Proceedings of the symposium

Extra Skills for Young Engineers

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October 18 – 20, 2000 **Maribor, Slovenia**

Edited by

Boštjan Vlaovič, Aleš Časar, Robert Meolic, and Filip Samo Balan

Organized by

University of Maribor IEEE Student Branch
Faculty of Electrical Engineering and Computer Science
IEEE Slovenia Section
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Foreword

The decision to actively participate in IEEE Student Branch Maribor was the start of a busy year. In the late 1999 a group of five people formed a new board of our student branch. In the end of October we got elected at the SB meeting. Seven people attended the meeting — including new board members. Quite honestly we were voting for ourself. That seems quite funny and sad at the same moment, but that is a fact.

We held our first meeting at the beggining of the following week. The past board gave as all materials and explained what they were doing during their leadership of the branch. They managed to set up Internet server for the branch and are to thank for our own domain `um.ieee.si` that we use for our web server, all our electronic mailing lists, and personal mail. In the past years the focus was on Student Paper contests. We were very successful (two second and one first prize in IEEE Region 8). Through the meeting we were trying to focus on problems they had and what they have learned from them. How to motivate people? That was the biggest question for the past board and I can safely say that most of our activities in the past year were trying to answer this question, too.

We started numerous activities and I believe we were quite successful. We have visited Student Branch Congress in Eindhoven, changed the look and feel of SB Maribor web pages, added local electronic registration form, visited SB Passau, hosted SB Eindhoven and SB Passau, provided local student members with 33 IEEE Magazines, participated in local Student Paper Contest, organised symposium, and many more. For detailed description of our activities please read contribution “Planet of visions” in the poster section.

You are reading the proceedings of our latest effort, the symposium “Extra Skills for Young Engineers”. We decided to organise the symposium during the R8 Student Branch Congress in Eindhoven, Netherlands. The main objective is to present facts, ideas, and visions of an engineer in the next millennium to the group of international students. We managed to get invited speakers from industry, IEEE and academia. All of them are experts in their field of work. In addition to our efforts Theodore Hissey from the Board of Directors provided us with 80 copies of his article “Education and Careers 2000”.

For all our Internet coverage by live broadcast of the symposium and all IP conferences we are very grateful to the Center for Distance Education Development (CDED), University of Maribor, lead by Matjaž Debevc. We would like to thank chair of Slovenian IEEE Section, Saša Divjak, for all his help and the organisation of the ISDN video conference lecture from University of Ljubljana. ISDN video conference equipment that was used in Maribor was kindly provided by Milan Ojsteršek.

Special thanks go to our sponsors. We believe that they will lead the way to better cooperation between our university, students and industry. We would like to thank IEEE Region 8, IskraTEL d.o.o, Hermes SoftLab d.d., Faculty of EE & CS, Slovenian IEEE Section, Esotech d.o.o., Institute “Jožef Štefan”, Mobitel d.d., and Gaudeamus d.o.o — ŠTUK. I hope next year more companies will decide to join us and present their visions and needs to the

international group of students. I would like to thank student organisations ŠOUM and ŠKD ŠOUM for all their help with the project.

We are very grateful for all the encouragement from Theodore Hissey, R8 director Rolf Remshardt, R8 SAC chair Javier Maricas-Guara, R8 SR Jorge-Luis Sanchez-Ponz, and many others. I would like to thank all student members and faculty staff for their help with the project. Especially Filip S. Balan, Robert Meolic, Aleš Časar, Aleksander Vreže, Dejan Kastelic, Bogdan Dugonik, Iztok Kramberger, and our counsellor Zmago Brezočnik for all their help and support during this past months.

See you next year!

October 1, 2000

Boštjan Vlaovič,
Chair of IEEE SB Maribor

Organizing Committee

Boštjan Vlaovič, *Slovenia*, **chair**

Zmago Brezočnik, *Slovenia*

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Dejan Kastelic, *Slovenia*

Robert Meolic, *Slovenia*

Aleksander Vreže, *Slovenia*

Invited lectures

Innovation & Idea Management for Engineers

Jorge-Luis Sánchez-Ponz

Abstract— **Innovation and innovation management are not new components of a company. Every organization bases its success or failure on the new products and ideas. It does not matter if it is a new technology company or a traditional business.**

Innovation, as something new, always needs to quell the resistance against novelty, but the innovation management provides the necessary mechanisms and techniques to do it.

Although individuals (innovators) usually support innovation, the teamwork, guided by the innovation management, is a good complement to improve the results and the public image of any company.

Keywords—**Innovation, management, organization, resistance, innovator, teamwork.**

I. Introduction

All the engineers must watch constantly toward the future. In the chain of the businesses, the changes take place at all times: from the products, equipment and facilities, to the workforce, providers and clients. The new opportunities, ignored by the company, will be certainly exploited by the competitors.

Every organization needs innovation. Though the access to the new technology could be obtained negotiating license contracts with other companies, any organization will need always to work on a stimulant innovation and creativity.

Scope difficulty and bureaucracy can drown the initiative and creativity, making too cumbersome the progress of new ideas through the company [1].

How can the innovation be promoted? The best and simplest answer is that the culture and attitudes of people in the organization promote the innovation. Accepted practices and methods must be constantly analyzed and challenged. The freedom of seeking and exploring new opportunities must be encouraged [2]. To induce knowledge creation, innovation and voluntary cooperation between individuals, companies must go beyond fair outcome to fair process.

Few ideas stem from intensive imagination sparkles. The ideas that contain the real value are usually not excludable or only partially so. Innovation and creativity are not merely irregular and spontaneous. The Polaroid camera was not the result of an isolated and luminous idea. It was the logical development of existing procedures and products, the result of a hard teamwork in a stimulant ambient.

II. Innovation

The term innovation has a wide variety of definitions. It is very common to find different meanings for this word along the technical and non-technical literature. Basically, these definitions give the main characteristics of the term:

- Innovation as a *fact of novelty*, direct result from the research and development (R&D) laboratories of the company, caused by the new combination of means and purposes within the company. This new range of activity can be based on the utilization or the exploitation.
- Innovation as a *perception of novelty*, the other departments of the company are conscious of the new ideas from R&D people.
- Innovation as a *first-time occurrence*, simply something new.
- Innovation as a *process aspect*, something that has changed in the production process.
- Innovation as an *extension*, something that increases its extent of applications.

In this way, the word innovation describes something new. But this newness can be analyzed in different dimensions, depending on the main focus area on which the novelty is. If the most important aspect is what is new or the new properties, it is called the *content-related dimension*. The people, for whom something is new are included in the *subjective dimension*, because this is built on personal feelings or prejudices and not on objective reasons. The *process-related dimension* is the dimension, which is of importance to the company on account of the location of the new elements within the processes of the company, e. g. timing, scheduling, and planning of resources. The last dimension is named *normative dimension*. There is something new, but has the company the certainty that this new thing will be a market success in the current legal and social environment? Consequently, the company must promote new legal and social circumstances to give the needed guarantees.

Thus, innovation does not always mean invention. The innovation process, also denominated innovation

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cycle, supports innovation itself, with the result that there is a defined characteristic manner from the initial idea to the desired market success. The innovation process gives practical and *emotional* help to innovation: environment, organization, culture and leadership guidelines [3]. It is in essence made up of the following steps: idea and initial conception, discovery, initial definition, trial development, specification, prototype and production and at the end the wanted market success.

This innovative cycle is the natural, reasonable and logical transition from the beginning state, which is dominated by the creativity and even by the chaos, to the final state, where the efficiency and the order are preferred. The way of balancing creativity and efficiency is the adequate selection of alternatives. For the decision between chaos and order, it is required to have clear the center of interest of the company at any moment.

Therefore, a brief and final definition for innovation is as follows: *"Innovation is the first economic utilization or application of inventions to achieve company goals. As a result, innovation includes the invention, its development (according to market needs) and the introduction into the market."*

It is crucial and evident for any company that its goals must be targeted to the increase and improvement of the own innovation ability. This rise depends basically on the kind of success that the company is rummaging.

When the principal aim is the continuous and uninterrupted success, the generation of ideas (basis of innovation) is intended to create an innovation environment in the company. This can be done through the global conception and vision of the inspirations instead of the strategic details, stimulating the experiments, which will be filtered and analyzed by developed mechanisms and purposeful simulations. Finally, the information and results are transferred to the rest of the employees using simple and concise methods of communication. The marketing of these ideas takes an active interest in the entrepreneurial behavior, whereas it is accomplished via an integrated approach, breaking up the organizational barriers (tight hierarchical structures), and relying on entrepreneurs and selected teams instead of complex corporate systems.

In contrast, if the company is looking for a one-time success, the generation of innovative ideas leans on a better application comprehension of the elementary concepts, simultaneously with a broad and extensive use of technology, and available options of business systems. Jointly, the marketing of the ideas is focus on the mobilization of all the market partners, in the optimum time frame, and with an observant control of the potential risks.

III. Innovation Management

Innovation management is the systematic planning, guidance and control of the different innovation processes. The main objective of this subdivision of management is to increase the success quota of innovations, because the number of starting ideas is always greater than the number of successful projects (accepted by the market). It is necessary to distinguish different types of innovation, in order to make easier the accomplishment of the tasks. According to the described innovation process and cycle and their principal steps, the types of innovation are:

- *Product innovation*, with reference to the initial steps and definition of the characteristics of new products.
- *Process innovation*, changes in the different processes of the product.
- *Structure innovation*, related to the structure within the company.
- *Strategy innovation*, how to achieve the success, i. e. marketing of the product.
- *Social innovation*, how to convince the people, i. e. changes in established way of behaving.

Examples of these tasks, suited to the innovation management purposes are:

- Settlement of innovation targets, within the company.
- Initiation of every innovation process.
- Evaluation and selection of genuine innovation projects.
- Creation of an environment, which is encouraging for innovations.
- Firm decision on the use of realization measures without doubts or discussions.
- Efficient and well-documented control of the applied measures and procedures.
- Optimization of the innovation process, based on the experience of past projects.

The fundamental way of setting about the main issues of innovation management is the answer to some basic questions. The intention of these questions is to make clear statements of the current situation and the desired situation. *"How can an active flow of ideas be created in a company? How can this flow be addressed and selected according to strategic points of view? By which means can the development of new products and services be evolved more efficiently? Which organizational structures are necessary to secure and efficient innovation management? Which internal and external barriers have to be overcome to put innovations into practice?"* are some typical questions.

The success factors of innovation management depend on the market orientation [4], the innovation culture, the intensity of innovation, and the coordination and control of the innovation issues.

The market orientation recognizes that an innovation is not an end itself. The market demands the regular and habitual integration and cooperation of customers into the whole innovation process, and not only at the end as a warranty of success. Besides, it is recommended to gain all the possible and accessible market information, throughout the intensive integration of the marketing, the field service, the distribution channels, and the providers.

The innovation firm culture formally introduces the top management as a role model and not as an oppressive control model. Hence, the communication is the essence of collaboration, successful creative experience and all-inclusive innovation process. This intensely pursues that the innovation culture becomes something inherent and inborn, i. e. *an automatic and natural innovation process*.

However, a special care is need when the intensity of innovation flow is considered. Often, the speed of innovation induces competitiveness. But, a minimum innovation level is constantly required, because of the replacement of matured products and services (evolution of the market). Although, excessive innovation demands have the hazard of damaging the enterprise. An equitable and intelligent equilibrium is an essential condition and requisite.

The coordination and control duties chase the decentralized concept development, but with a centralized and non-tyrannical coordination. In fact, a fanatical control can be counter-productive to creativity and innovation. In spite of that, the risks, which are intentionally taken, need to be limited and well defined by the innovation coordination, with the intention of a heedful consciousness of all of them.

IV. Resistance to Innovation

The resistance to innovation is the opposition offered by any of the components of a company (or even external components) to the passage of an innovation through the company hierarchy. Basically, it is the capacity to demolish the innovation process, supported by the bureaucracy and the accountancy, and using as arguments technological, economic and other non-classified reasons. The fundamental principles for these justifications are the ignorance, the lack of permission and the desmotivation.

More in detail, the arguments are authentic barriers to innovation. The technological explanations are essentially doubts regarding the functionality, naive objections concerning timing, or simply considerations about the shortage or absence of the adjusted technological environment.

The economic reasons are sponsored mainly by the capricious accountancy. Typically, innovations start with the loss, suppression or change of the old products. So, innovations require too risky investments and additional capital exigencies, first to get rid of the former products, and later to enhance and boost the applied efforts to innovations. But, as innovations play an important part in the business strategy, it is recommended to be aware of *unsuccessful* innovations, because these undesired innovations are much more expensive than the losses with the *status quo* (current way of thinking and behaving) [5].

The rest of the arguments keep the same process of reasoning. There is an innate fear of failures, due to that the impact of new technologies cannot be foreseen (e. g. mobile phones growth). The sorcerers are not traditional employees of a company and the workers are always afraid of personal disadvantages caused by innovations. Therefore, the linkage of technological and social systems dramatically increases their vulnerability. Thereby, the experts, outside their area of specialization, behave as amateurs. These are in essence psychological and human being related problems.

Given the described arguments, the resistance to innovation occurs in different places, such as:

- *Internal resistance of superiors, colleagues and subordinates*, which can be solved using all the elements and resources of the hierarchy.
- *Market-related resistance of the customers*, which can be overcome with incentives or something that encourages efforts, actions and attitudes.
- *Authorities and examinations institutions*, which can be arranged with persistence and a careful preparation of all the documentation.
- *Non-institutionalized environment*, i. e. civil movement, whose control can be gained over with simplicity and clarity of the presented ideas.

V. Innovators and Innovation Teams

The innovators are at the far side of the resistance. An innovator is a person with special abilities and characteristics, which help him or her to overcome the resistance. Before anything else, an innovator must be a technical authority, although with tact and skills in dealing with people: diplomatic and able of team integration and motivation. An innovator is as well implicated in the whole innovation process, not only during the first steps of the innovation cycle but moreover during the last steps of the innovation process. This disposition shows self-confidence in his/her abilities, persuading the opponents by the right arguments and evidences.

Naturally, any innovator must know his/her limitations, trying to reduce their effects as much as possible. Some of these limitations are:

- *Excessive project identification*, producing isolation and an exaggerate belief in a strong and secure position.
- *Extreme dependency of innovation*.
- *Lack of methodology*, including limited management capacity, teamwork or even motivation.
- *Exhausting cooperation requirements*, that causes personal hostility towards the innovator or the rejection of innovations in order to demonstrate power.

A quick solution to avoid these limitations is the teamwork. A heterogeneous group of people is the adequate answer to get the best performance and results. The idea of team members of diverse backgrounds and perspectives seems most conductive to higher levels of creativity. The contributions of any team are based on the plurality of characters of the different members, in such a way that there is a perfect combination of miscellaneous qualifications, ensuring that individual expertise is fully exploited [6]. Examples of these qualifications are problem solving, knowledge in specific fields, decision making, control of the processes, realization, organization, network, interaction and communication potentials, and the permanent impulse for the innovation process.

When this particular teamwork is generalized to the whole company, it is possible to project a new image of the organization, holding innovation as motto, characterizing completely an innovative organization. Thanks to this, the global competence of the company grows. The presence and service competence improves because of the new creative image and services. Hence, there are more external and internal impulses, e. g. social acceptance, which increase in value openness and orientation competence. Then, it is easier to combine the ideas and resources, and the personal financial issues, giving the required flexibility and competence to change. And finally, and as a global and widespread impression of the company, there is a perfect aggregation of knowledge and a steady flow of ideas, assuming the authenticity and creative competence.

VI. Conclusions

There is no magic recipe for the success. Only daily and cooperative work, combined with really new ideas, is the key to the success.

The intended goal is the automatic and natural innovation process within each department of the company. This changes the ways of thinking, acting, working and organizing. The innovation is now the essence of business strategy in the knowledge economy [7]. Innovation can occur in any organization and at any moment in an endurable manner with the proper process.

The blooming of new technology businesses is the perfect environment to study and analyze how only the genuine and efficient innovation management increases the profits and not the expenses. People possessing knowledge (*know how*) are the key resource of companies pursuing innovation. Knowledge and ideas are infinite economic goods that can generate increasing returns through their systematic use.

Consequently, the engineers, in addition to the technical background, must look for some basic or advanced courses on management, in order to become innovators and not just mere engineers.

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Jorge-Luis Sánchez-Ponz was born in Madrid, Spain, in February 1977. He received his degree in Telecommunications Engineering from the Technical University of Madrid in 2000. Last year, he started a two-year Master of Science degree in Information Technology, focus on Embedded Systems Engineering, at the University of Stuttgart, Germany. For IEEE he held the position of vicechairman of the Student Branch Madrid-ETSIT (1997-1998) and since 1999 he is the IEEE Region 8 Student Representative.

Information Society - End of PCs?

Matjaž Gams, IEEE member

Abstract--The paper analyses changes in the information society especially through the technical and employment viewpoint. As commonly known, qualified IT workers are heavily needed in the developed world and in Slovenia already. Shortages are going to grow in the forthcoming years and thus students with IT qualifications are going to be more and more needed. However, the work they will perform will change due to the forthcoming technological changes in the most dynamic and attractive profession.

