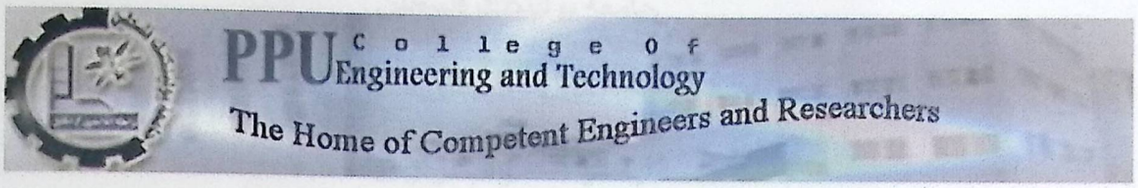

College of Engineering and Technology

Electrical Engineering Department

Communication and Electronics Engineering

Graduation project

An Advertisement Monitor Controlled Wirelessly By GSM Network

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كلية الهندسة والتكنولوجيا

دائرة الهندسة الكهربائية

اسم المشروع

An Advertisement Monitor Controlled Wirelessly

By GSM Network

أسماء الطلبة

هاشم الزغير **ابراهيم دويك**

صفاء عيسى **مريم أبوعليا**

بناء على نظام كلية الهندسة والتكنولوجيا واشراف ومتابعة المشرف المباشرة على المشروع وموافقة أعضاء اللجنة الممتحنة تم تقديم هذا المشروع الى دائرة الهندسة الكهربائية وذلك للوفاء بمتطلبات درجة البكالوريوس في الهندسة تخصص هندسة اتصالات والكترونيات

توقيع المشرف

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توقيع اللجنة الممتحنة

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توقيع رئيس الدائرة

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إلى من جرع الكأس فارغاً ليسقيني قطرة حب
إلى من كلّت أنامله ليقدم لنا لحظة سعادة
إلى من حصد الأشواك عن دربي ليمهد لي طريق العلم
والدي العزيز إلى القلب الكبير

إلى من أرضعتني الحب والحنان
إلى رمز الحب وبلسم الشفاء
إلى القلب الناصع بالبياض والدتي الحبيبة

إلى القلوب الطاهرة الرقيقة والنفوس البريئة إلى رياحين حياتي إخوتي

إلى الأرواح التي سكنت تحت تراب الوطن الحبيب الشهداء العظام

الآن تفتح الأشرعة وترفع المرساة لتنطلق السفينة في عرض بحر واسع مظلم هو بحر الحياة وفي هذه الظلمة لا يضيء إلا قنديل الذكريات ذكريات الأخوة البعيدة إلى الذين أحببتهم وأحبوني أصدقائي

إلى الذين بذلوا كل جهدٍ وعطاء لكي أصل إلى هذه اللحظة أساتذتي الكرام ولا سيما الدكتور مراد أبو صبيح

إليكم جميعاً أهدي هذا العمل

Dedication

We thank Allah who gave us the wisdom

and courage throughout the roughest and happiest moments during this project.

To the best father and mother on the world

Who have always wanted the best for me and worked so hard to

Bring me up as a responsible and respectable person.

To my brothers and sisters, all my friends and relatives who have

Always encouraged me to work hard no matter what I encounter.

We also dedicate this project to those who have contributed to its success in one

Way or the other and

We dedicate it to all the friends we made during our five years at

Palestine Polytechnic University.

Work Group

ABSTRACT

In every year the world is in increasing more and more to use GSM technologies in various field of life, making their use more intuitive and flexible. Now the response to the market continues demand for more advertising means this system can contribute in this field.

The project aims to build a system which makes advertising more practical. We want to develop and implement a system to control a commercial LED monitor by a Personal Computer wirelessly using GSM network based on GPRS technology to be able to display any advertisement, whether text or image. The project eases the use of the commercial monitors by enabling a high degree of flexibility in sending the advertisements without needing to reprogram them, when a new advertisement has to be added.

ملخص

نظرا للتطور الحاصل في مجال الاتصالات اللاسلكية و الحاصل في مجال الدعاية والاعلان جاء هذا المشروع ليدمج بين كلا المجالين ليجعل عملية الاعلان اكثر سهولة وذلك من خلال بناء نظام لارسال الاعلان الى الشاشة بطريقة لاسلكية من خلال شبكة الاتصالات النقالة وبالاعتماد على تكنولوجيا (GPRS) , مما يجعل عملية التحكم في شاشة الاعلان (LED Monitor) أكثر سهولة ومرونة وممكنة من اي مكان وكذلك التحكم في اكثر من شاشة في ان واحد باستخدام جهاز حاسوب واحد,وبهذه الطريقة سنتخلص من الطرق التقليدية في الاعلان التي لها الكثير من المساوئ التي من ابرزها التكلفة العالية .

List of Tables

List of Figures

Table of Contents

CHAPTER ONE

INTRODUCTION

1.1 Overview

1.2 Project Objectives

1.3 Project Motivation

1.4 Project Idea and Approach

1.5 Related Work

1.6 Time Schedule

1.7 Estimated Cost

1.1 Overview

The commercial advertisements especially by LED monitoring have a widespread demand all over the world. This project aims to manage and control LEDS over the wireless GSM network. The focus is given to sending the advertisement content such as images, text from a central office to a number of LEDS installed inside country.

1.2 Project Objectives

The project objectives are:

1. To build a multi-monitor system by only one controlling PC.
2. To allow a higher degree of freedom in working everywhere.
3. To get more easier and flexible advertising process.
4. To get rid of traditional ways in advertising such as newspaper, radio…etc.
5. To ease the process of modifying the advertisement.

1.3 Project Motivation

The rapid advances in commercial advertisements technologies created a need for a flexible way of advertising. At the same time, the new introduced technologies in Wireless/GPRS nowadays motivated us to combine these two technologies to create a wireless controlled commercial LED monitor. With traditional systems one needs to reprogram the LED whenever a new advertisement comes out. With this intended system, it will be possible to send the text, image to this monitor in reasonable time and low bandwidth. GSM Network is more reachable compared to Internet especially in advertisement locations. However, GSM does not need a provider for a monthly subscription as Internet does. Furthermore, no telephone lines are needed within the infrastructure. That in turn minimizes the complexity of the system. Sometimes we used the LED monitor temporary which needs a person to be behind it all time, where in this project, the system does not require any person, it will be controlled and managed from any place.

1.4 Project Idea and Approach

The idea of this project is to develop a system that can send texts and images from a personal computer to a LED wirelessly, where the main purpose is to make this system available to the commercial use i.e. advertising. The data is sent via GSM network through GPRS technology. This technology is expected to be more flexible in comparison with other traditional systems i.e. wired based methods.

- **Literature review:**

First of all, a comprehensive surveying study will be conducted to understand the GSM and GPRS technologies. Furthermore, a deep look on how to exploit the facilities of these techniques to send data to a normal LED wirelessly. In addition, a survey on different software developing tools will be conducted as well. The tool is expected to have a well-defined framework that supports image processing and networking. The system is illustrated in the Figure 1.1. As seen, through software at the office PC, the user will be able to access the LEDs Monitor and transfer the advertisement. The connection will take place over the GSM network through a main modem at the control office and a modem at each LED.

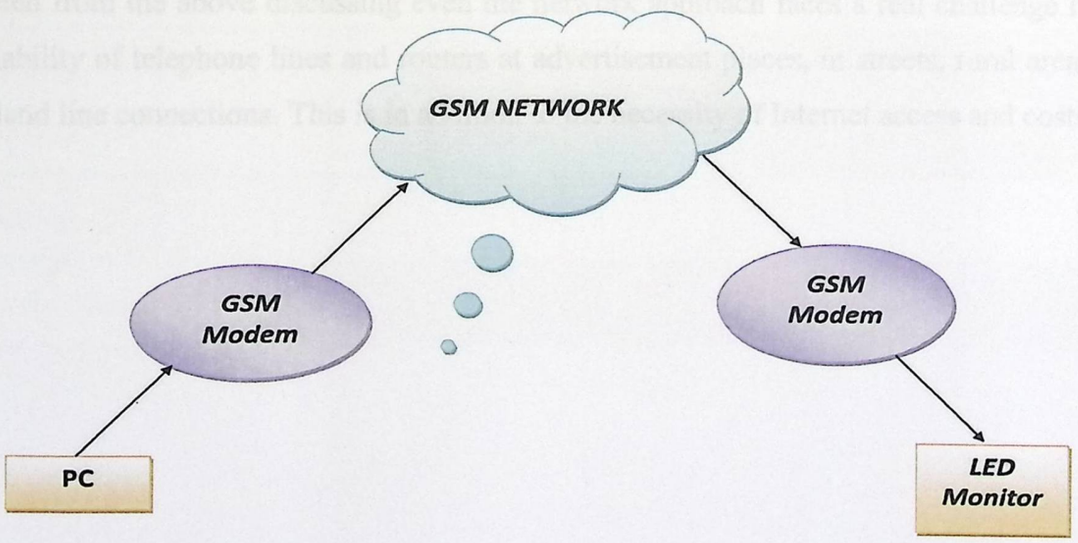


Figure 1.1: The System Block Diagram

1.5 Related Work

A comprehensive survey has been conducted in order to find out similar systems. However, due to the fact the project is creating a new method for controlling LEDs; it was not easy to collect enough information.

The systems that have been found are grouped into:

- Wired systems

In these systems two PC's are connecting and the data is sent over wires.

- USB Flash Memory

Data is stored at the LEDs through a flash memory which hold the advertisement needed to be displayed. Then, the data will be transferred to the PC through the USB port.

- Network System

With this approach, data is delivered to the LEDs through telephone lines and ADSL connection.

As seen from the above discussing even the network approach faces a real challenge regarding the availability of telephone lines and routers at advertisement places, in streets, rural areas, places with no land line connections. This is in addition to the necessity of Internet access and costs.

1.6 Time Schedule

The Table 1.1 shows the activities that done in the project, and the time of each one.

Table 1.1: Activities Planning

Activities \ Weeks	1-4	5-8	9-12	13-16	17-20	21-24	25-28	29-32
System Definition								
System Analysis								
System Design								
System Implementation								
Testing								
Documentation								

1.7 Estimated Cost

The Table 1.2 shows the components that needed to implement the project and their costs.

Table 1.2: Hardware Costs

Components	Price (NIC)
2*GPRS Modem	2*800
2*SIM Card	2*600
LED's Monitor rental	1000
Cables	200
Sending Card	1000

CHAPTER TWO

THEORITICAL BACKGROUND

2.8 AT Commands

2.1 Introduction

This chapter discusses the technologies and components that needed to the system implementation. It provides an overview about GSM network, GPRS technology, modems, and the programming language.

2.2 Global System for Mobile Communication (GSM)

2.2.1 GSM Definition

GSM or Global system for mobile communication is a world-wide standard for digital wireless mobile phones. GSM is the second generation cellular standard developed to provide voice services and data delivery using digital modulation.

GSM exists in four main versions, based on the band used: GSM-900, GSM-1800, GSM-850 and GSM-1900, where GSM-900 (900 MHz) and GSM-1800 (1.8 GHz) are used in most of the world, excluding the United States and Canada. The United States and Canada use GSM-850 and GSM-1900 (1.9 GHz) instead, since in the U.S. the 900 and 1800 bands were already allocated. [1]

GSM operates at two principles:

- Time division Multiple Access (TDMA):

It is very simple, where the radio frequency is shared by different users in time. This way many users talk at the same time on the same frequency. This has to be done, because as we now

frequency or Bandwidth is a scarce resource and is not available in plentiful so it must be shared.

- Frequency Division Multiple Access (FDMA):

In this principle, users use different frequencies.

Now, GSM uses a combination of TDMA and FDMA. This means that users are not only sharing the channel in time but also in frequency. The standard operation of GSM was able to provide data transfer speed up to 9.6 kbps.

2.2.2 GSM Network

A GSM network consists of several functional entities whose functions and interfaces are defined in the standard. [3]

The GSM network can be divided into four main parts:

- The Mobile Station (MS):
  The MS consists of the Mobile equipment/terminal (ME) and a smart card called the Subscriber Identity Module (SIM).
- The Base Station Subsystem (BSS):
  The BSS provides the interface between the ME and the Network Switching Subsystem NSS. It is in charge of the transmission and reception. It may be divided into two parts:
  Base Transceiver Station (BTS) or Base Station, it maps to transceivers and antennas used in each cell of the network.
- Base Station Controller (BSC): It controls a group of BTSs and manages their radio resources.

- The Operation and Support Subsystem (OSS): It is connected to components of the NSS and the BSC, in order to control and monitor the GSM system.

The architecture of the GSM network is presented in Figure 2.1

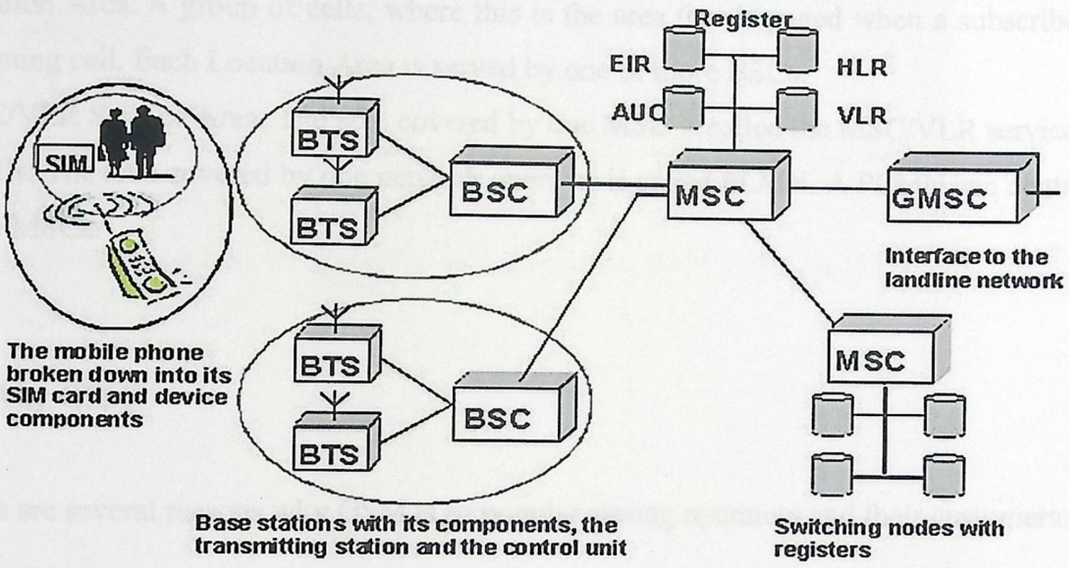


Figure 2.1: Architecture of the GSM Network

2.2.3 GSM Network Areas

The GSM network is made up of geographic areas, these areas are defined as: [4]

- Cell: Cell is the basic service area that given radio coverage by one BTS. These cells are of five different sizes (macro, micro, femto, and umbrella and Pico cells). Macro cells are the largest cells where Pico cells are the smallest.
- Location Area: A group of cells, where this is the area that is paged when a subscriber gets an incoming call. Each Location Area is served by one or more BSCs.
- MSC/VLR Service Area: The area covered by one MSC is called the MSC/VLR service area.
- PLMN: The area covered by one network operator is called PLMN. A PLMN can contain one or more MSCs.

2.2.4 Why GSM?

There are several reasons why GSM is so popular among operators and their customers: [5]

- Clear voice quality which helps to make GSM a viable alternative to wire line telephony for consumers and businesses.
- International roaming where GSM service available in more than 219 countries, the most of any wireless technology by a wide margin. As a result, users enjoy the convenience of being reachable with their GSM devices and phone numbers when traveling abroad, as well as the ability to access messaging and other advanced services that they use in their home markets.
- Spectral flexibility with network infrastructure and user devices available for numerous spectrum bands. Tri- and quad-band GSM phones are common, reducing the chances that users will ever travel to an area without at least one GSM network to which they can connect.

- Tight security including inherent protection from eavesdropping and hacking. This helps make GSM voice and data an attractive alternative to analog cellular and Wi-Fi in the eyes of users, particularly enterprises.
- Data support including SMS and web browsing.
- Subscriber Identity Module (SIM) cards which allow customers to buy a new or additional phone, or a GSM PC Card modem, and instantly transfer their settings, preferences and contacts to the other device.

There are more advantages for GSM, which it can process the weak signal inside buildings by using a repeater. The standard operation of GSM was able to provide data transfer speed from 9.6 Kbps up to 14.4 kbps, where in GPRS the data rate can be up to 171 kbps. Therefore, GPRS will be used in this project.

2.3 General Packet Radio Service (GPRS)

2.3.1 Introduction

General Packet Radio Service (GPRS) is a technological feature on GSM network, where it is an integrated part of the GSM network. [6]

General packet radio service (GPRS) is a data transfer specification used by Time Division Multiple Access (TDMA). The GPRS system makes use of the entire coverage area and frequency of its host networks to transmit data packets. Data packets are segments of data sent between computers or network devices. These mobile technologies work together to handle most of the world's mobile communications.

A packet control unit is present in a GPRS cell phone. This control unit provides a bridge for data to travel across mobile networks and the Internet by making use of radio channels. GPRS provides faster data transmission that what could be done over GSM, where the data rate of it can be up to 171kbps.

2.3.2 How Does GPRS Work?

At first, the user turns on a GPRS device. Then it will scan for a local GPRS channel. If an appropriate channel is detected, the device will attempt to attach to the network.
Each device has a unique address called "IP Address", which it allows for devices to communicate each other on a network.

2.3.3 Services Offered

GPRS extends the GSM Packet circuit switched data capabilities and makes the following services possible: [7]

- SMS messaging and broadcasting.
- "Always on" internet access
- Multimedia messaging service (MMS)
- Push to talk over cellular (POC)
- Instant messaging and presence—wireless village
- Internet applications for smart devices through wireless application protocol (WAP)
- Point-to-point (P2P) service: inter-networking with the Internet (IP)
- Point-to-Multipoint (P2M) service: point-to-multipoint multicast and point-to-multipoint group calls

If SMS over GPRS is used, an SMS transmission speed of about 30 SMS messages per minute may be achieved. This is much faster than using the ordinary SMS over GSM, whose SMS transmission speed is about 6 to 10 SMS messages per minute.

2.3.4 Advantages of GPRS

- GPRS usage is typically charged based on volume of data transferred, contrasting with circuit switched data, which is usually billed per minute of connection time.
- GPRS is a best-effort service, implying variable throughput and latency that depend on the number of other users sharing the service concurrently, as opposed to circuit switching, where a certain quality of service (QOS) is guaranteed during the connection.
- GPRS networks are very commonly used on cell phones worldwide. Their high speed allows them to be compatible with the most modern technology devices. [8]

2.4 GPRS/GSM Modem

2.4.1 GSM Modems

The word modem is derived from the words modulator demodulator. This device functions by enabling most computers to transmit data to different networks, such as mobile phones or other computers. Global System for Mobile Communications (GSM) modems are specialized types of modems that operate over subscription based wireless networks, similar to a mobile phone. A GSM modem generally uses a circuit-switched type of technology in transmitting data. Traditional modems are attached to computers to allow dial-up connections to other computer systems. A GSM modem operates in a similar fashion, except that it sends and receives data through radio waves rather than a telephone line. Similar to the way dial-up modems converted analog signals to digital and back, GSM modems convert digital data to Short Message Service (SMS) messages for sending and receiving messages over the wireless network. SMS messages are small bursts of data which are sent and received like the data packets on dial-up modems. A GSM modem may be an external device connected via a Universal Serial Bus (USB) cable or a serial cable, or an internal device by a card slot (PC Card / PCMCIA Card) on a laptop. GSM modem accepts a Subscriber Identity Module (SIM) card, and basically acts like a mobile phone for a computer. [9]

2.4.2 GPRS Modems

A GPRS modem is a GSM modem that also supports wireless data transmission using GPRS technology. A GPRS modem utilizes packet-switched technology in transmitting data. Where this technology makes GPRS modem faster than GSM modem. To use the laptop or desktop computer to send or receive short message service (SMS) or multimedia messaging service (MMS) messages via a GPRS network, a GPRS modem is usually required. This is generally a better way to connect to the Internet using mobile and wireless connections than the GSM modem. It is simply faster and more efficient in terms of bandwidth and connection time. Where by GPRS it can be sent about 30 SMS messages per one minute, but by GSM only from 6 to 10 messages per one minute. [9]

2.5 SIM Card

A Subscriber Identity Module (SIM) card is a portable memory chip used by all GSM devices, including phones and GSM/GPRS modems. These cards hold the personal information of the account holder, including his phone number, address book, text messages, and other data. One of the biggest advantages of SIM cards is that they can easily be removed from one mobile phone and used in any other compatible phone to make a call. This means that, if the user wants to buy a new handset, he can activate it quickly by inserting his old SIM card. The user's phone number and personal information is carried on the card, so there's no need to do anything else to transfer this information.

2.5.1 SIM Cards Sizes

SIM cards are made in three different sizes to accommodate different devices. Most phones use mini-SIM or micro-SIM cards, which are quite small. The mini is (25 mm by 15 mm), and the micro is (15 mm by 12 mm). Full-sized cards are much larger, (85.6 mm by 53.98 mm), and are too big for most phones. All cards are only 0.76 mm thick. However, the microchip contacts are in the same arrangement. This means that, with the proper adapter, the smaller cards can be used in devices designed for larger ones. [10]

2.6 LED Monitor

LED (light emitting diode) screen is a new version of LCD screen using LEDs to illuminate video display. [11]

2.6.1 How does it display the image?

Pixels are the small points of colored light on a display surface that combine to form an image. These pixels are representing on the LED monitor by LEDs. [11]

Here we must mention to the two colors types of LEDS monitor:

1. Monochrome LED display : each pixel made by one LED
2. Color LED display: each pixel made by three LEDs (red, green, blue) combine together, which are the basic colors (RGB).

2.6.2 LEDs monitor in advertising

However, in this project the led screen is a complete system it contains a number of cabinets organized as matrix shape, one of it called "the main cabinet" takes the power from any external power supply and takes the suitable signal (data) from personal computer behind it, and then deliver the power and signal to the other cabinet by UTP (Unshielded Twisted Pair) link from one to another.

2.6.3 Cabinet

LED module that building by rows and columns of LEDs, and have two ports for power cable and data cable. The cabinet receiving data by received card built in it, this card is integrated with hub card. Some systems have one receiving card for all cabinets and in other systems have in each row of cabinet a receiving card. [11]

Figure 2.2 Cabinet Module

2.6.4 LEDs Monitor Types

1. Outdoor LEDs screen: need to be more clear since they Exposed to various weather factors
2. Indoor LEDs screen: more simplicity since the environment is more suitable.

2.6.5 Main Controller

The Main Controller is an interface card (sending card) between the personal computer and the LEDs monitor.

This main controller has three main ports, two input ports and one for output.

The two input ports are:

1. DVI (digital visual interface) port: responsible for images and videos transfer.
2. USB (universal serial bus) port or Serial port: responsible of data transfer.

These two input ports have been connected to the computer, where the third port which is an output port is an Ethernet port and connected to the main cabinet

Main controller can be installed in the motherboard of the PC (internal controller) and may be out from PC (external controller), for external controller used an ADC (apple display connector) to transfer the signal. For the internal one, you can transport the media file directly. [12]

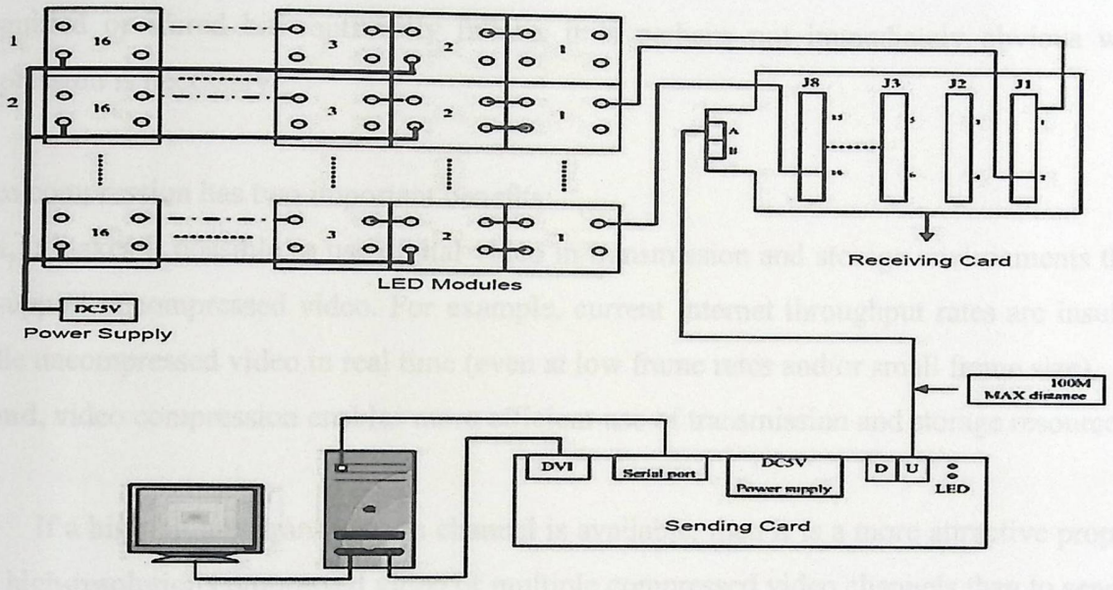


Figure 2.3: Connection between Sending Card and Receiving Card

2.6.6 Led Studio

Led Studio is standard control software for LEDs advertising, this program sends media files such as videos, pictures, voice to the main controller and then the main controller send them to the receiving card in each cabinet.

