Integration and Collaboration of Distance Learning to Conduct the Curricula

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ABSTRACT: *Most engineering Institutes and Universities utilize adapted e-learning systems to help learners get personal-suited information. The common characteristic of these efforts is presenting various courses by using multimedia materials. We have investigated technologies, methods and tools of e-learning applications. Based on the studies, we design and implement a distance teaching/learning system which combines on-campus courses and remote activities. In this paper, we propose our distance teaching/learning model. Our school creates the corporative distance learning curricula. Our goals are to promote the students' ability of solid learning, innovation, knowledge acquirement, teamwork spirit, and communication skills. In order to help our students, we set up the pedagogic scenarios to embed engineering education into our distance teaching/learning system. We offer the engineering education related courses and take students to participate in the activities of Mars exploration. After these Mars exploration activities, students are more interested in the on-campus courses. This proves that the distance teaching/learning courses plus with remote live activities can stimulate students' learning motivation. Besides, we describe the main goals, motivation, detailed methods, and related activities of our distance teaching/learning system in this paper. Our distance teaching/learning system has the following characteristics: 1) Interactive-based, 2) Activity-oriented, 3) Learner-centric oriented, 4) Personalization, 5) User-friendly, 6) Participation, 7) Geographic, and 8) Rich informative materials. The main contribution in our engineering education is that we integrate all education resources like the remote activities to enhance the contents of related courses.*

1 INTRODUCTION

In facing the challenges of the coming digital economical era, well-utilization of mature e-learning tools and collaboration with other engineering education resources are the key factors to upgrade our manpower. In order to achieve this task, building a practical e-learning system is the turning point issue. We focus on efficiently integrating the most talent persons from industrial circles to academic circles to stimulate our students' inspiration. Hence, we can raise the high value-added students in this century. Under the rational concept, our university creates a corporative distance teaching/learning curriculum. Our goals are to promote the students' ability of solid learning, innovation, knowledge acquirement, teamwork spirit, and communication skills. In order to help our students, we set up the pedagogic scenarios to embed engineering education into our distance teaching/learning system.

Along with the e-learning field becomes more and more mature, a lot of e-learning products beyond the simple "page-browsing" courses have driven the universities, government, and industry up to date. In the near future, e-learning products will allow the users to have full control of their own learning flow. Then, the learners can learn more efficient and save their time and money. An integrated e-learning

system gives students opportunity to be educated from distance in a wide range of advanced academic subjects. Our on-campus courses include the "remote sensing for our planets" in the spring semester and the "space exploration" in the fall semester for the graduate program. Moreover, we combine Mars exploration activities in our curricula to improve the quality of the distance learning.

People tried to find signs of life on Mars since 1960. As we know, the Mariner 4 was the first Mars exploration spacecraft launched in 1964. In the past 40 years, there were 31 Mars exploration missions, but two third failed. NASA launched two powerful new Mars rovers to the red planet in 2003. The first Mars Exploration Rover, Spirit, landed on Mars on January 4, 2004. We build up a series of remote activities related to Mars exploration to join on-campus courses such that our students can learn more than what traditional classrooms do. Besides, we achieve the e-learning courses not only learn flaky knowledge via the Internet at all.

Before the landing day, we held a series of speeches from 6th to 27th in December 2003. The topics discussed include "An Exciting Year in Space Science," "Mars Exploration Rover Mission Overview," "Mars Exploration History," and "The Future and Development of Mars Exploration". We introduced the Mars and Planet, the architecture of spacecraft, the instruments for remote sensing, the technologies of distance measurement, how to calculate and change the orbit of planet, and the on-going projects of Mars exploration. Two keynote speakers discussed the related topics for each speech at the same time. One was in Taiwan and the other was at JPL. By utilizing the video conference, the audience can interact with the speakers who are in two different countries. Our specialists explained most of the questions. By using the modern technology, it really encouraged students to acquire more Mars knowledge beyond traditional learning.

