No. 5/05 - October 2005

international newsletter on
micro-nano integration

mst news

VDI/VDE-IT | NEXUS Association / NEXUSPLUS | EUROPRACTICE
EURIMUS | Patent-DfMM | mst germany | MINAEAST-NET

AMBIENT ASSISTED LIVING

www.mstnews.de

Contents

VDI|VDE|IT

Look ahead to the next issues:

mstnews 6/05 on „Technology Programmes and Initiatives" in December 2005
Presentation of the efforts to promote and accelerate MST, in particular micro-nano-integration, in Europe on national level and international level.

Deadline for press releases, short news, event announcements and advertisement orders: Nov. 10, 2005

Date of distribution: Dec. 01, 2005

mstnews 1/06 on „Integrated Microsystems for Biomedicine" in February 2006
Report on new applications for nano- and microsystem technologies and new exemplary system solutions in the application field of medical equipment that works close to living organisms.

Deadline for abstracts: October 15, 2005

Date of distribution: February 07, 2006

Dear Readers,

If you have already leafed through this new issue of mstnews you may have got the impression that you're holding the wrong magazine in your hands: A lot of social topics instead of reports about new achievements in micro- and nanotechnologies… Indeed, this issue is a little bit different from the usual kind of mstnews.
The phenomenon of an ageing population in Europe is a huge challenge, not only for social politics but also for the high-tech industry and for service providers. You may know from your own experience that up to now product design, fashion, services market etc. are usually focused on and designed for young, active, communicative, flexible, sporty and highly capable people. It seems that the rapidly increasing share of people at the age of 65++ is simply ignored, and therefore it is high time to call to mind that this part of the European population will account for 50% of the population of working age in 40-50 years already (see article on pages 10-12).
Why should this situation affect the development of micro- and nanotechnologies and related products of all technologies? The very general reason for that is the essential role played by micro-nano integration in the development of comprehensive smart systems, including communication, information processing, automation (incl. robotics) and bio- and medical functions. This issue of mstnews is dealing in detail with the challenges of an "ageing society" and pointing out first technical approaches and solutions for creating a comfortable environment for the daily life of elderly and/or disabled people. Some of the solutions are admittedly not so "high-tech" yet and lack real micro technology, but at least they show development trends in an exemplary way. We hope that they will give you some ideas of what micro- and nanotechnologies can be used for in future.
I'd also like to remind you of the coming mstnews issue on "Integrated Microsystems for Biomedicine" to be published in February 2006 (the deadline for abstracts is October 15, 2005). That issue is intended to provide a deeper insight into the medical application fields of MST that are surely relevant to "ambient assisted living" too.

Bernhard Wybranski
Chief editor of mstnews

Embedded graphical object "SKeeper": See article on pages 42 -44; Source: Tadiran Spectralink Ltd., Kiryat Shmona, Israel Embedded graphical objects Pills and "iPAQ" from Compaq: See article on page 12 – 14; Source: Fraunhofer IMS, Duisburg, Germany

Main Topics of mstnews until 6/05

Issue	*Main Topics*	*Deadline for abstracts*
Dec. 05	Technology Programmes and Initiatives	passed
Feb. 06	Integrated Microsystems for Biomedicine	Oct. 15, 2005
Apr. 06	Improving Industrial Maturity of MST	Dec. 15, 2005
Jun. 06	Fun and Recreation with MST	Feb. 15, 2006
Aug. 06	Micro-Nano-Integration	Apr. 15, 2006
Oct. 06	Sustainable Developments with MST	Jun. 15, 2006
Dec. 06	Remote Training and Engineering in MST	Aug. 15, 2006

Publisher:
VDI/VDE - Innovation + Technik GmbH (VDI/VDE-IT)
Rheinstraße 10 B, 14513 Teltow, Germany

mstnews is published 6 times a year in February, April, June, August, October and December.

mstnews comprises newsletter pages from several European Networks (Nexus, Europractice, Eurimus, Patent-DfMM) and the German Microsystems Frame Programme.

Managing Editor / mstnews Office:
Bernhard Wybranski, VDI/VDE-IT
Rheinstraße 10 B, 14513 Teltow, Germany
Phone: +49 3328 435-167
Fax: +49 3328 435-105
E-mail: mstnews@vdivde-it.de

Editors:
Alfons Botthof
Patric Salomon
Dr. Matthias Werner
Wiebke Ehret
(German MST Programme News)
Dr. Hartmut Strese
(Ambient Assited Living)

Assistant Editors:
Annette Wittmann

Cover design:
Isabelle Brämer

Setting:
klahr.de

Advertising:
We welcome sponsors and advertisers.
Please visit www.mstnews.de to download our media data and advertising rates.

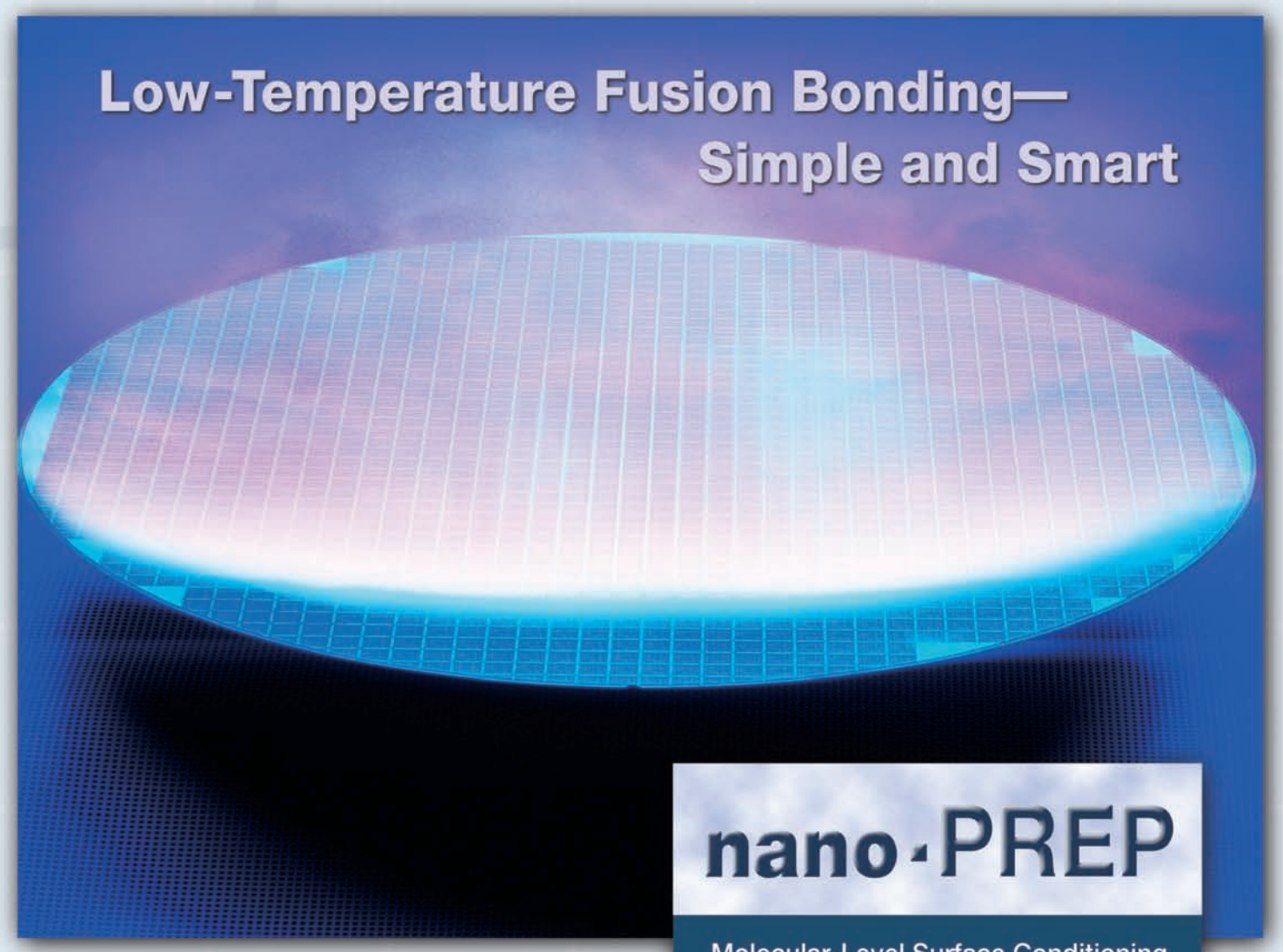
Subscriptions:
Subscriptions are free of charge to qualified readers in Europe.
Readers from outside Europe and commercial resellers may order a subscription at an annual rate of 120.- Euro.
Please make use of our on-line subscription service at www.mstnews.de

Submission of Articles:
Your submissions are appreciated. The main topics of the future issues are listed on the left, but other interesting articles that do not fit into this scheme are also welcome. Please send your abstract to the mstnews office. Guidelines for authors are available on www.mstnews.de

Announcements, New Products, Books, Studies, Company Information:
mstnews publishes selected announcements, product and company news free of charge. Please send your news (100 to 200 words preferred) to mstnews@vdivde-it.de.

Opinions expressed by the authors are not necessarily those of mstnews.

The Future is here...



There are smarter ways to enable low-temperature bonding without the complexity of high-vacuum plasma treatments . . . SUSS' nanoPREP enabling technology is available NOW.

In technical terms, SUSS' nanoPREP is a revolutionary approach to low-temperature fusion bonding—the capability of a high-vacuum plasma technology process without the complexity.

In financial terms, nanoPREP simply cuts the cost of doing business. No other technology comes close to the *speed and simplicity* behind nanoPREP.

For more information: info@suss.com • Visit our website at www.suss.com

SÜSS MicroTec

Ambient Assisted Living Initiative for the Ageing Population: Rationale, Opportunities, Challenges and Impact: the MST Case

Thomas J. Sommer

In the years and decades to come, European societies will be faced with serious demographic changes. The population in the developed countries of the world is getting older. An ageing society generally needs more health care with specific needs. The cost of health care systems is continuously rising, with serious implications for the social system of our societies. In order to address the legitimate needs of the ageing population and to slow down, in the ideal case to achieve even a significant reduction of expenditures for the care of elderly persons, it is planned to implement during the 7th EU Framework Programme for R&D a new European initiative, called Ambient Assisted Living for the Ageing Population (AAL). The objective is to enable elderly persons to stay in their home as long as possible, enabling them to live independently with more autonomy and, hence, enjoy a better quality of life than is possible in an old people's home or a nursing home.

Rationale

The ageing of societies is a phenomenon in all developed countries. In Germany for example, the average age that men can expect to reach is about 76 years and that of women around 81 years. The percentage of the population older than 65 years will probably double by 2050 as compared to 2005. Already today, approximately 20% of the European population is considered either aged (above 65 years old) or having disabilities.

This implies the need for more health care for older persons and this, in turn, has the consequence of ever-rising costs for the social security system. From this point of view, the goal is to limit or stop the increase in health care expenditure, which on average represents 8.5% of the European GDP with an upward trend. If no measures are taken, the increase in the health care related share in GDP is expected to more than double in a number of countries in the decades to come.

In terms of the global economy, it is necessary to find a solution that can limit or even reduce costs in relation to care for elderly persons, while at the same time maintaining and even increasing their quality of life.

The role of ICT and MNT

Can Information and Communication Technology (ICT) help to face the challenges? What would be the appropriate approach? Can smart sensors and Micro-Nanotechnology (MNT) in general provide efficient solutions? – Those are the questions to be asked. The high-tech community strongly believes that MNT technology is the key driver and enabler in such an endeavour, without which the objective to enable elderly persons to stay in their home environment as long as possible while being autonomous and independent would not be possible.

In general, in order to detect any kind of anomalies, e.g. the fall of a person, strong deviations from standards in the monitoring of health parameters, detection of upcoming fire, smoke, dangerous gas concentration, water leakage, refrigerator becoming empty, any kind of intrusion etc., sensors are absolutely vital and crucial. But sensing alone is not enough. What is needed are subsequent data processing, evaluation, and wireless communication.

Pre-processing of data and their 1st order evaluation at the premises of older persons could be an interesting option in order not to overload the medical personnel with irrelevant data. Only if an evaluation yields in revealing a sort of danger, a signal should be automatically generated to alert the doctor or the paramedical personnel, or the police or fire brigade, respectively.

Today elderly persons, often living alone and especially when suffering from one or more of diseases that are more widespread in that population, are asked to move to homes for elderly people, or homes with more or less regular medical care, etc. This is on the one hand connected with high cost, which is only to a small extent covered by the elderly persons themselves. Therefore, a major part of the costs has to be provided by the health care system, which is part of the social security system.

One should remember that the European R&D for elderly & disabled persons is not new. The importance of the subject was recognized a long time ago and a long series of EC-funded R&D projects addressing among other things independent living, home systems through assistive technologies and design for all solutions, with approximately 200 M€ funding over 15 years, has been successfully implemented. However, a take-up by industry on a large scale was not visible enough and has not had yet the expected impact. One reason might have been fragmentation, lack of critical mass, but also the lack of vision of the relevant industry. Another reason was probably the missing political signal of favourable conditions for an implementation on a large scale. This is why a R&D scheme alone, whether at national or at European level, would not be sufficient.

A concerted effort of politics, (providing the right overall conditions) of an appropriate European funding scenario, fostering the coordination of national efforts in the Member States (MS), and mobilising the industry is needed to achieve a real breakthrough.

That's why it is widely understood that the Ambient Assisted Living initiative would be best suited to be implemented in adopting the so-called Article 169 of the Treaty. The basic idea here is the coordination of the RTD programmes of at least some MS

in a specific research area. The EC would support such an initiative of the MS with a complementary financial contribution. MS and EC will provide an efficient public framework through the use of Article 169, which in turn will leverage private investments.

Although the use of Article 169 for the implementation of the AAL initiative is important, AAL contains much more than RTD. Product innovation, deployment, mechanisms for achieving critical mass, development of open standards, regulatory aspects, reimbursement schemes, flexibility to consider national particularities of the respective socio-economic system etc. are important complementary aspects.

In order to achieve a critical mass of resources, we are talking about a sum which will end up with several hundreds of million €,composed of contributions by MS, the EC and topped up by industry. The latter contribution is expected to be composed to a considerable part of applied research in the form of collaborative projects, out of which around 80-90% should be close to applications.

Possible technological approach

The vision is to work on ideas which at a glance might possibly look futuristic;– at the time of their implementation theywill set the pace of further improvements and contribute to and speed up the state of the art.

After fast implementing of "standalone" type of home appliances, a next step could be the networking of different sensor types, where in the context of a given situation other sensor types – receiving the relevant information – would react accordingly (context-aware services). The DG Information Society and Media of the EC is already funding an Integrated Project 'MIMOSA', dealing with such context-aware services. This could, as an example, have a RFID reader included in a mobile phone and, pointing the latter to other smart objects, additional information could be read out or, even, other actions triggered. The vision is to put sensors in as many objects as possible, to network them, i.e. enabling their wireless communication and actions, even to the outside world. All this will happen in the background, quasi 'invisible' for the elderly person. This is a user-centred approach offering high comfort and care without unnecessarily bothering the elderly person and, at the same time, offering a maximum of care, safety and security.

Another visionary example could be to spread sensors in large area networks, e.g. painting them on walls, placing them in intelligent carpets or floors. Such intelligent floors would be in the position to detect a deviating pattern of walking with the possibility of calling for help. In less critical situations together with wearables, e.g. a necklace with sensors, unobtrusive monitoring of vital physiological parameters, communication among the smart objects would be based on the physiological state and mood of the person modulating e.g. the light and/or music etc.
Sensors could play an important role

also in an appropriate monitoring of the quality of food.

Challenges, opportunities and impact
In order to be successful on the potentially growing market, several socio-economic factors have to be taken into account like user friendliness, acceptance by the targeted population, modularity, cost, i.e. affordability for both, the end-user and the social security system, reliability, and quick help in case of need. And, also the most appropriate marketing approach must not be forgotten. It is important that AAL products go for "mainstream" solution, i.e. they should be sold e.g. in supermarkets instead of purchasing them via the medical doctors.

Bearing in mind that in 2050 probably more than 100 million people in the EU will be older than 65, it is a real opportunity for a breakthrough and a widespread use of MNT technology especially in the home environment; therefore the potential impact is huge. It will benefit both the MNT industry and the system industry, providing smart products and complete solutions. And because of that, it is a great business opportunity for the European MNT industry. Such a major action may serve as a paradigm for a number of similar problems of our societies.

Conclusion
It is strongly believed that the solutions offered by AAL for the ageing population will extend the time people can live independently in their home environment. It will increase their autonomy, assist them in carrying out everyday activities, provide access to social, medical and emergency systems and enhance their safety and security. In this important endeavour MST technology with its potential in the systems integration of nano and bio components is the key driver and enabler of future AAL products and services. MST technology is in fact indispensable for the vast majority of future AAL based solutions.

The AAL initiative is also an important example of how innovation – also in the context of the EC flagship initiative "i2010:European Information Society 2010" http://europa.eu.int/i2010 adopted on June 1, 2005 (addressing among others also problems of the ageing population) - can contribute to solving burning problems of society and at the same time help create new jobs and economic growth.

Disclaimer
The views expressed in this paper are those of the author and do not necessarily reflect the official European Commission's view on the subject.

Contact:
Thomas J. Sommer
European Commission, Directorate-General Information Society and Media,
1049 Brussels, Belgium
Phone: +32 2 2964871
Fax: +32 2 2998249
E-Mail: Thomas.Sommer@cec.eu.int

Ambient Assisted Living – Preparing an Article 169 Measure

Michael Huch and Hartmut Strese

Addressing the Europe-wide phenomenon of an ageing population – with statistical figures and implications outlined in other articles of this "mstnews" issue – a European consortium is currently preparing a new European technology funding programme "bridging" national technology programmes and markets in the field of information technologies as enabling technologies, targeted to support the development of new products and solutions in an area called Ambient Assisted Living (AAL).

Ambient Assisted Living aims at **prolonging the time people can live in a decent way in their own home** by increasing their autonomy and self-confidence, the discharge of monotonous everyday activities, monitoring, and caring for, elderly or ill persons, enhancing security and saving resources.

www.aal169.org

Started in September 2004, a consortium that consists of national research ministries, programme managing agencies and research organisations explores the details of a new common technology funding programme made possible by the EC-funded project Ambient Assisted Living.

The ultimate objective of this project is the preparation of an article 169 instrument "Ambient Assisted Living" (AAL169), to be implemented within the forthcoming 7th European Framework Programme for Research and Technological Development (FP7) that is expected to start in early 2007.

Article 169 of the European Treaty provides a strong case for the European Commission to foster transnational cooperation in research funding. In short, on the basis of this article, the European Commission may contribute substantially to this new funding programme in terms of budget and political support. Currently, there is only one measure of this type being undertaken, the European & Developing Countries Clinical Trials Partnership (EDTCP), but several are being prepared for FP7.

Article 169 also specifies the pre-condition for the EC to get involved, i.e. the bottom-up initiative is to be taken by a group of European member states. Thus, the current group has elaborated a detailed analysis of the specific situation regarding the concept of Ambient Assisted Living in all 7 participating countries. Although all European countries share the situation of ever-increasing pressure on

social security and health care systems, it is of utmost importance to reflect the specific national situation, as there are differences on the national level, differences concerning demographic trends, societal structures and cultures. In addition, resources and competencies in R&D that are scattered throughout Europe within the AAL area are to be pooled for the benefit of the end user.

This rationale to overcome national boundaries in this area and to jointly set up a new funding programme has convinced a number of other European member states to join this initiative. Once up and running, AAL169 intends to regularly launch calls for proposals concerning certain, pre-specified topics.

The growing percentage of elderly people requires totally new solutions for their care and supply with goods. Facing already today´s existing shortcomings in an adequate number of skilled nursing, it is urgently necessary to develop technical devices for a solution to those problems. To consider needs and specific requirements, users (and their associations) have to be integrated into the innovation process and product development right from the beginning, i.e., in the conceptual phase. The decline of sensoric, physical and mental capabilities has to be taken into account – these changes are independent of any change of needs and requirements due to the cultural rejuvenation of elderly people.

Thus **major problems of elderly** people have to be tackled. Possible themes could be

- Creation of a smart, context-aware and barrier-free intelligent home
- Monitoring of risk patients at home
- Preventive health care and disease management
- Development of tools to cope with dementia
- Communication solutions for elderly people
- Development of textiles and wearables with built-in ambient intelligence
- Solutions to support and maintain the wellness and an active life of elderly people

Relevant sectors for AAL solutions, applications and products are:

- Health care and medical devices,
- Geronto-technologies,
- Wellness,
- Services,
- Smart home,
- Smart textiles,
- Robotics and
- Consumer electronics.