2.7 Compression

2.7.1 Introduction

Network bitrates continue to increase (dramatically in the local area and somewhat less so in the wider area), high bitrates connections to the home are common place and the storage capacity of hard disks, Flash memories and optical media is greater than ever before. With the price per transmitted or stored bit continually falling, it is perhaps not immediately obvious why video compression is necessary.

Video compression has two important benefits:
First, it makes it possible to use digital video in transmission and storage environments that would not support uncompressed video. For example, current Internet throughput rates are insufficient to handle uncompressed video in real time (even at low frame rates and/or small frame size).
Second, video compression enables more efficient use of transmission and storage resources.

If a high bitrates transmission channel is available, then it is a more attractive proposition to send high-resolution compressed video or multiple compressed video channels than to send a single, low-resolution, uncompressed stream. Even with constant advances in storage and transmission capacity, compression is likely to be an essential component of multimedia services for many years to come. In fact many websites use compression to reduce the amount of physical traffic they send and save time.

2.7.2 What is Compression?

In computer science and information theory, data compression, source coding, or bit-rate reduction involves encoding information using fewer bits than the original representation.

The process of reducing the size of a data file is popularly referred to as data compression; although it's formal name is source coding (coding done at the source of the data, before it is stored or transmitted). Compression is useful because it helps reduce resources usage, such as data storage space or transmission capacity.

2.7.3 The Two Categories of Compression

- **Lossless**

Lossless data compression algorithms usually exploit statistical redundancy to represent data more concisely without losing information. Lossless compression is possible because most real-world data has statistical redundancy. For example, an image may have areas of color that do not change over several pixels; instead of coding "red pixel, red pixel," the data may be encoded as "279 red pixels". This is a simple example of run-length encoding; there are many schemes to reduce size by eliminating redundancy. [13]

- **Loss**

Loss data compression is contrasted with lossless data compression. In these schemes, some loss of information is acceptable. Depending upon the application, detail can be dropped from the data to save storage space. Generally, loss data compression schemes are guided by research on how people perceive the data in question. For example, the human eye is more sensitive to subtle variations in luminance than it is to variations in color. JPEG (Joint Photographic Experts Group) image compression works in part by "rounding off" less-important visual information. There is a corresponding tradeoff between information lost and the size reduction. A number of popular compression formats exploit these perceptual differences, including those used in music files, images, and video. [13]

The most powerful techniques in loss for compressing video are:

- **Inter-frame Compression:**

Inter-frame compression uses one or earlier or later frames in a sequence to compress the current frame, the most commonly used method works by comparing each frame in the video with the previous one. If the frame contains areas where nothing has moved, the system simply issues a short command that copies that part of the previous frame, bit-for-bit, into the next one. If sections of the frame move in a simple manner, the compressor emits a (slightly longer) command that tells the decompressed to shift, rotate, lighten, or darken the copy: a longer command, Inter-frame compression works well for programs that will simply be played back by the viewer, but can cause problems if the video sequence needs to be edited. . Because Inter-frame compression copies data from one frame to another, if the original frame is simply cut out (or lost in transmission), the following frames cannot be reconstructed properly. In most Inter-frame systems, certain frames (such as "I frames" in MPEG-2) aren't allowed to copy data from other frames, and so require much more data than other frames nearby. [14]

- **Intra-frame Compression:**

Intra-frame compression uses only the current frame, effectively being compression. Some video formats, such as DV, compress each frame independently using intra-frame compression. Making 'cuts' in intra-frame compressed video is almost as easy as editing uncompressed video: one finds the beginning and ending of each frame, and simply copies bit-for-bit each frame that one wants to keep, and discards the frames one doesn't want. Intra-frame systems, each frame uses a similar amount of data. [14]

2.7.4 Video Compression

Once a video signal is digital, it requires a large amount of storage space and transmission bandwidth. To reduce the amount of data, several strategies are employed that compress the information without negatively affecting the quality of the image. Video compression technologies are about reducing and removing redundant video data so that a digital video file can be effectively sent over a network and stored on computer disks. With efficient compression techniques, a significant reduction in file size can be achieved with little or no adverse effect on the visual quality. Most network video vendors today use standard compression techniques. They are Motion JPEG, MPEG-4 Part 2 (or simply referred to as MPEG-4) and H.264. H.264 is the latest and most efficient video compression standard. [14]

2.7.5 Image Compression vs. Video Compression

Different compression standards utilize different methods of reducing data, and hence, results differ in bit rate, quality and latency. Compression algorithms fall into two types: image compression and video compression. [14]

Image compression uses intra-frame coding technology. Data is reduced within an image frame simply by removing unnecessary information that may not be noticeable to the human eye. Motion JPEG is an example of such a compression standard. Images in a Motion JPEG sequence is coded or compressed as individual JPEG images.

Video compression algorithms such as H.263 use inter-frame prediction to reduce video data between a series of frames. This involves techniques such as difference coding, where one frame is compared with a reference frame and only pixels that have changed with respect to the reference frame are coded. In this way, the number of pixel values that is coded and sent is reduced. When such an encoded sequence is displayed, the images appear as in the original video sequence.

2.7.6 Basic principles in videos compressions

There is some basic principles must be taken into account in videos compressions:

1. Video Codec: H.263

A codec is the format in which your video will be encoded. Different codecs have different features and varying quality. For best results, we recommend using H.263.

2. Frame rate: 24, 25, or 30 FPS

The frame rate is the number of frames (images) that are display per second in motion pictures, television, and in the computer video displays. Here we must take into account the different video standards that are varies from country to country, the two most common video standards used are National Television System Committee (NTSC) and Phase Alternating Lines (PAL).When used NTSC the video has 30 frames per second(FPS) ,and when used PAL the video has 25 (FPS) .

3. Data rate: 2000 kbps for Standard Definition (SD), 5000 kbps for High Definition (HD).

This setting controls both the visual quality of the video and its file size. In most video editors, this is measured of kilobits per second (kbps). Use 2000 kbps for standard definition or 5000 kbps for high definition videos.

4. Resolution: 640x480 (SD), 1280x720 (HD)

Choose 640×480 or 640×360 for SD videos, and 1280×720 or 1920×1080 for HD.

5. Color Spaces

Most digital video applications rely on the display of color video and so need a mechanism to capture and represent color information. A monochrome image requires just one number to indicate the brightness or luminance of each spatial sample. Color images, on the other hand, require at least three numbers per pixel position to represent color accurately.The method chosen to represent brightness (luminance or luma) and color is described as a color space.

6. RGB

In the RGB color space, a color image sample is represented with three numbers that indicate the relative proportions of Red, Green and Blue (the three additive primary colors of light). Any color can be created by combining red, green and blue in varying proportions.

7. Quality

Video processing systems may introduce some amounts of distortion or artifacts in the video signal, so video quality evaluation is an important problem. In order to specify, evaluate and compare video communication systems it is necessary to determine the quality of the video images displayed to the viewer.

What are Formats and Specifications?

Digital video can exist in many different formats with specific variables. This include file types, like MPEG-1 (MPG), MPEG-2 (MPG), Quick Time (QT), Real Media (RM), Windows Media (WM), H.264 (MP4),H263(Divx and Xvid),(AVI), Flash Video (FLV), etc.

2.8 System Software

2.8.1 Introduction

A programming language is an artificial language designed to communicate instructions to a machine, particularly a computer. Programming languages can be used to create programs that control the behavior of a machine and/or to express algorithms precisely. There are a lot of programming language that is used to build out a computer program, where choosing any language depends on the tasks of the program. In this project GPRS Modems configured by a code called (AT Commands) this code has written in a programming language called C sharp (C#).

2.8.2 C Sharp (C#)

C# is a new programming language designed for building a wide range of applications that run on the Dot NET Framework. C# is an evolution of Microsoft C and Microsoft C++. C# is simple, modern, type safe, and object oriented.

C# is intended to be suitable for writing applications for both hosted and embedded systems , ranging from the very large that use sophisticated operating system ,down to the very small having dedicated functions. C# is a programming language introduced with the introduction of the Dot Net Platform by Microsoft. It is used to create both Web-Based and graphical user interface GUI-Based applications on Windows. [15]

2.8.3 AT Commands

AT commands are instructions used to control modems. AT is the abbreviation of AT tension. Modem commands called AT commands because every command line starts with “AT ". AT is not part of command name, where it is informs the modem about the start of a command line.

GSM/GPRS modems have better support of AT commands than mobile phones, because the mobile phones usually do not implement all AT commands. [16]

There are two types of AT commands:

1. Basic commands: which are AT commands without "+".
2. Extended commands: which are AT commands with "+".

All GSM AT commands are extended commands. Some examples of the GPRS AT commands:

1. AT+SDATASTART: to enable GPRS service.
2. AT+SDATATSEND: to send the data specified by user in transparent mode.
3. AT+SDATATREAD: to read the received data and display in transparent mode.
4. AT+SDATACONF: to make the configure parameters of data sent by AT commands based on GPRS.

CHAPTER THREE

CONCEPTUAL SYSTEM DESIGN

3.1 Introduction

3.2 The General Block Diagram of the System

3.3 Interfaces

3.4 System Software

3.5 LED Studio

3.1 Introduction

This chapter describes the sub blocks of the system. Also discusses the system entities and the software and the flow charts needed it to explain the system operation.

3.2 The general block diagram of the system

Figure 3.1 explains the system block diagram, which represents how to transmit text and media (picture, video) from PC to the LED monitor wirelessly over the GSM network.

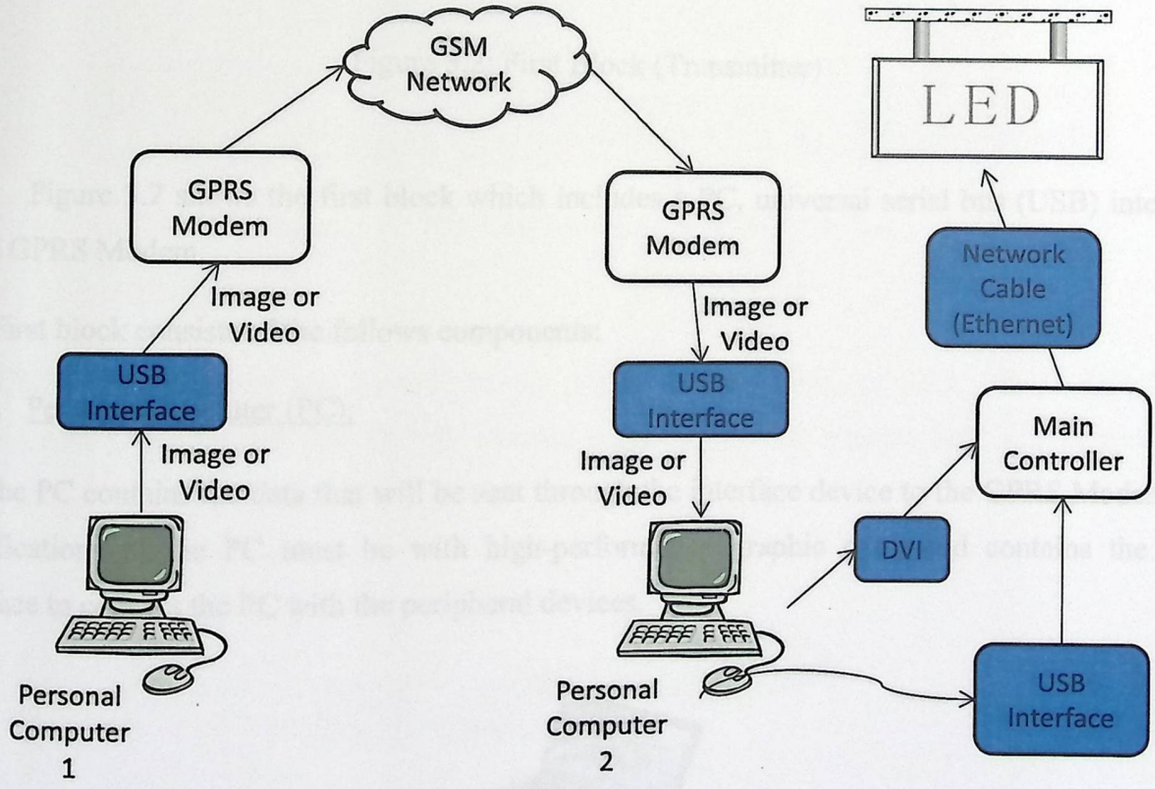


Figure 3.1: The General Block Diagram of the System

As shown in the Figure 3.1, the system can be divided into two sub blocks. The first block represents the transmitter and the second block represents the receiver. These two blocks connected by GSM network.

3.2.1 First Block (Transmitter)

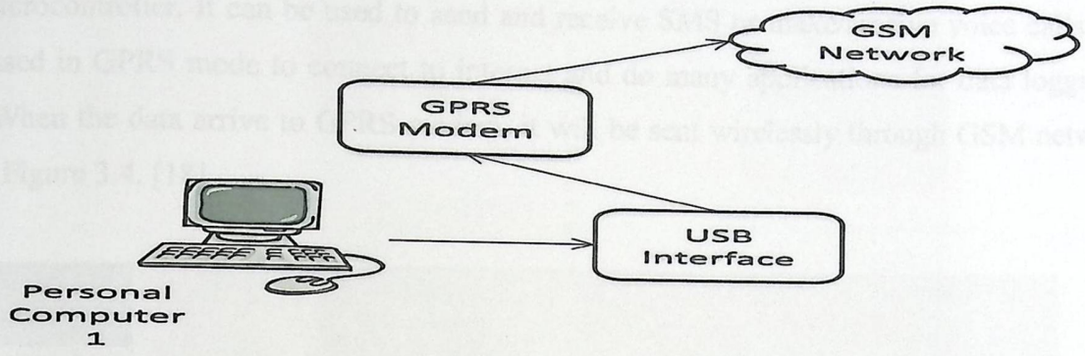


Figure 3.2: First Block (Transmitter)

Figure 3.2 shows the first block which includes a PC, universal serial bus (USB) interface, and a GPRS Modem.

The First block consists of the follows components:

1. Personal Computer (PC):

The PC contains the data that will be sent through the interface device to the GPRS Modem, the specifications of the PC must be with high-performance graphic card, and contains the USB interface to connect the PC with the peripheral devices.

Figure 3.3: Personal Computer

2. GPRS Modem:

GPRS Modem can accept any GSM network operator SIM card and act just like a mobile phone with its own unique phone number. The modem can use its RS232 port or USB port to communicate and develop embedded applications. Applications like SMS Control, data transfer, remote control and logging can develop easily. The modem can either be connected to the PC serial port directly or to any microcontroller. It can be used to send and receive SMS or make/receive voice calls. It can also be used in GPRS mode to connect to internet and do many applications for data logging and control. When the data arrive to GPRS modem, it will be sent wirelessly through GSM network as shows in Figure 3.4. [18]

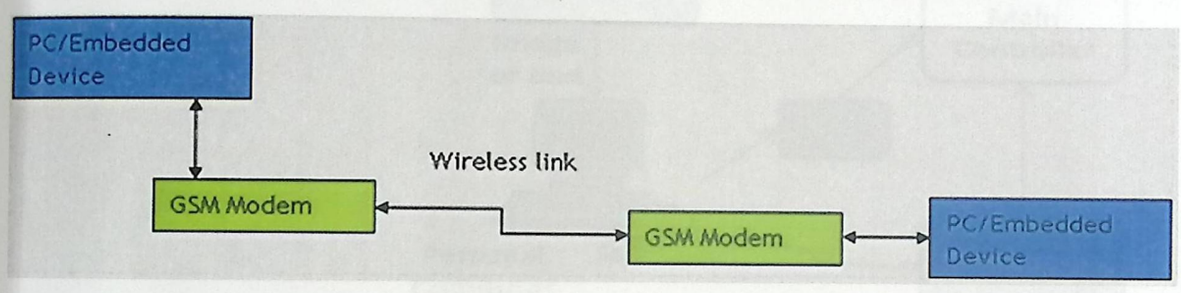


Figure 3.4: Wirelessly Sending by GPRS Modem

The GPRS modem which will be used in this project is Nokia Internet Stick CS-11. This GPRS modem with USB 2.0 and full TCP/IP internet capabilities. This modem hold a SIM card with dynamic IP as shown in Figure 3.5

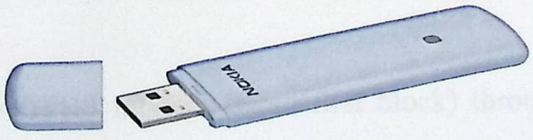


Figure 3.5:Nokia Internet Stick CS-11

3.2.2 Second Block (Receiver)

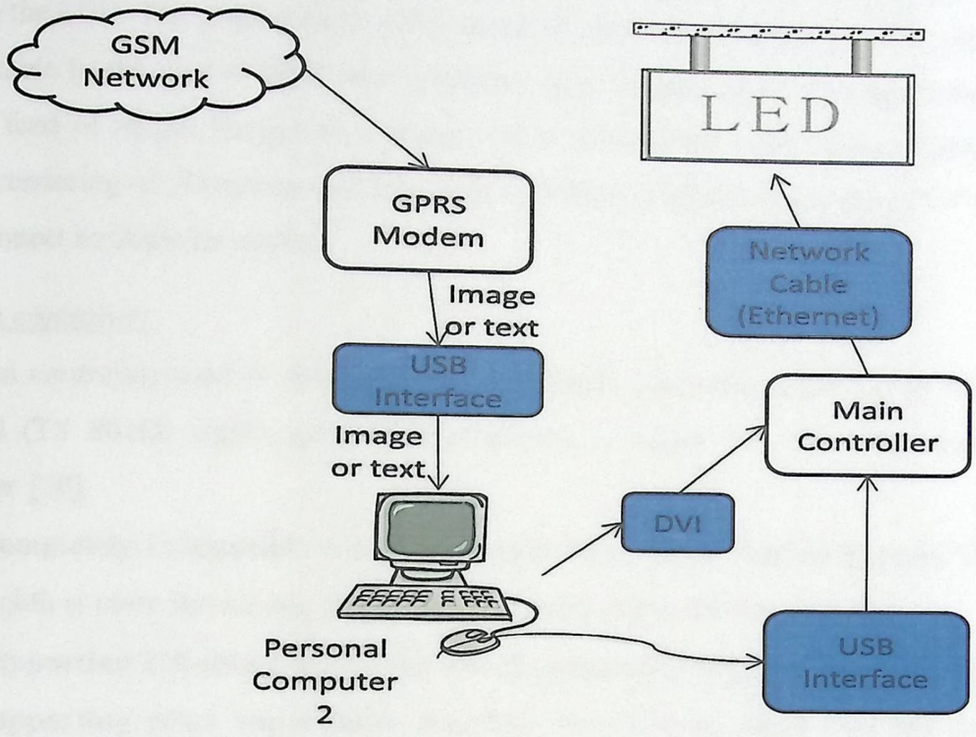


Figure 3.6: The Second Block (Receiver)

The second part of the system represents the receiver which includes a GPRS modem, a personal computer, a Main controller, and a LED monitor.

The second block consists of the follows components:

1) GPRS modem:

When the data sent from GPRS modem (from first block) through GSM network it will be received by GPRS modem at the receiver with SIM card hold a static IP.

2) Personal computer:

The data transfer from GPRS Modem to PC over USB interface as in the transmitter part. The PC must have a DVI interface to connect to main controller needed to control the data before passing it to the LED. The graphic card of the computer takes the picture from GPRS and then sends it by USB cable to the port of USB on the sending card. Graphic card is an expansion card which generates a feed of output images to a display. Most video cards offer various functions such as accelerated rendering of 3D scenes and 2D graphics, MPEG-2/MPEG-4 decoding, TV output, or the ability to connect multiple monitors.

3) Main controller:

The main controller used in the system is an internal controller called Linsn full color LED display card (TS 801D) eighth generation as shown in figure 3.7. The main features of this controller are: [20]

- **Completely Compatible with the Seventh Generation Control System.** Moreover, the eighth is more functional, more powerful, more stable and more reliable.
- **Supporting 210 colors where the seventh generation supports only 28 colors.**
- **Supporting pixel supervision function**: Dynamically check the bad pixels on the display.
- **Supporting more modules:** The eighth supports all the modules with width within 64 pixels, which is from 1 pixel to 64 pixels.
- **Multi-display synchronous and combination functions:** Supporting one sending card to control multi-display, and the multi-display can be willful combination, synchronous display, and independent play.
- **Super Long Transmission Distance:** The max transmission distance is 170M (actual measure); normal transmission distance is 140M.
- **Matching software:** Led Studio V9.0 or above.

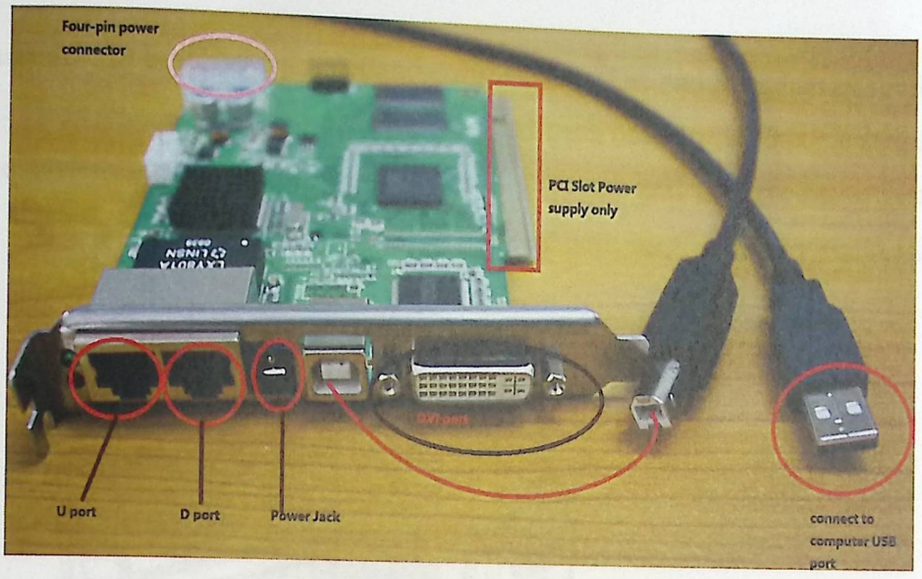


Figure3.7: Sending Card

4) LEDs monitor in advertising:

LED display consists of two parts, Main LED panel which consists of several LED display units (LED cabinet or LED panel) that can be connected together as matrix shape. One cabinet takes the power from any external power supply and takes the suitable signal (data) from personal computer behind it, and then delivers the power and signal to the other cabinet by UTP (Unshielded Twisted Pair) link from one to another. Another part is the controller. The controller can also be divided into two parts, control board (hardware) and control system (software). The control board includes the sending card, receiving cards and computer. [12] [20]

The Structure of the Screen is:

1-LED Module:

May be indoor or outdoor LED display, they are all composed of LED modules. Led modules include LED lamps, driving IC, PCB board and module frame.

2-Display Panel:

This is the main body of the screen. It is made of light-emitting materials and driving circuit. The display panel of indoor and outdoor screen is unit cabinet.

3-Cabinet:

LED module that building by rows and column of LEDs, and have two ports for power cable and data cable. The cabinet receiving data by received card built in it. This card is integrated with hub card. Some system has one receiving card for all cabinets and in some other systems each row of cabinet has a receiving card. The cabinets are fixed with each other by brackets as shown on Figure3.8.

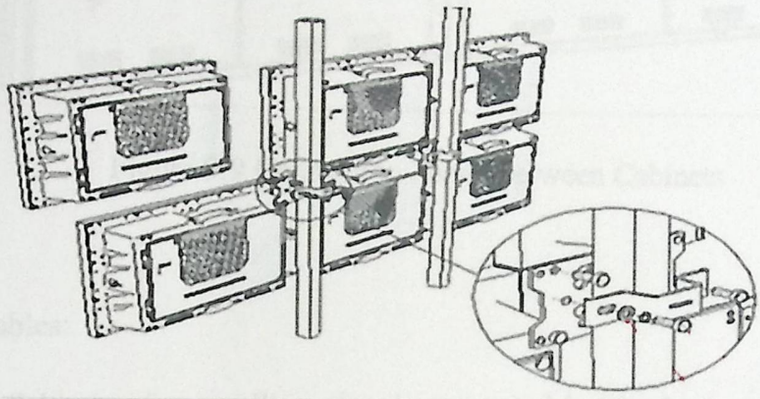


Figure 3.8: Cabinets Fixing

4-Display Controller:

It mainly includes the sending card, receiving cards, and the computer. The sending card should be installed inside the computer; the receiving cards should be installed inside the cabinets. Usually one cabinet needs one receiving card.

5-Power Supply:

It is used to transform the 220V or 110V alternating current into all kinds of direct current to support various circuits. Figure 3.9 shows the power connection between cabinets.

