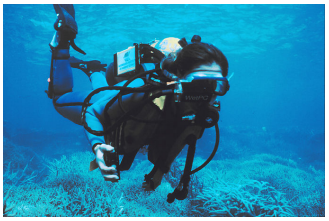
WHITE PAPER

COMPUTING DOWN UNDER

True mobile computing means using a computer, when needed, in any environment. Currently, users must carry around devices such as organisers, personal digital assistants, and laptop computers to achieve computing capabilities in the field. Flexible designs are now emerging that will enable people to use computers in non-traditional work areas such as under water, in bad weather, and in harsh environments.

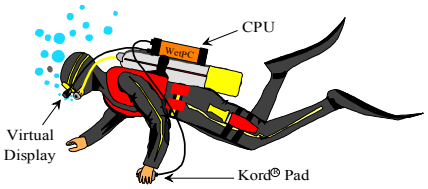


THE WETPC®

One such design is the WetPC® underwater computer. Originally conceived and developed at the Australian Institute of Marine Science (AIMS) it is thought to be the world's first wearable underwater computer. It comprises a miniature personal computer with a mask-mounted virtual display and a novel 5-button chordic graphical user interface (CGUI) The computer is mounted in a waterproof housing on the diver's air tank. A cable from it connects to a waterproof virtual display (attached to the diver's mask) which presents the diver with a high contrast display "floating" in the field of view. A second cable connects to a waterproof Kord® Pad which is attached to the diver's belt or chest. This is a 5-key device that can be used in either hand by pressing single or multiple keys (called chording). Rather like playing a piano (but nowhere near as difficult!), the user can interact with the computer in a very natural way - so much so it enables the diver to access and record information with one hand even whilst swimming. The system's design and its unique CGUI, offers a portable solution that may help to usher in an era of increasingly wearable computing systems.

A NOVEL INTERFACE

The CGUI facilitates the wearability and usability of the WetPC® underwater computer. Users operate the ambidextrous Kord® Pad, by pressing keys in various combinations. The Kord® Interface Technology (Kord® IT) is completely different from current chordic systems which require the user to learn which chords represent which character or command. The CGUI has graphic buttons on the screen that tell the user which buttons to press. Called WYSIWYP - "What You See Is What You Press", it is the subject of a broad-ranging international patent application which has been deeded in a number of countries including the United States (No. 5900864) and Australia (No. 693553).



Instead of memorising chords, the user merely looks at the screen to see which fingers to use. For example, the Save button on the screen might have a small iconic hand on it that indicates the thumb, first and second finger. Pressing and releasing the first, second and third keys simultaneously with those fingers, activates the button as if you had clicked it with the mouse. However, it can be vastly faster, because there is no cursor to manoeuvre. Typing, pointing, menu selection and other techniques are all possible with the invention.

Pressing two chord combinations sequentially to activate buttons - a couplet - multiplies the 31 combinations available from one hand to over 900, sufficient for most complex interfaces. Chord combinations can also be pressed on a conventional computer keyboard with one or both hands, allowing seamless movement between desktop and handheld (a useful feature for training).

Users find that 'muscle memory' rapidly develops, allowing them to not only make selections far faster than with a mouse or stylus, but totally eyes-free. Additionally, because the Kord® Pad is a digital device, it is unaffected by vibration or bumping the way pointers (such as a trackball) are. Harder to describe than to do, the method is readily learnt and very intuitive. New users are usually confident within minutes.

THE SEASLATE

A variant of the WetPC® underwater computer, the "SeaSlate" has been produced by WetPC Pty Ltd, in conjunction with AIMS. Two prototype units were produced for the Royal Australian Navy to enable Clearance Divers to search areas of the sea bottom without having to deploy buoys and other markers (eg. jack stays, lines).

Each SeaSlate consists of an off-the-shelf pen computer (with in-built LCD screen) which has been housed in a

Featured in the Australian Technology Showcase

waterproof clear acrylic casing. It has two external handles one of which incorporates a 5-button Kord® Pad (called a Kord® Grip) that is used to operate the computer. The Kord® Grip can be swapped to either side of the housing for either right-handed or left-handed use. The housing (which is rated to 30m operating depth) has a removable side door (complete with O-ring seal) and an external serial port so that data can be uploaded to a desktop computer or the SeaSlate can receive input from another technology (eg. GPS). An external socket has been provided so that batteries can be recharged without having to break open the casing. The SeaSlate also has a pressure sensor which automatically logs the depth of the diver.

The diver holds the SeaSlate by its two grips (with elbows resting on the side wings) so that the screen (which is in "portrait" mode) is immediately in the field of view. Field trials have shown that the computer can be steered using one hand and be easily operated (even using gloves) whilst swimming.

The SeaSlate receives positional information for diver navigation via an underwater GPS (or DGPS) which is connected via the external serial port. The GPS is connected via a cable to a small floating antenna system. The diver's swim path is plotted on the SeaSlate's display using data (in the form of a NMEA stream) from the GPS. The diver is also able to log the position of objects which may be encountered during the swim, as well as access a small database of mine types (with pictures). All this is done using the five buttons on the underwater Kord® Grip. The software has a variety of other features which allows divers to: flip the search grid (so that the diver is moving in the same direction as the icon on the screen), zoom the map (five levels), and transfer data (to a desktop PC).

APPLICATIONS

The ruggedised nature of the WetPC® underwater computer will make marine and freshwater environments the first logical market targets for the device. Tasks include navigation and positioning, mapping and monitoring, task planning, and information retrieval (such as maps, user manuals and schematics) and data transmission.

Incorporation of technologies such as GPS/DGPS, an acoustic navigation system, sonar, digital video, flux gate compass would enable the WetPC® underwater computer to perform a wide variety of tasks. For example, salvage divers or divers supporting offshore oil well operations could have access to critical textual and graphical information for both navigation and pinpointing location of estimated repairs. Maritime archaeologists could have digital photographic databases and maps to assist them in their retrieving artefacts.

Police divers searching for objects in lakes and embayments would know where they were at all times. The computer would provide them with real-time positional data thereby greatly improving search efficiency and accuracy.

Scientists could use the WetPC® underwater computer for mapping and monitoring ecosystems such as coral reefs. The position of objects (eg. coral thickets, patch reefs) could be logged and data on individual species recorded and stored within a database, which has been developed by the scientist back in the laboratory using Kord® authoring tools. The data could be uploaded to a mainframe computer for more sophisticated analyses within minutes of returning to the laboratory. Species keys, maps, and previous data could be taken underwater to assist the scientist in performing certain tasks.

The WetPC® underwater computer also has many applications in Defence. Navy divers could search for mines and unexploded ordnance without having to lay out physical markers on the seabed. By connecting the WetPC® underwater computer to a GPS/DGPS or even acoustic transponder system it could display the diver's swim path within the search area - accurate to within metres (depending on the system being used and the size of area being searched). Explosive ordnance disposal teams could have graphical information at their fingertips which would obviate the need to swim to an unexploded device, sketch it, swim back to the ship to check the manuals, and then return to defuse it. They could even send their information back for analysis using a through-water communications system. The CGUI on the computer would be used to control this process.

Pleasure diving is becoming an increasingly popular sport, and the WetPC® underwater computer could be used for the rapidly growing tourism industry where there is a well defined need for educational information on the environment - underwater eco-trails!!!!

CONTACT

WetPC Pty Ltd
PO Box 5179.
Garran, ACT. Australia. 2605.
PH. 61-2-6162 3602
FAX. 61-2-6162 3603
EMAIL. info@wetpc.com.au
WEBSITE. www.wetpc.com.au