Index Terms--employment, IT, IS

I. Introduction

From ACM technical news: Federal Reserve Chairman Alan Greenspan at an economic conference in Jackson, Wyo., cited technology as the main reason for the continued growth of productivity in the United States (Washington Post, 26/8/2000). Greenspan said, "The most recent wave of technology has engendered a pronounced rise in American rates of return on high-tech investments, which has led to a stepped-up pace of capital [spending] and increased productivity growth." He also noted that technology has improved trade and the integration of the world's economies. The Commerce Department released its latest figures on gross domestic product, which grew 6 percent for the 12-month period ended this June. This growth continues to amaze economists, who did not expect to see such prolonged growth without an accompanying rise in inflation. The Fed has raised the overnight interest rate six times in the last year to prevent just that. http://www.washingtonpost.com/wp-dyn/articles/A27424-2000Aug25.html. So, how can USA has a growth high above average while world leading economist are for years predicting that the growth will stop, that markets are overvalued and that market production is falling behind?
We find explanation in the technological changes that are accompanying information society [4]. Instead of material growth, information activities and services are becoming the dominant human activity spurring progress [6]. USA as the leading IT country in the world is facing a sustained growth and prosperity based on this technological progress [1].

This is the major reason for prosperity of IT professionals all over developed world, and shortcoming of skilled IT stuff.

Jobs created by the Internet economy in the United States and six European countries will exceed 10 million by 2002, concludes a new study (E-Commerce Times, 29/8/2000). The study reports that the Internet will be the cause of 3 million jobs in Spain, Italy, France, Germany, Ireland, and the United Kingdom, and 5.8 million jobs in the United States by 2002. Internet-related industries will create an additional 2 million jobs. These jobs include positions in tech firms such as Web portal companies, ISPs, and Web design firms, as well as in traditional firms establishing their own Internet presence [6]. The Internet economy's rapid growth has also increased demand for traditional marketing and customer-service. The study estimates the value of the Internet economy in 2002 at $1.23 trillion in the United States and $597 billion in the European countries surveyed.

The study also notes that firms in both the U.S. and Europe still cannot find enough qualified IT workers to fill all available positions.
http://www.ecommercetimes.com/news/articles2000/000829-1.shtml.

II. Employment in Information Society

All over the world, developed countries are forced to change their immigration policies in order to cover their internal shortage of skilled workers for the IT industry. The shortage is too big to be covered by additional change in national education systems, which are being more and more criticized because of memorizing huge amounts of non-IT related knowledge. In addition, the approach to encapsulate knowledge typically elaborated in schools is close to rote-learning, i.e. pure memorizing without creative thinking. The IT field is one of rare fields that is due to huge dynamics of the field staying open for the

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creativity. Several other scientific disciplines are more or less saturated in the sense that no major new knowledge is produced. This not only means that there is no new knowledge to be created, it also means that exams can be performed on the basis of previous exams. In addition, several lessons and exams demand rote-learning of knowledge that can easily be found on the Internet or in the books.

Both these factors: the need of skilled workers because of the enormous technological growth, and the failure of the education system to produce enough IT tech minds results in growing imports of technically educated stuff. USA has the following no. of visas for skilled workers:

Table 1: USA visas

1990	65,999
1998	115, 00
2000	200,000

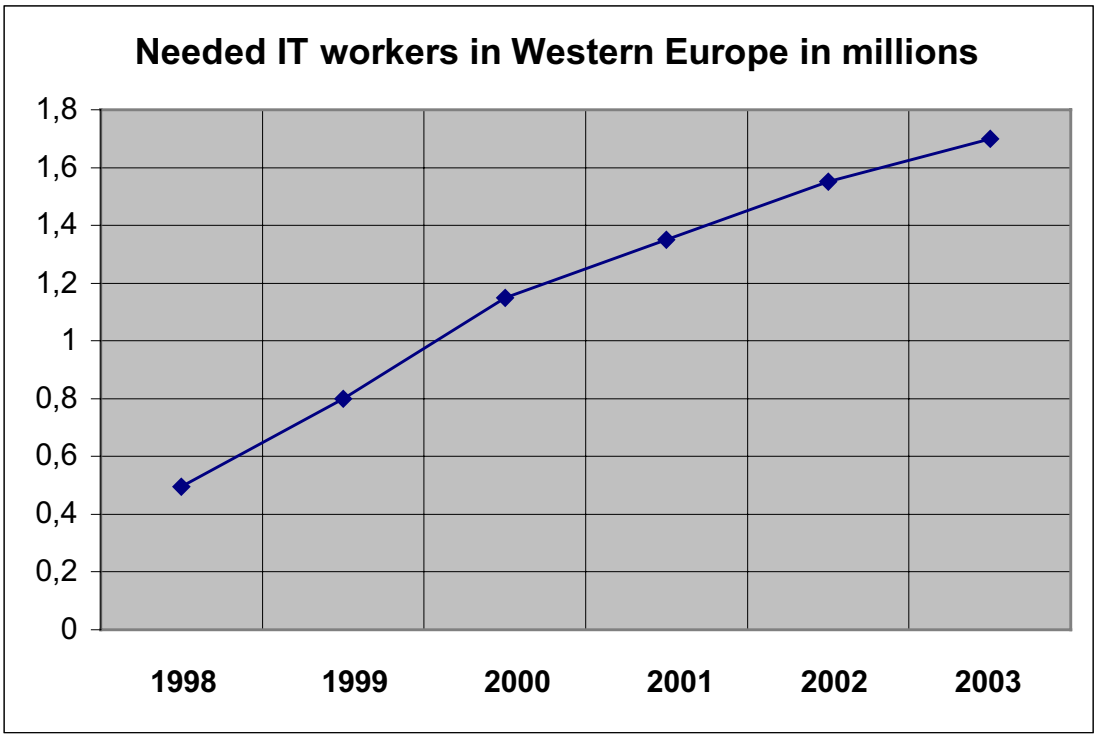
Table 2 further indicates the growing need for skilled IT professionals in Western Europe countries.

Table 2: needed IT Workers in W. EU

Similar situation prevails in developed countries all over the world: in Canada, which eased its rules in 1997 and again in 2000, in UK, which has a 200,000 IT workers shortage, in Germany, which currently added 20,000 visas. France still needs 185,000 and Japan 210,000 workers. Due to shortages of workers, outsourcing in Central and Eastern Europe and India is growing.

III. SLOVENIA

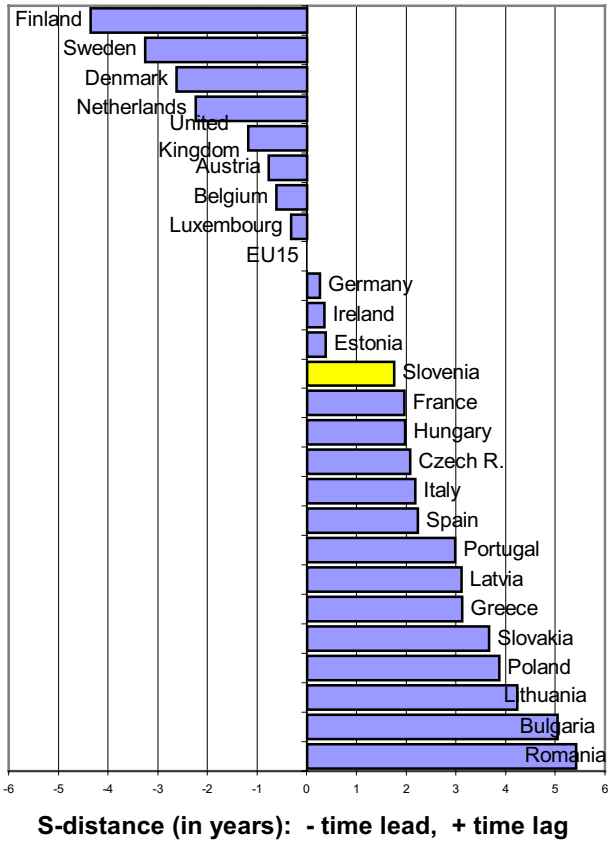
It is interesting to compare situation in the developed world and the one in Slovenia. First, Slovenia has substantially decreased its technical capabilities in the transition process from ex-communistic regime to a modern capitalistic society by degrading major IT companies like ISKRA, e.g. ISKRA DELTA. With this, the brand name and national IT industry was lost. While the IT growth is immanent and thus is bound to happen in Slovenia regardless of the speed of its growth, there is a significant difference if a country has its own companies or if it depends strictly on multinational companies. In Slovenia, there are currently companies like Hermes Softlab engaged in outsourcing by Hewlett Packard, having around 400 employees and several smaller companies with stuff around 50 concentrated on major national institutions like banks.



Does anybody remember Nokia 15 years ago? It was a small Finnish company comparable to ISKRA DELTA. Now it controls over 50% of the mobile market. BTW, while USA leads Europe in IT and the Internet in general, it lags back in introduction of mobile phones by a factor of 100%.

Currently, Slovenia is among middle-developed countries in Europe, be it economy or the IT sector. It also means that we are substantially lagging behind the most developed. It also means we can learn from then.

Table 3: Years of development needed to catch up with other countries [9]:



In Table 3, the average is in the middle of the chart calculated as the EU average. It shows that Slovenia is slightly lagging behind. This position is quite reasonable, yet the major problem is that recent years are not successful for Slovenian IT. We need faster IT progress!

It has been sufficiently shown that major countries in the world owe their success to the successful implementation of IT. Major national leaders and economists openly speak about extreme correlation between these factors. And what about Slovenia?

Slovenian leaders are hopefully more and more becoming aware of it. After a couple of years of ignorance of IT, in the election years many parties are trying to emphasize the importance of IT. After a couple of unsuccessful years, we hope to see a real improvement in the forthcoming years.

Figure 1. Percentage of PCs connected to the Internet (IT21) and GNP per PCs (E1) [5]

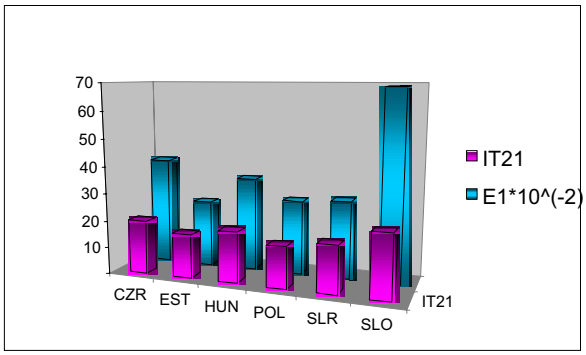


Figure 1 shows one of Slovenia's IT problems: while the standard is quite OK, and the percentage of homes with PCs is quite Ok as well, GNP per PCs shows one of the information society parameters. We could do much better!

If Slovenia is to progress quickly, it must spur its IT and find additional bonuses for IT stuff. Among several possibilities we should mention:

- change the rote-learning education into a creative IT-oriented one,
- change the educational system and provide more emphasis on IT courses at all degrees
- set additional benefits, e.g. higher salaries for IT teachers
- open new IT schools all over Slovenia
- start national IT projects
- free the telecommunication market for other Slovenian competitors
- fun more IT-oriented projects in R&D in Slovenia, e.g. more IT research projects which have been stagnant for the last 10 years.

It is important to understand that being fully integrated in the major IT processes in the world, Slovenian IT professionals will find their jobs easily anywhere in the developed world. Several of my colleagues and students are well situated in the most developed countries in the world from USA to Australia or Japan (not to mention Europe).

Slovenian IT students can expect to be very welcome

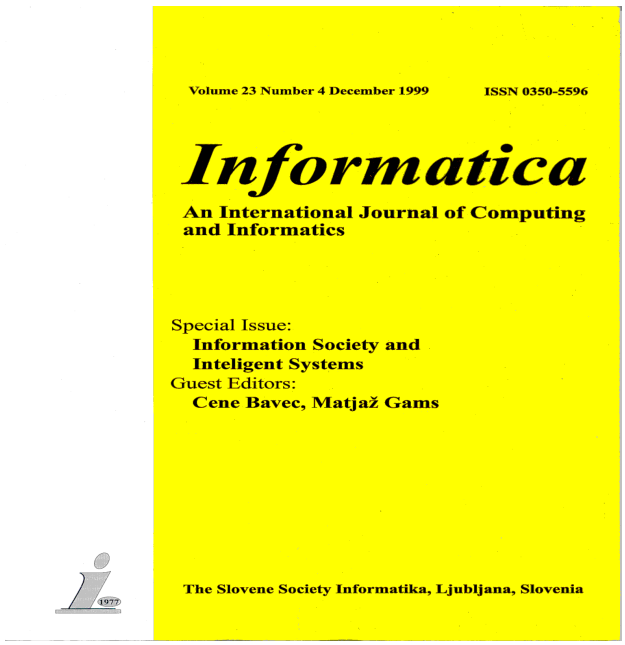
- because of the global lack of IT workers,

- because of lack of IT students in Slovenia (after independence, lawyers, economists and medical stuff were the most needed professions, but these profession are already becoming saturated), and
- because of the expected additional speed-up in Slovenian IT.

IV. Our experience

Our R&D Department for intelligent systems at the Jozef Stefan Institute has in the last ten years designed around 10 intelligent IT systems now available on the Internet http://ai.ijs.si/Katalog.html. With implementation of the EMA employment agent we were the first country to present over 90% of all available jobs on the Internet[3]. Slovenia was the fourth country in Europe to offer natonal employment information on the Internet. Currently, there are 3000.000 accesses to the sites (http://wwwai.ijs.si/~ema/proj.html), (http://www.ess.gov.si/English/elementi-okvirjev/F-Introduction.htm.
The system fluently speaks in English and Slovenian and translates Slovenian information into English. Just recently we have donated a system for Slovenian speech to all handicapped in Slovenia evaluated to 1.000.000 $.
Our department strongly was a founder of and supports the AI society in Slovenia, cognitive society in Slovenia, and Engineering academy in Sovenia. We actively cooperate in publishing the Informatica journal. In the last 20 years our department has published around 2000 bibliography items.

In Figure 2 one can see the cover page of the informatica journal devoted to the information society and intelligent systems [2]:



In July 2000, we have donated the Slovenian speech system we have developed, to all people with sight problems in Slovenia [8]. Since there are around 5.000 people in this category, and each system can be evaluated to at least 100$, the charity action can be evaluated to 1.000.000 US$.

Each year we organize the Information society conference (http://ai.ijs.si/is/indexa00.html). In 2000, we have co-organized the parliamentary Information society discussion (http://ai.ijs.si/is/parlament/default.htm).

Overall, our activities, systems and products influenced the way Slovenia moves into IS. These successful applications (not minding successful publications as well) have shown that the technological possibilities are huge and that we are working in an extremely attractive and fast progressing field.

V. Discussion

IT students should be enthusiastic about the possibilities the IT field offers. In addition, it is also the speed of the progress and interesting creative possibilities that can make our field so irresistible for the smart and bright.

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Which Extra Skills for Young Engineers?

Eveline Riedling[1]

Abstract: This paper gives an introduction to some extra skills as communication, technical documentation and team work, which are necessary for a young engineer from the beginning of the professional life in order to make a satisfying and successful carrier in industry or university. Topics as documentation skills, clear and understandable language, team process skills, computer skills and others are discussed. It is shortly described, how to gain such skills as student - and what to search for as additional education.

Index terms: communication skills, leadership, team work, user friendly development, computer skills.

I. Introduction

Long time ago the carrier of an engineer could be planned straight forward: The engineer had to learn the technical and methodological skills of the profession. After leaving the university these skills could lead to a satisfying carrier, even to a high level job in industry or university. Additional management skills were not required at university, where research talents and research creativity were job requirements number one. In industry, in-house training was provided for management people and other staff, mostly dealing with technological topics.

At the time, when industrial growth was blossoming, when technology was all you needed, extra skills were not so important, were no reason for a life long learning processes, and of course were not so important requirements for young engineers.

Times have changed significantly.

Technology is a much more complex field than ever, bringing together aspects of many fields as engineering basics and methodology, communication, computer technology, team work, creativity, social aspects, even political aspects of new technological inventions.

The title of this conference implicates the idea, that nowadays young engineers need extra skills in order to make a satisfying carrier. But a satisfying carrier is also connected to many other facts: Young engineers need extra skills as communication, creativity and leadership skills, to become very valuable and intensely needed members of the society, needed for problem solving in many aspects.

There is the important role of the engineer in bringing society to a better future, ensuring a healthy and ecologically compatible life standard, ensuring growth and wealth for all countries - if engineering takes up the challenge of our time and applies extra skills in all current engineering tasks.

So let us discuss some important extra skills for the young engineer, how to gain them and how to maintain them.

II. Extra skills for engineers

Let us analyse the skills, which are nowadays important for a successful engineer:
In the centre of our analysing process stands the engineer. And then there is a variety of skills, surrounding the individual, being more or less the crucial facts for success or failure.

First some short comments to the "title question":
Of course you should, if ever possible, make a degree in engineering. In some situations, people leave university without a degree. Problems with money, family or health – there are many aspects in life, which can lead to leaving university too early. To my experience in Austria, making a carrier without a degree depends on your topic. An excellent programmer, or an excellent computer technology or computer network specialist etc., can be highly paid without having any degree at all. In other fields of electrical engineering, there are not so many chances to get highly paid and satisfactory jobs without it. Or say it differently – even highly paid people will not make their way to the top of the scientific or development leader team without any degree.

But now to skills, which are no "extra skills" nowadays, but are "basic skills" for a successful carrier:

These are - quite evidently - communication and documentation skills!