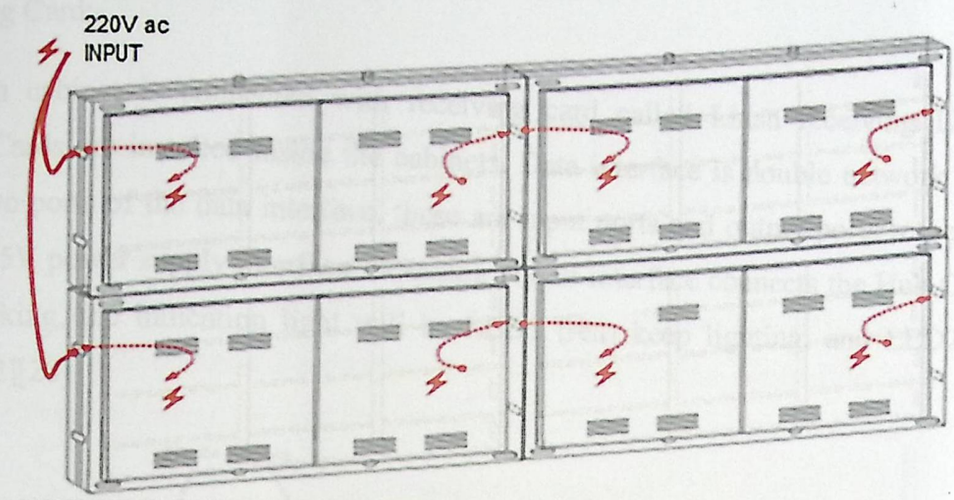


Figure 3.9 Connection Power between Cabinets

6- Transmitting Cables:

Data and all kinds of controlling signals generated by the host controller are transmitted through twisted-pair cables to the screen, and transition data between cabinets. Figure 3.10 shows how to connect the data cable between cabinets and inside the cabinets.

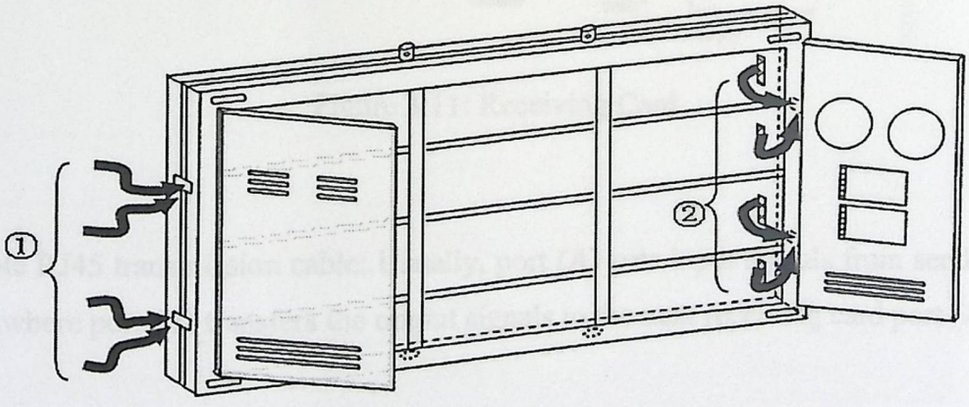


Figure 3.10: Connect the Data Cable between Cabinets

7- Receiving Card:

Each cabinet is connected with receiving card called Linsn receiving LED card. The Receiving Cards are installed inside the cabinets. Data interface is double network card interface, there are two ports of the data interface, these are input ports and output ports respectively. Power interface is 5V power supply interface. Scanning output interface connects the Hub Card. When the card is working, the indication light will be LED1 (red) keep lighting, and LED2 (green) keep flashing. [12][20]

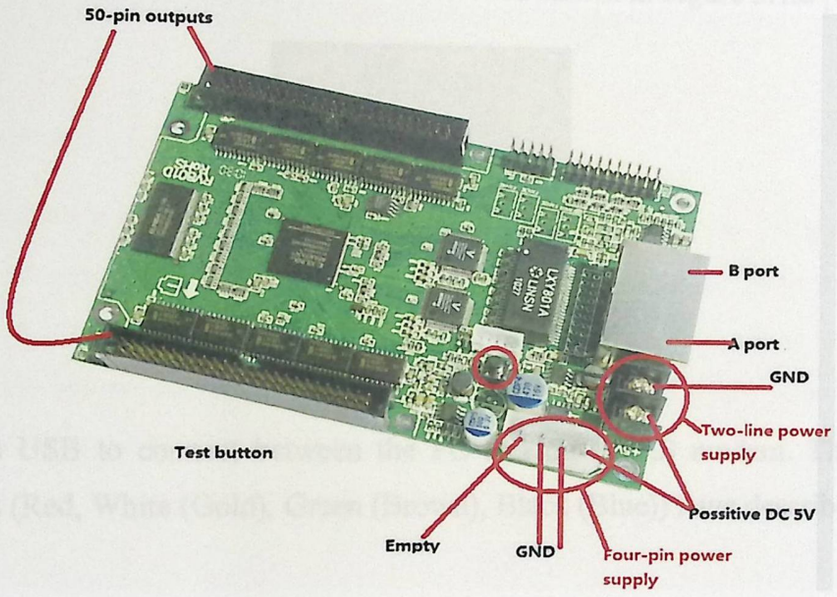


Figure 3.11: Receiving Card

Network cable RJ45 transmission cable: Usually, port (A) gets input signals from sending card port (U)/port (D),where port (B) transfers the output signals to the next receiving card port (A).

8- Hub card:

Hub Card which is connected to the Receiving Card has 6 (16PIN) flat cables respectively and which will connect to the first module in each row of each cabinet. Other modules will be connected to each other by short 16 pin flat cables. [12]

3.3 Interfaces

3.3.1 Universal Serial Bus (USB)

USB was designed to standardize the connection of computer peripherals and defines the cables, connectors and communications protocols used in a bus for connection, communication and power supply between computers and electronic devices as shown in Figure 3.12. [17]

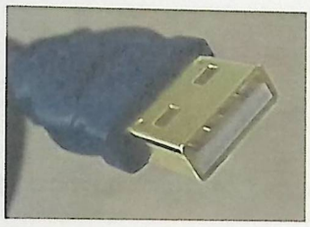


Figure 3.12: USB Interface

The system needs USB to connect between the PC and the GPRS modem. The USB interface consists four wires (Red, White (Gold), Green (Brown), Black (Blue)) have described in Table 3.1

Table 3.1: USB Pins

Pin	Name	Color	Description
1	VBUS	Red	+5 V
2	D-	Gold	Data -
3	D+	Brown	Data +
4	GND	Blue	Ground

They only send digital data, ones and zeroes. This is the PHYSICAL layer of USB communication. The data signals are D+ and D- , D- signal goes in one wire, to the other end, and back to the sender on the other wire. The receiver just notes which way the power was transmitting, forward or backward, to determine if it was a one or a zero. This way, 'noise' would influence both data lines at the same time and be ignored by the signal processor. The USB divides the available bandwidth into frames, and the host controls the frames. Frames contain 1,500 bytes, and a new frame starts every millisecond. During a frame, isochronous and interrupt devices get a slot so they are guaranteed the bandwidth they need. Bulk transfers use whatever space is left.

How is data sent across the USB?

When the software requires data transfer to occur between it and the USB, it sends a block of data called an I/O Request Packet (IRP) to the appropriate pipe, and the software is later notified when this request is completed successfully or terminated by error. Other than the presence of an IRP request, the pipe has no interaction with the USB. As suggested by the name Universal Serial Bus, data transmission in the bus occurs in a serial form. Bytes of data are broken up and sent along the bus one bit at a time, with the least significant bit first as illustrated by Figure 3.13.

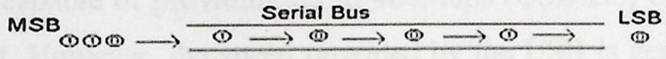


Figure 3.13: Serial Transmission of the Binary Sequence

An eight bit "SYNC" synchronization field is used by inputs to correct their timing for accepting data. Part of this field is a special symbol used to mark the start of a packet. The 8 bit Packet Identifier (PID) which uses 4 bits to determine the type, and hence format, of the packet data. The remaining 4 bits are a 1's complement of this, acting as check bits. Part of this field determines which of the four groups (token, data, handshake, and special) that the packet belongs to, and also specifies an input, output or setup instruction. [17]

This system used USB as interface between GPRS modem and PC not RS232 for many reasons:

- USB is intended as a high speed upward extensible fully standardized interface between 1 computing device using a single port and N peripherals using one port each with all control being accomplished by signals within the data stream.
- RS232 was intended as a 1:1 relatively low speed semi-standardized interface between 1 computing device and 1 peripheral per port with hardware control being an integral part of operation. In this project we use USB interface for the following reason.

Some advantages for USB over RS232:

1) Availability:

The USB ports due to their compact size are usually present in the modern computers. A computer may possess two to eight USB ports. On the other hand RS232 ports are too bulky and cover more space than the USB.

2) Speed:

There is a large difference between the speeds of both ports. The RS232 transmits by sending single bit of data over every clock cycle. The rate of clock pulses ranges from 150 to 119200. Roughly estimating, the speed provided by RS232 is approximately 10Mbps for internet usage. The USB is capable of providing up to 480Mbps (USB 2.0) of speed which is much more than the former port. However, the speed provided by the USB is generally limited by the factors such as number of devices connected to the same bus and also on the speed of the host computer.

3) Power:

The USB port has an inbuilt power supply of 5 volts along with the signaling pins. The devices nowadays utilize 5 volt or less to operate. Thus, one does not need an external cord to power them, they can effectively use the power provided by the USB port. This makes the device more portable as one does not have to carry additional power cords with them.

4) Plug and play:

The devices working with the RS232 port has a command transfer phase to communicate with each other using UART. The computer does not know what type of device is been connected to it. The plug and play feature supported in USB port of computer. Through this feature, the computer can easily detect the device connected to it by some sort of drivers installed in computer or the device is configured to install its drivers automatically as it is connected to the computer.

3.3.2 Digital Video Interface (DVI)

DVI is a video display interface. The interface is designed to transmit uncompressed digital video and can be configured to support multiple modes such as DVI-D (digital only), DVI-A (analog only), or DVI-I (digital and analog). In this project will use the DVI-D (True Digital Video) type use for direct digital connections between source (PC) and, main controller as shown in Figure 3.14. [19]

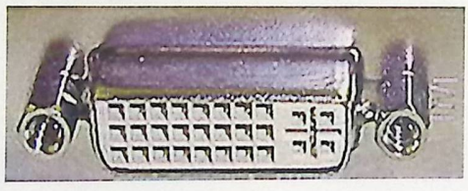


Figure 3.14: DVI Port

The DVI-D provides a faster, higher-quality image than with analog. This DVI-D is a single-Link, sends information using a digital information format called TMDS (Transition Minimized Differential Signaling), it can display a resolution of 1920 x 1200 on LEDs monitor. The maximum length of DVI cables is not included in the specification since it is dependent on the pixel clock frequency, if the cable lengths up to 4.5 m, it will displays at resolution of 1920 × 1200. [19]

The features of DVI-D are:

1-Transfers Uncompressed High-Definition Digital Video Signals.

2- Supports DVI Single-Link Resolutions up to 1920 x 1200

3- Supports up to 36-Bit Color for Billions of Colors.

4-This supports all DVI-D Single-Link Monitors.

5-This Engineered for a Fast and Easy Set-up, No Software to Install.

Figure 3.15: DVI-D Interface

3.3.3 Ethernet Cable

Ethernet cables are used to connect PC's and other electronic devices to networks, the Internet and to each other. In this project, the connection between sending card and receiving card is by one of the most common languages or protocols used with a LAN, it is the Ethernet. Is a physical and data link layer technology for local area networks (LANs). Ethernet uses a bus or star topology and supports data transfer rates of 10 Mbps. Later, "Fast Ethernet" standards increased this maximum data rate to 100 Mbps. Today, Gigabit Ethernet technology further extends peak performance up to 1000 Mbps. The Ethernet specification served as the basis for the IEEE 802.3 standard, and Ethernet uses the CSMA/CD access method to handle simultaneous demands. Ethernet use IP (Internet Protocol), data travels over Ethernet inside protocol units called frames. The run length of individual Ethernet cables is limited to roughly 100 meters. The type of Ethernet

used cable is Cat 5E – Enhanced Cat 5 cabling that helps to prevent cross-talk, works for 10/100Mb and 1000 Mb or Gigabit Ethernet. [21]

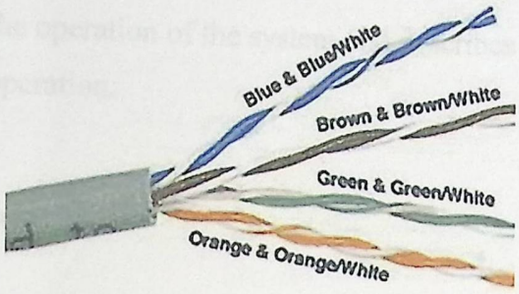


Figure 3.16: Ethernet Cable

Inside the Ethernet cable, there are 8 colors coded wires. These wires are twisted into 4 pairs of wires; each pair has a common color theme. One wire in the pair being a solid or primarily solid colored wire, and the other being a primarily white wire with a colored stripe, finally a straight Ethernet cable used to connect main controller to LED monitor. [21]

3.4 System Software

3.4.1 Introduction

This section explains the operation of the system and describes the path of the sending data. Also shows the compression operation.

3.4.2 Transmitter Flowcharts

The first flowchart explains the path of the sending data in the transmitter part as shown in Figure 3.17.

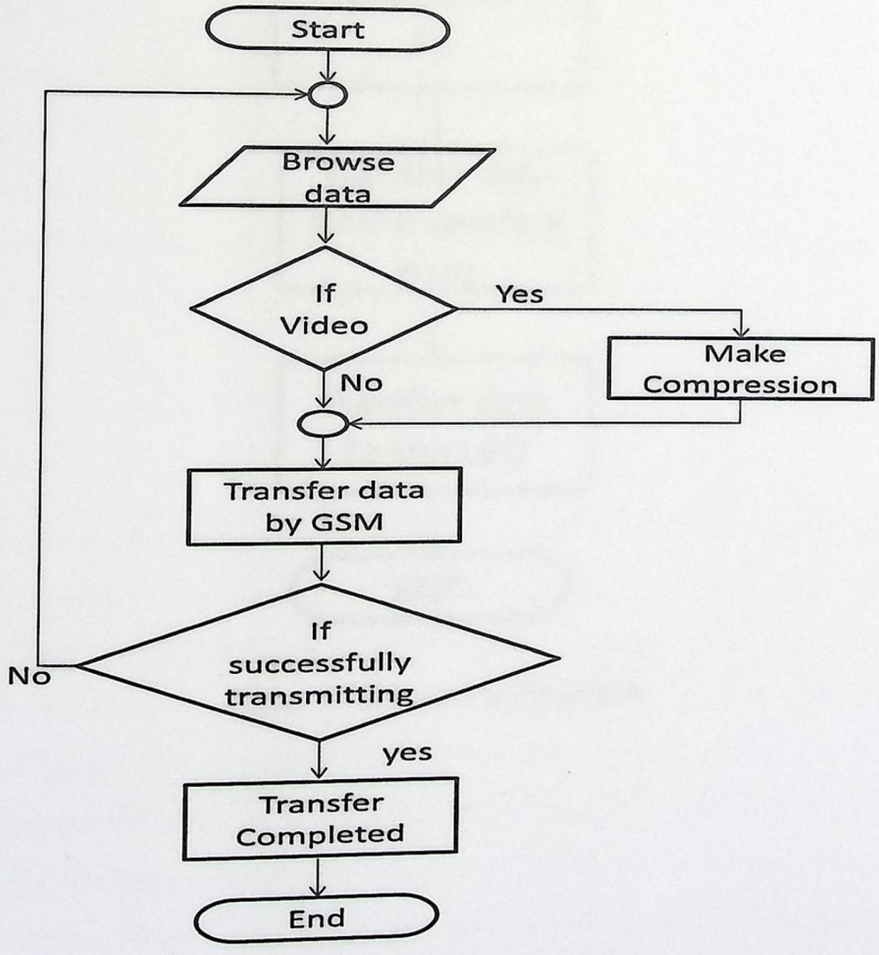


Figure 3.17: Transmitter Flowchart

3.4.3 Receiver Flowcharts

The first flowchart explains the path of the data in the receiver part as shown in Figure 3.18
.

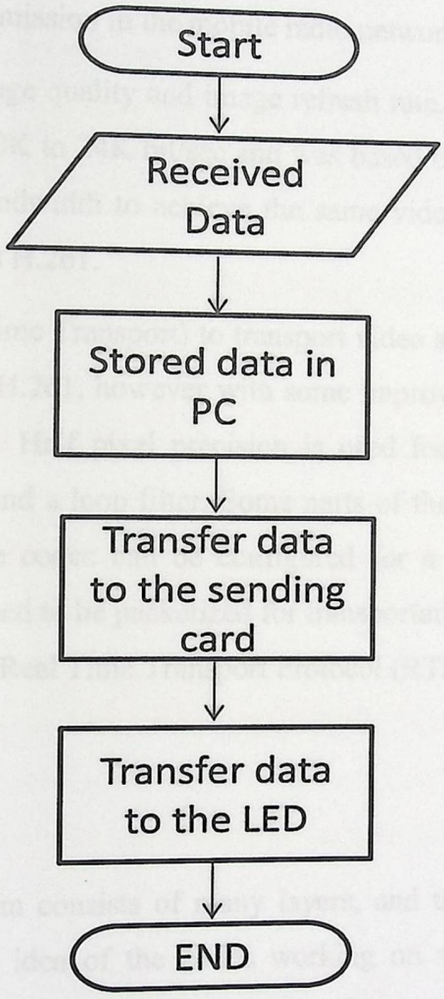


Figure 3.18: Receiver Flowchart

3.4.4 H.263

It is a video compression standard originally designed as a low-bit rate. Wireless phone standards such as 3GPP include H.263 as a video subsystem compression standard. H.263 lets users bandwidth usage and can achieve full-motion video (30 frames per second) at speeds as low as 128K bit/sec, especially for transmission in the mobile radio network GSM (9600 bit/s).

H.263 improves both image quality and image refresh rate. H.263 was developed to stream video at bandwidths as low as 20K to 24K bit/sec and was based on the H.261 codec. As a general rule, H.263 requires half the bandwidth to achieve the same video quality as in the H.261. As a result, H.263 has largely replaced H.261.

H.263 uses RTP (Real Time Transport) to transport video streams. The coding algorithm of H.263 is similar to that used by H.261, however with some improvements and changes to improve performance and error recovery. Half pixel precision is used for motion compensation whereas H.261 used full pixel precision and a loop filter. Some parts of the hierarchic structure of the data stream are now optional, so the codec can be configured for a lower data rate or better error recovery. H.263 video streams need to be packetized for transportation over networks. The transport protocol for H.263 streams is the Real Time Transport Protocol (RTP).

Encoding theory:

The H263 video bit stream consists of many layers, and the outermost layer is the video sequence layer. Encoding is the idea of the codec working on what is known as a 'Group of Pictures' (GOP). These consists three types of image. The first type, the 'I-frame', is a stand-alone compressed frame, and there is one I-frame at the beginning of each GOP. Between this there are two further types of image which predict the change (motion) between each I-Frame. The first level of predicted frame is the P-Frame, which contains the difference between the current and preceding frame. Secondly, the B-Frame contains the difference between the current frame and both the preceding and following frames. So before compression each frame is transmitted in full, after compression the bandwidth of the images is reduced as only a subset of information from each I-

Frame is required. To reduce the bandwidth for any given moving image, the length of the GOP is increased. As the GOP is increased the bandwidth will fall, but so will the quality of the images as deeper prediction is required. Furthermore, as the number of I-frames in a video stream is reduced, the stream becomes less easily editable. Figure shows a graphic representation of this. [23]

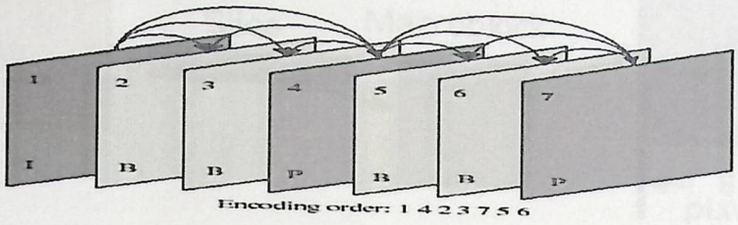


Figure 3.19: Coding Mode

Source format:

Macroblock: Each picture in an input video sequence is divided into macroblocks, which are the building blocks of an MPEG video. Each macroblock is made up of one 16 × 16 luma pixels, one 8 × 8 Cb pixels, and one 8 × 8 Cr pixels. However, the compression based on discrete cosine transform (DCT) is performed on each 8 × 8 block of pixels in all the three components. Pictures are coded as luminance and two color difference components(Y, Cb and Cr as the same with MPEG). In H.263, there are five standardized picture formats: sub-QCIF, QCIF, CIF, 4CIF, 16CIF. The spatial resolution is further reduced for sub-QCIF, while 4CIF and 16CIF are formats with an increased resolution. Sub-QCIF may be useful for extremely low bit rate and inexpensive low-end terminals. [24]

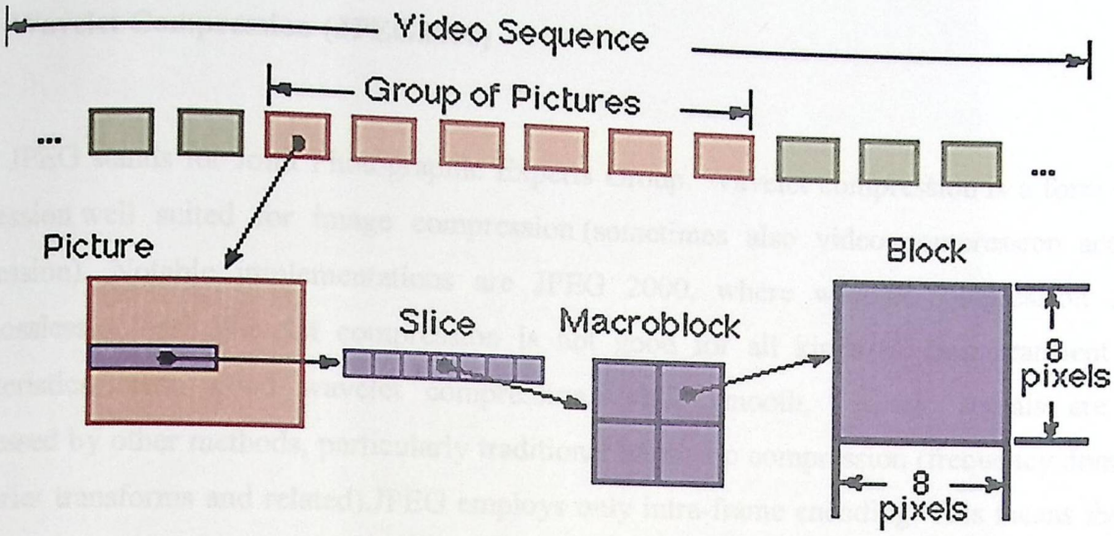


Figure 3.20: Picture Formats

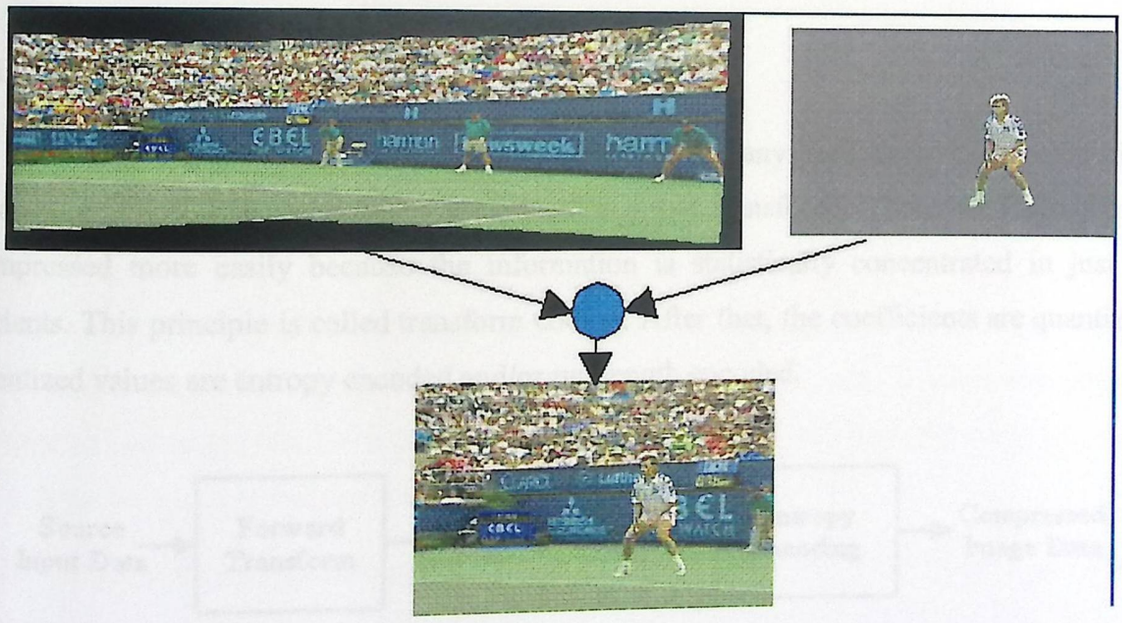


Figure 3.21 Difference Frame

3.4.5 Wavelet Compression (JPEG2000)

JPEG stands for Joint Photographic Experts Group. Wavelet compression is a form of data compression well suited for image compression (sometimes also video compression and audio compression). Notable implementations are JPEG 2000, where wavelet compression can be either lossless or loss. Wavelet compression is not good for all kinds of data: transient signal characteristics mean good wavelet compression, while smooth, periodic signals are better compressed by other methods, particularly traditional harmonic compression (frequency domain, as by Fourier transforms and related).JPEG employs only intra-frame encoding. This means that each frame is compressed individually, and no attention is paid by the encoder to either previous or following frames, and so it is not predictive in any way. The Discrete Wavelet Transform at the heart of the algorithm can be based on either a reversible filter (lossless) or a non reversible filter which is loss but provides a higher compression rate for any given material.[27]

Encoding Theory

First a wavelet transform is applied. This produces as many coefficients as there are pixels in the image (i.e., there is no compression yet since it is only a transform). These coefficients can then be compressed more easily because the information is statistically concentrated in just a few coefficients. This principle is called transform coding. After that, the coefficients are quantized and the quantized values are entropy encoded and/or run length encoded.

