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A Collaborative Virtual Learning Environment for Agro-Forestry Trainings

László Várallyai[1], Miklós Herdon[2], Charles Burriel[3], János Tamás[4], Péter Riczu[5], János Pancsira[6]

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ABSTRACT

The aim of the AgroFE project is to play an important role in Agro-forestry trainings. Depending on the European countries, states or professional organizations and training actors try to reintroduce Agro forestry training and qualification in the vocational, higher education and adult education. The main objectives of the project are to make a synthesis of needs and expectations, based on present the existing training actions and to set up a common framework, to build an innovative training system to create a technical collaborative support for the implementation of the project with communication tools and for providing access to the resources and training services during and after the project. The user profiles are Teachers, Professionals, Students, People (with disabilities in professional situations), Knowledge feeders, Knowledge builders and aggregators. There are needs for handling many formats in the knowledge databank. More open source and exist tools and services have been evaluated, tested, used and implemented in creating the service architectures and finalize the system components in the project. The architecture concept of the Knowledge Data Base and Services has been developed. The paper describes the results of the developments. The Moodle LMS system and videoconference servers are used for collaborative working and learning environment. This learning and collaborative platform is used as project management, project assessments tools and e-learning / on-line learning. The videoconference systems integrated with the Moodle system can demonstrate and show the path towards the near future service similar to the MOOC concept. This paper decribes the concept of the knowledge data base and service architecture and some aspects of using mobile tools.

1. Introduction

The agricultural system has experienced a strong abandonment of agro forestry in the 20th century, to count today only a few million ha in Europe. Following the work of scientific research, development structures and the experiments of the few professionals, in recent years, agroforestry has met a true national and European recognition. Based on the results of scientific research, development structures and those of the "farmer-researchers", experimental courses were conducted in different countries, including BE, FR, in the UK on a small scale as resources, trainers and available skills are

[1] László Várallyai
University of Debrecen, Hungary
laszlo.varallyai@econ.unideb.hu
2 Miklós Herdon
University of Debrecen, Hungary
miklos.herdon@econ.unideb.hu
3 Charles Burriel
Agrosup Dijon, France
charles.burriel@educagri.fr
4 János Tamás
University of Debrecen, Hungary
tamas@agr.unideb.hu
5 Péter Riczu
University of Debrecen, Hungary
riczu@agr.unideb.hu
6 János Pancsira
University of Debrecen, Hungary
janos.pancsira@econ.unideb.hu

scarce (Lundgren and Raintree, 1982). The partners have identified training needs in the short term: these needs are operators and future operators, adults and pupils / students, teachers and counselors, tutors. These requirements therefore relate to levels of European qualification L4 and L5 / L6 and two types of learners: Students and adults, farmers and future farmers on the one hand. In the short term, the project will address these two public through a system established by the partners: based on innovative teaching practices training, occupational situations providing access to recognized qualifications (Herdon et al., 2011; Várallyai and Herdon, 2013). Fortunately the ICT tools have been developed increasingly nowadays, so there are tools and methods for e-learning and e-collaboration (Bustos et al., 2007; Herdon and Lengyel, 2013; Herdon and Rózsa, 2012). 13 European partners from 6 countries participated in the project. One of the important parts of the project is to apply innovative solutions for building and using the web site (http://www.agrofe.eu/) and knowledge repositories for teaching and learning agroforestry. The ICT based concept and results are discussed in the next chapters.

2. The objectives and development methods

The main objectives are to make a synthesis of needs and expectations, based on the present existing training actions and to set up a common framework; to build an innovative training system (contextualized, modularized trainings, use of ICT, professionals participation); to create a technical collaborative support for the implementation of the project with communication tools (information of partners and promotion) and for providing access to the resources and training services during and after the project (knowledge databank, interactive services) (Ibanez et al., 2013). To achieve these objectives the following main activities have to be carried out:

- Exploitation of the tools and services.
- Building a collaborative working environment.
- Planning the architecture for development, teaching and training.
- Implementing the e-learning environment.
- Designing the multimedia tools to make the system accessible for learners, trainers.

That is why we will be able to build a collaborative working environment for the project partners and players who will join to this knowledge database and information service. We have to use the following methods (do the following activities):

- Using the experiences from former project and practice.
- Studying new technologies and methods.
- Developing Agroforestry in agri-environment BSc course
- Evaluating them.
- Selection.

3. Results in research and development on ICT tools

For the collaborative working in the project we plan to use existing open source and free services. One of the essential solutions was the latest version of the Moodle system. One selection criterion was based on that we have more than 7 years' experience in using this popular system which can give every function that we need for collaborative working during the project. The ICT system of the project will be based on a knowledge databank service and for mobility (field) work we will use tablets with Android, IoS, Windows platforms, using the central services and applications.

A variety of ways that two or more organisations can work together are covered the collaborative working. The range is wide from informal networks and alliances, through joint delivery of projects to full merger. Collaborative working can last for a fixed length of time or can form a permanent arrangement. What these options have in common is that they involve some sort of exchange, for mutual advantage, that ultimately benefits end users. In recent years, interest in collaborative working has been growing, driven by the sector's drive for effectiveness and efficiency, government policy and public opinion.