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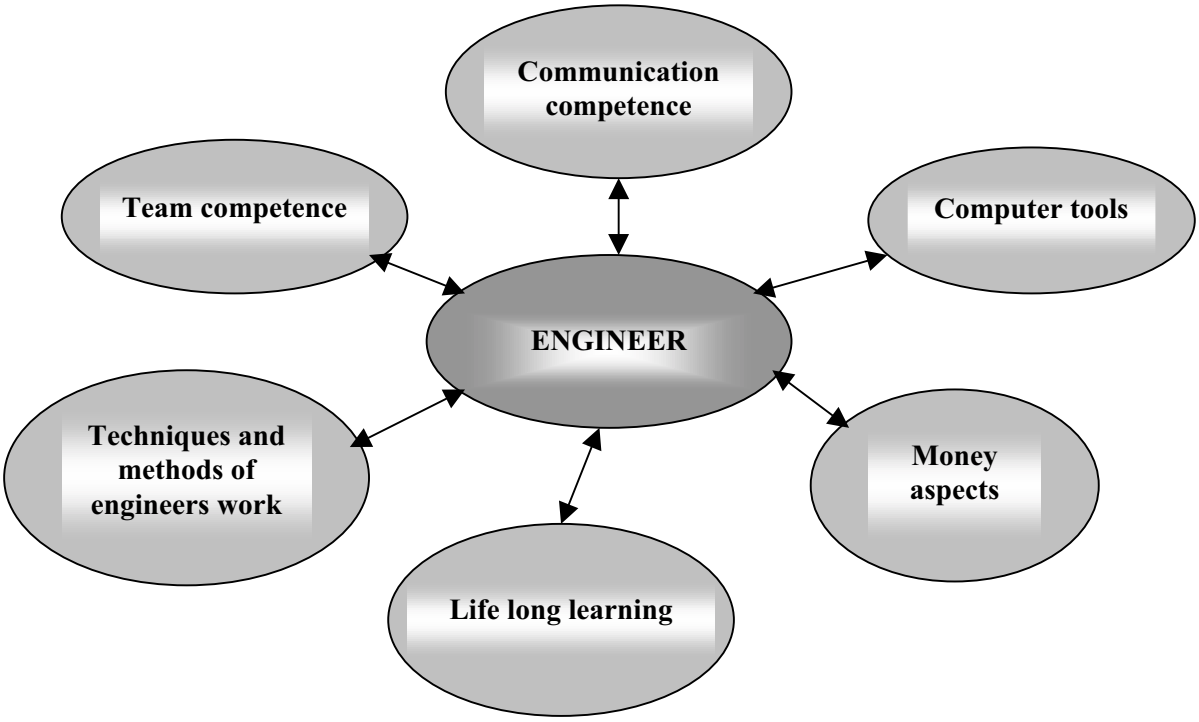

Technology, as a very complex field, needs teamwork in almost all aspects of research and development. The successful engineer has to

- Be a flexible team member, learning to talk clearly and to listen carefully
- To be able to share results with others in a clear and understandable way, which means being able to document and communicate results logically and understandably for others
- Master own emotions well
- Be skilled in team process discussions, conflicts, negotiations etc.

How can it be done to reach these skills?

The best start is at the educational institution (university etc.). A lot of laboratory work has to be done, which means working on technological tasks and writing laboratory protocols in order to deliver results of the work. One can learn and practice how to communicate technical details in writing excellent protocols - e.g. making clear, understandable, good and precise drawings and, of course, using excellent and understandable language. It is quite amazing, how many students negate the fact, that others do not know the specific laboratory process or the program in detail, and that these others have to be told the details in a clear way. Many students stick to the idea, that their own findings are evident, and everybody knows all details as well as they know it themselves. It is a special "art" to write technical documentation - it has to be practised. In practising these skills students create an advantage for themselves! They will be able to work with a team and communicate results to a team - a crucial skill for most jobs.

There can be intense help from educational institutions to gain such skills, e.g. as described by Glen C. Gerhard as strategy at the University of Arizona, Tuscon. ([i]). At this university a corporation is simulated, where students simulate work, negotiations, reports, order forms, and other tasks. So students gain skills in team work, negotiations, protocol writing, reporting to colleagues etc. Such company simulations are done in various universities in various study fields, e.g. economy and technological departments.

If there are no such simulations at your university - try to initiate such classes, try to find lecturers and trainers for such activities.

Learning communication skills can be done at special classes, too, without participation in a simulated company. At many universities there are now communication classes, where students learn how to make presentations, discussions, controlled criticism of team processes etc. In times, where almost nobody can work alone and has to communicate in a stressful and strenuous working environment, such "soft skills" become more and more important.

One major contribution can be done by IEEE Professional Communication Society. This society runs courses on communication, specifically tailored to members needs. ([ii]). There are online courses, but there

are various other activities, too, where members can get advice and support. Even events can be sponsored, so a membership at this special IEEE society can bring to some places very useful courses, advice and chances for professional growth.

Lets have a look at other extra skills, which are very useful for success in studies and job.

In addition to behavioural aspects and technical documentation, ability to implement user friendly design is another very important topic. Every engineer, who designs programs or products for users directly, should be aware of the importance of user friendly design and test methods to ensure this design. The reason for the importance of user friendliness is quite evident: users will buy products only if they are able to use it in a satisfactory and easy way. "User friendliness" is the keyword to success - so young engineers should learn to apply test methods and reengineering processes as soon as possible.

A good way to learn such skills is the iterative design method, described in many excellent books, e.g. Ben Shneiderman, "Designing the User Interface" ([iii]). Iterative design means to design products or programs, test it with real users, evaluate the users reaction and redesign if necessary.

So how is possible to learn these methods?

Normally, it should be taught and practised at the educational institution, as described by Fadi P. Deek, Murray Turoof and James A. McHugh in their paper "A Common Model for Problem Solving and Program Development"([iv]). The methods can be learned in programming classes or have to be learned, if devices are developed, directly in classes or in tests with colleagues. In making such test runs with users, which can be done e.g. with friends at the university first, the developer will train important skills, which are necessary for the development of successful products.

What should not be forgotten is the fact, that being able to design and develop user friendly products will enhance the job chances as engineer, being employed at a company or running the own firm. A well trained, user and market oriented engineer will make her/his way even if competition is very hard, which leads us again to the topic of the conference - the next extra skills for young engineers.

Many educational institutions offer creativity and team work classes as additional education. Participate! If your institution does not offer such classes, try to initiate such topics at your student branch. There are not so many born leaders in this world, most have to learn leadership in some ways - and classes can speed up the learning process significantly!

The last topic of this paper are computer skills. It was said, that new computer knowledge has to be gained at least every 5 years, better every 3 years. The situation changes rapidly. Currently new computer skills, handling new programs, new software, new hardware is not a question of years anymore. The slogan of "life long learning" means now to be able to handle the most current software without major problems - and to be willing to learn constantly about all aspects of communication and information technology as a tool. Nobody knows, where IT will be within the next 10 years. We just now, that computer skills are basic skills of life. Working with a PC, a communicator or using WAP and probably soon UMTS efficiently will be basics for engineers, of course. But of course young engineers are familiar with IT - and I do not have to go into details of these aspects.

III. CONCLUSION

There are many extra skills for young engineers, which are important for a successful carrier. But it depends on the personal viewpoint, if all these skills are called "extra" or " basic" skills for young engineers. All these aspects can be a fruitful combination with standard engineering education - and gaining such combined and flexible education should be one big aim of every engineer. And now I do not use the word "young" anymore. Aiming for a carrier, a successful life in industry, in research or in educational institutions, almost nobody will get good jobs without these additional skills - and, probably even more important, will not keep a good job without improving these skills in a life long learning process.

But everybody can be relaxed and reassured. Improving basic technical skills and gaining "extra skills" in a life long learning process, which has to start immediately, can be satisfying, fun and a big booster for a carrier. Just start now and meet the challenge!

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PREDSTAVITEV KADROVSKIH POTREB PODJETJA ISKRATEL

Bratkovič Miran, RD Iskratel

I. SPLOŠNO O PODJETJU

Lastništvo

Slovenski lastniki : 52,7 %
Siemens A.G. : 47,3 %

Splošni podatki o dosedanjem poslovanju podjetja in njegovih strategijah

Podjetje Iskratel je bilo ustanovljeno kot mešano podjetje med podjetjema Siemens A.G in Iskra Telematika leta 1989. Svoje poslovne rezultate izboljšuje iz leta v leto in leta 1999 je pri 1050 zaposlenih doseglo prihodek na zaposlenega v višini 222.000 DEM. Dodana vrednost na zaposlenega je znašala cca 60% prihodka na zaposlenega. V letu 1999 so bila vlaganja v Razvojno področje 30.400.000 DEM. Podjetje Iskratel temelji svojo strategijo na razvoju, proizvodnji in trženju dveh digitalnih komutacijskih sistemov, ki se v vseh ključnih tehničnih in tržnih parametrih zelo dobro dopolnjujeta. Eden od njiju je sistem EWSD, ki je industrijska lastnina podjetja Siemens AG in je tržno optimalen za gradnjo komutacijskih vozlišč od srednjih do največjih zmogljivosti. Drugi sistem je sistem SI2000, ki je v celoti industrijska lastnina podjetja Iskratel in je rezultat slovenskega telekomunikacijskega znanja in izkušenj. Sistem SI2000 je tržno optimalen za gradnjo komutacijskih in dostopovnih vozlišč od majhnih do srednjih kapacitet. S tem sistemom se Slovenija uvršča med tistih deset držav na svetu, ki so zmogle razviti lastni digitalni telekomutacijski sistem in ga tudi uspešno tržiti na svetovnem trgu. Podjetje Iskratel ima 1,3 % svetovnega trga digitalnih telekomutacijskih sistemov, ki po vseh mednarodnih merilih spada med najbolj zahtevne izdelke takoimenovane "high-tech" industrije.

Podjetje Iskratel je odločeno, da bo njegova poslovna strategija tudi v bodoče temeljila na razvoju, proizvodnji in trženju lastnih "high-tech" izdelkov in na strateškem partnerstvu s podjetjem Siemens AG.

Odtod zavezanost podjetja Iskratel sprotnemu osvajanju novih telekomunikacijskih znanj in tehnologij, kot tudi intenzivnem zaposlovanju visokostrokovnega kadra, ker je to edini način za ohranjanje in nadalnje izboljševanje sedanjega položaja na svetovnem trgu. Razvojni program je usmerjen h krepitvi že doseženega tržnega položaja telekomutacijskega sistema SI2000, s smiselnim uvajanjem najnovejših telekomunikacijskih tehnologij v produkt.

II. KADRI V ISKRATELU

Kadrovska struktura zaposlenih

Ob koncu leta 1999 je bilo v podjetju Iskratel zaposlenih 1050 sodelavcev. Od tega jih je 530 (51%) imelo univerzitetno izobrazbo ali več.

Razvojno področje Iskratel

V Razvojnem področju Iskratel je bilo koncem leta 1999 zaposlenih 405 izvajalcev z naslednjo izobrazbeno strukturo:

- 6 doktorjev znanosti
- 38 magistrov znanosti
- 225 diplomiranih inženirjev
- 138 inženirjev in tehnikov

Tako v preteklih letih, kot tudi v letu 2000, Razvojno področje Iskratel intenzivno zaposluje predvsem diplomirane inženirje elektrotehnike in računalništva, predvsem na razvoju programske opreme kompleksnih telekomunikacijskih sistemov. Približno 75% vseh razvojnih inženirjev je vključenih v razvoj programske opreme.

Koncem leta 2000 bo v razvojnem področju zaposlenih 435 izvajalcev. V letu 2000 bo v Razvojnem področju

zaposlenih 36 novih sodelavcev, večina diplomiranih inženirjev elektrotehnike in računalništva.

Razvojno področje Iskratel se deli na dva segmenta in sicer

- področje razvoja sistema EWSD, kjer je zaposlenih 195 izvajalcev
- področje razvoja sistema SI2000, kjer je zaposlenih 240 izvajalcev

Zaposlovanje

V diagramu 1 je prikazano zaposlovanje v Razvojnem področju ISKRATEL v obdobju 1992 do 2000. Diagram prikazuje na letnem nivoju tri postavke in sicer letno število zaposlenih v Razvojnem področju Iskratel (ITRD), število zaposlitev v enem letu, kot tudi rast števila novozaposlenih med letoma 1992 in 2000.

Iz diagrama je razvidno, da v razvojnem področju Iskratel zaposlujemo med 30 in 40 sodelavcev letno. Velika večina novozaposlenih ima univerzitetno izobrazbo ali več, predvsem elektrotehnike in računalništva. Enak trend zaposlovanja planiramo tudi v letih 2001, 2002 in 2003.

60% vseh zaposlenih so diplomanti fakultet, brez delovnih izkušenj. Povprečni čas vključevanje v delovni proces je bil med 6 in 9 mesecev. Večina novozaposlenih se je vključila v razvoj in testiranje programske opreme, tako na segmentu SI2000, kot tudi na segmentu EWSD.

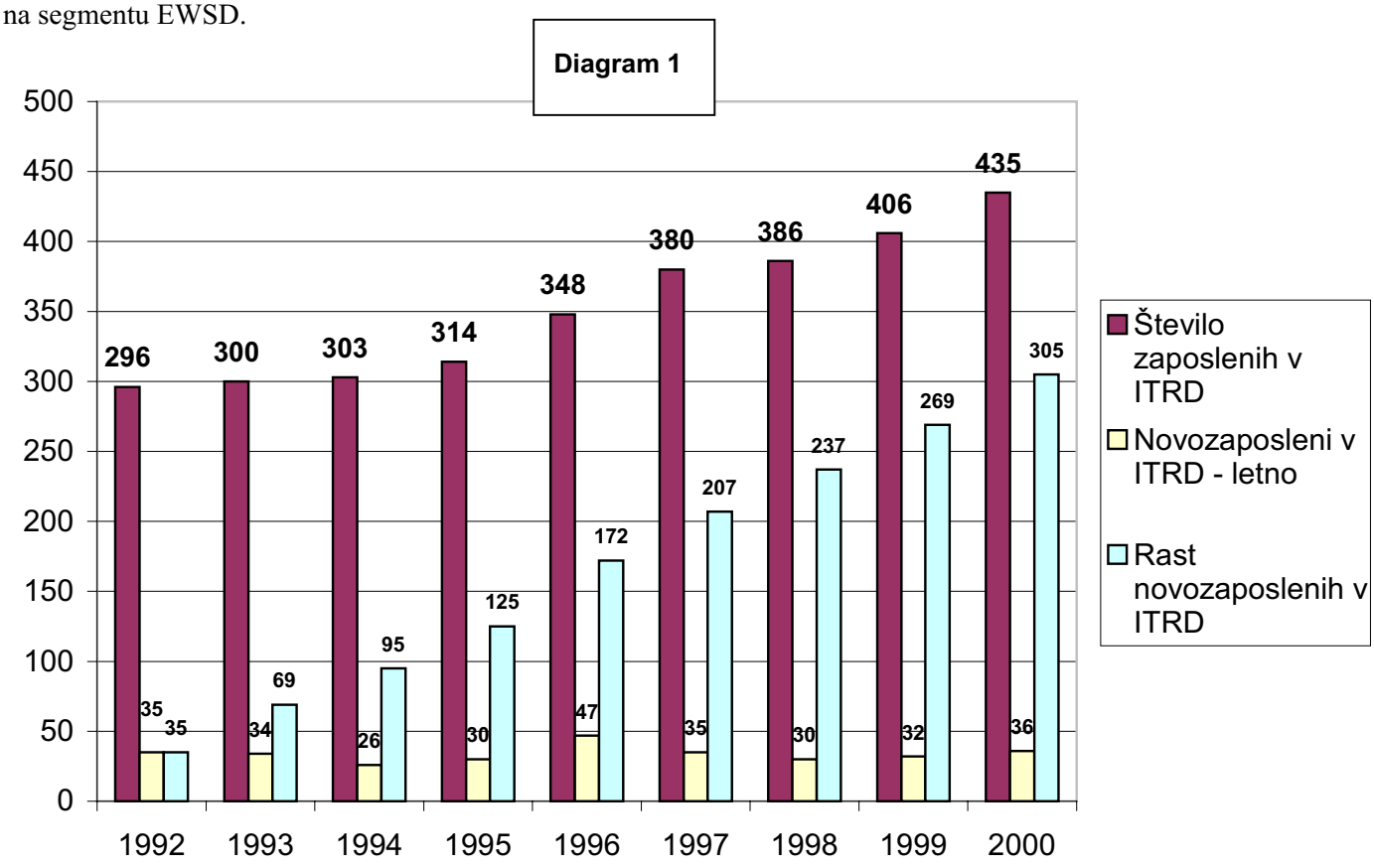
V Iskratel zaposlujemo tudi absolvente fakultet, ki jim v okviru razvojnih nalog omogočimo izdelavo diplomskih nalog. Pri tem težimo, da čimbolj približamo tematiko diplomske naloge nalogam, ki jih v razvojnem procesu izvajajo posamezniki. Tako absolventi, kot tudi diplomanti, ki so brez ustreznih delovnih izkušenj, so zaposleni kot pripravniki. Formalno je pripravniška doba za VS izobrazbeno stopnjo 12 mesecev, vendar jo vsem, ki s svojim angažiranjem in samoiniciativnostjo pokažejo pozitivne rezultate dela, skrajšamo na cca 7 mesecev.

Letna fluktuacija v Razvojnem področju je med 2% in 3%.

Pričakovana znanja in veščine

Osnovna znanja, ki jih od diplomantov pričakujemo ob zaposlitvi so:

- poznavanje programiranja (povdarek na C jziku)
- poznavanje logike procesorjev
- poznavanje digitalne tehnike
- poznavanje osnov telekomunikacij
- zmožnost logičnega razmišljanja
- pripravljnost na angažirano nadalnje izobraževanje
- zmožnost več kot osemurnega dela
- obvladovanje angleškega jezika
- obvladovanje osnov informacijskih tehnologij
- smisel za timsko delo



Izobraževanje novozaposlenih

Glede na to, da zahteva razvoj telekomunikacijskih sistemov specifična znanja, imamo v Iskratel izdelan plan uvajanja novozaposlenih, ki zajema tako individualno uvajanje ob mentorstvu izkušenih izvajalcev, kot tudi organizirano uvajanje v obliki enomesečnega tečaja za novozaposlene.

