Institution: **University of Glasgow**
Unit of Assessment: **B11: Computer Science and Informatics**
Title of case study: **Kelvin Connect – a highly successful spin-out providing advanced mobile data capture systems for police officers and healthcare professionals**
1. Summary of the impact

A quiet technology revolution in the UK has been changing the way that police officers on the beat and hospital nurses access and record information, using handheld electronic notebooks that bring large time and cost savings. This revolution began as a University of Glasgow research programme and led to the creation of a successful spin-out company, Kelvin Connect. Acquired in 2011 by the UK's largest provider of communications for emergency services, Kelvin Connect has grown to 30 staff. Its Pronto systems are now in use by 10% of UK police forces and nursing staff in several UK hospitals.

2. Underpinning research

Context

The underpinning research, the 'Paraglide Project', began in 1999 at the University of Glasgow's Department of Computing Science with an initial aim of improving pre- and post-operative anaesthesia assessments that were then poorly served by computerised anaesthesia information management systems (AIMS) in hospitals.

Research team

The original research project was supported with a grant of £185,000 from the Engineering and Physical Sciences Research Council's healthcare informatics initiative and lasted from 1999-2001. The cross-disciplinary team was led by Philip Gray (Senior Lecturer in Computing Science, 1987-2011, Honorary Research Fellow 2011-13) and included Professor Chris Johnson (1994-2010), Dr Martin Gardner (Honorary Research Fellow 2009-10) and Dr Meurig Sage (Research Assistant and later Research Fellow 1996-2002), and Dr Gavin Kenny (Professor of Anaesthesia, Glasgow Royal Infirmary, University of Glasgow (1977-2007).

Research outcomes

The result of the project was the development and evaluation of a model for information capture using context-sensitive handheld Palm PDA devices, the supporting software architecture and an initial XML/Java-based implementation, all of which formed the basis for the Paraglide Clinical Assistant.

There were a number of unique capabilities and features that were developed within the software architecture as a result of the initial thorough appraisal of the information needs of an anaesthetics department: these features provided a flexibility and functionality that subsequently enabled this initial application to be rapidly developed for other uses.

The first significant feature was the design of a screen presentation of data that would work on a wide range of devices, from handheld mobile units to desk-based PC units. A '*navigator*' component was developed to give the healthcare worker rapid access to all data in the system relating to a specific patient as well as an ongoing case summary. This interface was designed around task-related groupings from models developed from the observational research, and offered the anaesthetist or anaesthetic nurse access to case data and data from other sources such as patient records, theatre lists, staff rotas and lab results.

A data entry technique was developed called Smart Pasting that allowed the user to populate the case record with a single click, based on predefined associations between the incoming documents and the case data structures. Smart Pasting is enabled by a dynamic link architecture that provides a set of features that were not found in any other similar system.

Another distinctive aspect of the project was the dynamic reconfigurability built into the system using a set of XML files to define all aspects of the application. This allowed the application to be quickly and easily changed to adapt to circumstances and needs in other settings. It was originally developed as a way to support data capture and audit by surgical pre-assessment nurses but has resulted in making the application extremely adaptable for uses outside of healthcare.

By the time the initial project was completed, the researchers had gained extensive knowledge in mobile information capture systems. They were interested in the possible commercial development of the technology and the next step was to create a commercial vehicle to take the technology to market. The result was the formation in 2002 of Kelvin Connect (named Scottish Spin-out of the Year in the 2003 Scottish Software Awards).

3. References to the research

Grants

£184,819 from Engineering & Physical Sciences Research Council, to Philip Gray for: Palm-held Anaesthesia Record Assistant - Gestural Interface Design and Evaluation (ParaGlide). (01/08/1999-30/09/2001).

Publications

Sage, M., Gardner, M., and Gray, P. 2001. A multi-scaled display technique for PDAs. In *CHI '01 Extended Abstracts on Human Factors in Computing Systems* (CHI EA '01). ACM, New York, NY, USA, 123-124. DOI 10.1145/634067.634142

Gray, P. and Sage, M. Dynamic Links for Mobile Connected Context-Sensitive Systems. In Engineering for Human-Computer Interaction 2001, Lecture Notes in *Computing Science*, vol 2254, Eds Little, M., Nigay, L., Springer Berlin Heidelberg, pp. 281-297, 2001. DOI 10.1007/3-540-45348-2_24

Gardner, M., Sage, M., Gray, P. and Johnson, C.W. Data Capture for Clinical Anaesthesia on a Pen-Based PDA: Is It a Viable Alternative to Paper? In, *People and Computers XV—Interaction without Frontiers*, Eds. Blandford, A., Vanderdonckt, J. and Gray, P., Springer, London, 2001. pp. 439-456. DOI 10.1007/978-1-4471-0353-0_27

4. Details of the impact

Kelvin Connect has continued to build upon this software to create a set of products that have been used by police forces in Scotland, England and Wales, and in the healthcare sector. The University received support from Scottish Enterprise in the spin-out company's early years, including a Royal Society of Edinburgh/Scottish Enterprise 'Enterprise Fellowship' for Dr Meurig Sage (Research Assistant on the Paraglide project) to support the formation of the company and product development, sales and marketing efforts. In 2002 Sage went on to become the company's Chief Technical Officer and is currently in this post in 2013.

By 2008 Kelvin Connect had partnered with Airwave, the primary communications supplier for UK emergency services, to provide mobile handheld data capture devices to police in Strathclyde, Lothian and Lancashire regions. In 2008 Airwave invested £1million in the company to support Kelvin Connect's rapid growth and to enable it to successfully bid for large law enforcement contracts through the National Police Improvement Agency's Accelerator Programme. In 2011 the University spin-out was wholly purchased by Airwave for an undisclosed seven-figure sum. Kelvin Connect now operates as an independent subsidiary of Airwave Solutions. It currently employs 30 staff and is in the process of expanding further.

