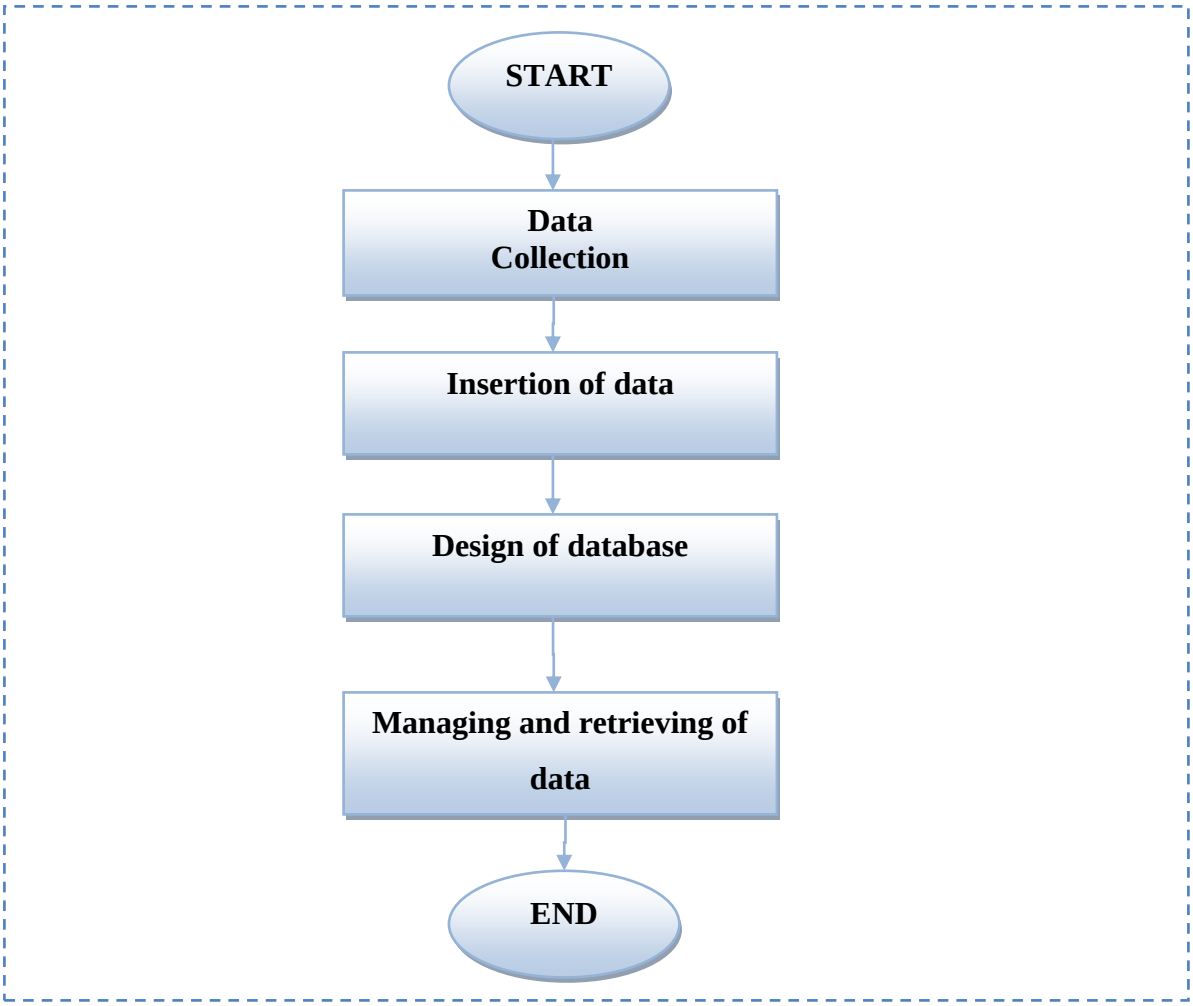


Figure (3.1): Main steps of research methodology

3.2 Data Collection

The first step to design a management system for managing, organizing and retrieving data is to collect the data from multiple DVRs.

All the data used in this research was fetched from Albaraka Sudanese bank. The types of data are videos with mp4 and avi extension, the video name is given by combining of branch number, camera number, and date and time information of the captured video.

3.3 Data Insertion

The data capture from DVRs are inserted to database using windows service application.

3.3.1 Microsoft SQL Server 2014

The database used in this research is Microsoft SQL Server 2014.

Microsoft SQL Server 2014 is relational database management system (RDBMS) designed for the enterprise environment.

SQL Server Management Studio (SSMS) is graphical user interface (GUI) tool included with SQL Server 2005 and later which can be used for managing, configuring, monitoring, upgrading and administering all components within Microsoft SQL Server, SQL Server Management Studio can also be used to create a new database, alter any existing database schema by adding or modifying tables and indexes, and manage databases wherever they are on local computer, or in the cloud , can also use (SSMS) to write and execute queries[21],[22].

3.3.1.1 Create a database in SQL Server 2014

The following steps demonstrate how to create a database in SQL Server 2014 using SQL Server Management Studio:

1. Open SQL Server 2014 Management Studio (SSMS) by clicking the SSMS icon or START | All Programs | Microsoft SQL Server 2014 | SQL Server 2014 Management Studio

Figure (3.2): Microsoft SQL Server 2014

2. When SSMS starts they have two different ways to sign into the software. Use Windows Authentication or SQL Server Authentication.

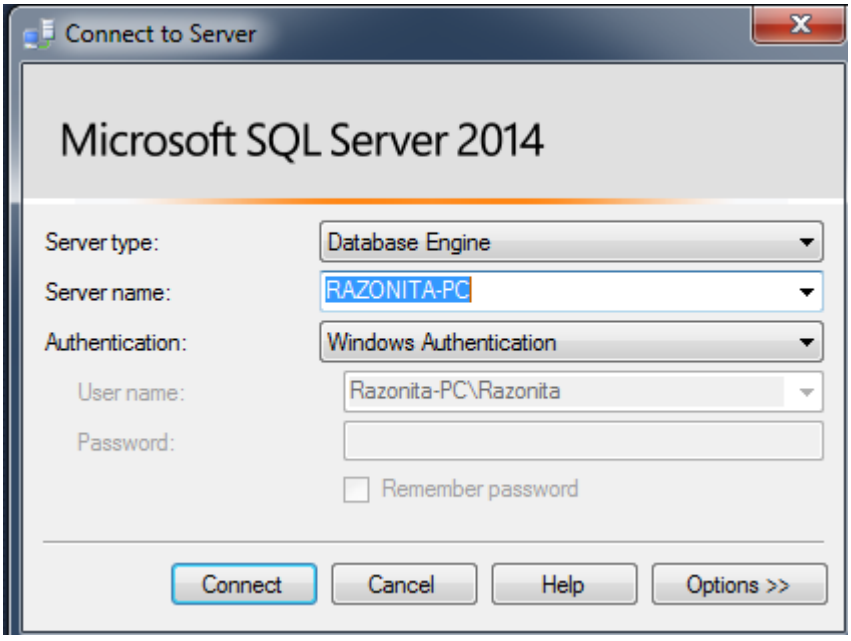


Figure (3.3): sign into SQL Server use Windows Authentication

3. From the Object Explorer, right click on the Databases folder and select New database:

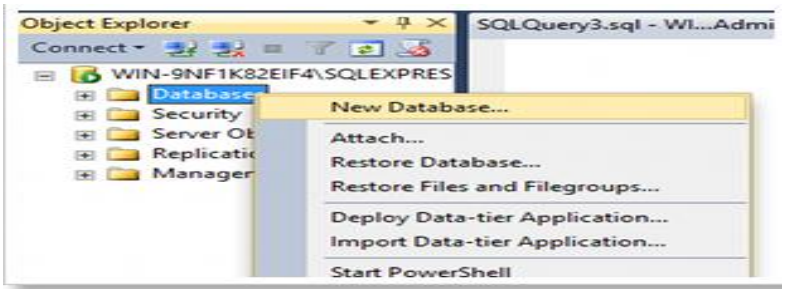
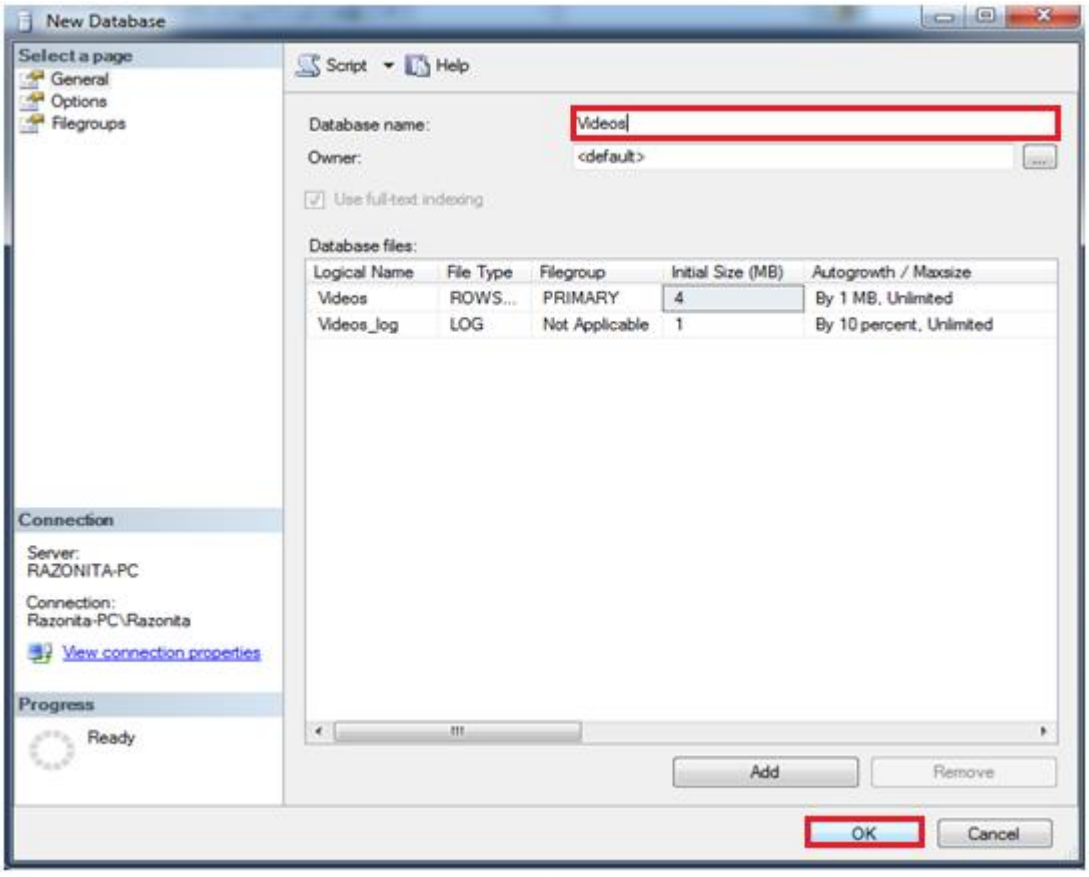


Figure (3.4): Create new database

4. Name database (Videos) and click OK:



Figure(3.5) :Videos database

5. new database will appear under the Databases section of the Object Explorer:

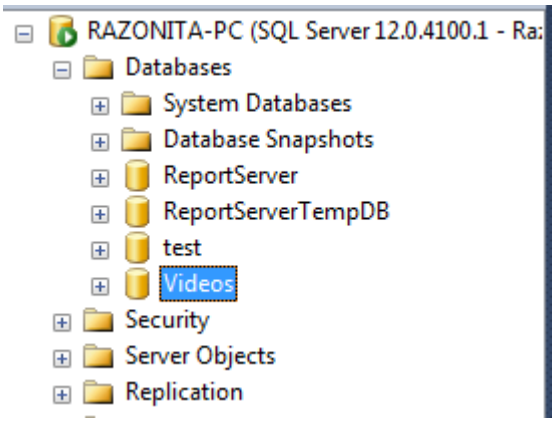


Figure (3.6) : new database (Videos)

6. After created a database, add tables to the database , to create a table in SQL Server using the GUI follow the following steps :

- right click on the Tables icon and select New>>Table

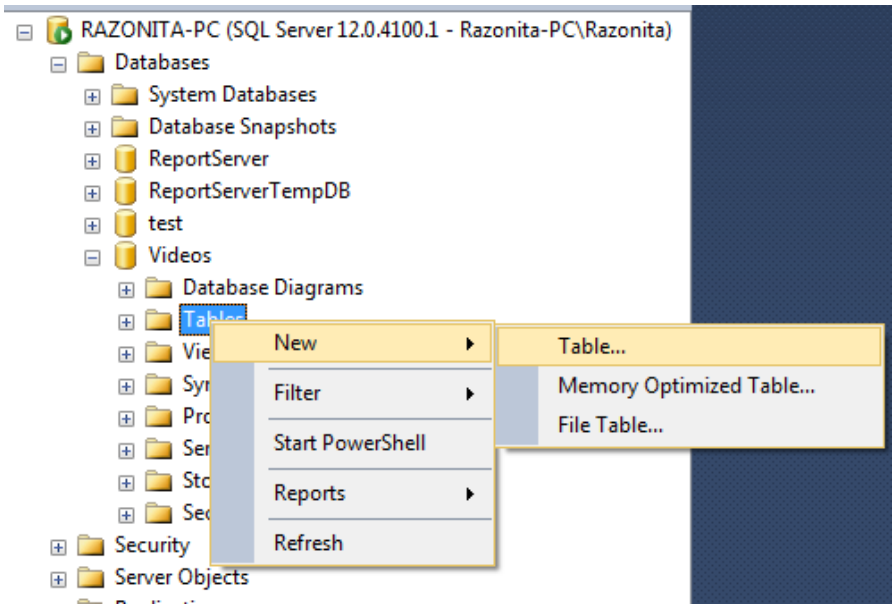


Figure (3.7) : Add table to database

- A new table will open in Design view. Add the columns, their data types, and column properties:

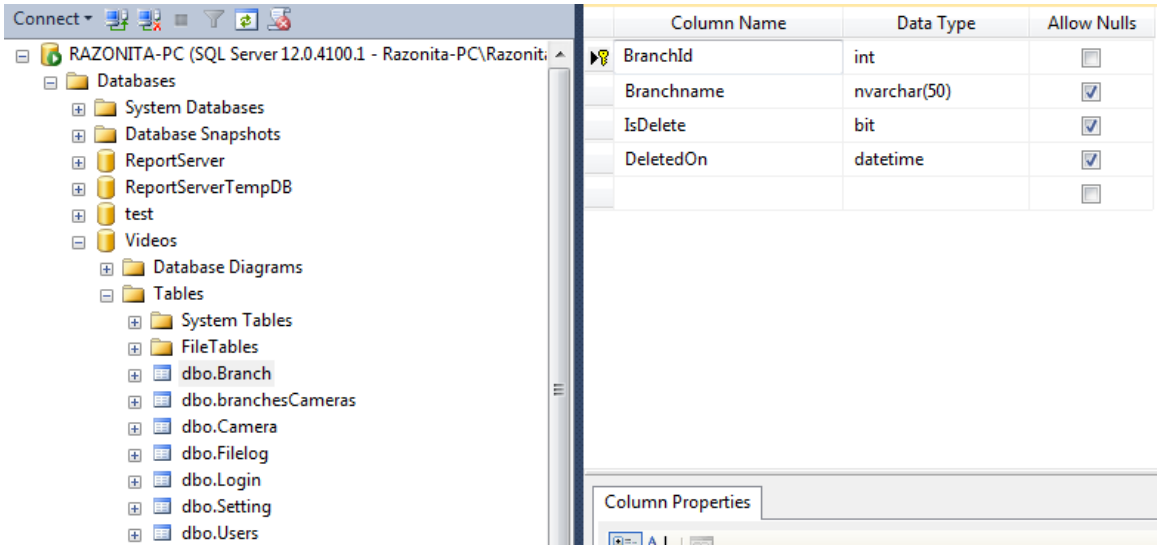


Figure (3.8): Add columns to table

- When add the columns, their data types, and column properties in the table, save the table (either from the File menu, or by right-clicking on the table tab and selecting Save Table_1):

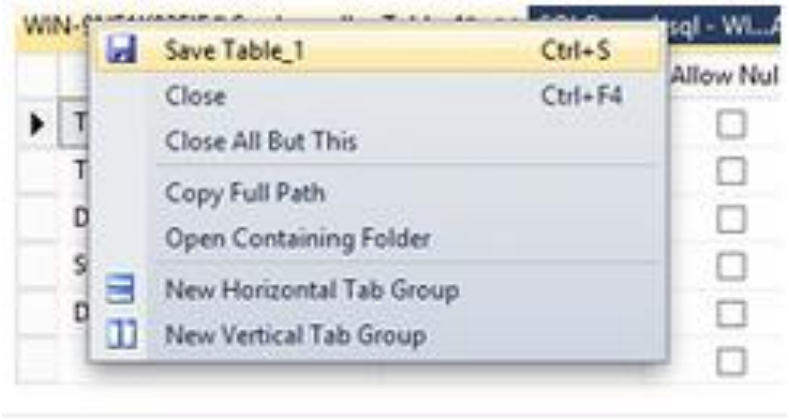


Figure (3.9) : Save new table

- Four tables have been created in the videos database:

❖ Branch Table

❖ Camera Table

❖ Users Table

❖ Filelog Table

RAZONITA-PC.Videos - dbo.Branch

Column Name	Data Type	Allow Nulls
BranchId	int	☐
Branchname	nvarchar(50)	☑
IsDelete	bit	☑
DeletedOn	datetime	☑
deletedBy	nvarchar(50)	☑
		☐

Figure (3.10) : Branch table Schema

RAZONITA-PC.Videos - dbo.Camera

Column Name	Data Type	Allow Nulls
CameraId	int	☐
BranckId	int	☐
Name	nvarchar(50)	☐
isDeleted	bit	☐
deletedBy	nvarchar(50)	☑
DeletedOn	datetime	☑
		☐

Figure (3.11) :Camera table Schema

RAZONITA-PC.Videos - dbo.Users

Column Name	Data Type	Allow Nulls
UserId	int	☐
Username	nvarchar(20)	☑
UserPassword	nvarchar(128)	☑
Role	nvarchar(20)	☑
p1	bit	☑
p2	bit	☑
p3	bit	☑
p4	bit	☑
p5	bit	☑
		☐

Figure (3.12) : Users table Schema

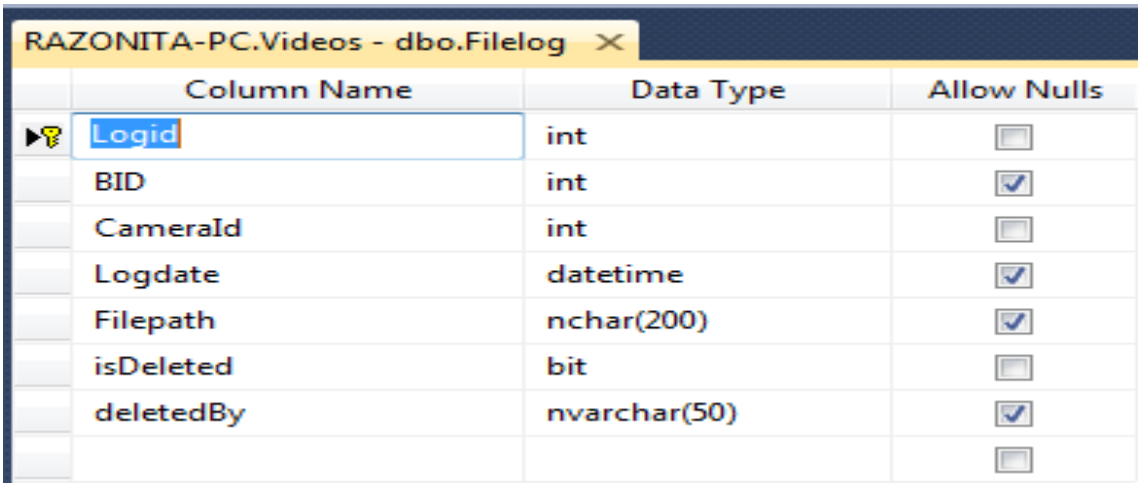


Figure (3.13): Filelog table Schema

3.3.2 Windows Service Application

Microsoft Windows services enable to create long-running executable applications that run in their own Windows sessions. These services can be automatically started when the computer boots or can be started manually or by an event, can be paused and restarted, and do not show any user interface [23].

In this research created Windows Service application that fetches the video files and spilt the name of video to determine the branch name, the camera name, date and time of video and the path of video. When the service is started these data (branch name, camera name, date and time of video, path of video) are inserted into Filelog table in the Videos database.

The Windows Service application has been created as a Microsoft Visual Studio project, using C# language.

3.3.2.1 Microsoft Visual Studio

Microsoft Visual Studio is an integrated development environment (IDE) from Microsoft; it can use to view and edit code, and then debug, build, and develop an app such as web sites, web apps, web services and mobile apps.

Visual Studio uses Microsoft software development platforms such as Windows API, Windows Forms, Windows Presentation Foundation, Windows Store and Microsoft Silverlight.

Visual Studio supports 36 different programming languages and allows the code editor and debugger to support nearly any programming language, Built-in languages include C,C++, C++/CLI, Visual Basic .NET, C#, F#, JavaScript, Typescript, XML, XSLT, HTML and CSS. Support for other languages such as Python, Ruby, Node.js, Java (and J#) were supported in the past [24].

3.3.2.2 .NET Framework

.NET Framework is software framework created by Microsoft for building, deploying, and running applications and services that use .NET technologies, such as desktop applications and Web services[25]. It includes a set of standard class libraries named Framework Class Library (FCL) and provides language interoperability (each language can use code written in other languages) across several programming languages.

FCL provides user interface, data access, database connectivity, and web application development. Programmers produce software by combining their source code with .NET Framework and other libraries [26].

3.3.2.3 C-Sharp Language(C#)

C# is an object-oriented programming (OOP) language that enables developers to build a variety of secure and robust applications that run on the .NET Framework. C# use to create Windows client applications, XML Web services, distributed components, client-server applications, database applications, and much more. Visual C# provides an advanced code editor, convenient user interface designers, integrated debugger, and many other tools to make it easier to develop applications based on the C# language and the .NET Framework [27].

3.4 Managing and Retrieving Data

TO access a SQL Server database use ADO.NET. ADO.NET is a set of classes that comes with the Microsoft .NET framework to facilitate data access from managed languages. It provides a comprehensive and complete set of libraries for data access. ADO.NET provides two models for data access: a connected model where can keep the connection with the database and perform data access, and

another way is to get all the data in ADO.NET objects that let us perform data access on disconnected objects[28].

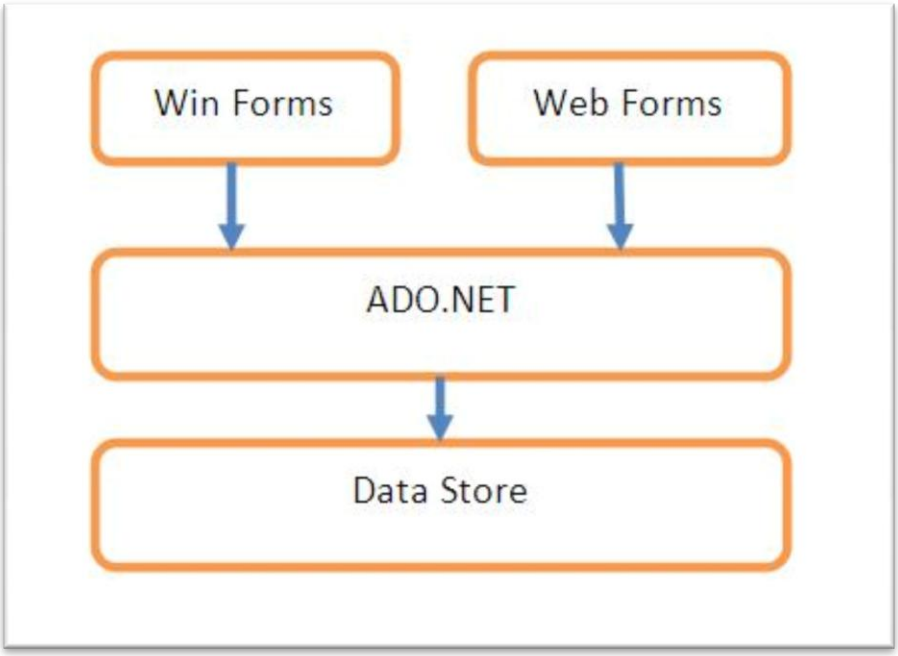


Figure (3.14): ADO.NET data access [28]

The diagram above shows that ADO.NET can be used with any kind of application, i.e., it can be used for a Windows Forms application, an ASP.NET application, or and/or Silverlight application. Also, the data store can be any data store, SQL Server, Access, or Oracle. It is just a matter of using the right set of classes specific to that data store and the methodology will remain the same.