Ocena je, da se lahko novozaposleni po polletni uvajalni dobi enakopravno vključijo v razvojne aktivnosti na produktih.

Celotno izobraževanje sodelavcev v razvojnem področju Iskratel zajema sledeče sklope :

- tečaj za novozaposlene
- strokovno izpopolnjevanje in došolanje - interni tečaji programskih jezikov in interno izobraževanje za delo z novimi orodji, izpopolnjevanje na področju informatike (izobraževanje v Iskratel)
- interno strokovno izobraževanje - interno izobraževanje na področju novih tehnologij (ATM, IP, TMN, BB...), organizirano v sodelovanju s Fakulteto za elktotehniko, kot tudi izobraževanje v SAG tečaji (Siemens) in CBT tečaji (interni računalniško vodeni tečaji) v okviru našega šolskega centra
- jezikovno izobraževanje (angleščina, nemščina, ruščina - različne zahtevnostne stopnje)
- strokovno izobraževanje (zunanji predavatelj) - tečaj tujega priznanega strokovnjaka, na temo novih tehnologij v telekomunikacijah (2 krat)
- sejmi - povdarek je na sejmih CeBit, Embedde systems, sejmi o novih telekomunikacijskih in računalniških tehnologijah
- konference, simpoziji - planiran je obisk več konferenc, povdarek bo na konferencah IP, BB in CT, VoIP, konference na področju novih informacijskih tehnologij. Konference so namenjene predvsem posameznikom, ki bodo prevzemali razvojne in raziskovalne naloge na novih tehnoloških segmentih
- izobraževanje ob delu - plačilo šolnin za podiplomski študij elektrotehnike ali računalništva, dodiplomski študij
- kadrovsko izobraževanje - vodenje ljudi, timsko delo, obvladovanje čada, vodenje sestankov ...

Podjetje Iskratel vlaga v izobraževanje svojih sodelavcev 1,5% celotnega letnega prihodka.

Razvojna skupina Maribor

V okviru Razvojnega področja Iskratel je bila v letu 1996 ustanovljena v Mariboru razvojna enota. Razvojna enota Maribor je bila v prvem obdobju angažirana predvsem na razvoju sistema EWSD, ki ga razvijamo skupaj z partnerjem Siemensom, v zadnjem obdobju pa postaja vse bolj neodvisen kompetenčni center, tako za razvoj posameznih segmentov sistema EWSD, kot tudi za razvoj zaključenih funkcionalnosti sistema SI2000.

Trenutno je v razvojni enoti Maribor zaposlenih 42 razvijalcev in sicer 35 na sistemu EWSD in 7 na sistemu SI2000.

Počitniško delo

V okviru Razvojnega področja Iskratel je organizirano tako počitniško delo, kot tudi obvezne študentske prakse. V razvojnem področju imamo na letnem nivoju angažiranih cca 25 študentov (predvsem tretji in četrti letnik Fakultete za elektptehniko in Fakultete za računalništvo in informatiko), ki opravljajo zaključena razvojna dela. Plačevanje teh študentov se izvaja preko študentskega servisa, tarifna urna postavka je odvisna od kompleksnosti dela, giblje se med 600 in 800 SIT na uro.

Delovni čas

V Iskratel imamo gibljiv delovni čas. Tedenska obveza je 40 urni delovnik, pri čemer je prihod na delo med 7.00 in 8.00, medtem, ko je odhod po 15.00. Zaradi narave nalog v razvojnem področju, je delovni čas razvijalcev večkrat podaljšan tudi na 12 ur. Vsi presežki ur se obračunajo kot nadurno delo (v skladu z zakoni).

Izvajalcem pripada tudi polurna malica. Topli oboki so organizirani v tovarniški restavraciji.

Rekreativne dejavnosti

V okviru Iskratel je organizirana Komisija za šport in rekreacijo, ki zagotavlja organizirano rekreacijo sodelavcev na različnih področjih kot so tenis, košarka,odbojka, kolesarstvo, plavanje.
Obenem je vsako leto organiziran piknik razvojnega področja, predvsem z namenom spoznavanja med sodelavci.

Štipendiranje

Vsako leto razpiše podjetje Iskratel 20 štipendij za univerzitetni študij in sicer 10 štipendij za študij elektrotehnike in 10 štipendij za študij računalništva.

III. RAZVOJNE AKTIVNOSTI IN PREGLED PRODUKTOV

Zaradi izredno hitrega razvoja informacijskih tehnologij, ter vse večje konvergence med računalniškimi in telekomunikacijskimi omrežji, katerih razvoj zahteva velika vlaganje, planiramu tudi v naslednjih treh letih intenzivno zaposlovanje visokokvalificiranega kadra, tako na lokaciji Kranj, kot tudi na lokaciji Maribor.

Glavne razvojne naloge v Razvojnem področju Iskratel so :

- razvoj programske opreme za telekomunikacijski sistem EWSD
- razvoj materialne in programske opreme za telekomunikacijski sistem SI2000
- razvoj mobilne telefonije
- razvoj TMN sistemov
- razvoj CTI aplikacij
- razvoj širokopasovnih pristopov
- razvoj IP telefonije
- verifikacija in validacija telekomunikacijskih sistemov EWSD in SI2000
- razvoj informatike

Na vseh segmentih razvoja Razvojno področje uspešno sodeluje tudi z zunanjimi institucijani, predvsem s :

- Fakulteto za elektrotehniko v Ljubljani
- Fakulteto za računalništvo in informatiko v Ljubljani
- Fakulteto za elektrotehniko, računalništvo in informatiko v Mariboru
- Institutom Jožef Stefan

Izvedeni razvojni projekti v zadnjih letih

Glavni razvojni projekti v letih 1995 do 1999 so se nanašali na razvoj verzije V5 digitalnega telekomunikacijskega sistema SI2000. Da bi komutacijski sistem SI2000 lahko uporabljali kot učinkovito in ekonomično vozlišče v digitalnih omrežjih, ki delujejo s signalizacijskim sistemom SSN7 in omogočili storitve ISDN, kot tudi širokopasovni dostop in učinkovit nadzor sistemov, je bilo potrebo razviti novo strojno in programsko opremo. Pri razvoju nove funkcionalnosti sistema SI2000 so sodelovali tudi strokovnjaki obeh slovenskih univerz.
Razvojni vložek v projekt je v zadnjih petih leti znašal cca 700 človek let oziroma 4.2 milijarde SIT.
V sklopu sodelovanja s Siemensom so bili razviti naslednji projekti:

- Prilagoditve sistema EWSD zahtevam kupcev in njihovih omrežij za 35 držav
- Bazični razvoj CTX, CAS in TUP funkcionalnosti, funkcionalnost analognih naročnikov
- Na sistemu D900 za mobilno telefonijo pokrivamo bazični razvij CAS in LI (Lawful interception), prilagoditve sistema posameznim kupcem (ISUP), sodelujemo pri razvoju novih funkcionalnosti (UMTS, GPRS, BSSAP)
- Na CT področju je bil razvit Geophone, predplačilni sistem, IP telefon (PC verzija), CTX posredovalno mesto in televoting.

Pregled razvojnih in tržnih aktivnosti podjetja Iskratel

Ponudba podjetja Iskratel zajena celotno paleto gradnikov sodobnega telekomunikacijskega omrežja in sicer :

- telekomunikacijska sistema SI2000 in EWSD, ki se uporabljata kot komunikacijski vozlišči za fiksna žična in brezžična omrežja. Zagotavljata povezljivost med omrežji (PSTN, Internet, ATM) s pomočjo različnih protokolov (SSN7, CAS, IP in drugi) ter omogočata priključevanje različnih uporabniških terminalov na različna omrežja
- gradnike dostopovnih omrežij, ki se s protokoli V5.1 in V5.2 povezujejo z nadrejenimi sistemi in ki podpirajo standardne in ISDN terminale ter tudi brezžične tehnologije DECT in CDMA, omogočajo pa tudi priključevanje širokopasovnih terminalov za tehnologije xDSL
- celotni sistem upravljanja in nadzora telekomunikacijskih omrežij TMN, ki glede na organiziranost operaterja omogoča centralizacijo enih in disperzijo drugih funkcij upravljanja
- razvoj in izvedbo klicnih centrov, naročniških služb in drugih storitev z dodano vrednostjo (VAS) na osnovi integracije računalništva in telefonije (CTI).
- mobilne komunikacije v tehnologiji GSM, kjer poleg komutacije in radijske opreme nudimo tudi celotno frekvenčno načrtovanje, gradnjo omrežja in vključitev v delovanje
- širokopasovna hrbtenična omrežja s tehnologijo ATM, vključno s širokopasovnimi vozlišči
- prenosne sisteme v tehnologiji SDH in PDH
- IP telefonija

Tehnološka predstavitev podjetja

Podjetje Iskratel je opremljeno z najsodobnejšo opremo za razvoj, proizvodnjo, testiranje, montažo in servisiranje strojne in programske opreme digitalnih komutacijskih sistemov EWSD in SI2000. Proizvodna sredstva za strojno opremo vključujejo najsodobnejšo popolnoma avtomatizirano linijo za montažo površinskih elektronskih komponent. Sredstva za

testiranje programske opreme omogočajo testiranje sistemske in aplikativne programske opreme v realnih razmerah s pomočjo računalniške simulacije različnih okolij in prometnih razmer, v katerih se bo ta programska oprema uporabljala. Orodja za simulacijo obvladujejo specifiko javnih omrežij za različne države in vse vrste prometnih situacij, ki lahko nastopijo v javnih in posebnih omrežjih. Večina simulacijske programske opreme je razvite v Iskratel.
Proizvodna sredstva omogočajo proizvodnjo 1.000.000 digitalnih portov na leto.

Obvladovanje kakovosti

Podjetje Iskratel je 07.12.1994 pridobilo certifikat ISO9001 od SiQ in DQS in 20.06.1995 certifikat ISO9002 od EQNet in DAR. Certifikata se letno obnavljata.

Ekološka usmerjenost

Industrijska dejavnost podjetja Iskratel ekološko ni problematična, pri procesih proizvodnje strojne opreme se dosledno upošteva veljavna zakonodaja na tem področju.

Implementacija informacijskih tehnologij v poslovnem procesu

Vse faze poslovnega procesa v podjetju Iskratel od razvoja in proizvodnje do trženja, montaže in vzdrževanja so podprte z informacijskimi tehnologijami, ki jih skupina za informatiko stalno izpolnjuje z novimi tehnološkimi zmožnostmi.

V podjetju je več kot 900 osebnih računalnikov, terminalov in serverjev, povezanih v enovit informacijski sistem, optimalno prilagojem specifiki poslovanja podjetja.

Contributed papers

Tacit Knowledge as Part of Engineers' Competence

Kaj U. Koskinen*, Hannu Vanharanta

Abstract—This article addresses tacit knowledge as part of engineers' competence. The presentation will illustrate tacit knowledge focusing on its foundation, how it is expressed and acquired. The conclusion of the presentation is that a young engineer lacks a lot of tacit knowledge after his/her graduation, but s/he can accelerate the acquisition of tacit knowledge by conscious action learning and by active informal communication.

Index Terms—tacit knowledge, experience, action learning, interaction.

1. INTRODUCTION

According to the management literature the competence of an engineer includes:

- *Explicit knowledge.* This is the type of knowledge an engineer has acquired through formal education. Explicit knowledge implies factual statements about such matters as material properties, technical information, and tool characteristics. Explicit knowledge can be expressed in words and numbers, and it is, therefore, easily communicated and shared.
- *Tacit knowledge.* This type of knowledge is highly personal and hard to communicate or to share with others. Tacit knowledge is deeply rooted in an engineer's *experience*, and it consists of schemata, mental models, believes, attitudes, and perceptions so ingrained that we take them for granted.
- *Personal characteristics* like stress toleration, which either enhance or decrease an engineer's commitment to a task, and which are also part of his/her competence.

A young engineer normally possesses a lot of modern explicit technical knowledge, but, instead, often s/he lacks relevant tacit knowledge. Therefore this presentation will illustrate tacit knowledge focusing on its foundations, on how it is expressed and, how an individual acquires and disseminates tacit knowledge through and by his/her working experience.

2. TACIT KNOWLEDGE

Tacit knowledge represents knowledge based on the experience of individuals. It expresses itself in human actions in the form of evaluations, attitudes, points of view, commitments, motivation, etc. Usually it is difficult to express tacit knowledge directly in words, and often the only ways of presenting it are through metaphors, drawings and different methods of expression not requiring a formal use of language. On the practical level many experts are often unable to express clearly all they know and can do, or how they make their decisions and come to conclusions.

Polanyi [17] encapsulates the essence of tacit knowledge in the phrase "We know more than we can tell", and provides further clarification of the concept in such commonplace examples as the ability to recognise faces, ride a bicycle or swim, without even the slightest idea of how these things are done. Rosenberg's ([19], p. 143) description of traditional technological knowledge, accumulated in crude empirical ways with no reliance upon science, provides a good definition of tacit knowledge in technology companies: "The knowledge of techniques, methods and designs that work in certain ways and with certain consequences, even when one cannot explain exactly why". Thus, tacit knowledge equals practical knowledge and know-how.

Powerful comprehensive intuition is associated with tacit knowledge, along with a flexible ability to evaluate the knowledge and know-how required by the situation. Thus, tacit knowledge reinforces an individual's practical preparedness and allows concentration on the key activities of the task since a part of the activity has become automatic through practice (Holma *et al.*, [13]). This kind of knowledge (which comes up in engineering tasks), quiet and non-verbal practical know-how, is difficult to study and define. Its structure is difficult to understand and therefore it cannot be fully comprehended or communicated. It is a question of knowing how complicated work situations should be managed and problems tended to.

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Tacit knowledge is acquired primarily through experience. Therefore the following discussion describes the views of various researchers on experience and the accumulation of tacit knowledge through action learning and interaction.

2.1 EXPERIENCE

Badaracco [3] claims that a human being cannot take advantage of new information unless s/he has earlier "social software" connected to that information. Also Cohen *et al.* [8], who have introduced the "absorptive capacity" concept, claim that man's capability for utilising new information for problem solving depends largely on his earlier knowledge. For example the chances that a technology firm will succeed in an engineering project can be dependent on staff experience in similar projects (c.f. Koskinen, [14]).

When people attempt to solve their problems, they are guided by the knowledge they have gained from earlier similar problems. The fact that knowledge and know-how based on experience can be utilised in the engineering of technology products is also supported by findings of cognitive psychology research (c.f. Ross, [20]). The results of these studies provide evidence for the important role of specific, previously experienced situations in the engineering of such products. Also Anderson [1] indicates how people use some earlier situation as a model when they are solving a specific problem.

The variety of a person's experience increases his/her chances to solve problems. This is because variety increases the individual's ability to see the entirety of an issue and the interdependence of situations and events. That is, the ability to solve a problem is dependent on the richness of the existing knowledge structure (Lyles *et al*., [15]). Such observations, drawing on studies at the individual level in the cognitive and behavioural sciences, are supported by Bower *et al.* ([6], p. 424), who claim that "the more objects, patterns and concepts that are stored in memory, the more readily is new information about these constructs acquired".

Also the depth of knowledge and know-how has a positive effect on knowledge creation. The depth of know-how is particularly important when the problem is a difficult technological problem. The variety and depth of know-how seem to assist in the formation of new knowledge. These varieties of experience, which can mean for example cause-effect understanding, constitute a great deal of this difficult to communicate and share tacit knowledge.

Von Krogh *et al*. [26] argue that when the continuity in the performance of a task is interrupted by the appearance of a problem, people seek to interpret the task through their 'current frame of reference'. When the performance of the task is perceived as problematic, the individual is not directly able to make sense of it with his/her current stock of knowledge. However, even if the problem is something outside the person's experience, it may still be well within the range of problems that his/her knowledge can address. For example, an individual might not have earlier experienced the task he faces at the moment, but through interaction with others can acquire new knowledge that helps him/her understand the task and make the needed 'adjustments' in behaviour in accordance with his/her interpretations.

Personal experience can also be a factor that limits learning. Path dependency (Teece *et al*., [24]) means that the earlier history of an individual limits his/her future behaviour. "Our experiences are not like water in a glass which can be emptied and then refilled" (Flöistad, [11], p. 73). Thus, a person's knowledge and know-how are often bound to a specific context and era; and therefore they could be difficult to utilise in other enterprises and/or at other times and situations. Enterprises and the people that work for them should keep in mind that education and training often have a longer term effect than originally planned for.

As mentioned above, tacit knowledge is hard to express formally. Therefore an individual uses informal means to acquire tacit knowledge. In the following sections we explore *action learning* (e.g. Argyris *et al.,* [2]; Nonaka *et al.,* [16]) and *informal interaction* (e.g. Nonaka *et al.,* [16]; Sveiby, [22]) which are mentioned in the literature as being the best means to accumulate tacit knowledge.

2.2 ACTION LEARNING

Action learning is a process through which participants learn with and from each other, by mutual support, advice and questioning, as they work on real issues or practical problems while carrying real responsibilities in real conditions. It is a social process, carried out when a group of learners cause each other to examine afresh many ideas that they would otherwise have continued to take for granted.

Action learning is not simply learning by doing or learning by using. It uses the explicit knowledge that can be gained from formal sources such as books, together with the tacit knowledge that is gained through experience, and it subjects both forms of knowledge to questioning and reflection.

A single person seldom knows enough to solve today's complex problems. In many enterprises knowing how to find and apply relevant knowledge efficiently is more practical than trying to master a large amount of knowledge and know-how.