All **technological fields** and options that help solve AAL challenges and meet user demand are relevant for AAL. Nevertheless, fields of higher priority can be identified. These are particularly:

- Micro- and nanoelectronics (nanocoatings, polymer actuators)
- Embedded Systems (e.g. as in smart textiles)
- Micro System Technology, including biomicrotechnology (biochips, sensors to measure values like blood pressure, temperature, weight, respiration, urine output and to observe activity patterns, nutrition, gait, sleep)

- New Materials (e. g. polymer technologies)
- Energy generation and control technologies (energy harvesting)
- Human Machine Interfaces (display technologies, natural language communication)
- Communication (body area network)
- Software, web & network technologies (tele-services)

The AAL innovation model comprises this graphically (see Fig. 1).

The aim is to deliver new products and services based on innovative technical solutions for the emerging AAL market. Some initial results are described in this issue, as e.g. a new blind man's stick or monitoring solutions for elderly people.

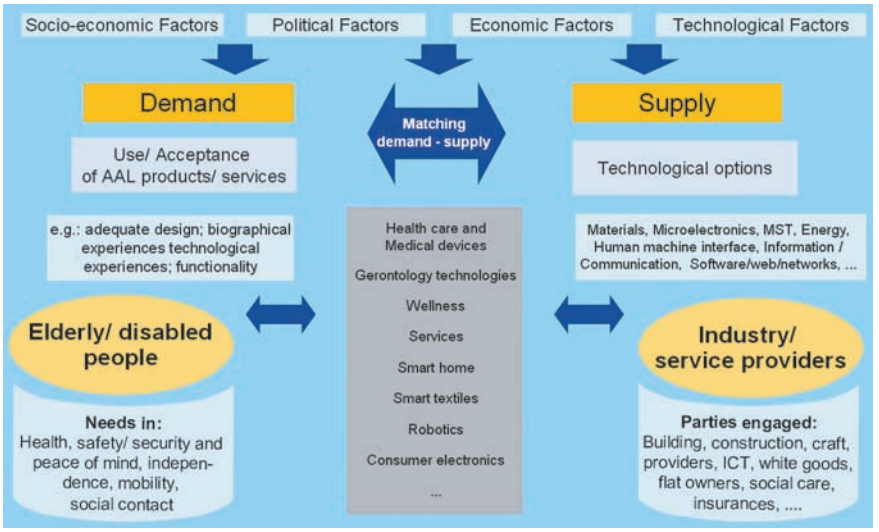


Figure 1: AAL169 – Innovation model

Contact:
Michael Huch, VDI/VDE-IT, Germany
E-Mail: huch@vdivde-it.de

Demographic Change in Europe and Industrialised Countries Requires AAL Innovations

Horst Steg, Jerome Hull and Sophie Schmidt

Europe and industrialised countries worldwide are confronted with a demographic change. Improving the quality of life of elderly people through AAL innovations is becoming an ever more essential task for today's European societies. The following article describes some major trends and consequences. In this context, microsystems – integrated in innovative products and combined with new services - will play a key role.

Major trends of demographic change
At the turn of the 19th century, life expectancy for males and females in Europe was 45.7 and 49.6 years, respectively; by the year 2000, this has increased to 75 and 79.9 years. However, the rising life expectancy is accompanied by a growing concern about the low fertility rate in Europe. Although fertility increased slightly from 1.45 children per woman in 1999 to 1.47 in 2001, it is still below the replacement level of 2.1. The consequence of both developments is a EU population that is becoming increasingly older (European Commission 2002; Oeppen, Vaupel 2002; Wedell 2003).

A clear shift has been witnessed from 1960 up to now regarding the proportion of older people (65 years and over) – and is expected to continue (European Commission 2003b; Office for Official Publications of the European Communities 2004). As figure 1 shows, in 2020 the fraction of older people in Europe (EU 15) will almost double compared to 1960. The proportion of older people will be about 21% of the total population while in 1960 it was about 11%. Furthermore there will be a significant increase in the number of very old people (80 years and over). Here the fraction will more than double compared to 1960.

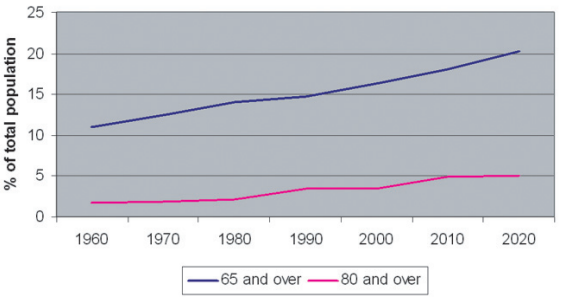


Figure 1: Ageing population, EU 15, 1960-2020 (European Commission 2003b)

Looking at long-term projections (up to the year 2050), the process of ageing is set to increase within industrialised countries at an even faster pace. In 2050 life expectancy will be 79.7 and 85.1 years for men and women, respectively. The share of the total European population older than 65 is set to increase to 22% by 2025 and 27.5% by 2050. The share of the population aged over 80 years is expected to reach 6% by 2025 and 10% by 2050 (European Commission 2003; Eurostat 2005).This challenge of ageing societies does not only exist in Europe, but is becoming a worldwide concern affecting other industrialised countries as well. That is illustrated by figure 2.

Irrespective of a demographic change in all industrialised countries, clear differences can be observed when comparing the rising shift of Japan with that of the EU 15 or the United States. In Japan, the population aged 65 and over has already reached a proportion of 20% - and is expected to be almost 28% by 2020. The EU 15 – as has been shown above - will be

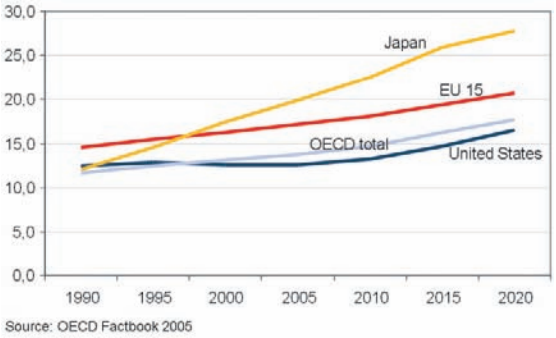


Figure 2: Population aged 65 and over in OECD countries; ratio of total population in % (OECD 2005)

clearly below that level but still higher than the average of OECD countries. Among European countries especially Italy, Germany, Finland, Sweden or the Czech Republic will have a share of elderly population above the OECD average rate. In contrast to that, the United States will face a more gradual shift (13% in 2005 – 16,5% in 2020, respectively) (OECD Factbook 2005).

Consequences

The steady increase of older age groups in national populations, both in absolute numbers and in relation to the working-age population, will have enormous economic and social implications in a number of areas.

As for labour markets and pension systems, we have to consider that demographic ageing means that the number of older people is growing while the share of those of working age (15-64 years) is decreasing: In 2002, the EU 15 population aged 65 and older corresponded to about 25 % of what is considered to be the working-age population. In contrast, in 2050 the EU 15 population aged 65 and over will correspond to 50% of the working-age population (under the assumption that there will be no regulatory reforms). This will result in an increasing pressure on our social security systems (Economic Policy Committee, 2001).

This will be even more so as not only the income side of social security systems will be affected by demographic change but expenditures as well. Health care systems for instance, will be concerned as population ageing will lead to an increase in the proportion of the population with disabilities or chronic illnesses. Thus, health care systems and social care in general will be faced with increasing costs (European Commission, 2005). This increasing and relative high proportion of impaired population in the future is illustrated in figure 3. It shows the population of the EU 15 in 2030 by age, sex and disability status. The red (dark) area covers the population that is severely or moderately impaired. The scenario assumes a two years gain in total life expectancy per decade and constant age-specific proportions of impaired people over time. In this context, microsystems – integrated in innovative products and combined with new services - will become increasingly important. They offer new or better functions with regard to needs and requirements of elderly people. Furthermore, they can keep up a high quality of life and im-

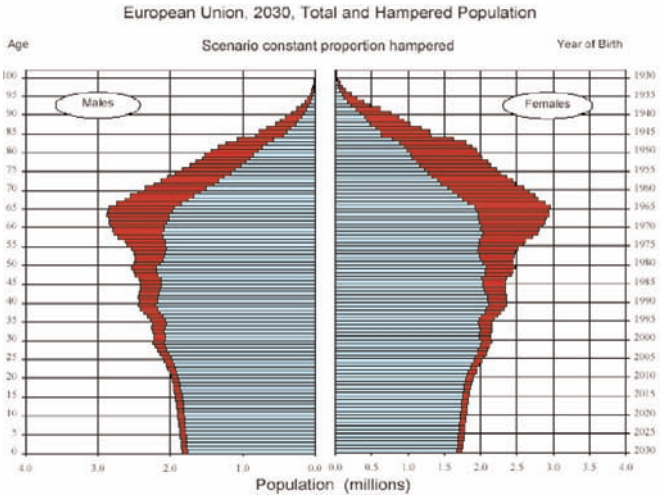


Figure 3: Projection of impaired population to 2030 (Office for Official Publications of the European Communities 2001, 50)

prove the efficiency of care. But to in order to make use of these chances we have to consider that a changing age structure in our societies might also result in a shift of consumers' behaviour. When it comes to design and develop new devices, products and services for elderly people, their specific requirements have to be taken into account, to ensure accessibility, acceptance and usability. For example, as for ICT usage by elderly people, we have particular user requirements due to their restricted ability to hear, to see or to control ICT equipment or a limited willingness to permanently get used to new products. Therefore, in the face of future demographic change it is necessary that the specific needs of elderly people as end users are adequately taken into account in the innovation process of "Ambient Assisted Living".

References:

[1] Economic Policy Committee (2001), Budgetary challenges posed by ageing populations: Executive Summary; Brussels.
[2] European Commission (2002), The social situation in the European Union 2003, Brussels.
[3] European Commission (2003), Proposal by the Commission for a Joint Commission-Council report on health care and care for the elderly, Brussels.
[4] European Commission (2003b), Living conditions in Europe, Statistical booklet, 2003 edition.
[5] European Commission (2005), The social situation in the European Union 2004, Brussels.
[6] Eurostat (2005) europa.eu.int/comm/eurostat.
[7] Oeppen, J; Vaupel J.W. (2002) Demography. "Broken limits to life expectancy". Science 296 (5570): p.1029-31.
[8] OECD (2005) Factbook 2005; www.oecd.org.
[9] Office for Official Publications of the European Communities (2001), The social dimension on health 2001, section 2, Brussels.
[10] Office for Official Publications of the European Communities (2004), Living conditions in Europe. Statistical pocketbook. Data 1998-2002. Luxembourg.
[11] Weddell, L. (2003) "Examining the elderly population, Strategies for the optometrist", www.optometry.co.uk.

Contact:
Dr. Horst Steg
VDI/VDE-IT
Teltow, Germany
E-Mail: steg@vdivde-it.de

Ambient Intelligence in Smart Homes: From Component Design to Service Design

V. Grinewitschus, G. vom Bögel and K. Scherer

Introduction

During their work at the inHaus-Innovation Center engineers have noticed that different trends in society change requirements concerning technical equipment and infrastructure in private homes [Grinewitschus 04]. These trends are:

- Ageing of society
- Requirement for lifelong, computer-aided learning
- Increase in telework
- Increase in health care costs
- Increase in energy costs

As a consequence, information technology in private homes is becoming more and more important and will form the basis for new applications and services. Various research teams throughout the world are working in the smart home field today. They are developing technology systems for new services and applications. The focus is increasingly changing from the "development of components" to the "development of services". The situation is not characterized by a lack of basic technologies, but by a lack of complete system solutions that are easy to handle and easy to instal.

Regarding applications, in the past the focus of system solutions in smart homes has often been on setting up an environment that was highly adapted to the user, thus increasing comfort and safety in luxury homes. Examples for applications are situations based on controlling lighting and blinds, single-room temperature control to reduce energy consumption and opening the door by fingerprint. These kinds of solutions consist of components with a high input of local intelligence, often using microsystem technologies to reduce costs, power consumption and even the size of components. At the inHaus-Innovation Center many new systems have been set up and tested [vBoegel 02]. Furthermore people

Figure 1: Smart labels attached to drug packages

have been supported who installed these solutions in real homes. Since no common standards for configuration, communication, diagnosis and user interfaces are available on the system level, the set-up of these solutions requires a lot of engineering power. This is affordable for owners of luxury homes, but not for the mass market.

In the last few years there has been an accelerated growth of connected multimedia applications in private homes. Today one can find more homes equipped with an Ethernet than with a home automation network. More than ten years ago the setting up of an Ethernet network was reserved to experts only. Today this is supported by plug&play mechanisms, diagnosis tools, etc. so that people with no technical background are able to set up a home network. This effect is an excellent example showing how a technology enters the mass market if it was designed on the system level, supported by functions enabling the customer to set up and modify the system on his/her own. How can the smart home technology benefit from this?

The growing demand for system and service solutions for health care, assisted living or reducing energy consumption makes possible a high potential for products based on microsystem technology. Different components with a high information processing capability are available. Now it is necessary to combine them to form complete solutions and collect experience on how to improve the characteristics of components and system configurations so that they will be more easy to use.

Figure 2: Process chain in medicine management

Service Example:
Medicine Management

The topic "smart fridge" as a new component of the internet has been in public discussion for some time. This discussion is focused only on a small subset of possible functions and does not emphasize the vast benefits of this technology. Stock containing goods marked with smart labels can be registered and maintained automatically.

For health care and assisted living, it is important to localize and recognize persons and devices. RFID technology, which is a result of microsystem technology, could be used as basis for this application. In order to control people's intake of medicine according to their prescription an intelligent medicine cabinet was developed and demonstrated within the inHaus-Center in Duisburg. Each medicine package was equipped with an RFID label (Figure 1). Using an RFID reader in the medicine box one can see if somebody took a package from the box and when it was put back. Fraunhofer-IMS has filed a patent for a procedure that can recognize if the content of a package has changed. To improve this function of the medicine box it has to be combined with recognizing persons or detecting the medicine at other locations in the home. It is thus necessary to reach a high level of integration between RFID tags, readers and user interfaces. If a service provider has access to this local information a complete value chain for medical supply and therapy control can be realized (Figure 2).

The data are collected in a local data base. With suitable web-based user interfaces, services can now be implemented and offered to the user (Figure 3). This can be ordering (even automated supplementary ordering) of medical prescriptions, notification of the delivery of goods, and reminding messages. To complete this service, delivery and disposal are included in addition to the internet-based services. For flexibility and increase in security, a special home delivery box (here HomeBox) is planned. The

Figure 3: Example of a user interface: reminder for an expiry date

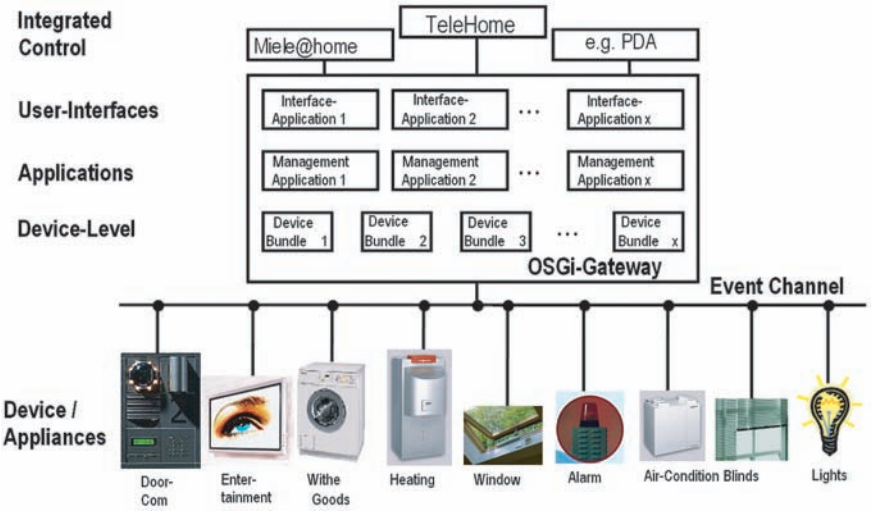


Figure 4: IT infrastructure in smart homes

HomeBox is intended for delivery and temporary storage. The HomeBox is an access-secured pick-up box with various units for food, drugs and other goods. The supplier receives an access code for a unique delivery and places the goods into the HomeBox. The stock receipt is acknowledged and notified to the user.

System Design

The combination of smart home technology and services is an important reason for customers to instal infrastructures and smart devices in their homes. Today, while developing smart components less attention is normally devoted to easy integration into complete applications. This is not only a question of standardized communication protocols. Our approach is a co-development of smart devices and proxies that can be integrated and manage the basic communication between the device and other services (Figure 4). This approach offers the chance for easy integration of different user interfaces [Ressel 04]. Our system will be installed in a pilot project in Germany, called "Smarter Wohnen NRW". During this project more than 200 dwellings will be equipped with infrastructures, intelligent devices and new services for the customer. This approach is being developed further under a EU project called AMIGO (www.amigo-project.org).

References

[1] vBoegel 02
Dr. Gerd vom Boegel, OPERATION OF APPLIANCES CONTROLLED BY SMART LABELS, IEEE International Symposium on Consumer Electronics 2002, September 2002 Erfurt / Germany

[2] Ressel 04
Christian Ressel, Integrated Operation of Intelligent Environments, Convention Documentation of ehome 2004, Berlin, 9/2004

[3] Grinewitschus 04
Dr. Viktor Grinewitschus, Das vernetzte Haus – Anwendungslösungen durch Systemintegration, Convention Documentation of ehome 2004, Berlin, 9/2004

Contact:
Dr. Gerd vom Boegel
FhG-IMS
Duisburg, Germany
Phone: +49 203 3783 228
Fax.: +49 203 3783 277
E-Mail:
Gerd.vom.Boegel@IMS.Fraunhofer.de

Technologies for Smart Toilets

Georg Edelmayer, Paul Panek, Peter Mayer and Wolfgang L. Zagler

In the framework of the EU-funded Friendly Rest Room (FRR) project (QLRT-2001-00458) several prototypes of adaptable toilet facilities have been developed and evaluated. By applying integrated sensor technologies, these prototypes of smart and user-friendly toilets are capable of adjusting automatically to the individual needs of the user; in particular, attention has been given to the needs of old people, of persons with a disability and of accompanying carers.

Introduction

Toileting is a sensitive topic not often talked about. However, Assisted Living research activities are also being done in this area. In order to outline the high needs of users a questionnaire was developed and used in the framework of the Friendly Rest Room (FRR) project. The results show that 36.1% out of more than 323 old and disabled persons who answered the questionnaire [6] in several European countries face moderate (23.4%) or severe limitations (12.7%) in their quality of life due to missing adequate toilet facilities, forcing them to stay at home instead of participating in societal life. To overcome this, the FRR project aimed at developing a new type of intelligent toilet for semi public environments (airports, theatres, museums, care institutions) usable by "all citizens" and also supporting the carers of old and disabled users [3].

Methods

The needs and wishes of users were

assessed and interpreted in direct interaction between users, researchers, technicians and designers, and thus operatively influenced the development process [7]. One of the final prototypes located in a laboratory environment (see Fig. 1) is described below.

Figure 1: FRR prototype in Vienna lab.

The toilet hardware (based on a product of [1]) is installed in a 'booth' which is wide enough to provide space for a wheelchair and a care person and was defined following the needs of laboratory testing with elderly and disabled persons. The prototype is connected to electricity but not to water. Testing simulations are done with the clothes on. During the tests a technician was available for supervision of the system.

System Control

The prototype system was controlled via a standard PC running Windows-XP, using a self-developed software (C++) for measuring, steering and logging tasks. PCI bus I/O cards (binary input, ADC, digital counter, relays output) connected the several sensors, the remote control and the motors with the system PC.

The basic functionality of the toilet is the adjustability of height and tilt of the toilet bowl, seat and support bars. The height of the seat can be adjusted between 44.5 cm and 77.5 cm at a speed of 1.1cm/sec. The tilt angle of the seat ranges from 9° (forward) to -1.5° (backwards) and changes with a speed of 1.3°/sec. Direct steering of the toilet by users is possible by a simple 6-button remote control and alternatively with a touch screen user interface, which also provides capabilities to control the more enhanced features of the system (speech recognition, audible feedback, lighting control, user preference settings, etc.)

Voice Control provides additional means for steering the toilet hardware and environment. For carers who are using both hands for assisting the primary users the voice control offers a "third hand". Using a simple desktop-type microphone and an off-the-shelf speaker-independent speech recognition engine with an adapted grammar for the specific task of steering the toilet 90% of the commands (pre-defined word-triplets) were recognized correctly for different speakers in a noisy environment.

Sensors

In the prototypes the following sensors were used for data gathering about the system and the user.

- **Position sensors:** For measuring the seat height and tilt, wire-actuated optical transducers were used. The actual seat height was directly derived from the digital sensor reading, tilt was calculated indirectly by the measuring software from the linear signal of the sensor for the tilt displacement.
- **Force sensors:** Deliver the distribution of forces due to a person's activities like sitting down, shifting on seat for better comfort or standing up. High-precision load cells were integrated into the frame of the toilet, mounted along the axis of the motors for picking up the vertical load (total weight) and the load on the tilting mechanism (centre of gravity) when the user moves forward and backward. Additional cheap strain gauge sensors were used to pick up signals on the frame of the toilet (related to tension in vertical and tilting direction) for comparison with the load cell readings. These different force sensors can also be used to provide information about the user's position and intention (e.g. to stand up) so that the system can

react to this (e.g. by moving the toilet seat into a higher position together with increasing the tilt).

