IBM PC Data Acquisition and Processing Software Evaluation

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Commercially available software packages for IBM PC-compatibles are evaluated to use for data acquisition and processing work. Moss Landing Marine Laboratories (MLML) acquired computers since 1978 to use on shipboard data acquisition (i.e. CTD, radiometric, etc.) and data processing. First Hewlett-Packard desktops were used then a transition to the DEC VAXstations, with software developed mostly by the author and others at MLML (Broenkow and Reaves, 1993; Feinholz and Broenkow, 1993; Broenkow et al, 1993). IBM PC were at first very slow and limited in available software, so they were not used in the early days. Improved technology such as higher speed microprocessors and a wide range of commercially available software made use of PC more reasonable today. MLML is making a transition towards using the PC for data acquisition and processing. Advantages are portability and available outside support.

It is not possible to evaluate all commercial software on the market except those that are commonly used. This memorandum will briefly look at the following software: LabView, HP VEE, HP BASIC, IDL and MATLAB.

LabView

National Instruments (1993) developed LabView for Windows primarily for acquiring data from instruments, which may be connected via serial I/O, GP-IB and internal A/D boards. This is used by the NOAA and NASA SeaWiFS team. Instruments may be controlled using a "front panel" interface in Windows, thus eliminating need for text prompts. LabView uses graphical programming which is very much like creating a flowchart and programming at the same time. Modules may be created to simplify interfacing program components. For faster execution, programs can be compiled to machine language. Data may be shared among other programs using either ASCII or binary files. Source code of LabView is available for those needing to customize their machines. LabView offers wide range of support from third party vendors and is available to use on PC, MacIntosh, and UNIX machines.

HP VEE

Another graphic programming language was developed by Hewlett-Packard (1994) labeled as Virtual Engineering Environment (VEE). This acquires data from instruments and test equipments connected via serial I/O or HP-IB. HP VEE operates similar to LabView with its front panel interface, math and statistics functions and module creation. However, HP VEE appears less cluttered by defining parameters and operations within each module, which can also be iconified to reduce workspace size. Data may be imported and exported by either calling up programs (UNIX and HP BASIC) or as ASCII or binary files. It is currently not known how widely this software is used among the scientific community as it is primarily used by electronic engineers. The support is limited to HP and is currently available only on PC and UNIX machines.

HP BASIC

Hewlett-Packard (1995) has made their "Rocky Mountain" BASIC available on PC which originally came from the HP Series 200 desktop computers. It also has the "look and feel" of the desktops with special function keys and formatted screen. It offers interfacing with serial I/O and HP-IB. This is a text based language and the user will be required to create programs to acquire and process data. One drawback is this software is protected by using a HASP key which is connected to the parallel port. This would require obtaining license for each PC.

IDL

Research Systems, Inc. (1995) originally created Interactive Data Language (IDL) to graphically display data. IDL behaves more of an operating system than an application due to separating the command line input from the windows and displaying the results in a window. IDL offers powerful graphic capabilities such as image processing, contouring, mapping, 2-D and 3-D plots, surface plotting, animation, and widgets. It also includes a variety of basic and advanced math and statistic functions. Data may be stored by using well known scientific data format such as CDF, netCDF and HDF or in customized files using the low level file I/O routines. Programs may be written in the native IDL language, but can also create and call an DOS executable program for speed. Like HP BASIC, it requires one HASP key for each PC. IDL is available in most platforms such as PC, MacIntosh, UNIX machines and VMS. Support is limited to RSI.

MATLAB

The MathWorks, Inc. (1995) developed Matrix Laboratory (MATLAB) for processing matrices. This is used mostly by universities and schools to teach matrix mathematics but may be used for scientific analysis. Although not as powerful as IDL, MATLAB offers graphic capabilities as 2-D and 3-D plotting, surface plotting and contouring. Image processing can be added from a separate package. Basic and advanced mathematic and statistical functions are also available. Graphical User Interface (GUI) can be used but found to be complicated to program and appears slow. Data may be stored using low level file I/O routines in either ASCII or binary format or in a .MAT file which simply saves a matrix to a file in binary form (8 bytes per element). MATLAB supports only 64-bit precision floating point numbers. Interestingly enough, each character in a string is stored as 8 bytes per character. Programs may be written the the native MATLAB language or can be written in FORTRAN and C as .MEX files for speed. MATLAB is available for PC, MacIntosh, UNIX and VMS.

Summary

LabView, HP VEE and HP BASIC are suitable for data acquisition while IDL and MATLAB are best for data processing. The author's choice is LabView due to it's flexibility and the support we can get. The level of difficulty in programming and using LabView and HP VEE is about the same in the author's opinion. HP BASIC would be suitable for small applications such as reading an instrument and simply scroll the data on the screen. In large applications such as MOS acquisition it can prove unwieldy. IDL and MATLAB would offer about the same degree of productivity for the average user. Although MATLAB appears more "user friendly", the author leans toward IDL because of excellent graphic capabilities and file formats.

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