Global Knowledge Bank

M. Adeyinka[1], L. Godlevsky [2], A. Debrah [3], Dr. D. Medenou [4], Y. Rouchiche [5]

[1] *Dr. M. Adeyinka is director of the Laboratory for Biomedical Informatics, The Netherlands*
[2] *Prof. L. Godlevsky is head of the dept. of Medical Physics, Odessa medical University, Ukraine*
[3] *Dr. A. Debrah is senior research fellow at kwame Nkrumah University of Technology, Kumasi, Ghana*
[4] *Dr. D. Medenou is Head of dept. of Biomedical Engineering, L' Ecole Polytechnique d'Abomey-Calavi, Cotonou, Benin Republic*
[5] *Ms. Y. Rouchiche is Chargee de Cours, University of Mouloud Mamerie Tizi, Algeria/Guest researcher University of Paris 8, France*
Correspondence address : m.adeyinka@lbmi.org

1. BACKGROUND

We have seen the age-long telecommunication barriers gradually being lifted. Telematics applications have seen the lease lines folding up, while the general-purpose internet facilities have been gaining the ground. At the very beginning, the medical experts turned cold shoulders to the digital renaissance. However, the waves and the ever propelling forces of telematics have moved the young ones on to other strata; where the ever hidden phenomena have come to see the light. From different walks of life, the whole world at large has clamoured round telematics (1). Based on diverse telecommunication infrastructures, Telemedicine which is a derivative of telematics has become of age nowadays, medical experts from every nude and corner around the globe are privileged to .digress on issues of common interest disregarding the distances and locations. According to Dr. Salah Mandil, 'the HELINA-L list is focusing on "how information and communication technology can be used to facilitate healthcare" in Africa. I understand that a list on telemedicine in Africa should focus on "healthcare by remote means"(2). Based on geo-satellite infrastructure, the COPINE Project, which was an initiative of the United Nations, World Health organisations and the European Space Agencies was launched to facilitate telecom exchange between the advanced and the upcoming nations(3).

Thanks to the reduced cost for the use of the digital highways, a number of Telemedicine applications have been performed including tele-surgery (4), telepathology (5) etc. While the depositories are being filled on daily basis, the gates to the global medical knowledge bank remain open. In times of distress and natural catastrophes' and crises, the medical first responders are well equipped with both terrestrial and satellite telecom infrastructure to render helping hands. Day in day out, we keep our eyes on the available infrastructure, checking and testing from pillar to post and at all ends (3).

2. OBJECTIVES

The Laboratory for Biomedical Informatics, (LBMI), Amersfoort, The Netherlands, originally specialized in quantitative cytology, re-directs her mission to exploring distance medicine, hence making plans for the introduction of telemedicine services wherever necessary and applicable across the globe and more still stimulating the creation of a mesh worked knowledge bank. Teleconferencing which is the pivot of this initiative was in earlier times reserved for the most financially privileged, due to the high cost of telecom infrastructure. The then exorbitantly priced hardwired teleconferencing gadgets, despite being massive and complicated to configure were accompanied by various integrated appliances. The new advanced telecom infrastructure has paved way to the advent of telematics. Coupled to the low cost of internet facilities, the software replica of the video conferencing gadgets have come to see the light, hence embracing affordable teleconferencing practices. In the light of this development, it has become worthwhile to devote time for exploring the open possibilities. Undoubtedly, facilities and infrastructures do not attain the same standard every where in the world. While paying special attention to the upcoming nations, we embark on strategies particularly tailored to individual entities, stretching from United States, Europe, (West, Central and East), Asia to Africa. The main objective was to stimulate collaborative Research and Development among inter-related entities across the globe. This paper is written in a natural language, avoiding complicated technical issues and jargons in order to render it accessible to the national authorities, which should be equipped with adequate and necessary knowledge infrastructure for promoting societal changes in the respective communities. At the same time, the paper invites the International organisations to respond to the short comings of the world communities in terms of telecommunication infrastructures.