- **Safety sensor:** Provides means for recognising falls. A prototype of an optic sensory system was tested. When a person falls, the output signal of this system is used to first request a response from the user and trigger alarm calls in case of a classified fall emergency. In this way the safety of fragile persons can be improved and undetected critical situations can be avoided. Obviously this approach is complementary to fall prevention [2].
- **RFID system:** To recall user preferences (e.g. preferred height, tilt etc) RFID smart card technology was used. A long-range reader module working at 125kHz with a single antenna was used to detect ISO card transponders worn by the users of the system. When the user enters the toilet room he/she is detected by the system (without the need to manipulate the smart card or any other device) and his/her preferred settings can be recalled. In this way the toilet prototype can presents itself in very different ways to different people.

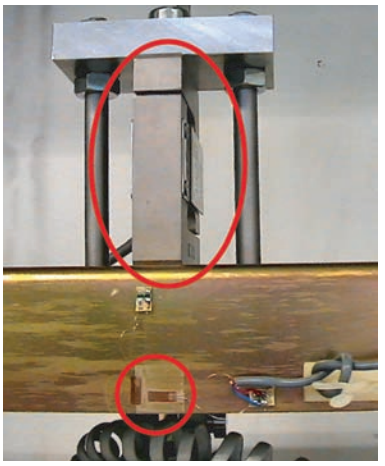


Figure 2: Load cell (upper red circle) and strain gauge sensors (lower red circle) mounted on upper part of toilet frame.

Test with users

The user tests of the system presented above have been carried out in a laboratory setting. Additionally a real life test with a selected number of smart toilet components was carried out in a day care centre for multiple

Continuation on page 35

EVENTS

Oct 10 – 12, 2005
Mikrosystemtechnik-Kongress
(in German)
www.mikrosystemtechnik-kongress.de
Freiburg - Germany

Oct 18 – 20, 2005
BioTechnica Int'l Fair
www.biotechnica.de
Hannover – Germany

Oct 19, 2005
NSTI Nano Impact Summit 2005
www.nsti.org/NanoImpact2005
Washington DC - USA

Oct 19 - 20, 2005
1st Austrian Nanotechnology Cooperation Event
www.ogms.at/nano05/default_e.htm
Vienna - Austria

Oct 20, 2005
Seminar: Sensor Applications of Micro-Systems Technology
www.sira.co.uk/downloads/skillsSAMSTOct0506.pdf
Sira, Chislehurst, Kent - UK

Oct 26 – 28, 2005
SEMI Europe Standards Autumn Conference and Meetings
http://wps2a.semi.org/wps/portal
Leuven - Belgium

Oct 31 – Nov. 03, 2005
IEEE Sensors 2005
http://ewh.ieee.org/tc/sensors/sensors2005/index.html
Irvine, CA - USA

Nov 1 - 3, 2005
NanoCommerce and SEMI Nano-Forum 2005
http://nanocommerceforum.com
Chicago, IL - USA
(for information on the previous NanoCommerce event see mstnews 5/04, page 19)

November 03 - 04 , 2005
1st Int'l Wafer-Level Packaging Congress
www.smta.org/iwlpc
San Jose, CA - USA

Nov 07 – 08, 2005
Course: Hand on MEMS
www.fsrm.ch
Besançon – France

Nov 08 – 10, 2005
NanoSolutions 2005 - The Engine for Industrial Growth
www.nanosolutions-cologne.com/client/en
Cologne – Germany

Nov 10 – 11, 2005
Course: Reliability and Test of Microsystems
www.fsrm.ch
Vienna - Austria

Nov 15, 2005
Test and Quality Control System for the Industrial Manufacturing of Wafer-bonded Microsystems
review of the German R&D project "MIKROPRUEF" at Productronica Fair 2005, Hall 05 (in English)
www.mstnews.de/events/mikropruef
Munich - Germany

Nov 15-17, 2005,
Nanotech-Montreux 2005
The 9th Annual European Conference on Micro & Nanoscale Technologies for the Biosciences
www.nanotech-montreux.com
Montreux - CH

Nov 15 - 18 , 2005
Productronica 2005 with MicroNanoWorld, see p. 46-47
www.global-electronics.net/id/35332
Munich - Germany

Nov 16 – 19, 2005
ComPaMED / MEDICA 2005
www.compamed.de
Düsseldorf - Germany

Dec 01 – 02, 2005
Course: Microfluidics for Labs on Chip
www.fsrm.ch
Mainz - Germany

Dec 5 - 7, 2005
Optomechanic Technologies, ISOT 2005
http://spie.org/Conferences/Calls/05/jom
Sapporo - Japan

Dec 11- 14, 2005
SPIE Int'l Symposion on
Microelectronics, MEMS, and Nanotechnology
http://spie.org/conferences/calls/05/au
Brisbane – Australia

mstnews publishes selected announcements and calls. Please send your announcement to mstnews@vdivde-it.de.

Dec 12 – 13, 2005
Course: Characterization and Modification of Micro- and Nano-structures
www.fsrm.ch
Lausanne – Switzerland

Dec 12 – 14, 2005
Micro and Nanotechnology 2005 (MNT 05) Int'l Conference
Incorporating the 2nd Int'l Conf. on Nanomaterials and -manufacturing
www.iom3.org/events/mnt2005.htm
London - UK

Jan 22 – 26,2006
MEMS 2006 – Int'l congress sponsored by IEEE and the Robotics and Automation Society
www.mems2006.org
Istanbul - Turkey

Call for Papers

April 24-28, 2006,
Microtechnology @ Hannover Fair 2006 - The int'l market place for applied Microsystems
Open call: IVAM organises the "Product Market Microtechnology"
www.ivam.de
Hannover - Germany

April 25 – 27, 2006
10th Int'l Forum on Advanced Microsystems for Automotive Applications (AMAA)
Abstracts due date: Oct 15, 2005
www.amaa.de/call.htm
Berlin - Germany

May 7-11, 2006
NSTI NanoTech Conference and Trade Show
Abstracts due date: Nov. 18, 2005
www.nsti.org/Nanotech2006
Boston, MA - USA

May 28 – June 01, 2006
euspen 6th Int'l Conference and 8th Annual General Meeting
Abstracts due date: Oct 21, 2005
www.euspen.org
Baden (near Vienna) – Austria

June 14 – 16, 2006
ACTUATOR 2006 - 10th Int'l Conference on New Actuators and the 4th Int'l Exhibition on Smart Actuators and Drive Systems
Abstracts due date: Nov 30, 2005
www.actuator.de
Bremen - Germany

Report from COMS, Baden-Baden, 21-25 Aug 2005

The 10th International Commercialization of Micro and Nano Systems Conference and Exhibition, COMS 2005, was held this year in the beautiful city of Baden-Baden in Germany. The COMS brought together key people from across the world and from many sectors of industry, government and education. The participants discussed major trends and issues in the industry like: paths to commercialisation, business and entrepreneurship, market analysis and challenges of MNT manufacturing.
Roger Carline presented the UK MNT network, a joint venture between regional and national government to invest in MNT and provide a contact point between UK MNT players. Although in the UK there is some hesitation about government funding, the MST/MEMS community there is very satisfied with the way the UK MNT network is organised, to catalyse technology-based innovation.
In general a trend is seen where government MNT support is shifting to the regions, being able to give better support to smaller enterprises and start-ups then can be done at national or European level.
After several difficult years, MST foundries are doing better than ever; all market segments flourish, but especially consumer products, like microphones, are showing high growth rates.
One of the highlights of the conference was the presentation of the results of the third Nexus Market study of Microsystems covering the years 2005 – 2009 by Henning Wicht from WTC, which will be available by the end of September.
Several institutes presented their strategies to commercialise MNT, either by promoting take-up by industry (IMEC) or fostering start-ups (MIC, MESA+). Ongoing developments in equipment performance were presented, dealing with wafer bonding (Suss, EVG and AML), DRIE (Adixen, STS) and nanoimprinting.
Successful entrepreneurs like Ronny van't Oever (Micronit), Richard Caro (Tangiblefuture) and Daniel Hyman (XCOM) discussed good and bad practices in commercialisation.
Over 40 exhibitors from across the globe, representing MICRO and NANO technology industry, were presenting their activities.
The conference was organised by Forschungszentrum Karlsruhe and the Micro and Nanotechnology Commercialization and Education Foundation (MANCEF). It was announced that next year's conference will be held in St. Petersburg, Florida, 27-31 Aug 2006.

Henne van Heeren
Patric Salomon
www.enablingMNT.com

Service robotics, a new market for miniaturized drives

ACTUATOR Meets KI and RoboCup in Bremen in June 2006

Bremen is announced to be in the focus of the international robot community in June next year. ACTUATOR, the International Conference on New Actuators, is going to celebrate its 10th event in this series of biennial events in a joint event together with KI 2006, the 29th Annual German Conference on Artificial Intelligence, and RoboCup 2006, the 10th RoboCup World Championship. All three events will give their special input to an accompanying exhibition "Service Robotics," demonstrating state-of-the-art products and outlining future trends in this emerging market sector.

RoboCup is more than "just" a soccer world championship for robots. This international initiative was set up in 1995 to intensify and promote scientific and technical progress in the fields of "Robotics" and "Artificial Intelligence" leading to autonomous mobile robots. In gaining the chance of free motion in a real physical world, these robots have to analyze their environment independently, to self-orientate, to identify barriers, to evaluate alternative strategies to achieve their aims and, last but not least, to communicate with other agents of their team and, of course, with human beings within their environment. Thus, the RoboCup competitions offer a standardized test area in different leagues, which demonstrates and compares the performance abilities of the current agents. The visionary aim of the RoboCup initiative is to build a team consisting of completely autonomous humanoid robots that have a realistic chance of winning against the human world champion soccer team by the year 2050.

Mobile robots like these are foreseen to serve their human counterparts as service robots not only in the business world, but in particular at their home in the near future. Experts believe that the use of personal robots will spread just as personal computers have already done. The first robots aimed at mowing the lawn, cleaning the floor or the building in your absence autonomously, are commercially available. Products dedicated to additional fields of applications are at the developing stage. For 2007, a huge crowd of 8 million home robots is predicted.

This year's competitions, RoboCup 2005 in Osaka, Japan, turned out to be a significant attraction for visitors: more than 100,000 spectators brimmed over with enthusiasm for the robots and the great job of the 2,500 participants involved. Whatever happens, the development of autonomous domestic robots remains one of the most exciting topics of research, and highly miniaturized actuators are – among others – key elements of this new generation of robots. Therefore, ACTUATOR 2006, KI2006 and RoboCup 2006 join in Bremen to present "Service Robotics" as a showcase into the future of robotics. Companies, research institutions and other institutions involved in these topics are kindly invited to contribute.

Further information
Dr. Hubert Borgmann
Messe Bremen, Germany
E-Mail: borgmann@messe-bremen.de
www.actuator.de
www.robocup2006.org
www.ki2006.fb3.uni-bremen.de

IME to Develop Fully-integrated Lab on Chip with EV Group Equipment

EV Group, a leading manufacturer of MEMS, nano and semiconductor wafer-processing equipment, announces Lab-on-a-Chip (LoC) research highlights achieved at their Singapore customer Institute of Microelectronics (IME). IME is currently setting its sights on developing a fully integrated LoC, also known as Micro Total Analysis System (µTAS), which will perform the three functions of DNA/ RNA analysis - extraction, amplification (or multiplication) and detection in one chip. This is expected to be ready for commercial production in two to three years' time. Throughout the past years, EV Group has supplied to IME several wafer processing tools like the EVG620 Mask Aligner and EVG501 Bonder for 150 mm wafer processing. The new EVG Mask Aligner and EVG520 Production Bonder for bonding silicon MEMS wafers to glass wafers are part of IME's new fully operational 200 mm silicon MEMS wafer process line, which was completed last year. The new 200 mm wafer process line increases the yield of the large DNA chips by 3 times, compared to the previous production process. MEMS are increasingly being applied in the biomedical field as miniaturization makes its impact, in minimally invasive surgery, in-vivo monitoring, in-vitro testing and smart implants. MEMS technology and microfluidics serve as the functional basis for many of these devices and research tools.
EV Group is a global supplier of wafer bonders, aligners, photoresist coaters, cleaners and inspection systems for semiconductor, MEMS and emerging nanotechnology markets. It holds the dominant share of the market for wafer bonding equipment (especially SOI bonding) and is a leader in lithography. Headquartered in Schärding, Austria, EV Group operates via a global customer support network. For more information, please visit www.EVGroup.com

RoseStreet Labs Announces 3D & MEMs Packaging R&D Laboratory and Alliance with SUSS MicroTec

RoseStreet Labs announced the opening of their 3D Research and Development laboratory for next generation semiconductor packaging. RoseStreet Labs and its subsidiary, FlipChip International, develop new materials and processes for packaging utilized in leading wireless products. RSL also announced an alliance with SUSS MicroTec. SUSS MicroTec's full suite of lithography and 3D packaging equipment was selected for RoseStreet's laboratory. RoseSteet Labs is headquartered in Phoenix, AZ with capabilities in polymer development, metal deposition, lithography, 3D packaging, System-in-Package, MEMs packaging and interconnect development. RoseStreet Labs R&D offers contract R&D services in addition to its internal R&D work in support of FlipChip International's globally recognized flip chip and wafer level packaging product lines. Dr. Joan K. Vrtis, CTO of RoseStreet Labs, said "We are very pleased to have such a strong technical alliance with SUSS MicroTec. The opportunity to expand RoseStreet Labs R&D capabilities in photolithography, MEMs & 3D structures strengthens our position to aggressively execute to RoseStreet's technology roadmap.
RoseStreet Labs, LLC, is a supplier of products and services for wireless infrastructure and sensors in the life science, renewable energy and homeland security markets. RoseStreet Labs actively provides interconnect and assembly R&D for next generation products and is the parent to FlipChip International, LLC., the global leader in flip chip bumping, wafer-level packaging, semiconductor dicing, tape & reel, and known-good-die sales. RoseStreet Labs and FlipChip International are located in Phoenix, Arizona. For more information, please contact:
www.rosestreetlabs.com
www.flipchip.com
www.suss.com

Alphasem AG opens its new premises in China

Three years after the founding of a subsidiary in Shenzhen in 2002, Alphasem Co, Ltd. relocated to larger premises in Suzhou. The grand opening took place on the 15th of September 2005. The Swiss based company, which has developed into one of the leading suppliers of die attach systems and die sort systems in the backend sector of semiconductor production, generates approximately 75 percent of its turnover in Asia. With the new subsidiary in Suzhou, Alphasem should be able to serve this market faster and more efficiently and be able to gain a larger market share. The new subsidiary offers tremendous advantages because of its closeness to customers, especially in Shanghai and the surrounding area, in working together and in implementing technically exacting solutions. Viewed like this, it is only consequent that what was once a mere production facility in China is now a full production and development center. The Easyline series of machines will be produced in the new facility in Suzhou as before. These machines are mainly used for the production of ICs and Power Devices. The research and development facilities for this machine type will be fully developed and in future, equipment innovations will also come from China. The first Easyline machines and an assembly-line for power devices have already been manufactured at the new facilities. There are more than 20 assembly areas for the production of the Easyline series of machines. The Easyline series of machines can be used in a broad-spectrum of applications. In the new facilities, which have a production area of almost 1 500 square meters, the necessary capacity for development, training, application and testing of the machine.
Alphasem has produced equipment for the semiconductor industry since 1979 and can look back on a successful business history. The company employs more than 300 staff worldwide and has generated a turnover of around 75 Million US Dollar. Since 1999, Alphasem belongs to the American Dover-Group. For more information please have a look to www.alphasem.com

Dear Readers,

many more Short news and press releases belonging to this mstnews issue you will find for the next 2 months at

www.mstnews.de/Homepage/shortnews.html

10th anniversary of the Innovation Relay Centre Network

The Innovation Relay Centre Network (IRC) celebrated its 10th anniversary from 27th to 29th June. The Network was established in 1995 in order to facilitate the transfer of innovative technologies to and from European companies or research departments. As a mover and shaker in innovation, the IRC network has become a leading European network for the promotion of technology partnerships and transfer mainly between small and medium-sized companies (SMEs).

Today the network consists of more than 250 technology transfer institutions in 33 European countries. Under the European Commission's new framework programme the IRC Network has also gone beyond its boarders and included a centre in Turkey and in Chile. The IRCs are innovation support service providers mainly hosted by public organisations such as university technology centres, chambers of commerce, regional development agencies or national innovation agencies. Each centre is staffed by personnel who have extensive knowledge of the technological and economic profile of the companies and regions they serve.

During the 9th Annual Meeting of the IRC Network, celebrating its 10th anniversary, the Commission's Vice-President Günter Verheugen, who is in charge of enterprise and industry policy, paid tribute to the results of the network: "Innovation is the key to opening the door to a brighter economic future. If we want to overcome Europe's current stagnation and raise its capacity for growth, we have to reduce the gap between the EU and the US in innovation performance. The IRC network is enabling SMEs to play a crucial part in reaching this goal."

During their 10 years of successful operation the IRCs have facilitated more than 1,000 transnational transfers of technology - signed agreements for the sale, licensing, distribution or joint development of new technologies. For more information about the network, go to: www.ircnet.lu.

Technology offers and requests from the Network of Innovation Relay Centres

- **Manufacture of semiconductor devices and substrateless thin-film field On 27th to 29th of June effect devices**

  An Italian university has developed a method for fabricating substrateless thin-film field effect devices and an organic thin film transistor obtainable by that method. A possible field of application is the development of chemical sensors. Another possible field of application is the production of pressure sensors and/or deformation sensors. The research group is looking for a license agreement.

- **Predictive Fault Sensor (PFS) for electrical motors**

  A Turkish SME has developed a predictive fault sensor for electrical motors, which provides continuous and automatic monitoring of electrical and mechanical fault conditions.
  The system warns the operator as a fault develops, preventing downtime and facilitating maintenance schedules. Licenses will be given to electrical macro component manufacturers to embed the technology in their products.

- **Microelectronic components and devices manufacturing facilities for fabless companies**

  A French company with 20 years experience in microelectronics proposes a complete manufacturing service for specific devices realisation. The offer includes Individual Steps (etching, depositions, photolithography, etc.), Technological Blocks (combination of steps) or Full Components. The company is looking for technical and commercial partnership within fabless companies involved in the development of microelectronic devices and offers manufacturing support from small to medium quantities.

Info at:
Miriam Kreibich, VDI/VDE-IT
Teltow, Germany
kreibich@vdivde-it.de

European Technology Platforms: fostering public-private partnership for research&development to boost Europe's industrial competitiveness

At the initiative of the European Commission and the industry "Technology Platforms" have been set up since Spring, which "bring together companies, research institutions, the financial world and the regulatory authorities at the European level to define a common research agenda that should mobilise a critical mass of - national and European - public and private resources."

First results of the initiative have now been summarised in a report on the first three steps within the preparatory work: the emergence and setting up, the definition of a strategic research agenda and their implementation.

The Commission has identified six areas were a Joint Technology Initiative could be of particular relevance:

- Hydrogen and Fuel Cells
- Aeronautics and Air Transport
- Innovative Medicine
- Nanoelectronics Technologies 2020
- Embedded Computing Systems
- Global Monitoring for Environment and Security

There are currently 25 platforms at various stages of development.
It is the aim of the Technology Platforms and therefore of the European Commission that the Joint Technology Initiatives become the flagship projects for a competitive Europe.

www.cordis.lu/technology-platforms

Advance notice

One-on-one cooperation forum on Microsystems

On 8th March 2006 the Innovation Relay Centre in Bavaria will organise a cooperation meeting on Microsystems Technologies in Munich. Registrations will begin on Oct 01, 2005. Please refer to www.bayern-innovativ.de for any further information.

Ambient Intelligence for Food Quality and Safety, Florence, Italy, 15-16 Nov 2005

The GoodFood Integrated Project (FP6-IST-1-508744-IP) aims at developing an innovative tool based on MST/MNT and IST technologies for full safety and quality assurance along the complete food chain in the agrofood industry. GoodFood, in collaboration with the University of Florence and the European Commission, announces the celebration of a 2-day open event on 15-16 November, 2005, in Florence (Italy), devoted to the application of wireless sensor networks and micro&nano technologies to the Agrofood field. The event will feature specific talks for fruit and wine sectors including the GoodFood vineyard pilot site Demo.

Contact:
Prof. G. Manes
University of Florence, Italy
E-Mail: presidente@csiaf.unifi.it
www.goodfood-project.com

FP6 Integrated Project "wearIT@work – A New Working Paradigm by Wearable Computing"

Currently wearable computing is still a technology of niches and at a laboratory stage. wearIT@work a project dedicated to applications was launched by the European Commission (EC IP 004216) a year ago and the first results are now available. The project strongly follows a user centred design approach and much effort was put into the first investigations with users in the four application domains of maintenance, production, hospital and fire fighting. Results relating to a wearable computing hardware platform and software framework were also achieved.