On the landing day, we designed a live broadcast activity. This online live broadcast activity of the NASA's Mars Exploration Rovers, Spirit and Opportunity, landing on Mars was held at Taipei Astronomical Museum on January 4, 2004. We cooperated with Jet Propulsion Laboratory (JPL), National Taiwan Science Education Centre, Tatung System Technologies Inc., and TVBS news station. We connected with National Cheng Kung University, National Dong Hwa University, National Museum of Natural Science, National Science and Technology Museum, and the Chunghwa Telecom Co., Ltd. via video conference. The TVBS live broadcasted the whole program for two hours. By hiding the engineering education in this activity, we connected the people around Taiwan and taught them the Mars related knowledge.

The purposes of live broadcasting activities of 2003 Mars Exploration Rover Mission from NASA (National Aeronautics and Space Administration) are to enhance the students' creation abilities, the science spirits, and thinking procedures. We expect to enlarge the students' fluency by using these facilities.

Only depending on the e-learning tools is not sufficient to face the challenges in the next century. The new information impacts us over and over. Under this situation, integrating all education resources and e-learning tools and forming a methodology of e-learning are part of the solutions. After taking the advantages of information technology, we can teach our engineering students equipped with more competence in the changing world.

2 MOTIVATION

In the early 1990, some researchers who made contributions in space exploration and space education proposed the reformed plans for the space technology education. Since then, the reform revolution stirred up people worldwide. Many countries, including the America, the Russia, Asia, and Europe, have caught up this trend. The Russian launched the first man-made satellite Spunik in October 1957. Two months later, the American launched the Explore I in January 1958. Since then, human tried to explore the space. Under this trend, it causes the procrastination of aerospace development. The engineering education pioneers have vigilance that even the engineering education changes with each passing day, the aerospace science technologies are not employed into general education courses. They are very anxious to make a revolution for the engineering education. The key turning points are as follows. 1) renewing modern information technology, 2) utilizing modern technology to educate our students, 3) avoiding the break-off of experience. All the countries have focused on these issues. In Taiwan, we improve the present curriculum for the engineering graduate students to meet the challenge of the advanced technology

environment. We have not only emphasized on adding and revising the courses and contents, but also paid more attention to add up the laboratory experience. Furthermore, we value the theory and technique training of students to meet the requirement of the modern industry.

The traditional and campus education cannot meet the professional industry requirement. In Taiwan, most of the engineering related departments invite specialists, scholars and technicians to make seminars to their students. Besides, universities endeavour to integrate the campus-industry-government cooperation. Moreover, they try to sign a contract with related companies to build a long-term cooperation mechanism. This is the future trend for engineering education. It is very important that universities must help graduate students identify their research directions. The universities and the industry representatives play a very important role. Hence, some departments will arrange practical training in domestic industry during summer vacation, and the others will schedule visits to research centers. Via the multi-channel learning, we encourage our students to exchange knowledge and experience with engineers.

In the twenty-first century, the commercial satellite begins to observe the earth and to take the digital images. The resolution of satellite remote photography from hyper-spectrum can achieve 1 meter square. The hyper-spectrum of satellite can be more than 10 bands. Different composition of surface will react to various bands. As a result, we can see different colors showing on the satellite images. The Space Imaging, Inc. launched the first commercial high resolution satellite, IKONOS-2, at Vandenberg Air Force Base on September 24, 1999. The photography resolution can be 0.82 meter. It resolved a lot problems caused by low resolution and raised the potential application ability.

The researchers proposed a lot of remote sensing algorithms which can be applied to different fields. But limited to some factors like meteorology, beams, and remote sensor instruments, the remote sensing image is not applicable. Recently, due to the satellite photography resolution is higher, more and more fields begin to utilize the remote sensing images to do researches.

Many scientists believe that there was the sign of water existing on the Mars. According to the data and imagery photographed by remote sensors, the researchers presume that there exists flood, big lake, even the ocean on Mars. The American Odyssey evidenced water existing on Mars polar by utilizing remote thermo sensor. The Mars Express captured the images of liquid molecule in the south pole of Mars by utilizing infrared camera. After analyzing the data, they found that the buried ice exists. These experiments encourage people's ambition to Mars exploration. We can conduct all the activities into our curricula and stimulate our students' innovation.