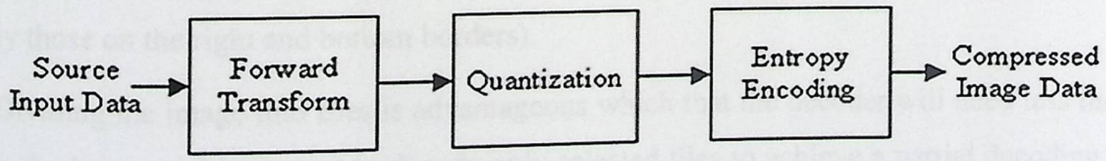


Figure 3.22: JEPG 2000 Block Diagram

جامعة بوليتكنك فلسطين
Palestine Polytechnic University
(PPU)
The Library المكتبة
Acc. 26435 الرقم المتسلسل
Class. رقم التصنيف

1) Color components transformation

Initially images have to be transformed from the RGB color space to another color space, leading to three components that are handled separately. There are two possible choices:

1. Irreversible Color Transform (ICT) uses the well-known Y, C_B, and C_R color space. It is called "irreversible" because it has to be implemented in floating or fix-point and causes round-off errors.
2. Reversible Color Transform (RCT) uses a modified YUV color space that does not introduce quantization errors, so it is fully reversible. Proper implementation of the RCT requires that numbers are rounded as specified that cannot be expressed exactly in matrix form. The transformation is:

$$Y = \frac{R + 2G + B}{4} \; ; C_B = B - G \; ; \; C_R = R - G$$

$$G = Y - \frac{C_b + C_r}{4} \; ; R = C_R + G \; ; \; B = C_B + G$$

2) Tiling

After color transformation, the image is split into tiles, rectangular regions of the image that are transformed and encoded separately. Tiles can be any size, and it is also possible to consider the whole image as one single tile. Once the size is chosen, all the tiles will have the same size (except optionally those on the right and bottom borders).

Dividing the image into tiles is advantageous which that the decoder will need less memory to decode the image and it can opt to decode only selected tiles to achieve a partial decoding of the image. The disadvantage of this approach is that the quality of the picture decreases due to a lower peak signal-to-noise ratio.

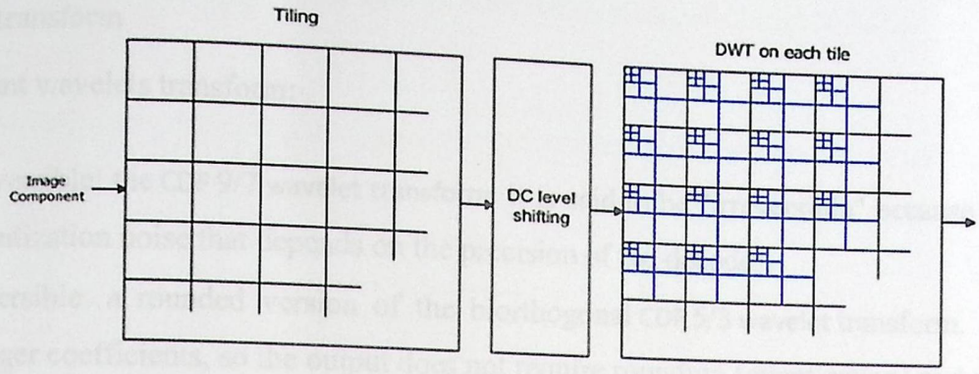


Figure 3.23: Tiling, DC Level Shifting, and DWT on Each Tile

Each tile component will decompose using the DWT into a series of decomposition levels which each contains a number of sub bands. These sub bands contain coefficients that describe the horizontal and vertical characteristics of the original tile component. All of the wavelet transforms employing the JPEG 2000 compression method are fundamentally one- dimensional in nature2. Applying one-dimensional transforms in the horizontal and vertical directions forms two-dimensional transforms. This results in four smaller image blocks; one with low resolution, one with high vertical resolution and low horizontal resolution, one with low vertical resolution and high horizontal resolution, and one with all high resolution. This process of applying the one-dimensional filters in both directions is then repeated a number of times on the low-resolution image block. This procedure is called dyadic decomposition. An example of dyadic decomposition into sub bands with the whole image treated as one tile is shown in Figure3.24.

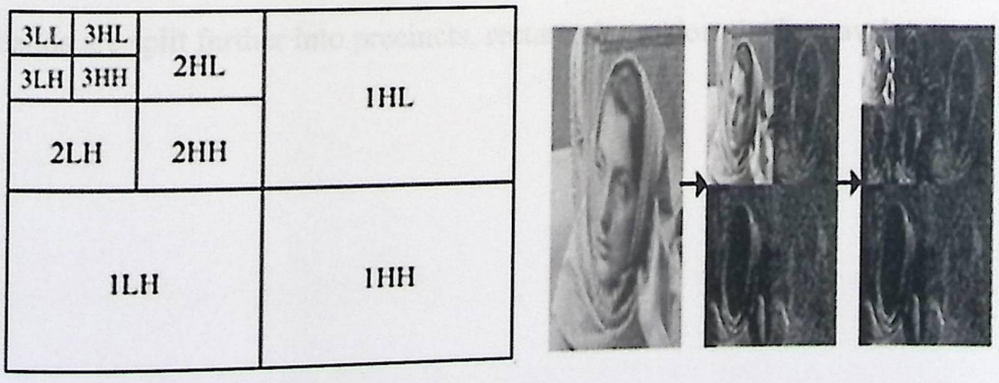


Figure 3.24 : Dyadic Decomposition

3) Wavelet transform

Two different wavelets transform:

1. Irreversible: the CDF 9/7 wavelet transform. It is said to be "irreversible" because it introduces quantization noise that depends on the precision of the decoder.
2. Reversible: a rounded version of the biorthogonal CDF 5/3 wavelet transform. It uses only integer coefficients, so the output does not require rounding (quantization) and so it does not introduce any quantization noise. It is used in lossless coding.

4) Quantization

After the wavelet transform, the coefficients are scalar-quantized to reduce the number of bits to represent them, at the expense of quality. The output is a set of integer numbers which have to be encoded bit-by-bit. The parameter that can be changed to set the final quality is the quantization step: the greater the step, the greater is the compression and the loss of quality. With a quantization step that equals 1, no quantization is performed (it is used in lossless compression).

5) Coding

The result of the previous process is a collection of sub-bands which represent several approximation scales. A sub-band is a set of coefficients-real numbers which represent aspects of the image associated with a certain frequency range as well as a spatial area of the image. The quantized sub-bands are split further into precincts, rectangular regions in the wavelet domain.

The compression operation on a video before transmitting it shows in Figure 3.25.

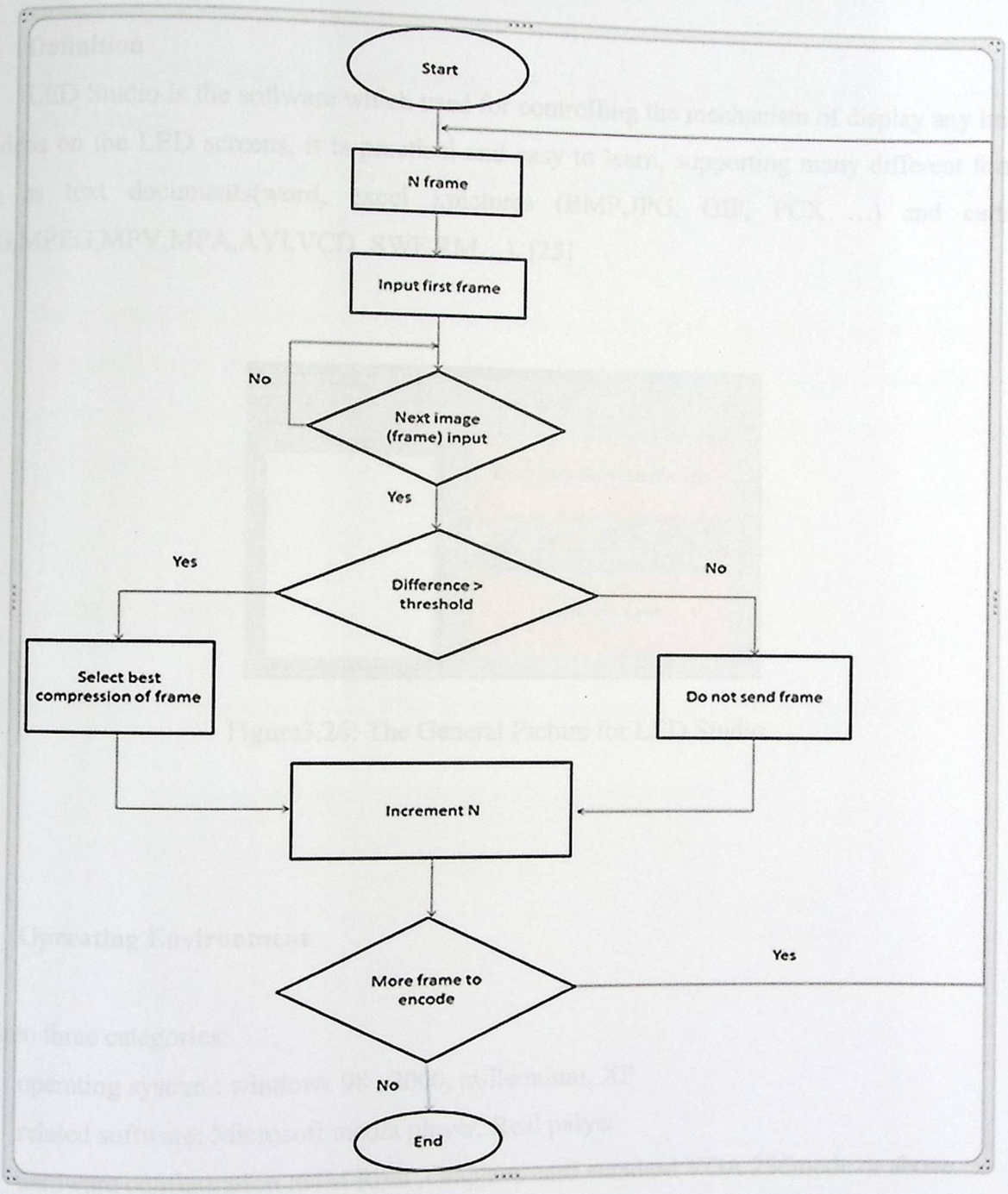


Figure 3.25: Description the Compression Operation

3.5 LED Studio

3.5.1 Definition

LED Studio is the software which used for controlling the mechanism of display any images or videos on the LED screens, it is practical and easy to learn, supporting many different formats ,such as text documents(word, excel),pictures (BMP,JPG, GIF, PCX …) and cartoons (MPG,MPEG,MPV,MPA,AVI,VCD ,SWF,RM…). [25]

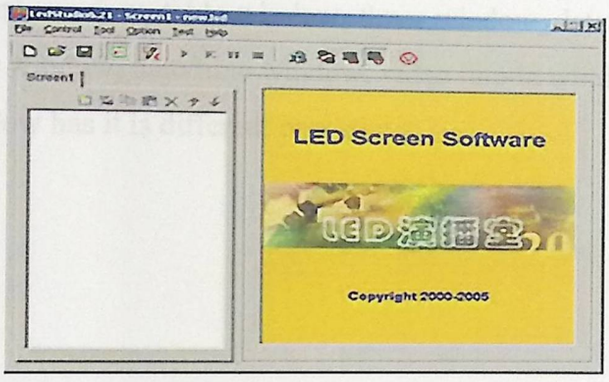


Figure3.26: The General Picture for LED Studio.

3.5.2 Operating Environment

Split into three categories:

1. operating system : windows 98 , 2000, millennium, XP
2. related software: Microsoft media player, Real palyer
3. hardware configuration :64M Rom ,Graphics card standard VGA 256mode or above

3.5.3 Instructions of the Program

There are two types of program pages

1. Normal program page: the main components of program, they will be played in order, one after another.
2. Overall program page: It is mainly used for fixed contents broadcast, such as clock, company logo etc.

The program pages includes number of windows ,such as file window, text window, single line text window, static text window, table window, timer window, data base window, DVD/VCD window, external software window, date/time window, video line-in window, and geometrical graph window. Where each window has it is different operations.

3.5.4 Interface Window

Led studio has two interface windows: Play Window and Control Window as shown in Figure 3.27.

Figure 3.27: Play Window and Control Window

1. Play window: used to display the files that users want to play in the led screen, like pictures, cartoons, multi-media.
2. Control window: used for controlling the position and size of the playing area, as we known the led screen consist from number of cabinets by this window determine where each part of image or video can be display in cabinet. It contains Menu Toolbar and Edit control, Menu bar including file, control, tools, settings test (only for producer) and help, in total 6 sub-menus. Toolbar: it is the fast operation of the menu functions. Edit: consists of two parts, left hand side are program options, displaying info of the program and sub-windows; right hand side are control options, controlling the playing actions, time, etc. of the program.

CHAPTER FOUR

Implementation System Design

4.1 Introduction.

4.2 Hardware Design Implementation.

4.3 Software Design Implementation

4.1 Introduction

After explaining the block diagram and the sub blocks of the system in the previous chapter, this chapter explains the specific details of the hardware and software system implementation.

4.2 Hardware Design Implementation

4.2.1 Introduction

This section presents the hardware details of the connections and components interfaces at both sides as shown in Figure 4.1.

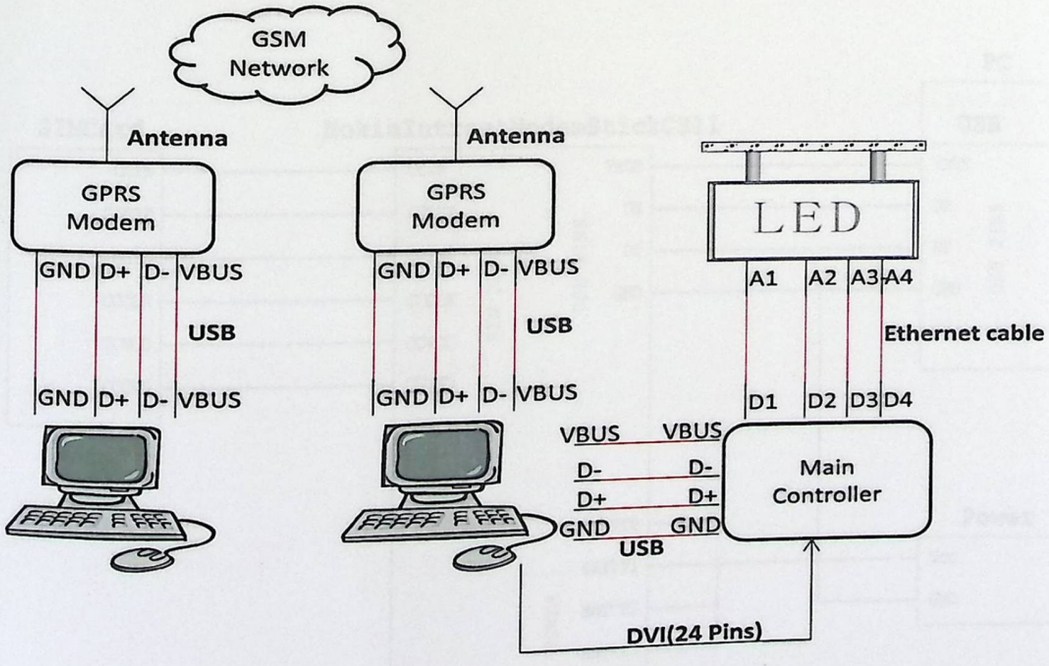


Figure 4.1: Detailed Main Block Diagram

4.1 Introduction

After explaining the block diagram and the sub blocks of the system in the previous chapter, this chapter explains the specific details of the hardware and software system implementation.

4.2 Hardware Design Implementation

4.2.1 Introduction

This section presents the hardware details of the connections and components interfaces at both sides as shown in Figure 4.1.

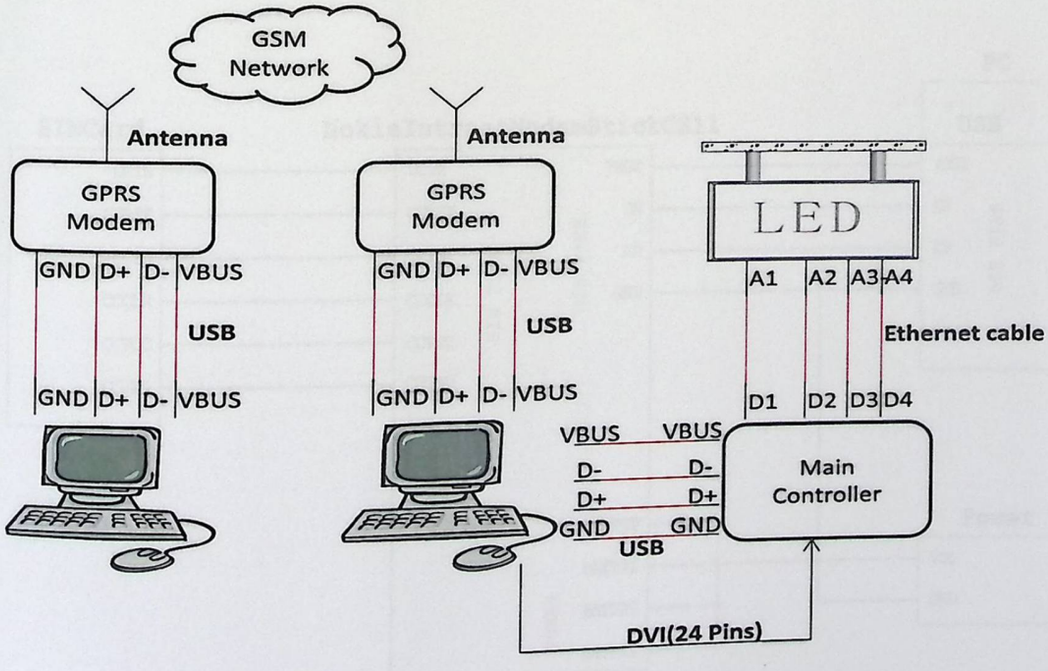


Figure 4.1: Detailed Main Block Diagram

4.2.2 GPRS Modem Interfacing

In this system, two GPRS modems have been used at the two sides. Figure 4.2 shows the Nokia internet stick CS-11 GPRS modem with the main input and output interfaces.

The sub-interfaces are:

- Power supply (5V/2A): 5 Pins one for Ground and four for BATT+.
- Charger interface: 5 Pins.
- SIM interface: 6 Pins are:
  1) CCIN: For knowing if there is a SIM Card in the holder or not.
  2) CCRST: For Reset
  3) CCIO: For Input /Output data.
  4) CCCLK: For control
  5) CCVCC: Supply 3V
  6) CCGND: For Ground.
- Serial interface USB: 4 Pins (VBUS 3V, D- , D+, GND).

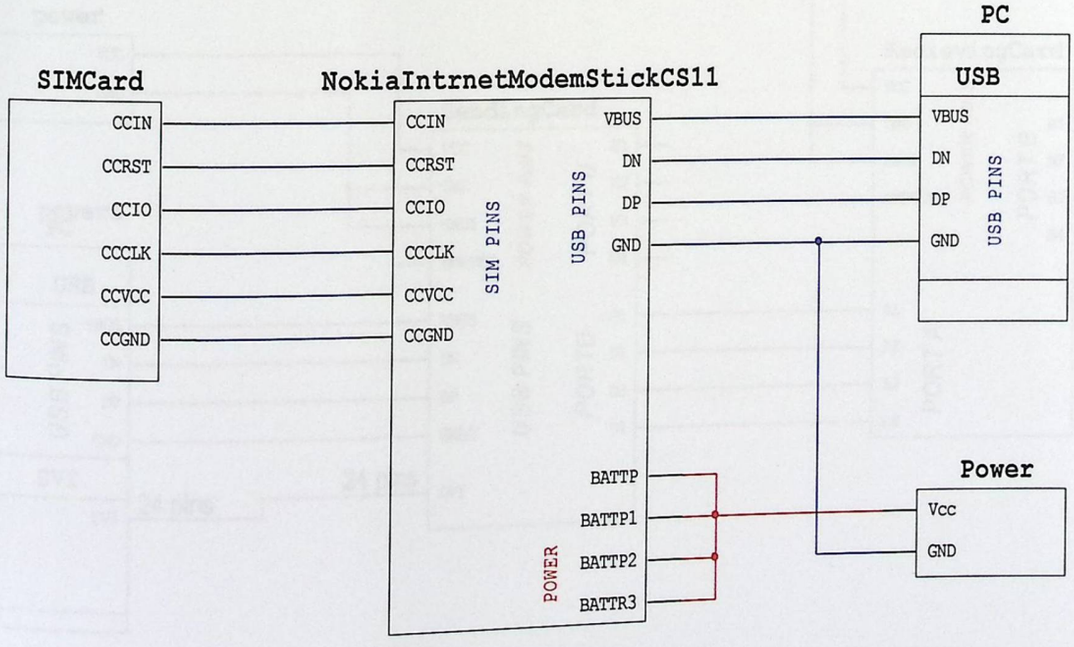


Figure 4.2: Interface GPRS Modem

4.2.3 Sending Card Interfacing

Figure 4.3 shows the sending card and the receiving card with the main input and output interfaces.

The sending card interfaces are:

1. Power Supply (5V/2A): 4 Pins (VCC, 2 GND, EMPTY).
2. Input Interfaces: USB Interface, and DVI Interface.
3. Output Interface: Ethernet Cable (U/D Ports).

The receiving card interfaces are:

1. Power Supply (5V/2A): 4 Pins (VCC, 2 GND, EMPTY).
2. Input Interfaces (Port A).
3. Output Interface (Port B): is connected to Port A in the next receiving card and so on.

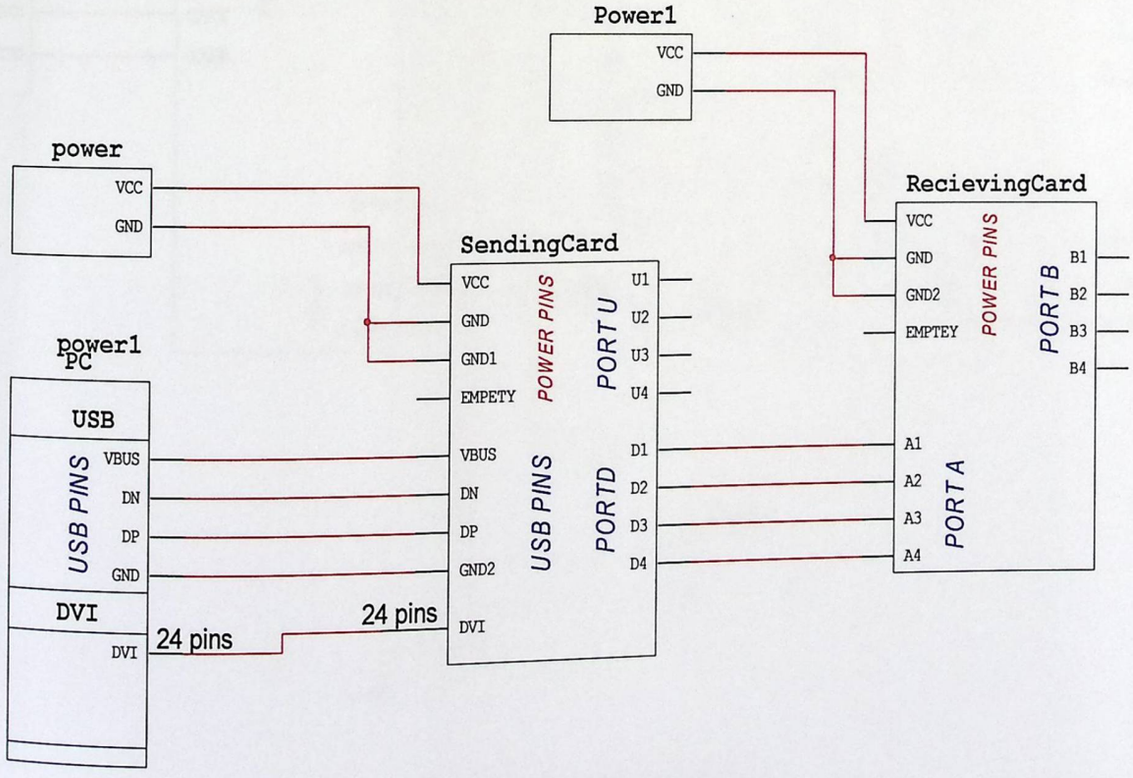


Figure 4.3: Interface Sending Card.

