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An Intelligent Web Based Platform that Enhances Acquisition Rate of Disabled Children

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Abstract: The proposed paper aims at designing a distributed educational platform that is capable of assisting users to acquire knowledge and develop abilities through on line interaction with teachers and fellow-workers. The main objectives are to provide an intelligent, adaptive environment for learning, enhancing knowledge acquisition rate and developing abilities of disabled children. It is a collaborative environment that will enable users to practice along with others in order to acquire collective experience and fortify the group's overall performance while minimizing the geographical constants. On the other hand, it can also be used on an individual basis and act as an intelligent self-training home assistant that enables users to improve their capabilities. Furthermore one of the systems main advantages is its capability of monitoring the emotional status of all actors and presenting visual enhancers in order to optimize their focusing capabilities and their performance. For this purpose the monitoring and recording of the user's psychological status is essential.

Key Words: Intelligent Web Based Platform, Enhances Acquisition, Disabled Children

Introduction

The full integration of disabled people is a major concern today and the area of education is no exception. Furthermore, the idea that Information Technology can get a primary role in the education of disabled students has now gained general recognition. The term "children with specific learning disabilities" (Coles, 1990) means those children who have a disorder in one or more of the basic psychological processes involved in understanding or in using language, spoken or written. The disorder may be manifested as an imperfection in abilities like read, spell, speak, write, listen, think or do mathematical calculations. Major focus has been given in children who have learning problems which are primarily results of emotional disturbance, and/or of environmental, cultural, or economic disadvantage. Numbers give an idea of the current educational status of disabled people: over 55% of disabled people had attained the first level of education, and more than 20% had attained the second level; (www. eurostat. Org).

In tale case Sally M. Reis *et al.*, (1992) comments: We investigated the experiences of college age students with learning disabilities. Most had been very bright in elementary school and had not been identified for gifted programs. . .or programs for learning disabled students. . . . Their brightness was enough so that they could do well on most of the tests for learning disabilities. . . . As the students got older, the learning disability became more pronounced. . . . They oftentimes did not gain the compensation strategies they would have needed had they been participating in a program--they started to have more problems in school.

The proposed system aims not only at providing valuable and innovative educational methods but also at monitoring the psychological status of the children and providing the needed guide and support.

Architectural Design: In this paper is described the design of a distributed educational platform that is capable of assisting users to acquire knowledge and develop abilities through on line interaction with teachers and fellow-workers. The projects objectives are to provide an intelligent, adaptive environment for learning, acquiring technical capabilities and enhance the learning rate both for disabled children and not. It is a collaborative environment that will enable users to practice along with others in order to acquire collective experience and fortify the team's overall performance while minimizing the geographical constants. On the other hand, it can also be used on an individual basis and act as an intelligent self-training home assistant that enables users to improve their capabilities. Furthermore one of the systems main advantages is its capability of monitoring the emotional status of all actors and presenting visual enhancers in order to optimise their focusing capabilities and their performance. "Facial expression communicates information about emotions, regulates interpersonal behaviours and person perception, indexes physiologic functioning, and is essential to evaluating preverbal infants" (Sayette *et al.*,). For this purpose the monitoring and recording of the user's facial expressions is essential.

The system consists of four main subsystems:

The Virtual Studio: An intelligent web-based platform,

The Educational Advisor: An educational tool,

The Multi-user Synchronizer: Or the virtual classroom and

The Emotions Handler: An innovative system for the facial's expression and emotional status recognition and process. Fig. 1 shows a general picture of the system's components and a brief description of its functionality and architecture is presented in the following sections.

Functional Description: In general, people that want to learn a subject or acquire specific capabilities address themselves to schools where teachers "supply" them firstly with the appropriate theoretical background and then they focus to the individual preferences of each student (Franca Pantano Rokou, 2001). It should be noted that the role of a teacher can not be limited in the provision of the knowledge but should extend to the psychological support of a student, for example, when student feels discouraged because of his performance.