In Taiwan, the second satellite has been assembled and is ready to launch for operation. This event encourages our students and convinces them to continue the research. We have noticed that some key turning points will affect future developments of Taiwan aerospace science. We address as follows: 1) how to catch up the aerospace trend, 2) how to set up a suitable courses and related activities, 3) how to plan valuable directions, how to improve advanced aerospace technology and knowledge, 4) how to enhance personality to adopt the challenge, and 5) how to build up distinguishing laboratory in university.

If we cannot provide qualitative students to meet the requirements of campus, industry, and government, Taiwan will face a serious loss in aerospace technology. Under this consideration, our university has developed some key technologies that can ensure our position in the engineering education.

In this paper, we propose our goals and detailed steps including related on-campus courses and out-campus activities. Through the integration and collaboration of distance learning, our university can conduct our engineering curricula. Based on the whole curricula, we can lift our engineering education environment to an advanced situation and compete with other engineering research centers.

3 RELATED WORK

Distance teaching/learning is originated in the late 20 century. In the beginning, schools issued all the learning materials such as handout, homework, and examination questions to learners. Along with the technology, people employed the multimedia into distance teaching to fulfil lifelong learning. Distance teaching/learning has two properties, one is to break the spatial obstacle and the other is to extend the boundary of classroom. Owing to the modern technology, distance teaching/learning makes it possible

that people can learn anytime at anyplace. By utilizing this flexible property of effectiveness and efficiency, we can construct a lifelong learning channel.

Today, education is more important than any other era, especially for a developed country. For our country, we face a challenge to improve the quality of our students. Our government hopes to create a lifelong learning society to build up a development foundation. In the universities, we need to integrate the resources of different departments such as the engineering departments and management departments to provide a sturdy supporting system for industry. The distance teaching/learning integrates education resource, computer technology, information propagation, communication network, and video conference to build up an open environment. By using this platform, the instructors can pass the images, voice, and learning materials to remote classrooms. At the same time, the instructors and the learners can discuss interactively via the modern technology. Generally speaking, distance teaching/learning is based on documents that are transported between teachers and students. It utilizes all the media and tools such as the Internet, the tape/video, the broadcast, the VCDs, the television, and the satellite broadcast. Our distance teaching/learning system is based on this platform. We detail the operations in section 5.

Mosterman et. al. [3] addresses the importance of systemization and globalization in showing domain knowledge under a learning environment to avoid being involved in a narrow sense. Instructors can utilize real object properties such as color, voice, picture, image, and animation to stimulate abstract knowledge. Meanwhile, instructors have paid attention to interact with learners. The systems can provide guidance according to learners' needs. The authors proposed the efficient learning tools equipped with four characteristics: 1) anchored instruction, 2) simulated environment, 3) scaffolding, and 4) active learning. Krasniewski et. al. [4] indicates that the efficient courses designs should consider two features as follows. 1) Flexibility: The teaching materials must depend on learners' habitual behaviors. 2) Adaptability: The distance courses should be compliance with the new market trend and be the domain pioneer. Mentioned by Sternberg and Lubart [5], there are three main factors affecting the creative ability: 1) integration ability, 2) analysis ability, and 3) implementation ability.

Tassan [7] utilized the satellite images from Landsat TM to study the relationships between the ocean and chlorophyll consistency. Williamson [8] used the images photographed by visible light, near-infrared, and medium-infrared of Spot HRV to distinguish grapes and four fruit plants. The precision can be 85% to 90%. Wu et. al. [9] applied all the features by using mean values, angular second moment, contrast, and entropy methods from GOES satellite to infer rainfall rate. Lillesand et. al. [10] exploited the images from Landsat TM to evaluate the eutrophic degree of the 60 lakes in Minnesota, USA. Chen [11] utilized the images from Spot to construct the relationships between images and chlorophyll factors by using evolution computation. Hence they can tell the eutrophic degree of a reservoir situation.

