. **Video Conferencing: Most Effective Technology to Run Assemblies and Meetings for Large Audience Dispersed In Distant Locations: Is It Feasible To Deploy in Nigeria**?

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Abstract
Solutions to Current economic problems associated with national economic depression need be approached from technology point of view. The cost of air and land movements have tripled in the last few months with the attendant risk of accident, armed robbery attacks and vehicular breakdown. If every member of staff, student or congregation can remain in his location and join lectures, meetings and listen to sermons without the additional burden, cost of travelling, we think such a technology that would make this feasible is friendly, economic and useful. Video conferencing technology, if effectively deployed, can achieve the above goals. ***Videoconferencing*** *is a technology developed to conduct a* ***conference*** *between two or more participants at different sites by using computer networks to transmit audio and* ***video*** *data The objetives of this paper is to present the need for its deployment, the technology involved, the cost and how it can be implemented in Nigeria. Its deployment will make life more meaningful and convenient, reduce costs and dangers of travelling as well as reduce the number of hands needed to execute meeting. The* **eBaithak** ***model has been adopted in this article.***

Key words *video conferencing mulyimedia data, protocols. Student motivation. Codec*

1.0 Introduction

What is Video-Conferencing (VC? It is a medium where two or mo people at different locations can meet face-to-face in real time. Video conferencing technology is a communication technology that uses audio, video, and data streams and allows participants at disparate locations to interact with each other by creating a face-to-face meeting environment for easy collaboration [5] It offers new possibilities t connect with guest speakers and experts. VC can make relevant learning opportunities more accessible and exciting. The real benefits of Vc can come clearer with a simple illustration. Let us assume you are taken a group of students to an excvursion to inspect the of a fagal bus accident where over 100 passengers died. Students present at the site can ask pertinent questios about the accident and this is relayed to all waitng stations where the vc is linked n real tme.Thus Videoconferencing provides students with the opportunity to learn with experts rich in knowledge and experience. Such experts are often in distant places, Videoconferencing provides students with an opportunity to observe the discovery of authentic artifacts in real time, which stimulates active learning

Authenticity – interaction with the real world increases motivation and
Promotes Confidence – success through participation, Realistic Outcomes – authentic learning opportunities provide real world results Combining lecture with interactive learning activities ensures that content is covered while engaging students and giving them real world experiences Actively involving learners early and often requires student engagement in

discussion Actively involving learners early and often requires student engagement in discussion Be sure all sites have the necessary hardware/software/supplies needed to deliver the videoconference. Designers must assure that people in all sites, guests and students, are visible to one another.

BENEFTS OF VC and why the technology should be integrated in teachinhg and in education

1. Student learning is impacted in several ways:

Enhances student motivation.
Is exciting or different, catches the student's attention.
Connects with the real world.
Promotes student retention and learning.
Accesses information from primary sources.
Accommodates many learning styles.
otherwise not accessible to students.
Interact with people different from themselves
Videoconferencing accommodates a variety of different learning styles through several modalities
Videoconferencing affords students the opportunity to develop and improve various communication skills such as

Videos
Animations
Audio
Graphics
Collaboration
Presentation and speaking skills.
Communication and management skills.
Questioning and interviewing skills.
Oblige students to view multiple perspectives of an issue
Videoconferencing maximizes time and resources
Easier than an actual trip.
No extra travel time**.**

COMONENTS OF VC
TYPICAL FEATURES AT A GLANCE :

- High Speed, Wide Range Pan/Tilt & Zoom
- 40x Optical Zoom, High Speed and Auto-Focus Lens
- S-Video & Standard Composite Output
- 12 or more Position Preset
- Auto Tracking / Motion Detector
- RS-232 Serial Control
- Control Via Your Computer Through The Internet
- IR Hand Held Remote Control
- 9600 Baud Data Pass-Through Mode
- Time/Date Generator

MODES OF VIDEO CONFERENCING VC can be telecast via:

