The Nucleus **50**, No. 1 (2013) 33-43

**The Nucleus**
A Quarterly Scientific Journal of Pakistan Atomic Energy Commission
NCLEAM, ISSN 0029-5698

# UHF/VHF INTERNET TV BROADCASTING SYSTEM

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(Received January 22, 2013 and accepted in revised from March 13, 2013)

The internet has a great impact on information broadcasting. It provides greater storage capacity and fulfills the requirement of mobility that satisfy human desires. With this broadband service, Internet users can watch video contents all over the world. Conventional Televisions are not capable of receiving digital video streams like the streams from the internet. In our research work, we have developed a system such that TV can be made capable of receiving digital streams after converting it in analog format. This converted analog video is transmitted using high power TV transmitter.

**Keywords:** HDTV, RTSP, IPTV, NTLM

## 1. Introduction

Internet technology has revolutionised the way of communication. It has converged different broadcast applications in digital form. It is the great move from narrow band capacity to broad band capacity. Internet technology has rich effect on broadcast technologies such as HDTV. It provides us efficient interactivity and low delivery costs and on-demand services. Transmission of digital data over the internet on a broad basis is very appealing. Computers and television display technologies are almost similar. TV sets are utilizing the processing power of computer technology. Figure 1 shows the convergence of TV, computer and internet technology that provides a different way for broadcasting the internet television services.

Internet Television defines the broadcast of information from Television stations that add an internet interface to their over the air transmission. Internet Television technology delivers the video content over the internet by video streaming technology and allows the user to watch the video contents from archive of contents or content channel directory. Contents can be viewed directly to the media player or downloaded to the user's computer.

In audio systems baseband frequencies falls between 20 to 20 kHz and in audio systems it ranges from 0 Hz to 4MHz. Television broadcast system has standards for broadcasting information.

***Acronyms***

| Acronym | Narration |
|---|---|
| RTP | Real-time Transport Protocol |
| IPTV | Internet Protocol Television |
| HF | High Frequency |
| VHF | Very High Frequency |
| UHF | Ultra High Frequency |
| SHF | Super-High Frequency |
| EHF | Extremely-High Frequency |
| DECE | Digital Entertainment Content Ecosystem |
| LLC | Limited Liability Company |
| IE | Internet Explorer |
| MAC | Mackintosh |
| EM | Electromagnetic |
| PCB | Printed Circuit Board |
| NTLM | NT LAN Manager |
| HDTV | High Definition Television |
| RTSP | Real Time Streaming Protocol |

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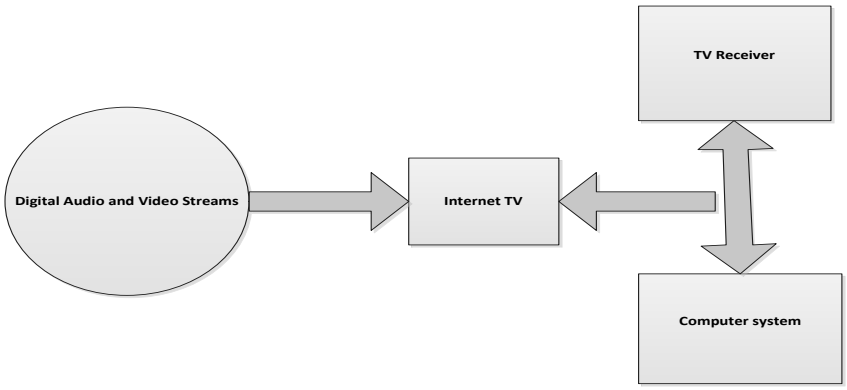


Figure 1. Convergence on internet TV.

### *1.1 Television Channels*

Television channels basically fall within three bands as shown in Table 1.

Table 1. Frequency distribution over TV channels.

| Channel Description | Channel Number |
|---|---|
| Low band Very High Frequency channel (VHF) | Channel number 2 through 6 |
| High band VHF channels | Channel number 7 through 13 |
| Ultra High Frequency(UHF) channels | Channel number 14 through 69 |

VHF Channel falls 30 to 300 MHz frequency band and UHF channel falls 300 to 3000 MHz frequency band. UHF and VHF bands require line of sight transmission which is limited to about 50-100 miles for VHF channels, or 25-40 miles for UHF channels.