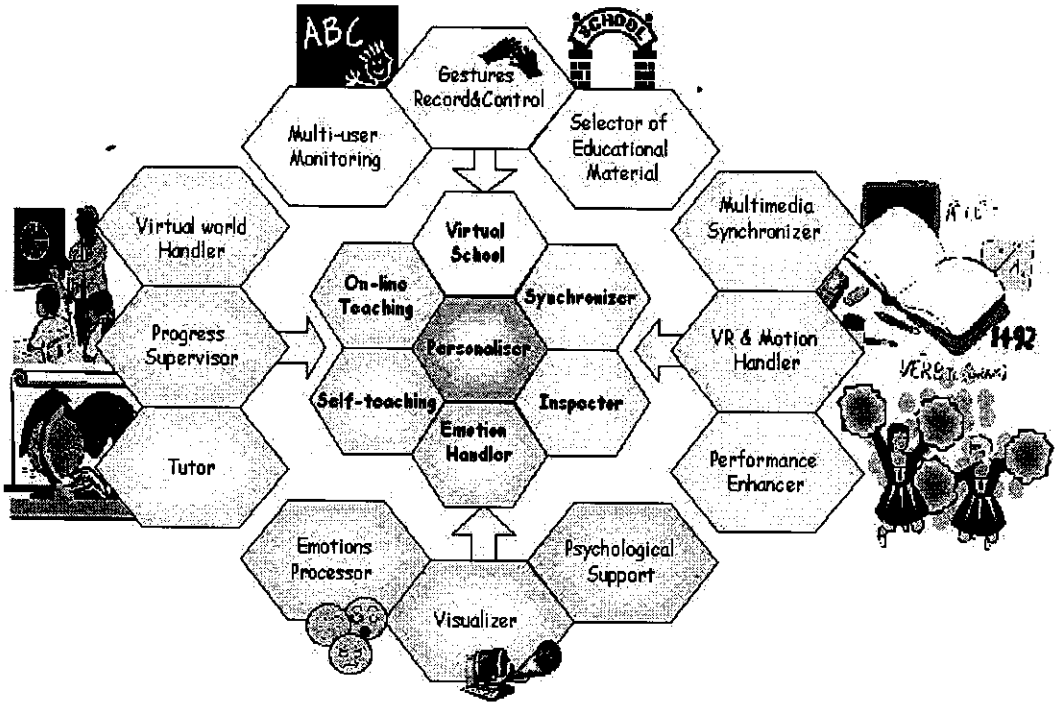

Fig. 1: A General Picture of System's Components

Moreover, the gathering of the members of a "special needs" classroom demands that the proper place has been found and all the members can easily reach there, which quite often is difficult to succeed, in case of disabled children. They usually are constricted to permanently move in another city, probably far away from their parents if they want to get properly educated.

Finally children with learning difficulties usually need a set of instruments that will enhance their focusing abilities and a sophisticated evaluation environment in order to test their progress and to optimize their performance, «When targeted to special needs, educational software is usually for visually impaired persons. Much attention has been paid to the design of alternative user interfaces, following the tradition of assistive technology». (Ramstein *et al.*,1996).

Using the system (Fig. 2), the user wears the provided accessories (gloves, glasses and earphones) through which, a virtual "personalised world" is depicted. Then, according to the user profile and the medical features of the child, (Korkman, 1988) an appropriate session is established between the user and the system's web platform, Virtual School.

A user that wants to participate to this distance learning process will communicate with the Educational Advisor, an interactive educational tool that creates an intelligent and adaptive environment into which children with special needs can have a personalized guidance in order to be rightly introduced in the world of knowledge. In that case, a combination of the user's knowledge level and his/her preferences is used in order to be determined, in an intelligent way, the appropriate educational method and the needed proportion of auxiliary means (sound, image, video, virtual reality) so that a personalised learning and optimum performance can be succeeded. An Emotional Handler monitors (Colin Johnson, 1999) the various facial expressions of the user through out the session and decides the content of the images that will present periodically in order to relax him/her so that can better focus in the learning process. Moreover, the Emotional Handler can provide psychological support via specialists if the system decides that is necessary. During the course data are collected, e.g. the gestures of the user, which represent the performance of the user. Those are processed and transmitted to teachers and specialised health professionals so that the progress of the user can be estimated and his/her profile updated.