To retrieve the data perform four major tasks:

1. Connecting to the database.
2. Passing the request to the database, i.e., a command like select, insert, or update, delete.
3. Getting back the results, i.e., rows and/or the number of rows effected.
4. Storing the result and displaying it to the user.

This can be visualized as:

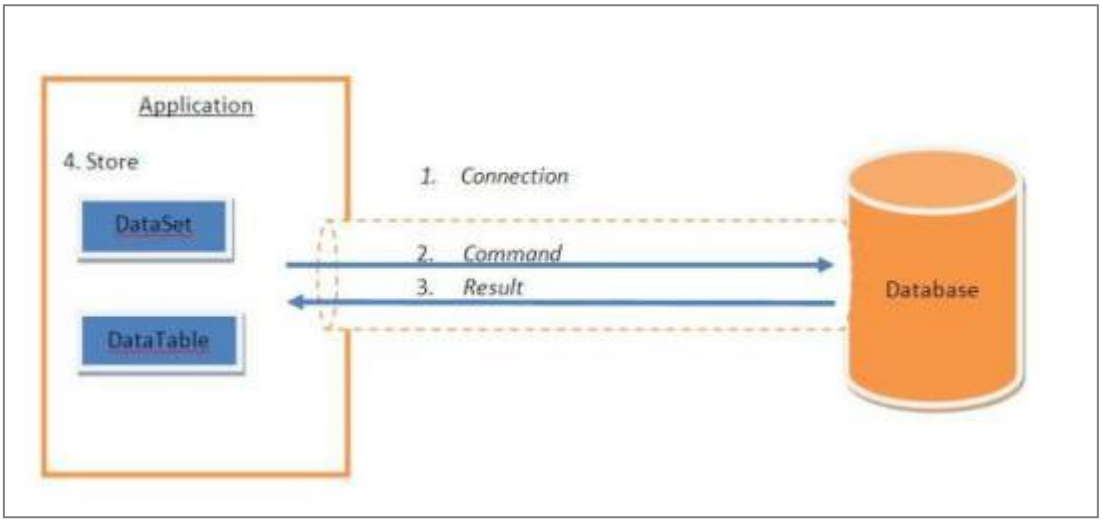


Figure (3.15): Four major task to retrive data[28]

- The Connection:

  The ADO.NET SqlConnection class is used to establish a connection to a SQL Server database. The SqlConnection class is used to identify the database server location, and other information to connect to the database.

  Using below code to connect to Videos database:

```
SqlConnection con = new SqlConnection("Data Source=RAZONITA-PC; Initial
        Catalog=Videos;Integrated Security=True;");
```

  Now a connection ready with the database.Whenever want to retrieve data, Just need to open the connection, perform the operation, and close the connection.

- Storing the Result:

  There are several base objects in ADO.NET use to store the results and these results can be displayed to the user :

  - DataReader Object: A DataReader is an object that can be used to access the results sequentially (row by row) from a database. The DataReader provides forward-only, read-only access to a set of rows returned from a SQL Server

database. This is used with the Command object and is invoked by the DataAdapter to execute a specific Command.

- DataAdapter Object: The DataAdapter provides the bridge between the DataSet object and the data source. A DataAdapter object is used to fill a DataSet/DataTable with query results. A Command object will be used to execute the query and a DataAdapter will use this Command object and fill the query results coming from the database into a DataSet/DataTable using Fill method
- Command Object: The Command object is used to execute dynamic SQL statements (insert, update, delete, and select), run stored procedures, and send or retrieve parameter information. Using SqlCommand to tell the database about the operation need to perform.

  The Command's ExecuteNonQuery method is used to execute nonresult returning queries such as an INSERT or UPDATE command.
- Dataset Object: A DataSet is a disconnected data access object .The DataSet is explicitly designed for data access independent of any data source. As a result it can be used with multiple and differing data sources. The result of the query can be stored in a Dataset. The DataSet contains a collection of one or more DataTable objects, as well as primary key, foreign key, constraint, and relation information about the data in the DataTable objects. The DataTables contain DataRow and DataColumns. A DataSet or a DataTable can be used with a Command and a DataAdapter object to store query results.[29]

Here are some codes that demonstrate how all of above objects are implemented:

```
SqlConnection con = new SqlConnection("Data Source=RAZONITA-PC;Initial
Catalog=Videos;Integrated Security=True;");
SqlDataAdapter da = new SqlDataAdapter("select Count(*) from Users where
Username='" + username.Text + "'  and UserPassword= '" + pass.Text + "'",
con);
DataTable dt = new DataTable();
da.Fill(dt);
```

The Above code explains how to connect to the video database, and select all the users who are authorized to login to the system using Users table.

The following code illustrates how to select video file from database according to specific time and display it to the user using Filelog, Camera tables:

```
DateTime theDate = Convert.ToDateTime(dateTimePicker1.Value.ToString("yyyy-MM-dd"));
SqlConnection con = new SqlConnection("Data Source=RAZONITA-PC;Initial
Catalog=Videos;Integrated Security=True;");
SqlCommand comm = new SqlCommand();
SqlDataReader dr;
comm.CommandText = "select CameraId,Logdate,Filepath from Filelog where BID=(select
BranchId from Branch where Branchname ='" + comboBox2.Text + "') and
year(Logdate)='" + theDate.Year + "' and month(Logdate)='" + theDate.Month + "' and
day(Logdate)='" + theDate.Day + "'and cast(Logdate as time) IN (select cast(Logdate
as time) from Filelog  where cast(Logdate as time)>= '" +
dateTimePicker2.Value.TimeOfDay + "' AND cast(Logdate as time) <= '" +
dateTimePicker3.Value.TimeOfDay + "')
and isDeleted =0";
 comm.Connection = con;
con.Open();
dr = comm.ExecuteReader();
if (dr.HasRows)
            {
                while(dr.Read())
                {
                   string file2 = (string)(dr["Filepath"]);
                    DateTime dd = Convert.ToDateTime(dr ["Logdate"]);
                    listBox1.Items.Add(file2);
                }
                listBox1.Visible = true;
            }

            {
                MessageBox.Show("No selected File");
            }
```

The following code demonstrates how to execute an insert statement to insert new branch into Branch table:

```
SqlConnection con1 = new SqlConnection("Data Source=RAZONITA-PC;Initial
Catalog=Videos;Integrated Security=True;");
SqlCommand comm2 = new SqlCommand();
comm2.CommandText = "insert into Branch(Branchname)values('" + Nbname + "')";
comm2.Connection = con1;
con1.Open();
comm2.ExecuteNonQuery();
con1.Close();
```

The following stored procedure that inserts video files into Filelog table when the windows service is started based on time interval:

```
ALTER proc [dbo].[loginsert]
@path nvarchar(512),
@id int,
@id1 int,
@date datetime
as
begin
       if (select count(*) from Filelog where Filepath = @path) = 0
              begin
              -- insert the record
              insert into Filelog (BID,CameraId, Filepath, Logdate) values
(@id1,@id, @path, @date)
              end
end
```

The code below explains how to execute the stored procedure and passes in the @id,@id1 @date, and @path parameters:

```
SqlConnection con = new SqlConnection("Data Source=RAZONITA-PC;Initial
Catalog=Videos;Integrated Security=True;");
                    SqlCommand comm = new SqlCommand();
                    comm.CommandType = CommandType.StoredProcedure;
                    comm.CommandText = "loginsert";
                    comm.Parameters.AddWithValue("@id", BID);
                    comm.Parameters.AddWithValue("@id1", CId);
                    comm.Parameters.AddWithValue("@date", dateTime16);
                    comm.Parameters.AddWithValue("@path", file);
                    comm.Connection = con;
                    con.Open();
                    comm.ExecuteNonQuery();
                    con.Close();
```

The following code demonstrates how to use the UpdateCommand property to change the name of camera in specific branch using Camera table:

```
int id = dr1.GetInt32(0);
SqlConnection con5 = new SqlConnection("Data Source=RAZONITA-PC;Initial
Catalog=Videos;Integrated Security=True;");
SqlCommand comm5 = new SqlCommand();
comm5.CommandText = "Update Camera set Name='" + cname + "'where CameraId ='"
+cid+"'";
comm5.Connection = con5;
con5.Open();
comm5.ExecuteNonQuery();
con5.Close();
```

Use DeleteCommand property to delete record or more records from database, As shown below use it to delete user from Users table, when the user deleted, he prevents to login to the system again:

```
int i = dataGridView1.SelectedCells[0].RowIndex;
                Nbname = dataGridView1.Rows[i].Cells[1].Value.ToString();
                Password = dataGridView1.Rows[i].Cells[2].Value.ToString();
                comm.Connection = con;
                comm.CommandText = "delete from Users where Username='" + Nbname
+ "' and UserPassword = '" + Password + "'";
                con.Open();
                comm.ExecuteNonQuery();
                con.Close();
```

CHAPTER FOUR

SYSTEM DESIGN AND IMPLEMENTATION

CHAPTER FOUR

SYSTEM DESIGN AND IMPLEMENTATION

4.1 Introduction

This chapter presents the methods that are used to transfer videos, that captured using closed circuit television (CCTV) cameras, residing in a digital video recorders (DVRs) devices, also it shows how to insert video files in database using windows service application, also it introduces the steps required to design a management system for manage, organize and retrieve videos, it also shows a GUI that implemented to facilitate interaction with the system and make it very comfortable to the users.

4.2 Data Gathering

As mentioned earlier the videos gathered for this study were taken from Albaraka Sudanese bank. USB drive is used to backup videos from digital video recorders (DVRs) devices to the computer device.

4.3 Insertion of data

The videos that were captured from DVRs, has been inserted to database using windows service application.

4.3.1 Develop a Windows Service in C#

The Basic steps to develop a windows Service to perform the a scheduled job based on a time interval are:

- Open Visual Studio and from the menus select "File" > "New" > "Project" A New Project window will open. Choose "Visual C#" > "Windows"> "Classic Desktop" and select "Windows Service" from the right hand side and name the project " winservice " as shown in the following screenshot:

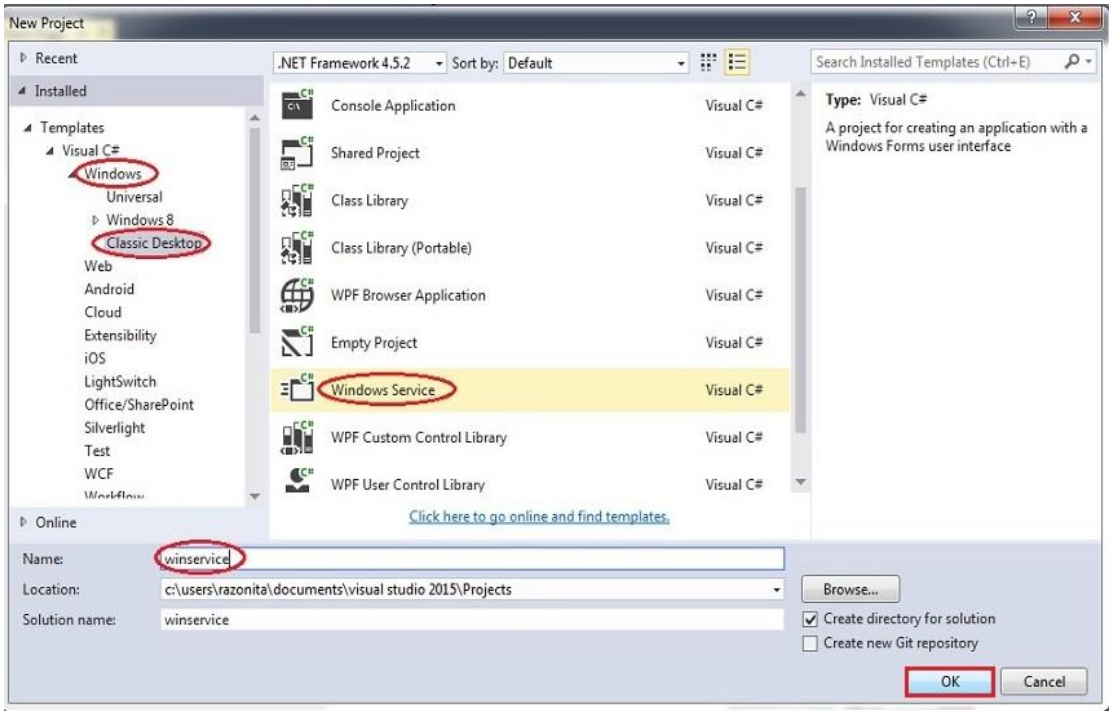


Figure (4.1): Create windows service

- After click "OK", the project will be created and the design view of the service appear as shown in the following screen. Then click “click here to switch to code view”

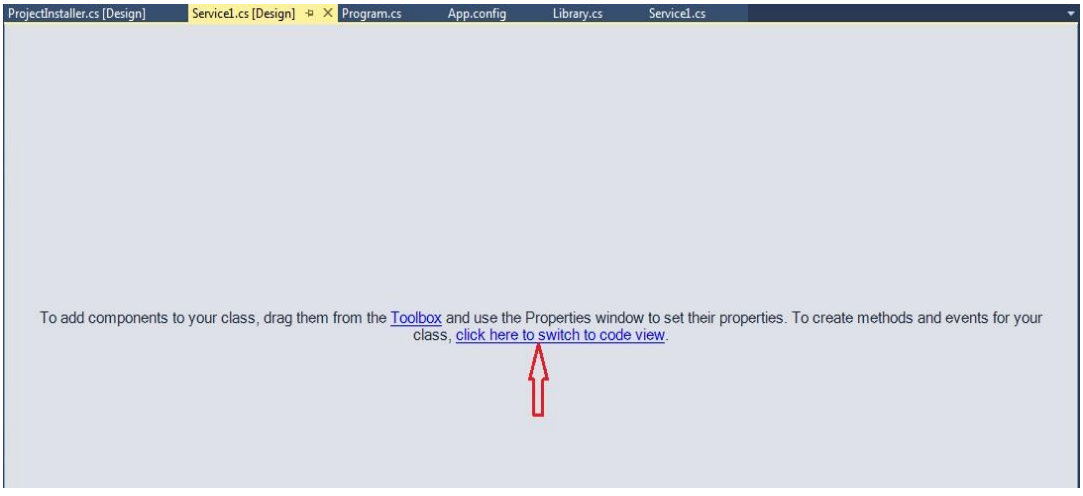


Figure (4.2): Design view of the service

- In the code view, there are two methods called OnStart() and OnStop(). The OnStart() triggers when the Windows Service starts and the OnStop() triggers when the service stops.

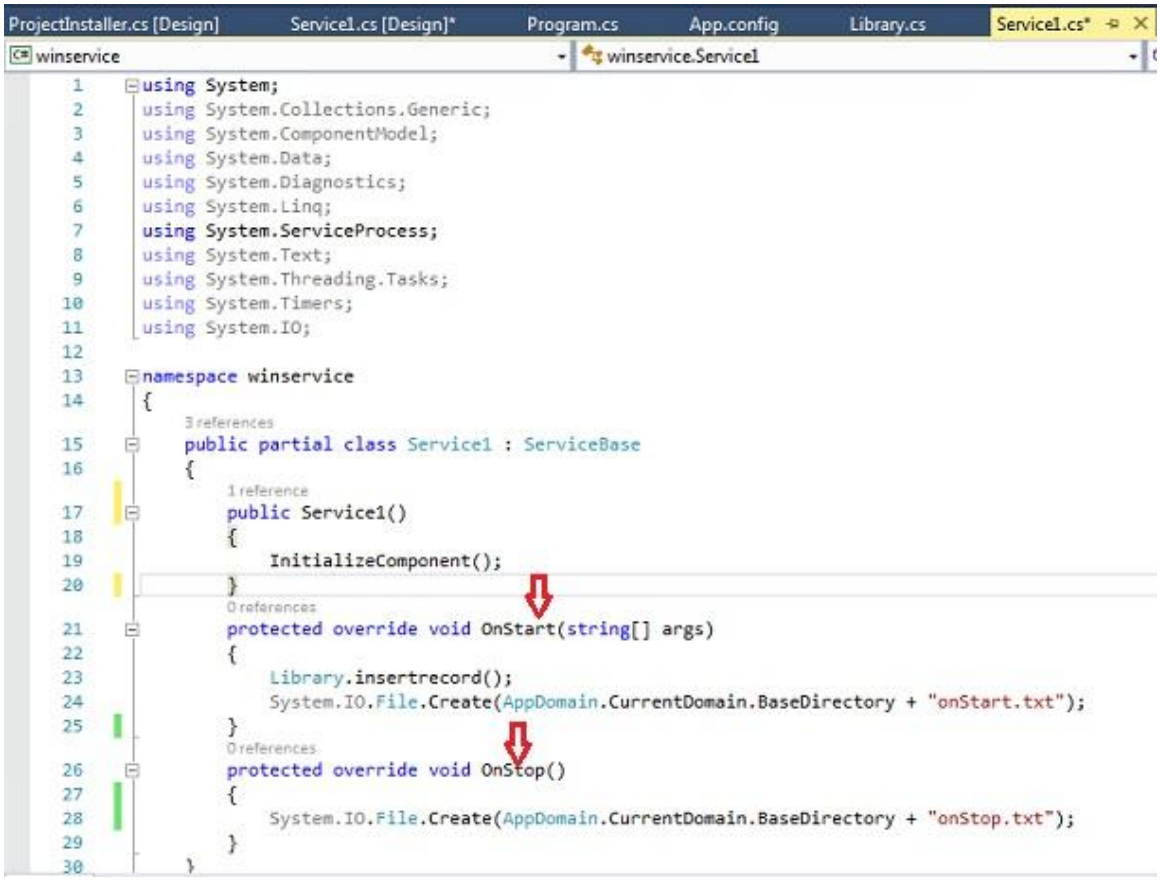


Figure (4.3): OnStart() and OnStop() methods

- Right-click the winservice project, add a new class and name it "Library.cs".This class is useful to create the methods that are required in this project.

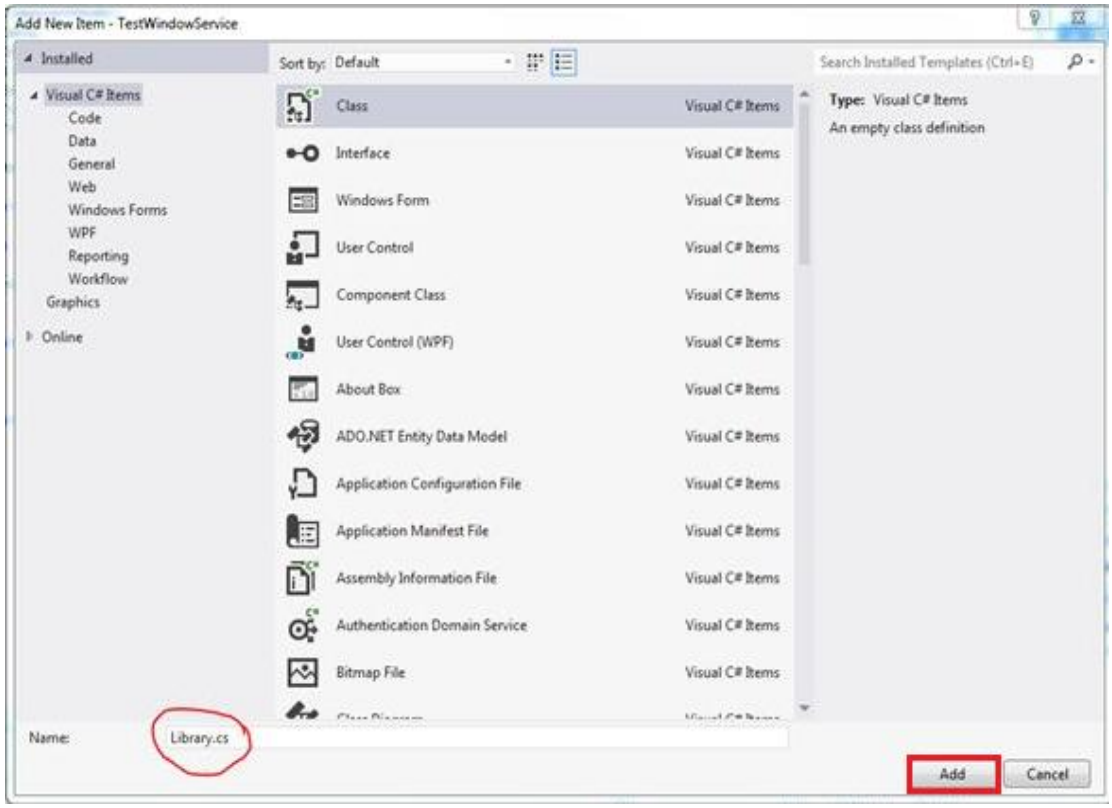


Figure (4.4) : Create a new class

- Make the class public and declare it as a Static class.