3. METHODS

We explore the possibilities of video conferencing and by way of example; we embark on the demonstration of Tele-microscopy, linking West Europe, East Europe and West Africa. We selected a number of different medical experts, from different nations (See fig. 1) and we proposed some affordable tele-bridge gadgets (video conferencing), which we installed in some of the institutions. During the course of this exercise, the following sites were linked:

- Laboratory for Biomedical Informatics, Amersfoort, The Netherlands
- Odessa Medical University, Odessa, Ukraine
- L' Ecole Polytechnique d'Abomey-Calavi (*EPAC*), Cotonou, Benin Republic
- Kwame Nkrumah University of Technology, Kumasi, Ghana
- LBMI site, Amsterdam, The Netherlands (Representative Univ of Paris 8 / Univ Mouloud Mamer I Tizi, Algeria
- International Medical University, Kuala Lupur, Malaysia

While the stage was set, a number of Minimum Requirements were recommended:

Fig. 1: World Map showing participating sites

3.1 Requirements

Hardware : Pentium 4 1Ghz with 256MB of RAM

20MB Hard disk space

Software : Microsoft Windows (2000, XP, Vista or WIN 7) and Oovoo

Telecom : Internet Broadband Connection (Cable, DSL etc)

Speed at Standard Resolution in kb/s		Speed at High Resolution in
Point to point : Upload 128	Download 128	384
Multi party : Upload 512	Download 512	384

Latency threshold :250 ms

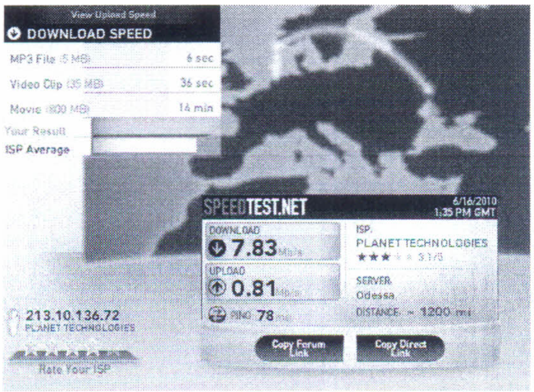

Fig. 2: Speed test Amsterdam – Atlanta

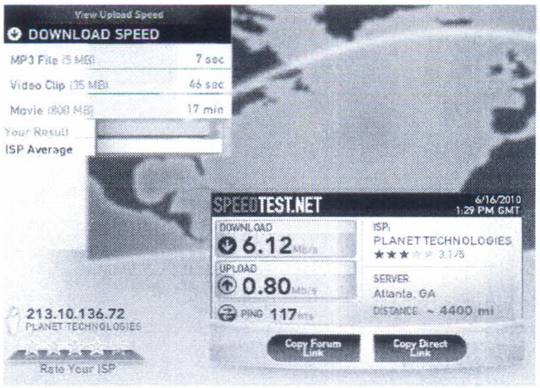

Fig. 3: Speed test Amsterdam – Odessa

By way of analogy, the down and upload speeds are comparable to the traffic (data set) situations on a road from a particular location. The breadth of the road conditions the amount of traffic it can receive (download) and expedite (upload), while the latency determines the amount of time the traffic needs to arrive at its destination.

Based on software video conferencing facilities, the first phase of this initiative was centred on international telecom infrastructure tests. This step was accomplished in order to improve video and data transmission. Furthermore we organised some point to point video conferencing sessions. Afterwards, we explored the possibilities of multi-party conference sessions which demanded different telecom operational requirements. Finally, we embarked on the demonstration of Telemicroscopy.

3.2 Telemicroscopy Sessions

The demonstration of Telemicroscopy was conducted by the Laboratory for Biomedical Informatics, (LBMI) The Netherlands. The hardwired configuration consisted of a standard transmitted light research microscope and a small sized digital camera (captor) which was directly superposed on the C mount microscope for captioning the photonic signals, issues of the microscopic field of view. These signals were in turns converted to digital images and displayed on the monitor of the computer. The digital camera was equipped with a resident Image Focus (See fig. 4) software capable of performing live video streaming, recording, object measurement and various microscope image processing functions.

