Detecting on the alternation of near-infrared ray absorbed by hemoglobin
When a flashlight is covered with a hand, red light transmits between fingers. Interesting phenomenon occurs when near-infrared ray is used instead of the flashlight. (Near-infrared ray's wavelength is slightly longer than infrared radiation and is invisible. It is often used for a TV remote controller). As enzyme carrier, hemoglobin in the blood absorbs near-infrared ray, so the amount of light going through the blood decreases. As a result, a camera catches a vein image with darker color than other parts.

Hitachi focused on the finger vein. If a couple of fingers are registered, even when a person injured a finger, the system can still authenticate him. Each person registers his fingers, and a computer authenticates him by comparing the registered data and the fingers. This basic technology was developed in 2000, and it was commercialized and applied to the door-access-control for computer rooms in 2002.

Achieving world's highest accuracy, compactness (small size), and high speed
The first problem to achieve high level of accuracy, speed, and operability with a small-seized device was a person's finger width, which is different for each person. If one's finger is fat, the emitting light decreases, so the camera cannot take the clear image of a finger-vein pattern. To solve this problem, automatic control technology was developed. It detects the finger's width and sheds appropriate amount of light on the finger, depending on the width.

Second, the temperature became the issue. Blood vessels constrict with cold, and they stretch with warm. There were cases that this causes trouble at the recognition rate. Hitachi realized that the central line of vessels could solve this problem, because the central line of the vessel is at the same position, regardless vessels' condition. Therefore, "New Vessel Extraction Algorithm" was developed to read only the axis.

The third problem was how fingers are placed. People put their fingers in various ways, and Hitachi created the system that adjusts the image data to match with the registered data accurately.

After these improvements, Hitachi's Central Research Laboratory tested 539 monitored people, and achieved 0% error at a demonstration experiment, that had 0.3% errors before. This error rate is the world's highest accuracy, even including other biometric methods, such as fingerprints and iris.

Then Hitachi worked on the Speed
Hitachi developed verifying software and enable registering and verifying the data in 0.5 seconds, whereas it used to take 3 seconds before. It made possible to authenticate a person very fast. Furthermore, because a normal computer can register about 10,000 people's data, this authentication system can be utilized in a large size facility, such as office, factory, and school. Downsizing is also achieved. The new system functions with a very small microcomputer chip, and this minimized the dedicated device.

Open System
Hitachi innovated in operability also. Finger Vein Authentication System requires putting a finger into the system, to read the vein patters by transmitting light from finger cushion. The movement of putting a finger into the system can be simplified and this can reduce the psychological burden. Hitachi simplified the system by incoporating technology to shed light from the side. How can the pattern be read from the bottom although light comes from the side? The light from the side is transmitting in the finger reflects diffusely, and it leaks to the bottom also. The amount of aperture differs on the both sides of the finger. Shedding light from each side and combining those images captured, it creates a clear image. Those improvements led an open system, which only requires people to just hold up a finger above the devise.

Door-access-control for houses and cars
The most important characteristic of Finger Vein Authentication System is its high-leveled security. It is very difficult to be counterfeited. Also, it can authenticate a person very easily by holding up a finger above the devise. This keeps hygienic safety.

The system can be also downsized more, and it can be utilized for access-control for houses and cars, and will be applied for computers and mobile phones. Finally, it has been recently integrated in some ATM across Japan. Last November, Hitachi developed Finger Vein Authentication System using the solar light, and it will produce more convenient system in the future.

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european CONNEXTION

THE NEWSLETTER FOR MEMBERS OF THE EU HITACHI SCIENCE & TECHNOLOGY FORUM

ISSUE 22 DECEMBER 2005

Editorial

"Make sure you will attend the Athens Forum",
I was told on several occasions when I took my new job and it was a very wise advice. In Athens Forum members, guest speakers, business guests and officials put together a dynamic and friendly image of today's EU.

The 2006 Forum will be held on May 19, 20 and 21 in Warsaw. This venue has been selected as a token of welcome for all new Member states which recently joined the EU bringing with them new enthusiasm, new opportunities for growth, additional traditions and culture.

In 2006 the Forum will focus on IT, their contributions to security and personal safety and the overall impact on European society. Hitachi will proudly present some of its latest technological developments in the field of security in an exhibition to be set up next to the main conference rooms. We also would like more business clients, partners and people in Warsaw to join the Forum.

I wish to thank the Forum members who volunteered to participate in the 2006 working group; their support is essential, we all appreciate their contributions.

It gives me great pleasure to wish you a Merry Christmas and Happy New Year and I look forward to seeing you all again in Warsaw.