- **Point-to-Point** A ideoconference that connect two locations

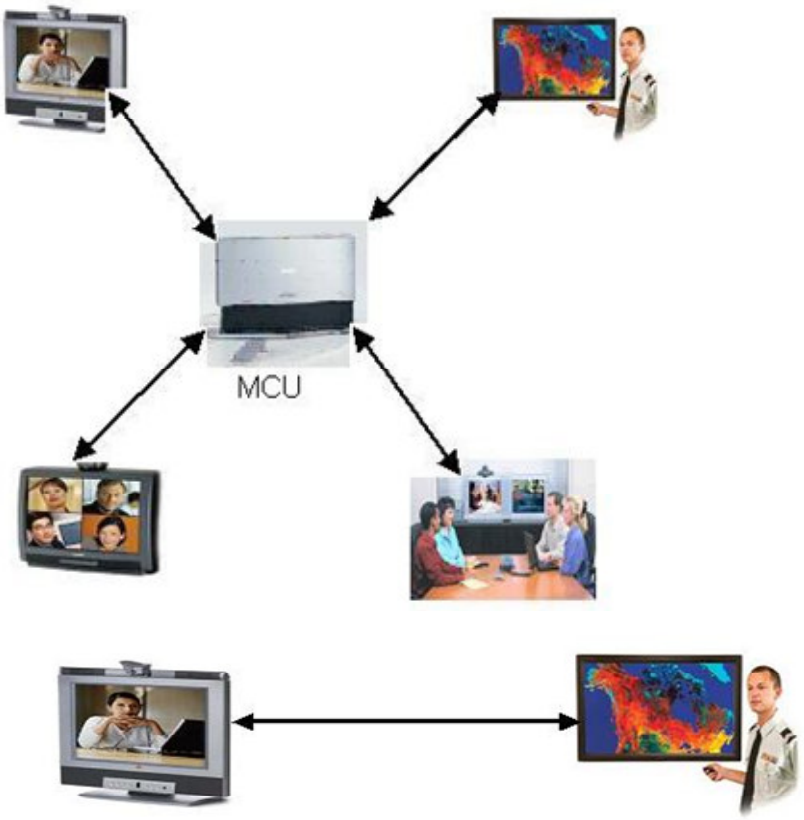

Fig 1 PoiNT TO POINT

Multi-point

AMulti-poinbt videoconference is one that connects more than two locations through a Multi-point Control Unit (**MCU**)

An **Omni Directional** Microphone which picks up sound equally well from all directions. It has 360 degrees of voice pick up and an Integrated Mute button A **Unidirectional** microphone is sensitive to sounds from only one direction.

Lcd TV Viewing angle : 176º (H) / 176º (V)

- Diagonal screen size (inch) : 42 inch
- Display screen type : LCD WXGA Active Matrix TFT
- Panel resolution : 1366 x 768p
- Sound Output power (RMS) : 2x12W + 1x24 W
- Loudspeakers Built-in speakers : 5
- Loudspeaker types : Integrated subwoofer, Dome tweeter
- Picture in Picture : HDMI-Component PIP
- Playback Formats : MP3, Slideshow files (.alb), JPEG, Still pictures
- Mains power : AC 110 - 240 V +/- 10%
- Power consumption : 263 W
- Bandwidth / Data Rate Requirement
- Frame Rate.
- Frame Size.
- Color.
- Mono / Stereo Audio.
- Sample per second.
- Bit per sample.

COMPRESSSON STANDARD

- Lossy and Lossless Compression
- Audio: G.711, G.722.1, G.728, MPEG-4
- Still Image: JPEG, JPEG-LS, JPEG-2000
- Video: MPEG-2, MPEG-4, H.263, H.264

Band-width requirements of different compressed multimedia data

Table 1

Band-width requirements of different compressed multimedia data

Type of Multimedia Data	Bandwidth
Usual data	100bps~2kbps
Image	40 Kbps~150 Kbps
Voice	4 Kbps~80 Kbps
Stereo Audio	125 Kbps~700 Kbps
VCR quality video	1.5 Mbps~4Mbps
3D medical images	6 Mbps~120 Mbps
HDTV	110 Mbps~800 Mbps
Scientific Visualisation	200 Mbps~1000Mbps

Protocols

- H.320 (1990)
  – ISDN
- H.323 (1996)
  – IP
- SIP (Session Initiation Protocol)
  – Used by most Voice Over IP (VOIP) solutions
- H.235 : for security within H.323, including both signaling and media security
- H.239 : describes dual stream use (usually for live video, the other for presentation.)
- H.460 : optional extensions that might be implemented by an endpoint or a Gatekeeper.
- In addition to those ITU recommendations, H.323 utilizes various IETF RFCs for media transport and media packetization, including RTP.