In wireless transmission, the transmitter has an extensive line-of-sight as compared to wired transmission that extends for thousands of miles.

The International Telecommunication Union has allocated Channel frequencies. Range order is:

HF < VHF < UHF < SHF < EHF

These days, SHF frequency band is being used in applications related to measurement.

### *1.2. Literature Review*

Satellite TV is essentially a wireless system used to deliver TV programs to viewers all over the world. Due to the wireless nature of the technology, there is no need for physical infrastructure such as cable deployment to the consumer premises [1].

The connection of setup box attached to the TV uses the underground lines with coax cables. This setup of underground lines is used by the cable TV providers. On the other hand satellite TV provides satellite set up of throwing signals from satellites to the ground where subscription is required and purchased. Cable TV is expensive for its buried lines and few people can use it. Weather is the major issue in satellite television transmission. Awful weather situation may cause loss of information. In some regions this happens most of the time. Satellite television services become expensive with increasing the televisions connections.

The only really tricky aspect about satellite TV programming involves local channels, especially for those who live in rural areas. Some satellite TV companies have a charge for local channels. Free internet TV websites are supported by advertisements. Cable companies once offered the advantage of offering a clearer signal and fewer commercials but it is not always the case. Most channels constantly interrupt programming with annoying and sometimes offensive commercials. Sometimes users are asked to download some codec which is some kind of circuitivity or programs (computer instructions) which sometimes carry adware [2].

With multimedia streaming applications, Internet transmission services become wider. Some protocols exist to manage the bandwidth required for the transmitted data.

Real time control of information is somehow difficult to convey information in appropriate manner. From some Network protocols like the Real Time Streaming Protocol (RTSP), is one of

the best protocols that can provide many applications.

Most streaming servers are not designed to be controlled by some other entity other than the RTSP client that consumes the media. It also helps in the implementation of other streaming functionalities that are required for IPTV service delivery, but which are not implemented in the current open source streaming servers [3].

Information media have been introduced over the time as technological advances permitted, such as movie theaters, radio, telephone, television, cable networks, satellites, and computers. New communication supports are currently being developed such as the Internet and information highways.

Presently it is possible to combine all these communication technologies into one single support, called multimedia, which is also called technology convergence. Our relationship with communication media is changing, since users are now able to select subjects, create their own information content, and their own viewing schedules.

Multimedia communication uses combinations of pictures (text, graphics, animation, video, etc.) and sounds (music, voice, sound effects, etc.) to distribute and communicate information to users. These services can be transmitted over the air, via a network, or through local interfaces.

To deliver programming to the homes of their subscribers, cable TV companies must install and maintain a vast network of transmission lines. Business startup costs are high. It would be impractical to place cable lines to some sparsely populated areas. Even in some areas that already have cable service companies could be faced with the expensive prospect of replacing existing cables with fiber optic lines.

The research on “UHF/VHF internet TV broadcasting” provides new idea to broadcast live digital streaming on standard television by designing our own UHF/VHF TV transmitter. This idea provides a way to broadcast internet live streams on multiple standards TV sets at a time. Thus, making television capable to receive digital stream using UHF/VHF Transmitter and TV out card is a great innovation. This research is not only beneficial for watching television services and in business it is also very helpful for students to watch live lectures, classes and different projects.

### *1.3. Media Streaming Server*

The Media Streaming Server (MSS) System typically consists of a computer running and encoder, a media server and a number of client computers running a media player. The encoder converts both live and pre-recorded audio to a digital format and the media server distributes the content over a network or the Internet. Players then receive the content. The MSS System also includes a web server as an optional component. Optional components allow the MSS system to stream encrypted content to the media player client.

The network has to be capable of supporting TCP/IP traffic such as TCP and UDP. Firewall ports are required to be opened in order to all network traffic to flow between clients, servers, and encoders. For authenticated streaming, the server, encoders, and clients are required to support NTLM or digest.

The development of wireless communication technologies has changed our living style in global level. After the international success of mobile telephony standards, the location and time independent voice connection has become a default method in daily telecommunications. As for today, highly advanced multimedia messaging plays a key role in value added service handling [4].

Finally, in some cases the protocol does not provide a mechanism for a client to discover the URL of the server. Therefore, the client will need to discover this data another way. This is often done by putting a URL to the server as a hyperlink in a web page. It also can be done by way of a redirector file such as an .nsc file or .asx file.