If the user is a member of a working team or a virtual classroom then the appropriate profile is loaded for the specific user and the proper virtual environment is created. A Multi-User Synchronizer is responsible for the coordination and synchronization of the classroom's members and actions are taken in order to optimise the overall performance. An Emotional Handler is used, as in the previous case, to create relaxing feelings and help the user to focus on his/her task.

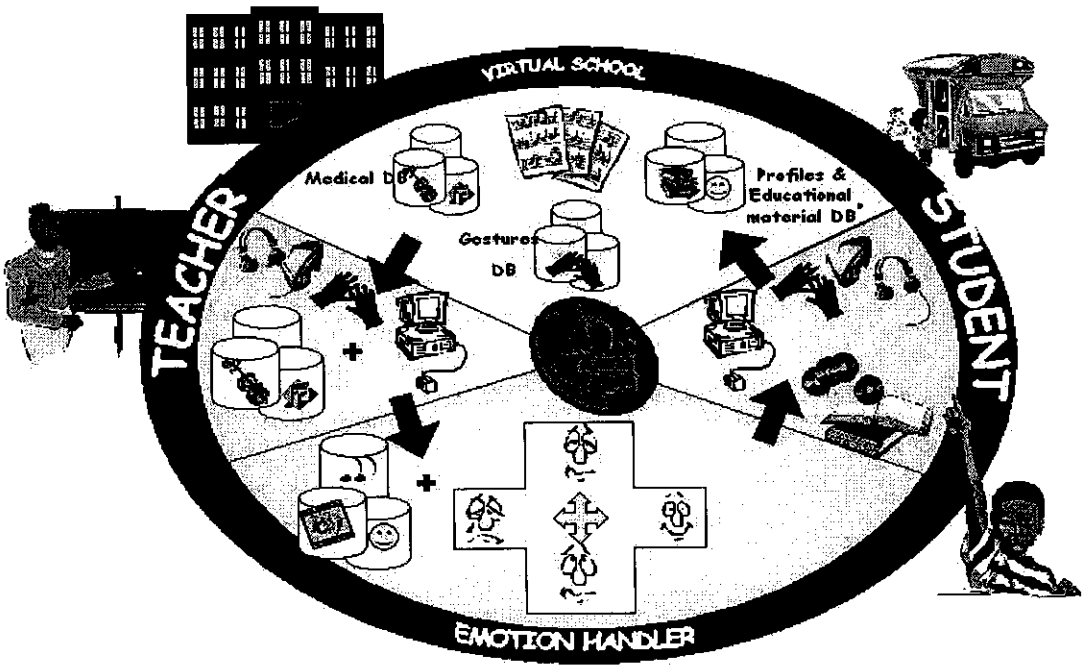

Fig. 2: Functional Description

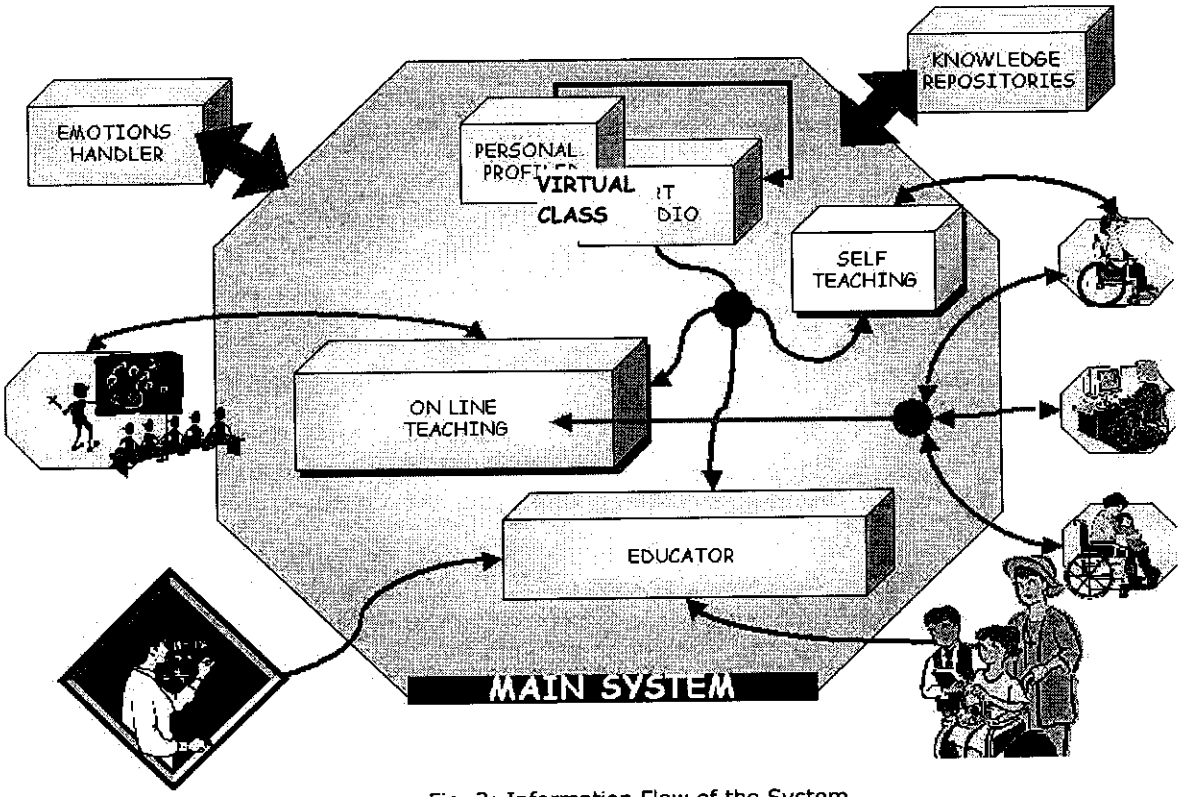

Fig. 3: Information Flow of the System

Fig. 3, shows the information flow of the system.

Main Sub-Systems: The system's major features along with the fundamental components that compose the platform are depicted in Fig. 4:

The platform consists of four main subsystems:

The Virtual Classroom: This module elaborates the profile of each student and along with his/her preferences decides for the teaching method that will be followed, based on a set of tests properly elaborated. Moreover, it monitors all the connected students that participate in a learning group, process the collected data and ensures that will be transmitted to the appropriate actors of the system (Franca Pantano Rokou, 2002). Finally, it is responsible for providing all those methods that will allow the user to smoothly operate the distant and shared gestures functions.

The Educational Advisor: This module consists of efficient educational tools capable of forming a completed on-line distance learning system as wells as an intelligent stand alone system of self-teaching. Those systems will offer a proper virtual reality world or generally a sophisticated multimedia application or both of them. The Educational Advisor: will communicate with the Virtual Classroom so that useful data can be exchanged. Finally, it will provide a Progress Supervisor in order to help students to optimise their performance.

The Multi-User Synchronizer: This module is responsible for the creation of a collaborative and sophisticated environment in which members of a learning team can practice and optimise the orchestra's performance. It provides the necessary set of functions, which will ensure that no undesired delays will occur during the team's practice.

The Emotions Handler: This module is an innovative system for the facial's expression and emotional status recognition and this is a prime time to use them system for this cause. Its goal is to provide the user with the psychological support via images, tips or sessions with specialists, if it is necessary, so that he/she can better focus to the various tasks. This facial-expression recognition system is said to be faster and more accurate than a human expert (Schmidt and Cohn, 2001).