The types of collaborative working can be the following:

- Separate organisations maintain their independence, but work jointly on some activities or functions.
- Organisations with resources or expertise offer assistance to other organisations, a large national organisation working with a small local group.
- A new organisation to do joint work on some activities or functions.
- A group structure where a 'parent' organisation governs a group of 'subsidiary' organisations.
- Merger to form a new organisation working as one body on all activities.

CWE (Collaborative Working Environment) can be perceived as the tools, technologies, services and environments supporting individual persons in their working tasks to become more creative, innovative and productive involving the direct or indirect interaction (collaboration) with other individuals, groups or organizations (Collaboration@Work, 2005; Ibanez et al., 2013). Collaborative platforms providing sophisticated upper middleware services required for environment and person-aware distributed collaboration. It is based on system integration of Web Services, Semantic Web, CSCW, utility-like computing and connectivity (grid or alike), sensor and wireless technologies (beyond 3G, 4G), advanced networks services (e.g. IPv6), knowledge and content management, and WFMS based on peer-to-peer design principles to enable radically new collaborative environments. They can provide the support and operations required for complex virtualised working environments. Works include development of tools for sharing resources, knowledge/resources discovery, service composition, CSCW tools (including multi-conferencing) to ensure stable, dependable collaborative applications.

Collaborative working is not right for every organisation in every case. Carefully identifying and addressing issues of concern helps establish if collaboration is the right way forward.

Potential benefits of collaborative work

- New or improved services.
- Wider geographical reach or access to new beneficiary groups.
- More integrated or coordinated approach to beneficiary needs.
- Financial savings and better use of existing resources.
- Knowledge, good practice and information sharing.
- Better coordination of organisations' activities.
- Competitive advantage.
- Mutual support between organisations.

In Hungary there is a high speed research and education networks which enable an uncompromised quality audio and video collaboration. This system offers the following collaboration services (http://www.niif.hu/en/):

- Video and desktop conference (IP based videoconference). From anywhere to anywhere, with any number of participants for project and administrative meetings, consultation, distant teaching and learning (Vidyo Inc., 2014).
- Videotorium: Video sharing portal for higher education, research and public collections. Share research and education recordings through Videotorium, in up to high definition (HD) quality.

The video network now features around 140 meeting room terminals spread all over the country, and a compatible desktop videoconference system is available to be used with a computer and web camera (Vidyo, Inc., 2012). Within the AgroFE project we use the Multipoint Control Unit which gives HD services, it is able to record and / or broadcast the meeting on the Internet. The Desktop system is also used because every partner can join in a virtual meeting room very simply and we connect this virtual room with every participant to the MCU server. This desktop system works with the Vidyo software. The virtual collaborative system architecture and main functions what are used in the project can be seen on Figure 1.

