Personal Help Device (PHD*) and the Safety Net * — a personal agent and its associated local, regional, national and international infrastructure for Aid and Rescue

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Definition.

A long-term "grand challenge" for informatics could be the development of linked systems for the provision of aid, help and rescue to individuals or communities facing unusual situations or where help or assistance is required. The entry point would be the ubiquitous availability of a "Personal Help Device" (PHD) (which could otherwise be termed a "Personal Agent" or "Personal Aid" - PA) for each member of the general population. It could assistant them in their lives and in interactions with other people, with a (growing) range of in-built help systems in products, with on-line aspects of government agencies, with medical and emergency services, etc. ... as well as acting in a personal support role for a wide range of other value added services that you can imagine growing in future. It would link to a local, regional, national and international grid of knowledge and assistance services – for this the term "Safety Net" has been used reflecting a proposal for a Grand Challenge in a related area at the US Computer Research Association Workshop in June 2002.

The PHD could be provided to all citizens at birth in a simple easily deployed form. It could assist them or their carers in all their interactions from cradle/incubator through to infirmity in old age. Low cost versions would be available via non-governmental organizations (NGOs) via aid programmes. More sophisticated versions would provide a new and ever expanding market for novel and useful products.

There are many near-term possibilities: personalized information gathering systems, intelligent data mining, standardizing best practice procedures, emergency help and unusual procedure support active "manuals" to assist someone endings help.

Future portable or wearable devices could employ miniaturised sensing and, possibly, actuator technology to assist its user or others in close proximity. Biosensing and biomechanical aids could be linked – perhaps for drug dispensing to the infirm, links to artificial limbs, wheelchairs, hearing aids and other technology to assist a user could be envisaged in future. Extensions to larger environments with more capable sensors and actuators (such as parts of the kitchen, living room or the car) would provide vast new markets. Imagine the car as an "exoskeleton" of its driver or imagine emersive entertainment environments in the home.

The infrastructure within which such a P.A. could operate would create new opportunities to create a safer, more easily managed helpful environment for all. There could be related services embedded in products of the future, (via links from their help systems and in built test and diagnosis functions to the P.A. as well as up the chain of escalation of problems). There could be local, regional, national and international levels of support and service available. Links can be made to current and next generation location based services such as GPS and Europe's Galileo. A next

generation OnStar service (as sold in the US by GM in its cars for driver aid) might be an example. Entire new intelligent cities, highways and airports could take advantage of these aids to monitor the safety of individuals from criminal activities and natural disasters. Areas prone to problems could be instrumented and equipped in advance to mitigate the effects of an event by working with the P.A.s of individuals to carry out local sensing (and possibly actuation of emergency procedures and facilities from the device) even if their owner was incapacitated. Higher-level aids and rescue systems could work with P.A.s of rescue personnel.

The agent could work with help systems in embedded devices in the future. It could work with help desks and provide remote assistance where needed rather than leave you "hanging on the phone". This "agent" would be intended to work with a growing corporate (product and service support) national and world wide infrastructure for help, assistance, emergency handling and disaster relief on a wide range of scales from care in the community through to local, regional, national or even international responses. It could be particularly valuable to the very young and the elderly, and can also act as support throughout life. It could adapt to changing technology and services while presenting a personalised and user-centric interface to the user.

A specific benefit of the personal device and its connections to external aid and rescue environments could be to allow people with infirmities and in old age to remain active and safe longer than might otherwise be possible. The personal device could become a “companion” in old age assisting with daily requirements and acting as a conduit to friends or helpers who might possibly be widely distributed via the overall help grid.

Many research topics could be explored within this general area. The agent could use adaptive technologies, data interpretation, planning aids, etc. and be aware of world-wide information infrastructures and next generation semantic web services. It would assist in cooperative and collaborative activity, etc.

You can imagine this (and similar wide ranging challenges) being a long-term challenge that would allow many different technologies to be demonstrated and achievements made over the coming years. Japan for example has developed a 50-year programme in rescue systems and robotics to think of how systems could be developed to assist in emergencies such as an earthquake. Given knowledge that such things will occur, the idea is what infrastructure could be laid down in suitably prepared "intelligent cities" and how to equip rescue services and local people with aids for such an emergency. You can imagine systems that augment such personal, local and pre-built infrastructure when specific problems or disasters arise. Say by seeding an area with suitable sensors and microactuators – “showflakes” or “smart dust” - that can link into system grids to assist the local population and those giving aid.