It should be noted that all the subsystems communicate with Knowledge Repositories in order to store, retrieve or update information that is necessary for the various operations of the system. The user interacts with the system via the Communication Layer, which includes all the needed accessories (gloves, glasses, earphones) and applications as well as the necessary communication mechanisms for the transport of data.

The Art Studio Subsystem

The Virtual Classroom Subsystem: Is a fundamental sub-system of the platform. It creates a Personal Profile where it is stored general information for each user along with the user's knowledge level in the sector of music. The Personal Profiler using this information retrieve from the Educational Advisor the most suitable teaching method for the specific profile, updates user's profile regarding the selected teaching plan and sends this information to the Educational Advisor too. According to the plan that will be followed for the specific user, the set of gestures is chosen from a Repository, for the current session, and "is loaded" to the Gesture Handler. At that stage, the Virtual Classroom becomes capable of acting as an automated inspector of the user's performance and motions, using the Multi-User Monitoring component in combination with the Gesture Handler and Motion Tracking components. This automated inspector functions as a virtual teacher since it can correct erroneous movements, any lack of synchronization and guide the user to put his/her fingers to the right positions on the virtual educational instruments explaining to him/her the various ways that exist to handle and use a specific instrument (for mentally disabled children) and how can be used in a specific situation. This information is retrieved by an appropriate Knowledge Repository.

More Specifically, the Virtual Classroom Module Consists of the Following Sub-systems

Personal Profiler: It includes all those mechanisms that are required for the creation of a personal profile. All user profiles are stored in a repository. A Personal Profile includes general information for the user as well as a knowledge level profile. The later is passed to the Educational Advisor in order to come up the teaching method that will be followed. The Personal Profiler stores it for future use.

Educational Advisor: Lessons are taught by a variety of different methods; individual teachers will have their preferences among the different methods.

Each method has its own set of strengths and weaknesses. The educational advisor's goal is pointing out both strong points and criticisms of teaching methods in order to provide teachers with an overview of a given method's strengths and weaknesses, so that he knows what he's getting and how he might supplement or improve it by good teaching and proper selection of the educational material and media.

All teaching methods involve compromises and not every method works well for every student. These methods should be evaluated in light of the individuals needs (Franca Pantano - Rokou, 2001). Although there are a number of means for teaching music theory to students, there are relatively few theory programs that allow the teacher to both drill the student in theory and adequately monitor their progress. This system helps students of all ages reinforce the knowledge and skills learned at their private lessons and/or theory lessons. The system, announcement in advance, is not restricted in teaching material; instead it provides a set of levels of theory challenges ranging from identifying keys on the keyboard, to identifying different objects and advanced learning material.

Multi-User Monitoring: This component collects processes and interprets the transmitted data from all the connected students and accurately presents them to the appropriate actors. Its role is fundamental for the effectiveness and the functionality of the system. It provides the platform and the correspondent interface to monitor a group of students during the lessons and/or their personal exercising. Thus can have a holistic view of their progress, strengths and weaknesses. Furthermore, the teacher has the opportunity to adjust erroneous movements without interrupting the students and to collect precious data about their general attitude.

Gestures Handler: It retrieves from a repository, according to the teaching plan, the set of gestures that user has to follow. It takes input from the Motion Tracking component and comparing those gestures with the given set decides for the correctness of the user's movements (a "check" function). Moreover, it has mechanisms for "save" and "record" gestures.

Motion Tracking: This component takes input from the gloves' sensors, process them and output them to the Gestures Handler.