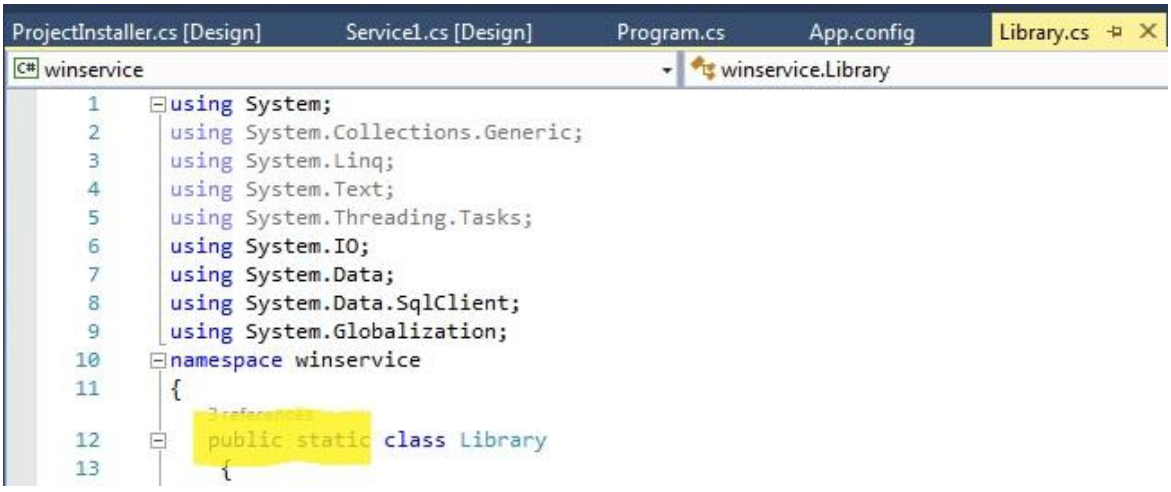


Figure (4.5): public static class Library

- Create a log method (WriteErrorLog) to log the exceptions:

```
public static class Library
 {
     0 references
     public static void WriteErrorLog(Exception ex)
     {
         StreamWriter sw = null;
         try
         {
             sw = new StreamWriter(AppDomain.CurrentDomain.BaseDirectory + "\\LogFile.txt", true);
             sw.WriteLine(DateTime.Now.ToString() + ":" + ex.Source.ToString().Trim() + ";" + ex.Message.ToString().Trim());
             sw.Flush();
             sw.Close();
         }
         catch
         {
         }
     }
```

Figure (4.6) : log the exceptions

- Create one more log method (WriteErrorLog) to log the custom messages:

```
public static void WriteErrorLog(string Message)
{
    StreamWriter sw = null;
    try
    {
        sw = new StreamWriter(AppDomain.CurrentDomain.BaseDirectory + "\\LogFile.txt", true);
        sw.WriteLine(DateTime.Now.ToString() + ": " + Message);
        sw.Flush();
        sw.Close();
    }
    catch
    {
    }
}
```

Figure (4.7) : log Custom message

- Create method (insertrecord) and write the following code inside the method to:

    1. Read video files from the directory that contains all video samples that has been taken from the bank.

    2. Insert videos paths to Filelog table in Videos database, to facilitate their retrieval after period of time.

```
public static void insertrecord(){
    try
    {
        string[] fileNames = Directory.GetFiles(@"C:\Users\Razonita\Desktop\Al Baraka", "*.mp4", SearchOption.TopDirectoryOnly);
        string[] vr = Directory.GetFiles(@"C:\Users\Razonita\Desktop\Al Baraka", "*.avi", SearchOption.TopDirectoryOnly);
        string[] arr = new string[fileNames.Length + vr.Length];
        int c = 0;
        for (int x = 0; x < arr.Length; x++)
        {
            if (x < fileNames.Length)
            {
                arr[x] = fileNames[x];
            }
            else
            {
                arr[x] = vr[c];
                c++;
            }
        }
        foreach (string fileName in arr)
        {
            string file = fileName;
            string logdate = fileName.Substring(43, 14);
            Library.WriteErrorLog(logdate.ToString());
            CultureInfo provider = CultureInfo.InvariantCulture;
            DateTime dateTime16 = DateTime.ParseExact(logdate, new string[] { "yyyyMMddHHmmss", "yyyyMMdd-HHmmss", "MM.dd.yyyy", "MM-dd-yyyy", "MM/dd/yyyy" },
            string bid = fileName.Substring(38, 2);
            string CId1 = fileName.Substring(40, 2);
            SqlConnection cn = new SqlConnection("Data Source=RAZONITA-PC;Initial Catalog=Videos;Integrated Security=True;");
            SqlCommand comm = new SqlCommand();
            comm.CommandType = CommandType.StoredProcedure;
            comm.CommandText = "loginsert";
            comm.Parameters.AddWithValue("@id", CId1);
            comm.Parameters.AddWithValue("@id1", bid);
            comm.Parameters.AddWithValue("@date", dateTime16);
            comm.Parameters.AddWithValue("@path", file);
            comm.Connection = cn;
            cn.Open();
            comm.ExecuteNonQuery();
            cn.Close();
        }
```

Figure (4.8) : insertrecord method

Use GetFiles( ) method to return the names of video files (including their paths) in the specified directory, after that split the name of video file to specify:

- Branch id that refer to a specific Branch name in Branch table.
- Camera id that refer to a specific camera name in camera table.
- Date and time of the video file.

When the service started, all the data (path of the video, branch number, camera number, date and time of the video) inserted to Filelog table in Videos database using stored procedure called “loginsert” in Sql Server as shown below:

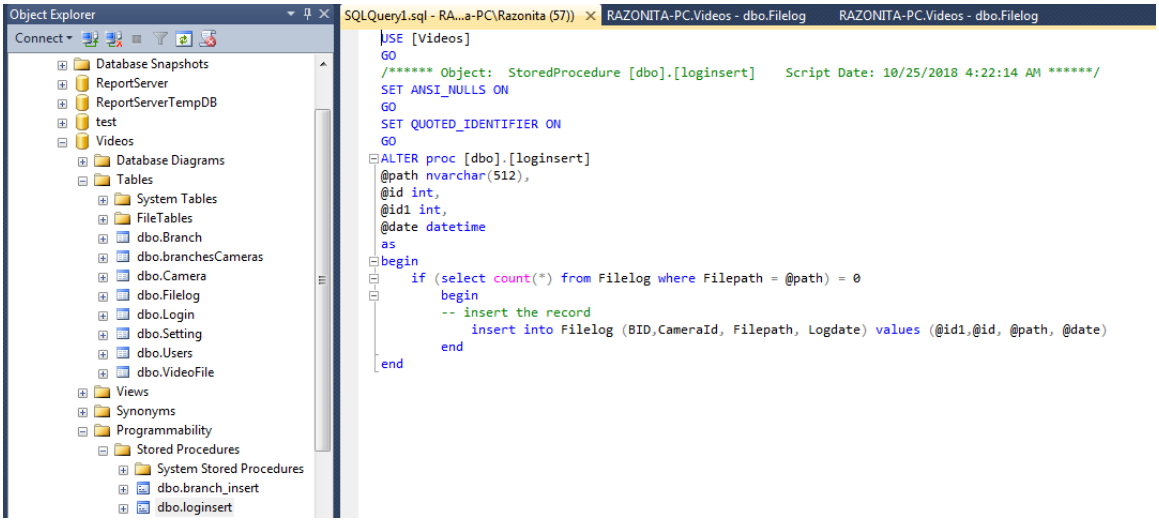


Figure (4.9) : loginsert stored procedure

4.3.2 Install a Windows Service in C#

There are many steps to install a windows Service in C#:

- Add Installer: to Add Installer return to the Service1.cs [Design] and right-click on the editor window then click "Add Installer":

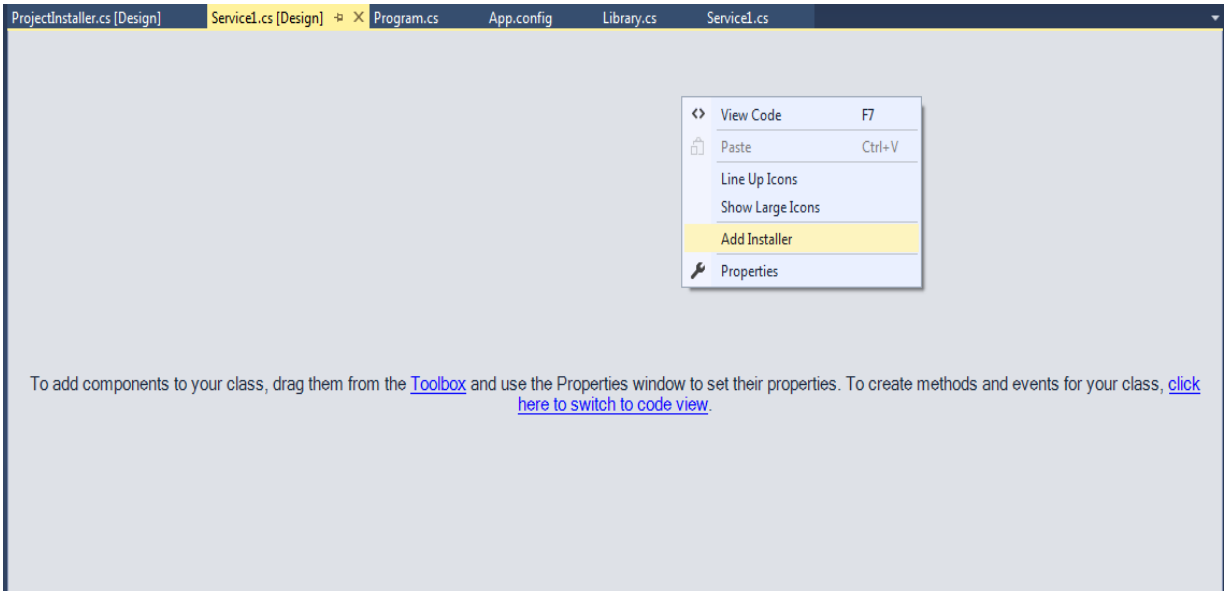


Figure (4.10) : Add Installer

- Then there will be a new file called "ProjectInstaller.cs" as shown in the following:

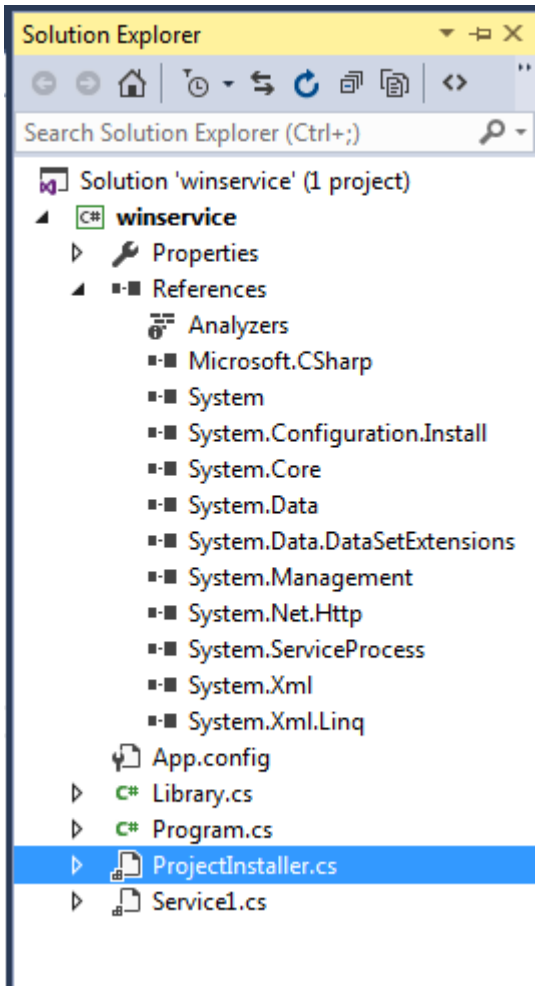


Figure (4.11): ProjectInstaller.cs

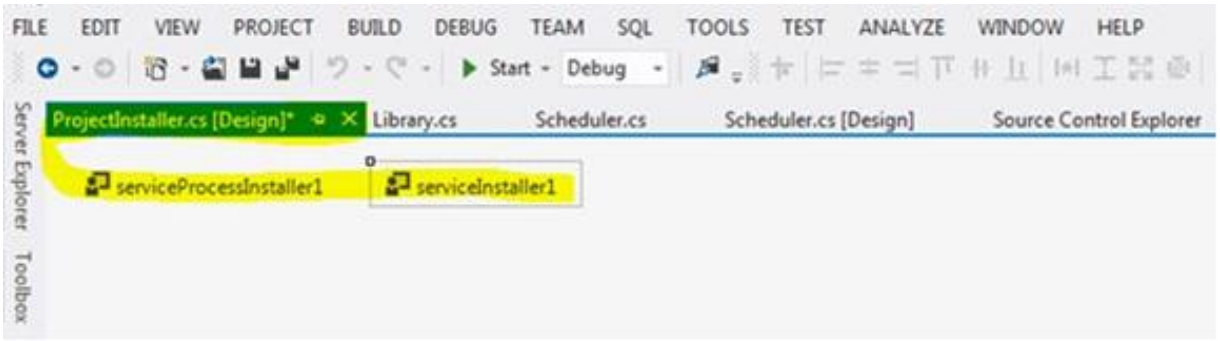


Figure (4.12): serviceInstaller1.cs

- Right-click on the "serviceInstaller1" and click "Properties":

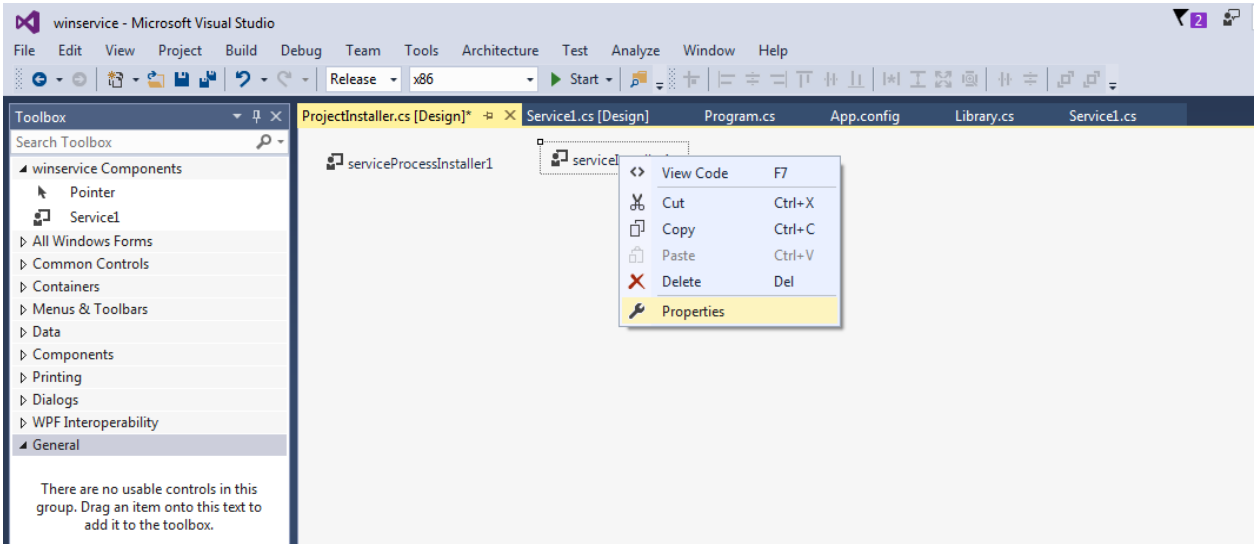


Figure (4.13) : serviceInstaller1 Properties

- Change the ServiceName to "LogRecordedVideoos" and StartType to "Manual" or choose "Automatic" if this service needs to be automatic :

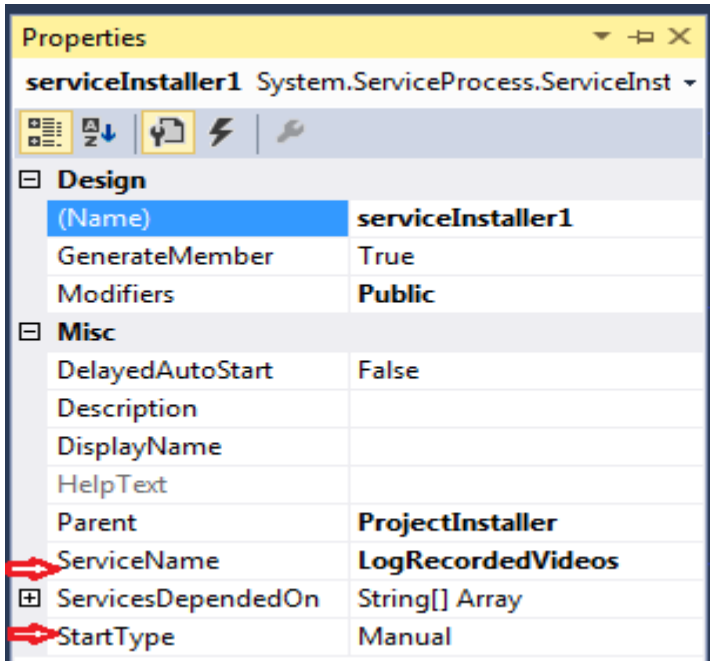
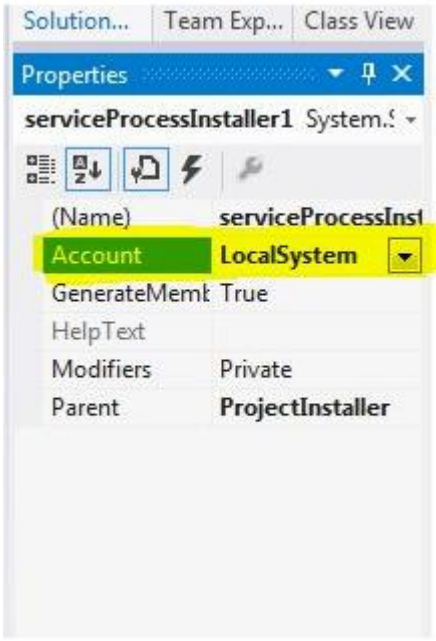


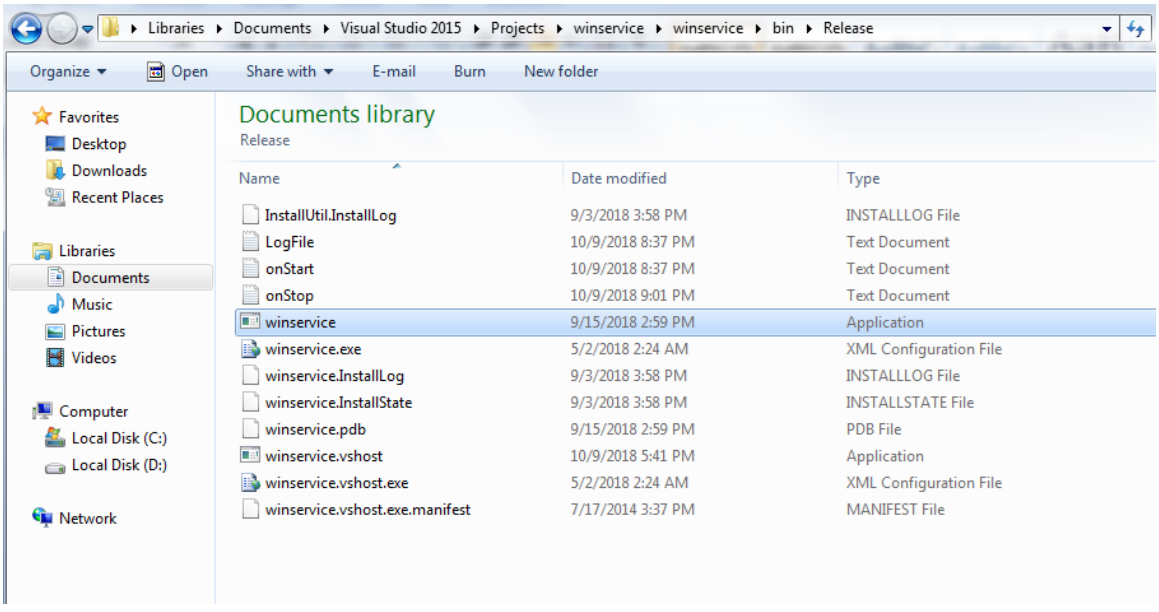
Figure (4.14) : Service Name and Start Type

- Right-click the serviceProcessInstaller1, click the properties window and change "Account" to "LocalSystem":



Figure(4.15) : change Account

- Build the project to see the .exe file at the location where the solution created:



Figure(4.16):exe file

- Go to "Start" >> "All Programs" >> "Microsoft Visual Studio 2015" >> "Visual Studio Tools" then click "Developer Command Prompt for VS2015"

  Type the following command :

  cd <physical location of winservice.exe file>

  in this case it is :

  cd C:\Users\Razonita\Documents\VisualStudio2015\Projects\winservice\winservice\bin\Release

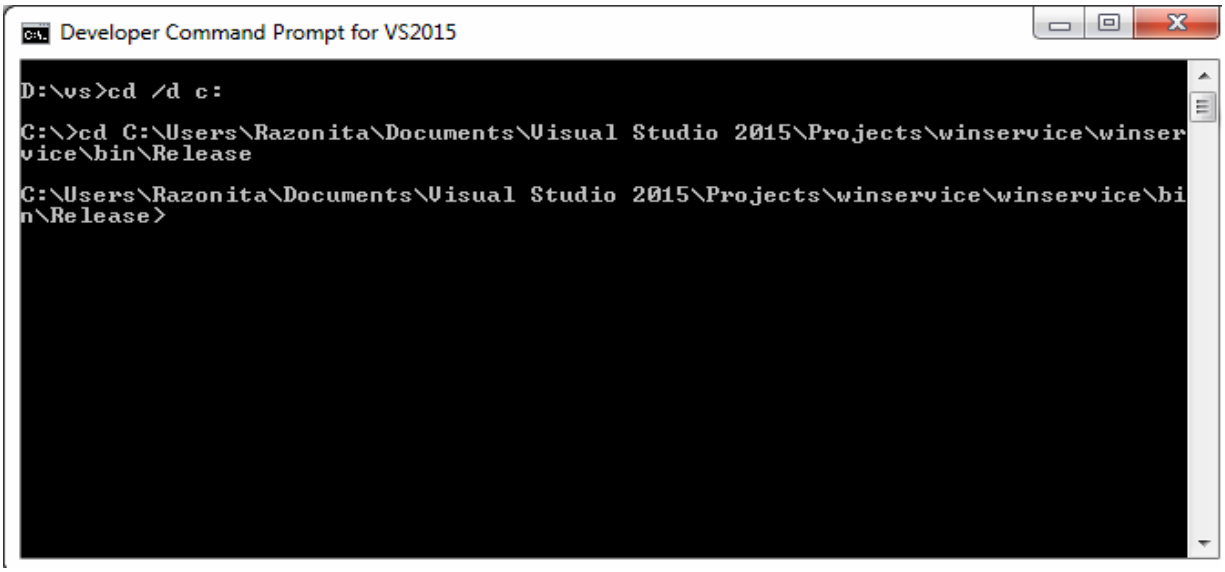


Figure (4.17): physical location of winservice.exe file

- Next type the following command:

  InstallUtil.exe “winservice.exe” and press Enter.