4.2.4 Hardware Connection

The whole hardware connections and components interfaces shown in Figure 4.4.

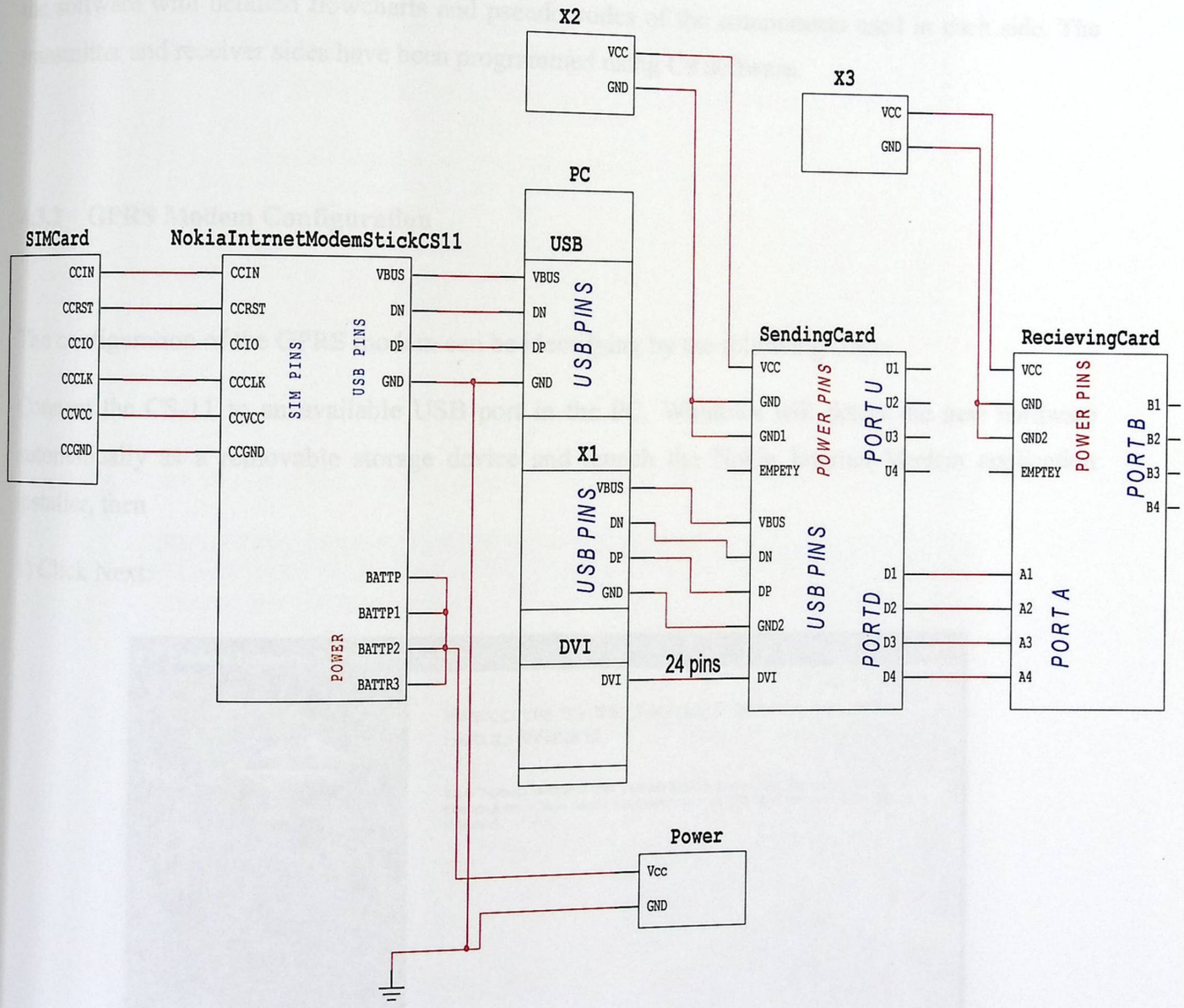


Figure 4.4: Hardware Connection.

4.3 Software Design Implementation

4.3.1 Introduction

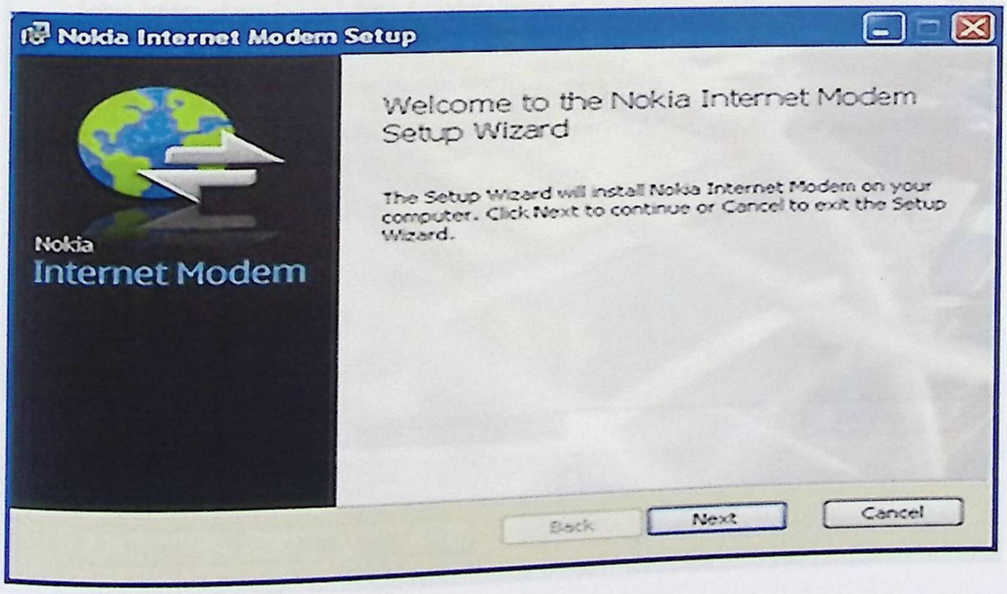
Operating and controlling any component requires software handling. This section presents the software with detailed flowcharts and pseudo codes of the components used in each side. The transmitter and receiver sides have been programmed using C# software.

4.3.2 GPRS Modem Configuration

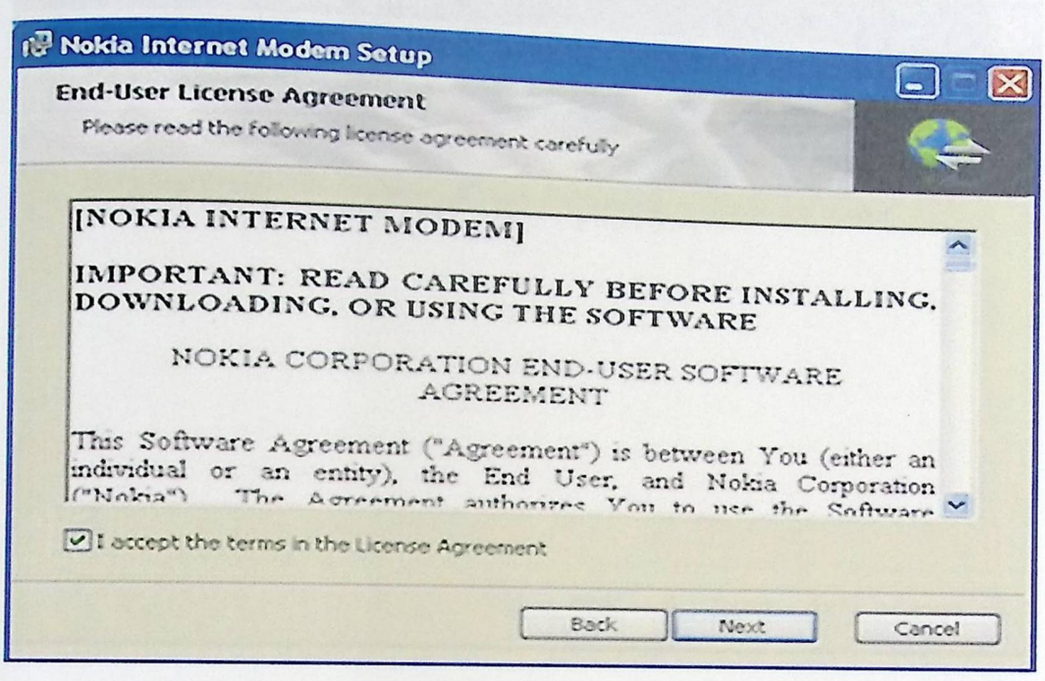
The configuration of the GPRS modem can be identifying by the following steps:

Connect the CS-11 to an available USB port in the PC. Windows will detect the new hardware automatically as a removable storage device and launch the Nokia Internet Modem application installer, then

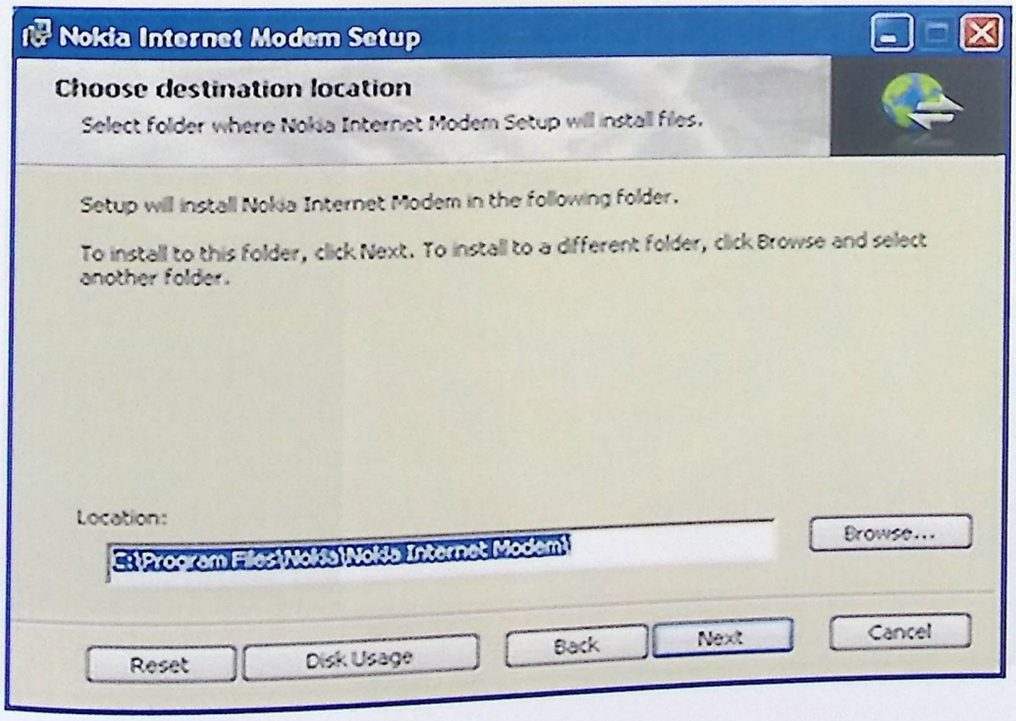
1) Click Next:



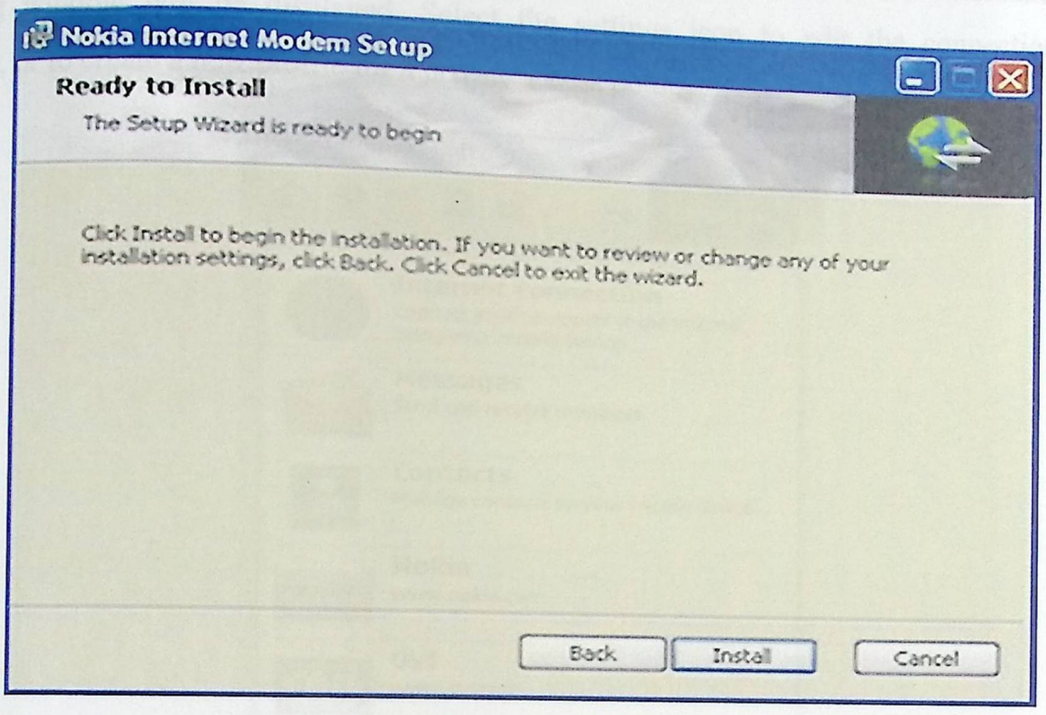
2) Read the license agreement and select the option to accept if you agree to the terms and conditions, Click Next.



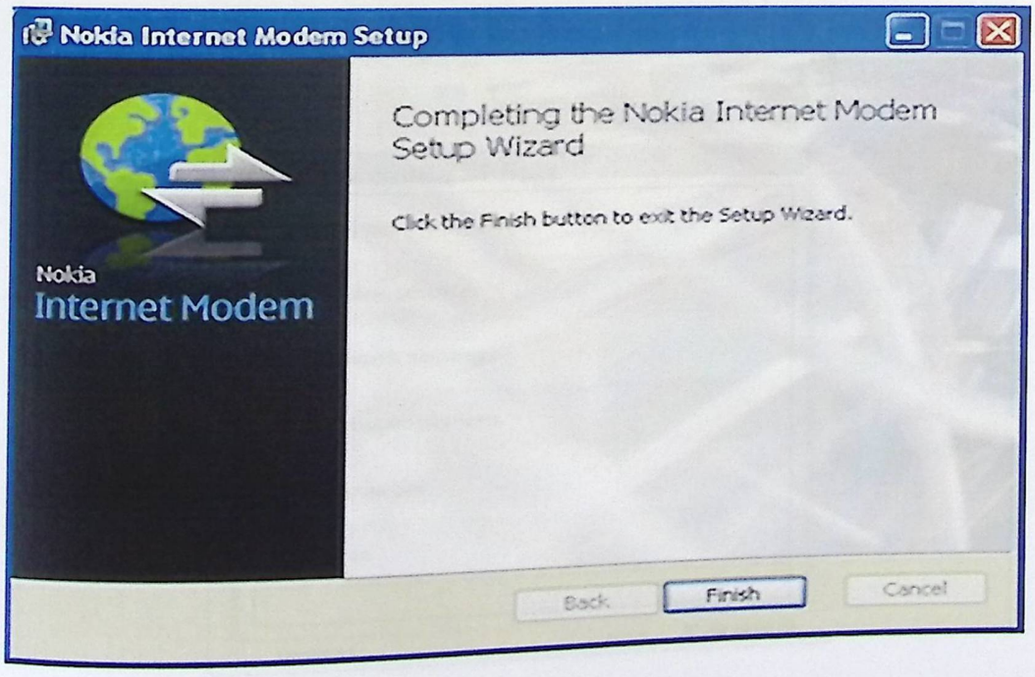
3) Specify, where you want the required program files to be saved on your PC, Click Next.



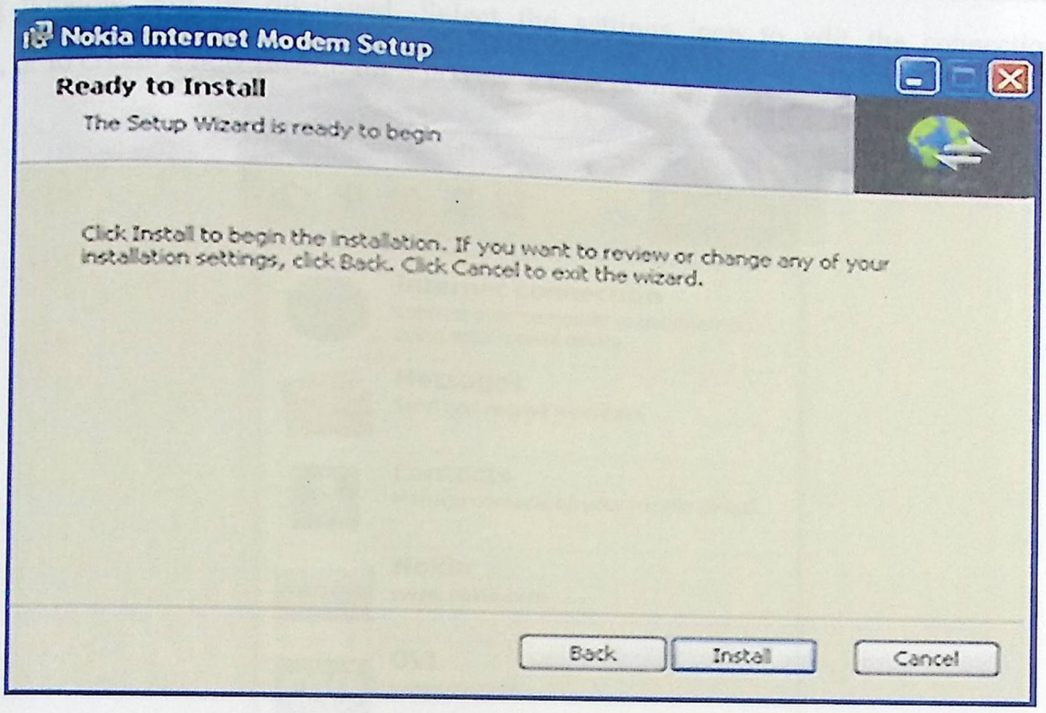
4) Click Install.



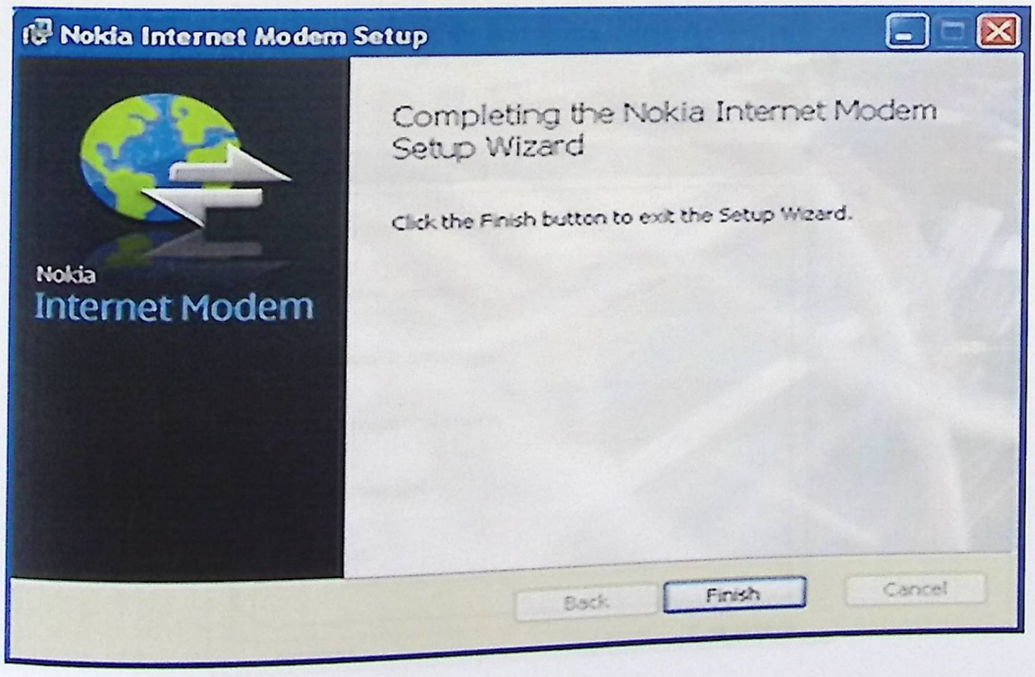
5) The required program files and drivers will now be copied to the PC. Once complete, Click Finish.



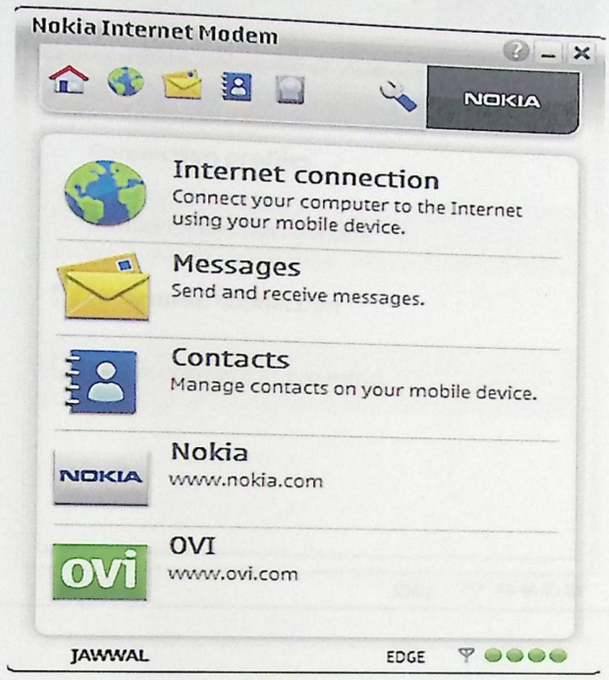
4) Click Install.



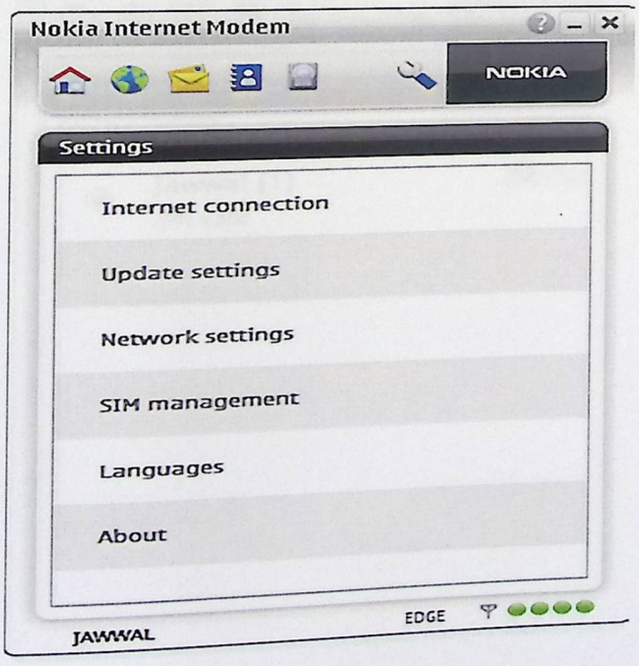
5) The required program files and drivers will now be copied to the PC. Once complete, Click Finish.