Contact:
Michael Lawo
TZI – University of Bremen, Germany
E-Mail: mlawo@tzi.de
www.wearable-computing.de

NEXUS IP and NoE Meeting and NEXUS GAM, 5-6 Dec 2005, Paris

The NEXUS IP and NoE meetings, held in 6-monthly intervals, have the joint aim of bringing Eastern organisations, SME and partners from EC IP and NoE projects closer to working together, as well as providing a platform for disseminating project information and exploitation potential. It is planned to hold a NEXUS GAM (General Assembly Meeting) meeting in conjunction with the IP and NoE Meeting.

More information is available from the NEXUS website and through the NEXUS E-zine.

Please register for the E-zine at www.nexus-mems.com/registration.asp

NEXUS and FP6 IP & NoE Calendar

15 - 16 Nov 2005
Ambient Intelligence for Food Quality and Safety
Florence, Italy
Organised by the GoodFood IP, in collaboration with the University of Florence and the European Commission
www.goodfood-project.com

25 - 26 Nov 2005
4M Workshop Micro/Nano Engineering: Technology and Applications
Sofia, Bulgaria
Workshop will be held in conjunction with the 7th National Workshop on Nanoscience and Nanotechnology.
www.4m-net.org

Further News from NEXUS

In addition to this NEXUS News page, an article about the latest issue of the NEXUS Market report is included on page 32 of this MST News issue.

NEXUS Contact

NEXUS News is provided to NEXUS members and other interested mst-news readers by the NEXUS Association.

The NEXUS Association is partly funded through the NEXUSPLUS project within the EC IST programme in FP6 to:

- Disseminate and cross-fertilise between FP6 Integrated Projects and Networks of Excellence.
- Increase ACC participation in NEXUS activities and within EC FP6 projects.

NEXUS Office
c/o Leti, France
E-mail: NEXUS@cea.fr
www.nexus-mems.com

NEXUS News Contact
Patric Salomon, Germany
NEXUS News Editor
4M2C PATRIC SALOMON GmbH
E-mail: nexus-news@4m2c.com

NEXUS Membership

NEXUS Membership is open to all companies and institutes, worldwide, that are able to contribute expertise in areas relevant to microsystems technology.
To apply for membership, complete the online questionnaire for the NEXUS Who's who on the NEXUS website:
www.nexus-mems.com
Membership is free of charge!

New Packaging Technologies for a Very Compact High Current Sensor and an Innovative Double Angle Sensor

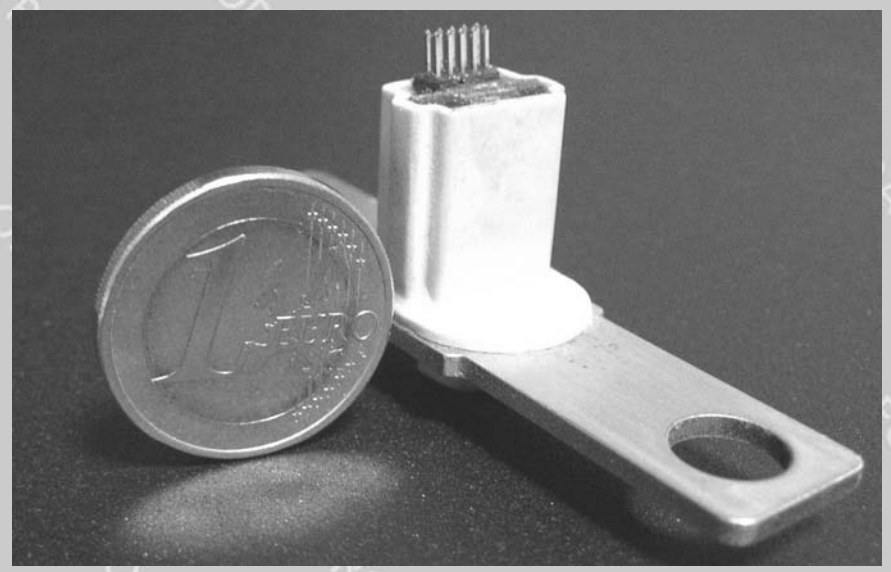
During the MAGSYS project (The Service for Modular Magnetic Microsystems Design and Packaging Support) a small multidisciplinary consortium succeeded in fabricating two demonstrators: a high current sensor system CSS and a three-dimensional angle sensor package. Both sensors are based on the anisotropic magnetoresistive (AMR) effect, which is increasingly being utilized to build very compact sensors robust against humidity, dust and applicable within a wide temperature range.

The great challenge in the development of the CSS sensor was to assemble various components made out of different materials into a compact system capable of working properly in a temperature range of –20°C to +85°C (industrial application) and for automotive application from –40°C to +150°C. In order to achieve first results within a rather short period of time virtual prototyping of thermo-mechanical deformation and stress behaviour was conducted by AMIC GmbH and Sensitec GmbH. For this purpose, a complex model was generated and material parameters collected and measured. Using Finite Element Analysis (FEA), various sensor parameters were evaluated and a reliable sensor design developed. Particularly the interaction between the sensor housing - designed and fabricated by Paragon AG - and the potting material was a critical point, which could easily lead to considerable deformation and stress on the sensor elements when exposed to temperature profiles.

By the end of the project a first prototype was fabricated and tested successfully for industrial application. Selected customers were provided with samples for in-house experiments. As a result of the customer feedback, the development of the available prototypes into a series product will be pushed forward in 2005 in order to satisfy the growing demand for CSS by new customers specialized in hybrid vehicle or electrical drive technology.

The second prototype assembles two AMR angle sensor chips mounted rectangularly in one package. The design requires very low distances between the sensor dies and a high accuracy of the 90° angle between the sensor chips. The Lithuanian project partner Vilniaus Ventos Puslaidininkiai applied a modified lead frame technology together with transfer moulding. First samples were exposed to a temperature range of –20°C to +85°C (industrial application) in a temperature shock chamber by AMIC and afterwards tested by Sensitec. The samples survived 500 shock cycles without any failure. Additional shock treatments are planned to further evaluate the robustness of the package. Possible applications for such a mass producible device could be in a compass or in the measurement of 2D movements, (e.g. joystick).

Contact:
Joachim Hölzl
Sensitec GmbH, Germany
E-Mail: Joachim.Hoelzl@sensitec.com



Prototype of Compact High Current Sensor CSS

EP Contact

EUROPRACTICE News is provided to mstnews readers by EUROPRACTICE Microsystems Service for Europe.

EUROPRACTICE is funded by the European Commission DG INFSO E5 within the framework of the Information Society Technologies (IST) Programme.

EUROPRACTICE Programme Manager:
Leonello Dori
European Commission, DG INFSO C2
E-mail: Leonello.Dori@cec.eu.int

EUROPRACTICE News Editor:
Patric Salomon
4M2C PATRIC SALOMON GmbH
E-mail: ep-news@4m2c.com

For information on specific activities within Europractice, please contact Competence Centers, Design Houses and Manufacturing Centers directly. Contact information can be found at www.europractice.com

Here we feature 2 specific activities of projects carried out under the PATENT-DfMM initiative – more will be available in upcoming issues of MST News and our Email newsletter.

Support Project to Sandvik Osprey in use of Controlled Expansion Silicon / Aluminium Alloys for MEMS packaging

This work has been carried out by Lancaster University's Product Development Unit with a specific objective of assisting Sandvik Osprey in entering the MEMS packaging market. Computational models capable of predicting the stresses involved in producing multiple layer assemblies from CE (Controlled expansion) Aluminium/Silicon alloys have been realised.

CE alloys are a product of Sandvik Osprey, and are manufactured by rapid solidification spray forming of Aluminium and Silicon. The effort required to produce these materials is considerable, however the properties of light weight, low Coefficient of Thermal Expansion (CTE) and good thermal conductivity are ideal for packaging of a range of high-power electronics and MEMS technologies where heat dissipation and low expansion are required to protect components. However the brittleness and low CTE of the CE alloys becomes a problem when it is a requirement that they be joined to other materials.

Although at present steps have been taken, and progress has been made, the analysis models produce results that conflict with the result of physical prototype manufacture. Before the extent of the disparity can be ascertained it will be necessary to compare the material properties used with a more complete set of values from the manufacturer. All the tools developed to date are equally applicable to the new models that are needed. As a result, progress can be made without time being spent reproducing existing work. Further progress will now rely heavily on the ability to characterise the as yet undefined, non-linear, material properties such as thermal creep.

Contact:
Dr Alan Rennie
E-Mail: A.Rennie@Lancaster.ac.uk

Electrical only testing of MNT based systems

MNT based systems in most cases contain a transducer that interacts with a non-electrical quantity such as pressure, chemical, temperature, motion and electronics for processing. Testing of these devices thus requires the application of this "physical quantity" that is normally expensive and slow hence not practical for mass-produced low-cost devices. This project is investigating the potential for testing these devices using electrical only stimuli applied by either superimposing test stimuli onto the bias signal or modulating the biasing of the device. The work is being carried out by Lancaster University, LIRMM, Montpellier and Qinetiq. To date the technique has been applied to an electro-chemical sensor, a silicon accelerometer and a magnetosensor for embedded compass applications.

Contact:
Prof. Pascal Nouet
E-Mail: nouet@lirmm.fr
Prof. Andrew Richardson
E-Mail: A.Richardson@lancaster.ac.uk
Dr John Bunyan
E-Mail: rjtb@Qinetiq.com

Report: MEMS Summer School, 5-7 Sep, Montpellier, France

The PATENT DfMM Summer School is an annual event which provides training in various aspects of technology related to the manufacturability of MEMS devices and packaging. It also presents a "shop window" for selected research topics undertaken by partners in the PATENT-DfMM Network of Excellence, involving advancements in Design for Manufacturable Micro and Nano Systems. Following an introductory overview of the industry and markets, the programme this year included a case study in Design and Test of MEMS, various sessions on MEMS Modelling and CAD tools, and sessions on Reliability including a major tutorial on Failure Analysis. Initial feedback again seemed positive, and a number of the topics will be developed into more substantial training courses within the PATENT training portfolio over the coming months.

Contact:
George Bell, ISLI, UK
E-Mail: george.bell@sli-institute.ac.uk

DfMM Contact

DfMM News is provided to mst-news readers by the project "Design for Micro & Nano Manufacture (Patent-DfMM)", a Network of Excellence funded by the European Commission DG INFSO E5 within the Information Society Technologies (IST) Programme of FP6.

Information Society Technologies

The NoE Patent-DfMM aims to establish a collaborative team to provide European industry with support in the field of "design for micro nano manufacture" to ensure that problems affecting the manufacture and reliability of products based on micro nano technologies (MNT) can be addressed before prototype and pre-production.

DfMM NoE PATENT

NoE Patent-DfMM Co-ordinator:
Andrew Richardson
University of Lancaster, UK
E-mail:
A.Richardson@Lancaster.ac.uk

NoE Patent-DfMM News Editor:
Patric Salomon
4M2C PATRIC SALOMON GmbH
E-mail: DfMM-news@4m2c.com

www.patent-dfmm.org

News from EURIMUS

1. EURIMUS in the ERA
With the aim of being part of the ERA (European Research Area) construction and reinforcement, the EURIMUS Organisation has decided to be an active partner in launching European initiatives. That's why today EURIMUS is participating in two projects funded by the European Commission.

EURIMUS will bring:

- its competence and knowledge of the micro- and nanotechnologies domain
- its competence and knowledge of MNT actors in Europe
- its technical expertise.

In addition, EURIMUS will transmit its knowledge in running EUREKA programmes such as:

- project evaluation
- project selection
- project follow-up
- links with EURIMUS members, project partners and national public authorities.

The two European projects in which EURIMUS is participating are:

1.1 ERA PILOT MiNa TSI "European Research Area Pilot Action on Micro-Nano-Technology Systems Integration".

Web site: under construction.

EURIMUS acts as full partner.

Summary:
The Era Pilot MiNa TSI will network national and European entities supporting systems integration related to micro- and nanotechnologies. The partners therefore are organisations and initiatives designing policies and/or running programmes in this sector including the EUREKA initiatives EURIMUS and PIDEA. The national ministries represent the member states' interests in the Board of the project. The European Commission as one of the main policy actors in this area will also be involved. The project will be based on and assist the attempts of industry to establish an initiative for defining research priorities and policy options for FP VII and beyond.

There is the necessity to transform an unsteady and irregular dialogue between the national and European programmes into a solid platform – including industry - on which those responsible for research management can establish mechanisms for co-ordination and explore formulas to be more efficient in the way research is carried out and specially to improve the transformation of technological excellence into economic and social achievements.

Bridges have to be built to industry in order to insure their input. The project will therefore help industry to define their research priorities and based hereon establish a formal dialogue between those institutional entities involved in promoting micro and nano systems and integration aspects in Europe. The project will include the following aspects:

- Research priorities will be defined and a research agenda will be set up in close co-operation with industry.
- A process of exchange and communication on funding and policy approaches of European initiatives and at member state level will be established.
- Common actions will be defined as interim and final results of the process (e.g. an output could consist of creating a basis for an Industry-driven Policy Initiative).
- Along technology roadmaps future R&D and innovation policy requirements will be defined.
- Policy/funding concepts will be developed.
- A commitment will be reached on the "division of labour" among national programmes, EUREKA initiatives and FP activities.

Strategic objectives addressed:

The Era Pilot will contribute to the creation of the ERA in realising a co-ordinated and concerted, better structured and more coherent policy related to MNT Systems Integration in Europe. It is the project's objective to optimise the allocation of resources, creating synergies and complementarities among the various entities funding/financing RTD and avoiding incongruities of policy efforts in Europe. The envisaged results will contribute to consolidating the leading position and competitiveness of European industry in that area.

Starting date: July 1, 2005
Duration: 24 months
Co-ordinator: VDI/VDE-IT (D)

1.2 MNT ERA-NET "Micro- and Nanoscale Science to New Technologies for Europe"

Web site: www.mnt-era.net

EURIMUS acts under this project as external expert.

Summary:
Micro- Nano- Technology (MNT) is a key enabling technology covering the fields of microtechnologies, nanotechnology and microsystems. MNT is expected to impact significantly on future economic and social development. It will stimulate new products and services, create and secure employment in Europe and improve living conditions, including people who currently lack autonomy as a result of age, illness or accidents. MNT will also contribute greatly to meeting ecological challenges and achieving sustainable development, innovatively and economically.

The main objectives of MNT ERA-NET during the four years are:

- exchanging strategic information about programme design and management between the participating programmes;
- learning from each other through the exchange of good practice;
- implementing joint and co-ordinated activities between participating programmes so as to add value for programme users, programme managers and programme owners;
- securing mid-term co-operation

between the participating programmes through a detailed action plan;
- expanding the project to further countries and regions in Europe so as to broaden its impact, and
- establishing long-term co-operation by exploring options and selecting and implementing a preferred institutional framework for sustained co-operation between the participating programmes, other European initiatives and other relevant stakeholders.

Europe currently holds a good scientific and technological position in MNT, but in comparison with North America, Asia and Australia our research and application efforts are dispersed and fragmented.

In order to exploit Europe's good position, this dispersion and fragmentation have to be addressed through, inter alia, better co-operation between national MNT programmes on a transnational level in Europe.

The partners participating in launching MNT ERA-NET are key MNT programmes and leading programme management agencies from 16 countries managed by Austria.

Starting date: January 1, 2004
Duration: 36 months
Co-ordinator: FFG (A)

2. Road show in Israel on June 14, 2005

In 2005, the EURIMUS Organisation is continuing its European tour started in late 2003.

The Chairman of EURIMUS II, Mr Gaëtan MENOZZI, made a presentation of EURIMUS II during a conference in Haifa, Israel, on June 14, 2005.

Israel was part of the countries to visit because it is a full member of EUREKA. So far, it has run about 40 cooperative projects amounting to a total volume of 100 million €, of which nearly one third is related to Israeli participation.

Israeli Public Authority contact:

Mr Udo J. Mannes
National Project Coordinator (NPC)

EUREKA Office Israel
MATIMOP
Israeli Industry Center for R&D, P.O. Box 50364, Tel Aviv 61500, Israel,

Phone: +972 (3) 511 8111.
EUREKA Israel: www.eureka.org.il.

3. Next Annual Progress Monitoring Meeting (APMM) Project Outline evaluation

The next APMM will take place in Madrid on September 28-29. 11 running or just finished projects will be presented. This meeting will give the partners of the projects the opportunity to present the evolution, the state and the results of their projects to the EURIMUS experts and the National Public Authorities representatives (EURIMAC).

Following these two days, the evaluation of the Project Outlines (short proposals) submitted for the 4th call of EURIMUS will be done. The leaders and partners of the proposals will have the opportunity, before the evaluation discussions between the TC, to present their proposal orally, and answer the questions of the TC. This procedure is very appreciated by the proposers, who can directly be in contact with their evaluators.

Next Call for Proposals

Call 4 of EURIMUS II:

- Closing date for FPP registration: October 28, 2005
- Closing date for FPP submission: November 17, 2005
- T.C. evaluation meeting: December 1, 2005
- Board labelling meeting: December 2, 2005

EURIMUS Contact

EURIMUS OFFICE
CEA-Grenoble
17 avenue des Martyrs
38054 Grenoble Cedex 9
France
Phone: +33 438 78 36 38
Fax: +33 438 78 56 70
E-Mail: EURIMUS@cea.fr
www.eurimus.com

BMBF is Funding Integrated Microsystems for Biotechnological Applications

Micro goes Bio: The BMBF is funding the development of microsystems for biotechnology under the recent "Microsystems" framework programme. Biotechnology has developed into a key technology in different industries and research areas and has become a relevant economic factor in Germany since the 1990s. Significant improvements have been made. Thus, therapeutic as well as diagnostic improvements in medicine and the development of pharmaceuticals are frequently based on new concepts of modern biotechnology.
In many areas of biotechnology minimising processes turns out to be an advantage. A key to this is micro fluidics, an area of microsystems technology (MST) that allows dosing and transporting minute amounts of liquids or processing something. Other microtechnologies like microelectronics, micro optics, micro mechanics or structural-design and joining technology play an important role in the transfer of biological and/or biochemical processes to a miniaturised technological environment as well. Technical miniaturisation has many advantages, for instance reduced resource input, shorter times of analysis or higher throughputs. Hence, the advantages of bioMST result from lower process costs as well as from entirely new application possibilities. Due to the enormous miniaturisation potential and the resulting high function density new biotechnological production concepts can be realised that are particularly characterised by large-scale technological integration. Thus, microtechnologies are used to an increasing degree in biological analysis (e.g. integrated bio-sensorics), medical diagnostic (e.g. point-of-care testing) or in the course of pharmaceutical development. The underlying biological and biochemical methods are based on modern biotechnological concepts and chiefly take place outside of the body, i.e. "ex vivo".
Microsystems for biotechnology will play a significant role in medicine and pharmaceutical development. Many basic micro technical components and processes that are suitable for biotechnological applications have already been developed in Germany. It is necessary to expand the integration of individual microtechnological solutions into complete systems to keep this technological leadership and, in addition, be able to address different application fields. The BMBF will promote this process with the new funding of "Integrated microsystems for biotechnological applications".
Projects eligible for funding should have the objective of finding MST solutions for the development of pharmaceuticals or molecular-medical diagnostics. The focus should be on those technologies that integrate all substantial work steps necessary for the particular biological and/or biochemical process within a machine or system platform. That involves sample preparation and processing, measurement and detection, outcome analysis and description or process controlling. The utilisation and analysis of function-critical biological key components, i.e., basically nucleic acids, proteins/peptides as well as cells or parts thereof, have to be part of the development work. Furthermore, biotechnological microsystems that are applied "ex vivo" will be funded specifically. "In vivo" microsystems used as implants are explicitly excluded.

Further information is available at www.mstonline.de/skizzen/aktuell.
The deadline for project drafts is January 16, 2006

New Touring Exhibition of the BMBF: Mars Automobile Inspires for Microsystems Technology

One of the highlights of the Microsystems Technology Congress to be held on October 10th-12th in Freiburg is the premiere of the new BMBF touring exhibition "Micro Worlds – Future Worlds: the Invisible Revolution". The exhibition shows special features and potentials of Microsystems Technology (MST) and thereby wants to inspire students, citizens, media representatives and politicians for this future field.
The application fields of life sciences, mobility, logistics as well as sports and leisure show the importance of MST for daily life, for the economy, the creation of jobs as well as for social progress. Countless MST products of German manufacturers are indicative of Germany's position in this growth field.
The exhibition starts with special features of MST, explaining, among other things, the systemic and cross-sectional character of MST and its significance e.g. for bio- and nanotechnology. The dimensional differences existing between microsystems and conventional technical solutions are well illustrated. Visitors are able to compare for instance a lab-on-a-chip with a laboratory.
The focus of the exhibition is on demonstrative MST application scenarios that show visitors the potentials of present and future developments. The journey through MST leads to automobiles which due to driver-assist systems have become significantly safer, to the networked logistic world of goods, to ambient assisted living, to intelligent textiles for sports and leisure and even to Mars. One of the most impressive exhibits is the model of the Mars Rover, which is equipped with MST Made in Germany. Other areas of the exhibition give insights into different technologies and components of MST.
The fun of playing and experimenting will occupy a major part of the exhibition. In the experimental theatre visitors may try out and experience live important micro world phenomena. They learn to know e.g. the functionality of a biosensor and can examine the characteristics of light on an optical workbench. In a computer game developed specifically for this exhibition the finishing line can be reached fastest if microsystems are inserted skilfully.
The exhibition can be seen first from October 10th to 12th in the concert hall in Freiburg and afterwards will be touring through Germany.