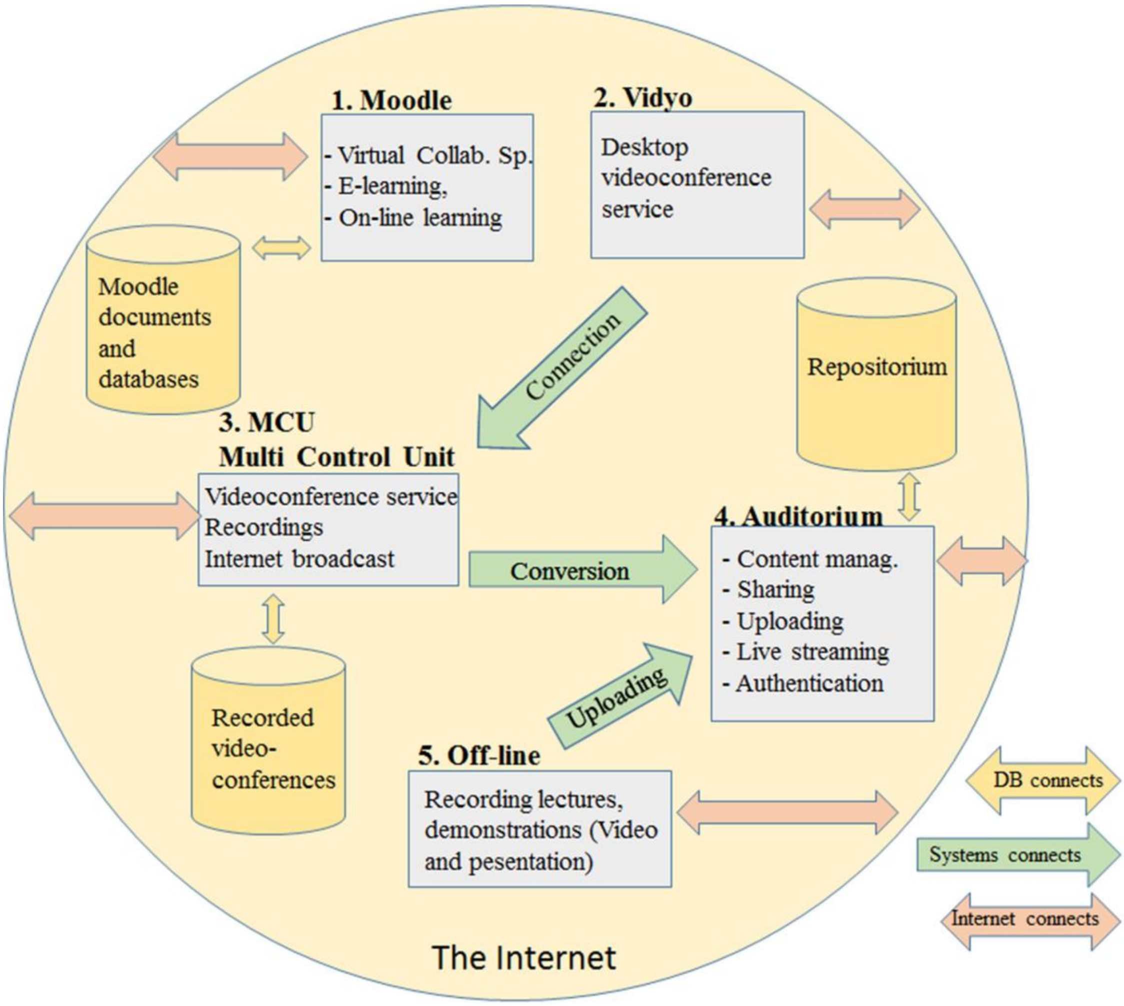

Figure 1. The architecture of the virtual collaborative environment

3.1. The Moodle as virtual collaborative space and e-learning platform

Online courses are moving into the mainstream and the software commonly used to deliver online courses can be prohibitively expensive. Classes take place online through the use of software packages that have special classroom features such as discussion forums calendars, chat rooms, where participants can communicate in real time with each other, and quiz and polling capabilities. Files such as word processing documents, sound files, pictures, and videos can be uploaded to the virtual classroom for viewing by students. Thus, the "platform" is essentially a place that looks like a private website and is intended to work like an electronic classroom. The classes taught on these platforms are accessible via the Internet, and are usually private, meaning that only individuals who are registered for the class can see the password-protected website. A platform for online courses may also be called an LMS (Learning Management System) or LCMS (Learning Content Management System).

Like many other higher education institutions, we introduced the Moodle system at University of Debrecen Centre for Agricultural and Applied Economic Sciences (UD CAAES) in 2007. The faculty leaders recognize the fact that modern technologies in education should be entered, which was realized in the Moodle system (Burriel, 2007, Lengyel and Herdon, 2009).

Departmental use and testing began in January 2008 with the introduction of the Faculty of Business and Rural Development. Since the introduction the Moodle System has been continuously updated. The system is used by a large number of users (teachers and students). The number of courses has grown rapidly. The Agri-Business Administration Education Program began in 2009 and number of courses and users has continued to grow. Implementation of the phases during the system upgrade has happened several times in order to make the newer features available. In the past we used the Moodle in more European project for collaborative work and adult trainings too. The preliminary experience entitled us to use this system for creating a collaborative space and e-learning in the AgroFE project (https://moodle.agr.unideb.hu/agrofe/).

The Moodle server is used as virtual collaboration space and e-learning system. The system implemented in September of 2014. We created the initial structure for collaborative work and starting the e-learning courses. Up to this time 136 users and 70 students are registered (enrolled) in the system (Figure 2).

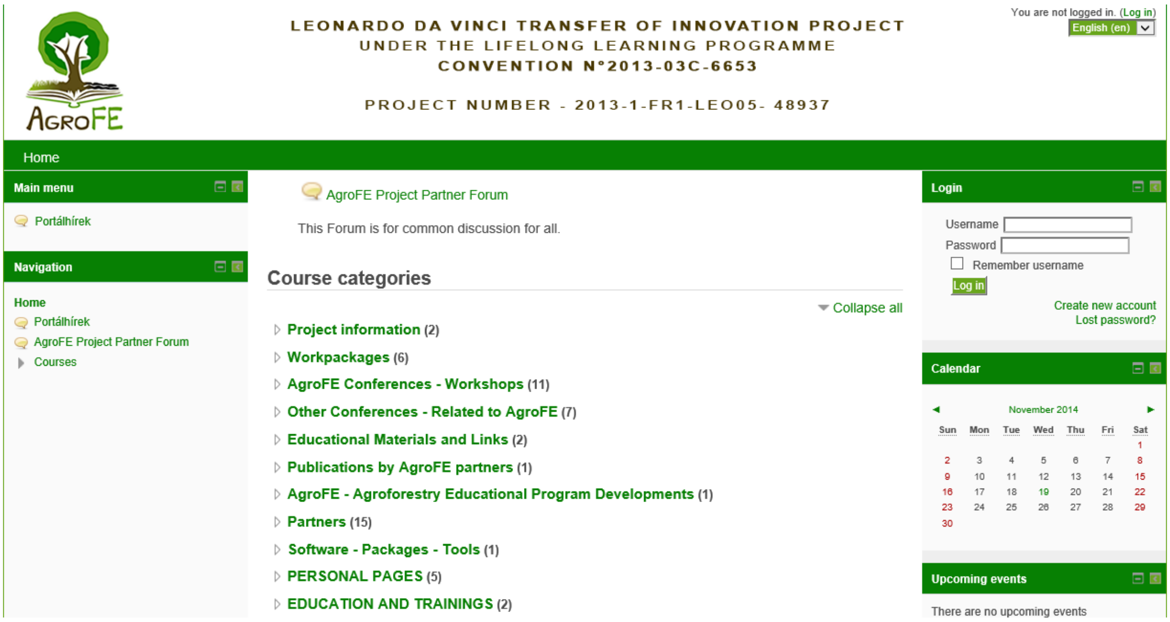

Figure 2. The main topic (called Course categories).