Ko Takahashi
General Manager
Hitachi Corporate Office, Europe

9th EU Hitachi
Science and Technology Forum
"e-Safety and its impact on European citizens"

Warsaw, Intercontinental Hotel
May 19-21, 2006

Notes from a very civilised Forum

The topic of the Hitachi Science and Technology Forum for 2005 was "Technology and its impact on the city of the future", and so it would be difficult to propose a more appropriate meeting place than Athens for such an esteemed gathering. Athens, my guidebook tells me, has a vast historical heritage and is considered by many to be the birthplace of western civilisation. Plaka, the site where Athens was founded, has apparently been populated by human settlements for over 5000 years, and the historical attractions of Athens include the Acropolis, the Agora, the Temple of Zeus, Hadrian's Arch and the Dionysos Theatre - the world's oldest theatre. Fascinating stuff indeed. On a slightly more modern note, who would have predicted three years ago that Greece would win football's European championships? Probably not even the Greeks…

After checking in to the hotel and taking advantage of the minibar the first thing I always do is to look at the timetable and list of speakers for the various sessions, and once again this year I was amazed. The topic of this year's forum was well chosen, and the speakers are without exception leaders in their fields. Whatever your area of expertise, as we progress into the future more and more of us will live in large cities, so what problems will our descendants face in these giant metropolises? Urban sustainability and regeneration are clearly critical, as Dr. Alessandrini and Prof. Asami so clearly illustrated, but equally the mobility of future denizens is crucial to their quality of life. Can we perhaps move towards a community where most of us work from home or are educated on-line? And although this will reduce the congestion on our roads it might also reduce our degree of social interaction, so do we really want to? Ask Prof. Hazel – his discourse on mobility was excellent and caused much discussion during the lunch break. Yet another aspect of modern times is citizen security and safety, a topic of particular concern after the recent blasts on the London Underground. General Konstantinidis is a security expert, responsible for the security of the Olympic games, so who better to talk about the subject? Hitachi's contribution to the future of our cities is also multifaceted – and it is reassuring to know that at least one of the world's largest companies is looking to the future. The presentation given by Mr. Ohnuma gave us all a taste of what may be to come, and I am looking forwards to having a front door that I can unlock with my retina.

Moderated by the enthusiastic Dr. Konidaris, the various topics were discussed clearly and incisively, and the conclusions are clear – we must all strive to make our future cities places

where our children can safely live, work and spend money (especially on their parents). The parallel working sessions were filled with lively debate, and everyone was seen to be having fun at the dance-like-a-Greek contest on Saturday night. There was only one note of melancholy and that was the announcement that this Forum would be the last to be run by our friend Koide-san, as he returns to his family in Japan. We all wish him well. Finally, it might be worth noting in passing that during the Forum weekend I bought a genuine Greek beer in a genuine Greek bar whilst watching the FA cup final on satellite TV – the price was 10 Euros, which is about four pounds in English money. In an attempt to negotiate a discount I sparred good-naturedly with the bartender for five minutes and was eventually charged 10 Euros, which is about four pounds in English money. Maybe you can't always get what you wish for, but the important thing is that it shouldn't stop you trying…

Chris Farren
2006 Forum Working Group Member
Development Chemist
Rhodia Pharma Solutions

As a member of the EU Hitachi Forum, I recently attended the Athens meeting and was once again very impressed by the forward looking nature of the organisation. To my knowledge, no other company or organisation is gathering people to examine the effect of technologies on all levels of society. The Hitachi Forum is making a genuine contribution because it is pioneering new technologies in a way that places human benefits first.

I had the opportunity to join the Forum for the first time in the year 2000 and have attended for five consecutive years. At these meetings, I have met fellows from very diverse backgrounds and origins. Speaking with them, I have discovered the wide range of Hitachi competencies that I had not fully noticed before. Every year the topics raised have been of interest and value. This year we tackled the impact of technologies on the cities of the future. Once again, the Forum has opened our minds, exposed us to new technologies with which we were not necessarily familiar, and given us a better idea of their potential impact on our society and environment, which we often underestimate or do not initially consider.

From my experience of the last five seminars, I find the Hitachi Forum's approach in pioneering new technologies very remarkable. Indeed, Hitachi does not create the technology for the technology alone but considers first its foreseen impact on society and the human being. The Forum actually seems to be a piece of the global corporate Hitachi philosophy (explained on the first page of Hitachi's website) of "guiding new technologies to be in constant harmony with our society." Hitachi, like some other Japanese companies, appears to be less concerned by the short term revenues the company could generate with new technologies than the real contribution the technologies could bring to society. This approach is mature and worthy of one of the biggest Japanese corporations. Its reward may be to help create the better society that we all desire; the reward for Hitachi will likely be to gain a greater durability for itself. The fact that Hitachi Forum members are from different backgrounds and origins help to bring this thinking forward because the mix of cultures truly generates creative and realistic contributions.