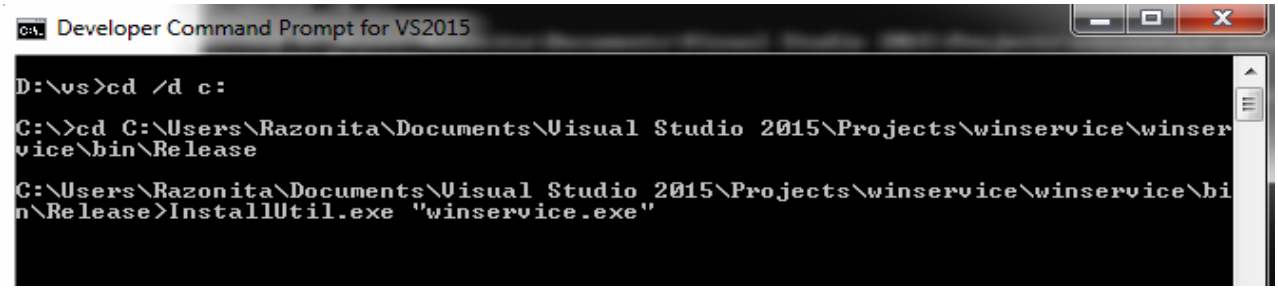
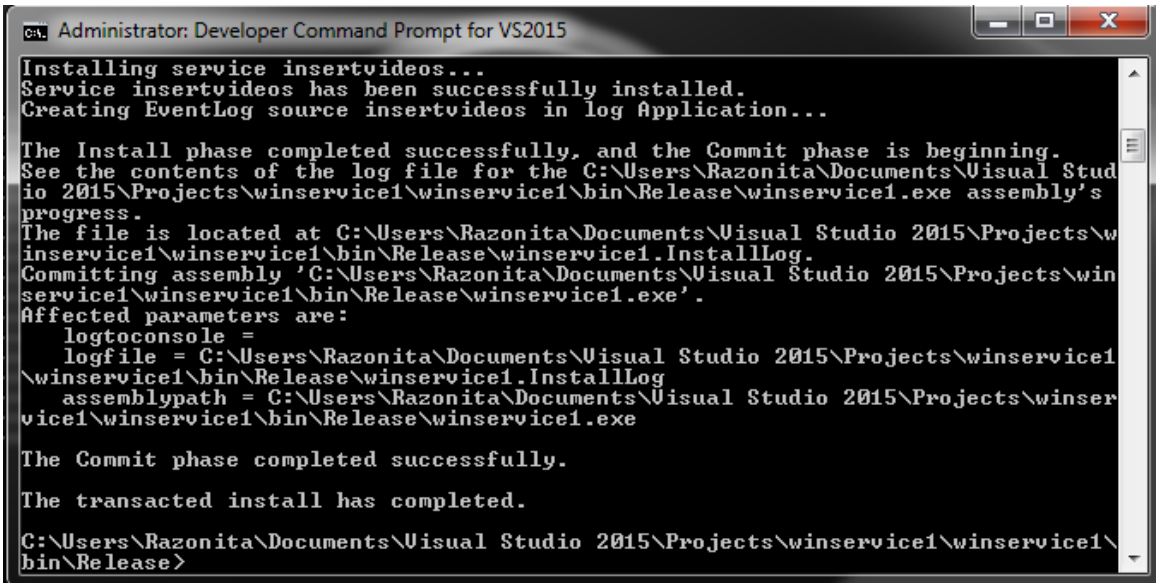


Figure (4.18): InstallUtil.exe “winservice.exe”

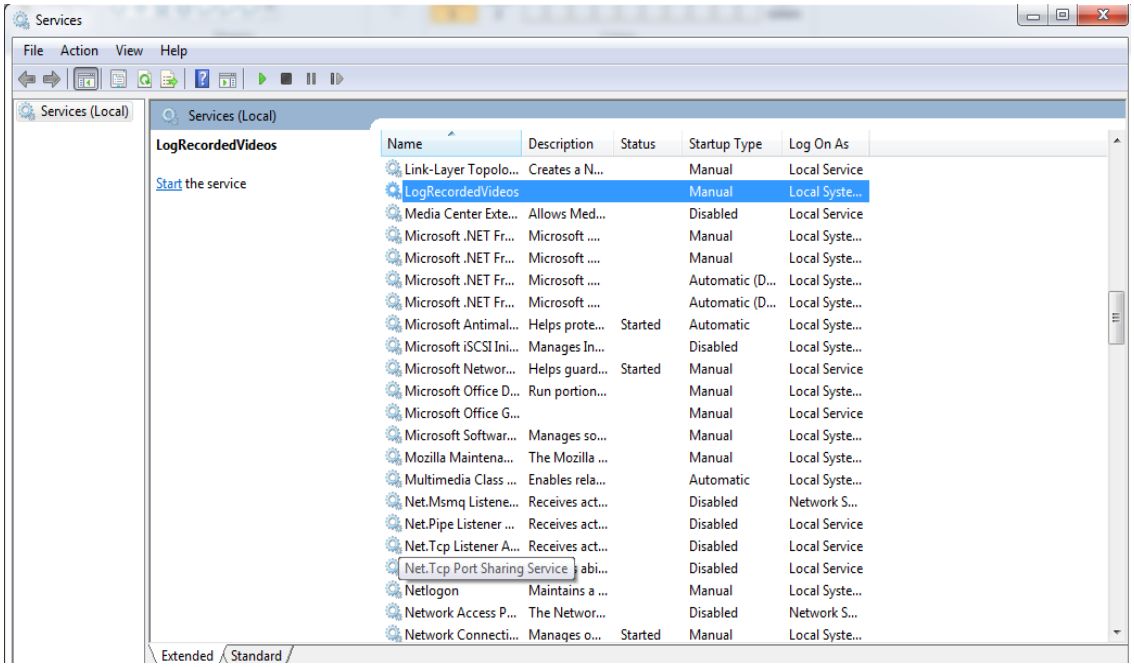
- When press Enter ,winservice will be successfully.



Figure(4.19): winservice is installed successfully

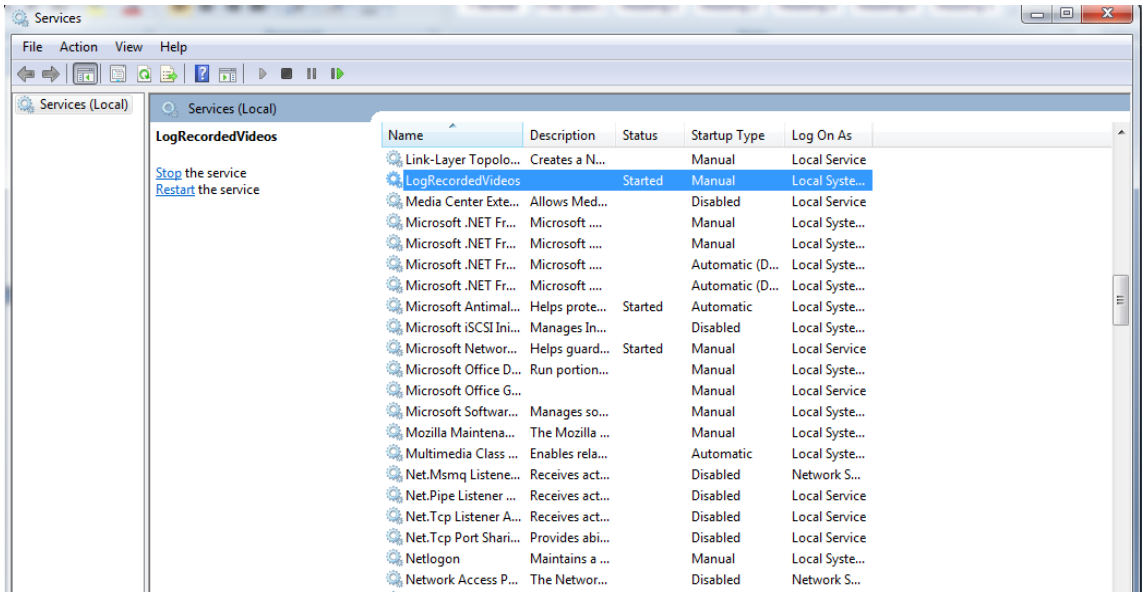
4.3.3 Start the Windows Service

- Since StartType = Manual has been chosen ,Windows Service must be started manually by visiting the "Services and Applications" window in the computer.



Figure(4.20): LogRecordedVideos

- Click "Start" to start the service. Go to the "winservice.exe" location to see the logs.



Figure(4.21): Start the service

- Tracking Windows Service by writing video names (including path) to .txt file called LogFile.txt; the working condition of Windows Service can be tested by looking at this log file.

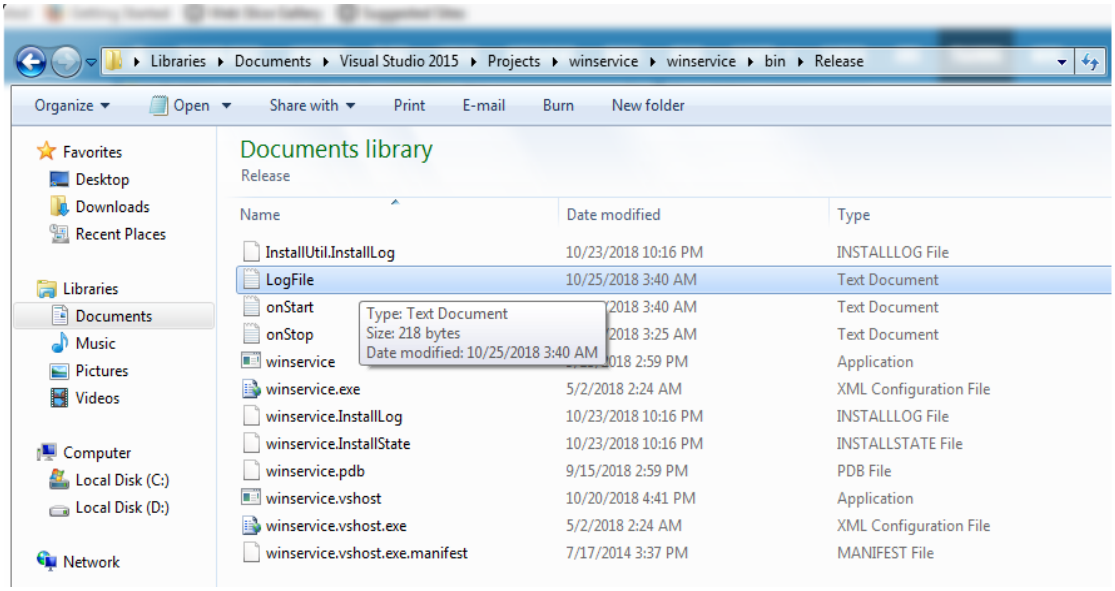


Figure (4.22): LogFile.txt

- Click the LogFile.txt to see the logs in order to check whether the service is doing the job that is set for it to do.

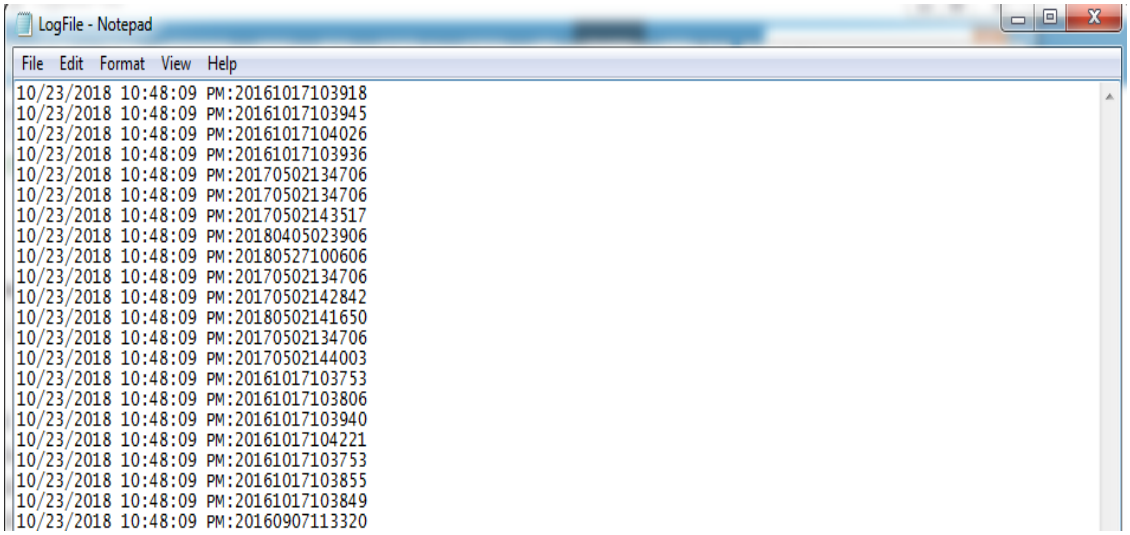


Figure (4.23): LogFile.txt to see the logs

- The preceding log file, prove that the Windows Service is running and doing the job that is wanted. And all the video files in the specified directory are inserted successfully into Filelog table. as shown below :

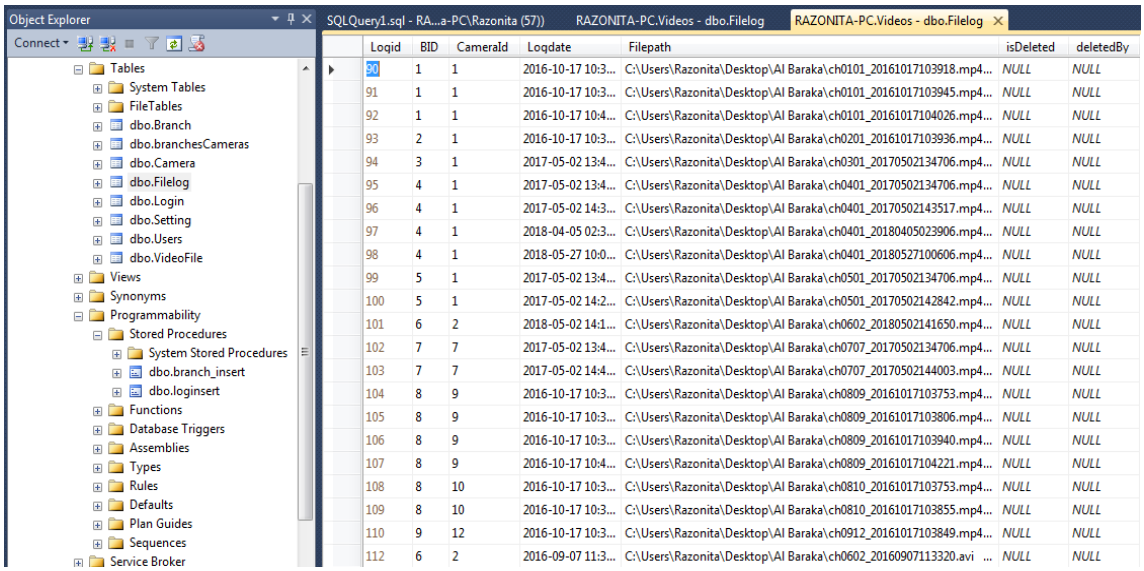


Figure (4.24): Filelog table

4.3.4 Stop the Windows Service

- To stop the Windows Service, just click "Stop" link in the Services window by selecting the LogRecoredVideos.

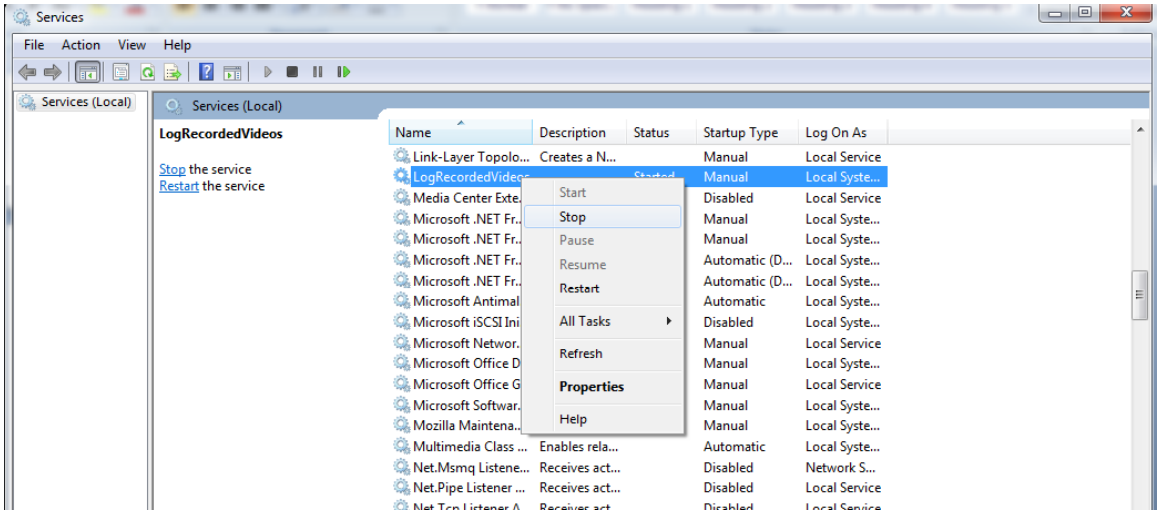


Figure (4.25): Stop the service

- When the service stopped, onstop.text file is created in "winservice.exe" location:

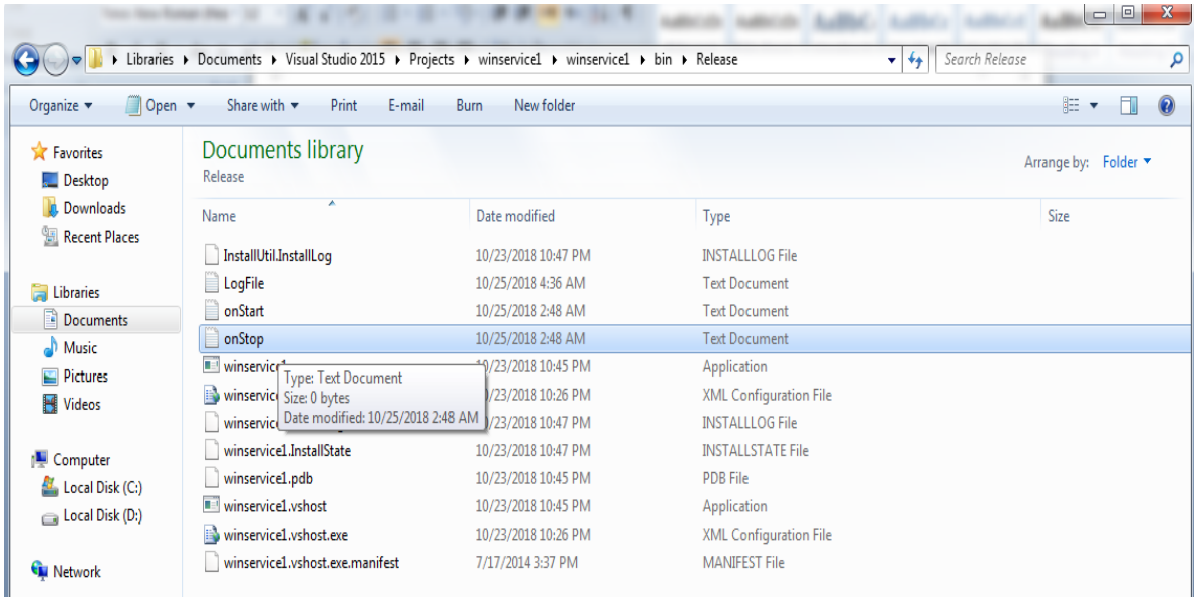


Figure (4.26): onStop.text file

4.4 System Design

After the video files have been inserted to database, windows forms application (is an application, which is designed to run on a computer. It will not run on web browser) is designed to manage, organize and retrieve videos.

The basic steps required to create and run a windows forms application using Visual Studio and C# language are:

- Open Visual Studio, Select File > New Project and then choose Visual C# and select Windows Forms Application template, Name the project Forms and Click Ok to start the project, See the below figure:

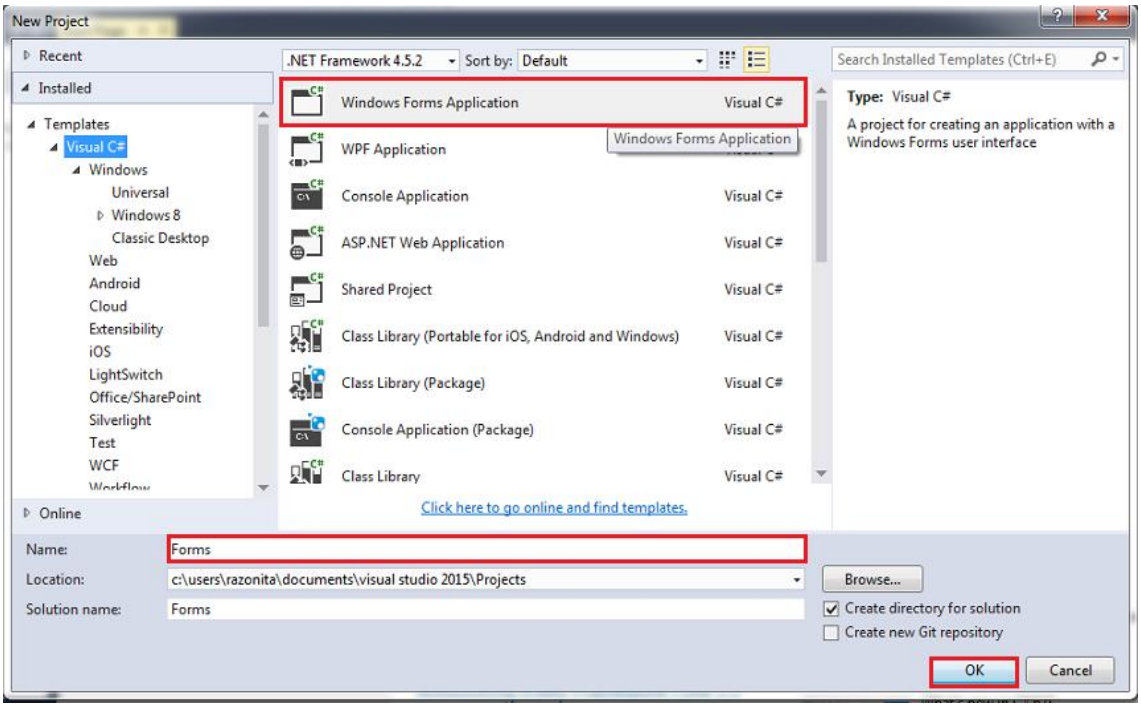


Figure (4.27): create windows forms application project

- Once the new project has been created the main Visual Studio window will appear. At the center of this window will be a new Form (Form1) in which the user interface will be created for the Forms of C# project. The Windows Form in Designer view. Switch between this view and code view at any time by right-clicking the design surface or code window and then click View Code or View Designer. The following picture shows how is the default Form (Form1) looks like:

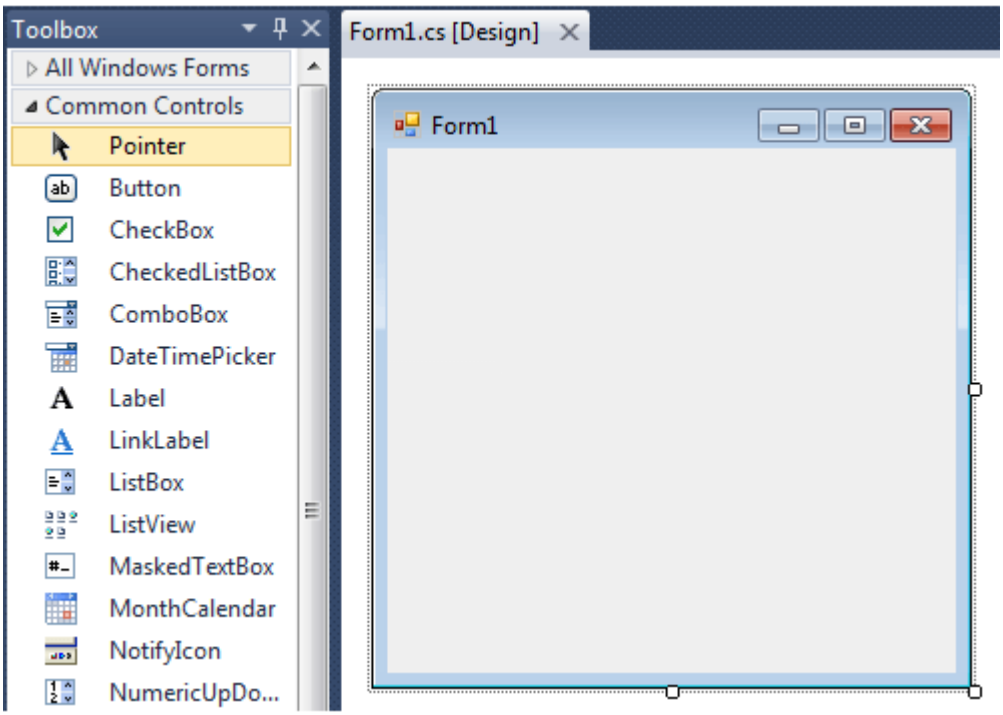


Figure (4.28): Form 1 windows form

- At the top of the form there is a title bar which displays the forms title. Form1 is the default name, Visual Studio Property window is used to set properties of the Form, For example to change the forms title from Form1 to Login Window, click on Form1 and move to the right side down Properties window, set Text property to Login Window.The title bar also includes the control box, which holds the minimize, maximize, and close buttons, to hide title bar set FormBorderStyle to None from Properties window. also we can set other properties to the Form such as select BackColor and change Font type as shown below:

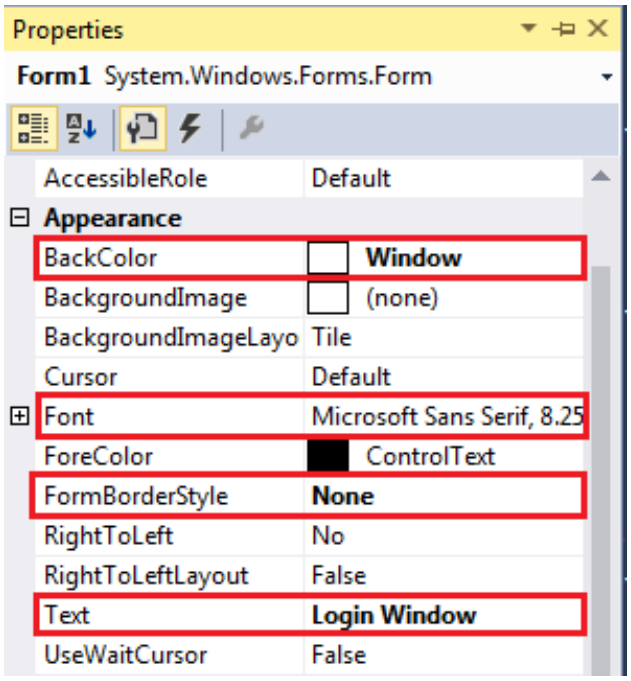


Figure (4.29): Form1 Properties

- To make the Form larger select the bottom-right sizing handle and drag it down and right, then the Size property will changes after dragging .Also resize a Form by typing new value for the Size property, set StartPosition property to CenterScreen to change the default position of the Form as shown in the following figure:

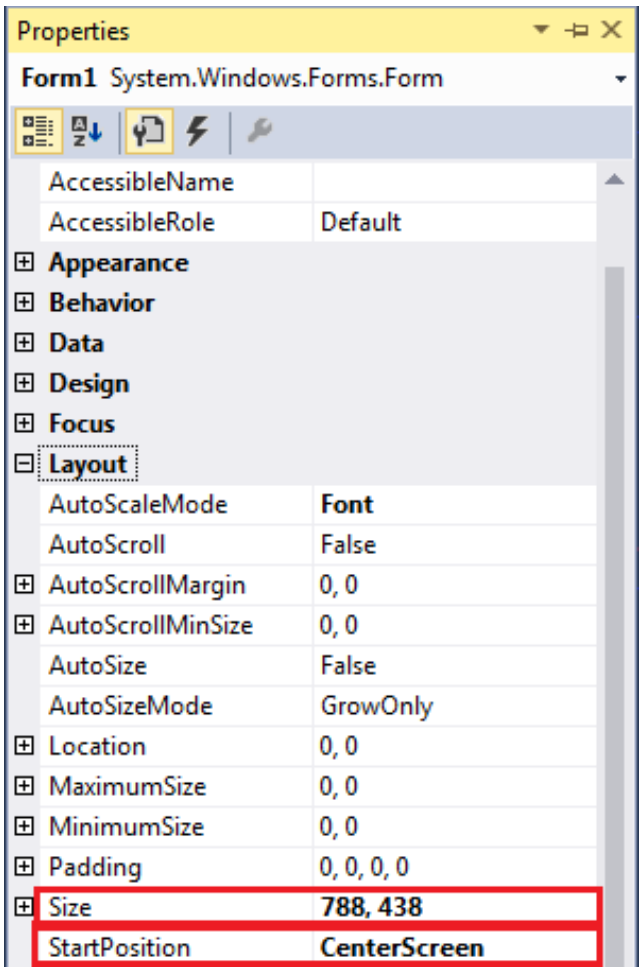


Figure (4.30): Form1 Properties

- At the moment our Windows Form (entitled Login Window) is empty. The next step is to start dragging components from the Toolbox to the Form.
- Drag and drop one pictureBox, one groupBox, two Labels, two TextBox, two Button and one checkbox components onto the Form.
- After components are added to the Form, Visual Studio assigns default names to each one. It is via these names that any C# code will interact with the user interface of the application. For this reason it is important to specify meaningful names which identify the component when referenced in the C# source code, therefore, the default names provided by Visual Studio are replaced by more meaningful ones. The other properties relating to components are specified through the Properties panel. For example to change the properties for the Label select the label1 component in the Form area, display the properties for this

component. Scroll to the top of the list of properties to change the font type and font style from Font property ,To change the color of the label select on ForeColor property , go to Text property and change it to User name ,Scroll to down until the Name property appear and change this name from label1 to User_name, as shown below:

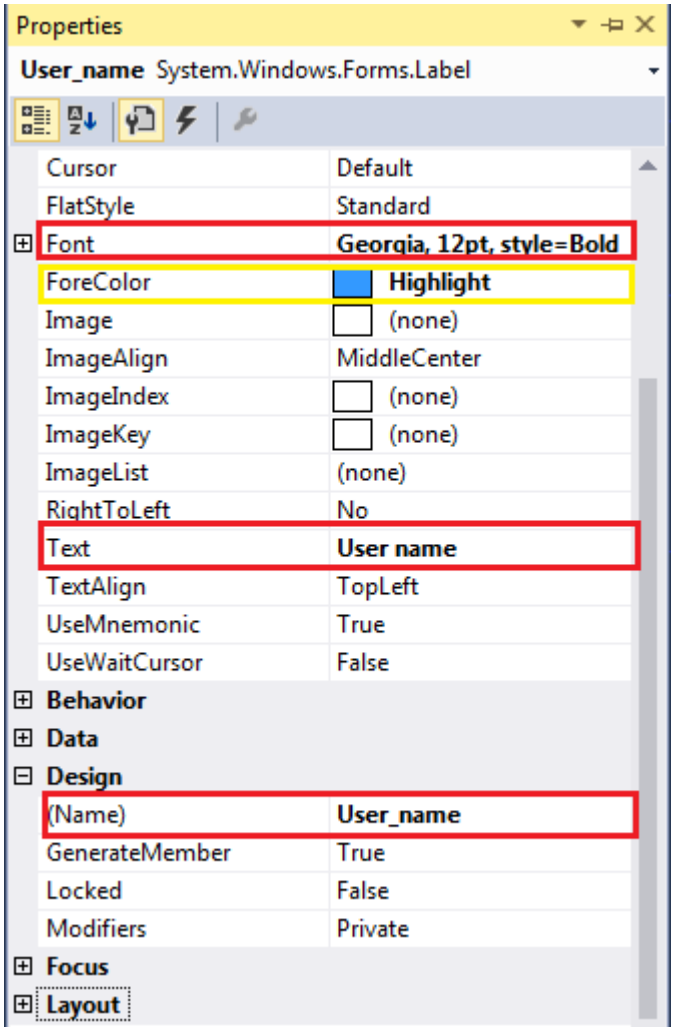


Figure (4.31): label1 Properties

- Repeat the above step by selecting each component in the Form and changing their properties. The second Label named Password, the two textBox one for username and anther for the password, the left hand and right hand buttons are Login button and Cancel Button respectively.

- After Applying above steps to the Login Window form and the components inside the form, it's look like as below:

Figure (4.32): Login Window

- The next task in creating the application is to add some functionality so that things happen when press the two buttons in the form. This behavior is controlled via events. For example, when Login button is pressed a Click event is triggered. All is needed, therefore, is to write some code for the login_Click events As it is illustrated here:

```
private void login_Click(object sender, EventArgs e)
{
    SqlConnection con = new SqlConnection("Data Source=RAZONITA-PC;Initial Catalog=Videos;Integrated Security=True;");
    SqlDataAdapter da = new SqlDataAdapter("select Count(*) from Users where Username='" + username.Text + "'  and UserPassword= '" + pass.Text + "'", con);
    DataTable dt = new DataTable();
    da.Fill(dt);
    if (dt.Rows[0][0].ToString() == "1")
    {

        this.Hide();
        Dachboard d = new Dachboard(username.Text);
        d.Show();
    }
    else
    {
        MessageBox.Show("please Check Ur Username and Password");
        username.Text = "";
        pass.Text = "";
    }
```

Figure (4.33): login_Click event

- Above code demonstrate how to access a SQL Server database and retrieves username and password from Users table using ADO.NET Objects as it mentioned earlier based on text entered into username textBox and password textBox.
- If username and password that user entered into textBox equal username and password into Users table then user is allowed to access the entire system.
- If username and password that user entered into textBox not found into Users table, a message will be displayed to user to the check the username and password by using Messagebox.Show (is used for the purpose of displaying a message with specified text).
- When the Cancel Button is pressed by the user , the application will exit, This can achieved by calling the Close() method in the Exit_Click event:

```
private void Exit_Click(object sender, EventArgs e)
{
    this.Close();
}
```

Figure (4.34): Exit_Click event

- Login Window is now built and will be the first window in the application, in the next steps, the second window will be built which will appear when the user authorized to login to the system.
- To add a new windows form to the project, click Project from the menu bar at the top of the Visual C# software. From the Project menu, select Add Windows Form. The Add New Item dialogue box will be shown. Make sure Windows Form is selected. Name it Dashboard.cs.When click Add, a new blank form will appear:

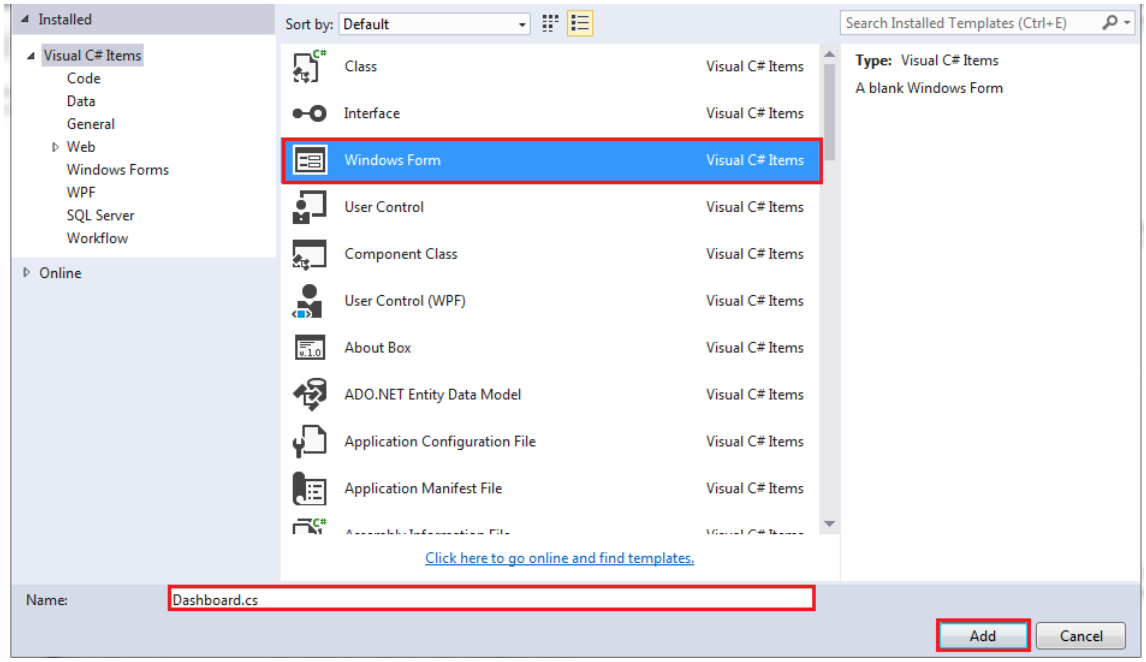


Figure (4.35): Dashboard Windows Form

- Add some components to Dashboard.cs form, and follow all the steps that mentioned above to set the properties to the form and the components inside the form.
- To display the Dashboard form, when the program runs to the first time, C# will create an object from Login Window class. But it will not do anything with Dashboard class. The object must be created.
- To create a Dashboard object, declare a variable of Type Dashboard:
  Dashboard d= new Dachboard( );
- To show this form , the Show( ) method of the object: d.Show() is used.
- The code looks like this:

```
private void login_Click(object sender, EventArgs e)
{
    SqlConnection con = new SqlConnection("Data Source=RAZONITA-PC;Initial Catalog=Videos;Integrated Security=True;");
    SqlDataAdapter da = new SqlDataAdapter("select Count(*) from Users where Username='" + username.Text + "'  and UserPassword= '" + pass.Text + "'", con);
    DataTable dt = new DataTable();
    da.Fill(dt);
    if (dt.Rows[0][0].ToString() == "1")
    {

        this.Hide();
        Dachboard d = new Dachboard(username.Text);
        d.Show();
    }
    else
    {
        MessageBox.Show("please Check Ur Username and Password");
        username.Text = "";
        pass.Text = "";
    }
```

Figure (4.36): Dashboard object

- The above code is written in Login_click event to allow the user to access the Dashboard window when press to Login button.
- After that there is an important step which is to create User control, The Advantages of using User control are :
    - Code re-usability
    - Time saving.
    - Less effort.
    - Easy to find Bug and fix it.
- To adding a new User control to the project, click Project from the menu bar at the top of the Visual C# software. From the Project menu, select Add User control, then Add New Item dialogue box will appear. Make sure User control is selected. Name it Branch.cs, When click Add, a new blank window appears, as shown below:

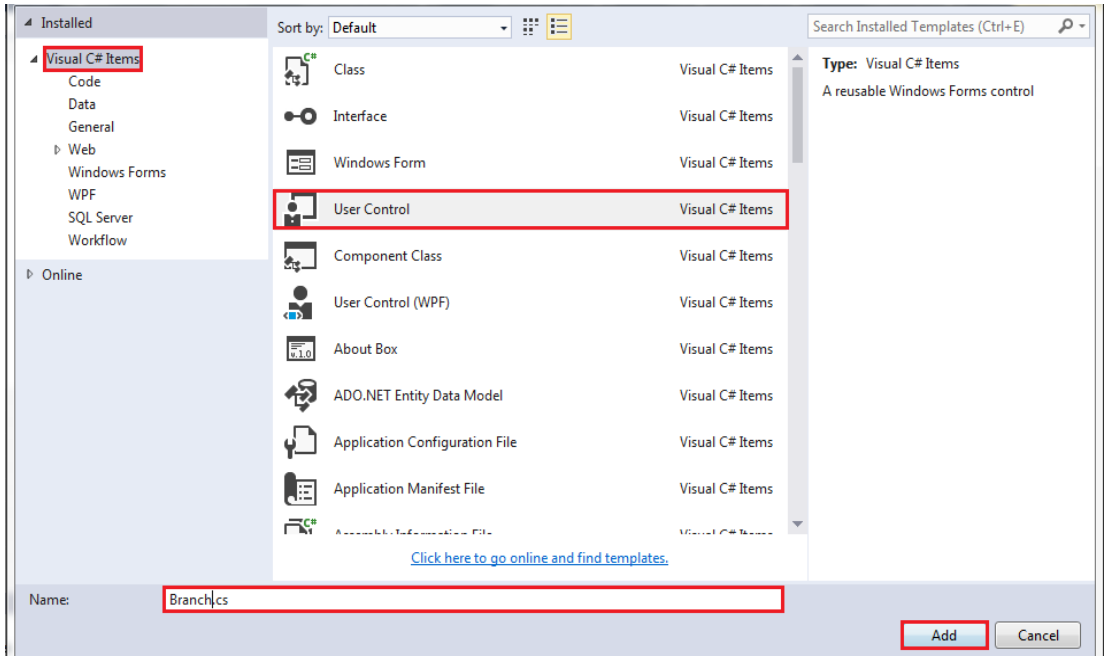


Figure (4.37): Branch User Control

- Follow the above step to create four User control, one to mange cameras named Camera.cs, anther to mange user named mangeusers.cs, View.cs to view and retrieve videos, and Role.cs to set role and permission to specific user.
- After creating the User Control, select each one to add some components and set property to it following the steps that mentioned earlier.
- Each User Control will display when press a specific button on the Dashboard form, for example , a button named Mange Branch is added to Dashboard form, when press this button the Branch User control will display by adding Branch object in Branches_Click event on the Dashboard form code view with steps that illustrated before.

4.5 GUI Implantations

As it mentioned earlier Login Window will be the first window in this application, the user has to fill this window before access the entire system. The Login Window is connected with the a SQL Server database which could hold information about the usernames and their corresponding password in the Users table when the user press the login button the verification will be done to check if the user allowed to be

logged in or not, if the user is verified and authorized then the second window will open. If the user is not authorized due to wrong username or password then it will show error message and it will be again directed to the Login Window. When run the application it will appear as the below picture:

Figure (4.38): Login Window

When the user pressed “Cancel” button the application will exit.

After the user login to the system the Dashboard Window will appear, the dashboard should look as follows:

Figure (4.39): Dashboard Window

There are five operations in this window:

1- **Manage Branches**: to mange branches in the bank by adding new branch name, edit the name of existing branches and delete branch.

Click on Manage Branches button to display Branch User control, it will look like this:

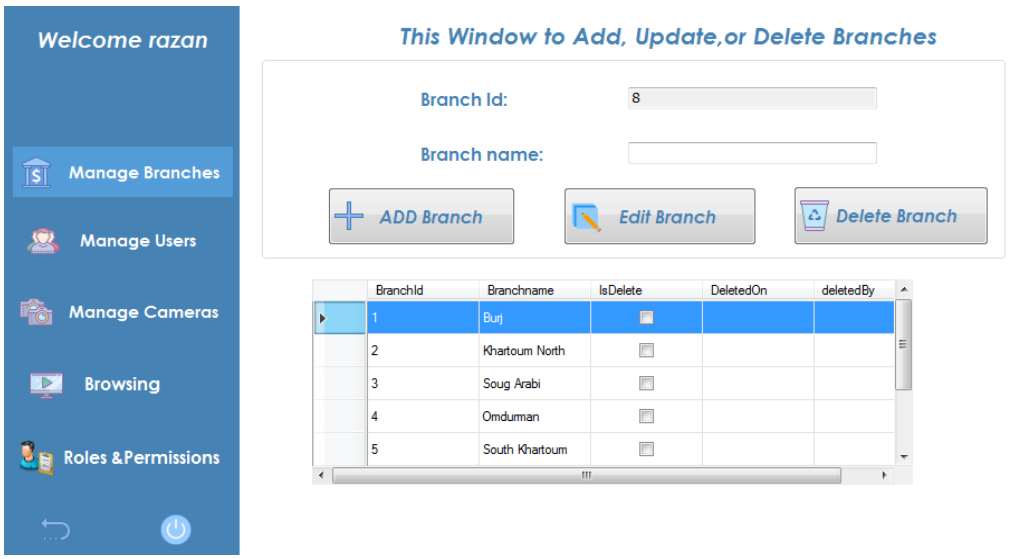


Figure (4.40): Manage Branches

There are three tasks in this window:

- Add branch: to insert new record into the database.

  When the user enter branch name in TextBox and then press the "ADD Branch" button, a new record will be inserted to database. As shown below:

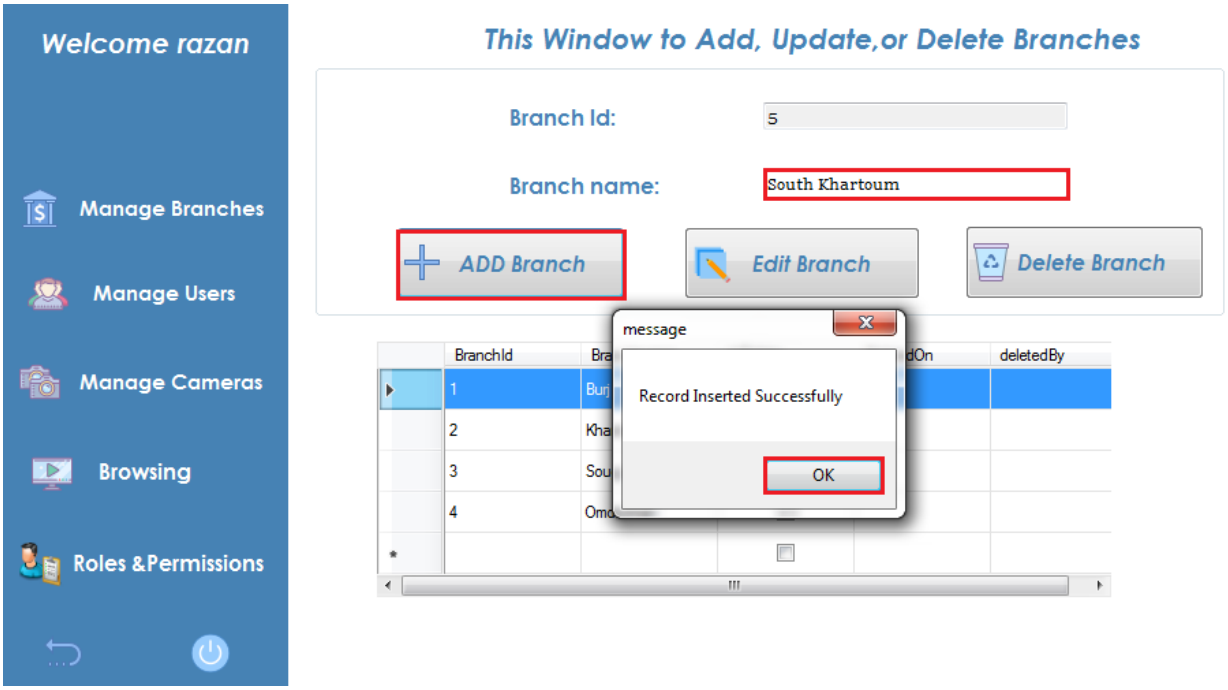


Figure (4.41): ADD Branch

In the above Window when clicking on the " OK " button a new row with Branch name “South Khartoum “ for example will display on DataGridView ,that is used to display the information from Branches table as follow :

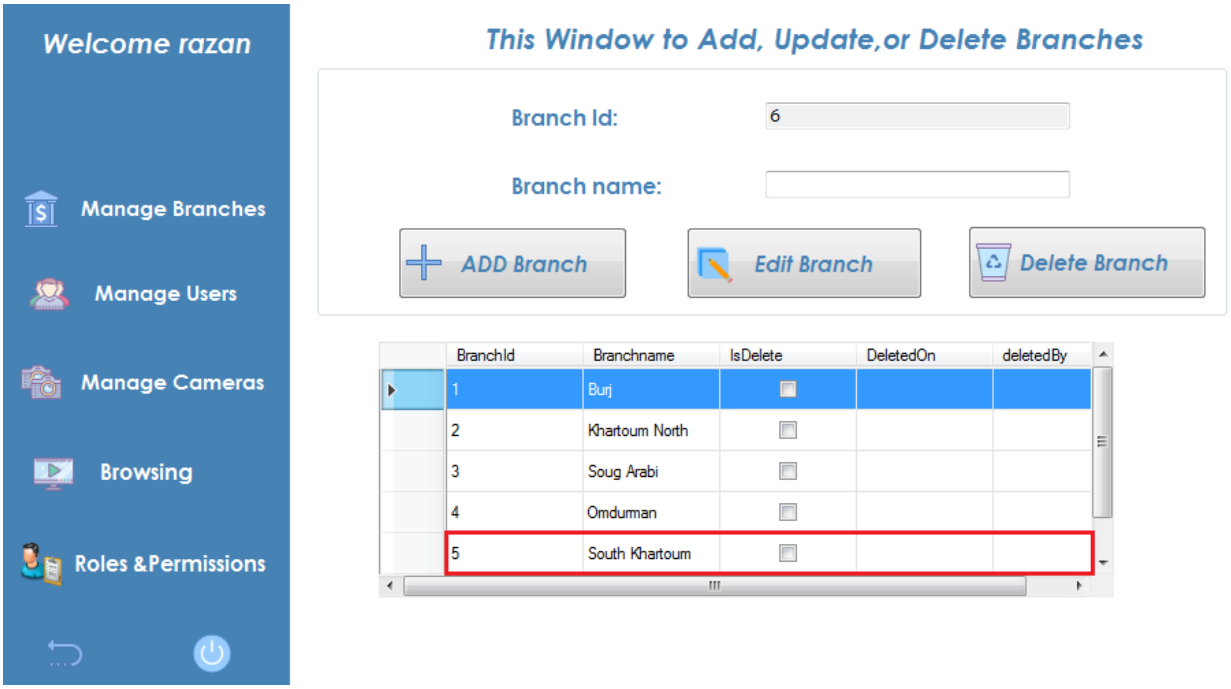


Figure (4.42): Add new row

- Edit Branch: used to update existing records into the database.