3.2. The Vidyo as collaborative and on-line teaching tool

The Vidyo portfolio (http://www.vidyo.com/) includes everything we need to deploy: the HD video collaboration to everyone in an organization, from core infrastructure to solutions that video-enable any device or application. Vidyo works the way we do. It runs on the devices we're using from smart phones to tablets, desktops to video room systems, bringing HD-quality video and content to every participant (Vidyo, Inc., 2012). The VidyoDesktop™ app extends high-quality video conferencing to Windows, Mac and Linux computers, allowing users on these systems to participate at office, from home, or on the road. The vidyo is by support encoding at resolutions up to full HD and dual-screen multipoint video. The key features are

- 2X Extreme Definition (XD) display people and content on one or two monitors, each up to 1440p.
- Multiple user-selectable layouts for continuous presence, active speaker, and shared content.
- In-conference public and private text chat.
- Share any app or desktop into the conference, and switch between multiple streams of shared content.
- Far-end camera control of Vidyo and third-party group solutions.

The VidyoMobile™ app brings high-quality video conferencing to popular Apple and Android tablets and smartphones. Host a person-to-person or multi-party video conference from your office, home, or in transit on both wireless broadband and WiFi connections. As a full-featured endpoint in your VidyoConferencing™ solution, VidyoMobile delivers transcode-free video conferencing for natural communication at the pace of conversation, without the broken pictures associated with traditional solutions. Using the Vidyo in the AgroFE project is shown on Figure 3.

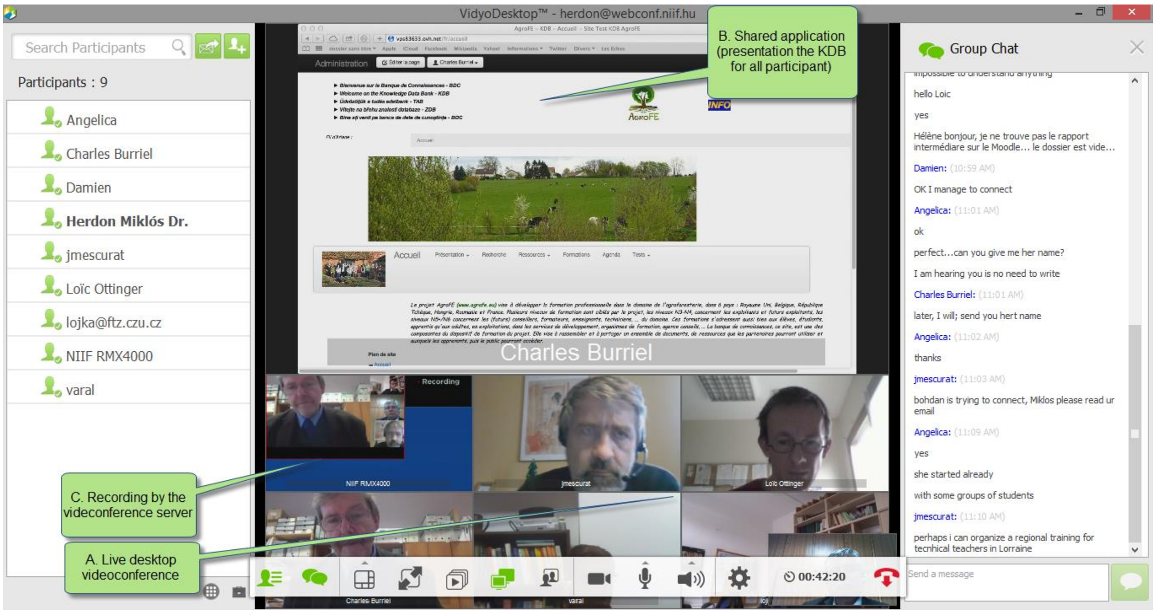

Figure 3. Using the Vidyo videoconference system for virtual meetings in the AgroFE project (The main functions of the system: A. the participants; B. Application share; C. The MCU server records the videconference and broadcast on the Internet; Personal chat; Group chat, Toolbar on the client computers).