The 'Pronto' product developed by Kelvin Connect and based on the original University of Glasgow ParaGlide research, can be easily and quickly configured to meet customer needs; it supports the rapid deployment of mobile information solutions allowing:

- data to be easily captured and accessed on a range of mobile devices, using discreet forms for specific purposes, ie for a police constable or traffic warden to enter details of parking offences
- data to be sent to a central Pronto server where it can be managed using sophisticated workflow rules and can be accessed by relevant users.

Pronto has been in use by the Lothian & Borders police since 2005. In 2008 Lothian & Borders began to roll out the use of Pronto to its entire force (The force covers an area of 2,500 square miles and serves a population of almost one million people, with around 4,110 staff including over 3,000 police officers.) From 2005 to 2012, Kelvin Connect has deployed more than 30 mobile processes to Lothian & Borders police, delivering business benefits such as the following:

- The use of digital and mobile Fixed Penalty Notices has reduced processing time from 4 minutes to 17 seconds, with the additional benefit that tickets issued are now 100% accurate (compared to a previous 80% accuracy rate, eliminating time and resource in dealing with returns). This one process alone has saved £126,000 per annum in keying and filing processing costs.
- With officers inputting crime reports directly via the electronic notebook £407,000 per annum has been saved in the cost of rekeying.

Other efficiency savings delivered through the use of Pronto include an annual saving of 19,000 hours per annum of police constable time in recording crime; a total saving of over 4,000 hours in the issuing of traffic tickets and 1800 hours in the issue of ASBO fixed penalty tickets. In total Lothian & Borders Police estimate their annual savings through the Pronto-supported changes to efficiency and frontline data collection at £600,000.

By 2013 Pronto had been rolled out to 10% of UK police forces including Surrey, and Kelvin Connect is currently involved in a trial for a national deployment of Pronto to all police forces in Scotland. A customer testimonial provided by Kelvin Connect states:

> *Being so close to London and with up to half of acquisitive crimes committed by travelling criminals from London, the workforce needs to be flexible and agile. Getting trusted information to the point of decision is key. This device, alongside mobile fingerprinting and ANPR, is one of the key elements of Operation Shield. [Surrey Police]*

In April 2013, Kelvin Connect successfully responded to the 'One Box' challenge set by the Association of Chief Police Officers to integrate the Pronto e-notebook into police vehicles, allowing the capture of information and images as well as the ability to search intelligence databases and back-office systems.

In the healthcare sector, the Pronto mobile health solutions developed by Kelvin Connect from the original ParaGlide research have been deployed to several hundred community nurses and to nursing staff in 3 hospitals in western Scotland. The system can be configured to suit any clinical or administrative team. It enables fast, validated data entry at the point of care/response and completely avoids the need to transcribe from paper forms, saving staff time and ensuring swift transmission and dissemination of patient or victim information. The system has enabled hospitals (such as Hairmyres, Monklands and Wishaw General – all NHS Lanarkshire) to implement 'Hospital at Night' services increasing the efficiency and accuracy of patient information and handovers between shifts.

In summary, the University's ParaGlide project has provided the foundation for the development of a successful University spin-out whose products have developed from this initial research to provide solutions that are saving the UK's police forces a minimum of over 50,000 officer hours per annum. In the healthcare sector, this technology provides a completely mobile front end that supports the rollout of electronic patient records and delivers faster and more accurate information from patients to healthcare professionals.

5. Sources to corroborate the impact

Kelvin Connect website
Airwave Solutions press release (25 April 2013) on the Kelvin Connect 'One Box' challenge: 'Kelvin Connect drives the future of mobile policing'
University press release detailing 2011 Airwave acquisition (April 2011): 'University spin-out company Kelvin Connect acquired by Airwave'
Original inclusion (2004) by Scottish Government news release as an exemplar of an 'award-winning academic spin-out company'

Kelvin Connect provide customer testimonials on their website (evidencing/reporting the implementation of the system by police forces in the UK), all of which appeared in *Police Professional* (professional journal for the UK law enforcement sector):

"It is a slicker process that will result in cashable savings. As the only force increasing police officer numbers in this time of austerity, the investment in mobile working will make a significant contribution to that. Mobile data also supports Surrey's Operation Shield, our initiative to tackle travelling criminals, where it is vital to obtain trusted information at point of decisions, enabling discretion based decision-making.

The ongoing dialogue that has helped to redesign processes could not have taken place in a classic contract discussion. The benefits of the process with Kelvin is that it has not been a straight replacement of a paper based system; it has been an opportunity to look at everything from end-to-end, from what happens with information right through to when it is no longer needed".

[Surrey Police].

"The days of using a paper notebook for 2000 of our officers have gone. The journey has involved altering support processes; it is not simply a case of giving out electronic devices and thinking the world will be better.

"It has borne fruit for both sides and the force looks forward to continuing to develop it in all the areas described. It has been a great benefit to have a long-term relationship to develop the system, to make it fit with the operational requirement. We have been hugely successful in making it work for the Lothian and Borders area. There are some things that need time to develop and test in an operational environment. There are discussions to be had with partners like the Crown Prosecution Service but, without the confidence in a partner like Kelvin Connect, that would be so much more difficult."

[Lothian and Borders Police]

"Police notes and witness statements are a vital part of the criminal justice process as they are used as evidence. Therefore, it is crucial that these documents can be proven to be authentic and easily accessible to police officers and lawyers. This new initiative will potentially allow frontline officer to type police notes and witness statements without having to return to the police station making the whole process more efficient and cost-effective at the touch of a button."

[National Policing Improvement Agency]