Great Time for Micro Fuel Cell Ahead

The Federal Ministry of Education and Research (BMBF) is boosting the development of micro fuel cell technology with a generous funding programme. Business companies and research institutions of different industries will apply for a sum of about 20 million Euro. They should be willing to cooperate under an inter- and multidisciplinary collaborative project.
The aim of the funding project "Micro fuel cell lead innovation" is developing efficient and cheap small fuel cell systems and their production.
In the near future micro fuel cells powered by hydrogen or methanol are supposed to replace regular energy supply systems, e.g. lithium batteries, in many portable electronic devices. Their high-energy yield and the separation between transducer (fuel cell) and storage (tank) will significantly increase the benefit of mobile electronic devices.
Bringing promising approaches to maturity will require cooperation between the key technologies Material science, Microsystem technology and Production technology. Therefore, the three framework programmes "Material Innovations for Industry and Society", "Microsystems" and "Research for Tomorrow's Production" all address the same goal: the funding of collaborative projects that will allow market access for the micro fuel cell.
Applicants should be prepared for intensive cooperation and should greatly enforce the reduction of the system periphery (e.g. pumps or valves), the microstructuring of e.g. microfluidic particles, the miniaturisation of system control or system integration. Alternative materials and construction methods are supposed to further miniaturised micro fuel cells. The result could be a flexible construction that provides to producers of portable electronic products new opportunities in the way of design and impulses for seminal solutions.
The BMBF expects from the applicants to work in an application-oriented way and to focus on subsequent production. Applied solutions should far exceed the present state of technology. The BMBF especially encourages small- and medium-sized enterprises to submit a tender. The deadline for project drafts is January 13, 2006. Eligible for funding are projects dealing with micro fuel cells with the following characteristics:
electrical power up to 100 W, gravimetric power density above 200 W/kg, volumetric power density above 150 W/l, energy density above 1.000 Wh/l, costs below 4 EUR/W, minimum durability 2000 h.

The BMBF has entrusted VDI/VDE Innovation + Technik GmbH, "Project Execution Organisation Microsystem Technology" with the processing of the funding measures. Details concerning funding application and criteria can be obtained from the BMBF leaflet www.kp.dlr.de/profi/easy/bmbf/pdf/0110.pdf or directly from the project management. Forms for project drafts, guidelines, leaflets and advice as well as riders are available from URL www.mstonline.de/skizzen/aktuell.

Contact

GERMAN MST PROGRAMME News is provided to mstnews readers by the German Programme Microsystems (MST), managed by VDI/VDE-IT on behalf of the German Federal Ministry of Education and Research (BMBF).

Support Programme
Dr. Lars Heinze
VDI/VDE-IT
E-Mail: heinze@vdivde-it.de

Accompanying Measures
Alfons Botthof
VDI/VDE-IT
E-Mail: botthof@vdivde-it.de

German MST Programme News is compiled by:
Wiebke Ehret
VDI/VDE-IT
E-Mail: ehret@vdivde-it.de
Fax: +49 3328 435 281

Events

Workshop
VUV and XUV – new opportunities for the measurement of microsystems
October 5, 2005
Göttingen Laser Laboratory
kuenzel@vdivde-it.de

Congress
Microsystems Technology Congress Germany
October 10 - 12, 2005
Freiburg concert hall
berger@vdivde-it.de
www.mikrosystemtechnik-kongress.de

Special event
Microsystems Technology for Biotechnology
October 18 – 20, 2005
Biotechnika, Hanover
schloetelburg@vdivde-it.de
www.mst-niedersachsen.de

Workshop
Nanotechnology – specific applications & possible cross-sectoral solutions
November 3, 2005
Physikalisch-technische Bundesanstalt Braunschweig
beumler@vdivde-it.de

Final presentation
New Approaches for demand-driven lubrication of bearings
November 9, 2005
VDMA-Building, Frankfurt a.M.
wybranski@vdivde-it.de

Review presentation
Test and quality assurance system for the industrial manufacturing of wafer-bonded Microsystems MIKROPRÜF
November 15, 2005
Munich Fairground
(at Productronica 2005, Hall 05)
wybranski@vdivde-it.de

Workshop
Wafer bonding for MEMS Technologies
April 9 - 11, 2006
Halle
wybranski@vdivde-it.de
www.microtesting.de

MINAEAST-NET

Specific Support Action from FP 6 (2004-2006): MIcro and NAnotechnologies going to EASTern Europe through NETworking" (MINAEAST-NET)

Coordinator: National Institute for Research and Development in Microtechnologies, Romania

The Second MINAEAST-NET Workshop within the MINAEAST-NET EU project

The Second MINAEAST-NET Workshop took place in Athens, Greece, organized by the Institute for Microelectronics (IMEL), National Centre of Scientific Research "Demokritos", on 15th July 2005.

The workshop was intended to intensify the collaboration with Eastern Europe in the micro-nanotechnologies domain.

During the first part of the workshop, the hosts from IMEL/ NCSR "Demokritos" presented their research activities and experience in international projects and networks. Dr. Androula Nassiopoulou, the director of IMEL, presented the research activities at IMEL, envisaging the main research domains and results, research projects, collaboration with industry and institute infrastructure and also the EU NoE "SINANO: A Network of Excellence for Silicon Nanoelectronics" within IST priority. The other presented projects from IMEL were: "TASNANO" (EU STREP on Tools and Technologies for the analysis and synthesis of nanostructures), "BIOMIC - An EU project on Monolithic Silicon Optical Biosensors", "EU Nano2life NoE" and "Issues for smooth roughness-free nano-patterning with lithography and plasma etching - EU projects: More-Moore, NanoPlasma, contract with INTEL".

Participants to the Second MINAEAST-NET workshop, Athens

A tour of the IMEL laboratories was provided by Dr. Nassiopoulou between the two parts, showing the main institute facilities.

During the second part, the Eastern participants presented recent research results obtained in the MNT domain, current projects and also the human and material potential, together with possibilities for cooperation.

All the presentations given at the workshop can be accessed on the project website, at the address http://www.minaeast.net.

20 participants from different countries, including the MINAEAST-NET project partners, attended the event. 2 participants from Bulgaria and Hungary benefited from travel grants for attending the workshop, offered by the project.

The event offered the participants the chance to identify better the scientific and technological capabilities of Eastern and Western organisations and opportunities for cooperation. New contacts were established between the participants and new project ideas put forward.

MINOS-EURONET (http://www.minos-euro.net) is another SSA project coordinated by IMT-Bucharest, especially addressed to the Eastern European countries, contributing to the same domain as MINAEAST-NET. MINOS-EURONET is devoted to stimulating, encouraging and facilitating the participation of New Member States (NMS) and the Associated Candidate Countries (ACC) in the IST domain activities. The project can be viewed as a follow-up to the MINAEAST-NET project. The characteristic of this project is given by the presence in the project consortium of eight coordinators of big FP6 projects (5 NoEs and 2 IPs, mostly from IST field).

The two projects, **MINAEAST-NET** and **MINOS-EURONET**, have common public and interactive electronic **databases**, in English, displaying information about **Research Centres, International projects, Specialists** and databases for **partner matching and expressions of interest calls in FP6.**

CEEX - The new Romanian research programme (on topics related to FP7)

The CCEX Programme was launched at the end of May 2005. The main objective of the CEEX Programme of research excellence consists in preparing the participation of Romanian research entities in the future FP7 programme, in the period 2007-2013. CEEX will support cooperation between the research units and institutions, universities and companies in order to determine a visible impact in the quality of Romanian research, to increase the number of researchers to be involved in high standards projects and to disseminate knowledge and results.

The CEEX programme therefore helps:

- increasing R&D system capacity in order to assure new competitive partners in programmes for scientific and technical cooperation and technological international alliances
- the process of concentrating and raising quality and performance in research&development activities, aiming to attain the level of compatibility and competitiveness necessary for integration into the European Research Area (ERA).

MINAEAST-NET project

MIcro and NAnotechnologies going to EASTern Europe through NETworking
EU Contract no.: 510470
(SSA in FP 6)
Project coordinator:
National Institute for R&D in Microtechnologies (IMT-Bucharest)
Contact persons:
Project coordinator
Prof. Dan Dascalu
(dascalu@imt.ro)
Project Vice-Coordinator
Dr. Carmen Moldovan
(cmoldovan@imt.ro)
E-mail contact: net@imt.ro
Phone: +40 21 490 82 12 or
+40 21 490 84 12
Fax: +40 21 490 82 38 or
+40 21 490 85 82
Web page: www.minaeast.net
Special pages also dedicated to this project are published in the **MNT Bulletin** (www.imt.ro/MNT)

Microsystems Clusters in Germany and Economic Performance of Small and Medium-sized Enterprises (SMEs)

Uwe Kleinkes

There is an intensive debate on Germany's economic performance and its capability to cope with future challenges these days. Small high-tech companies should play an important role in creating jobs and in growth. Data material about the economic performance of small and medium-sized MST/MEMS companies has been scarce and a comprehensive overview of Microsystems clusters in Germany does not exist. IVAM as an international association of one hundred and sixty companies and institutes working in the field of micro- and nanotechnology has investigated those companies and their regional economic and technological landscape in two different studies.

First IVAM conducted a survey among IVAM members as an anonymous internet-based e-mail poll. This survey covers numbers of employees, turnover, target markets and future expectations. We learned that SMEs are strongly export-orientated. Half of all German SMEs investigated export more than fifty percent of their annual turnover. In contrast to domestic sales, a quarter of those companies achieve export sales of about seventy-five percent of their annual turnover. Technology companies, e.g. microtechnology companies, apparently grow faster when they are situated in a cluster. Silicon Valley is a synonym for such a development. IVAM Research, a division within the IVAM association, has conducted a survey of clusters of five hundred Microsystems/MEMS and Nanotech companies in Germany.

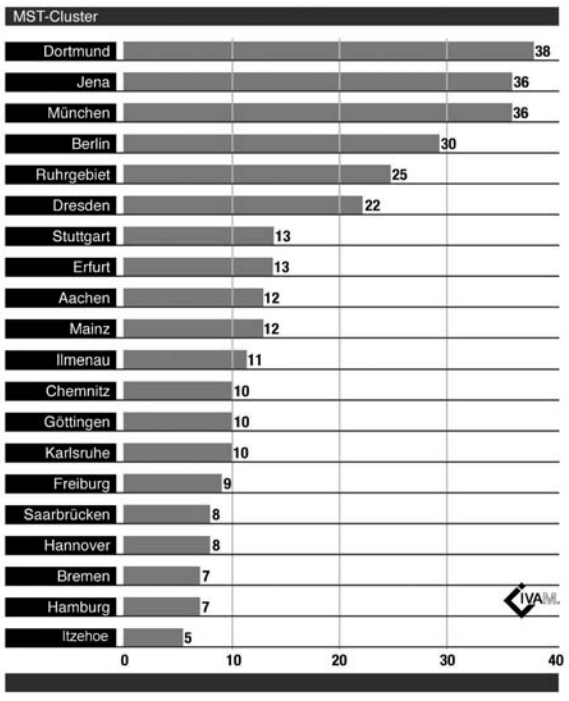


Figure 1: MST Cluster in Germany

As a result of the cluster study MST-Atlas Germany we were able to identify the top six MST clusters Dortmund, Jena, Munich, Berlin, Ruhr-Valley and Dresden and fourteen other clusters of young MST/MEMS companies at different stages of development. The MST-Atlas Germany provides information and trends e.g. for investors, companies looking for a location and for economic development agencies.

Why study small companies?

The emergent technologies Microsystems and Nanotechnology today already have an impact e.g. in the automotive industry with 70 up to 100 microsensors and actuators in premium cars. The leverage effect of small parts can create a high turnover, for instance micromirrors make DLP systems of Texas Instruments million-dollar sellers. Those DLP systems are used in projectors for better picture quality. Consumer goods are proclaimed to be the next high-volume applications with more products to come, e.g. cell phones with acceleration sensors. Besides big players such as Texas Instruments, Hewlett Packard and Bosch there is a lively and dynamic scene of small and medium-sized enterprises. Since companies such as Hewlett Packard started as small start-ups years ago, it might be useful to watch today's small companies in the high-tech field as well.

The MST-Atlas Germany – A cluster study

The MST-Atlas is based on the IVAM database and desktop research. Over five hundred SMEs were investigated. A major challenge was to define what constitutes a MST company. Since there is no internationally accepted definition, we chose a pragmatic one. We referred to product portfolio, activities in associations such as IVAM, NEXUS, VDMA MicroTechnology or participation in relevant B2B platforms such as the MicroTechnology trade show at the Hanover Fair or similar events. The report was presented for the first time at the Microsystems conference in Dortmund in September 2005 and is published in German. The MST-Atlas is not a data collection of addresses and company profiles as found in the MEMS directory (www.ivam.de) or other data compilations. Twenty clusters of MST/MEMS companies were investigated with regard to technologies and target markets (one example see fig. 2).

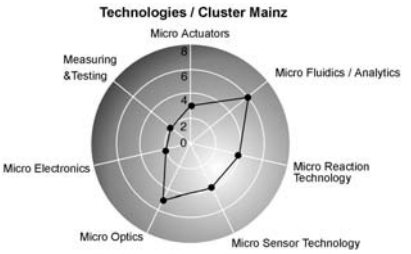


Figure 2: Technologies and markets in the cluster of Mainz

There is a belt of MST/MEMS clusters from Aachen to Dresden, from East to West, where most of the companies are organized in agglomerations (see fig. 3).

In southern Germany more companies are located on greenfield sites. Forty-five percent of all companies are not located in clusters and can be

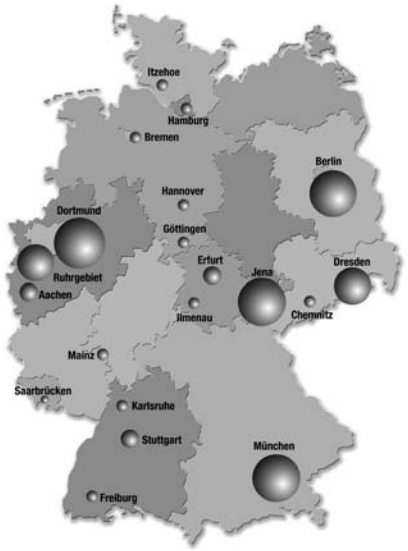


Figure 3: Map of Germany

found in Bavaria and Baden-Wurttemberg. Local economic development agencies tend to declare their city or region the "new silicon valley for MST or Nano" even though there are only three companies. From a more global point of view we can expect that not all the clusters will grow with the same performance or even survive.

In Germany twenty MST clusters with up to forty companies were identified. They are concentrated in Dortmund, Jena, Munich and Berlin. The states with most MST companies are North Rhine-Westphalia, Bavaria, Baden-Wurttemberg, Saxony und Thuringia.

2005 IVAM economic survey

IVAM conducted this internet-based survey in early 2005. The total number of companies and institutes polled was one hundred thirty-two with a response rate of fifty percent. Most of the IVAM members come from Germany. So it is no surprise that eighty percent of the replies came from Germany. Therefore the results strongly reflect the situation of SMEs in Germany. The first results of this survey were presented at the Hanover Fair and in the German magazine INNO Nr. 31 (p. 6). As we mentioned before, there is a strong orientation towards exports markets. The figure 4 shows a bifurcation between a majority of more than fifty percent of the companies with an export-oriented turnover.

There are companies who state their export ratio with more than ninety-five percent. On the other hand, twenty-five percent of the companies are nationally or regionally oriented. Top export markets for German SMEs are the USA, Switzerland, Japan and France. Regarding Eastern Asia at the moment Taiwan is named more often than China and India is not mentioned as a target market. This export orientation is astonishing if we take a closer look at the number of employees. More than fifty percent of the companies in this investigation have up to twenty employees. Twenty percent of the companies have between twenty-one and fifty employees.

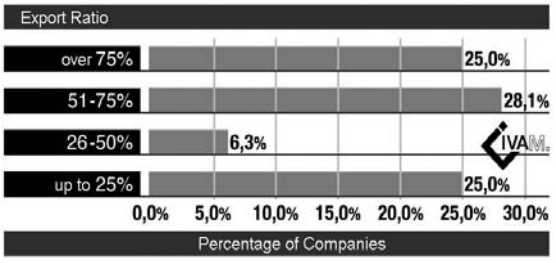


Figure 4: Export ratio

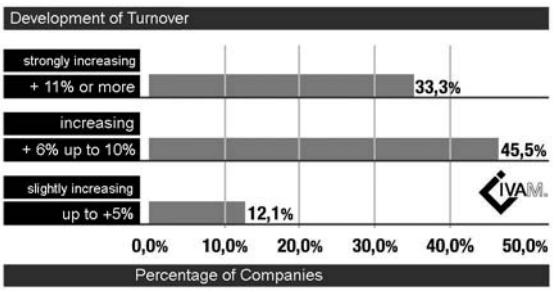


Figure 5: Development of turnover

Fifty percent of companies have a turnover of up to one million Euros. Twenty percent have a turnover of between one and five million Euros and twelve percent of the companies have more than ten million Euros annual turnover. Therefore the companies in this survey are rather small than medium-sized but they all expect a strong growth in turnover and the number of employees. One third of German companies expect a growth in turnover of more than eleven percent in the next three to five years. The same figures are true for the growth in the number of employees. We also have asked them to identify barriers to growth. The growing complexity of technology is no problem for the companies. But the implementation and duration of innovation plans, development costs of new technologies and acquiring equity and loan capital are major obstacles.

Conclusion

Germany has a lively scene of small and medium-sized enterprises in the field of micro- and nanotechnology. There is great potential for growth and companies expect a strong rise in turnover and in the number of employees in the next three to five years. There is a pronounced export orientation, which indicates international competitiveness and a probably weak national market. This may influence the German economy since MST companies find themselves at the very beginning of the supply chain. Although MST is necessary to manufacture competitive products, bigger profits are made at later stages of the supply chain. The MST-Atlas shows where clusters of microsystems and nanotechnology companies are based in Germany. Those clusters are an excellent starting base for entering the microtechnology business, securing further growth and creating jobs.

Contact:
Dr. Uwe Kleinkes, IVAM Research
Emil-Figge-Str. 76
44227 Dortmund, Germany
Phone: +49 231 9742 148
E-Mail: uk@ivam.de

IVAM is an international association of one hundred and sixty companies and institutes focusing on micro- and nanotechnology. It is the communicative bridge between users and suppliers. IVAM focus on
- technology marketing
- international networking
- lobby work for high-tech SMEs

Internet: www.ivam.de
www.mst-atlas.de

An Updated Report Card on the Barriers to the Commercialization of MEMS and Nanotechnology: Lessons to be Learned from the Semiconductor Industry

Barriers to the commercialization of every technology exist. Nanotechnology and Microelectromechanical Systems (MEMS)/Microsystems Technologies (MST) are not exceptions. We are currently at a half-century of MEMS research, design, and development. Many people ask, "Why has it taken so long for the MEMS/MST market and technology to realize its potential or reach the expected volumes?" Will Nanotechnology face the same barriers? Here, I will attempt to address the major barriers to the commercialization of MEMS/ MST and the progress made to overcome these barriers through the introduction of a "MEMS Industry Report Card " given in Figure 1. The report card has been updated yearly since 1998 [1], where it was first presented at the seminal Hilton Head (South Carolina US) Conference. It has been a popular presentation at the annual Commercialization of Micro and Nanosystems Conference (COMS) since the Report Card's inception and was a keynote presentation at COMS 2005 in Baden-Baden, Germany. The changes in grades from 1998 to 2005 will be addressed here with some rationale for the actual grade as well as recommendations for improvement. For the successful commercialization of Nanotechnology, lessons learned from the MEMS/MST (as well as from the semiconductor industry) areas must be heeded.

Research Methodology

The methodology used to develop the grades and the rationale was to employ a "Delphi" market research technique where a select number of MEMS/MST industry experts representing the Americas, Europe and Asia/Pacific were personally interviewed for their opinions. These interviewees represented the broad MEMS/MST industry and included people from infrastructure (testing, foundries, capital equipment, consultants and software providers); manufacturers of MEMS/MST components and end users of MEMS/MST products. In this fashion, a truly representative but not statistically significant sample was realized. The period of interest for the 2005 grades encompassed July 2004 to June 2005.

R&D (Grade = A-):

Spending on MEMS R&D has been robust even before 1998 with DARPA/ARPA making major investments early in the game. It has been through the visionary leadership and recommendations of many DARPA staffers that judicious investments have been made in MEMS that have been the foundation of its commercialization. Private funding also has historically supported this R&D activity in a robust fashion. The year 2005 saw a small upturn in the high-tech economy and in corporate R&D budgets (including personnel) but not enough to affect its grade. The 2005 grade continued from its "A-" value in 2004 and 2003.