Codecs

- Video codecs: H.261, H.263, H.264.
- Audio codecs: G.711, G.729, G.729a, G.723.1, G.726
- Text codecs: T.140

CODEC UNIT

Features include

- Embedded MCU(Multi-Control Unit)
- Support IP (4 Mbps) and ISDN (2 Mbps) connection
- ISDN & IP connections can be mixed-up
- Dial –In / Dial-Out Capabilities
- Up to 6 sites (5+yourself) H.320 and H.323 MCUs
- Up to 10 sites when MCU cascaded
- Multiple Display Output
- Improved Picture MPEG-4/AAC-LD
- Audio 14kHz Quality
- **Supported Protocols :** H.323 (LAN) and H.320 (ISDN)
- **Video Standards :** H.261, H.263, H.264, MPEG-4
- **Video Resolution :** QCIF, 4CIF, FCIF, SIF
- **Frame Rate :** Max 30 frames per second
- **Bit Rate :** Up to 2 Mb/s in H.320 (including audio), Up to 4 Mb/s in H.323 (including audio)
- **Audio Bandwidth and Coding :** G.711, G.722.1, G.728, MPEG-4, AAC-LD
- **Echo Cancellation :** Reduction rate 30 dB
- **ITU-T Standards :** H.320, H.323; H.221; H.281 FECC; H.225.0; H.245; T.120
- **Network Protocols :** TELNET (Server), HTTP (Server), FTP (Server), SNMP (Server), PING, DNS (Client), DHCP (Client), RTCP, RTP, TCP, ARP, NTP (Client)
- **Built-in Streaming:**Students or faculties can view and listen to your videoconference session in their PC from almost any location that has access to your network.

Site - Name Display: The Lecturer at the main hub should identify the institute location name from which institute the question had been asked.

ISDN - Connects sites utilizing the H.320 standard

IP - Connects sites utilizing the H.323 standard

The most cost effective speed for typical videoconferencing meetings is **384 Kbps or 512 Kbps.**

Optional accessories

- Data Solution Box

QoS Three advanced functions to enhance QoS over network are:

- **Forward Error Correction(FEC):** FEC function that corrects errors in transmission at the receiving end.
- **Adaptive Rate Control(ARC):** ARC function automatically varies the video data transfer rate to meet changing network conditions.

Real-time Auto Repeat Request (ARQ):ARQ function recovers lost IP packets

Challenges in nternet VC

- Firewalls
  - Port Blocking
- NAT
  - Hidden IP Address
- Bandwidth
  - NOT! Dial Up Modem
  - MAYBE… Cable Modem/DSL
  - Yes!!! Internet2

Networ servers

- Gatekeeper
  - Allows assignment of static numbers
  - Allows use of MCUs, and Gateways
- MCU
  - Allows more than two participants to be in the call at the same time.
- Gateway
  - Allows calls to and from telephones.
- Ridgeway Server

Firewall/NAT solution

Tyes of VC

- Dedicated Video Conferencing Suites
  - Special hardware required
  - Dedicated Communication links such as ISDN
  - Drawbacks :- Costly

- Desktop Video Conferencing
- Streaming / Archiving Equipment
- Interactive Whiteboard

LCD Projector & Laptop

  - Webcam

Phones required

  - Internet

allows multimedia com

  - Drawbac

Proxy limitations

- Mobile Video Conferencing
  - Just a Mobile with 3G services

Drawbacks:- Low quality

DTVC

- Advantages
  - Video Conferencing can be done from office or from anywhere.
  - Very Low Cost devices such as Webcams & inbuilt microphones can be used
  - Existing Internet connections can be used
  - People from anywhere on globe can connect

- Limitations
  - Bandwidths often deteriorates quality of Video
  - Corporate proxies often block regular protocols such as UDP/RTP which is main protocol for video transmission

Video servers

- Progressive
  - Video files are kept at a location on the server.
  - Files can be downloaded at a later stage for viewing in a suitable player
  - The problem is whole files has to be downloaded before actually playing
  - Any Server can host multi-media files.