A dataGridView1_CellContent Click Event is created for updating the selected record. When the user clicks on the Row Header of a row then the data present in the cell of the row is stored into the TextBox, Now enter some values into the TextBox and click on "Edit Branch" button that calls the edit method then the record in the GridView will be updated as shown in the following:

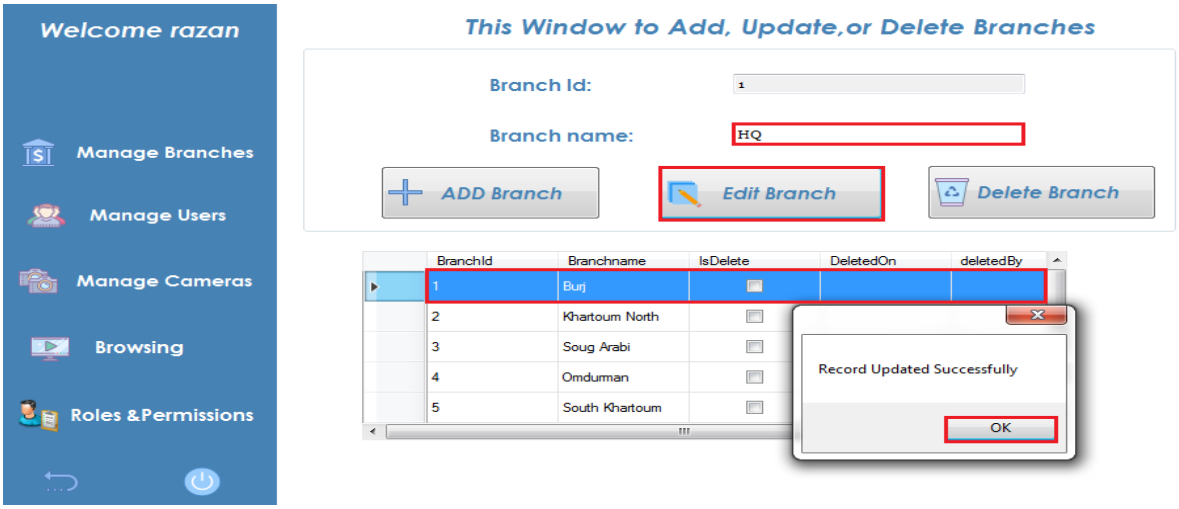


Figure (4.43): Edit Branch

When click “OK” button in the above window, the value of "Branchname" column in GridView will change from "Burj" to "HQ". As shown in the following grid:

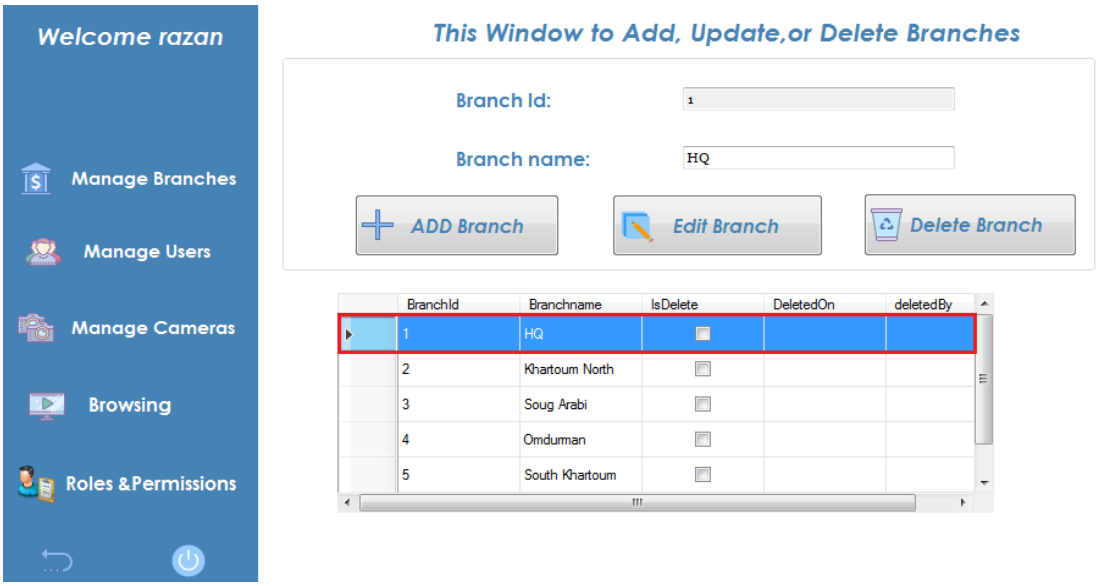


Figure (4.44): Update existing record

- Delete Branch: used to delete existing records from a database.

  Now click on the “Delete Branch” button that calls the delete method and deletes the selected records from the GridView as shown in next figure:

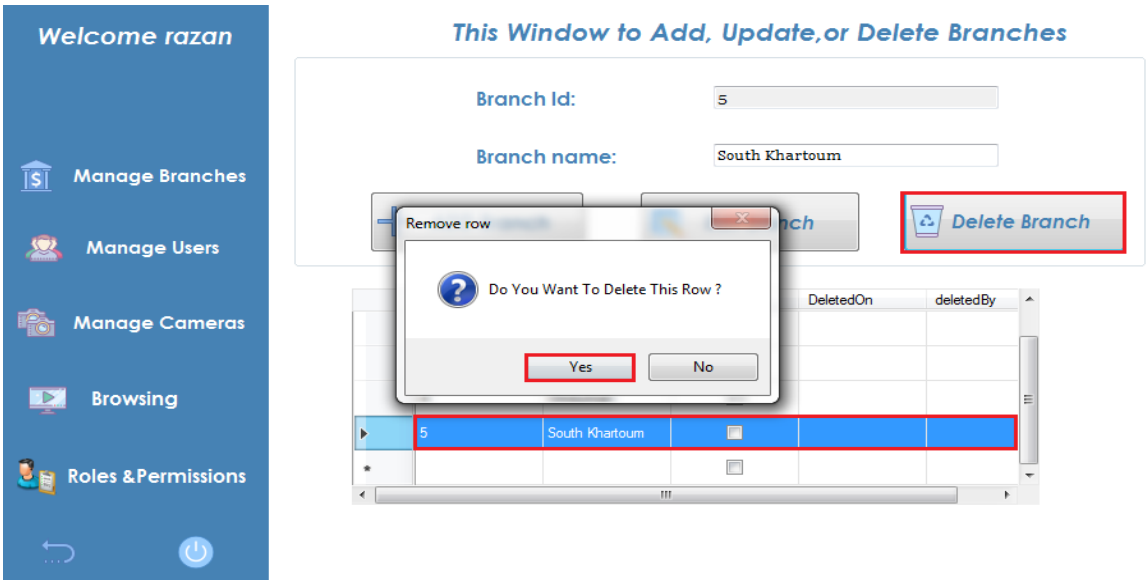


Figure (4.45): Delete Branch

A confirmation message box used before deleting items from a GridView. If the user clicked on the “Yes” button the Delete Columns is setup by adding three Colums in the Gridview. The first column “IsDelete” contains a checkbox control, with the CommandName property set to "checked" when record deleted , the second column “DeleteOn “ that store the date and time for deleted record , the third column “Deletedby” store the name of the user who deleted the record , The following figure shows how is the GridView looks like:

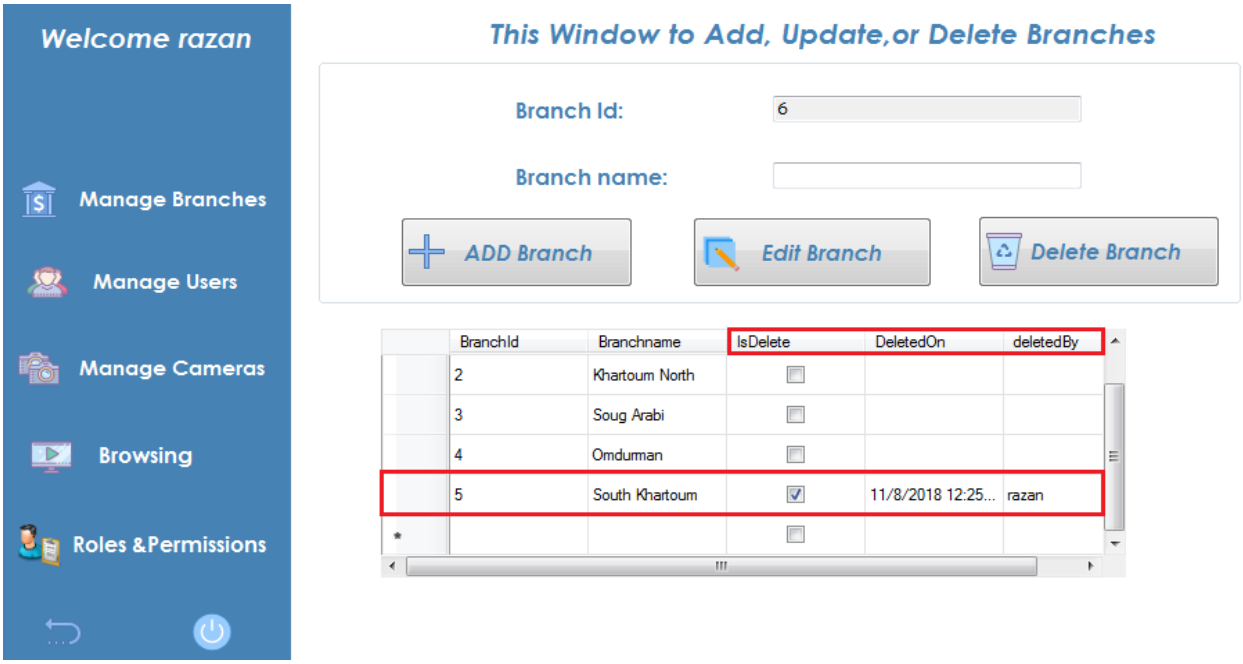


Figure (4.46): Delete existing record

If the user clicks on the Cancel button of the confirmation box, then the delete action is cancelled. And will show message to the user as below :

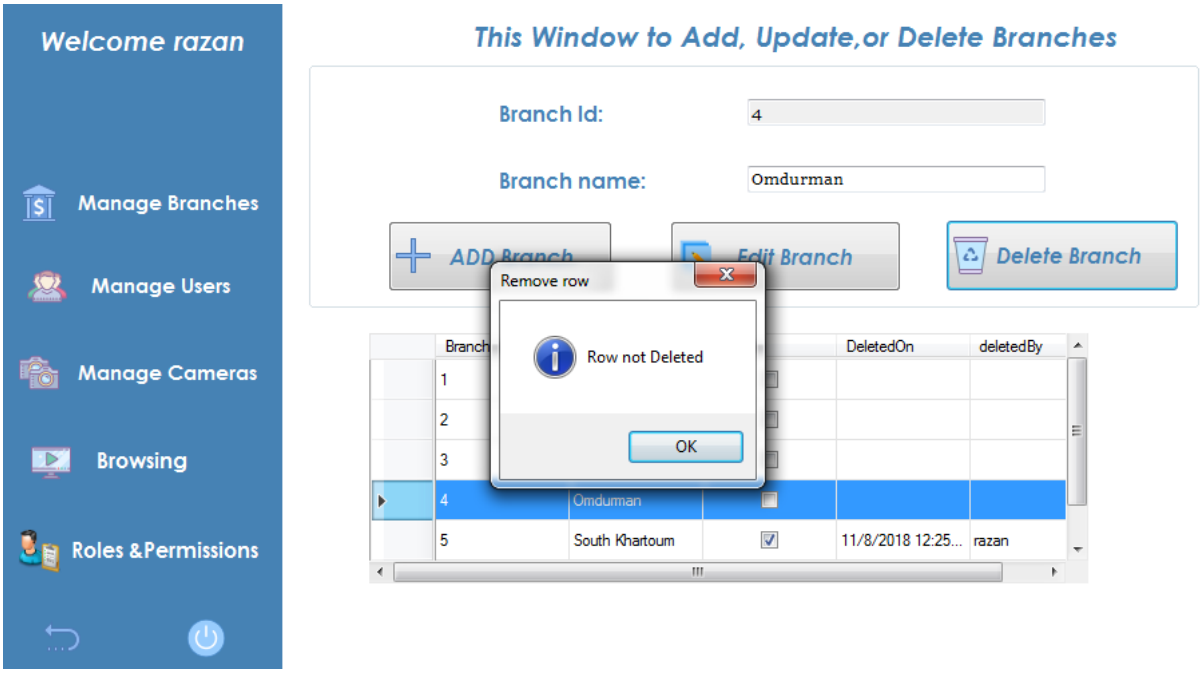


Figure (4.47): Cancel delete

2- Manage Users: We used same way which was used above in manage branches operation to perform insert, update and delete users.

Click on "Manage Users" button to show mangeusers window as in figure (4.48):

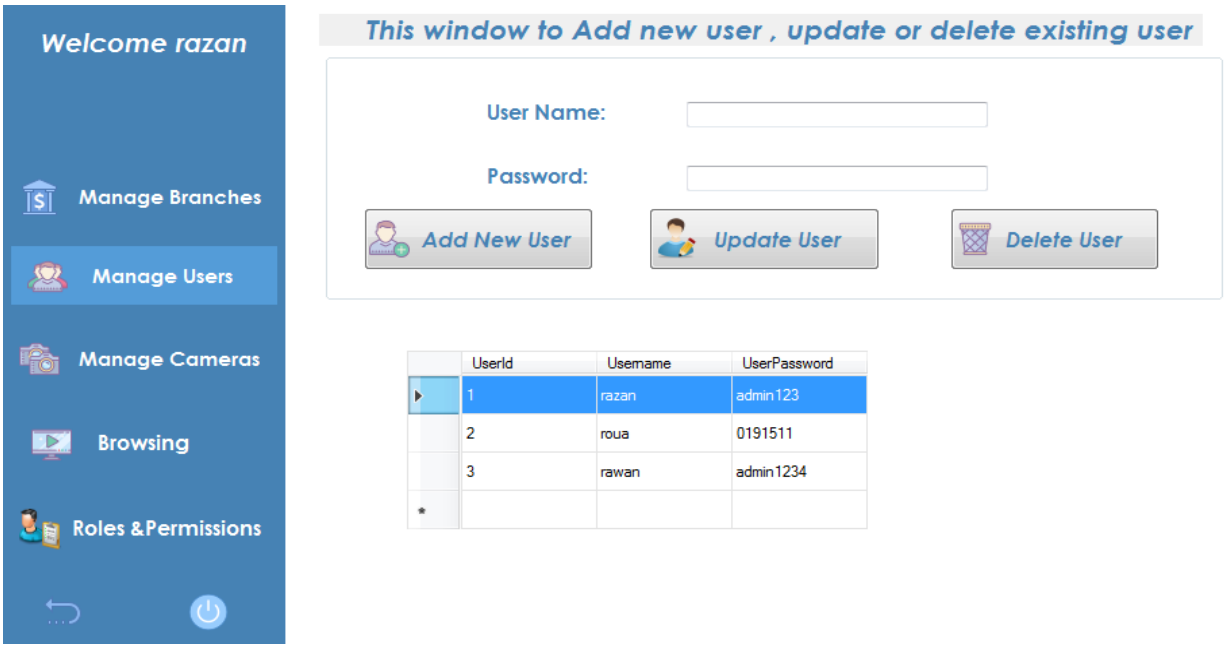


Figure (4.48): Manage Users

- Add New User: to insert new user in the database , the user has to fill User Name and Password textboxes and press on “Add New User” button then a new user inserted to database on the Users table, and will be displayed on the DataGridView, as example shown below :

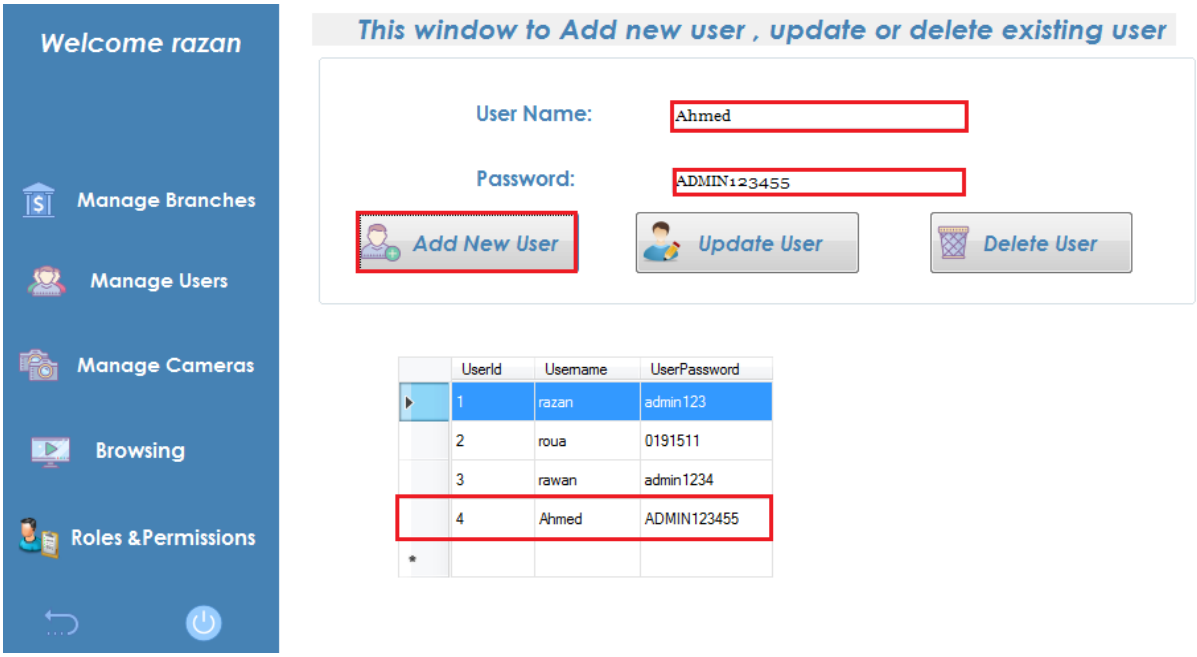


Figure (4.49): Add New User

- Update User: used to update existing user in the database.

As we mentioned before we created a dataGridView1_ CellContentClick Event for updating and deleting the selected record. When the admin clicks on the specific cell then the data present in the cell is stored into the User Name textbox and Password textbox, the admin modify the values of the username and password with new values and then when click on “Update User” button, the record will successfully updated in the database and the record in the GridView will be also updated. As the following:

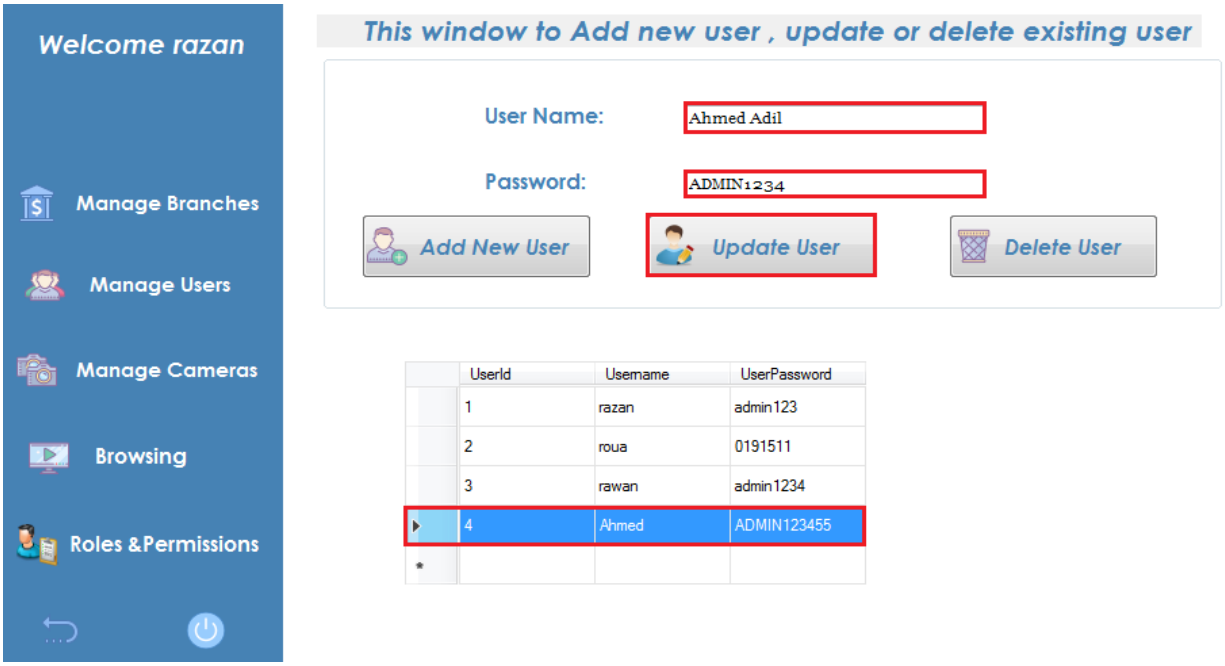


Figure (4.50): Update User

After Clicking on “Update User” button, it will be noticed that the value of "Username" column in GridView will change from "Ahmed" to Ahmed Adil" and the value of " UserPassword " column will change from "ADMIN12345" to ADMIN1234 " As shown in the following grid:

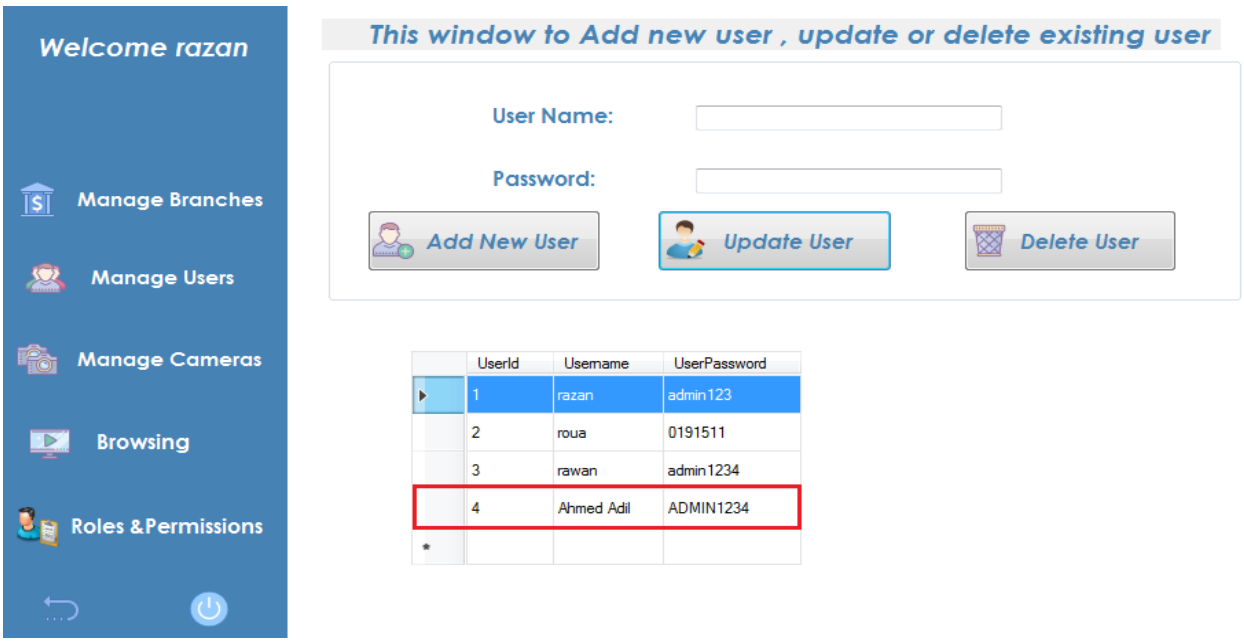


Figure (4.51): Update Existing User

- Delete User: used to delete the selected record from the GridView and from the database using a dataGridView1_ CellContentClick event and delete method.