3.3. Using the MCU server for videoconference service, recording and internet broadcasting

A multipoint control unit (MCU) is a video-conferencing device that links two or more audiovisual workstations into one audiovisual conference call. There are two kinds of multipoint video meetings; switched (or voice activated switching / VAS meetings) and transcoded meetings. In a switched meeting, the MCU switches the image of the currently speaking site to all sites. Most importantly, the MCU does not process the video signals at all. In a transcoded meeting, the MCU receives the incoming signal from each participant, mixes the signals together, then creates and sends a signal back to each participant. In this type of meeting, the MCU processes the video signals, and as a result can provide a signal optimized for each participating endpoint.

MCU makes it possible for a multipoint audio/video conference to be controlled and moderated from a single location. Multi-stream audio/video conferencing is bandwidth-intensive, easily requiring up to 6 Gbps, depending on the number of members. The units gather bandwidth data for all connected points and then adjust quality so that all points are capable of good performance. MCU are connected near the WAN, often contained in a rack server configuration.

MCU allow a user control different modes of displaying conferenced terminals. Modes include:

- All individuals displayed on a split screen.
- Voice-activated selection of displayed speakers.
- Individual conference points displayed full screen and switched between manually by a human moderator.

3.4. The Videotorium service and repository

Videotorium is a video/audio sharing portal created for the players of research and education. Videotorium provides professional presentation of video content recorded at higher-education organisations, research institutions and public collections. Videotorium has been launched in June 2010 by the maintainer of the Hungarian research and education computer network infrastructure, the National Information Infrastructure Development (NIIF) Institute (Kovács, 2009). The portal is the successor of former "Video on Demand" repository aiming professional accommodation for the growing collection of recordings and content upload and sharing by institutions.

Videotorium is freely available for users of any NIIF member institutions, but any non-profit research and education activity can be supported (Kovács, 2011). The content created by affected organisations can be infinitely various: scientific conferences, seminars, university lectures, trainings, scientific events, scientific experiments, research PR, documentary, interviews, etc.

Primarily, the portal offers its services to higher-education (students, lecturers), research and public collection community users, but the high number of public recordings offers a good opportunity for learning or self-entertainment. One recorded lecture (held by Prof Jerzy Weres on the Agricultural Informatics 2014 International Conference) can play as video on demand from the Vedeotorium (Figure 4).

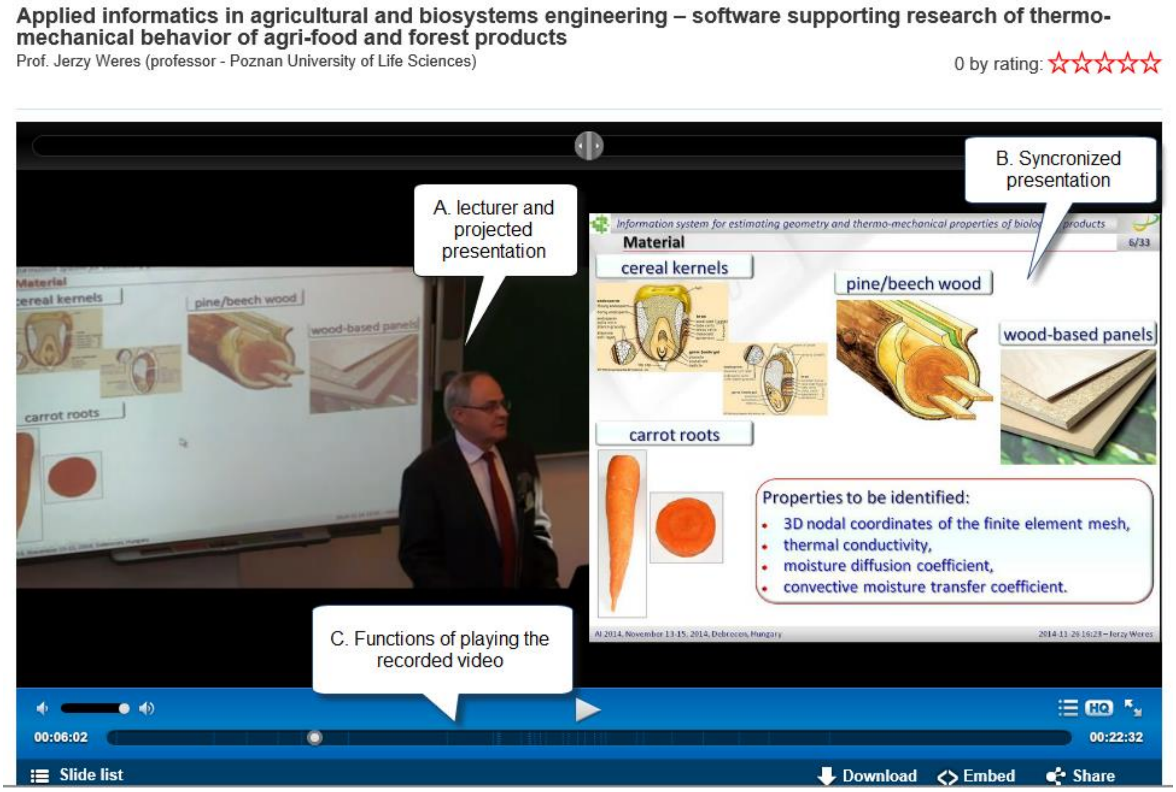

Figure 4. Playing the video from the auditorium (A. The lecture can be recorded on video; B. Upload the video and ppt presentation, synchronize the video with the ppt; C. Video on demand can be used for on-line learning with wide functionalities – share, embed, position to any slide, etc.) (http://videotorium.hu/en/)