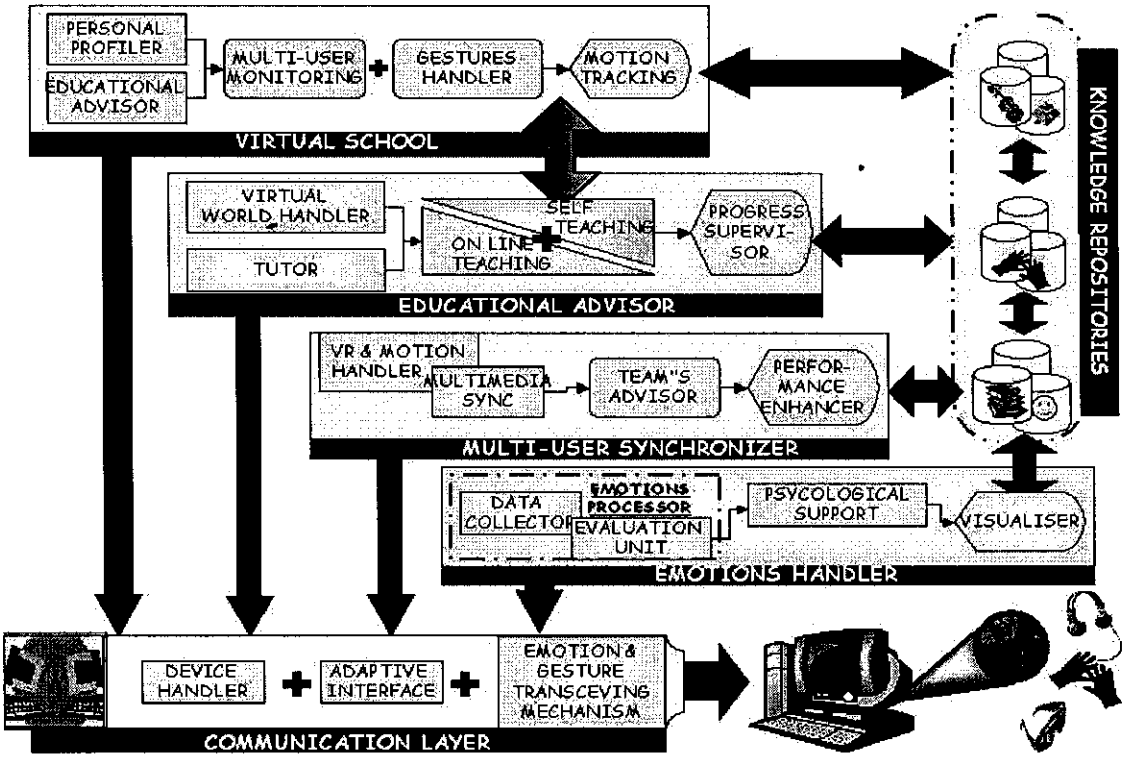

Fig.4: The Sub-Systems

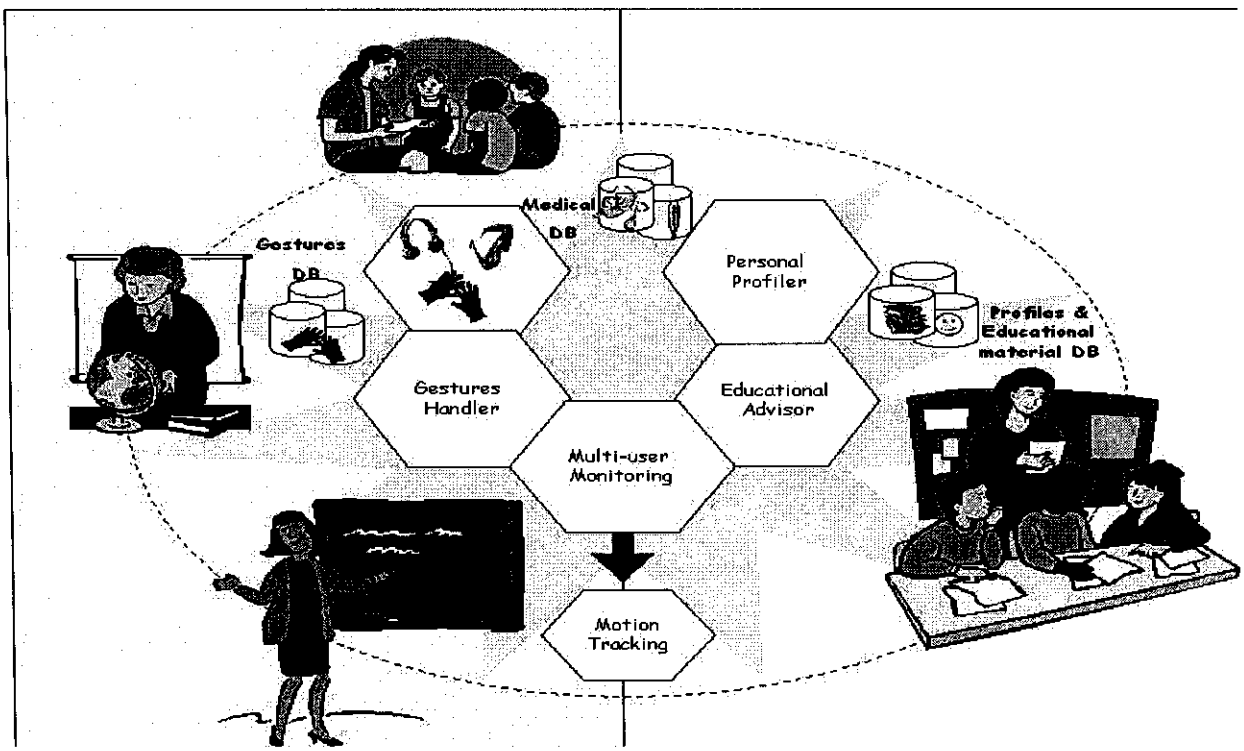

Fig.5: The Art Studio Subsystem

The Educational Advisor Subsystem: The Educational Advisor is basically an interactive educational tool. A Virtual World Handler communicates with the Virtual Classroom in order to retrieve information regarding the profile and the suggested teaching method for each user. Then creates the appropriate virtual world. In this virtual world, the **Tutor**, a two-dimensional component, is responsible for the guidance of the user either in an on-line or self-teaching session. The progress of each student is controlled by the Progress Supervisor.
More specifically, the Educational Advisor consists of the following components:
Virtual World Handler: This component uses information from the Personal Profiler and Educational Advisor in order to create a virtual world adapted to the needs, preferences and personality of each user.
Tutor: As pointed before, this is a two-dimensional component. Firstly, it provides with the appropriate tools the teacher so that can create his/her own presentations and teach the various on-line lessons according to his/her preferences. Secondly, it can act as an intelligent automated guide in self-teaching lessons, searching and extracting each time the appropriate educational material from a knowledge repository in agreement to each user's profile.
On Line Teaching: In this case, there is a timetable according to which a teacher and his/her group of student's access the system. An advanced virtual classroom and a collaborative environment are created. Virtual reality and sophisticated educational multimedia applications are used in order to support the on-line teaching.
Self-Teaching: It is an educational support tool that offers the appropriate theoretical background along with a number of exercises in order to help user to better consolidate the various definitions and techniques that have been taught by the teacher. In this case, lessons change dynamically, in proportion to user's profile, knowledge level, rate of learning and selected teaching plan.
Progress Supervisor: This module collects information for the knowledge level as well as for the teaching plan that follow each user. Using them as a base, it examines each user with theoretical and practical tests in order to track down their weaknesses. Then, it provides users with the appropriate exercises, which will help them to override their problems. If the performance of the users is satisfactory, it allows the user to go to the next stages of the course.