  For example if we want to delete the user “Ahmed Adil” that selected in GridView and press on the "Delete User" button, the confirmation message box will appear as below :

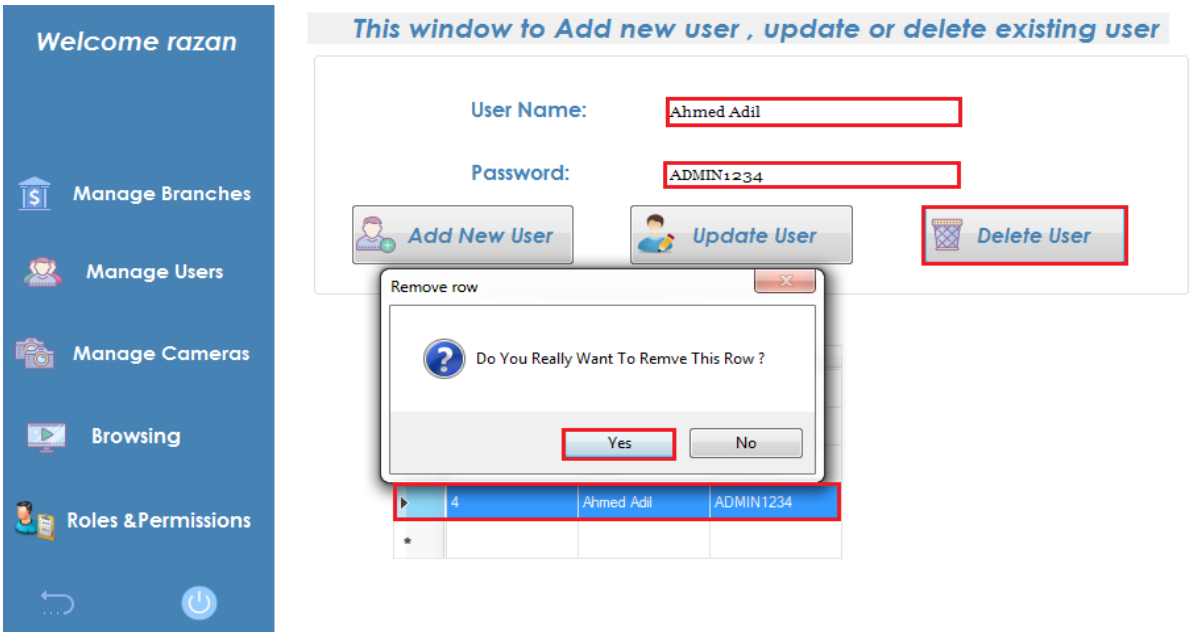


Figure (4.52): Delete User

When click on “Yes” button in message box above, the record will be deleted successfully as following:

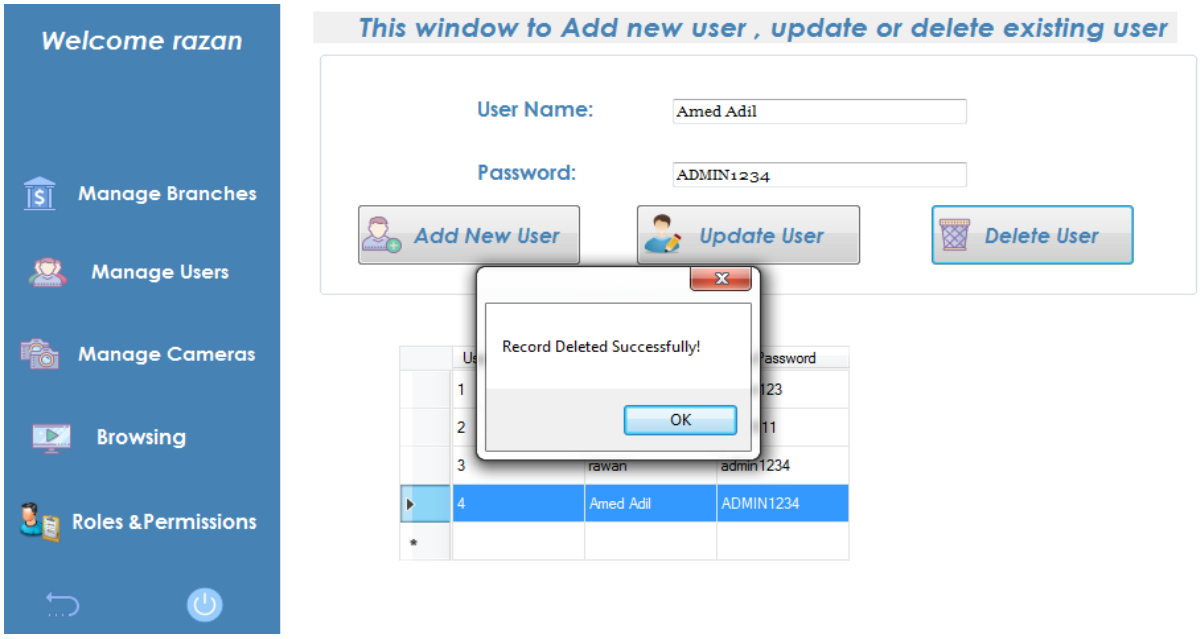


Figure (4.53): Delete Existing User

3- Manage Cameras: Also the same pervious way is used to perform operations of insert, update and delete camera. Click on "Manage Cameras" button to show cameras form as in figure (4.54):

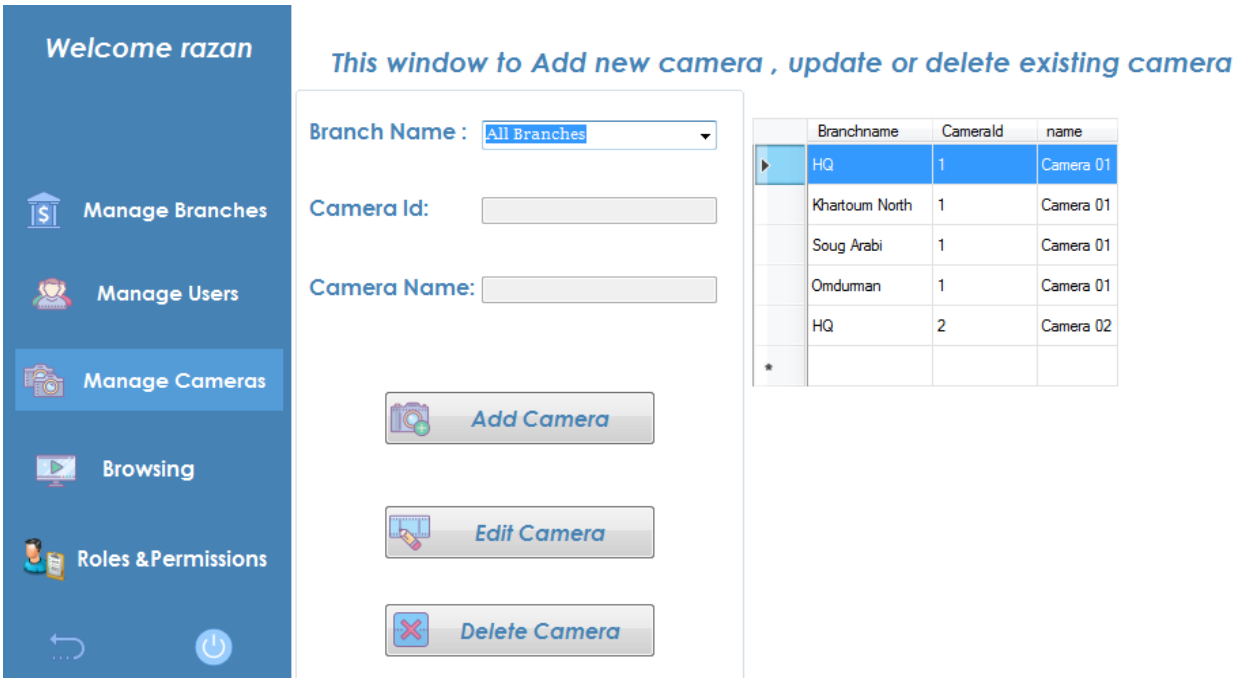


Figure (4.54): Manage Cameras

The above form shows DataGiredView that display all branch names and associated cameras, if is needed to show cameras for a specific branch just select the branch name from the list of branches as following:

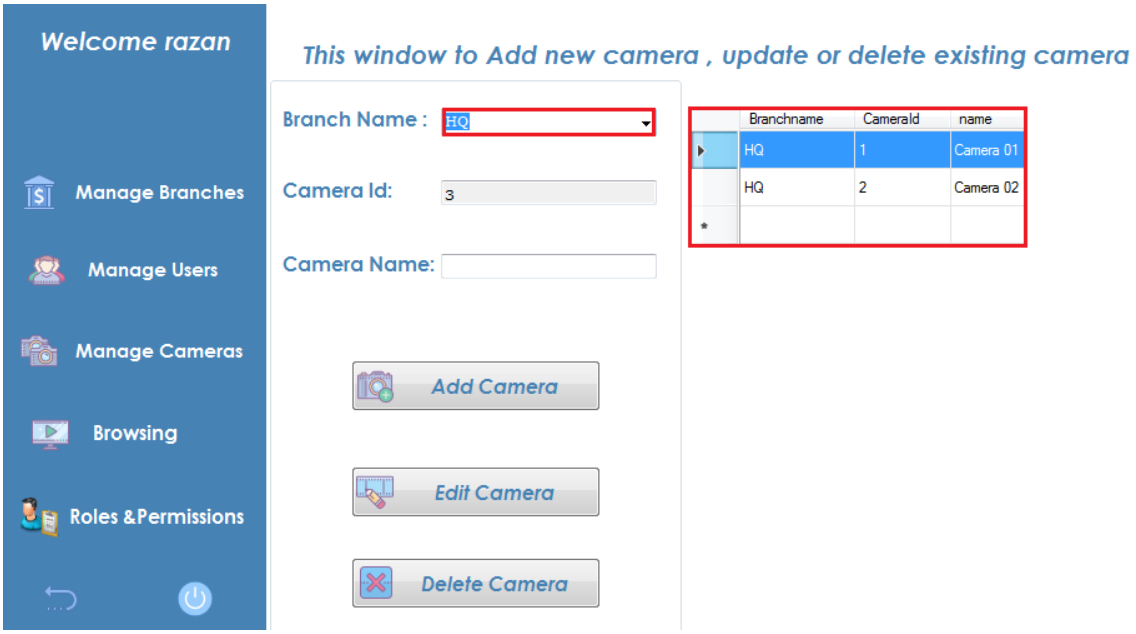


Figure (4.55): Cameras in a Specific branch

- Add Camera: To add new camera in specific branch fill Camera Name textbox with the name of camera and click on "Add Camera" button, as following :

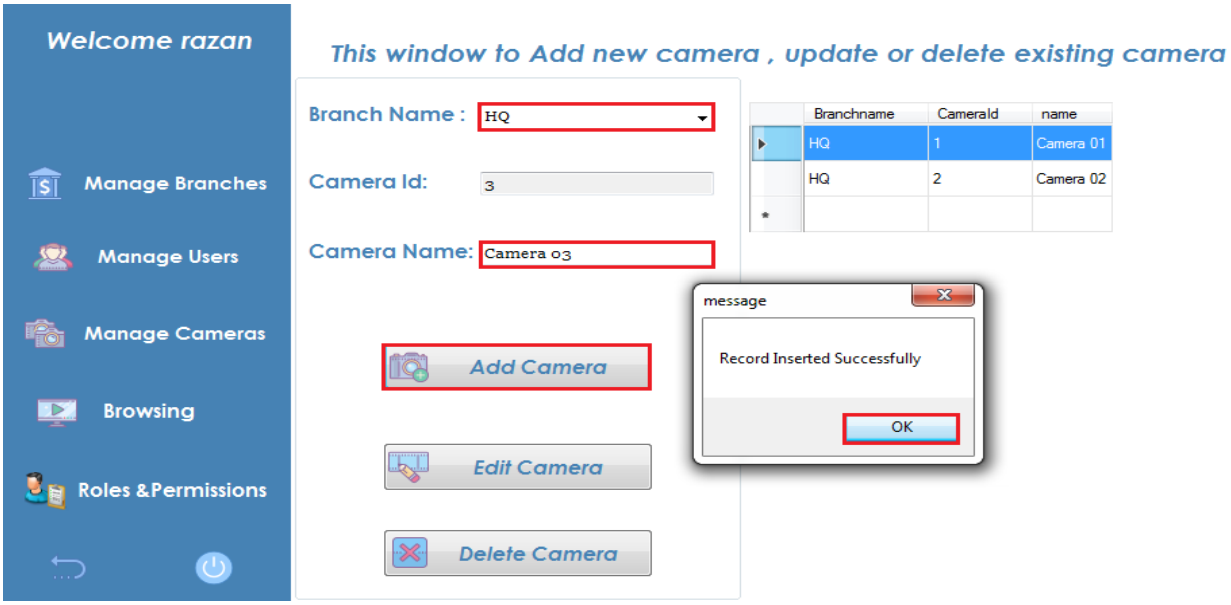


Figure (4.56): Add camera in specific branch

When press on "Ok" button in above window then new record will add in the database and display on a GirdView. As below:

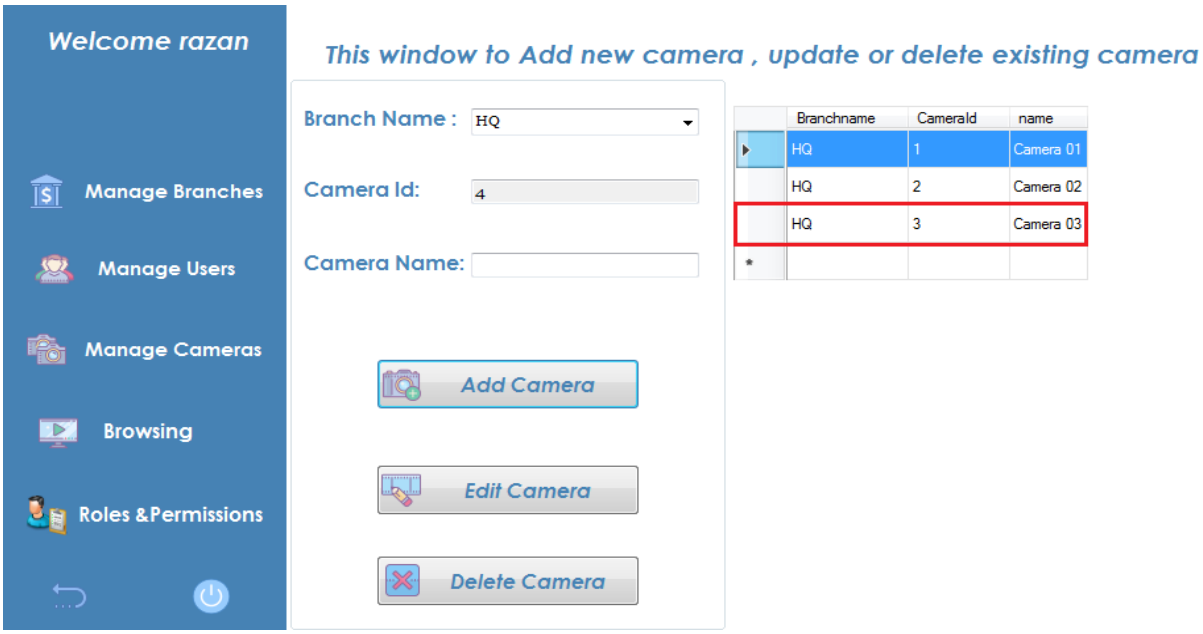


Figure (4.57): Add new camera

- Edit Camera: used to modify camera name in specific branch. To do this just select the branch name from the list ,click on the specific cell in the GirdView then the data present in the cell is stored into the Camera Name textbox, modify the values of the Camera Name with new value and then click on “Edit Camera” button, As the following:

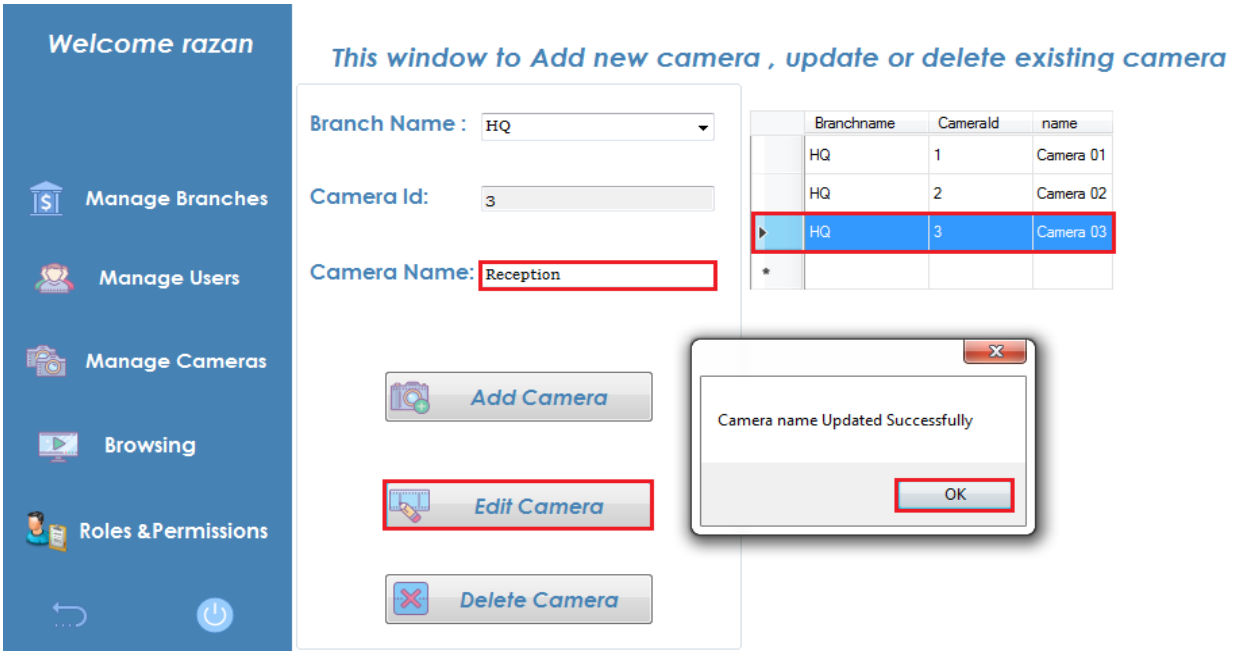


Figure (4.58): Edit camera name in specific branch

When press on "OK" button , it will show that the value of “name” column in row three change from “Camera 03” to “Reception” and the record in the database was also successfully updated. It will look like this:

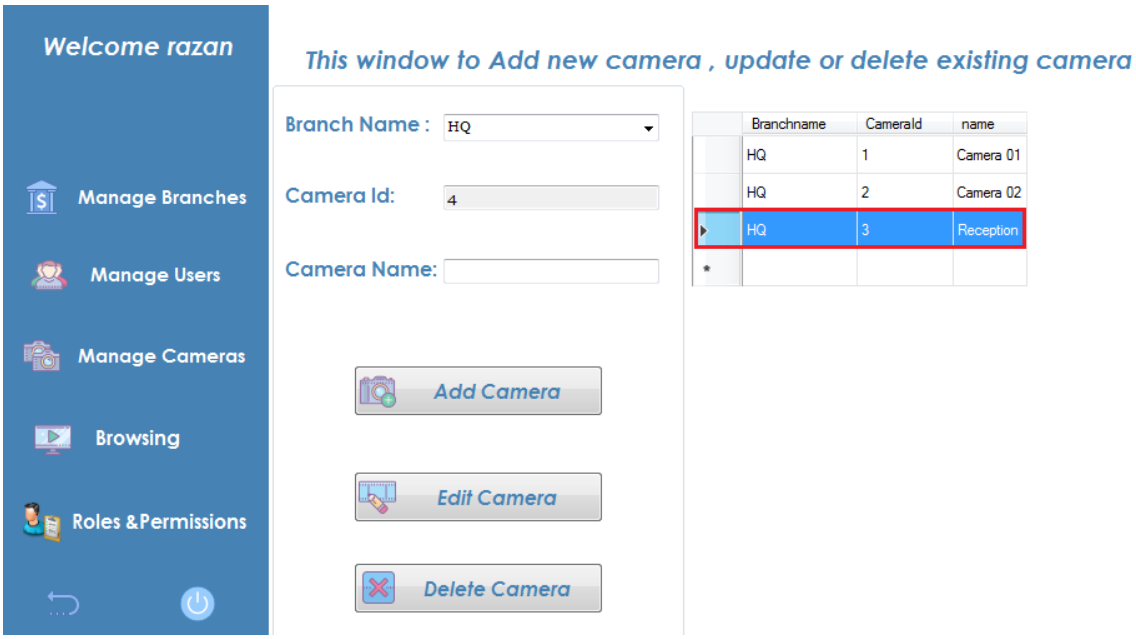


Figure (4.59): Update record

- Delete Camera: used to delete camera in specific branch, to perform this select the branch name from the list of the branches ,clicks on the specific cell in the GirdView then click on “Delete Camera” button, As the following:

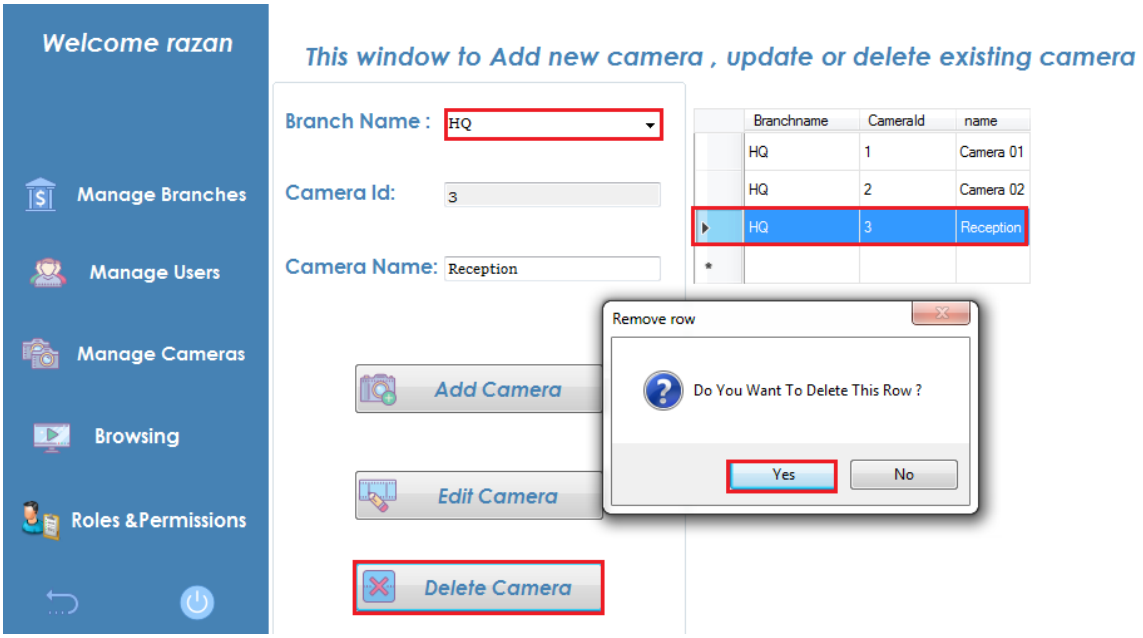


Figure (4.60): Delete camera in specific branch

A confirmation message box will appear if the user clicks on the “Yes” button; the Delete Columns is setup by adding three Colums in the Gridview. The first column “IsDelete” contains a checkbox control, with the CommandName property set to "checked" when record deleted , the second column “Deletedby” store the name of the user who deleted the record , the third column “DeleteOn “ that store the date and time for deleted record , The following figure shows how is the GridView looks like:

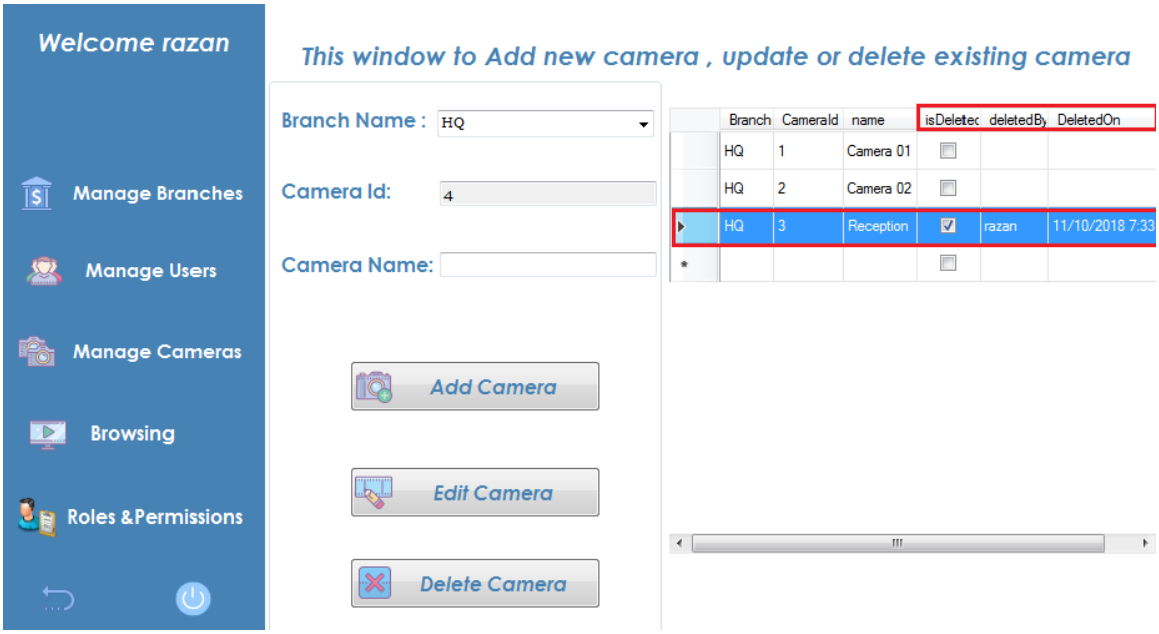


Figure (4.61): Delete existing record

4- Browsing: The user can click on the "Browsing" button to view videos in all cameras for a specific branch on specific date and time, or view specific videos in a specific camera in a specific branch on specific date and time. The below window will illustrate that:

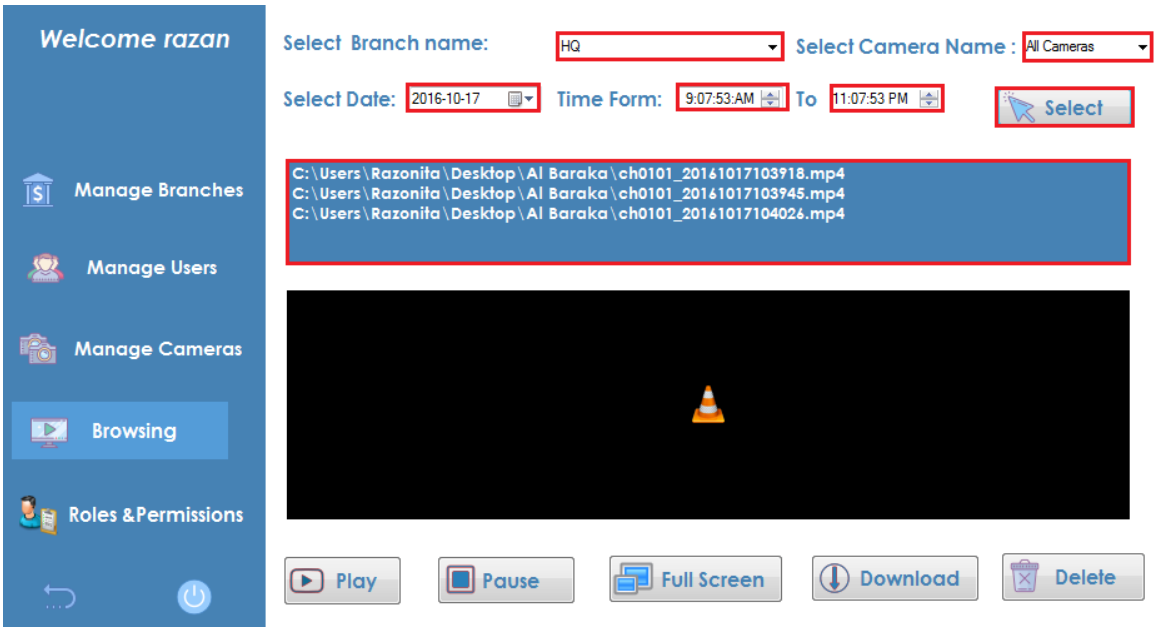


Figure (4.62): Select Video File

In this window, first the user should select the Branch name from the list of the branches, and then select all cameras in the branch, select a specific date and time, then press on the "Select" button, and will get the names (full path) of the videos and will display on list box as above. When the user selects video from the list and click on the "Play" button the video will play as shown below:

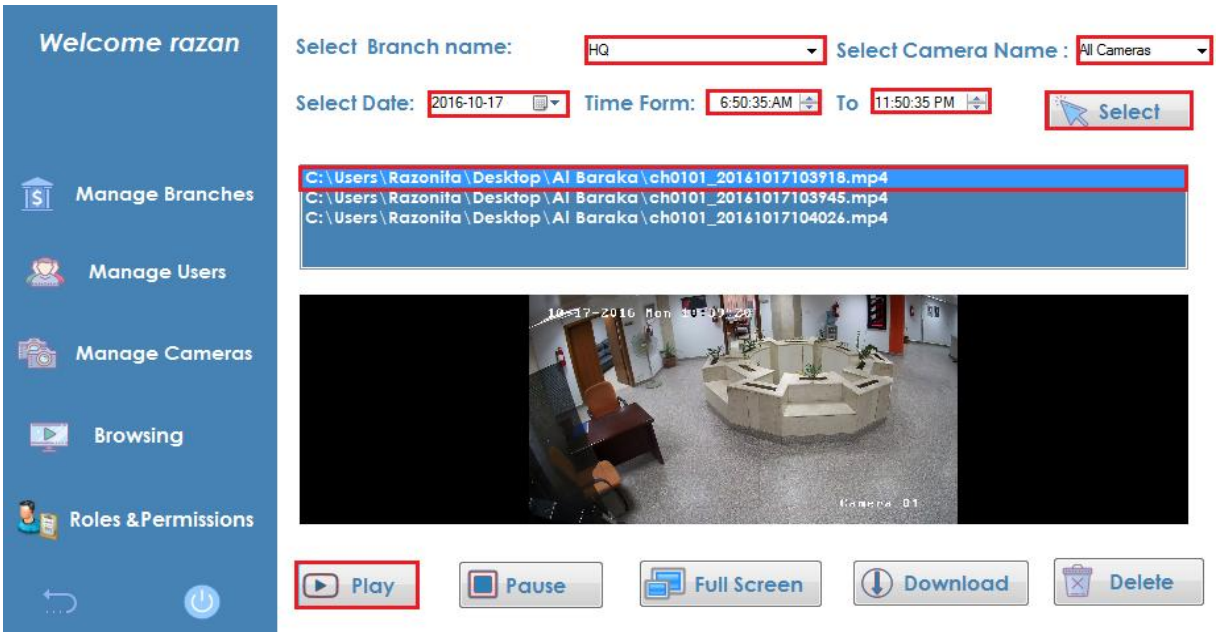


Figure (4.63): Play Video

It is illustrated that how to play a specific video, to stop that video just click on the "Pause" button in above window.

Click in above window on "Full Screen" button to go into full screen mode.

When click on "Download" button the selected video will copy to anther directory in the Computer.

"Delete" button is used to delete selected video, as it illustrated below:

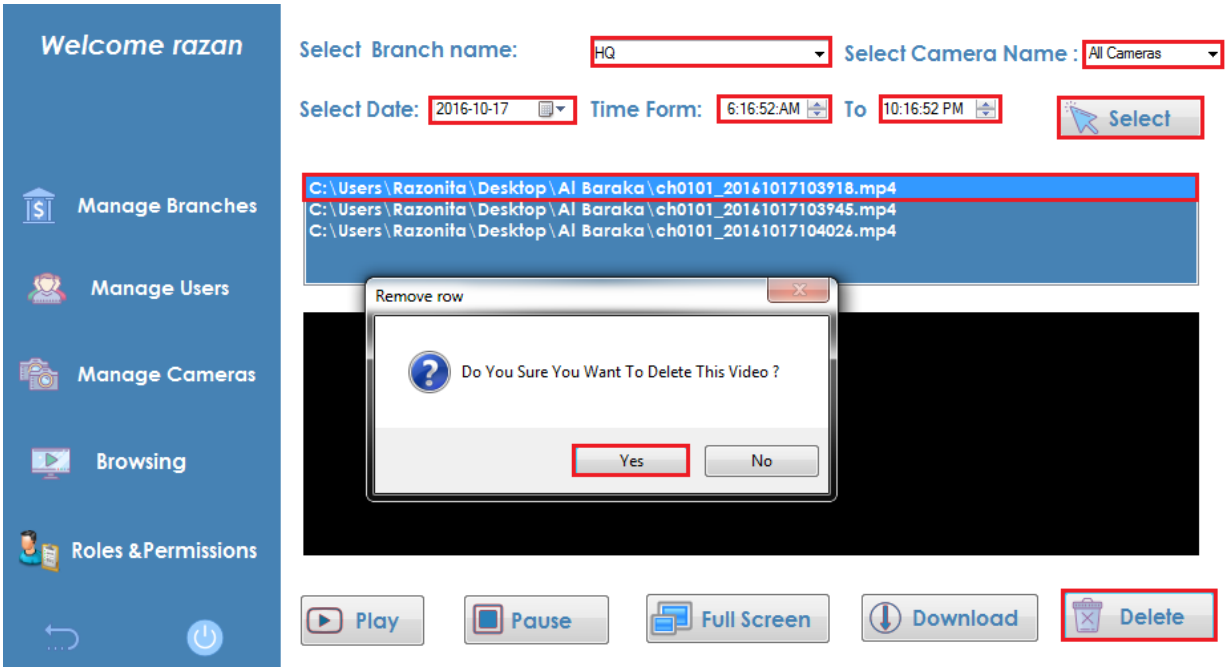


Figure (4.64): Delete Video

As mentioned earlier a confirmation message box will display after clicking on the "Delete" button, when the user click on "Yes" button in the message box the selected video will deleted from the list and mark in database as it deleted, also name of the user who deleted the video will be stored in the database, and a message will be displayed to the user as following:

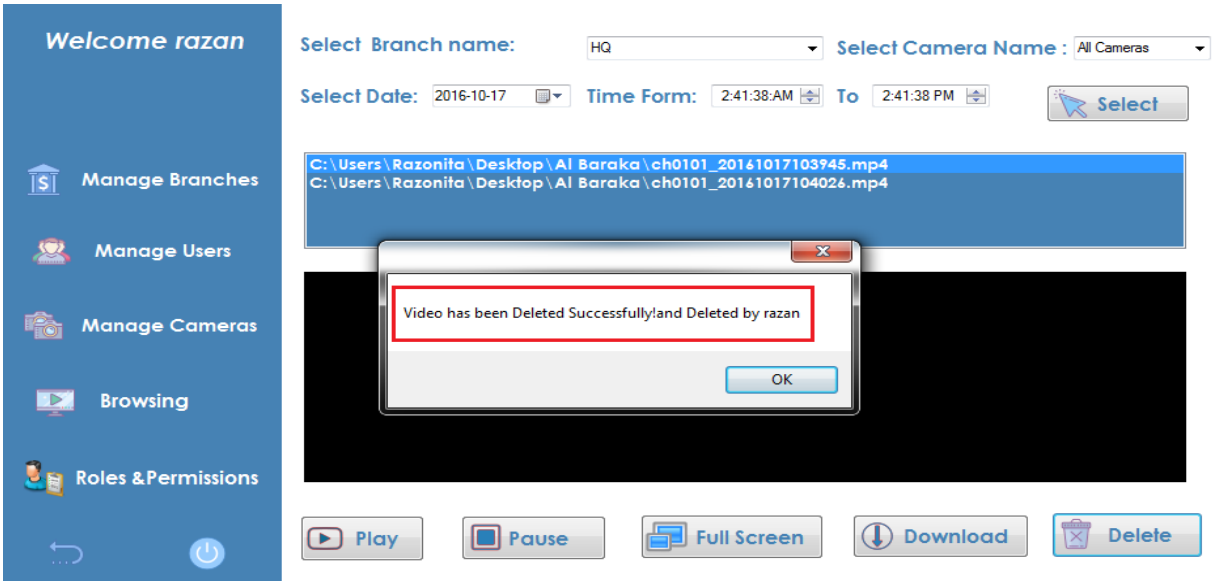


Figure (4.65): Video Delete Successfully

5- **Roles and Permissions :**The Admin lists all users in the database that is associated with the login, assign users to roles, which can be (Administrator or User), then assign permissions to roles. The below window explained the details:

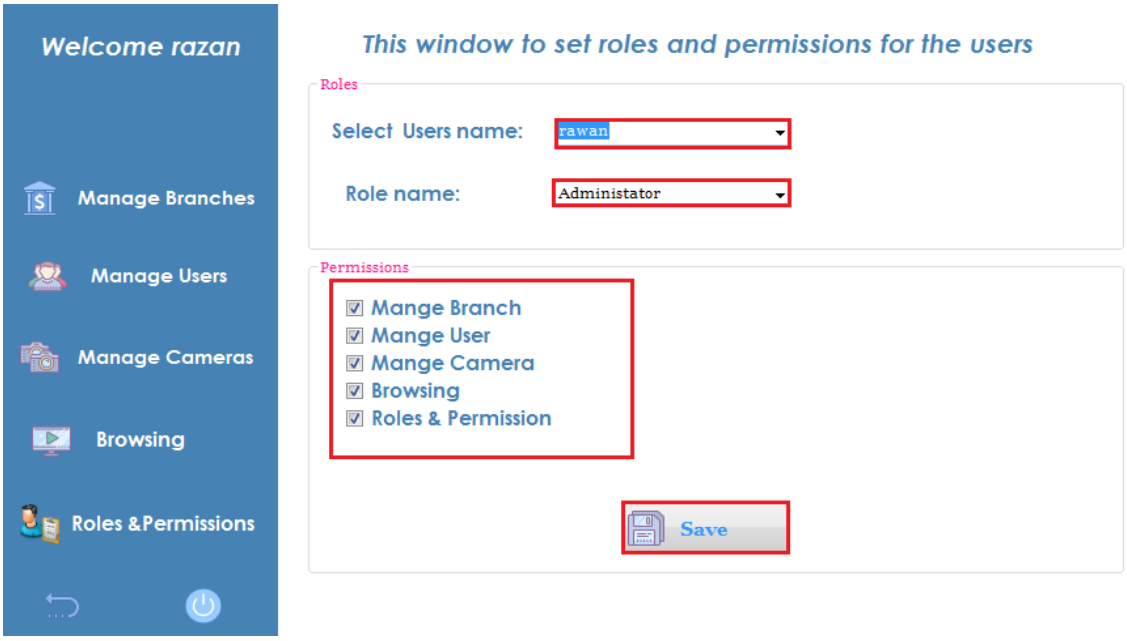


Figure (4.66): Administrator role

First the Admin must select the user name from the list , then assign role to this user , As Mentioned above the role can be (Administrator or User), when choose “Administrator” that means the user have the full rights to access all the forms and will give him all Permissions. Then click on "Save" button.

When the Admin select the user name from the list, and set role name as “User”, he needs to give permission to this user that lets a user to perform specific tasks. As below:

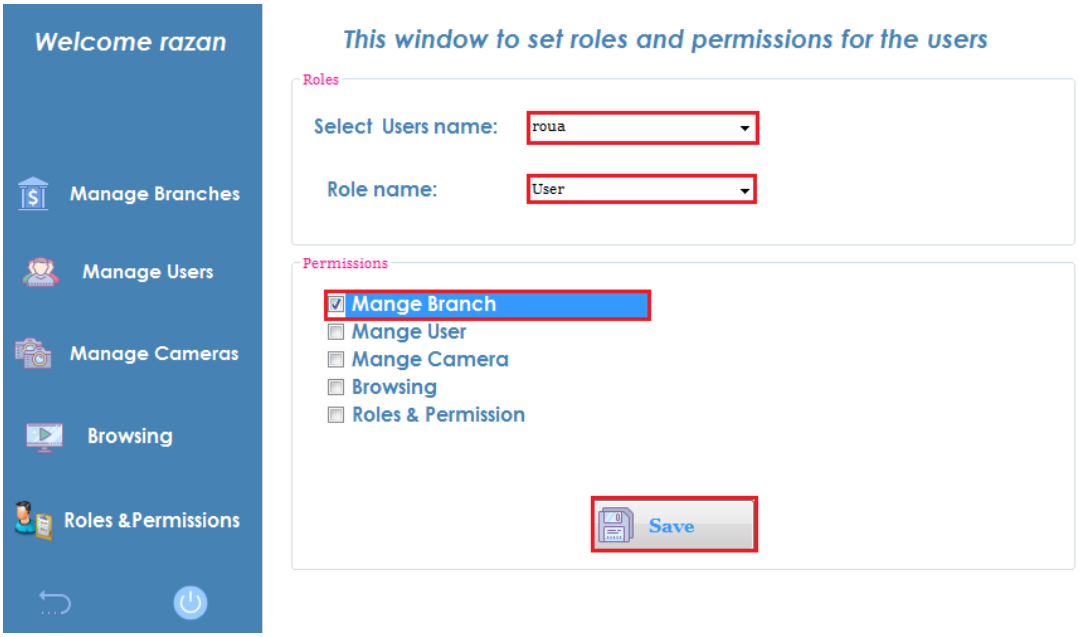


Figure (4.67): User role

In the above Window when the admin click on "Save" button, that mean the user name “roua” should not have access to other forms or screens except Mange Branch.

When the user “roua” login to the application should be able to access Mange Branch form, as shown in Figure (4.68):

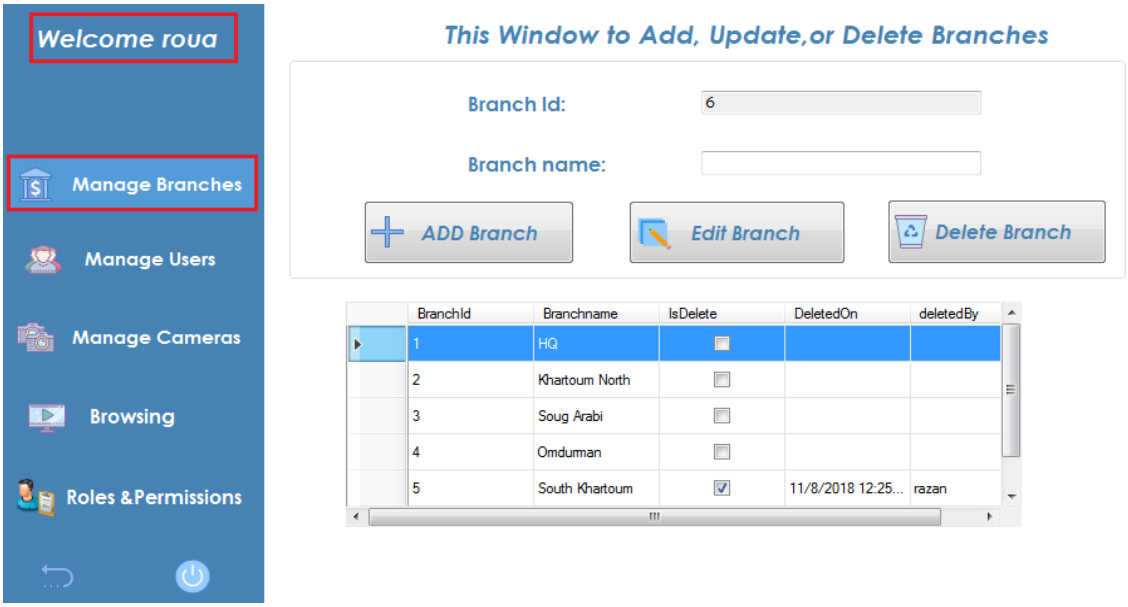


Figure (4.68): User has permission to access form

When the user “roua” click on the other forms will display error message. As below:

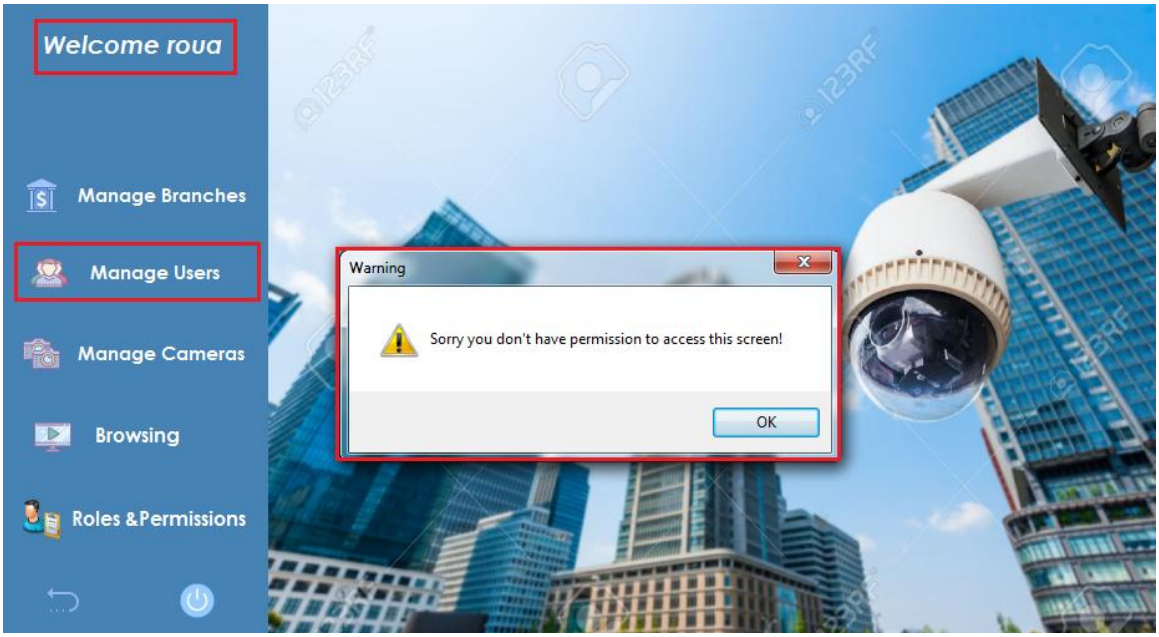


Figure (4.69): User has not permission to access form

Those are all the operations that can be perform in the System. To return to Login window click on “back” button as below:

Figure (4.70): Return to Login Window

To close the application press on close button as following:

Figure (4.71): Close the application

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

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CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter concludes the whole work by providing the conclusion of the work. It also provides some recommendations for future work in this field.

5.2 Conclusion

Closed Circuit Television (CCTV) is an electronic system for the capture of images, and their transmission to another location for viewing and/or recording. CCTV cameras or surveillance cameras are video cameras used for the purpose of observing an area that may need monitoring such as banks, stores, and other areas where security is needed.

A Digital video recorder (DVR) is an electronic device that records video in a digital format to a disk drive, USB flash drive, solid state(SD) memory card, solid-state drive (SSD), or other local or networked mass storage device.

The research reached its aim that transfer videos existing in multiple digital video recorders (DVRs) devices which it captured using CCTV cameras and store them in the database, then design a management system for managing, organizing and retrieving of videos.

The results shows that designing a management system for videos captured by a closed-circuit television cameras (CCTVs) facilitate retrieval of videos after a long time to detect theft cases, identifying any abnormal behavior or activity in the enterprise.

In the end we conclude that this system can be used at various places such as hospitals, shopping malls, college or school premises and banks.

5.3 Recommendations for future work

Some recommendations for future researches in related topics could be stated as follow:

1. Using a tool or manually create a new database with descriptor for each video, this will make it possible to search the database based on any descriptors offered by the user. Face recognition tool could also be used to detect the presence of a certain person at a certain location and time.
2. System for transfer videos from digital video recorders (DVRs) to Server periodically.
3. System that allows user to retrieve and view videos from database even if he is at some remote place. The user can retrieve and view the videos from database through web browser or through mobile.
4. System that provides real time monitoring. When intrusion is detected. It sends notifications to authorized persons so that action can be taken in response to the intrusion.

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