Profitability (Grade = C), Creation of Wealth (Grade = C-), and Venture Capital Attraction (Grade = C+):

The downturn in worldwide economic conditions severely punished most high technology companies in the 2001-2003 time frame, including companies with MEMS/MST programs. Corresponding to the height of the NASDAQ in 1999 and early 2000, many new MEMS/MST companies, especially those participating in the booming optical telecom market, were founded. Today, it is quite a different story. Moderate activity exists in new startups. Invensense, LV Sensors and SiTime are three new promising startups in Silicon Valley that have been venture capitalist funded. Most MEMS/MST optical telecom companies have gone out of business or have been consolidated. VC's have elected to not continue to fund many of these companies. However, the good news is that US venture capital firms have raised more venture money in the first half of 2005 than they did in all of 2003 and the $6.1 Billion US they raised in Q-2 2004 is greater than any three month period since 2001. Mergers and acquisitions (M&A) have been on the upturn, especially in optical telecom. The early wealth created in the MEMS/MST industry by a small number of entrepreneurs was vis-à-vis acquisition by large optical telecom companies. Due to the demise of this industry, these acquired MEMS/MST companies also were adversely affected, sold, or written off by their previous owners. A positive note here was the acquisition of BEI Systems by Schneider in a stock trade valued at $562 Million US and the pending acquisition of Knowles (microphones). In the US, there has been $7.16 Billion US in M&A through mid September 2005 comapred to $5.5 Billion US in 2003 and $8.3 Billion US in 2004. A number of biomems companies have gone public in the 1996-1998 timeframe. However, these companies have not been as successful as hoped for with their sales volumes less than projected and stock prices currently not much higher than their original offering price and certainly significant less than their historical high, e.g. Cepheid, Affymetrix. Profitable MEMS/MST companies are few and far between (e.g. Micralyne and NovaSensor, Analog Devices, Silicon Microstructures). This is due to many factors including the commoditization of solutions (automotive sensors), small number of killer applications, and lack of product differentiation and adequate marketing. Companies including Akustica (microphones), IMT (MEMS foundry),Colibrys (accelerometers and foundry) and Microfabrica (foundry) have received substantial second round venture capital funding. Although a great deal of funding has been allocated to new Nano companies, MEMS/MST companies are beginning (again) to attract the interest of VCs because they show well-established market opportunities. In summary, things are getting better and are expected to continue to do so into the near future barring unforeseen major economic downturns.

Technology Cluster Development (Grade = B+):

This subject was added in 2003 to reflect the ever-increasing value that regional and federal governments place on micro and nanotechnology as a viable business. No less than 20 MEMS/MST/NANO clusters have been

SUBJECT	1998	1999	2000	2001	2002	2003	2004	2005	Change
R&D	A	A	A	A	A	A-	A-	A-	0
Marketing	C-	C	C+	C+	C+	C	C	C+	+1
Market Research	C	B-	B-	B-	B	B	B+	B-	-2
Design For Manufacturing	C+	B-	B	B	B	B	B	C+	-2
Established Infrastructure	C+	B	B+	A	A	A	A	A-	-1
Industry Association	INC	INC	INC	B	B+	B+	B+	B	-1
Standards	INC	INC	INC	INC	C	B-	B-	B-	0
Management Expertise	C	C	C+	C+	C+	C+	C+	B-	+1
Venture Capital Attraction	C	B-	B+	A	C	C-	C	C+	+1
Creation Of Wealth	C	B-	B+	A	C	C-	C-	C-	0
Industry Roadmap	N/A	B-	B	B+	A-	A	A	B	-3
Profitability	C-	C-	C-	C-	C-	C-	C-	C	+1
Employment	INC	INC	INC	INC	INC	C	C	C+	+1
Cluster Development	INC	INC	INC	INC	INC	B	B+	B+	0
Overall Grade							**B**	**B**	**0**

Figure 1: MEMS Industry Report Card

formed since the first one in Dortmund Germany in 1986 [2]. Currently, clusters exist or are in the process of being formed in Europe, Asia/Pacific, North and South America. Of considerable interest is the level of commitment of the regional governments of Edmonton Canada, Manaus (Amazon) Brazil [3] and in Mexico especially in Paseo De Norte in their rapid expansion of programs to support MEMS technology development. To date, thousands of highly trained and high paying jobs and scores of companies owe their existence to the creation of these more than 20 clusters. Lesson to be learned from the Semiconductor Industry: clusters certainly have existed in the semiconductor industry since the early 60's. Silicon Valley, Route 128, and Austin, Texas are most noteworthy. The intellectual property, source of capital funding and establishment of in-depth infrastructure associated with these semiconductor clusters are prerequisites for future success.

Lessons to be Learned

So, what commercialization lessons have been learned to date by the Nanotechnology industry and what are the key lessons to be learned from the semiconductor and MEMS/MST industries? 1) Do not create technology for technology sake…the raison d'etre should be a well-defined market need for a specific solution that is uniquely enabled by a nanotechnology-based solution. 2) Care must be taken to understand competitive offerings and to communicate/promote to the market the unique customer benefit of the nanotechnology-based approach. 3) Do not fall prey to and participate in the great "hype" of nanotechnology in the popular press.

It is gratifying that nanotechnology research has received a great deal of support from governments worldwide with 2005 funding levels exceeding $3.0 Billion US. MEMS/MST has never achieved this level of support from federal governments and is more than likely not to ever achieve such. In addition, a great deal of private investment through venture capital has made itself available…more so than has ever been available for MEMS/MST. A number of the companies that are being funded are in the equipment and metrology area…the creation of a solid manufacturing infrastructure to insure large throughput and low-cost nanotechnology-based solutions was a major deficiency of the MEMS/MST industry as can be seen from the report card. Most noteworthy is the National Science Foundation in the US and their major support through numerous grants to support Nano-manufacturing research. At this point in time, it appears that nanotechnology has been a good student of its bigger brother, i.e. MEMS/ MST in a number of areas noted above. The challenge will be to continue to fund research; attract venture capital money; continue to support infrastructure development including design for manufacturing, metrology and manufacturing equipment; and to create roadmaps and standards to help guide the direction of these efforts.

Summary

As one can see, the MEMS/MST industry has made significant advances in overcoming commercialization barriers since the first report card was published in 1998. While a number of grades have changed over the past 12 months, the 2005 overall grade remains at a B. Many lessons have and still need to be learned from the semiconductor industry (as well as other industries). It is interesting to note that education continues generation after generation, today education opportunities abound in the nanotechnology industry from its big brother, the MEMS/MST industries. The author strongly recommends that people interested in the commercialization of nanotechnology become students of the progress of both the semiconductor and MEMS. To quote a popular author, George Santayana in his book, The Age of Reason (1908-1910)…"Those who forget the past are condemned to relive it". For an expanded version of the Report Card, please go to www.rgrace.com or reference [4].

References:

[1] Presentation to Solid State Sensors and Actuators Conference, Hilton Head, South Carolina, June, 1988.
[2] R.H. Grace, "Technology Clusters and Their Role in the Development of the Microsystems Industry", Proceedings of COMS 2003, Amsterdam, The Netherlands, September 8-11, 2003. (www.rgrace.com).
[3] R.H. Grace, "Conference Report on the Second SUFRAMA MST Conference (MINIPIM) in Manaus Brazil", Micro Nano Newsletter, December, 2005.
[4] R.H. Grace, "An Updated Report Card on the Barriers to the Commercialization of MEMS and Nanotechnology: Lessons to be Learned from the Semiconductor Industry", Proceedings of the 10th. International Commercialization of Micro and Nano Systems Conference, Baden-Baden Germany, August 21-25, 2005, pp. 471-476.

Contact:
Roger H. Grace
President, Roger Grace Associates
Past President, Co-Founder, Micro and Nanotechnology Commercialization Education Foundation (MANCEF)
E-Mail: rgrace@rgrace.com
www.rgrace.com

NEXUS Market Analysis for MEMS and Microsystems III 2005 - 2009

Henning Wicht and Jérémie Bouchaud

MEMS and Microsystems sensors and actuators are consolidating their position in established markets and finding new applications, leveraging a combination of low manufacturing cost, compact size, low weight and power consumption, and increased intelligence. In the next five years, the market will grow at 16% per year from $12 billion in 2004 to $25 billion in 2009 for 26 MEMS/MST products. Chief among these are read/write heads with a 51% share and micro-displays, which will overtake inkjet heads by 2009. Fast growing markets for microphones, RF MEMS, and tire pressure monitors are examined next to established pressure and motion sensors, which are increasingly being driven by consumer applications.

Introduction

The Nexus Market analysis for Microsystems has been the most recognized source of market data for Microsystems worldwide since 1998. The Task Force Market Analysis has just released the updated report entitled "Market Analysis for MEMS and Microsystems III 2005- 2009." This follows on from the highly successful 1996-2002 and 2000-2005 reports that have become industry standards. **The new report is completely revised**. It shows new MEMS/MST products, application fields and a worldwide regional analysis of competencies

The total market for MEMS and Microsystems

The new study estimates a projected market growth for 1st level packaged Microsystems and MEMS from US$ 12 billion in 2004 to 25 billion in 2009. This corresponds to an Annual Compound Growth Rate (CAGR) of 16%. Considering the traditional NEXUS definition used in the reports I and II - the market for the smallest unit, incorporating MST component(s), that is commercially available - the market will increase from US$ 33.5 billion in 2004 to US$ 57.1 billion.

Market by MEMS/MST products: micro-displays are the new blockbuster

Graph 1 features the market for 26 MEMS/MST products investigated in the study Three products will still account for 70% of the market in 2009: read/write heads, Inkjet heads and micro-displays.

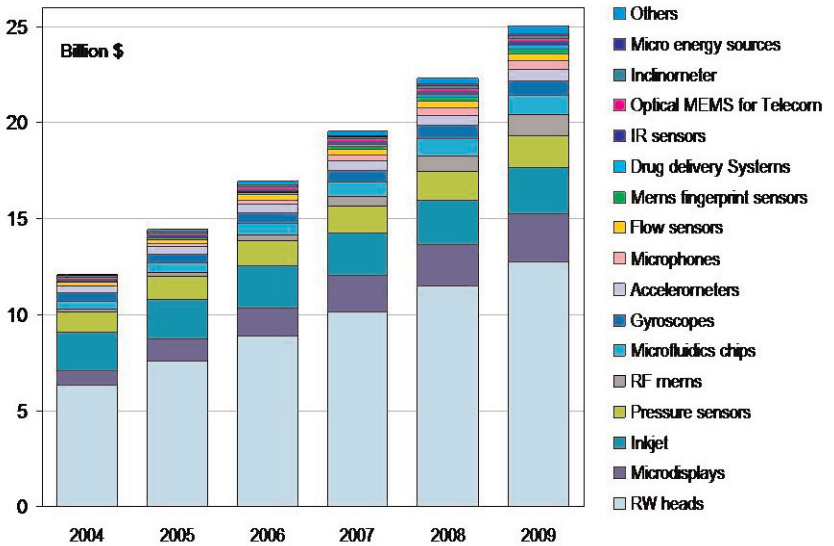
- **RW heads** will still represent around 51% of the market in 2009. Traditional application for PCs will grow moderately; however, the RW market is experiencing a renaissance in consumer electronics as hard discs are entering music players (e.g. in every famous i-pod), in smart phones (Samsung introduced the first cell phone with HDD in 2004), as well as digital video cameras, set top players, DVD recorders, etc.

- **Inkjet heads** will continue to be one of the most profitable markets for MEMS. The main driver for inkjet heads in the next 4 years is the printing of digital photos – especially cell phone cameras – growing at 15% to 20% per year. A major trend is the integration of non-disposable inkjet heads in the printer instead of disposable print heads in cartridges. After Epson and Canon, HP is starting to ship printers with integrated print head. This will slow down the growth in units; however, the value of these non-disposable print heads is 3 to 5 times higher.

- **Microdisplays** are the blockbuster of the 2004-2009 period. Microdisplays revenues will overtake inkjet heads in 2009 as Texas Instruments is forging ahead with the DLP chip for front projectors and rear projection TVs. DLP technology dominated the pront projector market almost 40% market share in 2004 and is also dominating the large screen rear projection market segment. The emergence of new MEMS micro displays products such as iMoD displays for mobile handsets from Qualcomm is also worth noticing.

Other fast growing markets are microphones, RF MEMS, and tire pressure monitors next to established pressure and motion sensors, which are increasingly being driven by consumer applications.

Emerging markets include wafer probes, liquid lenses for

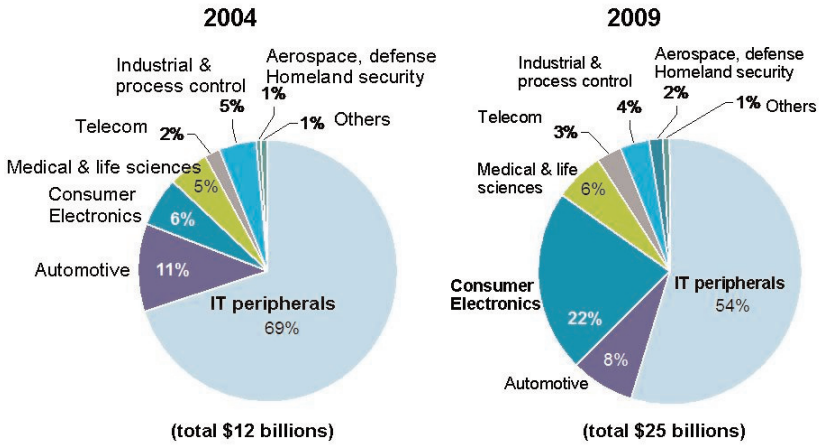


* Other are: Microreaction, chip cooler, MEMS memories, liquid lenses, microspectrometer, wafer probes, micro-mirrors for optical processing, micro-pumps, micromotors, chemical analysis systems

Graph 1: Total market for 26 MST/MEMS products

autofocus/zoom in camera phones, micro-motors, micro-spectrometers, micro-pumps and micro-reaction products. NEXUS also considers products that will begin to impact markets at the end of the decade, namely micro fuel cells, MEMS memories and e-fuses, chip coolers.

Market by application field: consumer electronics driving market growth



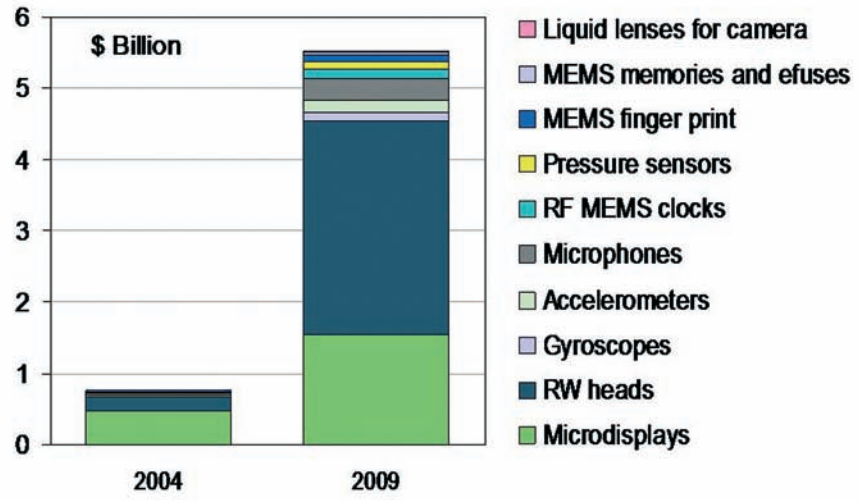
Graph 2: MST/MEMS market by application fields

The market by application field as shown in graph 3 may be subdivided into three main application fields: IT peripherals, Automotive and Consumer Electronics.

- **IT peripherals** will by far remain the first application field of MEMS and MST in 2009, mainly with RW heads and inkjet heads. However, the share of IT peripherals will decrease from 69% to 54%.
- **Automotive** will remain a major application field with several killer application fields such as airbags or Tire Pressure Monitoring (TPMS). Numbers of units will still grow at a rapid pace; however, the growth in revenue will be moderate due to a continuous pressure on prices (e.g. gyroscopes: + 15% /year in units buts 8% in revenue).
- **Consumer electronics** will experience the strongest market growth in the time period under consideration and will overtake automotive. The share of consumer electronics in MEMS/MST markets will grow from 6% in 2004 to 22% in 2009.

NEXUS identified the three drivers for MEMS in consumer electronics as the following:

1. Large screens High Definition Television for everybody. Indeed, the market for rear projection TVs is skyrocketing from 6.5 M units in 2005 to 11.9 M units in 2009 according to iSuppli Corp.
2. More storage in digital equipment. HDD enter digital video cameras, music players, smart phones… Shipment of HDDs is expected to explode in consumer electronics from 10 M units in 2004 to 200 M units in 2009
3. Mobile handset…you can also phone with it. After MEMS accelerometers from ADI which entered a cell phone from NTT Docomo in September 2003, a number of MEMS products are following including pressure sensors, gyroscopes, MEMS display, micro fuel cell, MEMS fingerprint, liquid lenses, thermopiles…



Graph 3: Market for MST/MEMS in consumer electronics

Conclusion

The MEMS/MST market volume was worth $12billion in 2004. It is expected to reach $24billion in 2009. The growth is still rapid: 16% CAGR in value in 2004–2009. Consumer electronics will drive market growth in the next 4 years. With regard to products, 14 out of 26 MEMS/MST products are expected to exceed $100 million in revenue in 2009. Completely new products in 2009 will include micro fuel cells, MEMS memories, chip coolers, liquid lenses for cell phone zoom and autofocus.

Contact:
Henning Wicht, President
Jérémie Bouchaud
WTC – Wicht Technologie Consulting
Frauenplatz 5
D-80331 Munich, Germany
E-Mail: henning.wicht@wtc-consult.de

Continuation from page 15

sclerosis (MS) patients and it verified that the system is actually able to improve the patient's quality of life. It is necessary to consider the fact that a smart assistive toilet will bring direct and indirect benefit to all the stakeholders involved. Being more independent and autonomous in using the toilet is not only important for the individual's quality of life but also for the wider society.

Figure 3: Height and tilt changes to support standing up.

By introducing innovative technologies in the area of toilet and especially by providing a complete solution for the whole toileting area, the FRR consortium has contributed to empowering old and/or disabled persons to use public restrooms throughout Europe even if the individual has an increasing level of disability, and to supporting secondary users by providing an innovative, user-friendly and highly adaptable, smart toilet system. For more information regarding the different activities and outcome of the FRR project, please contact the web site of the consortium at www.frr-consortium.org and the site www.fortec.tuwien.ac.at/frr.

Acknowledgements
FRR was partially funded in 2002-2005 by the European Commission as project QLRT-2001-00458 under the Quality of Life programme. Project partners: Industrial Design Engineering - TU-Delft (NL), fortec - Research Group for Rehabilitation Technology, TU-Vienna (AT), Certec - Department of Rehabilitation Engineering, Lund Univ. (SE), EURAG - European Federation of Older Persons, Graz (AT), Laboratory of Health Informatics – Univ. of Athens (GR), Applied Computing – Dundee Univ. (UK), Landmark Design Holding, Rotterdam (NL), Clean Solution Kft, Debrecen (HU), SIVA - Centro IRCCS S.Maria Nascente, Milan (IT), HAGG – Hellenic Association of Gerontology and Geriatrics, Athens (GR). Ethical Review Team: Institute for Design & Assessment of Technology, Vienna (AT)
We gratefully acknowledge the intensive contributions to the FRR project provided by the members of the user boards and by the persons who have participated in the iterative cycles of prototype testing.

References

[1] Manufacturing Partner of the FRR Consortium: Clean Solution Kft, Hungary, www.cstechnologie.com/ and www.conplan.org
[2] P. Panek, G. Edelmayer, C. Magnusson, et al.: Investigations to develop a fully adjustable intelligent toilet for supporting old people and persons with disabilities - the Friendly Rest Room (FRR) Project, in: K. Miesenberger et al. (Eds.): Computer Helping People with Special Needs, ISBN: 3-540-22334-7, LCNS 3118, Springer, pp. 392-399, 2004.
[3] R. de Bruin, J. FM Molenbroek, T. Groothuizen, M. van Weeren: On the development of a friendly rest room, Proc. of INCLUDE Conf., Inclusive Design for Society and Business, 2003
[4] N. Gentile, et al.: Concept, Setting up and first Results from a Real Life Installation of an Improved Toilet System at a Care Institution in Austria, to be published in [5]
[5] J. Molenbroek et al. (Eds): Developing adaptable toilets of the future for disabled and elderly people, to be published by IOS press in 2005
[6] C. Dayé: The FRR-questionnaire - Assessing Who Needs What Where, to be published in [5]
[7] C. Dayé and M. Egger de Campo: User-Driven Research - How to integrate users' needs and expectations in a research project, to be published in [5]

Contact:
Prof. Dr. Wolfgang Zagler
fortec - Research Group on Rehabilitation Technology
Vienna University of Technology
Favoritenstrasse 11/029
A-1040 Vienna, Austria
Phone: +43 1 58801 42900
Fax: +43 1 58801 42999
E-Mail: zw@fortec.tuwien.ac.at
www.fortec.tuwien.ac.at/frr

Sensoric Textile Bed Cover

Klaus Richter and Mario Möbius

ITP GmbH aims to develop textile products based on high tech – innovations, developments of several sciences and businesses with the technological potential of the textile industry. Together with Fraunhofer Gesellschaft e.V., SCAI and the companies Suess Medizin-Technik and theTelematik-Center TMD GmbH, ITP developed a telematic patient surveillance system based on a textile sensoric bed cover.