When National Space Program Office in Taiwan has announced the aerospace missions, the engineering related departments in the university are opening diversified courses to meet future industry requirements. The remote sensing utilizes a platform to send the sensors in a better observation position. We can collect related data without directly contacting the observed objects from a long distance. Taking human body as an example, our vision and hearing are the basic remote sensing tools extending human's ability to explore the surrounding. Remote sensing can transfer all the reflected or emitted energy into an image. Then, we can analyze the data and measure the target objects. The main tools include electromagnetic wave, acoustic wave, force fields. Most instruments use the electromagnetic wave which consists of visible light, near-infrared, and micro wave. For example, the meteorological satellite measures the temperature of the earth surface by infrared. The America Landsat TM utilizes thermo infrared to measure the energy emitted from the earth. The French Spot receives the reflection from objects which irradiate by the sun.

4 CURRENT DISTANCE LEARNING MODEL AND TOOLS

The web-based e-learning is the commonly used environment to create distance learning courses. Designers need to integrate software packages which support the appropriate characteristics and functionalities to build up integrated e-learning applications [1]. We have evaluated some available learning environments in current market as follows: Lotus Learning Space, Librarian, Blackboard, webCT, TopClass, Embanet, Intralearn, Ecollege, Eduprise, etc. [2]. Indeed, the e-learning environments

have some characteristics in the available services. We find that most designers have agreed in the following specifications:

- User administration/authentication including instructors, learners, authors, and reviewers.
- Reusable contents.
- Dynamic browsing of the courses.
- Ability of collaborative learning and co-operation among users and instructors.
- Logging and modifying users' profiles.

This set of basic functions provides every user an environment in which he/she can play his/her own role. Besides, different groups of users have their own subset of needed functions. For example, the learners may want to search and navigate the contents. The instructors may need to review the progress of each learner's profile. The administrators may have different degree of privileges on monitoring the system services. All the progress of learning platform aims at using these tools and functions efficiently.