However, in enterprises it is often assumed that people turn to manuals and databases to obtain information. In practice people often rely upon a network of relationships, i.e. action learning, for knowledge and advice (Rogers, [19]). Rather than turning to databases they seek information from trusted and capable colleagues. According to Handy [13] people are about five times more likely to turn to friends or colleagues for answers than to other sources of information. In short, who you know significantly affects what you will eventually know (Cross *et al.,* [10]).

In many organisations distributed technology is at the heart of knowledge management (c.f. Szulanski, [24]; Burt, [8]). Most initiatives have concentrated on identifying relevant knowledge in various places of an organisation in order to build a technical infrastructure to support knowledge retrieval and dissemination. Knowledge repositories often contain reports, memos, and other work documents. Ideally, these technologies allow an organisation to apply its collective intellect to any problem, regardless of time or geographical location.

However, databases only complement the action learning of those seeking answers to problems (c.f. Cross *et al.,* [10]). No matter how robust the search is functionally, a person's network of human relationships often determines which knowledge they access. In the opinion of Cross *et al.* people usually take advantage of databases only when colleagues direct them to a specific point in the database. Rather than engaging in an extensive search through an organisation's repository of knowledge, employees turn to friends and peers to learn where to find relevant knowledge.

2.3 INTERACTION

In order to benefit from tacit knowledge, one must be able to interpret, internalise, and understand different issues, circumstances, and situations. Therefore individuals working for a company communicate with each other by a number of different means, such as telephone, mail, electronic mail, and face-to-face conversations.

The richness of a communication medium can be analysed in terms of two underlying dimensions: the variety of cues the medium can convey and the rapidity of feedback the medium can provide (Daft *et al.,* [11]). Trevino *et al*. [26] propose a link between the selection of media and the ambiguity of the message to be conveyed. In situations characterised by a high degree of ambiguity, no established scripts or symbols are available to guide behaviour. "Meaning must be created and negotiated as individuals look to others for cues and feedback to help interpret the message" (Trevino *et al.,* [26], p. 557).

Berger *et al*. [4] argue that most experience of others takes place in face-to-face situations because the other person's subjectivity is available through a 'maximum of symptoms'; the here-and-now of each individual continuously impinges on the other, both consciously and subconsciously, as long as the face-to-face situation continues. The authors further argue that misinterpretation is less likely in face-to-face interactions than in less close forms of social relations.

Knowledge is acquired and transmitted through symbols with an efficiency that will vary with the characteristics of communication channels used for such transmission. According to Boisot [6] the process of codifying a message for transmission involves a loss of information that can only be recovered in situations where the receiver associates the same cluster of meaning with the symbols chosen as does the sender. The transmission of tacit knowledge, therefore, which may give rise to uncertain or ambiguous interpretations, requires either the simultaneous activation of several channels of communication, in order to minimise the loss of information implied by the use of a single channel, or a prior sharing of experiences out of which emerges a convention that reduces uncertainty for the use of certain symbols (Shannon *et al.,* [22]). An instance of the first type of communication would be the transmission of behaviour patterns by for example sight and touch, which are used together to convey a message, as when a music master demonstrates the application of a skill to his pupils (Boisot, [6]). An example of the second type would be the use of the cross by Christians to convey to one another an intangible cluster of meanings that mix values, norms, and expectations in inexplicable ways (Boisot, [6]).

3. A YOUNG ENGINEER vs. TACIT KNOWLEDGE

On the basis of the conceptual analysis above we conclude that the competence of a young engineer often lacks tacit knowledge. This is natural, because tacit knowledge can be acquired only through experience. However, a young engineer has often a chance to accelerate his/her tacit knowledge acquisition by conscious and abundant action learning and active informal interaction.

We can also conclude that the fixation (path dependency) of an old engineer can limit his/her possibilities to see a new solution to a problem. This is not, however, the case when a young engineer is concerned.

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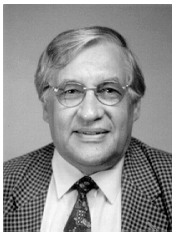

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MEDICINE IN THE VILLAGE: TECHNOLOGY, HEALTH, AND THE WORLD

Dag K.J.E. von Lubitz[*] and the Medical Readiness Trainer Team[+]

What's new in the Brave New World?

In January 1998, "Electronic design"[1] printed an article by Dr. Jerome L. Krasner titled "Intellectual property drives medicine's embedded future". In the paper, which could, in many ways, serve as a guide to the future career by a student of electrical/electronic engineering and design, the author entices fellow engineers to "listen up" to the explosion of lucrative opportunities within all fields of medical endeavour. The opportunities are unprecedented, and the breadth of the applications cited by the author is noteworthy. Things not even dreamed of a few decades ago become reality today, and even more daring exploration looms right above the horizon. Yet, before "listening up" to the sound of millions moving in a swift stream into the accounts of the entrepreneurial medical engineers, the novices of this rapidly developing field may need to "listen down" to the sound of money, and pay a very close attention instead to what is it really all about. It is about Health.

Just like in the preceding centuries or even millenia[2,3], today too, the main concern of the practitioner of medicine is the health and comfort of the patient. Yet, there is a difference: today since, to an ever increasing extent, technology assists in providing both. And thus, the engineers creating the magnificent tools that the physicians now have at their disposal became an inherent part of the of the "healing team." Their goals must now unite with those of the physicians: not profit but comfort and health of the patient.

Technology shrunk the world and within less than half a century converted it into a community of closely knit political and economical relationships, a network where disturbances at one of its points are rapidly, and often dramatically, perceived at all others. In parallel, not only the nature of medicine and science have changed, but also the way of their execution and dissemination[4,5,6,7]. Medicine entered the postmodern era with vigour although forced "to retain, and improve, the achievements of the modern era, but also respond to the priorities of postmodern society – namely: concern about the values as well as evidence, preoccupation with risk rather than benefit, the rise of the well informed patient"[8]. The Brave New World of postmodern medicine opened the door for the biomedical engineering as wide as never before. It also shut the doors of medical libraries with a mighty slam, and flung us all into the still poorly charted world of the World Wide Web. The village suddenly became global, but like the one of yore, it still retains its pre-modern divisions, the quarter of the rich, and the "wrong side of the tracks."

Global Technology, Global Medicine: neither really global yet

The single, most dramatic invention that changed the way world thinks and operates today is, indisputably, the Internet[9]. Like many other technologies born as a result of military necessity, it quickly evolved into a tool for communication within the scientific community, matured, and then exploded in its astounding richness that conquered and permeated essentially all forms of human activity[10]. Yet, while there are over 300 million registered Internet addresses, their concentration follows, for quite obvious reasons, the pattern of national wealth. Europe, USA, and the developed countries of Asia lead in the economic use of the Internet[11] with almost half a trillion dollars worth of business predicted in Year 2002 in the USA alone[12]. The skewed distribution of Internet access, where 85% of the world's population has no possibility to benefit of the advantages provided by the Internet[13] has its consequences. One of the major ones is the impact uneven Internet coverage on several aspects of medicine in the underdeveloped countries[9]. These are the regions where medical expenditures are among the lowest[14], but the need for medical expertise, training, and education – the activities for which the Internet is

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preeminently suitable – the highest[15]. Moreover, these are also the regions characterized by the abundance of remote areas, where access to advanced medical help is exceedingly limited or even non-existent[13,15]. The problem of the presence and use of the advanced medical technology in the Third World is related not only to the poor telecommunications infrastructure, but also to the cost of devices necessary to utilize whatever telecommunications systems might be locally available. When the price of a computer necessary to operate Web/Internet-available medical resources, no matter how badly they may be needed, exceeds yearly income of the potential user by hundreds if not thousands of dollars[9,16], the usage of such form of resources becomes the subject of wishful thinking, purely theoretical considerations, and, ultimately dismay and anger at being excluded.[9]

While the problems of the Third World may, in medical sense, border on the desperate, even those in the more affluent parts of the world suffer of inadequate resources, conceptual conflicts, and ill-defined forces of the modern medical market[17, 18]. Consequently, many of the advanced technology resources available to medicine are either underused (e.g., training simulators)[17], overused (e.g., scanning devices)[9], or even abused (e.g., incorrect and misleading patient information on the Web)[19]. Some of these factors have been described and analyzed in a seminal paper by Dardelet[18], in which the author contemplates the roles, influences, and interactions of the new and old players on the post-modern stage of global medicine. It is only through the crystallization of these trends, through final definition of the practical role and of the practical level of healthcare in the modern society that the concept of global medicine can be realized as a practical endeavour.

The home-visit paying doctor of the "old village" retired. The doctor of the "global village" tries to find out how to pay such visits[9] and, in some instances, whether it pays to pay such visits at all[23, 24]. Technology, its local and global availability and state, the transparency of its use, and, ultimately, its affordability play increasingly essential role in these considerations, and it is in this arena that the post-modern biomedical engineer finds the foremost challenge. Yet., global access to medical care made possible through technology-based advances and concepts such as telemedicine[25] are only a part of the solution. Adequacy and quality of medical care represent another. Simply stated, it is not enough to assure that every burger of the global village can and may see the doctor whenever a headache occurs. It is the way the headache is treated that defines the service. Persistent headaches may indicate nothing but a simple need for a new set of spectacles. Yet, new spectacles will not cure a misdiagnosed, life-threatening tumor whose symptomatic manifestations may include headaches as well. Clearly, problems of global medical training are a paramount issue that needs to be addressed when discussing the totality of the global medical services.

The Master said: What I hear, I forget. What I see, I remember. What I do, I understand[26]

The Confucian wisdom applies as well to medicine as to any other form of human activity. However, the way we train our physicians, nurses, or paramedics has repercussions far more serious than in many other fields. Last year, a report published by the Institute of Medicine of the United States American Academy of Sciences revealed that nearly 100.000 patients in the United States die due to medical mistakes[27]. In 1996, another report bluntly pointed inadequacies in the realm of nursing[28]. However, the existence of fatal mistakes in medicine points not at the general malevolence of its practitioners but at something that is probably even more disturbing – inadequate training or infrequent refreshment of once learned and long forgotten skills. Several studies documented this phenomenon both in the USA and a number of other countries[29]. As we have discussed in our earlier papers[9, 17, 29], many of these problems are caused either by inadequate access to the high-level training facilities, or by continuously mounting pressures that prevent health care providers from devoting sufficient amount of time to maintenance of their skills at a satisfactory level. The problem is particularly acute for those working in rural and remote regions[30], or in the underdeveloped countries[9].

Physicians, in similarity to other professionals where the ability to marshal theoretical knowledge, focus it on a specific problem, and institute concerted actions based on the analysis of the presenting facts and the body of the possessed knowledge, learn through experience[31]. While the theoretical underpinnings and the individual constituents of such experience[32, 33,34] are beyond the scope of this paper, it is important to realize that the ability to consult experienced colleagues, access to information resources and, ultimately, the ability to train under experts, all play a very important role. On the other hand, poor instruction results in the equally poor retention of the learned skills[35]. Thus, if skills are not practiced frequently enough under the guidance of true experts, formal training notwithstanding, their application in a crisis situation may lead to further injuries or even death[36,37,38].

Can technology be of the assistance in providing better medical learning and training platforms? Without any doubt. One can learn surgery [39, 40] or get acquainted with the secrets of skeletal function[41] by doing nothing

else but inserting a CD-ROM into the appropriate drive. There are plenty of courses on the Internet where visual, audio-, and interactive elements are fused into attractive packages needed for preclinical, clinical, and continuing medical education[42,43]. There is also the "brave new reality of telemedicine"[44] that has the potential for changing many aspects of medical practice[25]. Yet, all these media provide the trainee with only two elements of the Confucian dictum: the trainee hears, the trainee sees, the trainee does not do. Unless, of course, the heard and the seen are implemented on a living patient with a disastrous result as a very realistic probability.

Enter the "virtual"

In the modern world of technology euphoria and journalistic "pulp", everything that is not "face to face" becomes "virtual". There are "virtual workshops"[45,46,47], "virtual exhibitions"[48], "virtual doctors"[49] and their "virtual meetings"[50]. There are even virtual hospitals, and, to add versatility, their "virtual" civilian and military versions have been created as well.[51,53] The intent to portray the existing and quite common learning technologies based on the Internet/Web/CD ROM platforms as associated with the very advanced but still not often used technology of "synthetic"[54] or "augmented reality"[55] trivializes the issue since "virtual" means "future"[56]. And as the tool of the future, virtual reality (VR) gains a very rapid acceptance as a training tool in the manufacturing-[57,58,59,60], oil-[61, 62, 63], and aviation and space industries[64], in the armed forces[65], architecture[66], and even in stage production[67]. It role as the teaching/training/testing tool has been recognized by national governments creating national VR centers.[68,69]. Recently, virtual reality met medicine as well.[70]

Based on the type of image projection, VR systems can be separated into five major categories: VR theaters based on curved video-walls and serving large audiences, single wall theaters for small groups, four (or more) wall VR "CAVEs" suitable for small group presentations and training, VR desks/boom-mounted devices for individual use, and, finally, the portable systems based on hemispheric or concave lens image projection techniques[71]. All of these forms of VR can be readily applied to medical training. Thus, VR theaters and video-wall-based devices can be used in education and training of medical students giving them advanced insight into subjects as varied as molecular genetics or advanced microsurgery. The CAVE-centered systems can provide training of medical teams, while desk- and hemishperic projection systems are ideal for field deployment to the regions where the existing facilities are less sophisticated. More importantly, VR environments may allow the trainees the full adherence to the Confucian lesson - to hear, to see, and to do.[29,70] Several devices are that are commercially available allow a very comprehensive level of procedure training based on the utilization of VR.[72,73,74,75,76,77] However, although anatomic structures and their pathological modifications can be satisfactorily rendered in virtual reality, the problem of natural interaction with these "phantomic" images requires practical and satisfactory solution to the problem of "haptic feedback" - an essential prerequisite in medical training.[78,79,80]. To avoid this obstacle, the Medical Readiness Trainer (MRT) Team of the University of Michigan combined human patient simulation with VR-rendered environmental envelope[29]. In the MRT environment, the Human Patient Simulator provides haptic feedback while the "physical" setting of the medical event (e.g., emergency room, field, helicopter, etc.) is created using VR. MRT allows training of both individuals and teams and permits practice of procedures and medical management of a severely ill patient in the surroundings approaching the totality of those they would encounter in a "real-life" situation. As a number of studies have shown[29], such complex training settings are important as the generators of "stressor factors", i.e., elements that affect performance of the involved personnel but do not constitute an integral part of the treated medical condition, such as external noise, movement, smells, etc.

Advances in other fields such as in vivo imaging of the structure and function of internal organs[81,82,83,84] opens a completely new arena for virtual reality, where 3-D, fully interactive (and possibly even immersive) reconstruction will soon be possible, allowing diagnosis, skills training, and even full scale "dress rehearsals" before surgical procedures are conducted on living patients. Such VR-based visualization systems can be combined with non-invasive diagnostic devices under current development by NASA[85] resulting in a hitherto unprecedented level of technology-based approach to health. The nascent field of medical simulation and modeling opens yet another window to the future, where pathological processes will be simulated and modeled using sophisticated programming techniques and VR-based rendition of models.[86] The latter will allow a much better functional understanding of temporal and spatial relationships among different processes that characterize disease.[86] The new techniques of VR-based simulation and modeling will also help in development of appropriate interventions and may, ultimately reduce the need for animal experimentation[87].

The final advantage of synthetic systems is less obvious but not less important: studies of how health care providers perform, and how their performance can be

improved[88]. There is no doubt that, in the world of modern medicine, both quantitative and descriptive data are needed[89]. However, generation of such data in real settings for such studies is either difficult or simply impractical. Ethical concerns, potential danger to the patient, inconvenience, etc., result in a paucity of this type of studies despite their clear professional relevance. Implementation of artificial training systems (VR, Human Patient Simulators, or procedure simulators) allows execution of such investigations [90,91] in a safe yet highly realistic setting, without unduly burdening operational medical facilities, and without endangering the patients.

Exit "virtual", enter the "real"

There is no question that the world of medicine will change dramatically under the influence of technology[18]. The changes are clear already now, and medicine today has less and less in common with what it used to be even 50 years ago. Still, while the changes affect the most affluent, the "wrong side o the tracks" in the global village sees little of that change. The cost of many technologies discussed above is still exceedingly high. Accordingly to Scott Redmond, a proponent of technology integration, a portable, head-mounted VR system may cost as low as $ 600 – 800, providing half a million units are built. A high-end room system would cost up to $ 750.000 with a production tun of 2,000 units or more[92]. As alluring as these devices are, in countries where per-capita health budget might be significantly less than $ 10 per capita,[93,94] the quoted figures are incompatible with the local reality. The cost of "gadgets" and the need for better health are equally astronomical.

The change is imperative and the international community begins to think "global."[95,96,97] However, "global" will be attainable only through technology, and it is here the role of the biomedical engineer is particularly prominent. Today, the virtual reality systems operate as isolated and extremely costly centers. In future, such centers must be able to "talk" to each other in real time, exchange information, and incorporate external inputs into their own operational processes. In future, even the most remote user will have an easy access to any of such facilities, and will be able to participate in their activities from practically anywhere on earth. In future, the "virtual classroom" will be really virtual: the student will be surrounded by "virtual" colleagues, the novice surgeon will be able to practice on virtual tissue, and the virtual rat will serve as the new laboratory animal. Some of these concepts are already exist as fledgling experimental prototypes or are seriously considered for development.[70] Others are still in the sphere of dreams. One theme defines the future: access to technology must not be restrictive due to its presently very high costs but increasingly inclusive due to the efforts at lowering them. Particularly in medicine, the use of advanced technology must not be a matter of choice between providing inoculations to children in an underdeveloped country against VR training of the local nurses in administering such inoculations. Distance-based sharing of the expensive training facilities may offer the solution to the "technology gap." A practical demonstration of this concept has been recently provided by the Medical Readiness Trainer Team of the University of Michigan, who proved that a very costly Human Patient Simulator located at one site can be remotely accessed and successfully operated by the trainees from as far as 4,500 kilometres away[90].