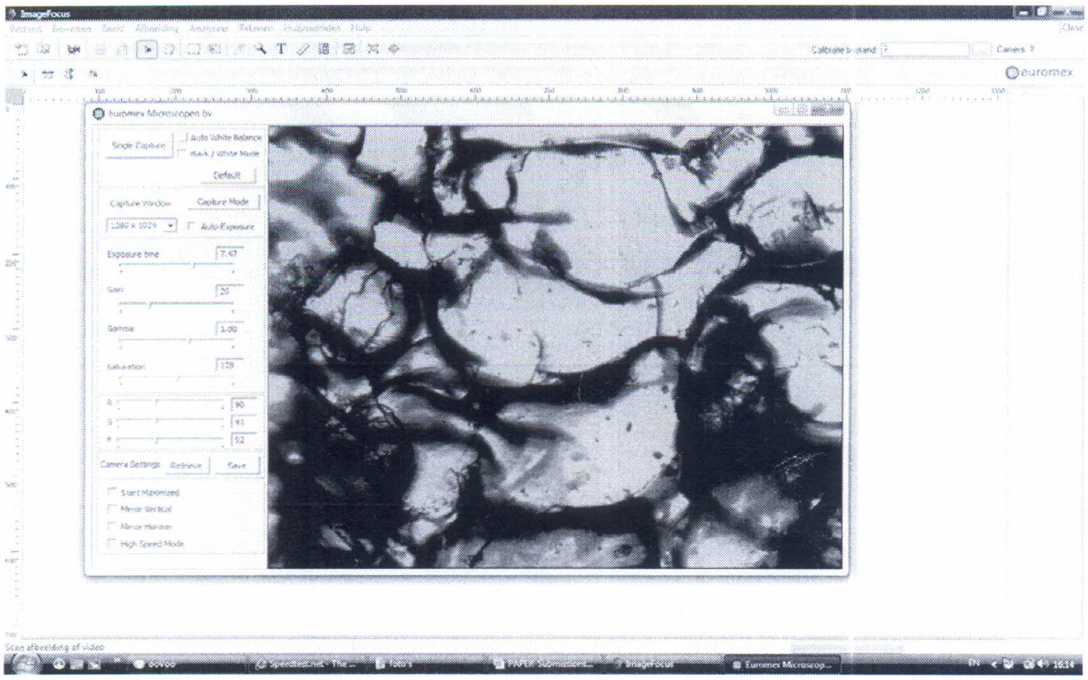

Fig. 4: Image focus Software showing CMEX image display.

The whole microscope photo-electronic assembly was connected to the video conferencing station which was readily remaining on the background. With adequate audio and light facilities, every participant was linked to the LBMI Telemicroscopy configuration in The Netherlands. More still, the incorporated Livestreamer (internet broadcasting) module was activated to allow internet audience to log on to a given website to be able to join the sessions. While the onlookers and spectators were attentively watching from different locations across the globe, the researcher/operator at LBMI demonstrated dynamic Telemicroscopy, in different resolutions, ranging from low, to high depending on the specific applications. (See fig. 5) The operator was able to review the microscope settings by choosing the right objectives for specific preparations refocus and fine tune the display while at the same time attending instantaneously to comments from the partners and audiences located abroad. The video conferencing workstation was equipped with a software speedometer for measuring the internet transmission speed from all ends in order to guide against high latency which occasionally might be tending above the standard threshold.