- Streaming
  - Video files are kept at a location on the server.

– Video file is played as it is being downloaded.

– Video file need not to be saved at the client

– Special streaming servers to be used for hosting files

– RED5, WOWZA, FMS, DARWIN, MICROSOFT MEDIA SERVER are example.

Protocols used

- **RTMP**

– Available as an open specification to create products and technology that enable delivery of video, audio, and data in the open AMF, SWF, FLV, and F4V formats compatible with Adobe Flash Player

- **RTMPT**

– Basically is a HTTP wrapper around the RTMP protocol

– Send POST requests from the client to the server.

– Clients to poll for updates periodically in order to get notified about generated

– events

– Four possible request types can be sent to the server

- **Initial connect (command "open")**
- **Client updates (command "send")**
- **Polling requests (command "idle")**
- **Disconnect of a session (command "close")**
- **RTMPS**

– works just like RTMPT, but over a secure HTTPS connection

- eBaithak uses Red5 as its Media Server
- Red5 is Open Source Flash Media Server written in Java
- Protocols Supported: RTMP/RTMPT/RTMPS
- RTMP : Real Time Messaging Protocol is a proprietary protocol of ADOBE

Systems.

RTMP based on top of TCP and uses 1935 port

- RTMPT is RTMP encapsulated within HTTP requests.
- RTPMS is RTMP encapsulated with in secure HTTP requests

eBank client

Flash Application

- Flash is a multimedia graphics program specially for use on the Web
- Flash enables you to create interactive Applications on the Web

- Flash uses vector graphics, which can be scaled to any size without losing clarity/quality
- ActionScript v3.0 is used for programming complicated Flash Applications

eBan and flash

- **Software Client Side**:

– Adobe CS4 for developing GUI

- Uses Action Scripting 3.0

– Adobe Flash Player for displaying GUI

- Across-platform browser plug-in that delivers multimedia content.
- Embedded inside html pages which can be served through Red5 Server.

Software server side

- **Software Server Side**:

– Embed Flash Application inside server-side scripting program like JSP/ASP for

Client Access:

```
<object width="550" height="400">
<param name="movie"
value="somefilename.swf">
<embed src="somefilename.swf"
width="550" height="400">
</embed>
</object>
```

- This can be saved a HTML file and has to be put on the website alongwith "somefilename.swf" Flash application

Cliebt Req

- Installed Webcam, Head-Phones

Any web-browser with flash player installed.

- Internet connection for connecting Video Server

User credentials for connecting the server

Red 5 server side

- In Simple form, it is a server side java program, hosted on the Red5 Server.
- It contains methods such as connect, appConnect, start, stop etc.
- Authentication etc are applied in appConnect method
- If any VOD data is there, it can be hosted in the streams directory.

RRed5 file structure **Red5 Folder Structure**

webapps
-> application-folder
-> WEB-INF
-> classes
-> logback-**APPLICATION**.xml
-> **APPLICATION_NAME**.class
-> lib
-> red5-web.properties
-> red5-web.xml
-> web.xml
-> streams

Server side progr\m

```
package path.to.my.package;
import <all reqd packages>
public class Application extends ApplicationAdapter {

public boolean appStart(IScope app) { }
public boolean appConnect(IConnection conn, Object[] params) {}
// and others

}
```

Compiled in Java and stored in Red5 Server.

Video quality parameters

- Quality of Video Depends on the following factors:

1. **Frame Rate**: This parameters define how many frames are displayed in one second.
2. **Frame Resolution**: Dimensions of each frame.
3. **Frame Quality**: Compression of each frame.
4. **Bitrate**: Supported on specific Video Formats

- Quality of images in the video depend on Frame Resolution & Quality.
- Smoothness of Video depends on Frame Rate.

Bandwidth and vdeo quality

- Bandwidth also known as bitrate, is rate of data transfer measured in bits per second.
- Higher the Video Quality we prefer, higher bandwidth is required.
- Video Quality has to be adjusted to meet the current bandwdith available.
- eBaithak prefers bandwidth of 512kbps at client
- Frames Per Second:
- Number of frames captured per second.
- Determines how many frames are captured by the camera for video transferring.
- Value ranges from 1/x to x frames.
- If the FPS is specified as 1/5, then per 5 seconds, one frame is captured.
- If the FPS is specified as 5, then per second, 5 frames are captured.