Much of these advances depend on highly versatile telecommunication platforms that must be accessible at low or even very low cost to anyone, anywhere, and at any time, and that will provide the essential backbone of the entire structure of global medicine. There will be no need to develop high-end training facilities at every university or medical training centre in every nation if collaborative networks are created. Such networks will provide access to the expert personnel and technical resources of the major training facilities to anyone who may need them. Training provided by world-class experts will not be restricted to a particular university or hospital at which they reside daily. Using the combination of VR and video technologies, high-speed telecommunication networks, and simulation and modeling techniques, such training will be available to the entire medical community of the globe. And at that stage, the global village will acquire its new home visit-paying doctor. He may be virtual, but he will always be there.

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Looking for technical reports

Robert Meolic

Abstract— **This paper is about technical reports, a special type of research papers, that are getting more and more popular source of scientific knowledge. Five most important search engines for locating technical reports are described. Some other sources of research papers on the Internet are mentioned, too. Reading the paper you can improve your skills to search for scientific knowledge significantly. This is also the main purpose of the paper.**

Keywords— **computer science, technical report, search engine, digital library.**

I. Introduction

A good research in computer science is usually based on acquiring information from other authors, who are working on similar topics. To enable exchanging information between scientists, many conferences, colloquia, and symposia are organised. Additionaly, technical and scientific journals publish numerous papers every day. One may think that this enormous quantity of information satisfy all the needs of today's researchers. However, in the age of Internet this is not completely true.

Internet enables people from different places in the world to communicate with each other and exchange data quickly and very easy. Therefore, it seems to be an ideal medium for exchanging scientific papers. Some advantages of electronic publishing over classic publishing are:

- low costs,
- easy distribution to very large population,
- enables complex search engines, which help users locating paper with interesting contents,
- better evidence about which papers are the most interesting and who reads them, etc.

However, there also arise some problems with publishing papers on the Internet. Scientific papers need to be reviewed to be trustworthy. In fact, the reviewing process determines the limit of how many papers can be published every year. On the other side, nobody can prevent one to publish her/his paper, even unreviewed, on the Internet. The inspiration for such act can be very similar to that why beta versions and sharewares version of software are giving away. If you publish your ideas often and quickly, then:

- you also get response from others more quickly,
- your ideas have more chances to get considered,
- you have more chances to attract others to your work.

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In the last decade, many institutions, especially the academic ones, recognize the importance of publishing the knowledge obtained by their researchers. The weaknesses of publishing in journals become very evident. For example, it is not unusual that two or more years pass before a submitted paper is published. Also, presenting papers at the conferences has some disadvantages. Conference fees are becoming very high. Moreover, many conference proceedings have only small circulation and therefore published papers do not reach many other authors. To overcome these difficulties, internal reports, abstracts, extended abstracts, preprints, unreviewed papers, and similar materials are increasingly used for exchanging information between scientists within institution and also worldwide. Nowadays, we refer to this documents usually as *technical reports*.

Most of technical reports available on the Internet have the following common properties:

- they are collected and published by institutions where the authors are employed,
- they have an identification label, which enables one to cite them,
- they are free for download and use.

Although technical reports are usually only locally reviewed, they are an important source of knowledge, especially if you are looking for new topics. Many good ideas appear first as a technical report and after that as a paper in a journal. The main advantage is that technical reports enable one to publish her/his ideas when they occur to her/him and not only at the end of the research. Technical reports also act as an important part of information exchanges when working in a team. They can even be a kind of milestones during the project.

II. Using search engines to locate technical reports

In this section we give an overview of some popular search engines, which can be used for locating technical reports. They can be divided into two groups:

1. general search engines, which look for information on the Internet,
2. special search engines, which look for documents in the collections of bibliographies of scientific literature.

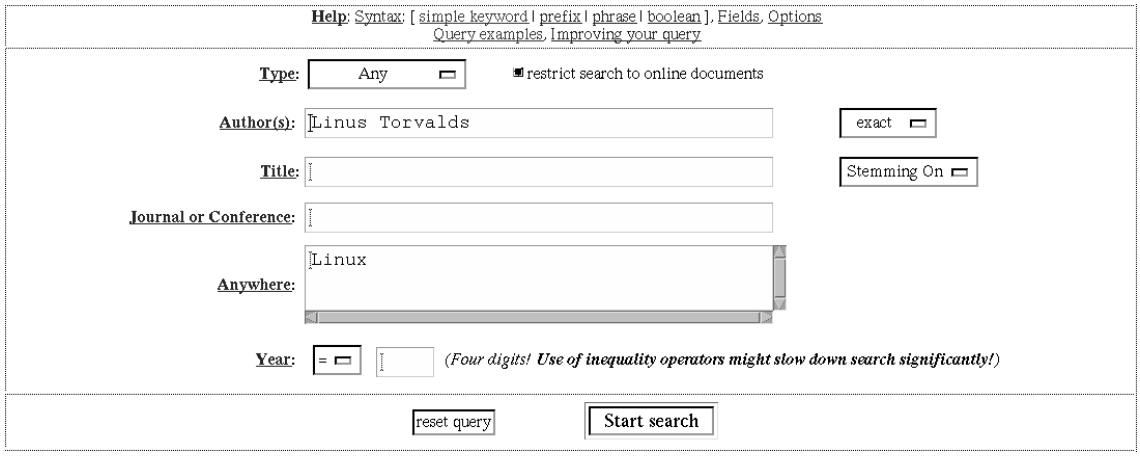

Fig. 1. The Collection of Computer Science Bibliographies

In the group of general search engines there are all popular Internet searchers. Let us list just few of them:

- AltaVista: `http://www.altavista.com/`,
- Google: `http://www.google.com/`,
- GoTo: `http://www.goto.com/`,
- Yahoo: `http://www.yahoo.com/`.

These search engines produce very good results when looking for a particular technical report. They are especially convenient when searching for a paper with a given identification label or for a paper from an unknown institution. You can also find a copy of document, for which the original was removed from Internet.

However, in this paper we are more interested in the group of special search engines. We have inspected the following search engines:

- The Collection of Computer Science Bibliographies (CCSB): `http://liinwww.ira.uka.de/bibliography/index.html`
- CORA - Computer Science Research Paper Search Engine: `http://cora.whizbang.com/`
- The Computing Research Repository (CoRR): `http://www.acm.org/repository/`
- Unified Computer Science TR Index (UCSTRI): `http://www.cs.indiana.edu:800/cstr/`
- Networked Comp. Sci. Technical Reference Library (NCSTRL): `http://cs-tr.cs.cornell.edu/`

Unified Computer Science TR Index (UCSTRI) [8] is a WWW service which provides a searchable index over thousands of existing technical reports, theses, preprints, and other documents broadly related to computer science. This service has been in operation since May 1993 and has enjoyed significant attention [2]. It was an attempt to unify a wide variety of technical documents broadly related to computer science as a searchable index. The entire index currently consists of 14111 items found at 185 different sites. UCSTRI was one of the first attempts to collect indices of contents from technical reports sources. Although UCSTRI is still usable and helpful, it seems not to be maintained very much since 1994 and therefore it is usefull only if looking for a paper in an archive which already existed in that year.

The Collection of Computer Science Bibliographies (CCSB) is located at Lehrstuhl Informatik für Ingenieure und Naturwissenschaftler in Karlsruhe, Germany (Figure 1). The authors currently report the following statistical numbers about the referenced publications: 498487 journal articles, 320440 conference papers, and 110521 technical reports. Each item in the collection is a BibTeX record. In the case of technical reports, BibTeX record contains a link to the full paper, where available. The bibliographies are collected using various Internet search tools and by contributions from individuals. They are automatically converted to BibTeX format. The local BibTeX copies of the bibliographies are updated with every new release of the bibliography collection (about every month). The statistic about accesses to the CCSB shows that this search engine is pretty popular. They noted 2165837 completed requests from Jan 12, 2000 to Sep 28, 2000 (259 days). This is an average of 8859 requests per day. The statistic also shows that in the same period about 50 MB of data was transferred from CCSB per day and that it was used by scientist all over the world.

CORA - Computer Science Research Paper Search Engine is the result of a continuing research project at Just Research (a company located in Pittsburgh, near the campus of CMU) with Carnegie Mellon University graduate and undergraduate students (Figure 2) [7]. CORA is a special-purpose search engine covering computer science research papers. It allows keyword searches over the partial text of Postscript-formatted papers it has found by spidering the Web. Currently, it provides access to over 50,000 research papers on all computer science subjects. The results are displayed by extracted title, author, and abstract. The extraction results are also used

Fig. 2. CORA - Comp. Sci. Research Paper Search Engine

to provide automatically generated BibTeX entries. Citation references are processed to provide forward and backward crosslinks — showing both, papers referenced by the current paper and papers that reference the current paper. The papers are automatically categorized into a "Yahoo-like" topic hierarchy with 75 leaves. The citation link structure is analyzed in order to identify seminal and survey articles in each category.

The Computing Research Repository (CoRR, see Figure 3) started in September 1998 through a partnership of ACM, the Los Alamos e-Print archive (LANL), and NCSTRL (Networked Computer Science Technical Reference Library). It is available to all members of the community at no charge. Everyone has to submit her/his paper manually by email, by FTP, or by using Web interface provided by LANL. It is interesting that they do not accept submissions with omitted figures, tables or sections, nor they accept 'abstract only' submissions. From their viewpoint, such submissions are unhelpful to readers and of very limited archival value. Authors submitting a paper classify their papers in two ways: the first is by choosing a subject area from a list of subject areas and the second is by choosing a primary classification from among the roughly 100 third-level headings in the 1998 ACM Computing Classification System. CoRR is a part of NCSTRL collection and therefore their material can be searched through the NCSTRL form, too.

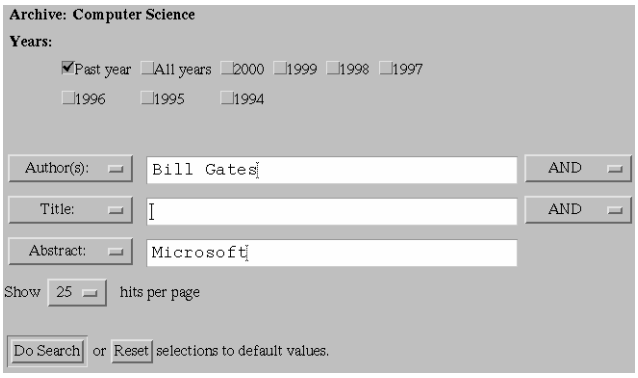

Fig. 3. The Computing Research Repository

Networked Computer Science Technical Reference Library (NCSTRL) is a common interface to the technical report collections of its (currently over 100) member institutions (Figure 4) [1], [4], [6]. It has been funded by DARPA and the National Science Foundations, with most of the technical work recently being carried out at Cornell University. For the most part, NCSTRL institutions are universities that grant PhDs in Computer Science or Engineering, with some industrial or government research laboratories. NCSTRL has its own viewer, which enables one to view documents without downloading them. NCSTRL is running the very succesful Dienst protocol and software [5].

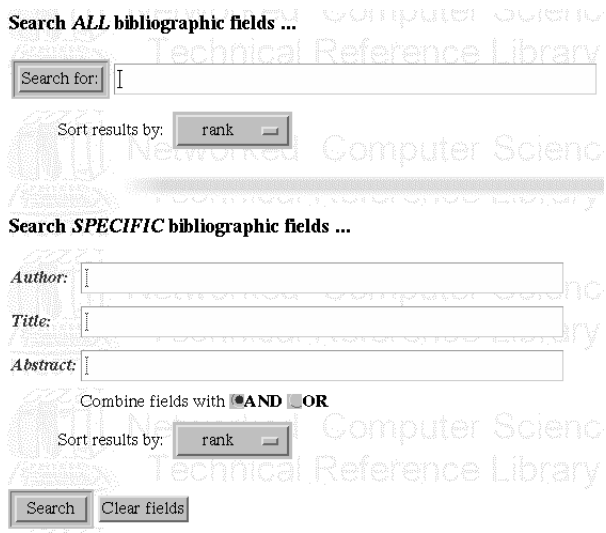

Fig. 4. Networked Comp. Sci. Technical Reference Library

III. A COMPARISON OF SEARCH ENGINES

We made a simple test of search engines. Results of the test are shown in Figure 5. There, the number of documents found is presented for each search engine. Because the reported papers not always exist, we also tested the reliabilty of given links. We checked first 10 hits within each search result. Only the links that directly led to the full paper in any format were considered as the good ones.

The results show that CCSB, CORA, and NCSTRL find much more papers than UCSTRI and CoRR. On the other hand, CoRR and NCSTRL report only papers which are really accessible, while not all links reported by UCSTRI, CCSB, and CORA are usable. We did not check the content of papers. Because of manually submitting and classifying papers we believe that CoRR is somehow superior in comparison to other repositories.

This simple test cannot be a criterion of which search engine is better. It is an individual decision of which search engine to use in a particular situation. Maybe, the best way to get interesting papers is to try all of them.

Search string	UCSTRI	CCSB	CORA	CoRR	NCSTRL
“speech recognition”	6	109	546	37	64
“temporal logic”	2	>170	252	10	167
“database architecture”	21	13	7	0	11
“digital signature”	0	74	35	3	28
“branch prediction”	1	57	89	0	56
“distributed multimedia”	0	60	132	1	63
“text categorization”	0	76	75	7	7
“mobile computing”	3	159	238	0	44
“real-time systems”	44	>170	422	0	233
“parallel computing”	3	>170	449	2	133
$\sum$	80	>1058	2245	60	806
reliability	45%	50%	75%	100%	100%

Fig. 5. A comparison of search engines

IV. Conclusions

Technical reports are an important resource of knowledge in computer science. They enable quick insight and also a broad overview of existing topics. Moreover, they can serve as a good source of references to other scientific publications. In this paper we presented all important search engines for locating technical papers. We excluded only the WATERS project (*Wide Area Technical Report Service*) which appeared in 1992 and seems not to be alive anymore [3].

If you are looking for a technical report from a particular institution, you can also search or browse their index if they have one. For example, a very significant index of technical reports in computer science is that from School of Computer Science at Carnegie Mellon University (`http://reports-archive.adm.cs.cmu.edu/`).

Although technical papers can be very helpful, they cannot replace journal papers. Therefore, you must never forget two important electronic sources of knowledge in computer science: IEEE Computer Society Digital Library (`http://www.computer.org/publications/dlib/`) and ACM Digital Library (`http://www.acm.org/dl/`). In the future, we can expect that huge libraries of informations and knowledge will appear, which will change the way we are looking for data on the Internet. For example, some rudiments of such libraries are LIBERATION Electronic Library (`http://www.iicm.edu/liberation`) and The New Zealand Digital Library (`http://www.nzdl.org/fast-cgi-bin/library`).

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Understanding and Promotion of Human value - A Necessary Skill for All Engineers

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Technological development and the global economy have made a unique workplace environment where engineers from the far corners of the globe work together as a team. Team success affects the success of individuals. For successful team performance workforce participants have to work and communicate with a diverse group of people who differ from each other in many ways including culture, gender, age, race, people with disabilities, educational background, etc. It is, therefore, important that each and every team member understands each other's thought process, communication techniques and communicates with each other with mutual respect and understanding. Globalization also represents interconnectedness of people, cultures, and technologies. Thus the workforces demand that the engineers not only achieve mastery level in the technological knowledge but also develop a deep understanding of the diverse workplace environment.

Diversity is a reality, can be observed in the classroom, in the workplace, in every aspects of our life and have forced businesses to adopt new methods of operation. Industries have started initiatives to learn and manage diverse workforce. More and more industries are realizing that individual uniqueness can be a source of conflicts but can also be a key to resolve conflicts. Thus, better understanding and well-managed diversity can help in establishing trust and professional relationships among individuals as well as between company and its employees. Industries have also recognized the need for additional clear moral compass to guide leaders through complex conflicts. Many companies are formulating business ethics with the active participation of employees and by recognizing diverse values and perspectives.

It is important that in team operation each member deal with one another in a sensitive and ethical manner. More and more companies now want to recruit and keep ethical employees. The code of ethics gives people a foundation to depend upon when dealing with a profession. Ethics provides values and principles by which we all live our lives. Employees in the workplace may find themselves in situations that could prompt or pressured into unethical behavior for a number of reasons. We need to make all students aware of those and encourage each of them to think through what the actions really mean, and what could be the consequences of those actions. In addition, gaining knowledge about managing ethics in the workplace provides tremendous moral and practical benefit for future leaders - our students. This is more true today when it is critical to understand and manage highly diverse values in the workplace.

It is also important to know that learning diversity helps individual's awareness about diverse approaches and communications skills in others. This awareness is critical and necessary for team building spirit. Recognition and appreciation of diversity provides an important training and skills to become a productive member of an engineering team. Therefore, we must look for ways to help our students in understanding diversity issues and their effects on individual, organization, and the society. To be a successful team member one needs to possess 'capability of understanding colleague' thought processes, which could be significantly different from one another because of their diverse background. When employees of diverse cultural backgrounds work together, conflict may be the likely result if they do not understand their differences and are therefore uncomfortable with each other. When cultural differences are understood and employees are more comfortable with each other, the team is likely to come up with a better solution by using the richness of its diverse perspectives and problem-solving strategies.