The Videotorium would like to meet special requirements of higher-education, research and public collections community, which would be rather difficult to satisfy by a general video sharing portal. Major features briefly:

- Sharing of audio- and video recordings without barriers on length and quality (up to High Definition), free and unlimited storage capacity.
- Uploading presentation slides to recordings. Upload your PowerPoint or OpenOffice presentation and synchronize slides to the recording of your speech.
- Organisational micro sites: present all recordings of your institution through an own Videotorium site with individual URL, design and news.
- Flexible metadata scheme meeting requirements of scientific publication and providing effective retrievability.
- Flash based playback, compatibility with all popular browsers.
- Sharing through community sites (e.g. Facebook) and embedding recordings in external web pages.
- eduID federative authentication and authorization (Shibboleth AAI).
- Content aggregation with standards based metaadata exchange mechanisms (OAI-PMH).
- Live streaming: broadcast your event live through Videotorium to deliver your event to thousands of users through our high capacity servers.

We are testing this system for storing and streaming videoconferences and on-line lectures (on-line learning).

3.5. Building the Knowledge Base Systems

A knowledge base or knowledge bank is a special kind of database for knowledge management (Glick, 2013). A knowledge base is an information repository that provides a means for information to be collected, organized, shared, searched and utilized. It can be either machine-readable or intended for human use. Behind a Knowledge Data Bank (KDB), there is, at least, a back-end which is a DBMS. Within the AgroFE project the final target is to build and open source based system. The concept of the system architecture can be seen on the Figure 5.

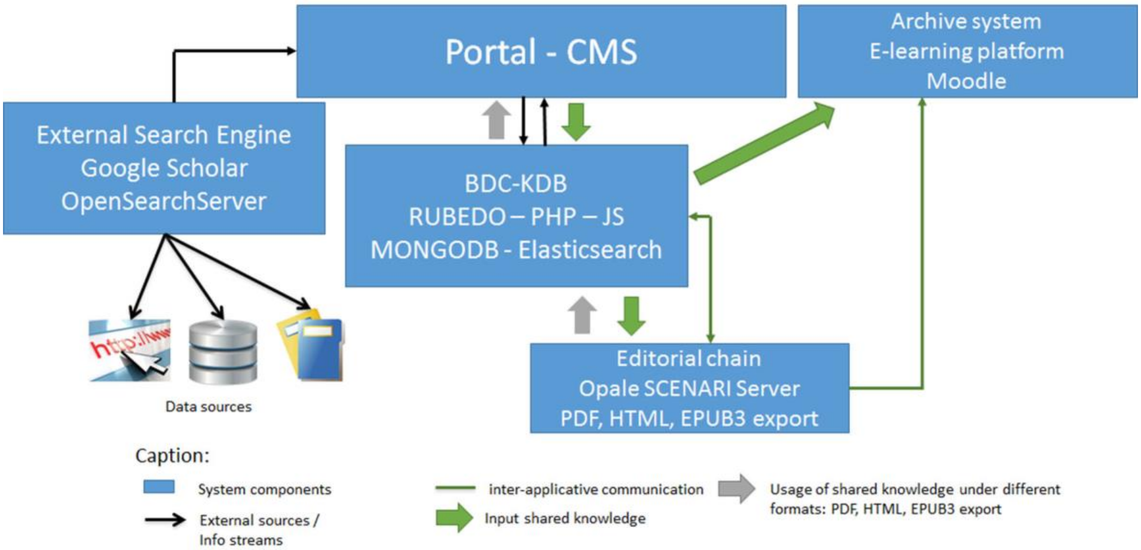

Figure 5. AgroFE Knowledge Data Base System architecture (Archiceture of the prototype)

In the context of the AgroFE project, the Technologies of Information and Communication, ICT, include four components, the collaborative tools (OTC-CWS), the Knowledge Data Bank (KDB-BDC), the tools for training and archiving and a portal that integrates the tools (Zheng et al., 2012).

The KDB, is to enable the sharing, access and consultation in the use of certain resources for training. These resources are under different forms:

- Mono document object, like a photo, a text, a diagram.
- Composite materials, for example an html web page with images, a “pdf” files with pictures and diagrams, a video clip, with images and sounds etc.

Under the project, these documents are identified, selected, proposed by partners and included into the KDB for the evaluation of their potential use in training, by one or more partners. A fact sheet originally written by the proposer, the institution, who proposed it to project partners, often accompanies, completes this document (So et al., 2009).

At the end of the evaluation phase, the KDB can be extended to other contributors, for other uses, such as exchange supports between different actors of Agroforestry.

In computing, a database is gathering highly structured data, a well-defined organization, based on different types of structures: Relational, hierarchical. This is absolutely not the case in a databank in which we store structured tables of numbers as well as illustrated text or video or emails, external knowledge or those from the project, in their various forms. But it should be noted that the knowledge data bank in the prototype of the AgroFE project is based on RUBEDO software, developed in PHP and RUBEDO is built on different components:

- A data base management software (DBMS), type 'NoSQL', MongoDB
- The user interface uses the ElasticSearch search engine.