In general, environment assumptions and preconditions are dependent on features and functional modes expected for the media streaming solution [5]. V/UHF band is occupied by various radio services and communication systems which are of interest for governmental agencies and forces [6]. Rich Internet applications which have many of the features and functionality of desktop software even though they run online have become increasingly important and popular [7].

### *1.4. Silverlight*

Silverlight lets developers rapidly build and deploy rich media applications for the Web and mobile devices. Audio/Video applications can be quickly and easily developed by Silverlight platform either it is on demand or live. It integrates Microsoft

Media Platform technologies for dynamic adaptive streaming over HTTP (Hypertext Transfer or Transport Protocol, the data transfer protocol used on the World Wide Web) and DECE-approved. Silverlight applications can run at different operating systems like Windows and MAC. Silverlight supporting browsers include IE, Mozilla and Safari.

### *1.5. ADCs and DACs*

Analog-to-digital converters provide digital data from the real world which is then used in different applications. Digital-to analog converters provides continued streams of data used in real world applications [8].

### *1.6. Internet TV*

Internet TV is conventional television obtained over the Internet. Rather than watching television programs broadcast over the air or over cable, television programs are accessed over the Internet and then watched in real time, using a technology known as video streaming [9]. A low pass amplifier is used in television and radar systems. FM signals require FM modulator and FM transmitter equipment for transmission. FM modulator specifies the frequency range. FM transmitter broadcasts the information defined by some range [10].

## 2. Methodology of Research

i. Capture the video by using existing software components.

ii. Convert the captured video into analog video using digital to analog transducer.

iii. Broadcasting the analog video on UHF/VHF bands using TV transmitter.

Standard TV sets are utilized for the reception of transmitted signals to present the video and audio contents broadcasted through this project at standard UHF/VHF channel frequencies.

### *2.1. Proposed System Organization*

For broadcasting EM signals to television sets a TV transmitter is used. Such a device can transmit video anywhere in the house or in some area and can be able to retransmit cable TV. Television Transmitter can be used with camera for monitoring applications. Following equipment is used to assemble the task that provides the idea to use TV sets for digital streams:

1. Antenna for VHF/UHF Transmitter.

UHF /VHF Transmitter consist of the following circuit modules:

   a. Video amplifier
   b. Filter circuit
   c. FM modulator
   d. Oscillator circuit
   e. RF amplifier
   f. Power amplifier

2. Indoor Reception Antenna for TV sets
3. Digital to analog transducer
4. Personal Computer System
5. TV set

### *2.2. System Description*

Figure 2 shows the UHF/VHF TV Transmitter block diagram. The block diagram is divided into two separate sections. Section one generates video signal corresponding to the actual picture and then uses this video signal to modulate an R-F carrier so as to be applied to the transmitting antenna for transmission, another section that generates audio signal contains sound information and then uses this signal to modulate another RF carrier and then applied to the transmitting antenna for transmission. However, Audio and video signals are transmitted by only one antenna. Thus some appropriate network is used to combine together these modulated signals. Oscillator generates an RF carrier frequency.

This carrier is then fed to an amplitude modulator in video transmitter and a frequency modulator in audio transmitter. The modulation signal with proper amplitude is fed into the modulator. Since employed modulation is low-level, the modulating signal is amplified by amplifiers up-to the desired degree required for transmission. The modulated signals are combined together in a combining network before they are fed to the common transmitting aerial system. L In and R In are left and right input connections.

### *2.3. Schematic Description*

Figure 3 is the schematic of a UHF/VHF Television transmitter. Sound signals are applied to the base of Q1 using Capacitor C1 and Resistor R1. This signal is modulated by the 4.5 MHz carrier frequency.