- Frame dimensions:
  – Size of video image.
  – Vary anything from 160x120 to 1600x1200 provided the camera can support for
  – capturing.
  – Capturing and rendering large images result in excessive CPU usage. Hence often few frames are dropped while rendering large images. However it has been found that the frame drop is acceptable for resolutions up to 352x288 (CIF).

eBaithak Client's Interaction with Server

1. Connect Camera & Headphone
2. Set Video Quality Options
   - Frame Rate (3-5 fps)
   - Frame Size (176x144)
   - Frame Quality (60-80)
3. Provide User & Password
   - Provided by eBaithak Administrator
4. Click Connect Button
5. Click Publish Button
6. Select Remote User
7. Click on Play Button of Remote Video

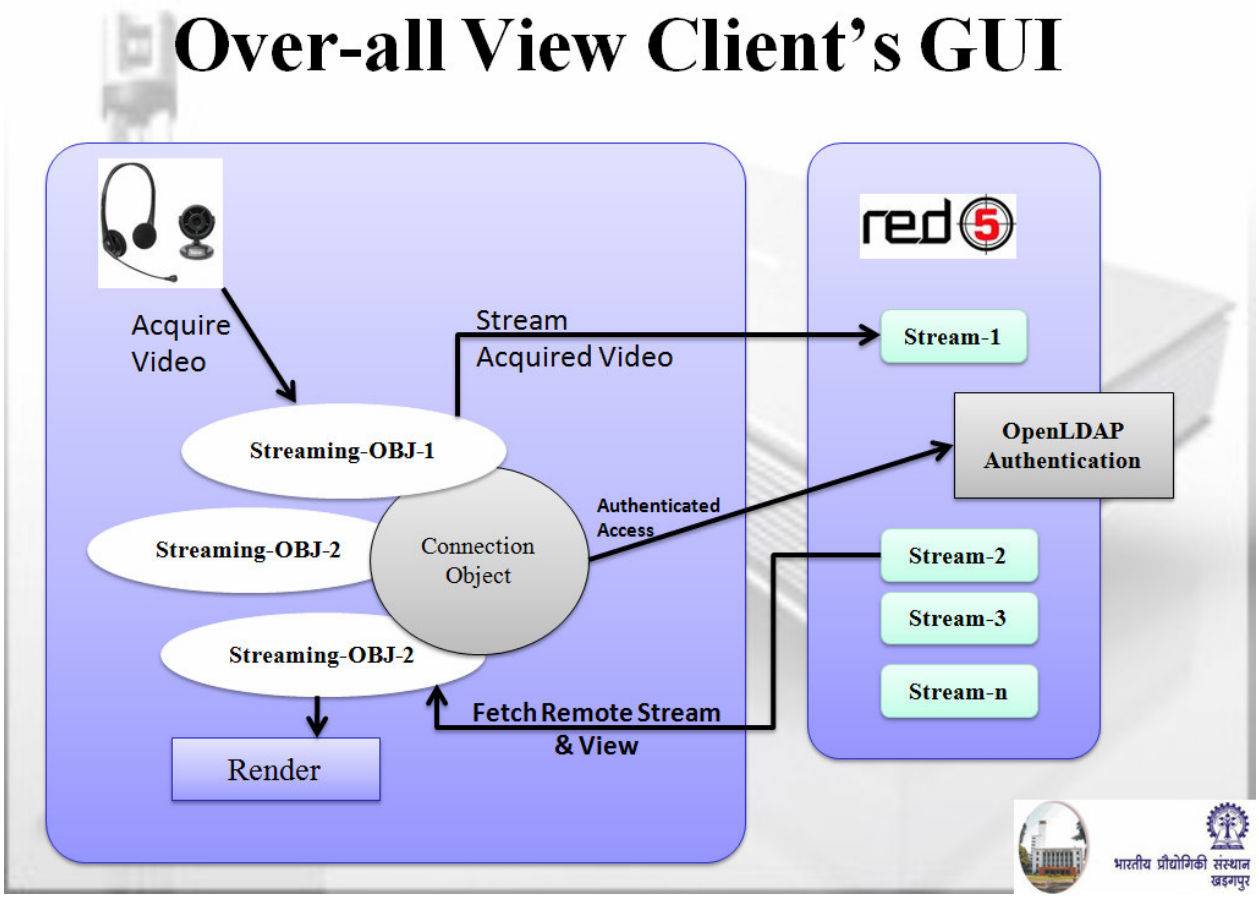

Fig.2: CLIENT SIDE OF VC~ source [1] [2]