Twenty-six nations around the Pacific Rim have been developing joint knowledge and procedures to assist in regional emergencies (the Multi-national Planning Augmentation Team). On a smaller scale the Washington DC area has just started a programme led by IBM and the University of Maryland working with all the local services to look at emergency responses by all agencies to a single freeway interchange in the DC area - to show the potential value of coordinated wireless computing services for integrated and cohesive response across all of the police,

ambulance, emergency support, fire brigade, chemical spill, military, etc. (CapWIN - Capital Wireless Integrated Network project).

Social research issues could be raised. Elements of trust in such devices in all their forms (what they do and how they do it) would need to be explored. How can we guarantee that personal data stays secure - as secure as if it was locked up in your own brain. There will be aspects of interaction with regulation and authority that need to be addressed. UN agencies might need to consider some extensions to the fundamental rights of man to ensure that national concerns did not interfere in the long term. The inputs and outputs of the device would possibly be subject to normal legislation and monitoring, but the personalised contents would not. It is a device for its owner only.

Intellectual property might be traded from a Personal Device with other devices and people on an agreed and user authorised basis. An enormous new peer-to-peer "knowledge" market could be encouraged to develop. The device might become a resource handed on (partially) to later generations in a family or in an organisation in which the individual works or operates. Imagine a great-grandparent saving the life of a young child years after their death by providing their handed-down knowledge through the family.

The dynamic and developing nature of the requirement would allow for many innovative solutions from local devices to entire large scale next generation product lines, local, regional, national and international agencies, etc. It is of course something that many organisations are already thinking about on narrower scales... but much more widespread thinking could follow from promoting the idea at a grand challenge level.

Scientific Significance.

Is it driven by curiosity about the foundations, applications or limits of basic Science?
The work requires many fundamental advances especially in the applications of science. Truly personalised and secure storage unavailable to others without authority. Trust aspects of computing and communications. Low cost, low power devices. User interfaces for the very young the very old. Knowledge systems and aids. Collaboration support. Etc. etc.

Is there a clear criterion for the success or failure of the project after fifteen years?
Lives saved and enriched.

Does it promise a revolutionary shift in the accepted paradigm of thinking or practice?
Yes.

Does it avoid duplicating evolutionary development of commercial products?
Yes. The scale and scope of the challenge precludes any initial development purely under commercial imperatives. Encourages a new deployment opportunity though. Government procurement for some rescue and emergency situations could provide an initial development spur.

Impact on Practice.

Will its promotion as a Grand Challenge contribute to the progress of Science?
Yes. “There cannot be a greater mistake than that of looking superciliously upon practical applications of science. The life and soul of science is its practical application” - Lord Kelvin of Largs, 1883.

Does it have the enthusiastic support of established scientific communities?
To be established.

Does it appeal to the imagination of the general public?
I think it might. Highly visible and exciting demonstrations could be planned.

What kind of long-term benefits to science, industry, or society may be expected?
Innumerable.

Scale and Distribution.

Does it have international scope?
Yes. Links to new long term challenging research in the US (e.g. DARPA’s new IPTO vision for Cognitive Systems) and in Japan (for the 50 year programme in the development of Robotic and Intelligent Rescue systems for natural disasters).

How does the project split into sub-tasks or sub-phases, with identifiable goals and criteria, say at five-year intervals?
It can be split up. Links to international competitions, etc.

What calls does it make for collaboration of research teams with diverse skills? Lots

How can it be promoted by competition between teams with diverse approaches?
Many aspects.

Timeliness.

When was it first proposed as a challenge? Why has it been so difficult so far?
Not really proposed on such a grand scale before. Aspects being studied in various places. Some attempts to create narrow scale commercial offerings (e.g. OnStar in the USA).

Why is it now expected to be feasible in a ten to fifteen year timescale?
Widespread personal communications devices provide a delivery platform. Work on long lived ontologically sound knowledge bases promises to avoid redundancy of early stored formats. Intelligent planning and collaboration support aids. Many aspects could be listed.

What are the first steps?
Build a small multi-tier aid and rescue system for a local authority liking in medical, police, fire and other emergency services – similar to the CapWin experiment in Washington DC..

What are the most likely reasons for failure?
Not having a sufficiently grand aspiration for how many aspects could be brought together, and leaving some parts as "islands of automation".

The desire by government agencies, and even companies, to access and control personal data and knowledge such that no one will trust the device to be a truly personal agent.

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