In addition, there is another and even more universal strength to the Forum. I believe that it contributes to tightening the link between Japan and Europe. We belong to two complimentary civilizations that, although distant, like and respect one another. Both of us have an ancient history and a strong culture. We have, therefore, a natural interest and solid basis for better knowing each other, in order to join forces, while at the same time respecting our differences and keeping our identities intact. There already exists a strong economic connection between Europe and the United States and the United States and Japan. We could now close this triangle by strengthening the economic and friendly relations between Japan and Europe. The Hitachi Forum is one piece which makes a practical contribution to this objective.

At a time when "sustainability" is on every tongue, where people are beginning to question the long-term effects of world-wide globalization, and where the place of culture is being recognised once again as an important factor, the Hitachi Forum is perfectly targeted. As Forum members, we should make sure that we all support the Forum and bring the right contributions to it in order to help the Forum achieve its philosophical goals and reach its potential year after year.

Fabrice Serey
2006 Forum Working Group Member
Freelance IT Consultant

2006 Forum Working Group Meeting

The 9th EU Hitachi forum of Science and Technology is going to take place in Warsaw, Poland on May 19th, 20th and 21st 2006. In order to prepare this event, the working group members met in Brussels on 14th and 15th October 2005. The main outputs expected from this meeting were the theme definition and an agenda for the next forum.

The Brussels meeting was led by Mr Jean Freymond, Director of Centre for Applied Studies in International Negotiations (CASIN), in his quality of Forum 2006 Moderator. As other attendees we were pleased to have MM Masahiro Abe and Toshihito Fujita (Hitachi Tokyo); MM Koyo Katsura, Kazumasa Takagi and Stéphane Amarger (Hitachi Europe); Dr. Michiharu Nakamura, MM Dolf Gielen, Pierre Longin, Didier Gambier and Antoine Ripoll (Forum Fellows); MM Ko Takahashi, Stéphane Dupuis and Mrs Yukako Kinoshita (Hitachi Corporate Office, Europe) and MM Nikola Knezovic, Hans Craen, Eldo Mabiala and Fabrice Serey (Working Group Members).

Before coming in Brussels, the Working Group Members and the Hitachi Corporate Office exchanged some information, making outline for the 2006 forum, it came out that it would deal with the topic of "Information Technologies". The meeting was opened by two Hitachi presentations. Dr. Amarger showed the vision of Hitachi Sophia Antipolis Laboratory on IP technologies and Society ("A Zoom on Mobile Communications") and Mr Fujita presented some current and coming Hitachi's IT technologies.

Then the Working Group Members made some proposals on possible sub themes about IT and Human beings as well as on the next forum format. As the part taken by IT in our daily life becomes greater, it's obvious that the possible themes for discussion are quite as various. The fact remains that some points were frequently evoked like impact of IT in citizens' expectations, privacy issues due to IT enhancements, the digital divide, and problems supposed to be solved with Information Technologies. During the discussions, inputs from MM Gambier and Ripoll, both being active actors in European Institutions, have been particularly precious. Indeed, the other point that has sustained the debates was the forum format; specially the how the forum should be (re) designed in order to provide the institutions working with the European Union with outputs at best useful. It is not likely that the 2006 Forum will present a revolutionary image, but several new ideas have been given for the future events.

Finally an agenda has been drafted and all attendees invited to propose some names for the future speakers.

MM Fujita and Takahashi pinpointed a crucial point: "How could we improve the EU Hitachi Forum?" Here, the quality of discussions, as well as parallel sessions one has been discussed. It was clear that the forum participants themselves should guide the improvement of the forum. That's why we are looking forward to meet you in Warsaw in few months, to attend the 9th EU Hitachi Forum of Science and Technology that, in despite of its topic ("Information Technologies"), will not be organized by videoconference.

Eldo Mabiala
2006 Forum Working Group Member
IT Systems Engineer
Credit Suisse Financial Services

Blood Vessel Patterns become the "Key"

"Finger Vein Authentication System" easily confirms one's identity

Ideally, a completely safe society, which does not require any keys or locks, is the best for everyone. However, it is absolutely necessary to have a security system in our society to protect lives, properties, and important information. But keys or cards could be lost and misused and, if passwords are made very complicated to eliminate the risk, it becomes inconvenient to use. This led Hitachi to develop a new technology, and put into practical use. Hitachi focused on veins that stretch in a finely meshed pattern under skin. One's vein is genetically determined and unique to the individual.

LED (Light Emitting Diodes)

Fingerprints Authentication System is well known, and it takes an important role even in criminal investigations. Biometrics Authentication also employs voiceprints, facial features, and iris of eyes. However, those physical characteristics can be heard or seen by others, so they can be easily imitated or forged. Vein patterns are other characteristics among individuals. Hitachi came up with an idea to make vein patterns to achieve a high-level security system. Hitachi had developed the basic technology for "Light Topography," which studies blood streams in the body. By using this technology, Hitachi's Advanced Research Laboratory has achieved concrete results in diagnosing brain and visceral disease, and in studying the growth process of baby's brain. Hitachi thought this technology could also be applied for the biometric individual authentication.