5. THE PROPOSED DISTANCE TEACHING/LEARNING MODEL

5.1 System Architecture

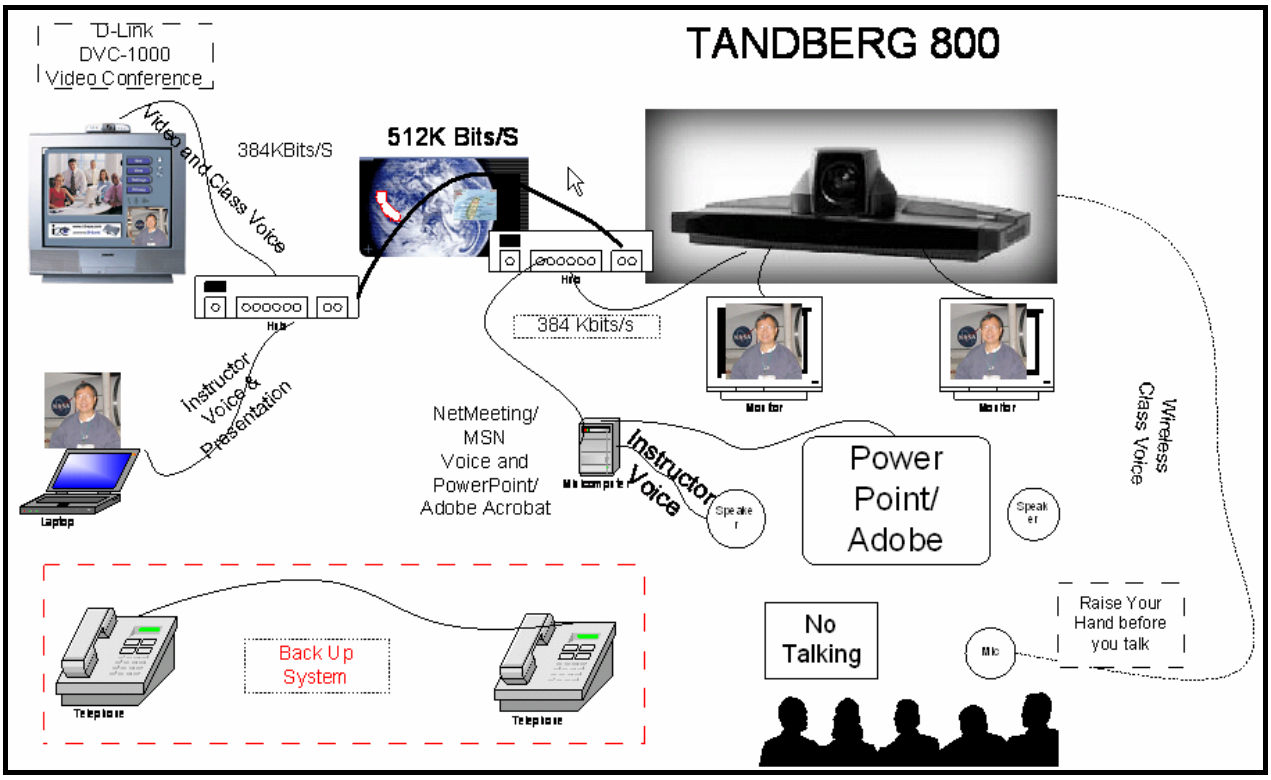

Figure 1 – The Architecture of the Proposed Distance Teaching/Learning Network.

We state some key factors about the engineering education in our university as follows. First, we try to shorten the gap between university education and industry requirement by emphasizing the well-practical training on experiments. Second, we equip our students with excellent internationalization. Third, we promote students' competition by strict courses and grading methods. Fourth, we improve the abilities of communication, coordination, and management by projects. The project is a one-year course for senior students before they graduate. Furthermore, our students have to participate in factory practical training during the summer break.

Our school initializes the space exploration and remote sensing distance teaching/learning courses since September 2001. We set up the distance learning environment as Figure 1. It shows the adopted distance teaching/learning model of the system. The content of the system addresses education concepts and computer tools for the graduate program. The courses include "remote sensing for our planet" and "space exploration". This system provides them with educational material such as text, voice, video and graphics. The main components of the distance teaching/learning system consist of the following items.

- Main class tools: video, voice, monitor and NetMeeting.

- MSN Messenger: In the class, we use MSN Messenger as our primary text message exchange.
- NetMeeting: We use NetMeeting, a Microsoft software, for presentation management and instructor voice communication control.
  (1). First, the instructor will log into Tatung server to remotely control the presentation.
  (2). By utilizing the network, the presentation materials are sent back to instructor's screen.
- Monitor: In the class, we equip three cameras for capturing students' video. Besides, we set up two TVs for both the instructors and students to see their images at the same time. Furthermore, we have a projector that can display the materials for all participants to discuss the related topics in no time.
- Wired Line: We apply a dedicated line for the distance class to avoid possible delay in network bandwidth.
- Video Conference: We put the D-link DVC1000 in the instructor's site and Tandberg 800 in the classroom for video and voice transmission.
- The eProject: We use a private project management system for our course material, communication, distribution list, calendar, and etc.

- Backup System: If the network is off-line, we have the telephone for substitution as the backup system. We can assure that the class will not be interrupted because of an unstable network.

5.2 Course Descriptions

A. Remote Sensing for Our Planets

The remote sensing is to acquire and record information about an object without directly contacting with that object. A photograph by a camera is a form of remote sensing. All the information is carried by electrical magnetic wave. Visual light is one of the electrical magnetic waves. As we know, the higher we stand, the better we can see the surrounding area. The following points the goals of this course.