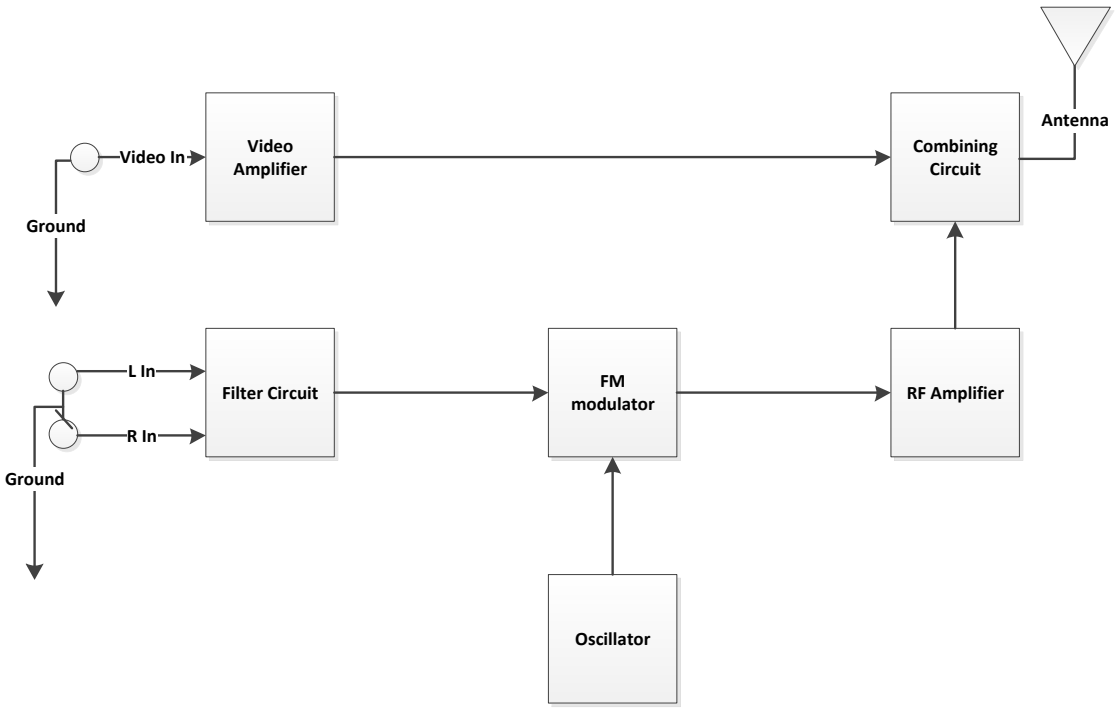


Figure 2. UHF / VHF TV transmitter block diagram.

R2, C2 defines RC filter used to block high frequencies. Primary winding of the RF transformer is center tapped which is divided into two inductors L1 and L2. L1, L2 has a parallel capacitor named CT. L1, L2 and CT makes the tank circuit which is called Hartley Oscillator with R4 forming a feedback Network. This oscillator is tuned at 4.5 MHz. The "tank circuit" forms Q1's feedback network through R4. Q1 is Emitter Biased amplifier, resistor R3 provides the emitter biasing. Capacitors C3 and C4 neutralizes the internal capacitance of Emitter base and collector base junction transistor. Transistors Q2 and Q3 amplifies the RF signals.

Since audio signal is provided at the base of transistor Q1, it is also modulated by the sub carrier frequency of the oscillator. In this way we get a 4.5 MHz frequency modulated signal at the output of RF transformer. The Frequency Modulated carrier signal is applied to the modulator segment with the help of a Resistor R7.

Audio and Video signals are amplitude modulated by the transistors Q2 and Q3. The tuning frequency is adjusted by the Inductor named L4. Amplitude Modulator modulates audio and video signals at the same sub-carrier frequency and produces Amplitude modulated signal at output terminal.

The amplitude of the sub-carrier frequency signal that is achieved by the Hartely oscillator is very low it is amplified by the Transistor Q2. The Capacitor C8 which is in parallel to the base and collector terminals of transistor Q2 neutralizes the Base Collector Capacitance. Capacitor C6, Inductor L3 and capacitor C7 makes the band pass filter circuit. Resistor R9 couples the Transistor Q2 output to the input of transistor Q3. Collector biasing is provided through capacitor C9.

Transistor Q3 amplifies the input signal so that it can drive RF amplifier. Resistor R11 provides the base bias to the transistor Q3 and Resistor R13 provides the emitter bias of the Transistor Q3. Resistor R12 and capacitor C13 provides collector biasing of transistor Q3. Transistor Q4 is RF power amplifier. Transistor Q4 is emitter biased using Resistor R16. Resistor R14 and R15 provides the voltage divider bias at the base of transistor Q4. The output of the transistor is coupled through capacitor C12. Inductor L4 provides collector biasing to transistor Q4.

Capacitors C6, C7 and Inductor L3 provide antenna matching and filtering applications. Figure 4a and Figure 4b shows the transmitter horizontal and vertical views.