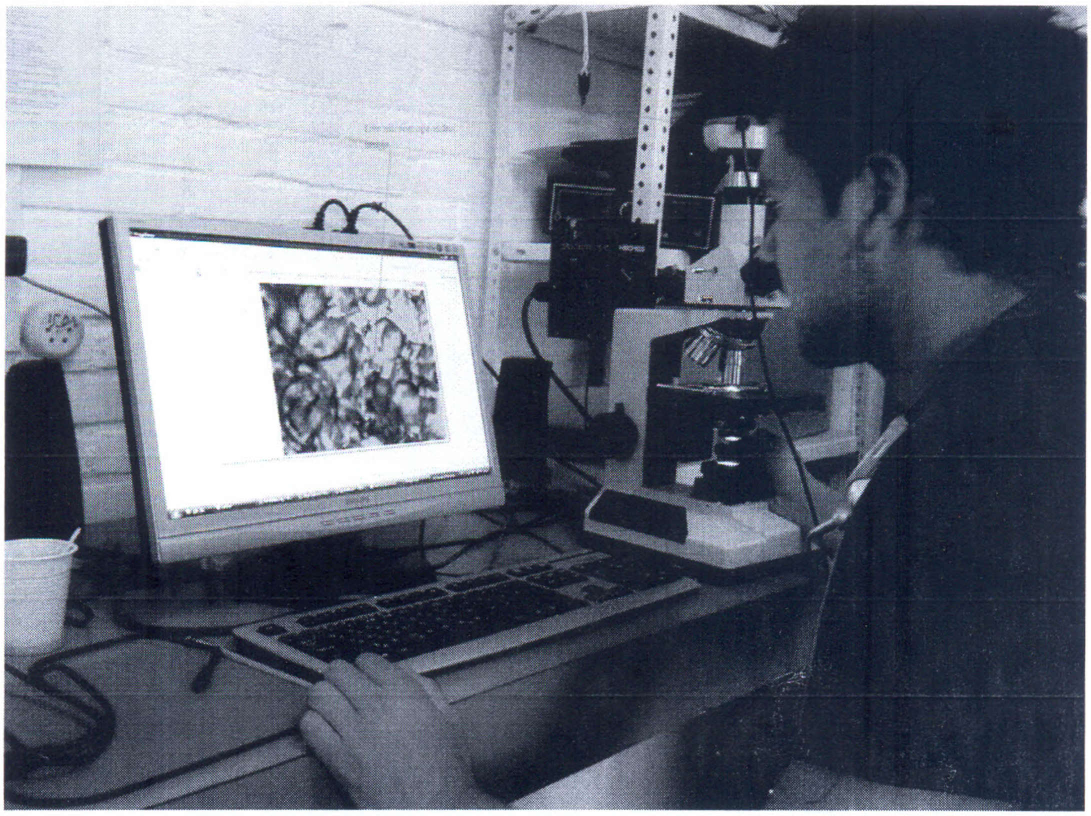

Fig. 5: Tele-microscopy configuration

4. RESULTS

Attention was not paid to the idea of fulfilling the hardware and operational requirements at the beginning of this exercise; hence the results were less attractive. The major problem was the latency, tending higher than technically recommended, hence producing unacceptable video streaming. Following technical recommendations, we achieved improved results.

The randomly organised infrastructure tests allowed participants to individually review the functionality of their respective hardware and telecom requirements.

The regularly organised multi-party sessions were exiting and socially inspiring. Under the chairmanship of Professor Leon Godlevsky, (Odessa Medical University, Ukraine) these sessions were dedicated to collaborative issues and international partnership. Participants presented and digressed on individual research activities ranging from cardiology, psychology, microscopy/pathology and tropical medicine, while at the same time presenting illustrations and results (See fig. 6). Video streaming from America to Europe and vice-versa were generally good and encouraging.

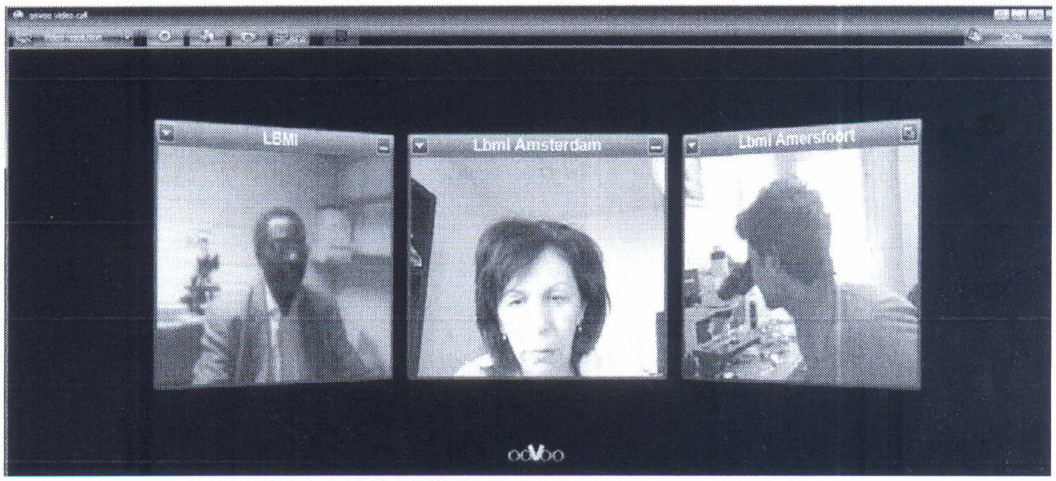

Fig. 6: Multi-party video conference

The LBMI Telemicroscopy demonstration was inspiring due to its educational and collaborative nature. From different ends of the globe, researchers developed excellent impression about the idea of effective 2nd. opinion in the medical practice, attempt of which could contribute to the amelioration of their professional standard.

Even though the results achieved in this exercise were not what one can describe as excellent due to some technical and operational short comings experienced, there were nevertheless indications of promising future perspectives. Without doubt audiences at different ends of the network enjoyed friendly intellectual audio-visual sessions.