The education system must responds to make sure that that the future participants are ready to face the new challenges and to be successful each and every individual must learn the commonality as well as the differences of cultures, classes, and nations to develop a best possible teamwork. All curriculums must reevaluate the contents to incorporate changes necessary to prepare engineers for the 21st century. Also all curriculums must be flexible enough to

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accommodate future changes with the goal of achieving excellence. There are many literatures outlining the need for understanding diversity and the necessity of the educational system change for the betterment of global community [1-5]. The multicultural and diversity emphasis should be viewed as an on-going integral aspect of the engineering education. To maximize the opportunities of the 21st century it is imperative that the engineering curriculum helps students to realize the existence of different learning and communication skills, provide an opportunity to appreciate the importance of team approach. It is critical that they recognize differences and are aware of their own assumptions about those differences. It is important that the students learn to work with the diverse group with a positive attitude. It is to be noted that the present emphasis, in many work environments, is more on changing the individuals who populate the organization. We need to promote human value and help students to see beyond gender, race, colors, religions, sexual preferences, social customs and prepare them for world citizenship. In addition one should learn to appreciate factors that influences ones' viewpoints, debate with each other without giving offense, and view the difference in a positive manner. It is necessary that we make fundamental changes in how we interact with people of different background and cultures.

Syracuse University is a leading student centered research university and we are constantly seeking creative ways to enhance student learning. Since many of our students will join the workforce after graduation it is important that we create an opportunity beforehand for them to develop an understanding on various diversity and ethical issues. We must address the global community concept in our teaching. In Fall 1999 I offered a course on diversity entitled "Diversity in the Workplace". The objective of the course was to create an opportunity for our students to improve their basic human interaction skills, as a part of their total learning experience, necessary for a team approach by comprehending the workplace diversity and related ethical issues. Students were introduced to the challenges of working in a multicultural group to gain awareness of the workplace environment and the importance of interpersonal relationships. They learned how industries are addressing the issues of diversity in today's ever changing workplace to create and manage diverse workforce. Discussions included issues like labeling, racial and cultural differences, affirmative action, stereotyping, and more in a thoughtful manner. The OPEN and NO PUT DOWN environment helped students to recognize the attributes to become an effective TEAM MEMBER by learning about themselves and understanding the different learning, thinking and communications styles in others. They realized that the growing cultural heterogeneity requires of people from all backgrounds additional knowledge and social skills to become positive participant of the workforce.

In each class the instructor/invited person detail various workplace-related diversity and ethical issues, and industrial strategies for bridging worlds of differences to nourish the spirit of responsible global citizenship. The course provided a forum for the discussion of various diversity related issues to improve understanding and respect among people of different gender, age, racial, ethnic, cultural background, and people with disabilities. Open dialogues help build understanding that those differences influence a person's attitudes, behaviors, and perspectives. Discussions topics include 'challenges and issues in recruiting and retaining a diverse workforce', 'importance of cultural diversity in the newsroom', 'ways organizations use diversity management as a key business strategy', etc. Discussion also included how industries are creating a work environment that encourages openness, integrity, and continuous dialogue regarding values in the workplace to build strong teams in the workplace. These discussions promoted the importance of valuing differences and plant the seed of commitment to establish positive connections between worlds of differences. Each talk set the stage for the interactive session in which students were encouraged to take active participation by asking questions and sharing their experiences and understanding of that specific diversity issue. These interactive sessions have helped students to learn the global and multicultural perspectives, develop better understanding about the influence of cultural impact on individual growth, thought-process and to respect cultural differences. It may not be a natural thing for many students of different cultural backgrounds, religious or moral upbringings, genders, disabilities, believe, or lifestyles to communicate effectively, or otherwise get along with each together. The experience from this course have helped students to learn to appreciate the perspective of alternative points of view and understand the potential negative impact of stereotyping, prejudice, racism, elitism, and ageism on individual. The contents and the structure of this course created an environment for open dialogue among diverse group of students with focused discussion on some of the unique workplace related issues that professionals face in working with a diverse population. The course offered an opportunity for in-depth understanding of the diversity and ethics in the workplace and to learn about approaches necessary to become a productive team member of a diverse group.

This educational experience provided an opportunity to develop an understanding of the need of self-evaluation of one's attitude towards like and unlike oneself and thus change the ways individual behaves toward one another. Students learned about the similarities and differences between themselves and others. At the end everybody understood that in this global environment many of them will work as a team-member of a diverse group where sometimes team-member will disagree enthusiastically – but members must remain as a group through their mutual respect, understanding, and shared responsibility of accomplishing the objectives. This learning opportunity, before they start their professional career, is very important for the students' educational growth.

In summary, a course was offered to heighten awareness of the diversity and related ethical issues in the workplace. The course provided an opportunity to learn from the experts on managing these issues as an individual, as a group, and as a leader. The knowledge gained has better prepared our students with a necessary human skill, before they join the workforce, to excel in their professional career.

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Personal Skills Development

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Abstract-- 'Potentials' is what up and coming junior staff are commonly called who are expected to enable companies to make it into the new millenium. There is a loud call for intelligent, well-trained, globally-minded and flexible experts. So far it has been taken for granted that high-quality technical training is sufficient to secure a young staff member's promotion in his/her company. So-called 'soft skills' have been increasingly added to the list of necessary and important skills. What we are talking about here are teamwork, teambuilding and project management as well as such skills as rhetoric and negotiating. In our paper we want to focus on the skills needed for (project-)teamwork and teambuilding.

Index Terms--Teamskills, Teambuilding, Group Facilitation

I. Introduction

In our paper we will focus on the topic "teamskills" in the widest sense of the word. Over the last decade the demands on young engineers have changed dramatically. The classical engineering training is a necessary but by no means a sufficient requirement for getting and being successful in a job. Companies search for team-capable, communicative, flexible, motivated young men and women. And a lot of these skills the students have never heard of or had a chance to develop at university.

The pressures of today's working world are such that working together with others in a collaborative effort has become a must, whether it means being part of a project team, leading a team or negotiating terms and contracts with competitors, business partners and colleagues.

Characteristics of high performance teams include:

- a clear purpose
- empowerment
- relationships and communication
- flexibility
- optimal performance
- recognition and appreciation
- morale (motivation)

These seven points are recognized as being crucial for high performance teams.

In a team all members are challenged to discover their resources, their professional and personal skills, and to create an environment which brings all these available resources into operation.

II. Process skills

There are two different types of skills which are necessary for successfully working in a team. Both types are important for high performance teams, and you have to find the balance between them. In any activity one may distinguish the task – what has to be worked on, and the process – how the work on the task is designed, done.

1. Task skills comprise all your engineering knowledge and know-how which you have developed during your studies
2. Process skills are normally strangers to or even non-existent in our curricula. These skills deal with how you and your team will work towards your aims.

Process skills can be subdivided as follows:

skills related to methods and procedures used:

- how to working systematically
- setting clear aims
- knowing how to facilitate
- managing time
- using creativity enhancing tools
- reviewing and
- giving feedback, etc; and

social skills (the human interaction level) such as

- active listening
- humour
- taking initiative
- sharing and combining ideas
- motivating
- being trustworthy
- etc.

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Let us now look in more detail at some of these process skills.

1. Working systematically

Especially when highly trained individuals set to work, they need to agree on a procedure how to work systematically which enables them to bring their particular task skills into play at the appropriate time in the process. We suggest using a systematic approach which addresses crucial questions which come up in a team, such as

- what has to be done?
- what are we trying to achieve?
- what is it used for?
- what is our aim?

Normally team members react to given task on different levels. Everybody has his or her own ideas of where to go. People also differ widely in the time scales they operate with. In this situation it is helpful to have a systematic approach to focus on a number of important points, both as a guide for the discussion at hand, and also as an aid not to forget something important.

One possible systematic approach to getting things done and achieving objectives includes

- making certain that the task is clear to all
- setting aims
- handling information (known – needed – ideas – risks ...)
- setting the steps necessary to reach the agreed goal
- planning in detail who what when where...
- doing
- reviewing (both the end product and the process)

2. Setting aims

Useful questions when setting aims:

Purpose: What is the job for? What purposes will the result serve?

Customer/Client: Who is the end result for? Who will utilize it?

End product: What do we want to end up at the task deadline?

Standards: What are the evaluation criteria which the end product has to meet? How will we/our customers/clients judge whether our results are satisfactory?

3. Active Listening

Listening is usually reckoned to be perfectly straightforward – if you talk to someone, naturally he or she will listen to what you say. But listening effectively, that is, really absorbing and understanding what someone means, is a skill which is difficult and complex. Think of meetings you have attended: for much of the time you are preoccupied with your own thoughts; at other moments the meeting drifts away from its objectives, and the arguments are hardly worth attending to. Now and then three people start talking at once ...!

The following questions help to really listen to the contribution of others to the end instead of rushing prematurely into answering:

- What exactly did the other person say?
- What does it mean in the context discussed?
- How does it fit in with the agreed aims, the issues at discussion right now?
- Can I support the contribution?
- What do I want to say ?

4. Review and Feedback

When the job is finished, it should be reviewed. Two sorts of questions need to be asked:

1. About the job itself: Have we achieved what we set out to do? What more has to be done? Can we improve the result?
2. About the process of working together: Can we improve it, are there other methods we could apply? What were the snags and how can we avoid them another time? What were the successful parts of our process which we can adopt and use on other occasions?

In this second part of the review stage, systematic approach becomes a basic method of learning. Experience, by itself, may teach very little: improvements come only from reviewing what happened, understanding why, and pulling out lessons that one can use for the future. If the review is carried out consciously and deliberately, the learning will come much faster. This is indeed the basic way in which we acquire skill (as opposed to knowledge): – by a cycle of thought – action – thought. Ten minutes' review at the end of a job or at the end of a day can save many hours for the future; it makes sure that we actually learn from the experience.

In any review, the emphasis should be on what to do next time, rather than merely what to avoid, and

it is at least as important to identify what went well as what went badly. Of course, failures must be traced and avoided; but time must also be deliberately spent on analyzing success, if only because a review that dwells mostly on failures does not serve to motivate us positively.

III. Summary

We have listed some of the aspects beyond the usual, classical skills needed for an engineering career in the context of today's economy. We can only encourage all engineering students most strongly to allocate sufficient time and effort to developing those "soft" skills to round off their professional education: for mutual benefit: – their own and that of their future jobs and "customers".

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Posters

VIDERO – Virtual Delivery Room

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Abstract--During the last decade, virtual reality became one of the most enthusiastic areas of computer science. The potential of its use is enormous. However, the reality is still much too complex to be simulated entirely by today's computers. Many compromises between realistic simulation and functionality have to be made when building a dynamic virtual environment. For the time being, the presentations of the virtual world consist mainly of audio-visual presentation of virtual scene and navigation by the user. In this paper, the development of an application simulating virtual delivery room is described, along with the problems and solutions of programming dynamic virtual worlds.

Keywords--VRML, dynamic virtual environment, navigation in virtual worlds, spatial sound, audio conference.

I. Introduction

Virtual reality (VR) is gaining popularity in many different areas of today's life, especially in education. It's use is particularly welcome for practical training that is dangerous or impossible to perform in usual environment. Such exercises are very common in medicine. To learn complex procedures and techniques, students of medicine must work with real patients. Because of their inexperience, such actions are of course undesired. VR systems can help bridge the gap between theory and reality. The students of neonatal medicine, for example need a virtual delivery room, in which their actions can be supervised by their mentor who has the ability of selecting different scenarios for the course of action. That way, the students can immediately see the results of their actions and are not afraid of learning from their mistakes.

In this paper our realization of such virtual delivery room is presented. Adding the dynamics to static virtual environments is outlined, along with the problems that were encountered. Methods of navigation in virtual space are explained and a system for real-time audio streaming between participants is described.

II. Programming dynamic VRML world

Virtual room and basic medical tools have been built in 3D Studio MAX and exported into VRML (*Virtual Reality Modeling Language*) [1]. For achieving more complex behavior, external programming languages such as Java or JavaScript and interfaces between them and the VRML world are needed. Script Interface allows building the new nodes with an arbitrary behavior. External Authoring Interface defines the set of functionality of the VRML browser that the external environment can access [2].

The dynamics in VRML is achieved by using TimeSensor nodes. They generate events as time passes and dictate the tempo of all animations in the VRML world. However, they aren't guaranteed to generate events with any particular frequency. To achieve the best performance, most VRML browsers generate time-related events as often as possible [1]. This results in poor respondence of the VRML worlds to the user's input. Furthermore, all TimeSensor nodes generate events with the same frequency and there is no mechanism to slow some of them down.

Because of the mentioned constrains, we were forced to develop our own TimeSensor node with exactly the same program interface and behavior as the standard TimeSensor. Our node (we call it Timer) enables setting of the maximum frequency of events in each individual instance of the Timer node.

The central part of our project is a simplified model of a new-born baby that has to encapsulate major vital functions of real baby, such as breathing, heart rate, the color of skin and the motion. For realization of all vital functions sophisticated submodels were developed allowing dynamic control and setting of all model variables over the time. Each submodel is an independent mechanism implemented as a set of the Timer and Script nodes that automatically control the state of submodel's variables.

All vital functions are introduced to observer of virtual world using audio-visual representation listed in Table 1.

Table 1: Audio-visual representation of virtual baby's vital functions

Variable	visualization
Breathing	chest movement, sound, graphical curve on the monitor
Heartbeat	sound, graphical curve on the monitor
Color	skin turns from normal to blue and back
Activity	movement of baby's extremities, crying

III. Navigation in VRML World

Basically, virtual reality is about using computers to create images of 3D scenes with which one can navigate and interact. By navigation we imply the ability to move around and explore features of a 3D scene, such as a room or a chair [3].

There are two ways of moving or exploring a virtual environment (VE). The first one is a browser built-in navigation using appropriate buttons on the navigation console and the mouse [1]. The second way of navigation is changing the avatar's position and orientation with use of a tracking device. The tracking device is collecting data from its sensors in physical world and sending it to the computer. The sensors can be attached to the user's head to transform the movement of user from the real world into a VE. Together with a head-mounted display (HMD), this VR system can help the users to immerse into a VE, so we decided to use it for navigation in our VRML scene of delivery room.

IV. Audio Communication Among Users

During a delivery, extensive verbal communication is carried out between the participants. A support for multiple users is planned to be implemented in our virtual delivery room, so the ability of direct audio connection should also be included. Therefore a system for real-time audio communication among participants has been developed.

To achieve platform independence, the system was implemented using Java and Java Media Framework (JMF) [4]. JMF was used to capture, process, store and transmit streaming data over network. The system uses classic client-server architecture. The client reads local user's spatial position, captures sound and sends it to the server, but at the same time it reads audio streams from other users, enhances them with spatial effects and presents them. The server maintains a list of all users and dispatches position data and audio streams.

Audio streams of all participants are enriched with spatial effects each individual user. Dependant on the locations of participants the audio streams are constantly monitored and updated. Two spatial effects are applied to the sound. First, the influence of distance on the signal gain is considered, then the interaural signal difference is calculated and gives the delays that stipulate the user's position in space.

V. Conclusion

In this paper a medical teaching and training tool in the form of virtual delivery room is shown (Figure 2).

Figure 2: Virtual delivery room

The VIDERO system is still under development. The problems we are currently facing are very high system resource utilization, slow response to the user's input, and the browser security restrictions for Java applets. In the future, an upgrading with teaching scenarios, a support for multiple users, advanced interaction of users with medical equipment, and a support for force-feedback and haptic devices are planned.

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Planet of Visions

Boštjan Vlaovič

Abstract— **This paper describes activities of Student Branch (SB) Maribor during the leadership of the current board. It focuses on the projects we had in the past year.**

Keywords— **Organisation, Symposium, IEEE, Extra Skills**

I. Introduction

THE title "Planet of Visions" represents a correlation between the exhibition opening the theme park of the Expo 2000 world exposition in Hanover, Germany and our vision of the young generation of IEEE engineers. All who visited EXPO 2000 were surely impressed by the François Schuiten and the scenic artists of the "Bleu Lumière" group's presentation of visions and utopias of past generations. Our generation is facing rapid changes in our daily environment. More and more people are using products of mobile and computer technology to help them in their daily tasks. Development of new materials and technics enables human kind to produce more in a shorter period of time. How are young engineers handling it? Do we get all the knowledge we need from the formal education? How to prepare for the fast changes and manage your professional life?

II. Formal Education

First contact with formal education for a child is usually primary school. In first years children learn through play. Educators try to motivate them to do their assignments in innovative and fun ways. Children learn how to live and "survive" in the environment without their parents to assist them every time they have a problem they do not know how to solve. Through problem solving they learn how to communicate with the rest of the world. We have similar situation in secondary school, but they have to face a world of decision making. If not sooner, at the end of the final year when they have to decide which study course they want to take. When students come to universities they have to accommodate to the new environment. For most students that includes getting an apartment and starting living on their own. The path of formal education for most students finishes with the graduation. When one gets his or her first job quickly notices that formal education is very important, but is far from sufficient. You have to work in a group of people you can not choose by yourself, you have to "fight" for your ideas and solutions, be able to accept compromises and plan your activities as rationally as possible. For all that you need experience on how to prepare and present your ideas, how to manage people, work in a group, and much more. Most of engineers get this kind of experience when they start working, but not all. Some manage to to get them sooner and that is surely an advantage. Active involvement with IEEE activities is one of the best methods to get experience on most if not all of the mentioned skills.

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III. IEEE Activities

During education one can choose to be an active person with numerous activities or take a "passive" way and focus only on his/her studies. As far as I have seen in my short life some people would like to be involved in more activities it is physically possible and some prefer to have a lot of free time. I believe it is a good thing to be an active person. Being active does not mean that you should forget to have fun. Not at all! Through the past year new and past board of SB Maribor practised their extra skills during the organisation of various activities. In the following sections I will try to describe most of our activities in the past year, with the aim to motivate more students to join and get actively involved within IEEE SB Maribor.