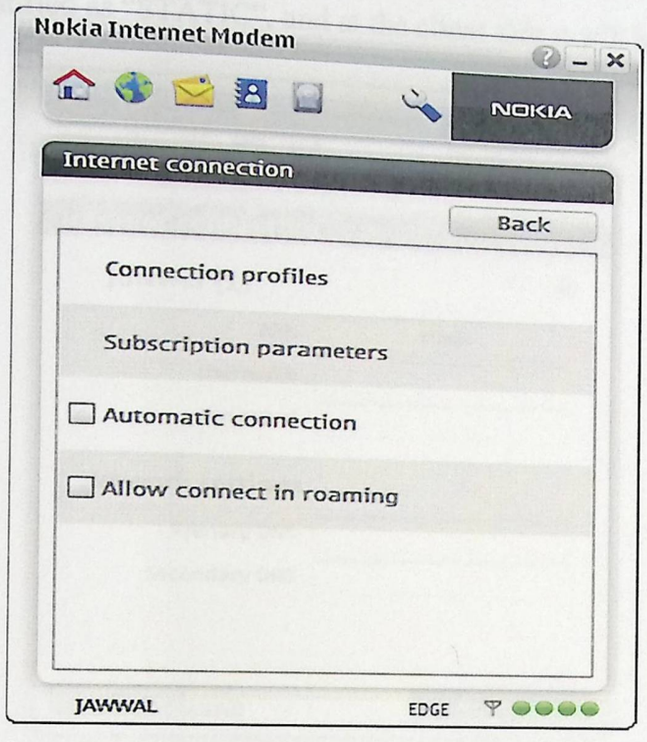
The Nokia Internet Modem dashboard application will now launch automatically. The following window will be displayed. Select the settings icon to edit the connection settings manually, or to create a new profile for a private access point:



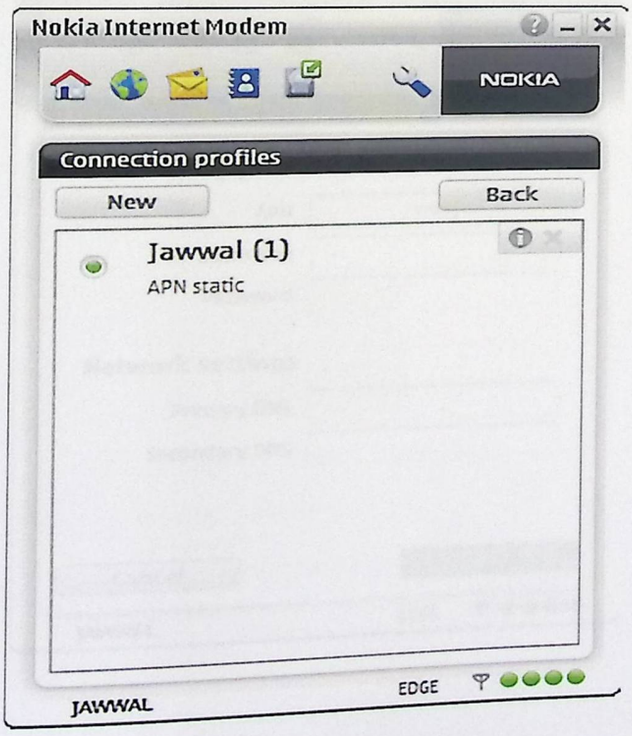
Then select Internet Connection:



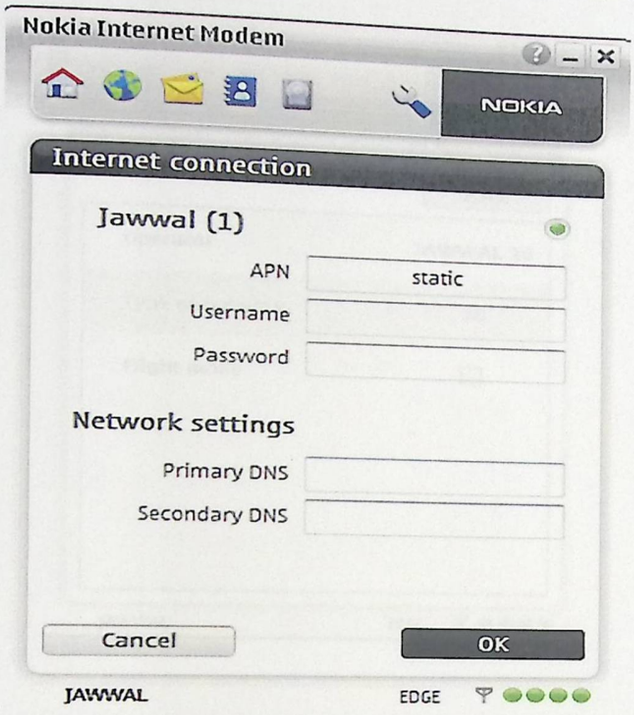
Then select Connection Profiles:

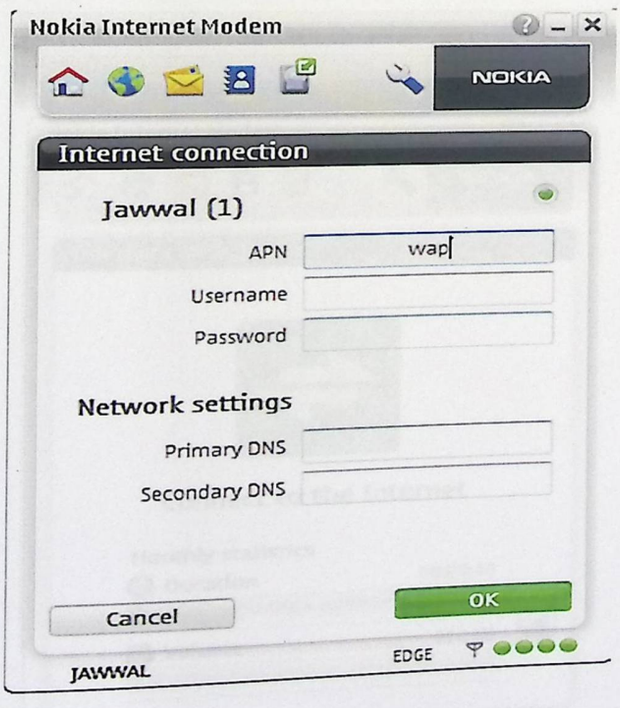


To create a new connection, select New:

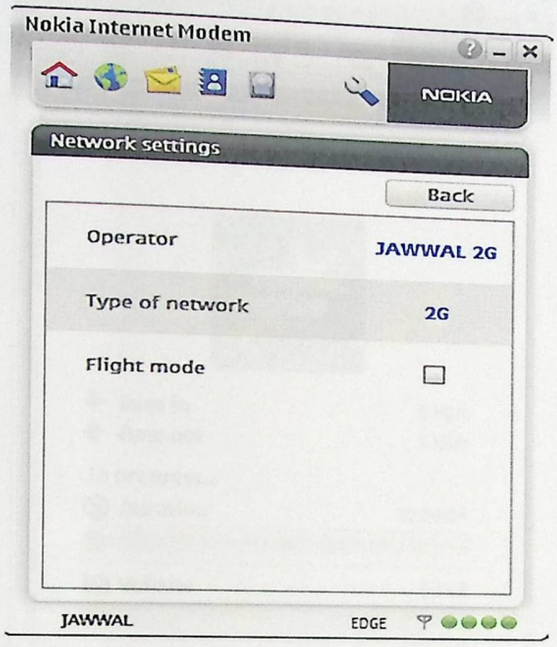


Enter the required connection settings and click OK. At the server side the Access Point Name (APN) will be identified as "STATIC", and at the client side it will be identified as "WAP".



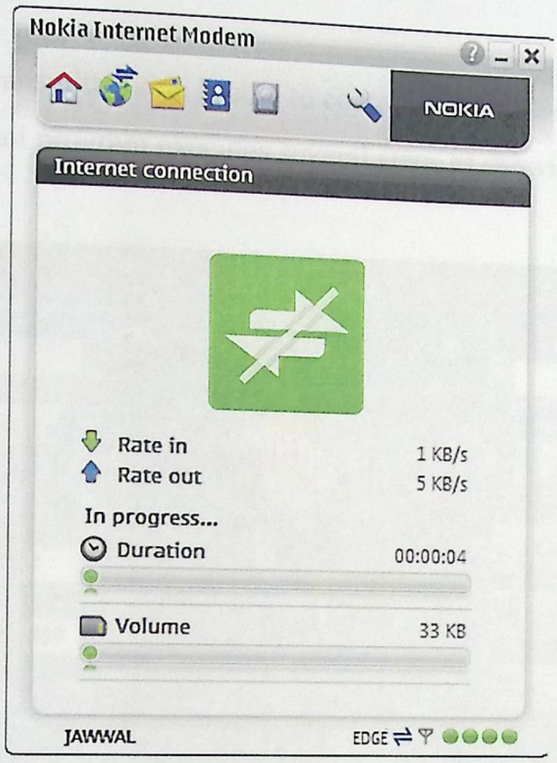


Enter the required Network settings by identifying the operator "JAWWAL 2G" and the type of network "2G".



To initiate the Internet connection, select the Internet Connection option, and then Connect to the Internet:

After a few moments the Internet connection will be established:



4.3.3 Client Programming

The client program at the transmitter side is able to control all the files that are needed to be sent at LED monitor side. The client program executes several steps as shown in Figure 4.5.

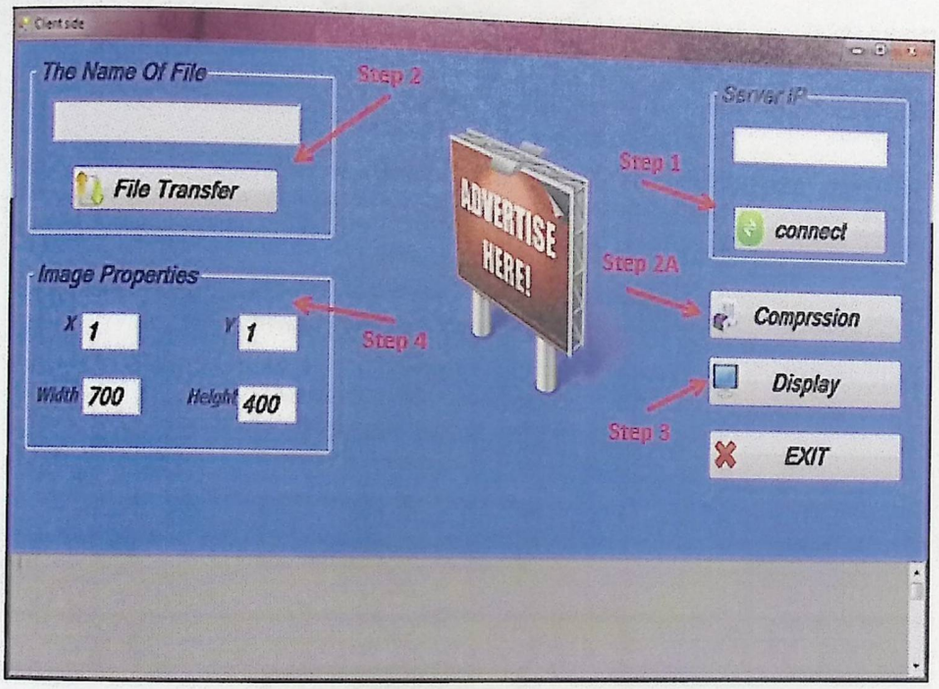


Figure 4.5: The Client Main Screen Window.

STEP 1: Established a connection with the receiver side by insert the static IP of the server.

STEP 2: Browse and transfer the file that does not need to be compressed (image and SWF).

STEP 2A: Compressing the video that needed to send, and then transfer it.

STEP 3: Determine the appropriate file dimensions for displaying.

Finally, the comment box shows the user all the information about each step whether it is completed or not.

The flowchart in Figure 4.6 and the pseudo code below describe and explain the sequential steps in the client program which are needed for connection established between the client and any server.

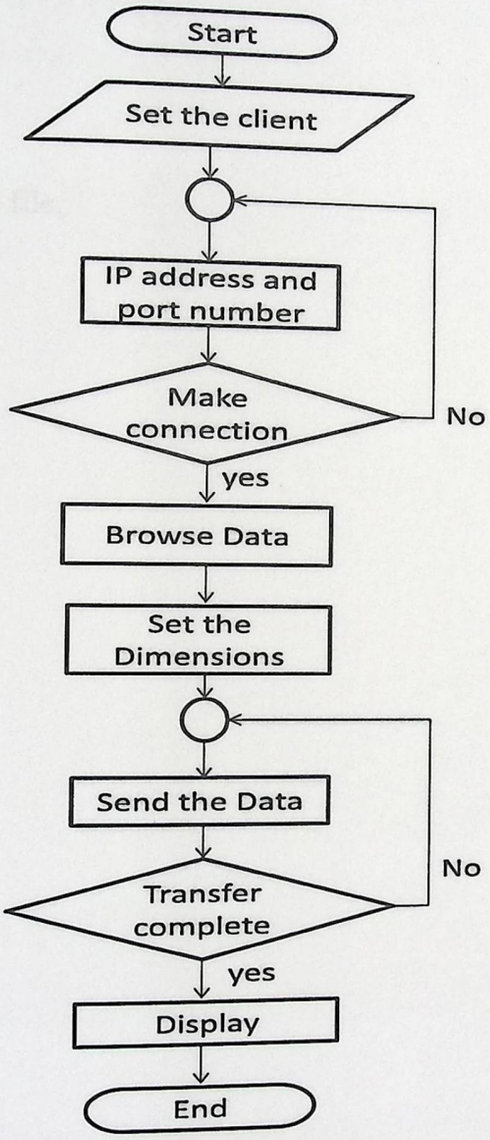


Figure 4.6: Client Program Flowchart.

```
Set as client;
Set the server IP;
If (Connection Succeeds)
{
  Browse the file to send;
  Set the dimensions of the file;
}
Else
  Try to connect again;
If (File transfer complete)
{
  Display the file;
}
```

4.3.4 Server Programming

The server program at the receiver side as shown in Figure 4.7 can receive and display the transmitter file from the client program, this file could be an image with several extensions (e.g., JPG, PNG, ...etc.), Flash Player with SWF extension, and video with AVI extension.

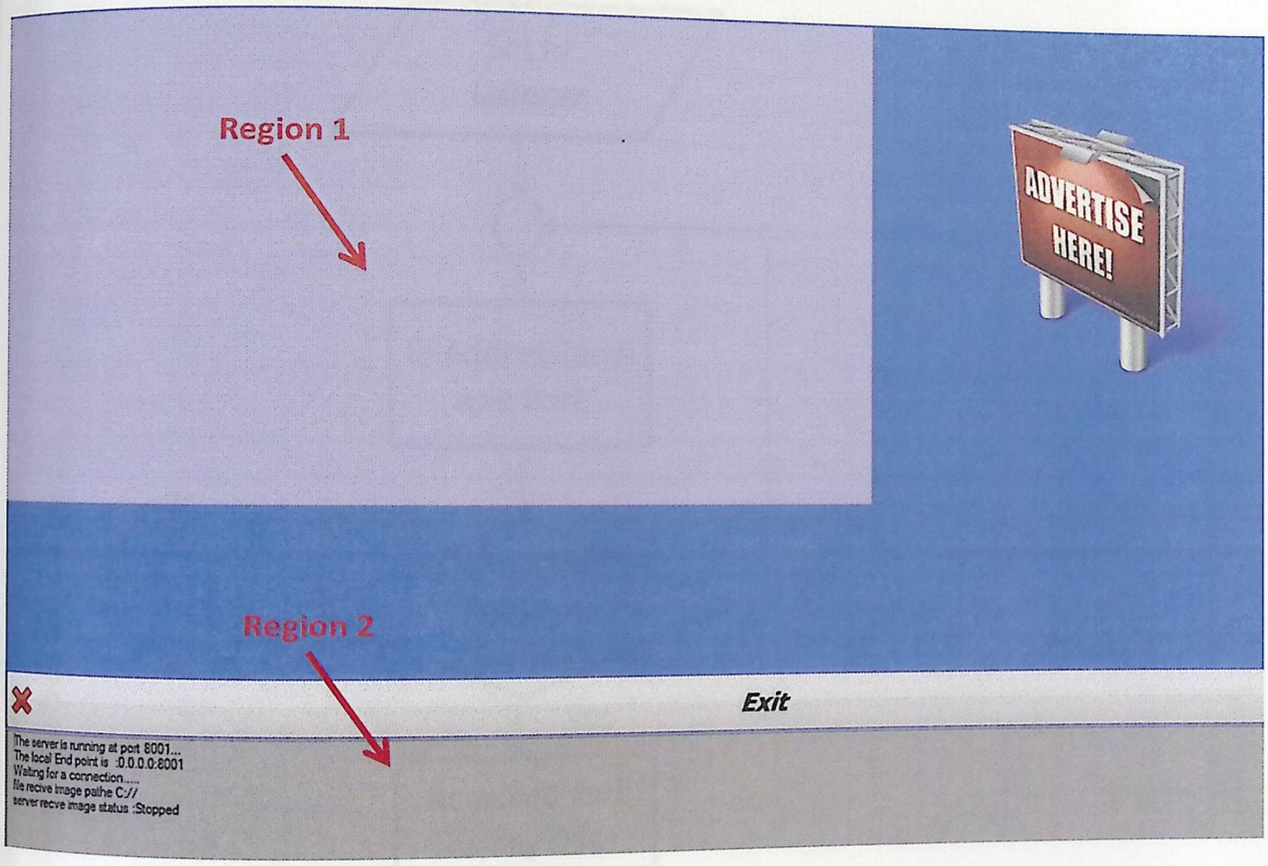


Figure 4.7: The Server Main Screen Window.

Region 1: Displays the file in this region. This region is controlled by the client program to set the dimensions (position, height, width) of the file to be suitable on the LED screen.

Region 2: Explains the port number, IP address of the client, the file stored location, and the status connection.

The flowchart in Figure 4.8 and the pseudo code below are describe and explain the sequentially steps in the server program which is needed to complete the connection process between the client and the server.

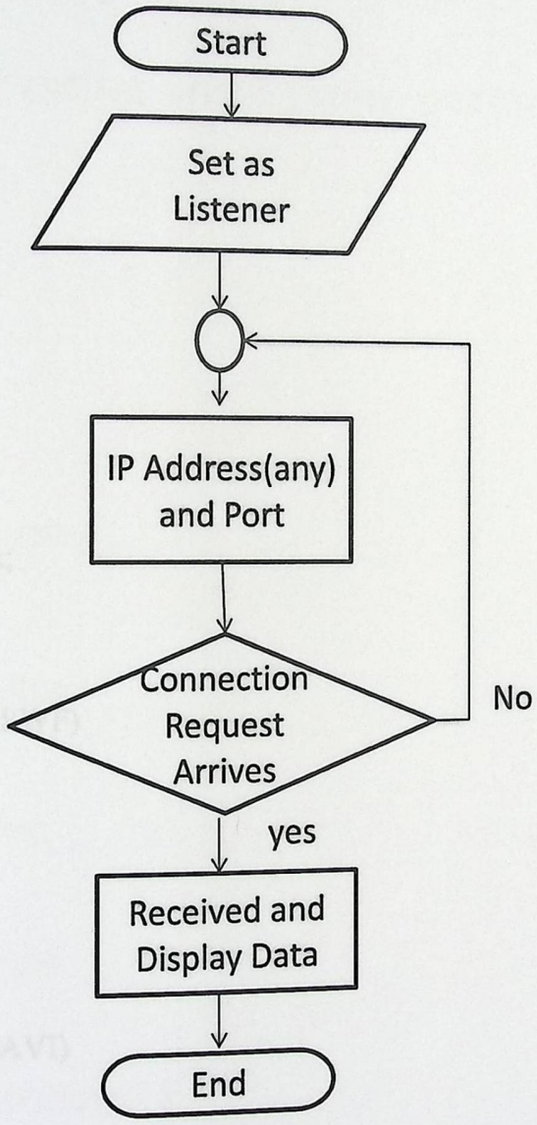


Figure 4.8: Server Program Flowchart.

```
While (True)
{
Listener on Port 8001;
If (Connection Request Arrives)
{
  Received File;
  Save It on PC;
}
If (File Format == JPG)
{
  Display at Picture Box;
}
Else if (File Format == SWF)
{
  Display at SWF Box;
}
Else if (File Format == AVI)
{
  Display at AVI Box;
}
```

CHAPTER FIVE

Testing and System performance

5.1 Introduction.

5.2 Sub-System Testing

5.3 Hardware Testing

5.4 Software Testing

5.5 Testing Scenarios

5.6 Performance Evaluation

5.1 Introduction

The final stage to complete the project is to test the system to get results and measure the performance of our system. This chapter shows all measurements needed to evaluate the performance such as delay and the data rate before and after the compression operation.

5.2 Sub-System Testing

This section will describe the main operations in the system. There are five main operations in this system. The first one is to enter to the system by setting the user name and the password, the second one is to connect to the GSM network, The third is checking the file extension, if it is video compressed it, the fourth transfer the file and store it at the client PC, the last operation is to display the file at the LED screen.

The operation of the system has been checked by make more than 50 trails of sending and displaying files and all of them have been succeeded without any failures.

5.3 Hardware Testing

This section shows GPRS modems testing.

GPRS modem has been tested as following:

1) The first test has a problem that the indicator light is red as shown in Figure 5.1, which means that the modem cannot register to any cellular network.

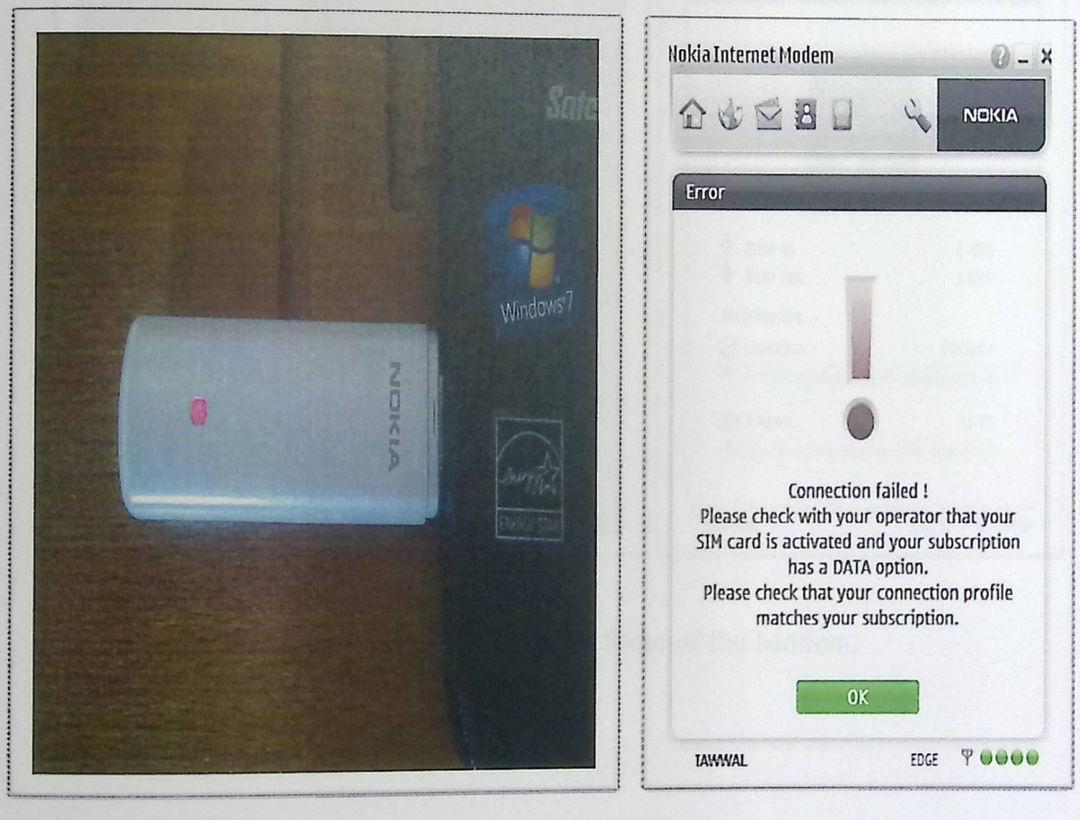


Figure 5.1: The Disconnected State of the Modem.

The second test solved the previous problem by set the IP of the SIM card as "STATIC" at the server and as "WAP "at the client. Figure 5.2 show the indicator light becomes green, which mean that the modem is registered to the GSM network.

Figure 5.2: The Connected State of the Modem.

5.4 Software Testing

5.4.1 Introduction

Checking and testing three softwares will be illustrated in this section. The first is the server software at the user side, the second is the client software at the LED screen side, and the last one will be a comparison between H.263 and Wavelet codes.

5.4.2 Client Software

- Open the client application from Microsoft visual studio 2010 program.
- Fill the user name and the password and sign in as shown in Figure 5.3.

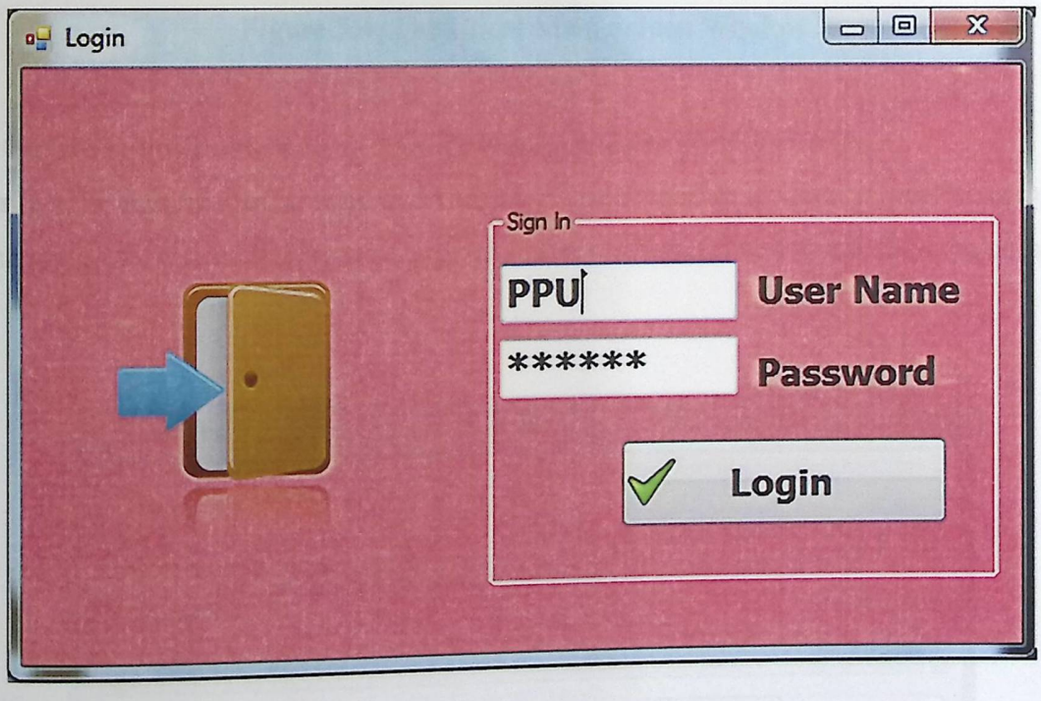


Figure 5.3: Login Window

5.4 Software Testing

5.4.1 Introduction

Checking and testing three softwares will be illustrated in this section. The first is the server software at the user side, the second is the client software at the LED screen side, and the last one will be a comparison between H.263 and Wavelet codes.