The prototype of the knowledge data bank will be evaluated during the project and is open to the public. The system can be accessed by the different project partner's languages.

3.6. Using mobile tools for field work

Within the AgroFE project University of Debrecen (UD) purchased the following tablets under a tendering process in June 2014:

- 2 pieces SAMSUNG Galaxy Note 10.1 P600 32GB WiFi TABLET PC - Android
- 2 pieces ASUS VivoTab TF600T 64GB TF600T-1B031R 10" - Windows
- 2 pieces TOSHIBA TAB Encore WT8-A-102, 8" - Windows
- 4 pieces LG G Pad 8.3 V500 16GB 8.3" – Android.

Mobil informatics solutions are begin to widespread from the education to the field work in the world, in which one of the most outstanding tools are tablet computers. It could be separated these tools based on a different point of views, e.g. goal of using and operation system (Rogers et al., 2010). As we highlighted before the mobile solution, tools became more and more important, that is why we are focusing these trends in the project. The e-learning, the Vidyo (videoconference service), Videotorium can be accessed and used by tablets and smart phones for collaboration, communication, e-learning. But besides these functions are very important to use these tools at any-where. This means we need these equipments in the field work. In the next paragraphs describe some examples where we tested mobile apps.

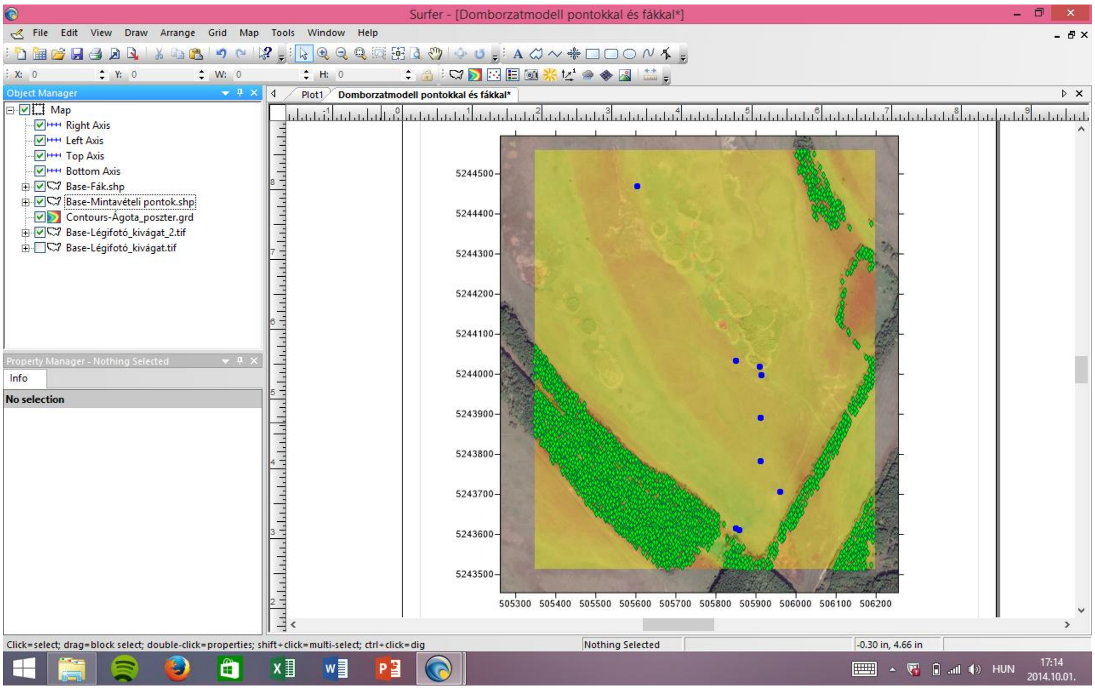

Figure 6. A Screenshot of the tablet, when Surfer 11 GIS software was running. Blue spots represent the field survey data which is collected by the GPS Satellite app

Field survey (Figure 6), data collection and data processing are sometimes carried out at different time, but we need prompt decision in many cases. Technical and informatics backgrounds are needed to solve these problem. These two main elements are the mobile data storage and handheld GPS devices (Wagtendonk and de Jeu, 2007). Tablets could be ideal tools for using on the field and supporting decisions. Tablets can be classified according to the operation systems. The Microsoft Tablets are operated by the Windows operation system, which is provided flexible platforms for work. Microsoft tablets worked on Windows 8 and Windows RT operating systems (Donatis and Bruciatel, 2006).

Now the Window 8 OS is basically a personal computer operating system, so some kind of GIS software can be installed on these tablets. Since the memory and the internal storage capacity of the tablets are now limited, so only preprocessing is possible or previously processed data can be used. Besides the installed software, on the Windows Store more than 500 000 application can be downloaded and installed. Tablets – independently from the operation system – have built-in GPS receiver which can communicate with certain applications, thus it provide real time data collecting (Figure 6).