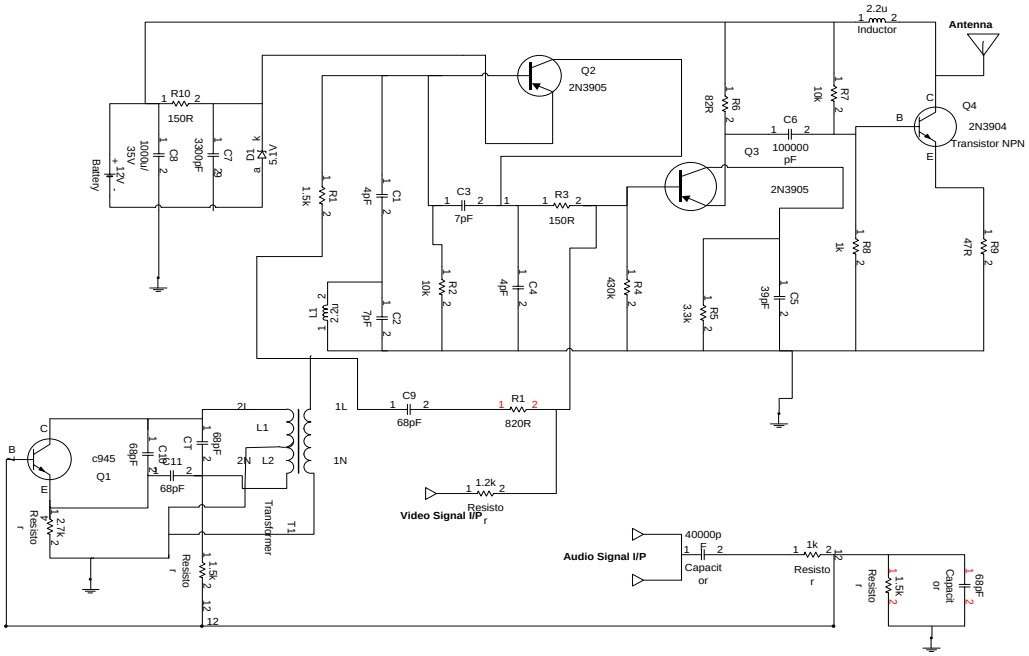


Figure 3. The schematic diagram of TV transmitter.

Figure 4a. Transmitter horizontal view.

Figure 4b. Transmitter vertical view.

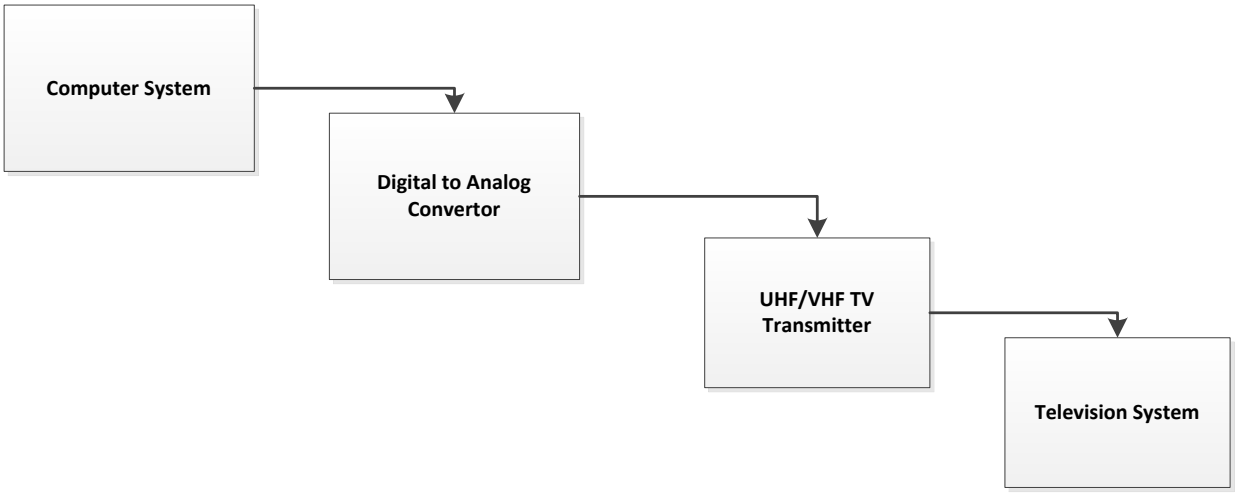


Figure 5. Schematic block diagram.