- Remote sensing is an end-to-end system.
- Emphasis on data gathering, handling and presenting.
- As part of a large/complex system design training.
- Discussing the design and analysis methods.
- As part of long-term goal that plays a significant role in the future outer space exploration journey.
- A first cross continental, real-time, synchronous class and part of historical event.

B. Space Exploration

This course covers two phases about space exploration as follows.

(1) Mission Fundamental:
- ✓ Mission design
- ✓ Spacecraft (bus) design
- ✓ Mission operation

(2) Emphasis on Avionics:
- ✓ Data handling
- ✓ Attitude control
- ✓ Power system
- ✓ Ground data system
- ✓ Beginning a large/complex system design training

5.3 The Characteristics of Distance Teaching/Learning Courses

Our distance teaching/learning model has the following characteristics.

A. Interactive-based: Teachers are the center in the traditional teaching environment. When the teaching revolution begins, web-based e-learning carries considerable number of media, but it lacks active interaction between instructors and students. Most of the web-based e-learning systems focus on posting teaching materials to the web page. To correct this drawback, our school opens the distance courses not only utilizing the Internet, but also paying much attention to the classroom discussion. By increasing the interaction via network, students can understand the contents better than before.

B. Activity-oriented: Students often lose their learning directions under the web-based teaching environment. The learners sit before the computers all the time and the technology easily catches their attention. They are short of the opportunity to verify the theory learned in class. We stress the importance of combing theory with outdoor activities. Taking our "space exploration" course for example, we organize a series of activities of Mars exploration in Taiwan. To lead our students interest in aerospace, we cooperated with the JPL and National Taiwan Science Education Center to hold lectures before the rovers landed on the Mars. The well-known scholars made speeches during these activities. Students can learn more than simply web pages.
C. Learner-centric oriented: So far, traditional teaching/learning method is still a teacher-centric oriented model. They emphasize what teachers need so that the learners have to adapt themselves. However, this relationship had to be reversed as learner-centric model. Our system accomplishes to put the learners to the center.
D. Personalization: By analyzing the learners' objectives and existing skill level, we insist that students have to choose one area in which they are already proficient or interested from the courses. The instructors can conduct them to do advanced research. We emphasize what students are glad to learn by investigating their aspiration. Students can extend their personal interests by completing the projects. The project-oriented information feedbacks to our department. We can build up learning templates which are helpful for our courses regulation.
E. User-friendly: Many people are not familiar with modern technology. We try to minimize the fear of learning new technology. We utilize the PDA to provide some interesting instructive information-searching systems. Through the user-friendly systems, we lead these people to be familiar with modern technology.
F. Participation: Some of today's web-based learning systems are simply an extension of traditional textbook-based learning models. The user browses and reads contents from a screen instead of from a page. All the learners have to do is clicking on an unknown word for its explanation, or on a linked page for further details, or a short video clip for play. The so called give-and-take type of learning lacks truly participation. The instructors and learners can discuss face to face in our distance teaching/learning system. And in the remote on-line live Mars exploration activities, we collaborate with other universities and organizations to simulate real-world events. It really helps our students walk out campus and cooperate with other learners and instructors.
G. Geographic: Our proposed system tries to establish the scenario that learners are able to join the class from anywhere at anytime in the future. This results from the fact that there is no building restriction for the learning process and we have no problems of overcrowding inside the classes. Geographic independence also means that the stored data in the web-based lesson can be changed whenever we want, without any delays in the distribution of the material. When information is in the web all users can access them. In that way, it is not necessary for both the instructors and the learners to be present in the same class at the same time. The freedom of choosing the time increases the sense of controlling the learning experience and thus increases the motivation for learning.
H. Rich informative materials: The teacher is able to enrich learning material by using new technologies (e.g., multimedia) that make lesson more interesting. In parallel, the material can be re-used that gives the teachers more freedom to update and enhance the material and not with its creation from scratch anytime the lesson is tutored. Finally, from the moment the learning material is available on the Internet, a shared database is created serving as a distributed source of information.