The Multi-User Synchronizer Subsystem: The Multi-User Synchronizer is a collaborative tool that provides members of a classroom with location transparency and a specialized musical environment capable of fulfilling the high synchronization standards that are required. Moreover, a variety of enhancements allow to the stakeholders to optimise their performance. Therefore, a VR Handler creates a virtual world where each student can have a picture of a classroom, his/herself and the other student that constitute the virtual class. Properly selected data are processed from a Performance Enhancer, which send tips and corrections to the musicians in order to optimise their performance. In addition, it gives the ability to the supervisor to direct and communicate with the members of the team.
Thus, The Multi-User Synchronizer consists of:
VR and Motion Handler: It is responsible for the creation of the appropriate virtual world so that participants can have the impression that they are in the same room along with the other members of the team and the tutor. Moreover, via the Virtual School tracks the gestures of each one and perform various checks through the help of Knowledge Repositories in order to find the necessary corrections that will optimise the performance of the end-user. It gives input to the Performance Enhancer.
Advisor: It communicates with a Knowledge Repository so that can retrieve all those information that are required in order to take decisions for the performance of the team in a specific action. Moreover, collects information for each student regarding his/her cooperation with the others and the tutor and in general all those data that are in a higher level from the motion tracking. It gives input to the Performance Enhancer.
Performance Enhancer: It gives the ability to supervisor to run the team and communicate with its members in real time so that can send them various tips for their actions. Moreover, it takes input from the VR - Motion Handler and the Advisor so that it can "check' the performance of the team and each student's separately. It sends guidelines and corrections to children and if it is necessary alerts the Emotional Handler trying to optimise the overall performance of the team.
The Emotion's Handler Subsystem: Emotion's Handler is the cornerstone of this innovative educational tool. It's role is mainly concerned with the collection and process of prosodic expressions of the student during his/her performance. The collected data are properly elaborated and along with data and rules from the knowledge repository, are used to provide users with innovative visual enhancers, in order to achieve optimum performance and maximise their focusing capabilities.
More specifically, Emotion's Handler mainly consists of the following modules:
Emotions processor: that collects from the wearable devices and following elaborates data concerning facial expressions of the involved actors.
Psychological Support: it consists of two discrete components: (Korkman, 1988)

