Forestry and Microcomputers in Tasmania: Some Future Options

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Abstract

Developments in the processing power and data storage capabilities of microcomputers in recent years coupled with their reduction in size have encouraged new forestry applications for microcomputers.

Four areas which have potential to improve the efficiency of data capture and the effectiveness of the information for forest management are discussed. They are: field data capture devices, global positioning system, trucking fleet monitoring and voice activated computing.

Introduction

It has been estimated that if the aviation industry had progressed as rapidly as the computer industry over the past 30 years, then a Jumbo jet would cost a few hundred dollars and fly around the world on about $1 of fuel.

Microcomputers, also known as personal computers, with their small size and low price have put the power of a computer within the affordable range of the individual.

This development which has been one of the technological achievements of the 1980s, has produced a tool which is rapidly becoming an essential component of forest management.

This paper reports on some innovative uses of personal computers which may have relevance to the Tasmanian forest industries.

Field Data Capture Devices

Developments which have allowed the use of portable computers capable of surviving outside the office environment have been dramatic over the last few years.

The challenge to produce a unit which will stand up to shock, vibration, temperature extremes and moisture has been met by several companies, providing the power and functionality of a small Personal Computer in a rugged, book-size package.

The major benefit of these portable hand-held computers in forestry is the reduction in the time taken to collect and process data from inventory plots in the forest. Instead of recording plot information onto paper coding sheets which then has to be manually entered into a computer back in the office before data analysis can occur, the plot information is entered straight into the hand-held unit in the field. This information can then be downloaded electronically (either remotely via a telephone line and modem or on site by an RS232 cable link) to a Personal Computer. This procedure also reduces the potential for data transcription errors and checks can be written into the data entry program.

Because of the limited amount of memory available in most early hand-held computers, there were limitations to the sophistication of the programming languages and screen layout. Programming in BASIC was often the only option and in many cases, the program development work could only be carried out on the small keyboard.

Recent developments which have increased the potential value of hand-held computers include:

- Increased memory allowing the use of MS-DOS with 512Kb RAM or more being available, so that standard PC packages (Lotus 1-2-3, dBase, FORTRAN, QUICKBASIC etc) can be used;
- Larger screen size so more data (or helpful instructions) can be viewed at one time;
- Ease of communication with personal computers for data and program transfer;
- Options include specialised input devices, such as bar code readers and electronic scaling sticks; and
- Improved keyboard layout and backlit display for ease of use in the field.

However, the cost of these units in Australia is quite high (from $AUS 3,000 to $AUS 10,000 depending on memory options), since most of the units are produced by North American or United Kingdom based companies.

Some of the more commonly used units include:

1. **Husky Hunter** - The most commonly used unit in Australia and also very widely used in North America. In Tasmania these units are used for inventory in both plantation and native forest. The Husky BASIC programming language is not identical to standard BASIC. Screen size is 23 lines by 80 characters, but only 8 lines by 40 characters are visible at one time. Weight is about 1.3 kg. QWERTY (key layout the same as a standard typewriter) keyboard with separate numeric keys.

   Contact: Moncrief Ltd. 176 Wittenoom Street, East Perth, WA 6000. Ph (09) 325-5722.

2. **Polycorder** - Used for monitoring sensors and instruments with both digital and analog input and output. Programming in smaller models is in POLYCODE, a simple data acquisition language. A recently released 1600 Series unit operates under MS-DOS with up to 720Kb and 1Mb of Ramdisk. Screen size is 20 characters by 8 lines with backlighting. Weight is about 1.4 kg. Non-QWERTY keyboard with separate numeric keys.

   Contact: Omnidata International Inc. P.O. Box 3489 Logan, Utah 84321, U.S.A. Fax (801) 753-6756.

3. **SerialPlus II** - Combines an environmentally sealed case with a Hewlett Packard 71 Hand-held Computer. Such units appeal to applications which have already been developed for HP units, although the memory available (up to 64Kb EPROM) is limiting compared to other hand-held computers. Screen size is larger than for the HP-71 using two display areas of two lines each. Weight is about one kg. QWERTY keyboard and separate numeric keys.

   Contact: Oregon Digital Systems, Inc. P.O. Box 367, Corvallis, Oregon 97339-0367, U.S.A. Ph.(503)752-0448.

4. **Paravant** - A rugged book-size hand-held computer which has been designed to the stringent military standard and is in use by the U.S. armed forces. RHC-88 model is MS-DOS compatible with fast processing (2.5 times a standard PC), and expandable Ramdisk to 2 Mb. Display is 16 lines by 42 characters with backlighting. Weight is a hefty 2 kg. Keyboard is non QWERTY with separate numeric keys. This unit has been trialled briefly in Tasmania and comes with some useful data capture software. A lighter version of this unit would be preferable.

   Contact: Forest Technology Systems, Suite 13, 25 Ralston Ave, Belrose NSW 2085, Fax (02) 451-0337.

Global Positioning System

The Global Positioning System (GPS) was developed for public and military use by the U.S. Department of Defence to simplify accurate navigation. The System uses a constellation or group of satellites orbiting the earth to provide reference data to a receiver on the ground. A radio signal from four satellites is necessary to accurately determine a position on the earth's surface.

Using atomic clocks on board each satellite and the fact that the satellites are in highly predictable orbits, the time taken for specially coded signals to reach the receiver from the satellites allows the location of the receiver to be determined.