We focus on the learning outcomes. We provide instructors/learners with the necessary IT tools to create or access the educational materials. Furthermore, they can communicate with each other in this system. We define the following three discrete profiles to help our understanding of the teaching/learning progress.

(1). Learner: uses the distance teaching/learning system for educational-communicational purposes.
(2). Teacher: defines the structure of the lessons and creates the contents.
(3). Teaching assistant: manages user accounts, configuration and maintenance tasks.

5.4 USING MARS ACTIVITY TO STIMULATE STUDENTS LEARING PROCESS

As we know, distance teaching/learning is a good solution to stimulate students learning process. Based on the current technology, we can do better than the passive distance learning. Besides, distance teaching/learning model can be applied to other activities which can really enhance the learning process. As a result, we describe why we took the activity of rovers' landing on Mars as part of distance teaching/learning course. The great event attracted students' attention and then they were willing to learn more related technologies.

Mark Twain said "We had the sky up there, all speckled with stars, and we used to lay on our backs and look at them, and discuss about whether they was made or only just happened…" For centuries, humans have looked up and wondered about the universe. Now, technological developments allow us to dramatically increase our knowledge of the universe, our solar system, our own planet earth, and our relationship in the universe.

Some statistic evidences can prove why aerospace education is so important today. We describe the space industry statistics as follows. Space employment was about 1 million in 2000. Worldwide space revenue achieves about 90 billion in 2000. There are 128 spacecrafts launched in 1999 including 76 commercial ones and 52 government ones. During 2002, 8 countries had launched satellites. And now, directly broadcasting satellite television, digital audio and radio programs are the hot commercial products. In America, the other related industry like semiconductor creates almost 72 billion in 2001. The American shares about 51 percent of $139 billion worldwide market. It provides 283,875 jobs related to the aerospace industry.

Some national space agencies are Canadian Space Agency in Canada, Centre Nationale d' Etudes Spatiales (CNES) in France, German Aerospace Center (DLR) in Germany, National Space Development Agency (NASDA) in Japan, Swedish National Space Board in Sweden, British National Space Center in United Kingdom.

It has been over forty years since human began to explore Mars. Mars is very cold, very dusty, and has a thin atmosphere that is saturated with carbon dioxide gas. Sometimes it gets so cold that the carbon dioxide condenses onto the Martian surface. So why do we want to go there? That is because Mars was not always this way. Thirty years of research in the form of spacecraft flybys, orbiters, and Landers has revealed that Mars was once earthlike. The fingerprint of a water planet lies in its landforms. Large channels and small gullies attest to a history of flowing water. Scientists believe there is the possibility that life may have existed there and might even exist there today.

The purpose of Mars exploration is to seek extraterrestrial life, to study Mars orbit and the planet's composition, to search for water, buried ice and shallow, and to measure deadly solar and cosmic radiation. The mission is one in a series that would help pave the way for human space exploration.

The Odyssey launched from the Cape Canaveral in April 2001. After travelling 450 million km, the Odyssey spacecraft arrived at Mars within 750 m of its target–a virtual tap in for a birdie. Its mission was to scan surface composition of Mars and to seek for water or the harmful radiations. Based on the results, human can avoid the latent danger in the future exploration. NASA once again tried to explore Mars after two failures since 1999. Although there are two third of over thirty missions failed, Mars exploration is still attracting human.

To seek for the evidence of existing life can explain the origin and evolution of life. Water is the main component of life. The discovery of buried ice in the south pole steps up Mars exploration. There were two failures before the missions of Spirit and Opportunity. One is Mars Polar Lander (MPL) and the other is Mars Climate Orbiter (MCO). The Spirit rover launched at 1:58pm on June 10, 2003 and landed at 12:25pm on January 4, 2004. The Opportunity rover launched at 11:18pm on July 7, 2004 and landed on January 25, 2004.

After landing on the Meridiani Planum on Mars, the Opportunity rover tries to find whether there is water existing under the ground and rock. After analyzing the crag composition, the NASA announced that there is water on Mars according to the data collected by the Opportunity on March 3. The evidences reveal that Mars has the liquid state. This discovery shows that Mars is suitable for organism to reside there. This significant discovery confides the NASA in fulfil President Bush's hope, delivering people to Mars.