- An alert mechanism that controls the overall status of the connected users and compares the data with those that have been set as standards for each individual and in case of emergency, expert psychological support it is provided, through on line communication.
- A module that aims at finding peaks of performance of each individual user and matches them with specific prosodic expressions. Then, it automatically creates a set of rules in order to lead the user in that emotional status that optimises his performance.

Visualiser: Based on the rules extract by the above component selects and presents to each individual user those scenes that make him comfortable and relaxed. Thus, the musician's ability in focusing is enhanced and his performance is always at the top of his own capabilities.
Furthermore data collected by this component turn to be very useful for research purposes. The Research Repository keeps " anonymous" data collected from the individuals systems. The term "anonymous", refers to data which are not related to the personal information and do not disclose any information on his identity.
There is also an Update Service that uses mobile agents that visit a defined list of and collects, only the data that was added after the previous visit of an

agent. This approach keeps the portal running at any conditions, and allows it to program efficiently the update function, according to the use of each station. Apart from the above-mentioned components, a User Profiler component is also available to enable different levels of access and personalised interaction according to the user preferences.

Conclusion

Computer applications have been developed rapidly and spread to practically every sector of human life. In order to use the latest and greatest computers in education-in a functional way – both computer scientists and experts of learning are needed. The key factor for success is cooperation from the very first stages of planning and development.

The main objectives the proposed application are to provide an intelligent, adaptive environment for learning, enhancing knowledge acquisition rate and developing abilities of disabled children. It is a collaborative environment that will enable users to practice along with others in order to acquire collective experience and fortify the group's overall performance while minimizing the geographical constants. On the other hand, it can also be used on an individual basis and act as an intelligent self-training home assistant that enables users to improve their capabilities.

Furthermore one of the systems main advantages is its capability of monitoring the emotional status of all actors and presenting visual enhancers in order to optimize their focusing capabilities and their performance. For this purpose the monitoring and recording of the user's psychological status is essential. Thus the proposed system aims not only at providing valuable and innovative educational methods but also at monitoring the psychological status of the children and providing the needed guide and support.

Our experiences have encouraged us to continue with the chosen path. The design has been refined and generalized. We are currently working to experiment this application in real life.

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