Most of the sites measured up to standard by fulfilling the proposed hardware and operational requirements. In some regions, we encountered high latency range which diminished the fluency of the video streaming. Principally, the achieved results were conditioned by the intensity of the telecom infrastructure, which at some ends provided adequate transmission speed. Nevertheless, we encountered less favourable situations from other sites due to unstable transmission. The drawback could be accounted for by increase in latency, which could be resulting from heavy Internet congestion.

However, we have in the last one year noticed tremendous improvement in the qualities of video streaming from East Europe (Odessa, Ukraine) almost comparable to TV studio quality.

5. DISCUSSION

In this exercise, we took time to notice the impact of the different changes we adopted especially with respect to the hardwired and operational requirements.

It will be worthwhile mentioning that the improved video exchange could only be achieved when the best practice is adopted by satisfying the specified requirements. Despite the minimum set of requirements recommended in telemedicine applications (7), it must not be forgotten that the applications in question also determine the choice of instrumentation as well as the telecom infrastructure. Furthermore, possibilities should be provided for file exchange among the partners. It is recommended that the

video conference room should be equipped with appropriate lighting facilities in order to avoid problems of grainy, choppy, dim and washed out video images often encountered as a result of poorly arranged lighting facilities.
Where, the hardwired gadgets would demand considerable period of time for repair and services, the software video conferencing tools would reduce the operational down time considerably. Software could be reinstalled or repaired on-line or subjected to new settings by the providers from afar off. This could be considered an extraordinary advantage.

An exercise that embraces the world at large would demand considerable effort to bring participants together due to time differences across the globe. Inevitably, this may create scheduling problems. While some partners are still asleep, the others are just waking up.

6. CONCLUSION

Nowadays, new applications are being developed based on the existing technologies. These technologies have opened abundant chances for delving into unimaginable applications for example litho spherical discoveries, which, years ago could not be embarked upon. At a distance of several thousands of kilometres, it is even possible to constantly acquire data from locally installed sensors and subject these data to systematic or periodic analysis, prior to making decisions. However, the use of the said technologies is considerably reduced in view of the potentialities due to lack of dissipation of knowledge. The knowledge bank is open. The telecom infrastructure is the principal element necessary for trafficking the items of the global knowledge bank across the world. This should remain at the disposal of all, but in abundance.

7. AKNOWLEDGEMENT

Many thanks to David Frasser of Oovoo, Atlanta, who spent a lot of time to coach us on technical Oovoo issues , Prof. Leon Godlevsky,of Odessa Medical University, Ukraine, who relentlessly devoted considerable time establishing tele-bridge sessions with us and Mr. Alex Lai, Technical dept, International Medical University, Kuala Lupur, Malaysia for his contribution. More still, we like to thank the trainees (Students) at the Laboratory for Biomedical Informatics, including ; Deniz Bican and Johan van Wolfswinkel and Marnie Vodounou, an EPAC trainee at the Accra University of Telecommunication, Ghana, for their persistent efforts.

REFERENCES

1. Adeyinka; M; Africa Signifies to join the Health Telemeatics Chorus, in Technology And Informatics, Volume 23, Health, Information Society and Developing Countries, IOS Press, 1995, Edited by European Commission, National School of Public health, Athens and World Health organisations.
2. Internet publication : http://www.uku.fi/english/organizations/helina-l/msglog/2001/0036.html
3 Mandil, S.H., "The Potential Requirements of COPINE Health Sector Users," World Health Organization, November, 1996.

4. Go, P, Duplaga, M, Bezpalec, P, Adeyinka M ´Triangular Telesurgery Exercise´ Internet Publication, International Conference of Radio Electronics, 2004. http://www.urel.feec.vutbr.cz/ra2008/archive/ra2004/abstracts/135.pdf
5. Michael Adeyinka, ‘ Telemedicine and telecare : Telepathology;, Teleambulance and Emergencies ‘ in Internet, Telematics and health, IOS Press, 1997
6. Godlevsky L, Kalinchuk S, Bayazitov N, Smirnov I,Adeyinka M, Samechenko U and Bayzakov U. `First Results of the Implementation of Telemedical Services in the Odessa region´, Polish journal of Medical and Physical Engineering, 2007;13(2) :105-114. PLS ISSN 1425-4689
7 S.H. Mandil, M. Adeyinka; ´Minimum Data Set for reporting and Describing Telemedicine Experience´; Book of abstract, The 3rd. International Conference on the Medical Aspects of Telemedicine´, Program and Book of Abstracts, May 30 /June 1, 1997, Kobe, Japan.