The Windows RT is an edition of Windows 8 designed for mobile devices that use 32-bit ARM architecture. Windows RT has some limitation for software and applications what are available in Windows Store.

The Android OS is based on Linux kernel and developed by the Google. Typical desktop software cannot be installed, but the high amount of applications (more than 1,200,000) provide the easy data collecting, which are downloadable from the Google Play. Some typical field survey applications are available and most of those communicate with GPS satellite (Figure 7).

Figure 7. A Screenshot of GPS Field Area Measure application with surveyed areas

One of the most important parts of the field survey is the photo documentation (Figure 8). In-built opportunities are achievable on tablets, which record the GPS coordinates during taking of the photo. Desktop software and/or different applications are ideal for taking geotagged photos on a map, due to it is easier to identify the surveyed object on it.

Tablets could be very useful tools in education too. The basic office service is both Windows and Android operation systems. Documents, worksheets and presentations are automatically synchronized with different operation systems. Tablets can be connected with projectors by network or video cable too, thus presentations can be displayed for the students during the lessons.

Data storage is on the internal memory and henceforth web-based storage is available. OneDrive system is supported by Windows OS, which provides up to 30 GB data storage in cloud. Opposite of this, Android OS was developed by Google, so the cloud storage is on the Google Drive, to this is needed internet connection (3G, 4G, Wi-Fi).

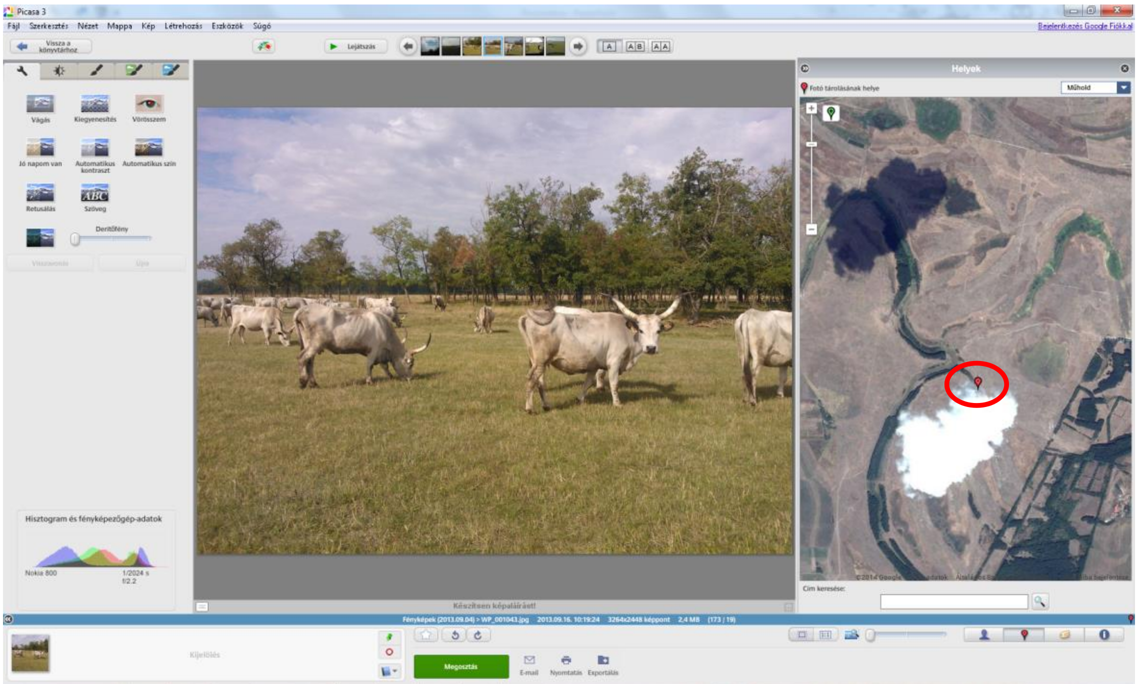

Figure 8. Geotagged photo with place of field survey in Google Picasa

4. Conclusion

The agroforestry will be important for rural areas and farms according to more aspects. Environmental, economic, agricultural production and rural living are very important issues. The project participants are involved in developing curricula for more training levels. Up to now we have developed subjects for BSc and MSc level in "Agroforestry" which are accepted by two faculty boards. The latest version of the Moodle system has been implemented for collaborative space and carried out more virtual meetings by the new videoconference systems, which have been tested and used times. All the virtual meetings have been recorded in the Videotorium system.

Within the AgroFE project the final target is to build and open source based system. In the context of the AgroFE project service system includes the collaborative tools (OTC-CWS), the Knowledge Data Bank (KDB-BDC), the tools for training, archiving and a portal that integrates the tools components. Under the project, the documents are identified, selected, proposed by partners and included into the KDB for the evaluation of their potential use in training, by one or more partners. At the end of the evaluation phase the KDB can be extended to other contributors, for other uses, such as exchanging of materials and supporting different actors of Agroforestry.

We are convinced that using the innovative technologies and solutions the system will serve and support to achieve the project goals.

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