The type of signal used means the System will work with very low power signals and small antennae. A single receiver can estimate its position to within about 50 m. By using two receivers instead of one, the accuracy of the positioning can be better than one metre.

A GPS receiver has been coupled with a hand-held computer and a small aerial making a rugged portable unit which can be carried in the forest. The computer analyses the signals and, via a menu, position data can be continuously and automatically stored in a file for detailed analysis following downloading to a Personal Computer back in the office.

The GPS can be used to provide boundary surveys of logged areas, roads or the location of sample plots. By storing the data in electronic form, the information can be utilised by most surveying or Geographic Information Systems, reducing the time and cost associated with more conventional techniques for providing and updating survey data. The GPS data from the Trimble Navigation GPS unit can be downloaded straight into the Arc/Info Geographic Information System (GIS) package.

Trials in North America have shown the practicality of the System, although there is not yet 24 hour satellite availability, since additional satellites are still being launched to complete the constellation necessary for continuous world-wide usage. Dense forest canopy or steep terrain can distort or block the signal and so reduce the accuracy and usefulness of the GPS in some applications. These factors and the quite expensive unit price (approximately $AUS 25,000 each), suggest that current GPS technology will not replace all standard surveying techniques in the near future.

Trimble Navigation based in California has developed a GPS field receiver unit using a Polycorder 600 Series data recorder. This unit is currently being trialled in Australian forests in Victoria and Tasmania.

Contact: GPS Satellite Surveys, P.O. Box, 118 Thornleigh, NSW 2120, Fax (02) 484-1978.

Trucking Fleet Monitoring System

An interesting application of microcomputer technology is being developed to reduce the high costs of off-highway trucks in coastal British Columbia. A sophisticated vehicle monitoring system incorporates three main components:

1. **On board monitoring system** - On each truck 28 sensors record various parameters such as engine oil, coolant and transmission temperatures and pressures, as well as other components which have potential for predicting failures and for maintenance diagnostics.

   The sensors are sampled every five seconds and the data are stored digitally in a dashboard mounted processor unit. Two hours of data can be stored in the processor to allow for backlogs and delays in transmitting this information to the base station. Critical temperature and pressure levels are also relayed by audible alarms to the driver, to enable emergency action if necessary.

2. **Telemetry System** - A mobile radio on

each truck transmits data stored in the dash mounted processor unit to a base station. The base station polls each truck in order and data are then transmitted and an acknowledgement of error-free data transfer is sent back to the truck. The information is then deleted from the truck's data storage. A standard aircraft LORAN C unit provides vehicle location information which is also transmitted.

3. **Base Station** - The base radio downloads received data to the hard disk on an 80286 Personal Computer. A backup tape is included in this system for data storage.

   A second microcomputer displays the log trucks' positions and mechanical status. Display features are selected using menu options. Batch file processing of shift data analysis can also be carried out.

   The aim of the project is to develop a system that will assist in reducing logging costs and help maintain the competitive position of the industry.

   Contact: Prof. G. Glen Young, Faculty of Forestry, University of British Columbia, Vancouver, BC V6T1W5.

Voice Activated Personal Computers

Another innovative application of technology which may prove to be useful in the forest-based industries involves programming a Personal Computer to respond to voice commands instead of typing the command on the keyboard.

The system uses a speech synthesizer and voice recognition board inserted into the microcomputer. A microphone is plugged into the board. A software controlled voice calibration procedure is carried out, involving audio analysis of verbal commands by the processor. The commands are repeated three times in the calibration process to provide a "range" of frequency variation in the make-up of each command. The analysis of the voice command is matched with one of the stored commands and the command is invoked by reference to an action file for that command in the same way as if the command had been typed on the keyboard. Commands can be optionally repeated by the processor to ensure correct interpretation has occurred.

A practical application of the system was demonstrated with digitising data for inclusion in the Arc/Info GIS package. In several procedures, the digitiser operator had to leave the digitising tablet and move to the keyboard to enter some commands, or alternatively remove the cursor from the map to activate a command from the digitiser menu. In both cases, data input was interrupted and the cursor location had to be remembered when digitising recommenced.

By using voice activated commands, the operator did not have to move the cursor from the map to carry out the intermediate command.

Other applications include:

- Providing computer access for handicapped people,

- Enabling foreign language commands to substitute for the original commands. This is particularly useful in allowing an English based program to be utilised without the need for either extensive modification of the package (changing all the menus to the local language) or English language training,

- A future use in forest inventory may allow diameter, height and other plot information to be called out to a hand-held computer placed in the middle of the plot, as the measurers move from tree to tree calling out the readings. Continuing developments in the processing speed and data storage capabilities of personal computers make such activities plausible in the very near future; and

- As different voices can be distinguished

by the system, it has some potential for providing security access control by only recognising people whose voices have been coded into the system.

Contact: Geocode, 306 Barstow St., Suite 208, Eau Claire, WI, USA 54701. Ph. (705) 834-5058.

Conclusion

The continuing expansion of the processing power and data storage at cheaper per unit prices indicates that the microcomputer will become an increasingly more useful tool for forestry in the 1990s. In particular, it can improve the efficiency of data capture and also the effectiveness with which information is incorporated into complex decision making processes. The information can be readily transferred to other software packages on the computer system for incorporation in other work.

But above all, the microcomputer is only a tool. It will not make the decisions, just provide better information on which forest management decisions can be based.

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