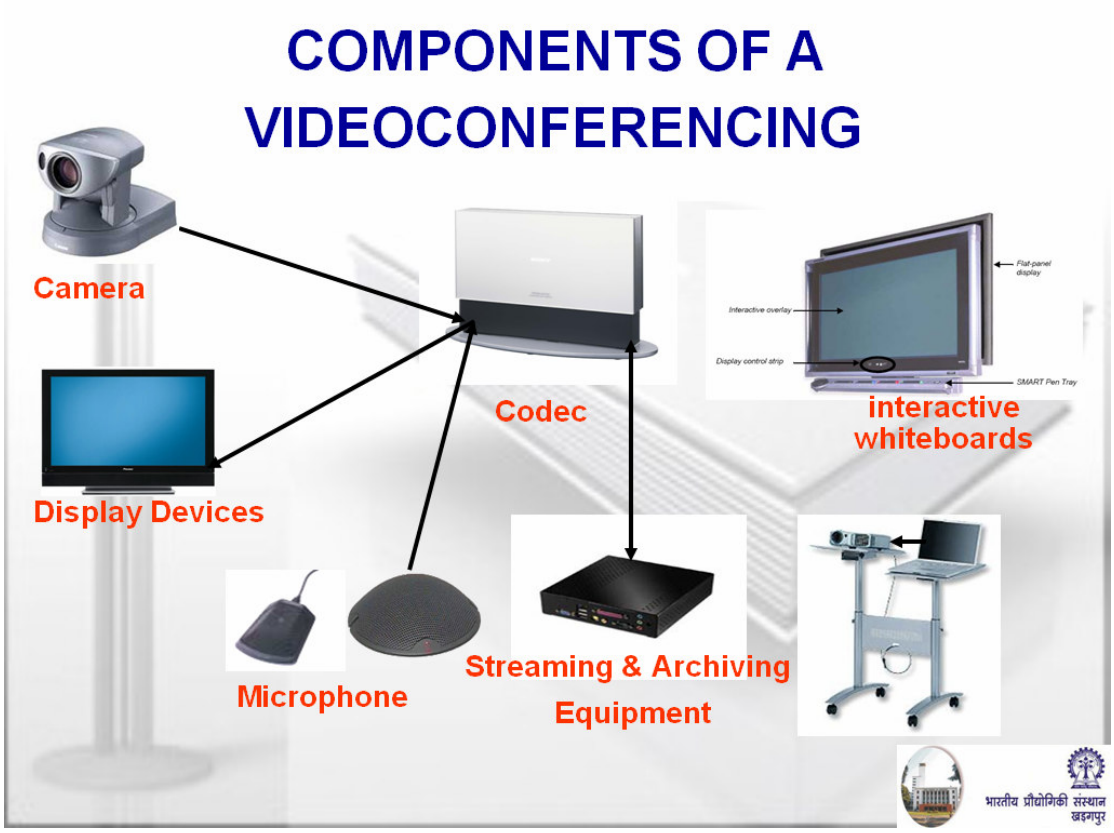

Fig. 3: COMPONENTS OF VC [1] [2] [3] [4]

Summary conclusion and recommendations

We have decomposed the properties of video conferencing technology. We have also identified various types of VC with examples. We have also shown how the technology will work. The component technologies have been presented and we conclude that VC can be lamented in Nigera without difficulties. The benefits highlighted earlier show that the teaching budget of most tertiary institutions can be reduced by half with all the attendant benefits of VC. Nigeria should as a matter of urgency include vc as one of the crucial teaching aids to shore up quality of education in Nigeria. The National Council on Education should move for the integration of VC into most schools curriculum as q component of educational technology.. The National Open University of Nigeria should take the first shot at pragmatic implementation for all the courses run at various centers throughout NIGERIA.

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