A. WWW pages

For our first major project we have chosen to update SB Maribor web pages. I am proud that we managed to do it so quickly. Pages were finished in a month. All thanks for that go to our secretary Mirko Zadravec who made the original design and first version of the pages. He is also the author of our three dimensional logo that represents IEEE SB Maribor symbol in very artistic way. It can remind the viewer of a IEEE symbol, satellite dish, but it can also be interpreted as a ship at the see. This is how I see our IEEE student branch. As every ship it needs a good crew. We know that we have a lot of good students. They have proven themself on many occasions. We wanted to present our ideas as quickly as possible and try to motivate people to get actively involved. Web is usually the first contact potentially new active members have with the SB. We wanted our web pages to look nice, work with web browsers under different operating systems, and have a lot of interesting and up to date information. Currently all reports from our meetings, pictures

from various activities and projects are on the Web and are regularly updated. From the hits on the WWW server it can be seen that pages are used daily.

Fig. 1. Winers of local SPC and best Ph. D. thesis award.

B. Local Electronic Student Registration Form

The development of the local electronic student registration form was motivated with the slow performance of the main IEEE registration form, problems that students had with different names of the courses, and a desire to have a local data base of all our student members. We have used PHP and MySQL to accomplish this task. During the development of the interactive application we have tried to copy the look and feel of the original electronic IEEE registration form as much as possible. To help students with their registration we decided to localise some information like the name of the University and study courses. At this point I would like to thank Aleksander Vreže, our secretary — yes, we have two secretaries — who helped me with the design of the database. I would also like to thank David Vrtin for all administration tasks during this project.

C. Networking The World

The true spirit of IEEE is represented by slogan "Networking the World". Our first international IEEE event was our visit of Student Branch Passau, Germany at their 10th anniversary. They have prepared Leadership Training Workshop (LTW) lead by R8 student representative Jorge Sanches Ponz, and a great party at their faculty. We had a great time! Thanks guys and girls! This was one of the best weekends in my life. It was really great to meet people with the same interests and very similar problems. I soon discovered that we were not the only board who was searching for the magic formula for motivating students. We had a couple of great discussions, especially with Regina and Jens Hanneman, Gerald Anleitner, Martin Ramsch, and Michael Schon, that gave us additional motivation and a couple of new ideas for our next projects.

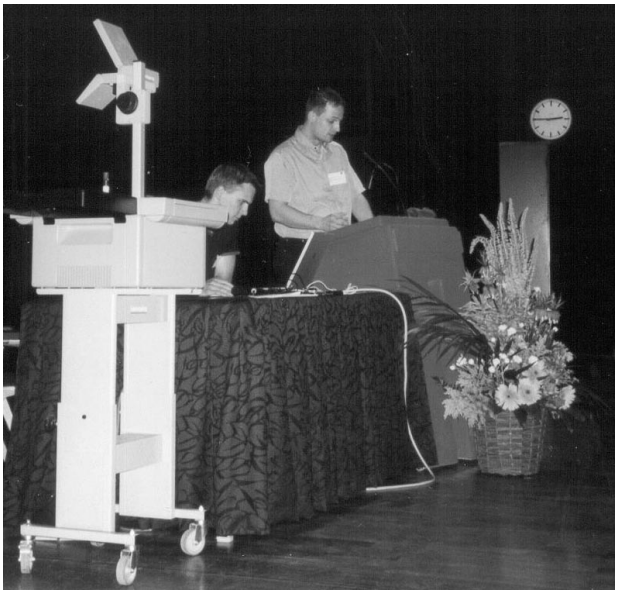

Fig. 2. Presentation of SB Maribor at SBC 2000 in Eindhoven

Next international project was Student Branch Congress 2000 in Eindhoven, Netherlands. Three SB members wanted to attend this event so we had to find financial support. I would like to thank R8, Slovenian IEEE Section, and SB Eindhoven for all their support. Special thanks go to our sponsors that made realisation of our goal possible — Mobitel d.d. and IskraTEL d.o.o. Thank you for all the support! Everything is possible! You just have to try hard and keep your eyes open on the way. We have learned a lot during that project, not to mention the fun we had during the trip and our stay in Eindhoven.

Fig. 3. Alien examination at SBC 2000 in Eindhoven

By now we already knew quite a few student members from R8. We started to feel as a part of a big family. And that is a nice feeling. A lot of participants were trying to

solve their organisational problems and difficulties they had with motivation of student members to get actively involved. Again, we have learned a lot. This is where the first idea of the symposium "Extra Skills for Young Engineers" was born. I would like to thank SB Eindhoven and all representatives of R8 and IEEE in general for their thoughts and for sharing their experience with us, the younger generation. We had a lot of honest discussions with clear objectives in mind. But do not be afraid, we did not forget how to have fun! We had a lot of fun with our hosts and student members from all over the world. Now we have good friends in Bosna and Hercegovina, Egypt, Germany, Lebanon, Macedonia, Mexico, Netherland, Russia, Serbia, and Spain to name just a few! The whole week in Netherland was a lot of fun!

Fig. 4. SB Passau student members in front of our faculty.

D. *Symposium "Extra Skills for Young Engineer"*

For our final project we have decided to organise the symposium "Extra Skills for Young Engineers". We believe this is a good way to show students what extra skills will be needed in their professional career. Very successful people from IEEE, industry, and academia will present their experiences and thoughts on the subject.

We wanted to prepare an interesting event for the students. This is why we decided to open the event with the performance of a well known Slovenian group "The Stroj" in the biggest student club in Maribor — ŠTUK. The formal part of the symposium will be held at the Faculty of EE and CS. The whole symposium will be broadcasted live on the Internet. One lecture will be held to the students at Faculty of EE in Ljubljana and ISDN video conferenced to Maribor. To make things even more interesting IP video conferencing will be used during one of the lectures and at the opening speeches. During the organisation we did not forget how much fun we had during the Egg Drop contest in Eindhoven. We decided to have a first Egg Drop Contest during the symposium. All the rules and detailed instructions are published on the Web. All credits for the great idea go to SB Eindhoven, which we will challenge next year to join us in Maribor on the similar event. Third day of the symposium will be devoted to company visits and farewell party at ŠTUK. We hope everybody will enjoy the event and students will get motivated to join IEEE and to continue our work.

IV. Conclusion

A lot of extra skill can be obtained if you decide to be an active member of IEEE Student Branch. You will learn how to work in group, how to organise meetings, how to prepare reports, how to present your ideas to the industry, how to manage people and much more. We hope students will present their candidates at the next elections in the beginning of the December 2000. New board will enjoy all our support and help with their future activities.

Acknowledgements

I would like to thank Iztok Kramberger, vice chair, Mirko Zadravec, secretary, Aleksander Vreže, secretary, Dejan Kastelic, treasurer, and all of the past board for all their help on the projects. I believe we all learned a lot. Now is time for new challenges.

Special thanks go to Prof. Marko Jagodič for all his help and numerous advice he gave me during past years and our counsellor Asoc. Prof. Zmago Brezočnik. Without his help none of the projects would be such a great success.

Boštjan Vlaovič (Student Member, IEEE) received diploma in Electrical Engineering from Faculty of Electrical Engineering and Computer Science, University of Maribor, Slovenia, in 1999. He is in his first year of a Ph.D studies at the same faculty and works as a researcher in the field of telecommunications. He is 1999/2000 Chair of IEEE Student Branch Maribor.

Increase Your Knowledge: the Monthly Publication of the IEEE Student Branch Graz

Dr. Bernhard Brandstätter and Ernesto Rico-Schmidt

Abstract—**This article describes** *increase your knowledge*, **the monthly publication of the IEEE Student Branch Graz for electrical engineering and computer science students at the Graz University of Technology.**

The articles are written by professors, teaching and research assistants, as well as students, and treat topics of interest and directly or indirectly related to lectures and practices at the University.

Single copies and one year subscriptions are available for low prices and can be ordered using the web. Subscribers also can download a PDF version of each issue.

I. Introduction

IN the summer of 1999 a new idea was born at the IEEE Student Branch Graz: to create a monthly publication for students of electrical engineering and telematics (computer science) at the Graz University of Technology.

The magazine should take up study-relevant fields of knowledge and interest an treat these in short articles.

This way *increase your knowledge* offers professors and teaching assistants the possibility to response to interesting questions of the students for a broader audience than is possible during consulting hours.

It is also possible to treat some interesting topics for students that can't be addressed during the lectures.

Finally it also gives research assistants a platform to present the results of their work, as well as students to present their diploma thesis, or some other interesting things, like smart solutions to common problems.

The major aim of *increase your knowledge* was to fill the gap between the knowledge offered at the lectures and the interests of students.

II. The First Volume

THE first volume of *increase your knowledge* started in December 1999, when the first issue was published. Single copies and one year subscriptions were available and could be ordered from the Student Branch's web page. Subscribers could also download a PDF version of the magazine.

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The interest and the number of copies sold increased steadily — as well as the number of pages. In the first volume seven issues were published between December 1999 and July 2000. The first issue of *increase your knowledge* had twelve pages, the seventh issue offered thirty pages for the same price.

A series on very interesting and actual topics like optimization and object-oriented programming were published. The basis for these articles were lectures thought at the University.

The diploma thesis and some of the further work of two students were also presented.

A lot of questions about electromagnetics and fiber optics that raised within the lectures and practices were addressed.

A very interesting article about the human brain and artificial intelligence, written by Professor Wolfgang Maass[1] was published in the April 2000 issue.

All of the electrical engineering and computer science institutes at the University and the Executive Committee of the IEEE Austrian Section as well as the ÖVE (Austrian Association of Electrotechnical Institutions) receive a complimentary copy of each issue.

III. The Second Volume

CURRENTLY the first of nine issues that are planed for the second volume, is in preparation and will be published by end October.

A new layout for *increase your knowledge* has been created and the web page is being redesigned and will be expanded to offer the seven issues of the first volume for download at no charge as PDF documents. New sponsors are being contacted and some new sections are under development

Companies will be able to present themselves and offer students a chance to get a more clear picture of the job market and contact them for possible job offerings.

Books directly or indirectly related to lectures will be reviewed by professors, other new books or publications of interest for students will also be announced.

Students will get more space to present their work, specially diploma and doctoral thesis but also solutions

[1] Prof. Mass is the head of the Institute for Theoretical Computer Science at the Graz University of Technology.

to common problems and small technical projects or activities, not necessarily related to lectures.

IV. Conclusion

SINCE the start in December 1999 the magazine has grown considerably. *increase your knowledge* is now a recognized publication within the Graz University of Technology.

Articles are being submitted by professors, teaching and research assistants as well as students. The number of pages has increased from twelve to thirty in seven issues of the first volume.

For the second volume, to be started with the October 2000 issue, nine issues are planed. This second volume will definitively establish *increase your knowledge* as an important publication for electrical engineering and computer science students at the University.

The future of the publication looks bright as the interest of the students for knowledge related to lectures keeps growing.

Acknowledgement

THE IEEE Student Branch Graz is very grateful to the Student Branch Counselor, Professor Michael Muhr, the head of the Institute for High Voltage Engineering at the Graz University of Technology and the Chairman of IEEE Austrian Section.

Thanks to the support he kindly provides it is possible for the Student Branch to keep the price of *increase your knowledge* low and the quality high.

Resources

The IEEE Student Branch Graz Web page:
http://www.cis.tu-graz.ac.at/ieee

The *increase your knowledge* Web page:
http://www.cis.tu-graz.ac.at/ieee/ik

Bernhard Brandtätter is working at the Graz University of Technology, Institute for Fundamentals and Theory of Electrical Engineering (IGTE) on optimization problems. He is Research Associate at the Institute since March 1st, 1998 and holds a PhD degree since May 29th, 1999. He is IEEE Member since 1992 and currently vice-chairman of the Student Branch Graz.

Ernesto Rico-Schmidt is currently finishing his studies at the Graz University of Technology and will receive his Masters Degree on Electrical Engineering (Process Engineering) next year. He is IEEE Student Member since 1998 and currently chairman of the Student Branch.

Pšššššššššššššššššššššššššššššššššš

Strežniki Sun so tako zanesljivi, da bi lahko pozabili nanje – če ne bi bilo šuma ventilatorjev

Zanesljivost delovanja je prvo merilo pri izbiri strežnika. Sistem, ki bo skrbel za vašo povezavo v internet, elektronsko poslovanje in baze podatkov, mora biti **zanesljiv** in **zmogljiv**. Zato ne preseneča, da so strežniki Sun najbolj razširjeni strežniki za baze podatkov in internet rešitve v podjetjih po celem svetu.

Marand ima znanje in izkušnje, da skupaj z vami sestavi **pravo rešitev** – od svetovanja pri izbiri strežnika do celovitega informacijskega sistema. Za dodatne informacije nas pokličite na **01/283-33-77** ali obiščite **www.marand.si**.

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Vse uporabljene blagovne znamke pripadajo njihovih latstnikom.

Institut ”Jožef Stefan”, Ljubljana, Slovenija

Institut »Jožef Stefan« je bil ustanovljen l. 1949 in nosi ime po slavnem slovenskem fiziku 19. stoletja Jožefu Stefanu in je vodilna slovenska raziskovalna organizacija. Obvladuje širok spekter temeljnih in uporabnih raziskovanj na različnih področjih naravoslovnih in tehničnih ved. Okoli 500 sodelavcev raziskuje na področjih fizike, kemije, biologije, elektronike in informatike, jedrske tehnologije, gospodarne uporabe energije in ekologije.

Da bi spodbudili mlade ljudi za znanstveno delo, podeljujemo vsako leto Zlati znak Jožefa Stefana za najboljše doktorske disertacije v zadnjih treh letih s področja naravoslovno-matematičnih, tehničnih, medicinskih in biotehničnih ved.

Dobršen del raziskav Instituta »Jožef Stefan« je povezan z okoljem. Multidisciplinarni projekti iz ekologije prinašajo razvoj in uporabo novih tehnologij ter omogočajo delovanje mobilne ekološke enote.

Tesno sodelovanje s Kliničnim centrom Ljubljana je pripeljalo do razvoja raznih medicinski naprav (tomografija, funkcionalni električni stimulatorji, merilna oprema,…), oskrbe z izotopi za klinične raziskave in zdravljenje bolnikov, pa tudi uvajanje novih raziskovalni tehnik in diagnostičnih metod v klinično prakso.

Institut »Jožef Stefan« in Ortopedska bolnišnica Valdoltra sta ustanovila Raziskovalni institut Valdoltra, ki je center za interdisciplinarna raziskovanja in inženirstvo ter uporabno fiziko in matematiko v medicini.

S svojimi sodobnimi napravami in izkušnjami so laboratoriji instituta sposobni izdelati zahtevne projekte. Institut vlaga velike napore v prenos rezultatov svojega raziskovanja in znanja v produktivne aplikacije in na trg.

Institut je odprt za univerzitetne in druge raziskovalne skupine, saj jim na nekaterih področjih znanstvenega in aplikativnega raziskovanja zagotavlja edinstvene možnosti v Sloveniji.

ŠTUK

1 Petek, 20.10.2000
After OBONJAN

2 Ponedeljek, 23.10.2000
Koncert RAMBO AMADEUS

3 Sreda, 25.10.2000
Študentska diskoteka

4 Sobota, 28.10.2000
HALLOWEEN DISCO PARTY

5 Torek, 31.10.2000
HALLOWEEN HOUSE
CLUBBING IN YOUR HOUSE

Center za razvoj
študija na daljavo
pri Univerzi v Mariboru

Center for Distance
Education Development - CDED
University of Maribor

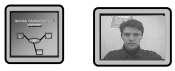
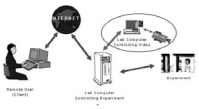
GENERAL INFORMATION

The **Center for Distance Education Development (CDED)** at the University of Maribor has been established in February 1999 upon the initiative of the three faculties working in the field of open and distance learning (ODL). Its mission is to bring together their experiences and knowledge in the field, provide competent consulting, technical support and guidelines for development of the ODL activities at the University of Maribor.

GOALS AND ACTIVITIES

- Providing technological and didactical support for development of distance education (video production, multimedia production)
- Advising and informing on newest distance education technologies, creating demo applications, spreading knowledge and awareness on distance education (through courses, seminars, internet, CD or DVD and catalogues),
- Helping members of the University and education institutions to transform their study material into a form suitable for interactive distance education (through its specialist group),
- Representing the European Program SOCRATES - Open and Distance Learning Action Research and development activities,
- Active international cooperation and participation in national and international ODL projects.

PROJECTS

	**TEMPUS PHARE Joint European Project: DETECH** Development of the Department for Technology Supported Distance Education.
	**Video supported Multimedia Education** Interactive User Interface combining indexed video, slides and subtitles in Slovene and English language.
	**Virtual Classroom** The first virtual classroom in Slovenia, combining interactive study material, information for students and communication.
	**Hypervideo** Interaction inside streaming video.
	**Real-time video supported Web control** Remote (WWW) laboratory connection with video observation

PARTNERS

Slovenia:

- ROLAN, Maribor
- Mat Design, Maribor
- MIBO Communications, Ljubljana
- SMARTCOM, Ljubljana
- Faculty of Electrical Engineering, Institute of Telecommunications, Ljubljana

Europe:

- TELAB, TU Vienna, Austria
- FORTEC, Austria
- Interface Consult, Austria
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- University in Oldenburg, Germany
- University Dundee, England
- University in Oulu, Finland
- Gyovik College, Norvege
- University of Bratislava, Slovakia

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Stvarno kazalo