Elderly bedridden persons have a tendency to decubitus, incontinence, unconsciousness, sweating, high heartbeat and similar conditions. Persons with dementia tend to escape from bed. A regular surveillance makes it possible to find out about a patient's current state. If necessary, an appropriate response can be activated. Quick measurements of several parameters (surface pressure, temperature, humidity etc.) serve as a basis for the required decisions.

The modular structured bed cover consists of several systems to register the parameters measured by integrated textile sensors.

The systems consist of the sensoric bed cover, an electronic device to process signals and a computer to process and store the data. All information is processed for further use via standard interface.
In the telematic solution the information is transferred to a central da-

ta bank via internet, where several measures can be coordinated.
The system is suited for people who are in need of care and attention, especially for home care use. The two-layered textile sensoric bed cover is placed on the mattress of the bed.

Maintenance:
The top and the bottom layer consist of the tight material AmbaGate, which is permitted for clinical use. It is welded to build a cover. 17 sensors on a carrier layer are embedded in this cover. Both, cover and carrier, can be tended textile.

Picture 1: Electronic device with mains appliance and wire to the bed cover

The bed cover was equipped with the following sensors:
- 12 textile pressure sensors with a size of 10cm x 10cm each
- 1 textile humidity sensor
- 1 textile sensor for incontinence
- 3 temperature sensors

Picture 2: Arrangement of textile sensors in the carrying layer
– here: 6 pressure sensors and 1 humidity sensor

Textile pressure sensors:
Textile pressure sensors developed by ITP were first used in this system. The use of textiles and avoidance of other materials is the particularly attribute of this innovative sensor. This implies positive attributes like textile care and a sensoric effect over the whole area. A specific arrangement and analysis ensure detection of a patient's position and movements.

Detecting movements helps prevent decubitus. A person's staying in bed may be recognized. After operations a certain position can be kept under surveillance. Through combination with the other sensors a multitude of conditions are deducible.

12 textile pressure sensors are embedded in the cover. They work independently from each other. The capacitive principle is performed by two conductive textile surfaces that build a plate condenser, while the carrying layer is the dielectric. It prevents plates contacting each other.

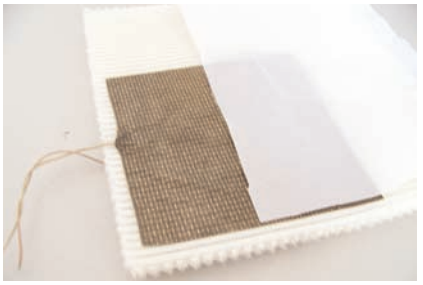
$$W = \frac{C * U^2}{2} \quad \text{(in VAs)}$$
$$Q = C * U \quad \text{(in As)}$$

Powering the condenser with voltage, an electric field develops between the plates.

The stored energy W and the charge Q depend on the capacity C and the voltage U.

The capacity is determined by the design of the condenser and it's getting higher as:
- the size of the plates increases,
- the distance between the plates decreases.

The capacity is changed by changing the dielectric. This effect is used to receive electrical signals. The pressure sensors in the cover have the following capacities:
- 30 pF without pressure
- 50 pF while maximally loaded



Picture 3: Structure of textile pressure sensor

The sensor consists of a spacer fabric with high conductive surfaces. To transfer the signals outside those surfaces are contacted to the electronic device using conductive glue.

Textile Humidity Sensors:
The Textile Research Institute Greiz e.V.developed those humidity sensors. They detect relative humidity within the bed cover. A patient's sweating can thus be established. The working principle bases on resistivity. The sensor signal output is indirectly proportional to humidity. The same sensor is integrated in the electronic device, because the humidity of the environment influences the measurements of the sensor in the bed cover. This allows calculating actual humidity.

Picture 4: Textile Humidity Sensor

The sensor for incontinence is located in the centre of the cover near the surface. Since it emits a 0/1 signal, calibration is not needed.
The contact zones are at the right and left end of the sensor. Again the contact is realized using conductive glue.

Temperature Sensor:
To detect a patient sweating, his/her temperature has to be measured too. Likewise a non-intentional uncovering and subsequent freezing can be detected. A reference in the electronic device is planned to receive precise results.

Analysis of Sensor Signals:
The electric signals are transferred by a bus system via flat cable to a plug that is still part of the bed cover. The plugged electronic device controls and analyzes the measured signals. The sensoric bed cover is a closed textile system that can be linked via standard protocol to several other systems.

Contact:
Mr. Klaus Richter, CEO
ITP GmbH
Otto-Schmerbach-Str. 19
09117 Chemnitz, Germany
Phone: +49 3643 777596
Fax: +49 3643 202088
E-Mail : richter@gitp.org

MEMS-based Technologies and Smart Detection Systems for Ambient Assisted Living

Leandro Lorenzelli, Cosimo Distante, Andrea Simoni, Paolo Busetta and Mukhiya Ravindra

The aging of the population, the increasing cost of hospitalization, and the desire for living independently in a familiar environment make MEMS-based technologies and smart sensors for home safety particularly valuable to elders as well as to their concerned relatives and to health authorities. Care at home is often preferable for patients and is usually less expensive for care providers than institutional alternatives. For healthcare applications, the objectives are to recognize and to prevent potentially dangerous situations. Heath and humidity alarms, remote health monitoring, wireless and wearable electronic microsensors, such as fall detectors, can improve older people's safety and security. Sophisticated multisensor fusion is often needed in home care to reduce the chance of missing events and at the same time preventing a sense of intrusion in the private life of the patient. We present, as a case study, a system in which data from wearable wireless MEMS devices are integrated with information from static optical environmental sensors to detect home accidents and react according to user's feedback (or lack of it, as in case of a shock).

The health care need

It is widely claimed that innovation in healthcare technologies can contribute to increased access to and improved quality of care and reduced costs. Health care consumes 15% of the US gross national product and over 10% in Japan and Europe, and these numbers are increasing.

With healthcare expenditures of over several millions Euros, even small efficiency gains in labour – the most expensive element - can have a significant economic impact. Technologies for ambient assisted living can help, by addressing the problem of transferring basic patient information over networks, holding diagnosis, treatment, monitoring and education of patients by using systems that allow remote access to expert advice and patient information. For the devices and software to be effective, however, it is necessary to integrate technology with healthcare applications and clinical procedures.

New developments in assistive technology are likely to make an important contribution to enabling elderly people to live self-determined and comfortably in their own home. Remote health and video monitoring, wireless electronic sensors and equipment such as fall detectors, heath and humidity alarms can improve older people's safety and security. Care at home is often preferable to patients and is usually less expensive for care providers than institutional alternatives: having patients treated and monitored outside hospital structures is not only an economic issue but an important aspect in improving the quality of life of the patient. With this aim in mind, we highlight an important consideration that has come from the Association for the Advancement of Assistive Technology in Europe (AAATE) conference (AAATE 2003 Conference, Dublin): "There has been considerable interest in providing assistive technologies and telecare solutions to enable people to stay in their own homes for longer. However, there has been little formal evaluation of these technologies." The next generation of older people may live in a world where every beat of their hearts and every ordinary thing they do is watched, analyzed, and evaluated for signs of trouble. Such care may actually be less intrusive than the alternative: the loss of independence that follows when people must leave their own homes for nursing homes.

The case study

The ITEA (Trentino Institute for Public Housing), a public institution utilized by the Autonomous Province of Trento (Italy) to implement public residential housing projects, has started a domotic programme to aid citizens with physical disabilities. Particular attention is given to the elder population, as the average age is increasing. In the Trento province, 17,8% of the total population is above 65, 8,7% is above 75, and 2,4% above 85. The goal is to let the elder citizens live in their home as long as possible to avoid the discomforts of hospitalization, but providing the same level of safeness and health monitoring. The reference scenario within the ITEA programme is that of an autonomous elder home user whose environment is pervaded with sensors and computing devices, which, in turn, are connected to remote assistance as required and appropriate for each specific case.

A solution based on Microsystem Technology

In the first phase of the project, we have decided to focus on the detection of the fall of the home inhabitant. This is one of the most common home accidents for elder people. To detect a fall we use two types of sensor: (1) a custom wearable MEMS accelerometer with WiFi radio transmitter, being developed by ITC-irst and DIT-University of Trento; (2) a set of WiFi cameras together with a sophisticated image processing module computing mass centre and posture in real-time, developed by CNR-IMM of Lecce. The devices publish their events on the event server; one of their subscribers is an expert system that provides instantaneous reaction to alarm situations and longer-term mining of data to detect patterns of behaviour. The expert system, based on the JESS rule engine, uses ECA rules and approximate pattern matching.

The general architecture is summarized in Figure 1. All sensors, including the video, broadcast updates on their state on dedicated multicast IP channels; in particular, the video processing system sends its current hypothesis on the posture of the person being tracked as well as the raw output of the neural networks, analyzing the features at the end of the analysis of each frame. Similarly, a computer equipped with a radio receiver filters the raw data sent by wearable sensors, removes noise, and re-send them on its multicast channel.

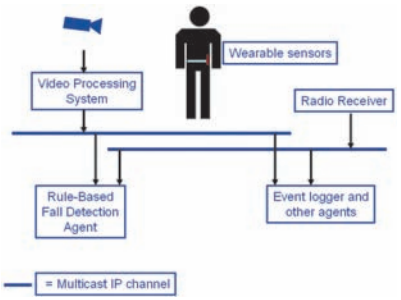


Figure 1: General system architecture

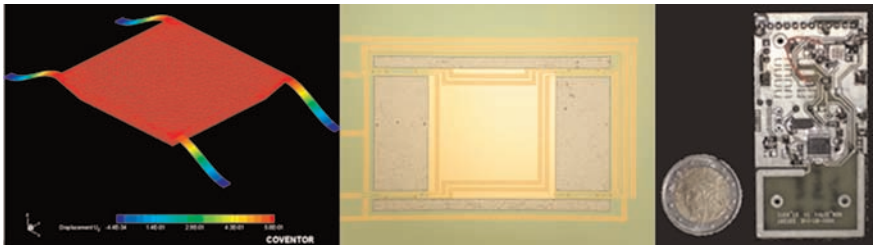


Figure 2: MEMS accelerometer. Finite element simulation of displacement in Z- direction (left) and microphotograph of the fabricated device (centre) and first prototype of the wireless wearable fall detector (right).

The MEMS-based wearable fall sensor

The first prototype of wearable sensor used for the current demonstrator is an accelerometer, developed by Microsystems Division of ITC-irst, to be attached at the level of the hips. Both commercial and custom MEMS-based accelerometers have been evaluated as fall detector. MEMS inertial sensors are becoming more and more popular because of their small size, CMOS compatibility, reliability and on chip integration with the electronics. Among varieties of applications of MEMS accelerometer, here our focus of concern is on the consumer and safety appliances. Bulk micromachined accelerometer is a miniaturized silicon accelerometer based on Newton's second law of motion, consisting of seismic mass, four beams and reference frame. Proof mass is truncated pyramidal shaped due to an-isotropic etching in TMAH (25%), and suspended by four beams symmetrically. Beams are placed on the edges of proof mass to minimize off-axis sensitivity. N-type (100) Si wafer is used to fabricate the accelerometer, in which proof mass edges and beams are oriented in <110> direction. Sensing is based on the piezoresistive property of the silicon because of its ease of fabrication and to integrate with electronics, but suffers from cross axis sensitivity because beams are on the top of the wafer.

Cross axis sensitivity is minimized by the proper electrical interconnections of the piezoresistors and connected to form a Wheatstone bridge. Based on simulation and technological limitations the device dimensions are found to be 9900 µm X 5500 µm. Sensing direction and range are application-specific; the device is designed for low-g singe-axis (out-of-plane) acceleration, but can be used for two/three axis acceleration measurement by changing the orientation and the sensing direction.

This device samples the vertical acceleration and sends up to 4 notifications per seconds, representing the average value of the acceleration since the last notification: at regular intervals the accelerometer sends a liveliness message to inform of correct functioning, then it notifies when it detects acceleration due to the fall and an even stronger, negative acceleration due to the impact with ground. Finally, no acceleration is detected when the user is lying on the floor. To save battery, messages are sent only in the presence of a significant acceleration and for a short time afterwards.

Image processing and event aggregation

The recognition experiments have been executed on grey level sequence images acquired with a Pulnix CCD camera at a frame rate of 15Hz. Examples of casually chosen images used in the experiments are shown in Figure 3. The images coming from the camera are analyzed and the position of the user is categorized in "upright", "bent" or "lying". The software is very accurate as long as there are no other people in the range of the camera, otherwise tracking of the user may result in mistakes. Finally, the expert system aggregates the notifications from the accelerometer and from the camera and generates an "attention" event followed by a "fall detected" event. The implemented architecture is completed by a wireless subscribing to the "fall detected" event, and generating an alarm whenever notified of the fall event.

Conclusions

Initial tests on our fall detector are very positive. Its architecture is designed to accommodate additional sensors (biometrical and biochemical sensors) and processing components. The results obtained inevitably lead to the conclusion that the proposed microsystem architecture could be a very useful tool for monitoring and managing health status in a person. Nevertheless, a thought should also be given to the massive amount of testing that any medical system must go trough before being allowed out into the market.

Contact:
Dr. Leandro Lorenzelli
ITC-irst Microsystems Division,
Via Sommarive, 18
I- 38050 Povo (TN) – ITALY
Phone: +39 0461 314455
Fax: +39 0461 314 591
E-Mail: lorenzel@itc.it

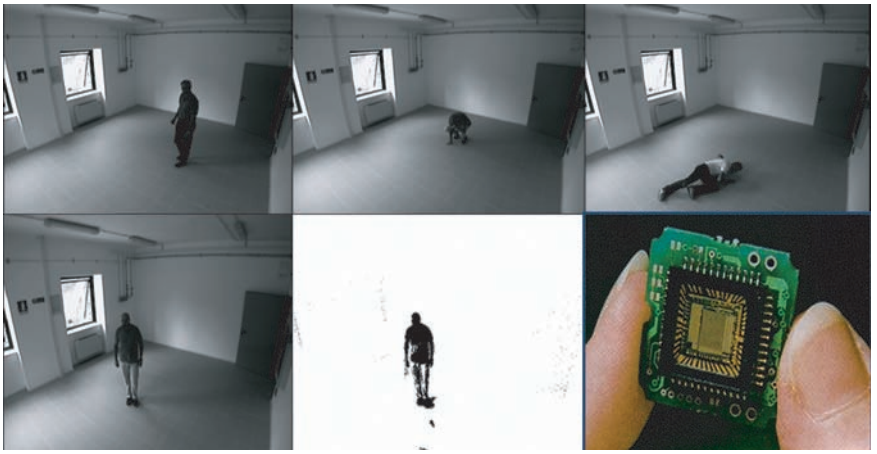


Figure 3: Example of image sequences used for posture estimation in the experiments, (the set is a series of people images in standing, squatting and laying position) and results of the adaptive background subtraction technique for motion detection in indoor scene (bottom centre image).

Laser Technique Improves Safety for the Blind

Maria Ritz and Lutz König

Blind people use a long cane for orientation. The long cane is a very simple, yet very effective aid. However, it has one major disadvantage: Obstacles in the head and chest area are not detected and this can lead to accidents and injuries. Vistac GmbH in Teltow, Germany, has developed the Laser Long Cane to overcome these difficulties using laser distance measuring techniques.

The Laser Long Cane is a primary mobility device for the blind. A laser system, integrated into the handle of a conventional long cane, provides protection against obstacles in the head and chest area like lorry loading ramps or low-hanging branches that cannot be detected by the conventional long cane.

The laser beam is emitted in walking direction approximately 90° to the cane and shaped like a fan: it is focused in the horizontal and widened in the vertical dimension (see Fig. 1).

Thus, the space directly above the cane is covered. As soon as an obstacle is detected within the cane's range the handle vibrates, forcing the user to react. Since the laser fan is very narrow and is projected above the cane, obstacles can be localised very accurately.

In the field of electronic travel aids the unique selling proposition is the limitation of the range to the length of the long cane. This range limitation spares the user a lot of unnecessary warning signals and it allows simple yes/no information.

Technically speaking, the Laser Long Cane uses a Lidar (light detection and ranging) system based on the time-of-flight principle. A short laser pulse (30Wpeak, 3,5ns fwhm, 1kHz repetition rate) is generated and the reflected light is detected by a high-speed detector. The detector is equipped with an avalanche photodiode (APD), the signal of which is amplified by a three-stage amplifier. The main problem during the development of the detector was to find a suitable compromise between sensitivity, speed, power consumption and accuracy while dealing with signals of very high dynamics (6 orders of magnitude!

Figure 1: Use of the Laser Long Cane (red is a schematic representation of the laser beam shape)

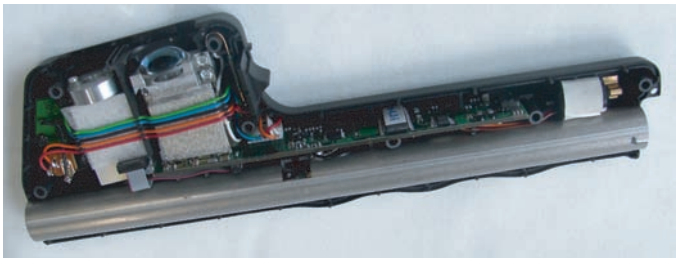


Figure 2: Interior of the Laser Long Cane handle

Imagine a bright wall directly in front of the detector or a clothes line as high as a user's head, i. e. at a distance of 1.5 metres).

The time interval between the emission and the detection of the laser light is analysed by a mixed-signal circuit generating a logic signal. This logic signal is interpreted by the microcontroller, which, in case of an obstacle, sends out the warning signal. Besides, the microcontroller monitors the functioning of the system, e.g. the accumulators, the voltage supplies, laser pulse, etc. The user is warned by a vibrational signal, similar to the vibrational alarm in mobile phones, but much stronger. The warning distance is individually adjusted to the size and cane technique of the user by simple push buttons.

The two-fold laser optics consists of a standard collimator and a microlens-array serving as a line generator. The easiest solution for a line generator – a cylindrical lens – could not be used, because these lenses create a Gaussian intensity profile. But it is essential to detect especially obstacles at the upper end of the line, i.e. at the height of the user's head. For the same reason no off-the-shelf lens for the detector could be used. The boundary conditions for the detector optics were: 1. high sensitivity at large detection angles, 2. focus of large angles onto the small diameter of the high-speed-photodiode (photosensitive area 0.25mm^2), 3. small distance between the lens and the photodiode. The best result could be achieved by using meniscus lense slightly off focus. The efficiency for off-axis light was increased and the distance between lens and APD could be kept as small as 6mm while focusing light from an angle of 35° onto the 0.5mm diameter of the APD. Fig. 2 shows the interior of the Laser Long Cane handle.

The two AA batteries are enclosed in the rear end of the AL-tube, whereas the front end holds the end of the long cane.

The Laser Long Cane may not be literally a micro-nano device, but it is one of the – if not the – smallest, lightest and least power consuming lidar systems. Future development will concentrate on further integration and miniaturisation to minimise size, weight and power consumption.

Contact
Dr. Lutz König
Vistac GmbH
Warthestr. 21
14513 Teltow, Germany
E-Mail: koenig@vistac.de
Phone: +49 3328 35 37 21

Elderly Remote Video Monitoring: Latest Technological Developments for a Greater Autonomy and Intimacy Preservation

Virginie Carniel

Older people consider the fact of being able to manage their own home as central to their independence. To facilitate remote monitoring of elderly people, EMITALL Surveillance has developed advanced solutions providing image access and automatic alarm notification via remote devices in mobile environment (e.g. mobile phones, smart phones, etc.) and Internet environment (e.g. PC's, laptops, PDA's, etc.). The system performs automatic event detection relying on one or more cameras, and eventually other sensors such as microphones, smoke or motion detectors. The scene under surveillance is continuously recorded and can be consulted either in real-time or offline. By analyzing the signals from sensors, and using advanced signal processing algorithms, the system detects alarm situations and notifies appropriate recipients. An automatic scrambling of regions corresponding to people enables relatives, caregivers, and authorized third parties to remotely verify the situation of elderly persons while preserving their intimacy.