Additional Parts and Materials

- Telescopic-whip Antenna
- 12V power supply
- J1-J3- RCA cinch connector
- RCA Cable
- L4- 0.14-0.24 mH Variable coil
- T1- RF transformer 4.5-MHz
- PCB- Printed Circuit Board
- Connectors and solder

Table 2. Component list for TV transmitter.

| Semiconductors | Resistors | Capacitors |
|---|---|---|
| Q1—C945<br>Q2—2N3905 PNP transistor<br>Q3—2N3905 PNP transistor<br>Q4—2N3904 NPN transistor<br>D1—5.1 V | R1—1000 Ω<br>R2—1.5 k Ω<br>R3—2.7 k Ω<br>R4—1.5 k Ω<br>R5—1.2 k Ω<br>R6—820R<br>R7—1.5k Ω<br>R8—10 k Ω<br>R9—150R<br>R10—150R<br>R11—430 k Ω<br>R12—3.3k Ω<br>R13—82 R<br>R14—10 k Ω<br>R15—1k Ω<br>R16—47 R | C1—40000 pF<br>C2—68 pF<br>C3—68 pF<br>C4—68 pF<br>C5—68 pF<br>C6—4pF<br>C7—7pF<br>C8—7 pF<br>C9—4pF<br>C10—1000-uF<br>C11—3300 pF<br>C12— 100000 pF<br>C13—39 pF |

### *2.4. System Configuration*

As shown in Figure 5, for TV transmitter broadcast services, a television set and video streams from the internet is required. Internet streams are converted into analog format using digital to analog transducer then transmitted on the standard television set using TV transmitter.

In TV transmitter circuit, coil L4 and transmitter T1 is adjusted by a non-metallic tool for the required channel. 12 volt DC power supply is used for the circuit operation.

### *2.5. Connection of PC and UHF/VHF TV Transmitter*

For broadcasting the internet stream on the TV set, the computer needs to be connected to the TV transmitter circuit via digital to analog transducer or VGA converter. The connectivity between the PC and the TV Transmitter circuit is configured in Window XP platform.

## 3. Experimental Results

Due to developed setup of Figure 5, live streaming from the internet on the computer system which is viewable on the conventional TV sets is tuned at UHF/VHF channels. Following steps are taken to obtain live streaming on TV.

### *3.1. Digital Video on Computer*

Streaming media is basically multimedia that is provided by the supplier and given to the end-user. It defines the compressed form of data over the internet which is played lived instead of saving on the hard drive. Different tasks can be applied to the downloaded file such as pause, replay and fast

forward. Following are the advantages of the streaming media:

- Provides interactive and personalized applications for the users.
- It allows the data delivered to the monitor for the visitors.
- It provides efficient bandwidth.
- Provides the secure applications.
- Media can be streamed lively or from the recorded files. Video signal is transformed to digital signal in compressed form. A web server transmits this signal as a multicast signal, multiple users can get a single file simultaneously.
- Server provides the streaming media services which are using user's applications such as media player. A media player may be the part of the browser or a separate application program or may be in the form of dedicated device like iPod. Most of the video files have embedded media players such as YouTube which has embedded Flash players.

A client uses the file from the media player when it is completely transmitted. Different data delivery methods are used in the communication. Muzak was the popular streaming media; IPTV is very common nowadays. Lives streaming consists of camera, encoder, publisher and a delivery network. The information delivered from the server is a stream of data. Decoder is a part of the browser. These data stream technology and information decoder provides live information or data in recorded form.

A live digital stream from the internet is viewable on the computer which is pre-requisite of the proposed scheme. Computer achieves this with some streaming protocol. Different venders provide these kinds of services and it is very common these days for information scattering. We have visited http://live.samaa.tv for their live streaming as shown in Figure 6.

We have randomly selected samaa.tv which is live.

### *3.2. VGA Converter*

There was a need to convert digital audio/video data in analog format to make it possible to broadcast through VHF/UHF transmitter. For this purpose VGA converter has been used which is commercially available and is affordable for student research.


Figure 6. Live streaming from the internet i.e. samaa.tv.