6 THE OUT-CAMPUS ACTIVITIES

We held a series of lectures about "seeking for the Martians" as Table 1. We invited some noted specialists and scholars to make the speeches. We connected with JPL and held all the lectures by video conference. When the Spirit rover landed on Mars on January 4, 2004, we connected with the JPL by video conference and live broadcasted the landing event to the public synchronously. The Skylink station in Los Angeles, CA broadcasted the landing program at the same time. Besides, we cooperated with Taipei Astronomical Museum, National Taiwan Science Education Centre, Tatung System Technologies Inc., and TVBS news. We connected with National Cheng Kung University, National Dong Hwa University, National Museum of Natural Science, National Science and Technology Museum, and the Chunghwa Telecom Co., Ltd. The TVBS news live broadcasted the activity over Taiwan. Our students attended all the activities. Through the series of lectures, students can listen to what the speakers taught us. They can also ask questions to all the speakers directly. These activities brought the true and live story of Mars to students. Through this interactive discussion, students participated in the Mars exploration in person such that they have a wider and advanced view of the Mars.

Table 1 The Mars Exploration Program in Taipei.

Date	Time	Topic	Speaker
2003/12/06	10:00~12:00 am.	An Exciting Year in Space Science	JPL: General Tattini, JPL, NASA.
			Taipei: Dr. Y.-P. Huang, Tatung Univ.
2003/12/13	10:00~12:00 am.	Mars Exploration Rover Mission Overview	JPL: Dr. George Chen, JPL, NASA.
			Taipei: Dr. D.-M. Ma, Tamkang Univ.
2003/12/20	10:00~12:00 am.	Mars Exploration History	JPL: Dr. Dankai Liu, JPL, NASA.
			Taipei: Dr. J.-J. Miau, National Cheng Kung Univ.
2003/12/27	10:00~12:00 am.	The Future and Development of Mars Exploration	Taipei: Dr. W.-H. Ip, National Central Univ.

7 FUTURE WORKS

Our school is anxious to build up a distance teaching/learning platform. We can provide the engineering education resources to neighbouring schools. To achieve this goal, we are planning some targets which can evaluate our steps.

(1) Constructing digital teaching materials and distance teaching evaluation mechanism.
(2) Enhancing students' ability of thinking and resolving problems.
(3) Seeking the opportunity to cooperate with the software/hardware industry company.
(4) Setting up the remote and virtual laboratory to construct the strategic alliance schools.
(5) Encouraging instructors to involve in distance teaching researches.
(6) Conducting our students to fit to industry early by designing engineering program.
(7) Augmenting students exchange program and encouraging them to take courses in foreign universities.
(8) Integrating the education resources and sharing with neighbouring community.

8 CONCLUSIONS

The main difference between traditional classroom and distance learning is the teaching/learning place. Students used to learn in the same place, while the distance learning allows them to learn in separated locations. Instructors/learners can communicate with each others through the modern technology such as computers, Internet, and video conference. Moreover, distance teaching can provide diversified teaching/learning environment. Learners can get knowledge in a more efficient and convenient

way such that they can achieve the goal of lifelong learning. Our university establishes the distance teaching/learning curriculum which can provide students just in time learning and an education without walls. We also integrate the hot news like Mars exploration into our courses. We take students to participate in Mars exploration activities such that they can learn the newest trend from those activities. When the students are back to campus, they can embed reality into theory.

Our distance teaching courses still have some limitations as follows. 1) The cost of teaching devices is still very high. 2) Currently, we restrict students staying in the auditorium in scheduled time. 3) The network is unstable and sometimes we are unable to transmit and receive the frames or voice. Obviously, distance teaching/learning can break the spatial and time barrier in teaching/learning. The distance teaching is compliance with interaction, personalization, and flexibility. It can meet the engineering education needs in the information age.

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