Autonomous living

There is a growing concern over the speed and scale of global ageing worldwide and ageing society is one of the largest preoccupations for industrial countries.
Statistics about the demographic evolution of the EU population (about 374 million) gives a good illustration of this matter. It appears that in 2003 20% of the population was over 60 and forecasts show an increasing trend to reach 25% in 2020 and 33% in 2050.
In addition, demographic trends show as well that an increasing proportion of elderly persons in most Western countries are living alone, often in urban regions, and this propensity increases with age, especially for women in very old age. The likelihood of living in a nursing facility increases with age but most elderly people wish to live independently as long as possible.
A German study, conducted by "Deutsches Zentrum für Alternforschung" in 2001, shows the following results:
About 93.5% of Germans over 65 years of age live in private households, while 1.6% in special housing for the aged (e.g., assisted living), and 5.3% in nursing homes.

Of the 9.6 million private households with one or more persons over 65 years of age, 52.4% are single-person households, 42.1% are two-person households, and 5.5% are three-or-more-person households.
Those aged 60 to 64 years old spend 19 hours per day at home, whereas those over 70 years of age spend 20.5 hours per day at home, which corresponds to ca. 80% of the day.
It is clear then that among various socio-economical factors, housing conditions and autonomous living can be considered as some of the most important elements for the quality of life of older people. According to the Swiss National Research Program NRP 32 "Ageing" (François Höpflinger and Astrid Stuckelberger), they have a central effect on social integration.
The wish to stay in one's own home requires measures (e.g. forms of housing suitable for people with disabilities, remote monitoring systems) that enable autonomous living to remain predominant as long as possible. Latest developments of household technologies are the type of actions that contribute to improving elderly people's autonomy.
The rapid development of micro-systemic sensors, micro-electronic instruments and telecommunication-based support services is opening up new possibilities for older and elderly people.

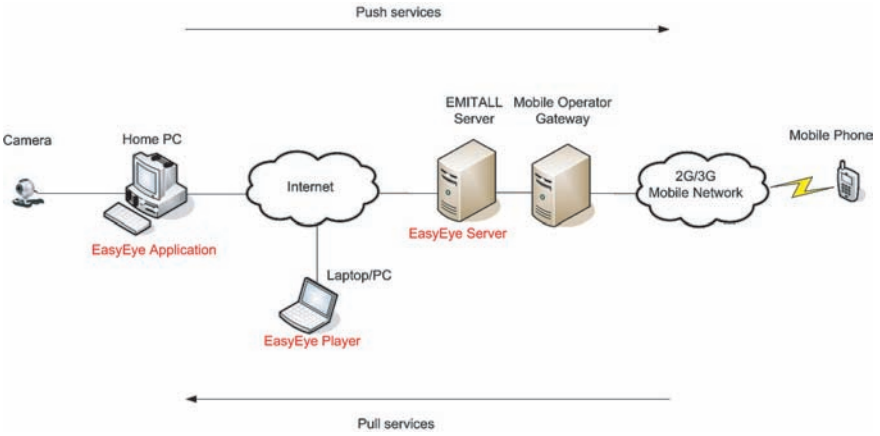


Figure 1: EasyEye system

Remote video monitoring system
The feeling of greater security can relieve the burden on social relationships, especially on relatives.

Thanks to remote-controlled appliances, elderly people feel more secure. Their autonomy is increased as elderly people decide themselves if they need assistance and help can quickly be called in emergency situations (e.g. after a fall).

EMITALL Surveillance has developed EasyEye Elderly monitoring system, a solution providing peace of mind for relatives and autonomous living for seniors. Relatives, friends, caregivers,

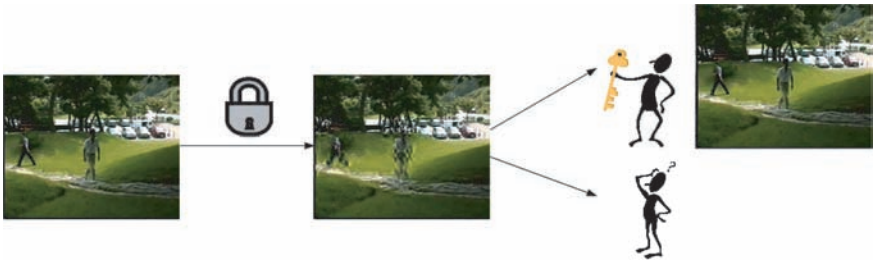


Figure 2: Scrambling / authorized unscrambling process

and other authorized parties can verify if the situation of a monitored person is normal using remote devices in mobile environment (e.g. mobile phones, smart phones, etc.) and Internet environment (PC's, laptops, PDA's, etc.). The solution generates automatic detection of alarm situation (e.g. slip and fall detection) and automatic alert notification to remote devices simultaneously in mobile and Internet environment.
Main Functionalities offered by EasyEye from EMITALL Surveillance are (as shown in Fig. 1):

PULL SERVICES

- **Remote command of the home security system**
  User can start or stop the system any time using a remote device (mobile or Internet environment).
- **The user can request any time an image of the scene under surveillance**
  Mobile environment: Multimedia Message Service (MMS)
  Internet environment: Internet image formats such as JPEG
- **The user can request any time a live video view of the scene under surveillance**
  Video streaming for 3G mobile environment or Internet
- **The user can request a view of recorded video**
  Video streaming for 3G mobile environment or Internet, and
  MMS for mobile environment

PUSH SERVICES

- **Automatic alert notification to remote devices simultaneously in mobile and Internet environment**
  User receives an alert notification (e.g. slip and fall detection) on remote device in mobile and Internet environment.
  User can verify the nature of the alarm, visualize the scene under surveillance, and take appropriate action if necessary

Intimacy and personal dignity
Monitoring systems bring the ethical question linked to electronic supervision with regard to restriction of personal dignity. In the USA for example, the long-term care industry has largely managed to block the use of "granny cams," video-surveillance cameras that families sometimes use to watch over elderly or disabled residents in nursing homes or other facilities. There are no laws against such cameras, but many nursing-home owners, as well as employees and insurers, discourage their use, on the grounds that they are an invasion of privacy.

EMITALL Surveillance therefore has developed an advanced technology providing privacy protection in private or public elderly monitoring. The system performs automatic scrambling of regions corresponding to people, and their goods, thus allowing to preserve their privacy. Fig. 2 shows the result of the process.

EasyEye Elderly monitoring system runs on basic home infrastructure such as a PC and webcams, and can be enhanced by other types of microsensors such as smoke, temperature and motion detectors. This way microtechnologies and vision technology together can help elderly to stay safe and secure in their own home.

Contact:
Virginie Carniel
EMITALL Surveillance (CEO)
Rue du Théâtre 5
1820 Montreux, Switzerland
Phone: +41 79 476 14 86
E-Mail: virginie.carniel@emitall.com
www.emitall.com

Innovative Mobile-Health Solutions Promise to Improve Elderly Care and Save Costs

Ofer Atzmon

The growth of the aging population increases the pressure on traditional healthcare systems that suffer from increased costs and shortage of resources. Recent advances in biosensor and wireless communications technologies enable the design of advanced mobile wearable telehealth monitoring solutions for elderly care. These solutions promise to improve the level of care and quality of life for the elderly population, and to expedite the trend of shifting healthcare delivery from hospitals to the community. Some of these new innovations are described in this article.

The Growing Burden of Elderly Care and the Paradigm Shift in Healthcare Delivery
With an aging population, hypertension and cardiovascular diseases (CVD) are major epidemics that significantly reduce quality of life and life expectancy, afflicting more half of all people older than 60. Hypertension is the main cause of cardiovascular disease which is today the #1 killer in the Western world. This is the cause of an ever-growing burden on national healthcare systems, which already suffer from increasing costs and chronic shortage of resources. As healthcare providers and national governments have been searching for cheaper and more responsive ways of delivering services, this has brought about a significant growth in telehealth and homecare services that enable people with chronic conditions to take greater control of their own health, and to be treated at home rather than keeping them in the hospital. The result is a significant

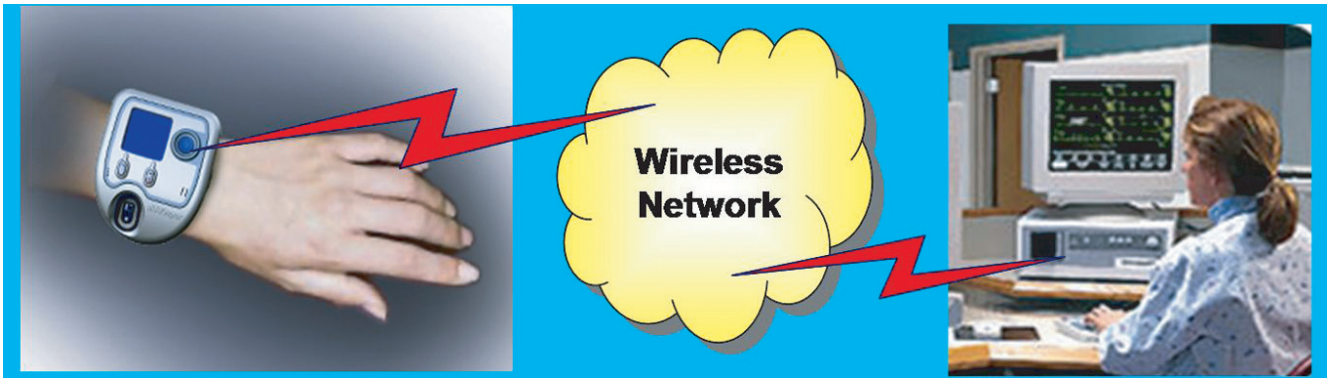


Figure 1: MDKeeper™
MDKeeper™ enables elderly users to be continuously monitored for their health by remote medical professionals, trigger an alarm, talk to a doctor, receive calls from anyone, and stay in touch with relatives or caregivers, from anywhere at anytime.

paradigm shift in the healthcare industry that is taking place on a global scale. After centuries of delivering health care in hospitals, healthcare providers are now shifting towards treating patients in their homes and communities.

Innovative Wireless Solutions Hold Promise for the Future
Recent advances in biosensor miniaturization and mobile wireless communications technologies hold the key to this change and enable the introduction of highly usable mobile-health devices to enhance elderly care.

Tadiran LifeCare, a new business unit of Israeli-based wireless communications company Tadiran Spectralink Ltd. (www.tadspec.com/lifecare), recently unveiled a series of new and exciting products addressing these trends. These cellular-based wrist-wearable mobile monitoring devices enable the transmission of real-time data, such as medical information, environmental data, location or distress alarm, to a remote monitoring center. All of these products incorporate a built-in Wireless Module by **Siemens Communications** (www.siemens.com/communications), enabling users to be monitored continuously and effortlessly from anywhere, at anytime.

MDKeeper™ - "Mini Hospital" on the Wrist
MDKeeper™ - which was recently unveiled by Siemens Communications and Tadiran Spectralink Ltd. at the Innovations Day on Communication Networks 2005 - is a portable "mini-hospital" which is designed to make life easier for at-risk patients, chronically ill and people requiring nursing care. The device lets patients monitor their health and get help when there is no doctor around.
MDKeeper™ is worn on the wrist like a watch and enables continuous monitoring of patients' vital signs, such as pulse rate, Electrocardiogram (ECG) and blood oxygen saturation level (SpO_2). Patient at risk with cardiac or circulatory diseases, seniors and people with chronic illnesses can enjoy constant monitoring and support without having to visit their doctor. The information is stored, analyzed and transmitted in real time, or as needed, by an embedded Siemens MC55 GSM/GPRS radio module, to a remote medical center, where it is received and further analyzed.
A special medical monitoring station, called **RemoteKeeper™**, enables medical professionals to view, analyze and react on the information or alerts received from patients at remote locations. It also has a database and can be integrated with other hospital information systems, allowing exchange of data for better informed medical decision-making.
In addition, the device can send emergency calls or place mobile calls to predefined people or call center. With its integrated cellular module, the device works almost everywhere in the world on all GSM/GPRS networks. Above all, MDKeeper™ is very lightweight and easy to operate, requiring very little intervention from the user. Additionally, it can provide value added services, such as reminding the user when to take his/her medication or go to his/her doctor's appointment.

Figure 2: SKeeper™
With SKeeper™ worn on their wrist or neck, elderly people can trigger a distress alarm, talk to a doctor or a relative using speed dialling, receive calls from anyone, stay in touch and be located by relatives or caregivers, from anywhere at anytime.

First product tests are currently being conducted in Israel and in Sweden (with Karolinska hospital and Telia-Sonera telecom operator), with results expected later this year. MDKeeper™ will be commercially available early next year, with future models to be introduced later, that may include additional innovations, such as blood pressure measurements; real-time video encounters; and GPS location finding to enable the dispatch of specific medical emergency help when and where it is needed.

SKeeper™ - Cellular Distress Alarm for those in Need

Another new device intended for elderly or chronically ill, or even for children, is **SKeeper™**, a wrist-wearable personal locator and cellular communicator with distress alarm. SKeeper™ is not a medical device but is designed to provide peace of mind to users, their relatives and their caregivers. It can be used for example to assist people with Alzheimer. SKeeper™ enables users to place cellular calls to pre-defined numbers (such as to relatives or family doctor), location finding via a Web interface or another mobile phone, and a distress alarm in case of need, so help or medical advice is always just a pushbutton away.

Conclusions

The practical implementation of new wireless technologies offers elderly people and their caregivers enhanced quality of life, peace of mind and cost savings. Although healthcare systems are quite conservative, many experts believe that eventually the huge benefits of telehealth will overcome the bureaucratic and regulatory barriers and will become the foundation for future healthcare and social care systems. With innovative mobile-health solutions such as MDKeeper™ and SKeeper™ coming into the market soon, it is likely that these benefits will become a reality even faster than might be expected.

Contact
Ofer Atzmon
Business Development Manager
Tadiran LifeCare Div.
Tadiran Spectralink Ltd.
Kiryat Shmona 11015, Israel
Phone: +972 3 9229550
Mobile: +972 52 2451771
Fax: +972 3 9217714
E-Mail: oatzmon@tadspec.com
www.tadspec.com/lifecare

Advanced Technology for Production in Miniature Formats at Productronica 2005

Angela Präg

The entire hall B5 with more than 160 exhibitors will be dedicated to micro-manufacturing at Productronica 2005. The companies will present solutions for micromachining, ultra precision manufacturing and micro assembly. This makes Productronica the world's most important trade show for this growth segment. The MicroSystemsTechnology User Forum and live demonstrations will round off the exhibits in this sector.

PCs, mobile devices and electronic devices that are being used in an ever widening range of applications in industry, transportation and medicine have one thing in common: They are steadily shrinking in size – and with them, the electronics components and assemblies that comprise them. According to estimates from the "International Technology Roadmap for Semiconductors 2004," the width of the structures used in DRAMs will be reduced to 45 nanometers in five years, and by 2016, they will drop down to just 22 nanometers. Technologies that are used for processes such as those used to create ultra-thin transistor structures will be shown at Productronica 2005 from 15 through 18 November in Munich, Germany.

Making the Move into the Nanoscale Range

The exhibitor micro resist technology of Berlin, Germany, for example, is forming the foundation for an inexpensive alternative to lithographic processes with its thermoplastic polymers: The nanoimprint technology shown at MicroNanoWorld promises to enable the creation of structures that can even go below the scale of 10 nanometers. So far, it has been possible to print these structures on wafers with diameters of up to 20 centimeters. As a manufacturer of reticules, graticules and microstructures, the company IMT Masken und Teilungen AG of Greifensee, Switzerland, has additional complex microlithographic solutions in its exhibition portfolio. Visions for the advancement of production technology down into the nanoscale range are being made possible by the Fraunhofer Institute for Reliability and Microintegration (IZM) of Berlin, Germany. With what is referred to as a "nanolawn," IZM is making it possible to take a look at a connection technology of the future: Following the principle used with hook-and-loop fasteners, it could become possible in the future to connect electronics components without thermal side effects.

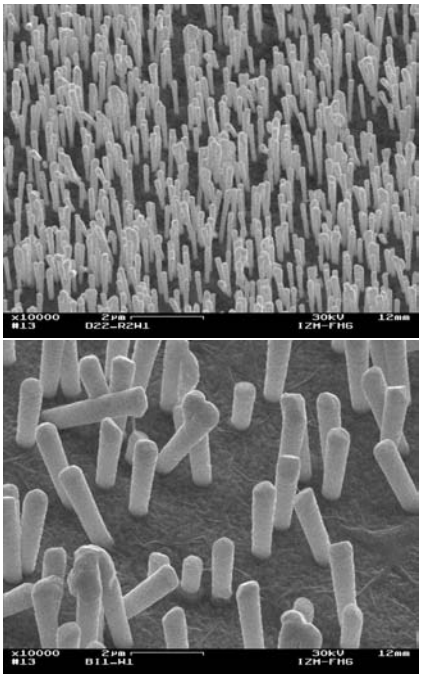


Figure 1 / 2: BIT 100 / 600 Nanolawn: "Nanolawn," consisting of gold wire with a diameter of 100 / 600 nm (source: Fraunhofer IZM)

Microproduction Technology in Action

At MicroNanoWorld, the Technical University of Munich's Institute for Machine Tools and Industrial Management (iwb) is demonstrating a telepresent microassembly plant. With this plant, it will be possible to conveniently put together microsystems from a workstation with a computer screen. This can be done by remote control using a force feedback control lever – which the trade public can try out in a live demo at the trade show. A demo plant for contactless wafer handling on the basis of ultrasound as well as a component mounting system equipped with air cushion grippers that also works without mechanical contact represent additional innovations from the iwb for microscale handling.

As additional exhibitors for microproduction technology, participants include such companies as Etchform precision etching, Netherlands; Häcker Automation of Schwarzhausen, Germany or QUASYS AG, Switzerland. Other participating companies include piezosystem jena of Jena, Germany; Carl Zeiss SMT NanoTechnology, Germany; Trumpf Laser GmbH, Germany; or Tecan Components Ltd., UK.

MicroNanoWorld – The Unique Platform for a Growth Segment

A total of 115 companies will present products related to MicroNanoWorld. Within this area the "MicroSystems Technology" User Forum will feature industry presentations and live demonstrations with a microproduction line. The focus is on all areas of microtechnical production including the packaging of integrated circuits, materials, production, component mounting, assembly and handling systems as well as measurement and testing systems. Here, the microproduction technology being presented is not only related to the manufacturing of electronics, but also to other fields such as mold and die making; microprocessing and ultraprecision production; measurement, testing, and adaptation technology as well as nanotechnology/ nanoproduction.

Fields that are related from a technical perspective, such as materials processing and back-end equipment for semiconductor manufacturing, are represented in the same hall. Thus, the entire hall will be dedicated to exhibiting microproduction.

Contact:
Angela Präg, Deputy Head of Marketing and Communications New Technologies
Messe München International, Munich, Germany
Phone: +49 89 949 20670
Fax: +49 89 949 97 20670
E-Mail: angela.praeg@messe-muenchen.de

MESSE MÜNCHEN INTERNATIONAL

MicroNanoWorld

Focus on the entire spectrum

® PRODUCTRONICA 15–18 NOV. 2005

Process flow and production equipment

Focus:

- MicroProductionTechnology
- MicroProductionSystems
- MicroSystemsTechnology – User Forum
- Product Market MicroTechnology
- MicroProductionLine

New Munich Trade Fair Centre

Organizer:
Messe München GmbH
Messegelände
81823 München, Germany
Phone (+ 49 89) 9 49 - 2 03 18/2 03 30
Fax (+ 49 89) 9 49 - 2 03 39

® electronica 14–17 Nov. 2006

Products and applications

Focus:

- MicroComponents
- Sensors
- MicroSystems
- SectorSpecificApplications
- World of MEMS

New Munich Trade Fair Centre

www.micronanoworld.com

Global electronics

www.global-electronics.net

Winning in accuracy is the strategy to winning the race.

NanoAlign

>>> ahead in throughput

We offer a full range of mask aligners with NanoAlign technology for high throughput double-sided MEMS lithography and bond alignment.

Your Benefits:

- Highest Alignment Accuracy
- Lowest Cost of Ownership
- Superior High Aspect Ratio Exposure Results

Wafer Bonders – Precision Alignment Systems – Resist Processing Systems – Wafer and Mask Cleaners – Inspection Systems – Integrated Systems

SOI – MEMS/MOEMS – Compound Semiconductors – Advanced Packaging – Power Devices – Nanotechnology – www.EVGroup.com

EVG®

EV Group
E-mail: info@EVGroup.com
Europe: +43 7712 5311-0
USA: +1 480 727 9600
Japan: +81 45 438 0663

SETTING THE PACE FOR MICRO ASSEMBLY SOLUTIONS

ASK ALPHASEM.

Boost your productivity all the way down from R&D to volume production in the MEMS and Microtechnology market with the advanced Flexline system. The Flexline platform line provides the distinct ability to quickly and easily change with today's flexible manufacturing environment. Whatever the job is or how turning demands are the system allows complete process implementation and tailored solutions for different applications. Benefit from Alphasem's more than 25 years experience in the backend and packaging market.

PLEASE CONTACT US FOR MORE INFORMATION.

Alphasem AG | Andhauserstr. 64
CH-8572 Berg/TG, Switzerland
contact@alphasem.com
Tel. +41-71 637 63 63
Fax +41-71 637 63 64

Alphasem
A DOVER COMPANY

www.alphasem.com