5.4.2 Client Software

- Open the client application from Microsoft visual studio 2010 program.
- Fill the user name and the password and sign in as shown in Figure 5.3.

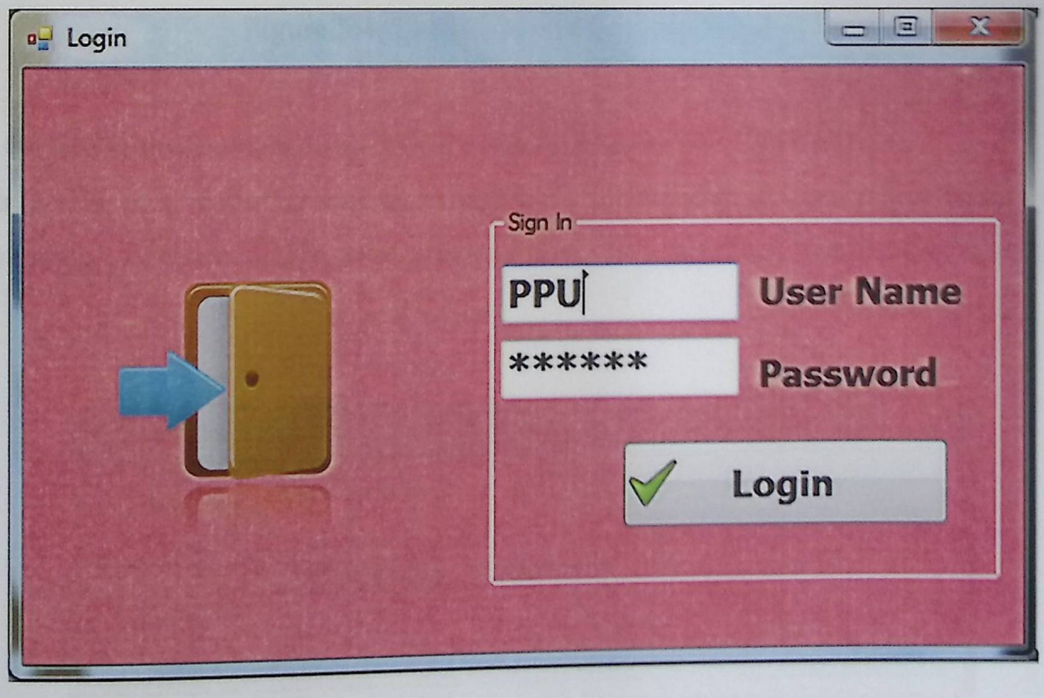


Figure 5.3: Login Window

- After sign in, the application will enter to the main screen window as shown in Figure 5.4.

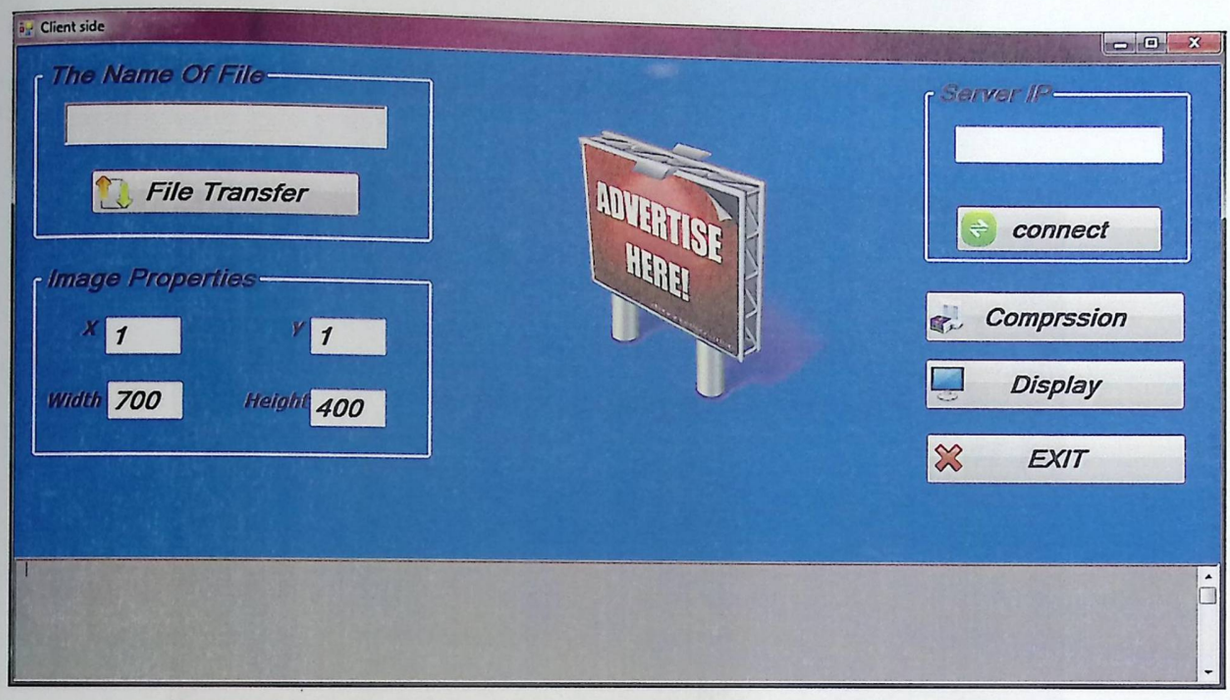


Figure 5.4: The Client Main Screen Window

- Open a connection with the receiver side by insert the static IP of the server.
- Transfer the file that needed to send and display it, but if the file is video it must be compressed before sending. As shown in Figure 5.5, firstly enter the name of the video, then the compressed format.

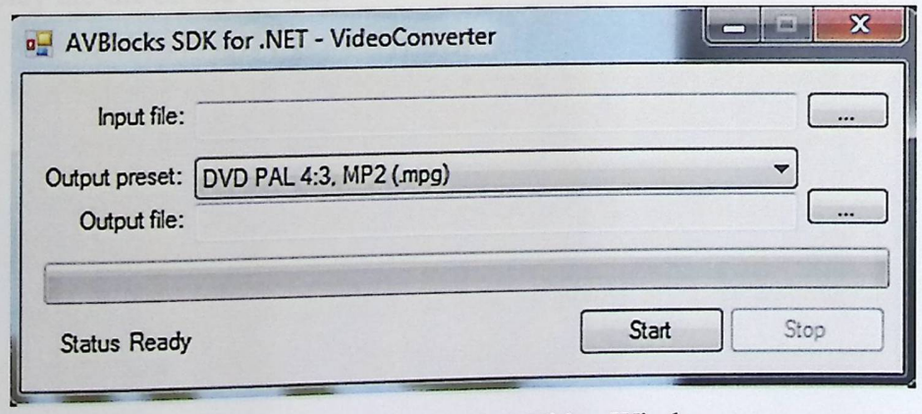


Figure 5.5: Compressed Video Window

5.4.3 Server Software

- Open the server application from Microsoft visual studio 2010 program, the application will enter to the main screen window as shown in Figure 5.6.

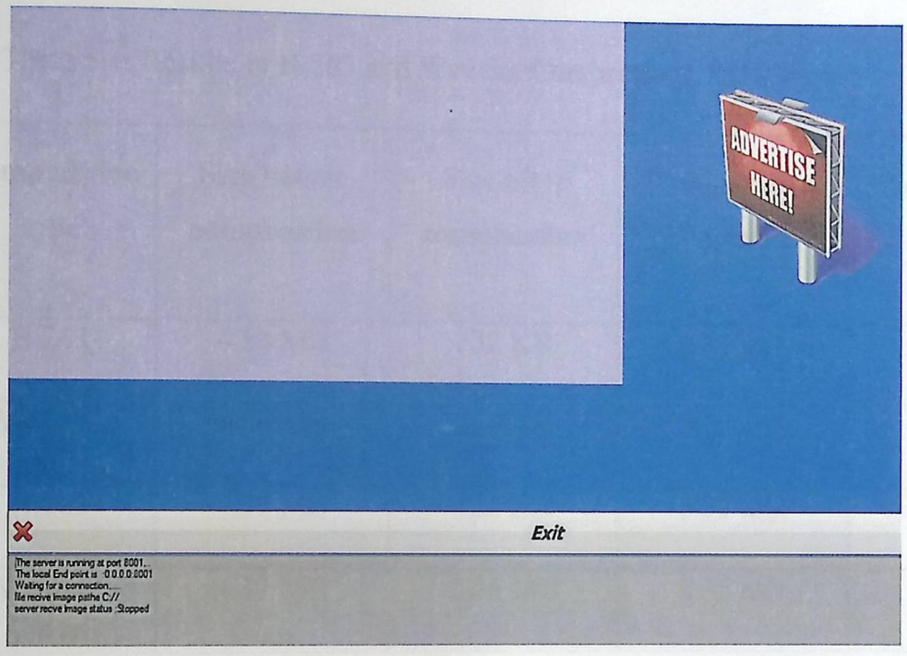


Figure 5.6: The Server Main Screen Window

- After that, the server will be able to receive the sending file.
- After receiving the file, it will be stored on the PC.
- Finally, display the file on the screen.

5.4.4 A Comparison between (H.263) and (Wavelet) Compression Algorithms

This section shows a comparison between two video compression algorithms (H.263) and (Wavelet), the main objective from this comparison is to select the higher performance between them and the results are shown in Table 5.1.

Table 5.1: Results of H.263 and Wavelet Compression Comparison.

Number of elements	Compression type	Size before compression	Size after compression	Compression time	Compression ratio
Video "1"	H.263	4.66 MB	332 KB	0.27 min	1 : 0.071
	Wavelet	4.66 MB	1.2 MB	0.27 min	1 : 0.25
Video "2"	H.263	4.37 MB	722 KB	0.35 min	1 : 16
	Wavelet	4.37 MB	2.86 MB	0.35 min	1 : 65

According to the results of Table 5.1 we conclude that H.263 algorithm is better than the Wavelet algorithm and this advantage will be explained as the following:

1- Wavelet has to encode and transmit each frame individually, unlike the H263 algorithm, which sends only the differences between a numbers of frames, ultimately meaning that the bandwidth requirements to transmit wavelet can be higher, with an increase in storage needs. Wavelet is more resilient to errors in transmission than H263; a small loss of data in a wavelet stream will be far less noticeable than the corresponding loss in an H263 stream.
2- Also, wavelet is computationally much more complex to decode than H263. This means that though wavelet can be decoded in software (for example on a generic PC CPU running a software application such as Kakadu), this can place quite a burden on the host CPU, leaving it

5.4.4 A Comparison between (H.263) and (Wavelet) Compression Algorithms

This section shows a comparison between two video compression algorithms (H.263) and (Wavelet), the main objective from this comparison is to select the higher performance between them and the results are shown in Table 5.1.

Table 5.1: Results of H.263 and Wavelet Compression Comparison

Number of elements	Compression type	Size before compression	Size after compression	Compression time	Compression ratio
Video "1"	H.263	[illegible]	382 KB	0.27 min	1 : 0.074
	Wavelet	[illegible]	[illegible]	0.27 min	1 : 0.25
Video "2"	H.263	[illegible]	[illegible]	[illegible]	1 : 16
	Wavelet	[illegible]	[illegible]	[illegible]	[illegible]

According [illegible]
Wavelet algo[illegible]

1- Wavelet [illegible] sends [illegible] requirem[illegible] more [illegible] be fa[illegible]

2- Also [illegible] though [illegible] softwa[illegible]

less capable of running other tasks, or in extreme cases leading to frames being dropped. This means that most of the time it is desirable to accelerate wavelet using a hardware-based decoder.

3- Supports five resolutions (CIF (Common Interchange Format'' is a format used to standardize the horizontal and vertical resolutions in pixels of YCbCr sequences in video signals''), QCIF (Quarter Common Interchange Format''), SQCIF, 4CIF and 16CIF).
4- Has a motion compensation capability, allowing optional incorporation of this technique in the coder.
5- It uses spatial redundancy (Elements that are duplicated within a structure, such as pixels in a still image and bit patterns in a file. Exploiting spatial redundancy is how compression is performed) as a compression advantage.
6- It enhanced robustness against data loss in the transmission channel.
7- It is used for bidirectional or unidirectional visual communication.
8- Supports flexible customized picture formats and custom picture clock frequencies
9- It is uses variable length coding to be transmitting symbols.
10- Supports international transmission systems, telephone circuits, telegraphy, facsimile and leased circuits.

5.5 Testing Scenarios

This section will show two testing scenarios as well as explaining the results, errors, and the challenges for each one. The second scenario will solve the problems that we faced in the first scenario to get high performance.

Test 1

The first test is applied on sending images (JPG, PNG…) and Flash motion (SWF) at different sizes.

Results:

- Transmitting time: the time is changing according to the size of the sending data (10s - 5min).
- Time to connect on GSM network: 2 seconds
- Time to start displaying: 1second.
- Probability of failure: zero (no GPRS error).

Errors

While testing the system the following errors happened:

- Image or SWF with size more than 2MB is completely received but cannot be displayed.
- There are a failing during sending videos.
- Dimensions of images and SWF are not suitable on the LED screen.
- The client does not send any acknowledgement shows that the transmitted file has been received completely

Challenges

The mentioned errors bring the following challenges:

- Give perfect solution to solve the problem of sending videos.
- Solve the problem of large sizes (more than 2MB) which cannot be displayed.
- Make a free control in the dimensions of each image.
- Sending an acknowledgement message after transmitting finished.

Test 2

The second test is applied on compressing and sending videos.

Results:

- Compression time: the time is approximately 1minutes.
- Transmitting time: the time is changing according to the video size (1min - 10min).
- Time to connect on GSM network: 2 seconds
- Time to start displaying: 1second.
- Probability of failure: zero (no GPRS error).

Errors

- There are not any errors in the final test except that the data rate of the GPRS network is very low, and this can be solved by using the third generation network (3G).

5.6 Performance Evaluation

We have decided to evaluate the system performance using the following measures:

1) **Delay:** it is a significant factor which defines how long the file takes to completely arrive at the receiver side from the beginning.

2) **Data Rate:** the data rate of GSM network is 171.5 Kb/s; in this system we can measure the data rate depending on the size of the transmitting file, and the transmission time of the file from server to client. The data rate is calculated by dividing the size of file by the delay.

$$Data\ Rate(Kbps) = \frac{Size\ (Kb)}{Delay\ (s)}$$

3) **Size of video before and after compression:** after applied the compression algorithm for each video to reduce the size of it, the time of transmission must be decrease, and the data rate must be improved.

Table 5.2 shows the results of many trails applied on the system, with related information for each file such as type, size, delay, data rate, and the relation between all of this measured before and after compression.

Table 5.2: Testing Results

Trails description		Before compression			After compression		
Number	Type	Size(KB)	Delay(s)	Data Rate(Kb/s)	Size(KB)	Delay(s)	Data Rate(Kb/s)
1	Image	34.6	9	30.75	****	****	****
2	Image	60.4	11.94	40.46	****	****	****
3	Image	104	18.11	45.94	****	****	****
4	Image	705	63	89.52	****	****	****
5	SWF	29	9	25.778	****	****	****
6	SWF	116	15	61.867	****	****	****
7	SWF	588	46	102.26	****	****	****
8	SWF	1,308	147	71.183	****	****	****
9	Video	25000	****	****	1,959	250	62.688
10	Video	20000	****	****	1,432	200	57.28
11	Video	12000	****	****	758	120	50.533

$$AveregeData\ Rate(Kbps) = \frac{\sum Data\ rate}{Number\ of\ Trails} = \frac{638.26}{11} \approx 58Kbps$$

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

This chapter describes the real learning outcomes have been acquired during the work on the project, we will mention what we achieved in this project, and the conclusion for all things that we have done, also we will talk about the challenges that we faced and ending with recommendations needed for the future work.

6.2 Problems

Many problems, challenges, and issues have been faced during the work on the project. Many experiments, suggestions, ideas and researches have been carried out to deal with the different situations. Some of these problems are:

1) The Availability of the quantity and the quality of some of the Project's equipment.
2) The Israeli Restrictions on the imported equipment and the delay that occurs accordingly.
3) Problems with transfer data over GPRS technology, due to the low data rate, which means more delay with high cost.

6.3 Acquired Learning Outcomes

After accomplishing, the project tasks many talents and abilities have been achieved as:

1) We have learned C# programming language.
2) We have learned how to interface the PC with the LED screen through the sending and the receiving cards.
3) We have learned how to make a connection by TCP/IP.
4) We have learnt how to configure the GPRS modems.
5) We have learned how to control the LED screen, by building a software system for this purpose.

2) We have learned how to interface the PC with the LED screen through the sending and the receiving cards.
3) We have learned how to make a connection by TCP/IP.
4) We have learned how to configure the GPRS modems.
5) We have learned how to control the LED screen, by building a software system for this purpose.
6) We have developed our abilities in troubleshooting and problem solving.

6.4 Conclusion

1) We have sent images, SWF, and videos to the LED monitor successfully.
2) We have compressed the videos using H.263, which the video still have a good quality and resolution.
3) We make a success connection to the LED monitors through GSM network, which permits to control the transmitted and received advertisement to show it on the LED monitor.

6.5 Recommendation for future work

At the end, some ideas can be given to develop the system or extend its duties and functions, and some recommendations can be given for moving forward to avoid the problems that may happen in the future as:

1) Develop a network connection between multi LED monitors controlling by one user.
2) Applied this system by using 3G or LTE networks.

APPENDIX A

Transmitted Side (Client) Code

Receiver Side (Server) Code

Transmitted Side (Client) Code

```
using System;
using System.Collections.Generic;
using System.ComponentModel;
using System.Data;
using System.Drawing;
using System.Linq;
using System.Text;
using System.Threading.Tasks;
using System.Windows.Forms;
using System.Net;
using System.Net.Sockets;
using System.IO;
using System.Diagnostics;
using Microsoft.VisualBasic;


namespace winclient
{
    public partial class Form1 : Form
    {
        TcpClient tcpclnt = new TcpClient();
        public Form1()
        {
            InitializeComponent();
        }
        public void connect()
        {
            try
            {
```

```
            stat.Text += ("Connecting.....\n");
            tcpclnt.Connect(textBox5.Text, 8001); //use the IP address as in the server
            stat.Text += ("Connected\n");
            FTClientCode.SendFile("", textBox5.Text);
            stat.Text += ("Enter the string to be transmitted : \n");
            send.Enabled = true;
        }
        catch (Exception ex)
        {
            Console.WriteLine("Error..... " + ex.StackTrace);
        }
    }
    private void Form1_Load(object sender, EventArgs e)
    {

    }
    private void button1_Click(object sender, EventArgs e)
    {
           //store all information you want to send it to server in variable store.
(name of pic and h&w and position)
            String str = send.Text+ "|" + textBox1.Text + "|" + textBox2.Text + "|" +
textBox3.Text + "|" + textBox4.Text;
            System.IO.Stream stm = tcpclnt.GetStream();
            ASCIIEncoding asen = new ASCIIEncoding();
            byte[] ba = asen.GetBytes(str);
            stat.Text += ("Transmitting.....\n");

             stm.Write(ba, 0, ba.Length);
            byte[] bb = new byte[100];
           // int k = stm.Read(bb, 0, 1);
           // for (int i = 0; i < k; i++)
           // stat.Text += (Convert.ToChar(bb[i]));
            str = "";

      //  tcpclnt.Close();
    }
    private void button3_Click(object sender, EventArgs e)
```

```
        {
            String str = send.Text + "|" + textBox1.Text + "|" + textBox2.Text + "|" +
textBox3.Text + "|" + textBox4.Text;
            System.IO.Stream stm = tcpclnt.GetStream();
            ASCIIEncoding asen = new ASCIIEncoding();
            byte[] ba = asen.GetBytes(str);
            stat.Text += ("Transmitting.....\n");
            stm.Write(ba, 0, ba.Length);
            byte[] bb = new byte[100];
            int k = stm.Read(bb, 0, 1);
            for (int i = 0; i < k; i++)
                stat.Text += (Convert.ToChar(bb[i]));
            str = "";
        }
        private void timer1_Tick(object sender, EventArgs e)
        {
            label8.Text = FTClientCode.curMsg;
        }
        private void button2_Click(object sender, EventArgs e)
        {
            FileDialog fDg = new OpenFileDialog();
            if (fDg.ShowDialog() == DialogResult.OK)
            {
                FTClientCode.SendFile(fDg.FileName,textBox5 .Text );
                string x = fDg.FileName;
                string[] arr= x.Split('\\');
                send.Text = arr[arr.Length-1];
            }
        }

        private void button4_Click(object sender, EventArgs e)
        {
            connect();
        }

        private void groupBox3_Enter(object sender, EventArgs e)
        {
```

```
        private void button3_Click_1(object sender, EventArgs e)
        {
            Application.Exit();
        }

        private void Form1_FormClosing(object sender, FormClosingEventArgs e)
        {
            Application.Exit();
        }
       /* private void ww_DoWork(object sender, DoWorkEventArgs e)
        {
            Service(listener);
       */

        private void button5_Click(object sender, EventArgs e)
        {
            string[] Files = Directory.GetFiles("C:\\", "*.*")
                                      .Select(path => Path.GetFileName(path))
                                      .ToArray();
          //  comboBox1.DataSource = Files;


            ProcessStartInfo startInfo = new
rocessStartInfo("VideoConverter.clr4.x64.exe");
            startInfo.WindowStyle = ProcessWindowStyle.Normal;

            Process.Start(startInfo);



          //  comboBox1.DataSource = Files;
```

```
    }


}
/*000000000000000000000000000000*/
class FTClientCode
{
    public static string curMsg = "Idle";
    public static void SendFile(string fileName,string ip)
    {
        try
        {
            IPAddress[] ipAddress = Dns.GetHostAddresses(ip);
            IPEndPoint ipEnd = new IPEndPoint(ipAddress[0], 5656);
            Socket clientSock = new Socket(AddressFamily.InterNetwork, SocketType.Stream,
ProtocolType.IP);
            string filePath = "";
            fileName = fileName.Replace("\\", "/");
            while (fileName.IndexOf("/") > -1)
            {
                filePath += fileName.Substring(0, fileName.IndexOf("/") + 1);
                fileName = fileName.Substring(fileName.IndexOf("/") + 1);
            }
            byte[] fileNameByte = Encoding.ASCII.GetBytes(fileName);
            if (fileNameByte.Length > 850 * 1024)
            {
                curMsg = "File size is more than 850kb, please try with small file.";
                return;
            }
            curMsg = "Buffering ...";
            byte[] fileData = File.ReadAllBytes(filePath + fileName);
            byte[] clientData = new byte[4 + fileNameByte.Length + fileData.Length];
            byte[] fileNameLen = BitConverter.GetBytes(fileNameByte.Length);

            fileNameLen.CopyTo(clientData, 0);
```

```
                fileNameByte.CopyTo(clientData, 4);
                fileData.CopyTo(clientData, 4 + fileNameByte.Length);

                curMsg = "Connection to server ...";
                clientSock.Connect(ipEnd);

                curMsg = "File sending...";
                clientSock.Send(clientData);

                curMsg = "Disconnecting...";
                clientSock.Close();
                curMsg = "File transferred.";

            }
            catch (Exception ex)
            {
                if (ex.Message == "No connection could be made because the target machine
actively refused it")
                    curMsg = "File Sending fail. Because server not running.";
                else
                    curMsg = "File Sending fail." + ex.Message;
            }
        }
    }
}
```