VGA is a graphic system for personal computers. It has a 720 x 400 pixels resolution in text mode and 640x480 pixels resolution in graphics mode. VGA employs analog signal rather than digital signal. Older monitors do not support VGA facility. Some standards recommend more resolution and colors for better picture quality. Today most of the computers support VGA and more standards. Originally it follows by XGA standard now suppressed by different VGA extensions. VGA interface is used for the best video quality. Greater VGA broadcast bandwidth support greater resolution. Picture quality also depends upon the quality of the cable and its length. Picture quality is very prominent in larger sized monitors which have HDMI connection. VGA defines graphic array rather than graphics standards because it starts from ASIC then Motorola 6845 and many tiny chips that cover ISA and EGA board.

VGA connector consists of three rows which carries 15 pin DE-15 connector. Video cards and display monitors has 15 pin VGA connector. Laptop or small seized devices have mini port for the VGA connector instead of greater sized connector. DE-15 connector is also called RGB connector.

VGA cable and connector carries analog video signal. In DE-15 pin out connection one pin is plugged to the female connector this prevents the use of VGA socket. Monitor ID bits which consists of four pins are infrequently used. VESSA DDC has defined the pins by replacing it with power supply of 5V DC. VGA converter can be plugged in and plugged out even when the host is in operating or running condition which does not provide any harm or any problem to the devices.

VGA cable provides many VGA resolutions that range from 640 by 400 pixels at 70 Hertz frequency to 1280 by 1024 pixels at 85 Hertz or 160 MHz frequency and 2048 by 1536 pixels at 85 Hertz or 388 MHz frequency. Resolution quality does not require any standard. Cables that provide the quality consist of coaxial wire and insulation. Signal distortion and unwanted signal does not occur in the cable of better quality. Some Video cards and monitors contain BNC connectors that provide connection of better quality for the RGBHV signal with coaxial cable of 75 ohm.

VGA supports to watch the movie on big screen like television. Video converter converts the VGA signal to Video output signal. Some features of the VGA converter are given below:

- Single input and single output for the VGA signal.
- Single output for vi1deo and s video.
- Advanced Configuration and Power Interface of 5 volt DC.
- VGA signals resolutions that range from 640 by480 at 60 HZ or 72HZ or 75 Hz to 800 by 600 at 60 or 75 Hz, 1024 by 768 at 60Hz or 75 Hz, 1280 by 1024 at 60 Hz.
- VGA output and S Video signal output.
- Shows pictures on the Television.
- Supports the Television that follows different standards such as NTSC, PAL.
- Supports the scanning mode.
- Portable.

VGA converter device receives signal from RCA device for the VGA monitor. VGA Setup consists of the power supply, VGA converter, USB power cord, RCA cable and VGA cable. VGA converter detects the input signal at the first stage so power supply is connected at the last step after I/O connection. VGA converter is rebooted whenever required.

Figures 7a and 7b show the VGA converter.

### *3.3. Tuned TV*

The live video streaming after conversion is broadcasted using TV transmitter which has been discussed earlier and finally can be viewed on conventional TV sets which can be tunned at UHF/UHF frequency channel within the range of transmitting antenna. In the experimental results we have used single TV as shown in the figures. Figures 8a, 8b, 8c and Figure 9 show the results of the tuned TV at UHF/VHF frequency channel.

Figure 7a. VGA Converter.

Figure 7b. VGA Converter.

Figure 8a. Output of VHF/UHF tuned TV set.

Figure 8b. Output of VHF/UHF tuned TV set.

Figure 8c. Output of VHF/UHF tuned TV set.

Figure 9. Overall test system.

## 4. Future Enhancements

The research provides the idea of building our own internet television station that carries number of TV sets as one tuned TV client is implemented here. Thus, Live streaming from the internet is broadcasted to the television station using high power UHF/VHF TV transmitter that may cover any geographical area.

The project can be further enhanced by providing multiple UHF/VHF channels transmitted in parallel. Furthermore, bi-directional UHF/VHF links can be incorporated for interactive applications.

## 5. Conclusion

In this paper we proposed internet TV broadcasting system using UHF/VHF TV transmitter. The proposed system delivers live internet streams on standard television. We designed and implemented the prototype system. From the results, we found our proposed system can provide free of cost reception, time shifted television, video on demand services, student television services that may cover certain area.

Propagation delay is much less in proposed scheme as compared to VoD services provided by PTCL, DVB satellite transmission and many others.

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