Received Side (Server) Code

```
ısing System;
ısing System.Collections.Generic;
ısing System.ComponentModel;
using System.Data;
using System.Drawing;
using System.Linq;
using System.Text;
using System.Threading.Tasks;
using System.Windows.Forms;
using System.Net.Sockets;
using System.Net;
using System.IO;
namespace winserv
{
    public partial class Form1 : Form
    {

        Socket s;
        TcpListener myList;
        public Form1()
        {
            InitializeComponent();
        }

        private void Form1_Load(object sender, EventArgs e)
        {

            FTServerCode.receivedPath = "C://";
            System.Windows.Forms.Control.CheckForIllegalCrossThreadCalls = false;
            try
            {
                //IPAddress ipAd = IPAddress.Parse("127.0.0.1"); //use local m/c IP address,
and use the same in the client
```

```
            /* Initializes the Listener */
            myList = new TcpListener(IPAddress.Any , 8001);

            /* Start Listeneting at the specified port */
            myList.Start();
            richTextBox1.Text += ("The server is running at port 8001...\n");
            richTextBox1.Text += ("The local End point is  :" + myList.LocalEndpoint +
"\n");
            richTextBox1.Text += ("Waiting for a connection.....\n");
            richTextBox1.Text+=("file recive image pathe C:// \n");
            richTextBox1.Text += ("server recve image status :"+ FTServerCode.curMsg);
            backgroundWorker1.RunWorkerAsync();
            backgroundWorker3.RunWorkerAsync();

        }
        catch (Exception ex)
        {
            Console.WriteLine("Error..... " + ex.StackTrace);
        }
    }

    private void backgroundWorker1_DoWork(object sender, DoWorkEventArgs e)
    {
        s = myList.AcceptSocket();
    }
    private void backgroundWorker1_RunWorkerCompleted(object sender,
RunWorkerCompletedEventArgs e)
    {
        richTextBox1.Text += ("Connection accepted from " + s.RemoteEndPoint + "\n");
        backgroundWorker2.RunWorkerAsync();

        /* clean up */
        //s.Close();
        //myList.Stop();
    }
    private void backgroundWorker2_DoWork_1(object sender, DoWorkEventArgs e)
```

```
    {
        try
        {
            while (true)
            {
                byte[] b = new byte[5000];
                int k = s.Receive(b);
                richTextBox1.Text += ("Recieved...\n");
                for (int i = 0; i < k; i++)
                {
                    richTextBox1.Text += (Convert.ToChar(b[i]));//the data who recive it
and
                    textBox1.Text += (Convert.ToChar(b[i]));//stor it in textbox1 to
seprate the data
                }
                string ss;
                string[] strArr = null;
                ss = textBox1.Text;
                strArr = ss.Split('|');//betwen each data seperat by char "|" and this
to seperate between it.
                bool _jpg = strArr[0].EndsWith(".jpg");
                bool _swf = strArr[0].EndsWith(".swf");
                bool _mp4 = strArr[0].EndsWith(".mp4");

                if (_jpg)
                {
                    pictureBox1.ImageLocation = "C://" + strArr[0]; //path of pic
strArr[0]=name of image
                    swf.Visible = false;
                    axWindowsMediaPlayer1.Visible = false;
                    pictureBox1.Visible = true;
                }
                else if (_swf)
                {
                    swf.LoadMovie(0, "C:\\" + strArr[0]);

                  pictureBox1.Visible = false;
```

```
                axWindowsMediaPlayer1.Visible = false;
                    swf.Visible = true;
                }
                else if (_mp4)
                {

                    axWindowsMediaPlayer1.URL = @"C:\\" + strArr[0];
                    //axWindowsMediaPlayer1.URL(0, "C:\\" + strArr[0]);
                    axWindowsMediaPlayer1.Visible = true;

                    pictureBox1.Visible = false;
                    swf.Visible = false;
                }
                    if (strArr[1] == "" || strArr[2] == "")
                    {
                        strArr[1] = "100";
                        strArr[2] = "100";
                    }

                pictureBox1.Location = new Point(Convert.ToInt32(strArr[2]),
Convert.ToInt32(strArr[1]));//strArr[2]=x, 1=y


                if (strArr[3] == "" || strArr[4] == "")
                {
                    strArr[3] = "100";
                    strArr[4] = "100";
                }


                pictureBox1.Width = Convert.ToInt32(strArr[3]);
                pictureBox1.Height = Convert.ToInt32(strArr[4]);
                textBox1.Text = "";
                ASCIIEncoding asen = new ASCIIEncoding();
               // s.Send(asen.GetBytes("The string was recieved by the server.\n"));
                richTextBox1.Text += ("\nSent Acknowledgement\n");
                System.Threading.Thread.Sleep(1000);
```

```
            //  backgroundWorker1.RunWorkerAsync();

        }
        }
        catch (Exception ex) { }

    }
    private void button2_Click_1(object sender, EventArgs e)
    {
        Close();
    }

    private void button1_Click(object sender, EventArgs e)
    {
        FolderBrowserDialog fd = new FolderBrowserDialog();
        if (fd.ShowDialog() == DialogResult.OK)
        {
            FTServerCode.receivedPath = fd.SelectedPath;
        }
    }



    FTServerCode obj = new FTServerCode();
    private void backgroundWorker3_DoWork(object sender, DoWorkEventArgs e)
    {
        while (true)
        {
            obj.StartServer();
        }
    }
    /*0000000000000000000000*/
    class FTServerCode
    {
        IPEndPoint ipEnd;
        Socket sock;
        public FTServerCode()
```

```
        {
            ipEnd = new IPEndPoint(IPAddress.Any, 5656);
            sock = new Socket(AddressFamily.InterNetwork, SocketType.Stream,
ProtocolType.IP);
            sock.Bind(ipEnd);
        }
        public static string receivedPath;
        public static string curMsg = "Stopped";
        public void StartServer()
        {
            try
            {
                curMsg = "Starting...";
                sock.Listen(1000);
                curMsg = "Running and waiting to receive file.";
                Socket clientSock = sock.Accept();
                byte[] clientData = new byte[4096 * 10000];

                int receivedBytesLen = clientSock.Receive(clientData);
                curMsg = "Receiving data...";

                int fileNameLen = BitConverter.ToInt32(clientData, 0);
                string fileName = Encoding.ASCII.GetString(clientData, 4, fileNameLen);

                BinaryWriter bWrite = new BinaryWriter(File.Open(receivedPath + "/" +
fileName, FileMode.Append)); ;

                bWrite.Write(clientData, 4 + fileNameLen, receivedBytesLen - 4 -
fileNameLen);
                int recived2 = clientSock.Receive(clientData);
                while (recived2 > 0)
                {
                    bWrite.Write(clientData, 0, recived2);
                    recived2 = clientSock.Receive(clientData);
                }
                curMsg = "Saving file...";
                bWrite.Close();
```

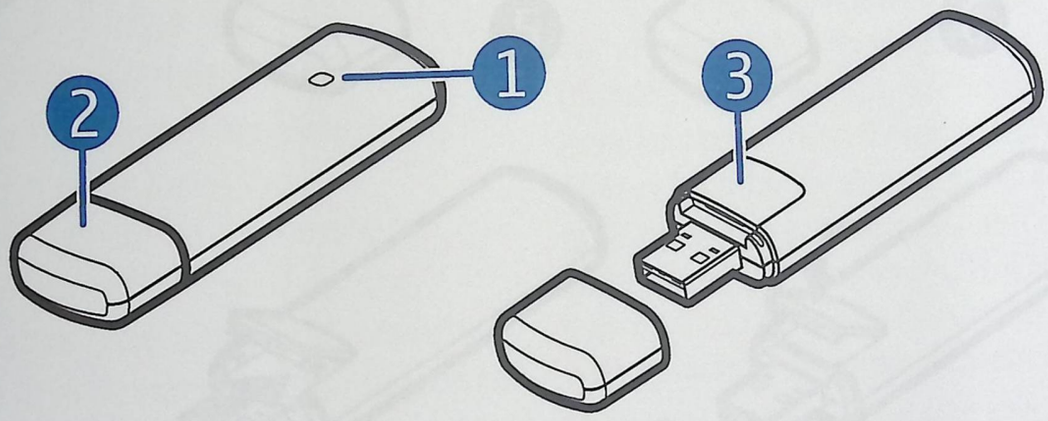
```
                clientSock.Close();
                curMsg = "Reeived & Saved file; Server Stopped.";
            }
            catch (Exception ex)
            {
                curMsg = "File Receving error.";
            }
        }
    }

    private void pictureBox1_SizeChanged(object sender, EventArgs e)
    {

        swf.Width = pictureBox1.Width;
        swf.Height = pictureBox1.Height;

    }

    private void pictureBox1_LocationChanged(object sender, EventArgs e)
    {

        swf.Location = new Point( pictureBox1.Location.X,  pictureBox1.Location.Y);

    }

    private void pictureBox2_Click(object sender, EventArgs e)
    {
        swf.Location = new Point(pictureBox1.Location.X, pictureBox1.Location.Y);

    }


}
}
```

APPENDIX B

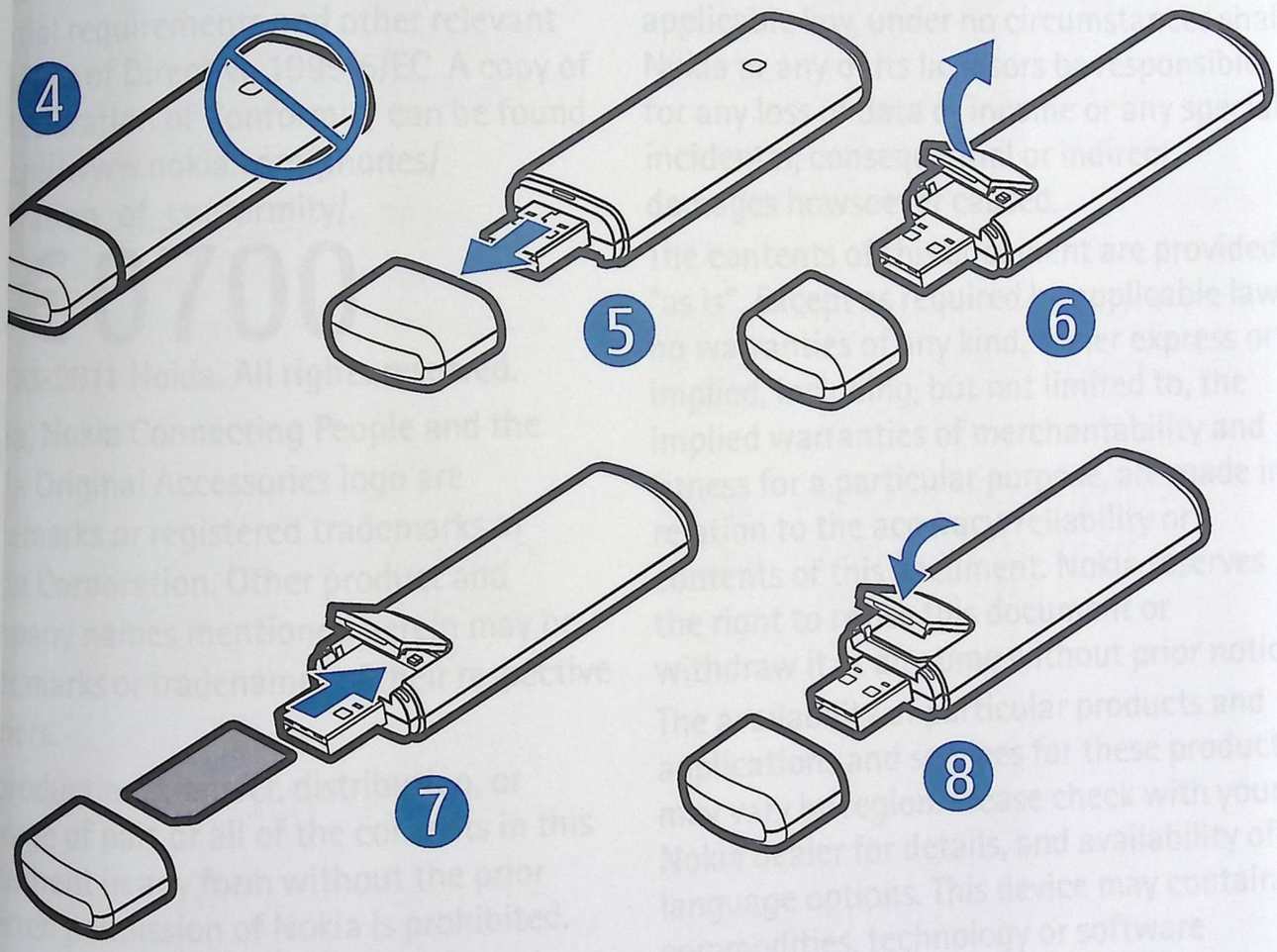
Data Sheet of the GPRS Modem

"Nokia Internet Stick CS-11"

Nokia Internet Stick CS-11



Issue 2.0


4
5
6
7
8

CLARATION OF CONFORMITY

reby, NOKIA CORPORATION declares that s RD-15 product is in compliance with the ential requirements and other relevant visions of Directive 1999/5/EC. A copy of Declaration of Conformity can be found http://www.nokia.com/phones/ claration_of_conformity/.

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The availability of particular products and applications and services for these products may vary by region. Please check with your Nokia dealer for details, and availability of language options. This device may contain commodities, technology or software subject to export laws and regulations from the US and other countries. Diversion contrary to law is prohibited.

SAFETY

Read these simple guidelines. Not following them may be dangerous or illegal. Read the complete user guide for further information.

SWITCH ON SAFELY
Do not switch the device on when wireless phone use is prohibited or when it may cause interference or danger.

INTERFERENCE
All wireless devices may be susceptible to interference, which could affect performance.

SWITCH OFF IN RESTRICTED AREAS
Follow any restrictions. Switch the device off in aircraft, near medical equipment, fuel, chemicals, or blasting areas.

QUALIFIED SERVICE
Only qualified personnel may repair this product.

WATER-RESISTANCE
Your device is not water-resistant. Keep it dry.

About your device

The wireless device described in this guide is approved for use on the (E)GSM 850, 900, 1800, and 1900, and UMTS 850/1900/2100 HSPA networks. Contact your service provider for more information about networks.

During extended operation, such as a high speed data connection, the device may feel warm. In most cases, this

condition is normal. If you suspect the device is not working properly, take it to the nearest authorised service facility.

When connecting to any other device, read its user guide for detailed safety instructions. Do not connect incompatible products.

Network services

To use the device you must have service from a wireless service provider. Some features are not available on all networks; other features may require that you make specific arrangements with your service provider to use them. Network services involve transmission of data. Check with your service provider for details about fees in your home network and when roaming in other networks. Your service provider can explain what charges will apply. Some networks may have limitations that affect how you can use some features of this device requiring network support.

Introduction

The Nokia Internet Stick CS-11 is a wireless modem that lets you transfer data in cellular networks.

To use the device with your computer, you need the Nokia Internet Modem application that is automatically installed when you connect the device to the computer for the first time.

Read this guide carefully before using the device. Also read the user guides for the Nokia Internet Modem application, your computer, operating

system, and any software that you use with the internet connection set up through the device.

For additional information, go to www.nokia.com/support or your local Nokia website.

The operating temperature of this device is -15°C to 35°C (5°F to 95°F), and the storage temperature is -40°C to 85°C (-40°F to 185°F).

Warning: The plug of this device may contain a small amount of nickel. Persons who are sensitised to nickel may have symptoms from prolonged skin contact with the plug.

Read the user guide for Nokia Internet Modem

To read the user guide for the Nokia Internet Modem application, you must have a PDF reader application installed on your computer. You can download the PDF reader, for example, from the Adobe website.

To access the user guide, select the question mark (*Help*) in the main view of the Nokia Internet Modem application. The user guide is displayed in the language that you selected during the installation of the application.

Supported hardware and software

The USB plug on the device supports the data transfer rates defined in the USB specification version 2.0.

To use the device for data transfer with your computer, the computer must have a 500 MHz 32-bit (x86) or 64-bit (x64) processor or faster, a compatible USB port, and 350 megabytes of available space on the hard disk. You also need one of the following operating systems: Microsoft Windows XP (Service Pack 2

with Hotfix KB943198, or Service Pack 3 or newer), Microsoft Windows Vista, Windows 7, Linux Ubuntu 9.04, or Apple Mac OS 10.4, 10.5, or 10.6.

Microsoft Windows XP 64-bit Edition is not supported.

Get started

The device contains the following parts shown on the title page: indicator light (1), USB plug covered with a protection cap (2), and cover of the SIM card slot (3).

Antenna locations

Your device has internal antennas. Avoid touching the antenna area (4) unnecessarily while the antenna is transmitting or receiving. Contact with antennas affects the communication quality and may cause a higher power level during operation and may reduce the computer battery life.

Insert the SIM card

Warning: Keep the protection cap out of the reach of small children.

1. Remove the protection cap (5).
2. Lift the cover of the SIM card slot (6).
3. Insert the SIM card (7).

   Ensure that the contact surface on the card is facing down, and the bevelled corner is on the right.
4. To close the cover, press it against the device (8), and slide it into place.

First time setup

To set up the device for your computer, you may need the administrator rights for the operating system. You may also need to change the firewall settings of your operating system to let the device access the internet.

1. Ensure that a SIM card is inserted in the device.
2. Remove the protection cap from the USB plug.
3. Switch on your computer, and connect the device to the USB port on the computer, so that the Nokia logo is facing up.

   

   Tip: To connect the device to a compatible computer using the Nokia Connectivity Cable CA-175D, connect the cable to the USB plug and the USB port on the computer.
4. To install the device and the Nokia Internet Modem application, do one of the following:
   - In Windows, the installer opens automatically if the autorun feature is enabled.

     If the autorun feature is disabled or your Windows version does not support it, in Windows Explorer, double-click the Nokia Internet Modem drive and then the setup.exe file.
   - In Mac OS, double-click the Nokia Internet Modem drive and then the Nokia Internet Modem icon.
   - In Linux, double-click the CD drive and then the nokiaInternetmodem.deb icon. Select Install Package.
5. Select the desired language from the list, and select *OK*. Follow the displayed instructions.

Carefully read the end-user license agreement and accept it.

The application and the needed drivers are installed on your computer. The installation may take several minutes.

6. Based on your SIM card, the device automatically tries to define the settings for the cellular network of your service provider (operator).
7. When prompted, enter the personal identification number (PIN) code of your SIM card. The PIN code helps to protect your SIM card against unauthorised use and is usually supplied with the card.

   The main view of the Nokia Internet Modem application is displayed.
8. To exit the Nokia Internet Modem application, select **X**.
9. To disconnect the device from the computer, unplug the device from the USB port.

   You may need to stop the device before disconnecting it, if your operating system supports this function.

Indicator light

If the indicator light is red, the device cannot register to a cellular network because the SIM card is not valid or properly inserted or cannot find a supported network in your location. If the red light flashes, the device is not registered to a cellular network because you have not entered the PIN code, if the PIN code request is enabled in the Nokia Internet Modem application.

If the indicator light is green, the device is registered to a GSM network and transferring data. If the green light flashes, the device is registered

to a GSM network, but the data connection is not active.

If the indicator light is blue, the device is registered to a 3G network and transferring data. If the blue light flashes, the device is registered to a 3G network, but the data connection is not active.

Uninstall

To uninstall the device and the Nokia Internet Modem application from your computer, do one of the following:

- In Windows, select the uninstall application from the Start menu.
- In Mac OS, select the uninstall icon in the Nokia folder.
- In Linux, use the package manager.

Connect to the internet

For the availability of data services, pricing, and tariffs, contact your service provider.

1. When a SIM card is inserted in the device, switch on the computer, and connect the device to the computer.
2. If the Nokia Internet Modem application does not start automatically, do one of the following:
   - In Windows, start the application from the Start menu. For example, in Windows XP, select Start > Programs > Nokia > Nokia Internet Modem > Nokia Internet Modem.
   - In Mac OS, select the application from the Finder.

- In Linux, select Applications > Internet > Nokia Internet Modem.

3. If prompted, enter the PIN code of your SIM card.
4. Check the network indicator light to see whether a network connection is available.
5. To connect to the internet, select *Internet Connection* > ⇄. Start using the connection with the software you want.

   During data transfer, the *Internet Connection* window shows the transmission rate of sent (*Rate out*) and received (*Rate in*) data, the duration of the current session, and the total amount of data sent and received during the session (*Volume*).

   If the computer enters standby or hibernation mode, data transfer may stop. Using the device for data transfer increases the demand on computer battery power and reduces the battery life.
6. To close the connection, in the *Internet Connection* window, select ⇄.

   To exit the application, select **X**. This also closes the connection.

To minimise the application without closing the active connection, select ▬. To restore the application window, select the icon of the minimised application.

Taking care of your device

Your device is a product of superior design and craftsmanship and should be

treated with care. The following suggestions will help you protect your warranty coverage.

- Keep the device dry. Precipitation, humidity, and all types of liquids or moisture can contain minerals that will corrode electronic circuits. If your device does get wet, allow it to dry completely.
- Do not use or store the device in dusty, dirty areas. Its moving parts and electronic components can be damaged.
- Do not store the device in high or cold temperature. High temperatures can shorten the life of electronic devices, damage batteries, and warp or melt certain plastics. When the device warms to its normal temperature from a cold temperature, moisture can form inside the device and damage electronic circuit boards.
- Do not attempt to open the device other than as instructed in this guide.
- Do not drop, knock, or shake the device. Rough handling can break internal circuit boards and fine mechanics.
- Do not use harsh chemicals, cleaning solvents, or strong detergents to clean the device. Only use a soft, clean, dry cloth to clean the surface of the device.
- Do not paint the device. Paint can clog the moving parts and prevent proper operation.

These suggestions apply equally to your device or any accessory.

Recycle

Always return your used electronic products, batteries, and packaging materials to dedicated collection points. This way you help prevent uncontrolled waste disposal and promote the recycling of materials. Check product environmental information and how to recycle your Nokia products at www.nokia.com/werecycle, or nokia.mobi/werecycle.

The crossed-out wheeled-bin symbol on your product, battery, literature, or packaging reminds you that all electrical and electronic products, batteries, and accumulators must be taken to separate collection at the end of their working life. This requirement applies in the European Union. Do not dispose of these products as unsorted municipal waste. For more environmental information, see the product Eco-Declarations at www.nokia.com/environment.

Additional safety information

Small children

Your device and its accessories are not toys. They may contain small parts. Keep them out of the reach of small children.

Operating environment

This device model has been tested and meets RF exposure guidelines when positioned at least 0.5 centimetre (1/5 inch) away from the body when plugged directly into a USB port on the host device or used at the end of the Nokia Connectivity Cable CA-175D that may be supplied in the sales package.

Medical devices

Operation of any radio transmitting equipment, including wireless phones, may interfere with the function of inadequately protected medical devices. Consult a physician or the manufacturer of the medical device to determine whether they are adequately shielded from external RF energy. Switch off your

device when regulations posted instruct you to do so. Hospitals or health care facilities may use equipment sensitive to external RF energy.

Implanted medical devices

Manufacturers of medical devices recommend a minimum separation of 15.3 centimeters (6 inches) between a wireless device and an implanted medical device, such as a pacemaker or implanted cardioverter defibrillator, to avoid potential interference with the medical device. Persons who have such devices should:

- Always keep the wireless device more than 15.3 centimeters (6 inches) from the medical device.
- Turn the wireless device off if there is any reason to suspect that interference is taking place.
- Follow the manufacturer directions for the implanted medical device.

If you have any questions about using your wireless device with an implanted medical device, consult your health care provider.

Hearing aids

Some digital wireless devices may interfere with some hearing aids.

Vehicles

RF signals may affect improperly installed or inadequately shielded electronic systems in motor vehicles such as electronic fuel injection, electronic antilock braking, electronic speed control, and air bag systems. For more information, check with the manufacturer of your vehicle or its equipment.

Only qualified personnel should service the device. Faulty service may be dangerous and may invalidate your warranty. Do not store or carry flammable liquids, gases, or explosive

materials in the same compartment as the device, its parts, or accessories.

Switch off your device before boarding an aircraft. The use of wireless teledevices in an aircraft may be dangerous to the operation of the aircraft and may be illegal.

Potentially explosive environments

Switch off your device in any area with a potentially explosive atmosphere. Obey all posted instructions. Sparks in such areas could cause an explosion or fire resulting in bodily injury or death. Switch off the device at refuelling points such as near gas pumps at service stations. Observe restrictions in fuel depots, storage, and distribution areas; chemical plants; or where blasting operations are in progress. Areas with a potentially explosive atmosphere are often, but not always, clearly marked. They include areas where you would be advised to turn off your vehicle engine, below deck on boats, chemical transfer or storage facilities and where the air contains chemicals or particles such as grain, dust, or metal powders. You should check with the manufacturers of vehicles using liquefied petroleum gas (such as propane or butane) to determine if this device can be safely used in their vicinity.

Certification information (SAR)

This mobile device meets guidelines for exposure to radio waves.

Your device is a radio transmitter and receiver. It is designed not to exceed the limits for exposure to radio waves recommended by international guidelines. These guidelines were developed by the independent scientific organisation ICNIRP and include safety margins designed to assure the protection of all persons, regardless of age and health.

The exposure guidelines for mobile devices employ a unit of measurement known as the Specific Absorption Rate or SAR. The SAR limit stated in the ICNIRP guidelines is 2.0 watts/kilogram (W/kg) averaged over 10 grams of tissue. Tests for SAR are conducted using standard operating positions with the device transmitting at its highest certified power level in all tested frequency bands. The actual SAR level of an operating device can be below the maximum value because the device is designed to use only the power required to reach the network. That amount changes depending on a number of factors such as how close you are to a network base station.

SAR values may vary depending on national reporting and testing requirements and the network band. Additional SAR information may be provided under product information at www.nokia.com.

This device model has been tested and meets RF exposure guidelines when positioned at least 0.5 centimetre (1/5 inch) away from the body when plugged directly into a USB port on the host device or used at the end of the Nokia Connectivity Cable CA-175D that may be supplied in the sales package.

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